A Teamwork Approach to Investigating Foodborne Illness Outbreaks

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Food, Dairies and Devices Section Chief

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Foodborne Disease Coordinator

September 9, 2019
Objectives

• Introduce various partners involved in a foodborne illness outbreak investigation
• Discuss the Environmental Health, Communicable Disease, and Laboratory Roles
• Demonstrate planning, coordination and communication
• Discuss the steps of a communicable disease outbreak investigation
• Cover the 6 steps of an Environmental Assessment and the differences in inspections based on suspect organism
What is a foodborne outbreak?

Any clusters of illnesses in which:

• two or more persons (usually residing in separate households) associated in time and place

• experience onset of a similar, acute illness (usually gastrointestinal)

• following ingestion of common food or drink
Investigation Partners

- Communicable Disease
- Outbreak Investigation
- Environmental Health
- Laboratory

Illinois Department of Public Health
Group Effort

• Investigation of food and waterborne disease outbreaks are not accomplished by a single individual and require the efforts of a team of individuals with different areas of expertise.

• This team includes EH and CD at the LHD and CD, Lab, and FDD at IDPH. The restaurant or food source and the media are involved as well.
Purposes of Outbreak Investigation

• Identify the cause, the risk factor(s), or source
• Implement interventions or corrective actions to prevent others from becoming ill
• Fulfill statutory obligations and respond to public and political concern
• Evaluate existing recommendations or strategies for preventing similar outbreaks
• Learn more about the public health implications of foodborne pathogens
Possible Etiological Agents

**Bacteria**
- Bacillus cereus
- Campylobacter*
- Clostridium botulinum
- Clostridium perfringens
- Escherichia coli
  - Shiga toxin-producing *E. coli* *
  - Enterotoxin producing *E. coli* *
  - Enteroinvasive *E. coli*
  - Enteropathogenic *E. coli*
- Listeria monocytogenes*
- Salmonella, Typhi and non-typhoid*
- Shigella*
- Staphylococcus aureus
- Vibrio*
- Yersinia enterocolitica*

**Viruses**
- Norovirus
- Astrovirus
- Hepatitis A virus*

**Parasites**
- Cryptosporidium*
- Cyclospora cayetanensis*
- Entamoeba histolytica
- Giardia intestinalis
- Trichinella*

**Chemicals/other**
- Heavy metals
- Pesticides
- Fungal toxins
- Fish toxins
1 parasitic foodborne outbreaks in 2017 was caused by *Cryptosporidium*

All 17 viral foodborne outbreaks in 2017 were due to *Norovirus*
Bacterial Pathogens Identified in 2017 Foodborne Outbreaks, Illinois (n=21)

- Salmonella, 62%
- Bacterial Toxins, 14%
- STEC, 14%
- Listeria, 5%
- Campylobacter, 5%
Food Vehicles

- Variety of foods associated with foodborne illnesses
- Almost any food can be a vehicle for disease but food and production/processing must
  - Allow opportunity for contamination by causative agent
  - Allow agent (or toxin) to survive (not be inactivated)
  - (For some agents) support proliferation of agent and/or elaboration of preformed toxins
- Common food-causative agent pairings
# Top Food-Pathogen Pairs Causing Outbreaks in 2016

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Food Category</th>
<th>Number of Outbreaks</th>
<th>Number of Outbreak Associated Illnesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scombroid toxin (histamine)</td>
<td>Fish</td>
<td>12</td>
<td>35</td>
</tr>
<tr>
<td>Ciguatoxin</td>
<td>Fish</td>
<td>11</td>
<td>33</td>
</tr>
<tr>
<td>Salmonella</td>
<td>Chicken</td>
<td>8</td>
<td>307</td>
</tr>
<tr>
<td>Campylobacter</td>
<td>Dairy (unpasteurized)</td>
<td>7</td>
<td>57</td>
</tr>
<tr>
<td>Norovirus</td>
<td>Mollusks*</td>
<td>6</td>
<td>209</td>
</tr>
<tr>
<td>Salmonella</td>
<td>Pork</td>
<td>6</td>
<td>96</td>
</tr>
<tr>
<td>Vibrio paraahaemolyticus</td>
<td>Mollusks*</td>
<td>6</td>
<td>19</td>
</tr>
</tbody>
</table>

*such as oysters or scallops

### Top 5 Food-Pathogen Pairs Causing Outbreak-Associated Illnesses in 2016

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Food Category</th>
<th>Number of Outbreaks</th>
<th>Number of Outbreak Associated Illnesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacillus cereus</td>
<td>Grains and Beans</td>
<td>5</td>
<td>348</td>
</tr>
<tr>
<td>Salmonella</td>
<td>Chicken</td>
<td>8</td>
<td>307</td>
</tr>
<tr>
<td>Hepatitis A</td>
<td>Mollusks*</td>
<td>1</td>
<td>281</td>
</tr>
<tr>
<td>Norovirus</td>
<td>Mollusks*</td>
<td>6</td>
<td>209</td>
</tr>
<tr>
<td>Staphylococcus aureus enterotoxin</td>
<td>Pork</td>
<td>4</td>
<td>170</td>
</tr>
</tbody>
</table>

*such as oysters and scallops

# Food Preparation and Food Consumption site, Illinois, 2017

<table>
<thead>
<tr>
<th>Site</th>
<th>Food preparation</th>
<th>Food consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restaurant</td>
<td>54%</td>
<td>50%</td>
</tr>
<tr>
<td>Grocery store</td>
<td>12%</td>
<td>0%</td>
</tr>
<tr>
<td>Caterer</td>
<td>6%</td>
<td>0%</td>
</tr>
<tr>
<td>Commercial product</td>
<td>6%</td>
<td>0%</td>
</tr>
<tr>
<td>Private home</td>
<td>4%</td>
<td>24%</td>
</tr>
<tr>
<td>Farm/dairy</td>
<td>4%</td>
<td>15%</td>
</tr>
<tr>
<td>Work site</td>
<td>0%</td>
<td>4%</td>
</tr>
<tr>
<td>Other food prep locations: Correctional facility, mobile truck, church, sorority or multiple locations</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Foodborne Outbreak Summary

