Anatomy of an Outbreak:
Salmonella Outbreak at a Restaurant in a Colorado Resort Town

Alicia Cronquist, RN, MPH
Epidemiologist
Colorado Department of Public Health and Environment
Goals

Participants will....

• Be familiar with the steps of outbreak investigation

• Know where to find resources and tools for LPHAs

• Not be terrified of outbreak investigations!
Process for today

• Describe a real outbreak (those parts in blue)
• Discuss ways to respond
• Practice decision making
• View new tools and training
What is the Colorado Integrated Food Safety Center of Excellence (CoE)?

• Collaboration between CDPHE and Colorado School of Public Health
• Best practices for outbreak detection and response
• Training public health professionals and responders in outbreak methods
• A result of Food Safety Modernization Act (FSMA)
Welcome to the Colorado Integrated Food Safety Center of Excellence
Environmental Assessment QuickTrain

This training is designed for public health professionals as an introduction or re-fresher on conducting environmental assessments during an outbreak investigation.

Click on a module to begin

- Introduction to Foodborne Outbreak Investigations
- Environmental Assessments
- Contributing Factors
- Clinical and Environmental Specimens
- Toolbox
- Definitions
- Print Modules
- CoE Home
What is a foodborne disease outbreak?

• Two or more people with the same illness from the same contaminated food or drink
The outbreak investigation team

- Laboratory
- Epidemiology
- Environmental health
- Communication
Outbreak investigation steps

• Establish existence of an outbreak
• Verify the diagnosis
• Form the investigation team
• Define and identify cases
• Describe and orient data
• Develop hypotheses
• Implement control measures
• Communicate findings
The call: Thursday December 19

- Physician called local Environmental Health office to report a potential outbreak
- 3 people with gastroenteritis and dehydration
- 1 stool sample submitted for testing
- Group breakfast at restaurant A on Dec 16

- Should you investigate?
- Is this an outbreak? {Two or more people with the same illness from the same contaminated food or drink}
- How can you figure out if this is more illness than expected?
More information

- 2 breakfast groups at restaurant A on Dec 16
  - Church group (10)
  - School cafeteria workers (8)
- Illnesses began Dec 17
  - Diarrhea, fever, myalgia
  - At least 8 people ill

- Verify the diagnosis
- Does it make sense that the ‘ill’ people have the same illness?
- Determine or make a good guess about the pathogen
Verify the diagnosis:
Non-laboratory methods

- Collect **detailed** symptom info, onset date/time, duration of illness
- Compare to clinical info on various reference tables
- Make educated guess

<table>
<thead>
<tr>
<th>ORGANISM</th>
<th>COMMON NAME OF ILLNESS</th>
<th>ONSET TIME AFTER INGESTING</th>
<th>SIGNS &amp; SYMPTOMS</th>
<th>DURATION</th>
<th>FOOD SOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Bacillus cereus</em></td>
<td>8-cassava food poisoning</td>
<td>12-18 hrs</td>
<td>Abdominal cramps, watery diarrhea, nausea</td>
<td>24-48 hrs</td>
<td>Meats, stews, gravies, vanilla sauce</td>
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<tr>
<td><em>Campylobacter jejuni</em></td>
<td>Campylobacteriosis</td>
<td>2-5 days</td>
<td>Diarrhea, cramps, fever, and vomiting; diarrhea may be bloody</td>
<td>2-10 days</td>
<td>Raw and undercooked poultry, unpasteurized milk, contaminated water</td>
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<tr>
<td><em>Clostridium botulinum</em></td>
<td>Botulism</td>
<td>12-72 hours</td>
<td>Vomiting, diarrhea, blurred vision, double vision, difficulty in swallowing, muscle weakness. Can result in respiratory failure and death</td>
<td>Variable</td>
<td>Improperly canned foods, especially home-canned vegetables, fermented fish, baked potatoes in aluminum foil</td>
</tr>
<tr>
<td><em>Clostridium perfringens</em></td>
<td>Perfringens food poisoning</td>
<td>8-16 hours</td>
<td>Intense abdominal cramps, watery diarrhea</td>
<td>Usually 24 hrs</td>
<td>Meats, poultry, gravies dried or precooked foods, time and/or temperature-abused foods</td>
</tr>
<tr>
<td><em>Cryptosporidium</em></td>
<td>Intestinal cryptosporidiosis</td>
<td>2-10 days</td>
<td>Diarrhea (usually watery), stomach cramps, upset stomach, slight fever</td>
<td>May be remitting and relapsing over weeks to months</td>
<td>Uncooked food or food contaminated by an ill food handler after cooking, contaminated drinking water</td>
</tr>
</tbody>
</table>
Verify the diagnosis: Laboratory methods

• Ask about the testing ill people have already had
  – Did anyone go to doctor?
    Submit a specimen?

