Foodborne and Waterborne Outbreaks: It’s not just Salmonella, E.coli and Legionella!

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Outline

• Background
  – Foodborne Disease Estimates
  – Outbreak Investigation
    • Complaint Driven
    • Laboratory Driven
  – Outbreak Investigation Examples
    • Guess that pathogen!
  – Resources
    • Centers of Excellence (CoE)
    • CIFOR Outbreaks of Unknown Etiology (OUE)

• Questions
Each year roughly
- 48 million illnesses
- 128,000 hospitalizations
- 3,000 deaths

Causes of Foodborne Illness

• Many different disease causing germs can contaminate food
• More than 250 foodborne diseases exist
• Most foodborne diseases are caused by a variety of:
  – Bacteria
  – Viruses
  – Parasites
• Other causes of foodborne illness:
  – Harmful toxins
  – Chemicals

Source: https://www.cdc.gov/foodsafety/foodborne-germs.html
Common Foodborne Pathogens

- **Top five:**
  - Norovirus
  - Salmonella
  - Clostridium perfringens
  - Campylobacter
  - Staphylococcus aureus

- **Foodborne illnesses → hospitalization:**
  - Clostridium botulinum
  - Listeria
  - Escherichia coli (E. coli)
  - Vibrio

Source: https://www.cdc.gov/foodsafety/foodborne-germs.html
Three-Legged Stool of Investigations

- Environmental Health
  - Visit and conduct evaluation at site
  - Review food prep procedures
  - Conduct staff interviews
  - Collect food & environmental samples
  - Interventions
- Epidemiology
  - Establish case definition
  - Design questionnaire and conduct ill & well interviews
  - Calculate food specific Attack Rate (AR)
  - Epi curves
  - Stool samples
- Laboratory
  - Sample analysis
  - PFGE matching
  - WGS

Communication is Key
What is an Outbreak?

• A foodborne outbreak is defined as the occurrence of two or more cases of a similar illness resulting from the ingestion of a common food in the United States.
  – Before 1992, three exceptions existed to this definition; only one case of botulism, marine toxin intoxication, or chemical intoxication was required to constitute an FBDO if the etiology was confirmed. The definition was changed in 1992 to require two or more cases to constitute an outbreak.
Complaint Driven Foodborne Illness Outbreak Communication

- Local Health Department (LHD)
- Environmental Health (EH)
- Communicable Disease (CD)
- New York State Department of Environmental Conservation (NYSDEC)
- New York State Department of Agriculture and Markets (NYSDAM)
- United States Department of Agriculture (USDA)
- Food and Drug Administration (FDA)
- Centers for Disease Control and Prevention (CDC)

Lab Driven Foodborne Illness Outbreak Communication
Guess That Pathogen?
Example 1: July 2008

- 6 adult family members admitted to a hospital emergency department
Example 1: July 2008

- 6 family members shared a meal of homemade stew and bread
- Another family member arrived 1 hour later and found
  - 6 family members
    - Laughing
    - Confused
    - Hallucinating
    - Dizziness
    - Thirsty
    - Vomiting (1)
Example 1: July 2008

- 6 people sick
- 3 Male 3 Female
- Age from 38 to 80 years (Median 42 years)
- Incubation period ~ 1 hour
- Sx: Laughing, Confused, Hallucinating, Dizziness, Thirsty, Vomiting (1)
- At the Emergency Department
  - 2/6 were unconscious
  - 4/6 had altered mental status
  - 5/6 had tachycardia and dilated, sluggishly reactive pupils
  - Temperatures ranged from 98.0°F (36.7°C) to 99.4°F (37.4°C)
  - Respirations ranged from 17 to 22 breaths per minute
- Review of food preparation could not be completed
Example 1: July 2008

• During the next 6 hours in the emergency department the six patients continued to experience:
  – Tachycardia, mydriasis, and altered mental status
  – 1/6 remained unconscious
  – 5/6 demonstrated confusion, aggression, agitation, disorganized speech, incoherence, and hallucinations
  – 6/6 were admitted to the hospital
  – 5/6 went to the intensive-care unit
Example 1: July 2008

- What did they eat?
  - Stew
    - Potatoes
    - Garlic
    - Onion
    - Tomato
    - Curry powder
  - Leaves from two plants grown in the yard:
    - One plant was confirmed to be mint
    - The meal preparer did not know what the other plant was, only that it grew wild in the yard.
Poll Question #1

1. What got them sick?

A. Scombrototoxin  
B. Ciguatera toxin  
C. Anticholinergic poisoning  
D. My Wife’s Cooking
Poll Question #1

1. What got them sick?

   C. Anticholinergic poisoning

CDC MMWR: Jimsonweed Poisoning Associated with a Homemade Stew --- Maryland, 2008
February 5, 2010 / 59(04);102-104

Source: https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5904a3.htm
Example 2: May 2012

- Taiwan National Buddha’s Birthday Celebration
- Celebrated second Sunday of May
- Approximately 700 people attended
  - Approximately 500 arrived on multiple chartered buses
  - Several arrived using personal vehicles
Example 2: May 2012
Example 2: May 2012
Example 2: May 2012

What happened at the Monastery?