U.S. Data

<table>
<thead>
<tr>
<th>Quick Stats - Current Filters</th>
</tr>
</thead>
<tbody>
<tr>
<td>8,496 Outbreaks</td>
</tr>
<tr>
<td>153,318 Illnesses</td>
</tr>
<tr>
<td>8,788 Hospitalizations</td>
</tr>
<tr>
<td>220 Deaths</td>
</tr>
</tbody>
</table>

Illinois Data

<table>
<thead>
<tr>
<th>Quick Stats - Current Filters</th>
</tr>
</thead>
<tbody>
<tr>
<td>589 Outbreaks</td>
</tr>
<tr>
<td>18,390 Illnesses</td>
</tr>
<tr>
<td>2,492 Hospitalizations</td>
</tr>
<tr>
<td>74 Deaths</td>
</tr>
</tbody>
</table>

NORS Dashboard - https://wwwn.cdc.gov/norsdashboard/
Cluster and Outbreak Identification

Two primary means

- Disease surveillance (notifiable disease reporting)
- Foodborne illness complaints
Foodborne Outbreak Surveillance

• Detect and mediate lapses in the food safety system to prevent additional cases
• Identify common and new vehicles
• Discover emerging pathogens
• Understand the settings of consumption and contamination of foods
• Assess trends and progress
Diagnostic Testing Innovations

• Non-culture based testing (culture-independent testing)
  – Identify pathogen(s) within hours
  – Prevents/delays
    • Outbreak detection
    • Tracking antibiotic resistance
    • Monitoring disease trends
  – Increased false positives (low PPV)

• Encourage culture and required submission of positive specimens to the IDPH lab
  – Serotyping
  – PFGE
  – WGS

Common Gastrointestinal Panel -
• 22 pathogens in 1 test
• Bacteria
• Diarrheagenic E. coli/Shigella
• Parasites
• Viruses
I-NEDSS

• Illinois’ National Electronic Disease Surveillance System

• All reportable infectious diseases, except HIV/AIDS and syphilis

• Daily review and updating
Monitor Disease: Reporting

Local Health Department

Electronic Reporting

Provider web-based data entry into I-NEDSS

Merge cases into I-NEDSS by matching to existing persons and, if previously reported, cases.

LHD enters paper and faxed copies into I-NEDSS

Business Objects database syncs with I-NEDSS.

IDPH

CDC
Disease Surveillance

• Third party identification
• LHD may notify IDPH of an increase in cases
• Daily reports from the Illinois National Electronic Disease Surveillance System
  – Monitor for increases in diseases by serogroup or PFGE pattern
  – Multiple people eating at the same restaurant
  – Common food exposures
  – Vibrio exposures
  – Raw Milk Report
• CDC disease surveillance in SEDRIC
## Disease Surveillance Reports

<table>
<thead>
<tr>
<th>Serogroup</th>
<th>State Case Number</th>
<th>Onset Date</th>
<th>Specimen Collection Date</th>
<th>Other Test Result</th>
<th>Cluster Code</th>
<th>Outbreak ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUENCHEN</td>
<td>19-147917</td>
<td>08/09/2019</td>
<td>08/13/2019</td>
<td>J6X01.0640</td>
<td>JJ6X01.0640</td>
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<td>MUENCHEN</td>
<td>19-150247</td>
<td>08/17/2019</td>
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<td>MUENCHEN</td>
<td>19-152933</td>
<td>08/19/2019</td>
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<td>Count:</td>
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<table>
<thead>
<tr>
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<th>State Case Number</th>
<th>Onset Date</th>
<th>Specimen Collection Date</th>
<th>Other Test Result</th>
<th>Cluster Code</th>
<th>Outbreak ID</th>
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<tbody>
<tr>
<td>MUENCHEN</td>
<td>19-125388</td>
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<td>07/08/2019</td>
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<table>
<thead>
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<th>Onset Date</th>
<th>Specimen Collection Date</th>
<th>Other Test Result</th>
<th>Cluster Code</th>
<th>Outbreak ID</th>
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<tbody>
<tr>
<td>NEWPORT</td>
<td>19-120105</td>
<td>07/04/2019</td>
<td>07/11/2019</td>
<td>J6X01.0010</td>
<td>1809MLUP-1WGS IL2018-702</td>
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<td>NEWPORT</td>
<td>19-127551</td>
<td>07/12/2019</td>
<td>07/15/2019</td>
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<td>NEWPORT</td>
<td>19-135436</td>
<td>07/20/2019</td>
<td>07/23/2019</td>
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<td>NEWPORT</td>
<td>19-135943</td>
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<td>NEWPORT</td>
<td>19-136300</td>
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<table>
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<th>Specimen Collection Date</th>
<th>Other Test Result</th>
<th>Cluster Code</th>
<th>Outbreak ID</th>
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</thead>
<tbody>
<tr>
<td>INFANTS</td>
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<th>Outbreak ID</th>
</tr>
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<tbody>
<tr>
<td>OMBANDAKA</td>
<td></td>
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</tbody>
</table>

**Supplementary Information:**

- **Shiga toxin-producing E. coli (STEC)**
  - O157, H antigen unknown
  - Shiga toxin positive, non-O157 serotype
  - Shiga toxin positive, not cultured or serotyped