• Collect specimens
  – 5-6 from ill people
  – Call CDPHE before sending
Back to our outbreak...
Verify the diagnosis

• Agent unknown
  – Fever, duration $\geq 3$ days, incubation $\sim 24$ hrs
  – Recommended more stool samples
  – Suspect bacterial agent such as Salmonella
Who is on your team?

- County environmental health agency
- County public health agency
- Public information officer/communications
- Regional Epidemiologist
- CDPHE epidemiology
- CDPHE environmental health
- State public health lab
- CDC
- FDA/USDA/CO Dept Agriculture
What next?
Thursday December 19

• Local environmental health visits restaurant A
  – No major violations or issues found
  – Impressed with overall hygiene
  – No ill workers reported

• Start to interview ill people
  – Collect food histories and symptom info

• Define and identify cases
• Describe and orient data
• Develop hypotheses – Epi and EH perspectives
Define Cases: Case definition

Person – Place – Time – Clinical Info

• A person who had diarrhea (≥3 loose stools in 24 hours), and
• Ate at Restaurant A
• Between December 13 and December 24.
Interview cases in depth

• Develop hypotheses about potential exposures
• Use a questionnaire— it can change as things evolve
• Write it all down
• Don’t start from scratch! Many templates exist
  – CDPHE outbreak investigation page: [www.colorado.gov/cdphe/outbreak-investigation-guidelines](www.colorado.gov/cdphe/outbreak-investigation-guidelines)
  – Food Safety Center of Excellence Toolbox
What are some ways to identify cases?

- Asked about dining companions
- Sent letter to town’s health care providers
- Contacted IP, ED and local physicians daily to inquire about new cases
- Posted on Hot topics and EpiX
- Reviewed CEDRS daily for any new *Salmonella*
- Posted PFGE pattern on PulseNet
Describe and orient data

• Line list – it is never too early to start one!
• Download templates to get started
• Designate ONE person to be in charge of data per day

<table>
<thead>
<tr>
<th>Name or Initials or Person ID#</th>
<th>Age</th>
<th>Sex (M/F)</th>
<th>County</th>
<th>Occupation</th>
<th>Onset Date/Time</th>
<th>Symptoms*</th>
<th>Symptom Duration</th>
<th>Dr Visit (Y/N)</th>
<th>Specimen Collected or Lab Tests</th>
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Environmental investigation

• Purpose: Assess factors that could have caused the outbreak
• Not a routine inspection
• Partly hypothesis-generation, partly control measures
• Just like epi investigation, can start out broad and narrow in focus as more is learned

• QuickTrain resources:
Initial environmental investigation

- No agent / suspected food yet
- Assessed general kitchen operations
- Focused on breakfast menu: eggs and fruit salad
- Food temperatures
- Hand washing
- Ill workers?
- Control measures – reinforced all required practices
Friday December 20

- EH learns of another group from Dec 16 with illness (3rd dining group at Restaurant A)
- Suspecting fruit salad based interviews so far (~90% of ill people reported eating it)
- Call state health department
  - Ask to test whole fruit used to make salad (melon)
  - CDPHE says no, without knowing etiology
Further developments

• Monday December 23
  – Interviewing continues
  – EH visits restaurant again

• Thursday December 26
  – Lab isolates Salmonella from 4 patient cultures

• December 27
  – All are Salmonella serotype Newport
Regrouping – Next steps?

- Confirmed Salmonella outbreak
- All known ill people ate on Dec 16 at same restaurant
- Suspect fruit salad
- Test hypothesis with an epidemiologic study
- Revisit restaurant to focus on fruit salad
- Research if fruit has been associated with Salmonella outbreaks
- More case finding
- Test workers for Salmonella
What are the ways Salmonella can come from a restaurant?

• What are the potential contributing factors?

• Cross contamination from raw foods such as meat or eggs

• Contaminated produce

• Worker illness combined with poor hand hygiene
Rapid access for public health professionals to information on agricultural production practices from farm to fork.