- Food festival was held, over 15 vendors
- Not licensed food vendors
- Vending booths reportedly set up in parking lot
- Food transported in cars from hundreds of miles, no temperature control
- Very small kitchen at Monastery, food not reheated properly
- Ill people vomited:
  - On the bus
  - At shopping center
  - Pulled over on the side of the road
Example 2: May 2012

Summary

• 56 cases interviewed
• 56 reported vomiting
• 28 reported diarrhea
• Incubation period 1-2 hours
• Approximately 40 attendees went to Emergency Departments in two States outside of New York and 5 different counties within New York
• Sticky Rice had Relative Risk (RR) = 6.47
• No left over food
Example 2: May 2012

Summary

• 5 primary specimens obtained
  • 4 fecal, 1 vomitus
• 11 food items collected
Poll Question #2

2. What got them sick?

A. *Salmonella*
B. *Staphylococcus* Enterotoxin
C. Scombrototoxin
D. My Wife’s Cooking
Poll Question #2

2. What got them sick?

B. *Staphylococcus* Enterotoxin
Example 3: May 2002

- Emergency personnel called to a household
  - 5 adults of Middle Eastern descent
  - 60% Male, 40% Female
  - Age range: 29-60, Median 43
  - Symptoms
    - Dizziness, lightheadedness, cyanosis, vomiting (2),
    - 1 female unresponsive
  - 1 asymptomatic male did not eat meal
Example 3: May 2002

- En route to hospital
  - 2 women
    - Respiratory distress, loss of consciousness and intubated
  - 1 woman
    - Seizures
  - All 5
    - Cyanotic and had oxygen saturation levels of 72%--96% (normal: >92%)
    - Blood drawn for routine testing was described as "black colored"
Example 3: May 2002

What did they eat?

- Implicated meal consisted of meat, rice, and vegetables
- Meat was purchased on May 15, 2002, from a national discount food warehouse
- Meat was boiled in water
  - A white crystalline substance from a plastic bag labeled "Refined Iodized Table Salt" in both English and Arabic was added
  - Herbs were added to the water, which was subsequently used to make the rice and vegetables
- Herbs, the product labeled as salt, spices found in the kitchen and samples of the remaining uncooked meat, were submitted for testing.
Poll Question #3

3. What got them sick?

A. *E. coli*
B. *Campylobacter*
C. Sodium nitrite poisoning
D. My Wife’s Cooking
Poll Question #3

3. What got them sick?

C. Sodium nitrite poisoning

CDC MMWR: Methemoglobinemia Following Unintentional Ingestion of Sodium Nitrite --- New York, 2002 - July 26, 2002 / 51(29);639-642

Source: https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5129a2.htm
Resources

• Integrated Food Safety Centers of Excellence (CoE)
  – Funding provided by the Food Safety Modernization Act (FSMA)
  – 6 Centers across the United States
  – Mission is to provide tools and resources to assist other state and local public health professionals

Source: https://www.cdc.gov/foodsafety/centers/sites/index.html
Resources

• Council to Improve Foodborne Outbreak Response (CIFOR)
  – Multidisciplinary collaboration of national associations and federal agencies working together since 2006 to improve methods to detect, investigate, control and prevent foodborne disease outbreaks
  – Council member representatives include expertise in epidemiology, environmental health, public health laboratory and food regulation at the local, state and federal levels.
  – Vision
    • Local, state and federal partners collaborating effectively to reduce the burden of foodborne illness in the United States
  – Mission
    • To improve methods at the local, state, and federal levels to detect, investigate, control, and prevent foodborne disease outbreaks.

Source: https://cifor.us/about
Resources

• CIFOR - Outbreaks of Undetermined Etiology (OUE) Guidelines
  – The OUE Guidelines cover both infectious and non-infectious agents
  – A companion OUE Agent List provides detailed information on each agent including incubation period, primary signs and symptoms, primary specimen(s) and key epidemiological information
  – CIFOR OUE Guidelines Work Group and the Oregon Department of Health developed an application-based, interactive version of the OUE Guidelines
  – Who should use it:
    • The OUE Guidelines are primarily intended for state health departments making recommendations on specimen collection and conducting testing for foodborne outbreaks.
    • iPad user version
    • Windows PC users

Source: https://cifor.us/clearinghouse/cifor-oue-guidelines
Resources

Source: https://cifor.us/clearinghouse/cifor-oue-guidelines
Resources

CIFOR OUE Specimen Collection
Shipment and Retention Guidelines

Key Feature: DIARRHEA

Additional collection (beyond Cary Blair and raw stool):
Blood culture bottle or obtain blood culture information from the primary provider; serum (red top tube)

Temporary storage
2-8°C

Supplementary laboratory processes
Extracted nucleic acids

Long-term storage
5 - 20°C

Additional shipping considerations
Potentially Category A agents, UN2914, only if shipped as cultures.*

*Category A agents: when shipped as cultures, include Bacillus anthracis; Brucella abortus, suis, melitensis, and canis; Coxiella burnetii; Clostridium botulinum; Escherichia coli; Salmonella enterica; Staphylococcus aureus; Yersinia pestis

Unless otherwise noted, all specimens/ samples should be shipped according to Category B requirements outlined in the Department of Transportation Transporting Infectious Substances Safety guidelines.


1) Have the cases had any exposure to seafood and/or brackish water 12-72 hours before onset of illness?
2) Have any cases traveled outside the U.S. in the two weeks prior to illness onset?

Source: https://cifor.us/clearinghouse/cifor-oue-guidelines
Example 4: November 2016

- 24 people attend Thanksgiving Dinner
- 4 people develop coughing while eating
  - 75% Male
  - 25% Female
  - Age range (25 – 55), Median 40
  - 2/4 coughed up a feather
Poll Question #4

4. What caused this?

A. My Wife’s Cooking
B. My Wife’s Cooking
C. My Wife’s Cooking
D. My Wife’s Cooking
E. My Wife Better Not See This Presentation
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• CDC

• FDA

• CIFOR
Questions?

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