**Table:**

<table>
<thead>
<tr>
<th>Serogroup</th>
<th>State Case Number</th>
<th>Where did patient swim in non-chlorinated water</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRSB</td>
<td>19-003620</td>
<td>Antique</td>
</tr>
<tr>
<td></td>
<td>19-014530</td>
<td>Antigua</td>
</tr>
<tr>
<td></td>
<td>19-014522</td>
<td>Antigua</td>
</tr>
<tr>
<td></td>
<td>19-000885</td>
<td>Colombia</td>
</tr>
<tr>
<td></td>
<td>19-002448</td>
<td>Dominican Republic</td>
</tr>
<tr>
<td></td>
<td>19-007849</td>
<td>Mexico</td>
</tr>
<tr>
<td></td>
<td>19-007837</td>
<td>Mexico</td>
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<tr>
<td></td>
<td>19-011649</td>
<td>Panama</td>
</tr>
<tr>
<td></td>
<td>19-004445</td>
<td>Porta Nuevo Beach</td>
</tr>
<tr>
<td></td>
<td>19-008017</td>
<td>Punta Cana</td>
</tr>
<tr>
<td></td>
<td>19-005500</td>
<td>Punta Cana</td>
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<tr>
<td></td>
<td>19-014547</td>
<td>Reserve At Paradisus</td>
</tr>
<tr>
<td></td>
<td>19-009989</td>
<td>In Punta Cana</td>
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<tr>
<td></td>
<td>19-006983</td>
<td>In Punta Cana</td>
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<tr>
<td></td>
<td>19-000407</td>
<td>In Punta Cana</td>
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<tr>
<td></td>
<td>19-009998</td>
<td>In Punta Cana</td>
</tr>
</tbody>
</table>

**Footnote:**

[Link to Illinois Department of Public Health (IDPH) website](https://www.idph.state.il.us)
Steps of an Outbreak Investigation

✓ Identify investigation team and resources
✓ Verify the diagnosis
✓ Establish existence of an outbreak and notify IDPH (ORS)
✓ Construct a case definition
✓ Find cases systematically
✓ Interview cases (possibly more than once)
✓ Conduct an environmental investigation

Not Sequential
Steps of an Outbreak Investigation

- Collect samples and/or arrange for laboratory testing
- Describe the cases/exposures and develop hypotheses
- Evaluate hypotheses/perform epi studies as necessary
- Implement control measures
- Communicate findings
- Maintain surveillance

*Takes a Team!*
Outbreak Notification

Preliminary Report: Foodborne; Salmonella

Prepared by: Judy; Altman, Shana; erin.murray@illinois.gov; Austin; Conlee; Clark; Heidi; Ealy; Michelle; Wallbey; Kelly; McKinney, Jessica; Lane; Brandy; Lamb; Molly; Flores; Dawn; Hennings, David; Dow; Julie; Caselli, April; Haberman, Carolyn; Mitchell; Joe; Tiburi; Dennis; Chinn; Isaac

This item will expire in 29 days. To keep this item longer apply a different Retention Policy.

Preliminary Report Number: ORS-1177074

Note: The information contained in this report is preliminary and will most likely change after investigation of the outbreak.

Etiology Information:

<table>
<thead>
<tr>
<th>Etiology/Genus</th>
<th>Species</th>
<th>Serotype/Genotype</th>
<th>Capsid</th>
<th>Polymerase</th>
<th>Etiology Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salmonella</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reporting Health Department: Illinois Dept. of Public Health

First Onset Date: 08/15/2019

Total # Ill: 3

# Non-Staff Ill: 3

# Staff Ill: null

# Lab Confirmed: null

# Seen by Health Care Provider: null

# Exposed: null

# Hospitalized: null

# Fatalities: null
Outbreak Toolkit

Steps of an Epidemiologic Outbreak Investigation:

The following page provides general steps that local health department staff should take during a foodborne disease outbreak investigation. These steps do not necessarily have to be completed in this particular order since multiple steps may need to be completed simultaneously. Generally speaking, a successful investigation will incorporate the steps listed below.

The Illinois Department of Public Health Principles and Procedures for Investigating Suspected Outbreaks of Foodborne and Waterborne Illness contains the steps that should be completed in a foodborne or waterborne outbreak investigation in a more detailed format. Feel free to refer to it throughout the course of an investigation.

CDC Field Epidemiology Manual

If an outbreak is multi-jurisdictional, coordinate the investigation with other health departments. The jurisdiction where the food was prepared is typically the lead jurisdiction. If an outbreak involves a facility that is licensed by IDPH, the local health department CD section will lead the epidemiologic investigation, but the environmental investigation should be in coordination with the LHD and the IDPH licensing division. If the outbreak is in a facility licensed or regulated by another state agency or a federal agency, contact IDPH for guidance.

<table>
<thead>
<tr>
<th>Document Complaints</th>
<th>Establish the Existence</th>
<th>Describe the Outbreak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiate Environmental Investigation</td>
<td>Develop a Questionnaire</td>
<td>Establish Case Definitions</td>
</tr>
<tr>
<td>Collect and Submit Specimens</td>
<td>Implement Prevention/Control Measures</td>
<td>Collect and Analyze Data</td>
</tr>
</tbody>
</table>
What date and time did you first eat or drink anything at the event?

* must provide value

### SALADS & STARTERS
Did you taste, eat or drink any of the following items at the Brunch? (If you are not sure, answer if you would have LIKELY ate/drank the item.)

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BBQ Chicken Salad with Black Beans</td>
<td>Yes</td>
</tr>
<tr>
<td>Pasta Salad</td>
<td></td>
</tr>
<tr>
<td>Cataloupe</td>
<td></td>
</tr>
<tr>
<td>Honeydew</td>
<td></td>
</tr>
<tr>
<td>Grapes</td>
<td></td>
</tr>
<tr>
<td>Watermelon</td>
<td></td>
</tr>
<tr>
<td>Pineapple</td>
<td></td>
</tr>
<tr>
<td>Strawberries</td>
<td></td>
</tr>
<tr>
<td>Antipasto Bar - Ham</td>
<td></td>
</tr>
<tr>
<td>Antipasto Bar - Turkey</td>
<td></td>
</tr>
<tr>
<td>Antipasto Bar - Prime Rib</td>
<td></td>
</tr>
</tbody>
</table>

### Participant ID
91

### Questionnaire Type
NHGQ

### State Case Number
19-070118

### PulseNet ID Number
S19EN000315

### WGS ID
Begins with PINUSA

### WGS Allele Code

### Disease
Salmonellosis

### Serotype
Mbandaka

### PFGE Xba1 Pattern
TDRX01.0613

### PFGE Bln1 Pattern

### CDC Cluster Code
Foodborne Illness Complaints

During the initial phone call with complainant, collect the following:

• Date complaint received
• Complainant’s name and contact information
• Establishment name and address
• Date and time person(s) ate at establishment
• Date and time of illness onset
• Symptoms experienced by ill person(s), including diarrhea, vomiting, nausea, abdominal cramps, fever and duration
• Total number of persons reporting illness
• Of those reporting illness, number of households involved (determine if outbreak)
FBI Complaints cont.