Answer questions such as: How would grapes be contaminated with Salmonella?
Food Source Info Wiki Articles

- Key Facts
- Introduction
- Foodborne outbreaks
- Food Production
- Food Safety
- Consumption
- Nutrition
- References
Restaurant workers infected?

- **December 27**
  - Decided to culture all restaurant workers for Salmonella
  - Rectal swabs

- **December 29**
  - 6/24 (25%) restaurant workers tested to date positive for Salmonella

- All workers had denied having GI symptoms
Control measures

- Culture-positive restaurant workers no food prep or handling until 2 negative stools/swabs for Salmonella at least 48 hours apart
- Asymptomatic, colonized may work without food contact (waiters, dishwashers, hostess, etc)
- Glove order
- **What is the public health authority to make these restrictions?**
- Communicable disease regulations 6 CCR 1009-1 [www.colorado.gov/cdphe/regulations](http://www.colorado.gov/cdphe/regulations)
Case-control study

- Controls selected by convenience
- Cases asked to name dining companions
- If ill and met case definition → case
- If well → control
- Questionnaire to cases and controls
- Used Salmonella questionnaire modified with restaurant menu attached
### Case patient demographics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident of County Z</td>
<td>96% (49/51)</td>
</tr>
<tr>
<td>Female</td>
<td>45% (23/51)</td>
</tr>
<tr>
<td>Age, median (range)</td>
<td>47 years (4-72y)</td>
</tr>
<tr>
<td>Duration, median (range)</td>
<td>5 days (1-21d)</td>
</tr>
<tr>
<td>Incubation period, median</td>
<td>30 h (16h-14d)</td>
</tr>
</tbody>
</table>
## Characteristics of illness among case-patients

<table>
<thead>
<tr>
<th>Condition</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhea</td>
<td>51/51</td>
<td>100</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>40/49</td>
<td>81</td>
</tr>
<tr>
<td>Fever</td>
<td>36/48</td>
<td>81</td>
</tr>
<tr>
<td>Myalgia</td>
<td>24/47</td>
<td>64</td>
</tr>
<tr>
<td>Vomiting</td>
<td>18/48</td>
<td>37</td>
</tr>
<tr>
<td>Bloody diarrhea</td>
<td>12/44</td>
<td>27</td>
</tr>
<tr>
<td>Hospitalized</td>
<td>3/51</td>
<td>6</td>
</tr>
</tbody>
</table>
Lab results

• 26/51 (51%) cases culture-confirmed

• 9/31 (29%) workers tested positive
  – 5 restaurant workers did report illness
  – 4 denied any symptoms (not counted as cases)

• All isolates indistinguishable PFGE patterns
<table>
<thead>
<tr>
<th>Food item</th>
<th>% cases who ate</th>
<th>% controls who ate</th>
<th>P-value</th>
<th>Odds ratio (CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit salad</td>
<td>95%(37/39)</td>
<td>13%(2/16)</td>
<td>&lt;.0001</td>
<td>130 (13,2237)</td>
</tr>
<tr>
<td>Eggs benedict</td>
<td>30%(13/43)</td>
<td>24%(4/17)</td>
<td>NS</td>
<td>1.4 (0.3,6.3)</td>
</tr>
<tr>
<td>Omelet</td>
<td>23%(9/43)</td>
<td>6%(1/17)</td>
<td>NS</td>
<td>4.2 (0.5,97)</td>
</tr>
<tr>
<td>Turkey w/ brie</td>
<td>7%(3/43)</td>
<td>12%(2/17)</td>
<td>NS</td>
<td>0.6 (0.1,5.4)</td>
</tr>
</tbody>
</table>

NS=Not significant
Fruit salad

- Fruit contaminated when received?
  - National distributor
  - No other PFGE-matching cases in nation
- Contamination at restaurant?
  - Many Salmonella-positive workers
  - All denied symptoms initially
  - 5/9 who tested positive reported illness
  - Incentives for workers not to disclose illness/tasks performed
Questions for group

• When do you think the restaurant should have closed?
• At what point would you have notified the public?
  – How would you have done it?
• What else was missed or could have been done better?
  – Timing of response
  – Testing fruit
  – More aggressive collection of invoices / traceback
Thanks!

Alicia Cronquist

Alicia.cronquist@state.co.us