• Of those reporting illness, any medical visits, hospitalizations, stool specimens collected and the name, address, and phone number of the providers who collected the specimens
• Total number of persons in the group, including those who did not become ill
• Contact information for all parties
• General food items eaten by ill and well
• Any food items available for testing – take food home?
• Any other common activities or meals shared during the three days prior to illness
• 72 hour food history
Step 1 – Call Received

• Mechanism for sharing: how does the LHD EH staff communicate complaint calls to the LHD CD staff?
  1. Log – electronic or paper
  2. Shared drive
  3. Smartsheet
  4. Database
  5. Email complaints
  6. Direct – in person or call
  7. Other
• **Who** is responsible for checking and determines outbreak?
• Is there a written SOP on communication method?
Step 2 - Plan

Suspected outbreak investigation meeting before restaurant visit

- Environmental health supervisor and Inspector assigned to that establishment
- LHD CD Division
- LHD Administrative Staff
Plan (continued)

• Review available Epi information:
  – Dates of onset
  – Incubation period
  – Likely exposure dates/meals
  – For commercial food products
    – exact product description
    and purchase dates
  – Anecdotal information

• Review food facility information
  – Existing regulatory records
  – Menus, recipes, product formulas

• Review suspected causative agent information
  – Reservoir (viral vs. bacterial)
  – Suspect food or staff
  – Mode of transmission
Plan (continued)

• Once information has been gathered internally, relay to IDPH CD Division for guidance and to receive an outbreak number to be used on all correspondence. FDD may be contacted for specific inspection guidance as well.

• After hours, the IDPH emergency officer can be notified at 1-800-782-7860
Step 3 – On Site Investigation

- Conduct within 24 hours.
- On-site investigation should be based on suspected food and biological agent
- Review establishment file and menu
- Gather routine inspection equipment
- Gather foodborne illness kit (inventory, check exp. dates of neutralizing solution, bring frozen ice chips/insul-ice)
- Inspection, Interview, Sample Collection Forms
- Camera for taking photos of food labels, invoices, other documentation/evidence
- If large outbreak, consider taking CD staff on the investigation
On Site Investigation (continued)

Traceback investigation includes the following:

- Label and package information
- Product name
- Package code/lot number
- Expiration/sell by/use by date
- Product size/weight
- Date of purchase
- Manufacturer name and address
- Distributor name and address (invoice information)
- All retail food establishments where purchased
- Whether or not food is an imported product
- Take samples of suspect foods
- Obtain copies of receipts/invoices from suppliers
- Food labels provide additional valuable information (copy info from label or take a picture)
FDD and Traceback

• Once traceback information has been gathered by the LHD EH, FDD takes over

• If it’s an Illinois manufactured food firm or warehouse, it’s our jurisdiction and we will contact directly

• If it’s outside of Illinois, or the Illinois firm gets their product from outside Illinois, we communicate with the FDA and/or other state agency who has jurisdiction
Challenges to Outbreak Investigations – Food Trace Backs

Tracing the Food Back to the Source

Restaurant Consumers

Home Consumers

Retailers

Suppliers/Distributors

Processors

Producers

IDPH
ILLINOIS DEPARTMENT OF PUBLIC HEALTH
Not a Routine Inspection

The inspector(s) will conduct an environmental assessment at the establishment.

- An environmental assessment is a science-based evaluation of environmental factors that contributed to transmission of a particular disease in an outbreak.
  - What happened and where?
  - What went wrong? (past)
  - How can we fix/control the problem? (present and future)
Inspector duties

During a site visit, the inspector will meet with the person in charge (PIC) to:

- Explain reason for the investigation
- Spell out steps that will be taken
- Conduct manager/employee interviews
- Observations of the operations (contributing factors)
- Sample collection
- Collection of records (menu, illness log, temperature logs)
- Put controls in place
Investigation Interview

• During an outbreak investigation, EH is responsible for conducting employee interviews and Epi is responsible for conducting patron interviews.

• Restaurant operators are required by law to provide requested employee information or contact information (e.g., credit card receipts) for their patrons.
On Site Investigation (continued)

- Interview manager about ill staff
- Interview food handlers who most likely prepared the suspect foods
- Look at their hands and face for cuts, burns, open wounds, etc.
- Recent food handler illnesses? Check time cards for dates of recent absence
- Are excluded employees off premises?
- Are restricted employees working? If so, what are their duties
- Collect staff schedule (current and past)
Employee interviews

• Can they refuse to participate?
  – Yes, but in order to protect public health we likely need to exclude them from work

• Can you interview employees that are under the age of 18 without speaking with their parents?
  – Yes, if calling the employee at home explain why you are calling to their parents but you do not need their permission to interview them
On Site Investigation (continued)

• Ensure adequate hand washing facilities (easily accessible, soap, hot/cold water)
• Check sanitizing concentrations and temps
• Are employees washing their hands when needed? Correctly?
• Municipal or private-water supply? Recent boil order?
Possible waterborne illness

• Has there been any recent sewer back-up or malfunction of the sewage treatment system?
• Has there been any recent repairs or changes to the water distribution system or the water well?
• Recent work, cleaning or malfunction of ice machine?
• Is there adequate protection to prevent back siphoning or back flow?
• Check that drains on ice machines, dishwashing sinks and beverage dispensing machines are connected according to the plumbing code
<table>
<thead>
<tr>
<th></th>
<th>Environmental Observations - On-site Investigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Inadequate/Improper hand washing</td>
</tr>
<tr>
<td>2.</td>
<td>Food employees have visible cuts, burns, or infected sores on hands/arms</td>
</tr>
<tr>
<td>3.</td>
<td>Bare-hand contact by a food worker who is suspected to be infectious</td>
</tr>
<tr>
<td>4.</td>
<td>Glove-hand contact by a food worker who is suspected to be infectious</td>
</tr>
<tr>
<td>5.</td>
<td>Food or water not from approved sources</td>
</tr>
<tr>
<td>6.</td>
<td>Inadequate protection of suspected food(s)/Improper food storage</td>
</tr>
<tr>
<td>7.</td>
<td>Insufficient cold holding time/temperature(s) of suspected food(s)</td>
</tr>
<tr>
<td>8.</td>
<td>Prolonged cold storage (more than 7 days) of suspected food(s)</td>
</tr>
<tr>
<td>9.</td>
<td>Improper thawing of suspected food(s)</td>
</tr>
<tr>
<td>10.</td>
<td>Insufficient cooking time/temperature(s) of suspected food(s)</td>
</tr>
<tr>
<td>11.</td>
<td>Insufficient cooling time/temperature(s) of suspected food(s)</td>
</tr>
<tr>
<td>12.</td>
<td>Insufficient reheating time/temperature(s) of suspected food(s)</td>
</tr>
<tr>
<td>13.</td>
<td>Insufficient hot holding time/temperature(s) of suspected food(s)</td>
</tr>
<tr>
<td>14.</td>
<td>Major equipment malfunctions or facility operations failures</td>
</tr>
<tr>
<td>15.</td>
<td>Calibrated food thermometer not available</td>
</tr>
<tr>
<td>16.</td>
<td>Cross-contamination of RTE foods with raw ingredients</td>
</tr>
<tr>
<td>17.</td>
<td>Cross-contamination of ingredients – Workers/Equipment/Utensils/Cloths</td>
</tr>
<tr>
<td>18.</td>
<td>Improper cleaning and sanitization of equipment/utensils/food contact surfaces</td>
</tr>
<tr>
<td>19.</td>
<td>Poisonous substance accidentally/inadvertently or intentionally/deliberately added</td>
</tr>
<tr>
<td>20.</td>
<td>Toxic container - Container that held suspected food(s) is made of toxic substances</td>
</tr>
<tr>
<td>21.</td>
<td>Addition of excessive quantities of ingredients that are toxic in large amounts</td>
</tr>
<tr>
<td>22.</td>
<td>Inadequate modified atmosphere packaging</td>
</tr>
<tr>
<td>23.</td>
<td>Inadequate processing (acidification, water activity, fermentation)</td>
</tr>
<tr>
<td>24.</td>
<td>Insufficient/Improper use of chemical processes designed for pathogen destruction</td>
</tr>
<tr>
<td>25.</td>
<td>Person in charge not assigned, knowledgeable, or performing duties/responsibilities</td>
</tr>
<tr>
<td>26.</td>
<td>Food employees not knowledgeable about food safety or employee health reporting</td>
</tr>
<tr>
<td>27.</td>
<td>Consumer advisory requirements not posted, if applicable</td>
</tr>
</tbody>
</table>
HACCP During Investigation

Identification of ingredients and steps
Review menu to identify the ingredients and steps involved in the receiving, storage, preparation and service of suspect food(s). Obtain recipes for all suspect food(s), identify ingredients, and collect source information. Pay close attention to potentially hazardous foods and high-risk preparation factors.

Identify critical control points
Identify critical control points and corrective actions to reduce potential hazards. Emphasis should be placed on contamination, survival, and growth/toxin production risks at these points.

Observe suspect food(s) through establishment
The inspector should observe the suspect food(s) and record the procedures conducted through the operation — from receipt of food from the delivery truck to consumption by the consumer. Observe personal hygiene also. Document how food(s) were handled, what equipment was used, and who handled the food(s) during each preparation step. A flow chart should be developed as a visual tool of the process.
Special Processes & HACCP

• Is HACCP plan required at this facility?
• Do they have written policies?
• Do they have any HACCP plans approved by the LHD?
• Do they have a separate area for special processes?
• Who takes temperatures? How often?
• Are employees knowledgeable about required temps?
• Are temperatures written down?
• If HACCP is implemented, review their plan and become familiar with their procedures (CCPs, corrective actions, non-compliance with HACCP plans)
• Ask for a copy of any of these documents
Food Sample Collection

• Only send food to the IDPH lab if directed to do so by FDD
• Collected as soon as possible after initial report is received, it’s better to collect and not need the sample than to regret not collecting later
• Store until identified possible food item(s) associated with illness
• Seek guidance from IDPH FDD or CD for which food items and how to collect/send and use proper forms labeled with the outbreak number, also Chain of Custody forms
• Consult with IDPH as soon as incubation and symptoms of the cases are known and begin to formulate a tentative hypothesis regarding the responsible agent. This helps us tell the lab what organism(s) to sample for.
Sample Collection

“You must use sterile containers and instruments to collect samples, using sterile techniques

In some situations even a compromised sample taken from an opened container may provide information to help identify the source of the outbreak.

Obtain the original commercial container if it is available even if it is in the trash. It can be used to identify microorganisms, toxins, and the lot code or processing code can be identified to provide info about place and time of processing.

“inspect at reasonable times and within reasonable limits, and in a reasonable manner... and to obtain samples necessary to the enforcement of this Act.” Illinois Food, Drug, and Cosmetic Act
410 ILCS 620/22
Environmental Samples (Swabs)

- You may be asked to collect environmental samples with swabs/SpongeSicle and media liquid (these are in the FBI outbreak sample collection kit with instructions) of food contact and non-food contact surfaces
- Take environmental samples early in the investigation (they’ll be cleaning later)
- Focus on hard-to-clean areas and clean in place equipment like slicers, mixers, large pans/bowls/cutting boards
- Chain of custody
If Hazard Exists

Immediately stop the outbreak:

- Communicate with supervisor and CD
- Hold or Embargo questionable food
- License Suspension
- Menu Limitation
- Identify and implement corrective interventions.
Step 4 - Communication

• When the environmental outbreak investigation has been completed, conduct another outbreak investigation team meeting to inform both LHD and IDPH CD

• Continue communicating frequently with IDPH CD as additional information about the outbreak becomes available

• Coordinate food and clinical lab testing

• Once results are received, a hypothesis will likely be developed
Communication (continued)

- Coordinate a unified response for public notification (phone calls, media interviews, etc.) using a Public Information Officer (PIO)
- Consider using Incident Command System from the beginning
Step 5 - Prevention

• To prevent future occurrences, revisit the establishment. Education and prevention measures should be discussed to ensure that the establishment serves food that is safe and prepared by healthy food handlers.

• **Long term strategies to prevent recurrence:**
  – HACCP
  – Risk Control Plans [“Mini-HACCP”]
  – Training
  – Menu/Supplier/Recipe Modifications
Prevention (continued)

Follow-up Environmental Assessment

• If a specific food item is identified as causing illness, the inspector will want to determine:
  ▪ Who prepared implicated food?
  ▪ What is their illness history?
  ▪ Food flow of implicated item?
  ▪ Likely or possible explanations for contamination, amplification, survival or other factors contributing to outbreak?
Step 6 - Report

• CD should send EH a draft of the outbreak investigation report for comments/edits and may need additional information from EH to complete the report

• Once finalized, it can be shared with the establishment
# Characteristics of Foodborne Pathogens

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Bacteria</th>
<th>Viruses</th>
<th>Parasites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause Infections</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Cause Intoxications</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Survive in environment</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Multiply in environment</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Multiply in host</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Multiply in food</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Form spores</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product toxins</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Form cysts</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Infections vs. Intoxications

<table>
<thead>
<tr>
<th></th>
<th>Infections</th>
<th>Intoxications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organism</strong></td>
<td>Bacteria, viruses, parasites</td>
<td>Toxin</td>
</tr>
<tr>
<td><strong>Mechanism</strong></td>
<td>Invade and multiply within the lining of intestines</td>
<td>No invasion or multiplication</td>
</tr>
<tr>
<td><strong>Incubation period</strong></td>
<td>Hours to day</td>
<td>Minutes to hours</td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
<td>Diarrhea, nausea, vomiting, abdominal cramps, fever (lack of fever in intoxications may aid investigation)</td>
<td>Vomiting, nausea, diarrhea, double vision, weakness, respiratory failure, numbness, sensory and motor dysfunction</td>
</tr>
<tr>
<td><strong>Transmission</strong></td>
<td>Can be spread person-to-person via the fecal-oral route</td>
<td>Not communicable</td>
</tr>
<tr>
<td><strong>Factors related to food contamination</strong></td>
<td>Inadequate cooking, cross-contamination, poor personal hygiene, bare hand contact</td>
<td>Improper holding temperatures</td>
</tr>
</tbody>
</table>
Often Transmitted by Infected Food Handlers

- Norovirus
- Hepatitis A virus
- *Salmonella Typhi*
- *Shigella spp.*
- *Staphylococcus aureus*
- *Streptococcus pyogenes*
Occasionally Transmitted by Infected Food Handlers

- Campylobacter jejuni
- Cryptosporidium parvum
- Entamoeba histolytica
- Enterohemorrhagic Escherichia coli
- Enterotoxigenic Escherichia coli
- Giardia lamblia
- Non-typhoidal Salmonella
- Taenia solium
- Vibrio cholerae
- Yersinia enterocolitica
Norovirus and Food Handlers

During 77% of norovirus outbreaks, food handlers reported illness around the time of the outbreak.

During 91% of norovirus outbreaks when testing was completed (54%), food handlers tested positive.

Confirmed restaurant outbreaks in Illinois, 2006-2012
Suspect Norovirus

- CD will interview customer cases
- EH will interview employees and manager
  - Current or recent GI illness?
  - Ill family members?
  - Try to interview before begin next shift
  - Job duties (especially on implicated date)
  - Exclusion based on current IDPH CD requirements
Suspect Norovirus

Checklist of areas to assess:

• Food worker illness
• Handwashing
• Bare hand contact with ready-to-eat foods
• Do ready-to-eat foods need to be discarded?
• Does establishment need to be closed?
• Cleaning/disinfection of all surfaces (chlorine)
• Cleaning of vomit/diarrheal events
Bacterial

Checklist of areas to assess

• Food worker illness, duties, meals at establishment
• Handwashing, bare-hand contact with ready-to-eat foods
• Undercooking of foods of animal origin
• Cross contamination from raw foods of animal origin
• Do ready-to-eat foods/ice need to be discarded?
• Cleaning/disinfection of surfaces, utensils
• Product information (e.g., invoices)
What Happens When a Foodborne Outbreak is Linked to a Restaurant?

• Local health department leads an investigation
• Epidemiologic investigation
  – Interviewing of patrons for foods consumed, date consumed, symptoms, date of onset
• Environmental/Food Investigation
  – Restaurant inspection
  – Invoices/receipts
  – Food/environmental sample samples
• Lab testing
Complexity of Salmonella in Restaurants

Why Close a Restaurant While the Foodborne Outbreak Investigation is Ongoing?

- Interviews of manager and food handlers
- Testing of food handlers x 2 may be needed
- Cleaning/disinfecting of facility
- Removal of any possibly contaminated food
- Education
- Completion of an epidemiologic study to determine source
- Typical recommendation…close restaurant with bacterial outbreaks unless risk is known to have passed
Number of Restaurant-associated Foodborne Outbreaks in Illinois by Year, 2006-2017

57% of outbreaks were restaurant-associated
Salmonella Outbreak

![Bar chart showing the number of cases before and after the recommendation to close the restaurant and the actual closure date.](chart.png)

- **Onset Date**
  - 10/15-10/21
  - 10/22-10/28
  - 10/29-11/4
  - 11/5-11/11
  - 11/12-11/18
  - 11/19-11/25
  - 11/26-12/2

- **Case Count**
  - Y-axis

- **Legend**
  - Orange bars: Cases after recommendation but before closure
  - Blue bars: Cases before recommendation

- **Key Events**
  - Restaurant actually closed, 11/23
  - Recommendation to close restaurant to LHD, 11/16

[Logo: Illinois Department of Public Health]
Food Worker Testing

• Coordinate with CD. If any indication that outbreak is not point source (specific food), or any indication of food worker illness, test everyone
  – Regardless of job duties
  – Regardless of illness status
  – Until 2 stool specimens collected 24-hrs apart test negative for *Salmonella*

• Exclude any food workers that report illness (current or recent)

• Exclude any food workers that test positive
Resources

• Council to Improve Foodborne Outbreak Response Toolkit has been developed to help public health use the CIFOR Guidelines to improve foodborne illness investigation response. (www.cifor.us)

• FDA ORAU has 10 web courses on foodborne illnesses and investigations. (www.compliancewire.com)

• IDPH web portal/Communities/Communicable Disease Control

• IDPH Principles and Procedures for Investigating Suspected Outbreaks of Foodborne and Waterborne Illness, 2004 (available on portal, under revision)
Sources for Presentation

- Foodborne Disease Outbreak Detection in Minnesota, Minnesota Department of Health (2015)
IDPH Retail Food Website Tools for Food Service Staff

http://www.dph.illinois.gov/topics-services/food-safety/retail-food

- Contains IL and FDA Food Codes
- Vomit and Diarrhea Clean Up Procedure Example (now required)
- New IL Inspection Report and how to read it (types of violations, focus on 1-29)
FDA Website Tools for Food Service

[www.fda.gov](http://www.fda.gov)

- Commercial Deli Slicers free posters in English and Spanish

[https://www.fda.gov/food/retail-food-industryregulatory-assistance-training/retail-food-protection-industry-educational-materials#posters](https://www.fda.gov/food/retail-food-industryregulatory-assistance-training/retail-food-protection-industry-educational-materials#posters)

- Oral Culture Learner posters in multiple languages

- Topics: bare hand contact, employee health, handwashing, cross-contamination, hot holding, proper cooling, cooking temperature chart, and date marking
NACCHO

http://toolbox.naccho.org

• Select Food Safety in the dropdown
• Topics: raw chicken handling, foodborne illness response, emergency handbook for food managers, Active Managerial Control, Job Aid for TCS Foods, foodborne illness-causing organisms, legal aspects, food defense, and more!
Outbreak Investigations
Cyclospora 2018

NUMBER OF REPORTED CYCLOSPORIASIS CASES – ILLINOIS, 2010-2018

- Domestically Acquired
- Travel Associated
- Unknown

2018 = 1242 cases
(87.0% domestically acquired)

5-year median = 18 cases
(55.6% domestically acquired)
Number of reported cyclosporiasis cases by first report date – Illinois, 2018

- 6/19 - Memo sent to HCPs
- 6/17 - Exceeded 2017 total
- 6/11 - 1st restaurant outbreak
- 6/2 - Exceeded 5 yr median
Number of reported cyclosporiasis cases by first report date – Illinois, 2018
Number of reported cyclosporiasis cases by first report date – Illinois, 2018

- 7/17: Outbreak at large event and Mexican restaurant reported
- 7/18: 115 cases reported
- 16 additional restaurant outbreaks identified
Public Health Response

• Identify outbreaks and contaminated ingredients
• Collect traceback information
• Identify source
• Remove product
• Notify public

<table>
<thead>
<tr>
<th>Total Cases Interviewed</th>
<th>CNHGQ + Salad</th>
<th>Country Club</th>
</tr>
</thead>
<tbody>
<tr>
<td>921</td>
<td>569</td>
<td>268</td>
</tr>
</tbody>
</table>
Norovirus – Country Club

- LHD received notification of illness related to events 04/19 and 04/20
- EH inspection; facility voluntarily closes
- LHD receives notification of illness related to 04/26
- Facility reopens
Public Health Response

- EH Inspection
- Multiple site visits
- Hand washing in-services
- Sign-in sheet declaring not ill
- Policy guidance
- Education
Salmonella Ohio

- Identified through routine interviews
- Meal dates two weeks apart
- Case findings
- EH inspection
- Environmental swabs and food collection
- Food handler testing – negative x 2
- Criteria to serve hot foods
Office Luncheon - Norovirus

- Multiple illnesses associated with a catered luncheon in an office with 200 staff.
- LHD gathered the menu from the luncheon.
- Restaurant inspection.
- Meal served over multiple days.
- IDPH developed a survey in REDCap.
- Over 100 responses within 1 hour!
Chili Cook-Off Outbreak

- October 7-8, 2016
- ~60,000 attendees
- >60 vendors
  - 50% fundraising for non-profit or charity
  - Sell more than chili
- **Salmonella** ser. Newport
- 22 cases (including 1 secondary case)
  - 3 hospitalized
- Press release to reach attendees
- REDCap on-line questionnaire on LHD website
- 100 surveys of ills and wells
Salmonella Schwarzengrund

• The IDPH lab notified CD of multiple cases of S. Schwarzengrund that were all geographically clustered.
• No commonalities were identified in the initial round of interviews.
• Additional cases identified in CO and OH as well as in other parts of the state.
• Cases were interviewed with a modified questionnaire to review original hypotheses.
S. Schwarzenberg Timeline
Overall Epi Information

- Confirmed Cases: 16
- Probable Cases: 19
- Onsets: 07/07-08/30
- Of ills identified, 30 reported eating at the implicated restaurant
- Hospitalized: 7
- Deaths: 1

- Cooked BBQ rib tips from restaurant tested positive for S. Schwarzengrund
Hepatitis A Outbreak

- 34 cases, 14 hospitalized
  - 5 counties and 1 other state
- June 11, 2009 – first case
  - Food handler
  - Reported June 26
  - Too late to prophylaxis other employees and patrons
- 2nd food handler from same restaurant
  - Reported in time for co-worker and patron prophylaxis - over 5000 patrons

Statewide Public Health Response to Hepatitis A Outbreak in Rock Island County

Illinois Public Health Mutual Aid System activated to assist with clinic

SPRINGFIELD, ILL. – Illinois Department of Public Health Director Dr. Damon T. Arnold today announced the activation of the Illinois Public Health Mutual Aid System (IPHMAS) to assist the Rock Island County Health Department (RICHID) with a vaccination clinic in response to a hepatitis A outbreak. A food service worker employed by the McDonald’s restaurant in Milan, Illinois and diagnosed with hepatitis A was reported to have worked during his/her infectious period and handled food items that were not subsequently cooked.

The Rock Island County Health Department, with assistance from IPHMAS and the Illinois Medical Emergency Response Team (IMERT) and the Illinois Nurse Volunteer Emergency Needs Team (INVENT), will hold clinics on Monday and Tuesday.

Clinics Scheduled for Hepatitis A Response

- When: Monday, July 20, and Tuesday, July 21, 2009
  - 10:00 am to 6:00 pm each day. Additional clinics will be held if needed.
- Where: Rock Island High School
  - 1400 25th Avenue, Rock Island, IL
- What: Hepatitis A vaccinations and immune globulin will be administered at no charge.
- Who: Eligible recipients are those with the following criteria:

  Consumed food or beverages at McDonald’s Restaurant in Milan, IL
  **** From July 6 through July 13 and July 16 and 24, 2009****
  Those eating on July 11 and 12 were not exposed

IDPH
Illinois Department of Public Health
Multi-state Clusters

- CDC conducts ongoing surveillance
- CDC identifies an increase in cases
- Notification to states
- Exposure information added to SEDRIC
- Additional questionnaires administered
Tracking Multistate Clusters

Multistate Clusters Tracked by Illinois DPH

- 2013: 90
- 2014: 80
- 2015: 90
- 2016: 70
- 2017: 60
E. coli O157:H7 Infections Linked to Romaine Lettuce (as of 6/28/2018)

- 210 people infected from 36 states
- 96 people hospitalized, including 27 who developed HUS and 5 deaths reported.
- Of 166 people interviewed, 145 (87%) reported eating romaine lettuce in week prior to illness.
- Most of ills ate romaine lettuce from the Yuma growing region
- Canal water tested positive
- Animal feeding operation suspect
*E. coli* O157:H7 Infections Linked to Romaine Lettuce
Produce Outbreaks

• Opportunities for contamination
  – Handling; irrigation water; fertilizer; grown near animals

• Shipping long distances

• Multiple sources mixed together

• Produce characteristics
  – Good growth medium; low salt; high sugar

• Importation

*E. coli* O157:H7 outbreak linked to romaine lettuce
• Over 200 cases
• More than 35 states
Kratom

- PH investigations utilized PulseNet to identify increase in cases of *Salmonella* I 4,[5],12:b:-.
- Kratom is a plant consumed for its stimulant effects and as an opioid substitute.
- PulseNet utilized to identify additional cases.
- Eighty-five different DNA fingerprint of Salmonella bacteria were identified in Kratom products.
Kratom

- 199 people infected from 41 states.
- 38% of ill people were hospitalized.
- 74% of those interviewed reported consuming Kratom.
- Outbreak investigation is over, but there may still be some Kratom products that may still be available.
- Those at severe risk should avoid using Kratom products.
O157:H7 Infections Linked to I.M. Healthy Brand SoyNut Butter

- PH investigators utilized PulseNet to identify an increase in O157:H7 cases with the same PFGE pattern.
- Illness onsets ranged from January 4, 2017 through April 18, 2017.
- Ill people ranged from 1 to 70 years, with a median age of 9.
- 81% of cases were under 18 years of age.
O157:H7 Infections Linked to I.M. Healthy Brand SoyNut Butter

People infected with the outbreak strains of *E. coli* O157:H7, by state of residence, as of May 2, 2017 (n=32)
O157:H7 Infections Linked to I.M. Healthy Brand SoyNut Butter

• Twenty-five (78%) of the 32 cases reached for interview reported exposure to I.M. Healthy SoyNut Butter.
• Lab testing identified STEC O157:H7 in opened containers of I.M. Healthy SoyNut Butter.
• WGS showed that the STEC O157:H7 from the product containers was highly related to isolates from ill people.
• Epi, lab and traceback evidence indicated that I.M. Healthy brand SoyNut butter was the likely source of the outbreak.
Listeria – Caramel Apples

• In December 2017, PulseNet identified a cluster of three *Listeria monocytogenes* clinical isolates that shared the same PFGE pattern combination and were highly related by WGS.
• Isolation dates ranged from 10/15/17-10/27/17.
• Patients ranged in age from 55-71 years with a median age of 69 years. All patients were male.
• All three patients were hospitalized and no deaths were reported.
• All three patients reported consuming caramel apples prior to illness onset.
• One IL retail location had caramel apples in stock so samples were tested which were negative.
Challenges to Investigating Listeria Outbreaks

- Few cases in each cluster
- Long questionnaires
- Long incubation periods
- Food recall is poor
- Ages of some of the cases
- Variety of foods implicated including raw milk, soft cheeses, cantaloupe, ice cream.
Multi-drug Resistant Salmonella

- Public health concern
- Associated with more severe illness
- All animals carry bacteria
- Resistant bacteria can contaminate food from the animals
- Resistant bacteria in food can cause infections in humans
- National Antimicrobial Monitoring System (NARMS)
S. Heidelberg Outbreak

- 56 cases from 15 states
- 35% of people were hospitalized. No deaths reported.
- Epidemiologic, laboratory, and traceback investigations linked ill people in this outbreak to contact with calves
- Antibiotic resistance testing on clinical isolates shows that isolates were resistant to multiple antibiotics.
- Cattle can carry Salmonella and not appear sick
TEAMWORK makes the dream work
THANK YOU

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