Multistate Listeriosis Outbreak Associated with Soft Cheese, The Power of Specific Exposure Ascertainment

Carlota Medus, PhD, MPH
Foodborne Diseases Unit
Minnesota Department of Health
Minnesota At A Glance

- **Number of Counties**: 87
- **2012 Pop.**: 5.4 million
- **7-county metro-area**: 2.9 million
Surveillance activities are centralized, including PFGE cluster detection/investigation.

Epi outbreak investigations are mostly centralized.
FOODBORNE AND WATERBORNE DISEASES

Botulism (*Clostridium botulinum*)

Campylobacteriosis (*Campylobacter sp.*)*

Cholera (*Vibrio cholerae*)*

Cryptosporidiosis (*Cryptosporidium sp.*)

Enteric *Escherichia coli* infection (*E. coli* O157:H7 and other pathogenic *E. coli* from gastrointestinal infections)*

Giardiasis (*Giardia lamblia*)

Hemolytic uremic syndrome

Listeriosis (*Listeria monocytogenes*)*

Salmonellosis, including typhoid (*Salmonella sp.*)*

Shigellosis (*Shigella sp.*)*

Toxoplasmosis

Yersiniosis (*Yersinia sp.*)*

*Submit clinical specimens to the Minnesota Department of Health
Minnesota Approach to Investigation of PFGE Clusters:
Dynamic Cluster Investigation Model

Case #1 ↔ Case #2 ↔ Case #3 ↔ Case #4
Diseases Reportable to the Minnesota Department of Health

FOODBORNE AND WATERBORNE DISEASES

Botulism (*Clostridium botulinum*)

Campylobacteriosis (*Campylobacter* sp.)*

Cholera (*Vibrio cholerae)*

Cryptosporidiosis (*Cryptosporidium* sp.)

Enteric *Escherichia coli* infection (*E. coli* O157:H7 and other pathogenic *E. coli* from gastrointestinal infections)*

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Shigellosis (*Shigella* sp.)*

Toxoplasmosis

Yersiniosis (*Yersinia* sp.)*

*Submit clinical specimens to the Minnesota Department of Health
Routine Follow-up of Reported Cases

Listeria Case Form

CASE-PATIENT INTERVIEW

Date of interview (mm/dd/yyyy): 01/19/13
Interviewee: [X] Case-patient [ ] Surrogate [ ] Unknown

If surrogate, relationship to patient: [ ] Parent [ ] Child [ ] Sibling [ ] Spouse [ ] Other, Specify

When did your illness begin? (Onset of illness) (mm/dd/yyyy): 01/15/13 [ ] Not applicable (e.g. postoperative)

During the 4 weeks before your illness (delivery date), were you admitted to a hospital (overnight)? [ ] Yes [ ] No
During the 4 weeks before your illness (delivery date), were you a resident in a nursing home or other long term care facility?
If yes, Date of admission (mm/dd/yyyy) [ ] [ ]
Date of discharge (mm/dd/yyyy) [ ] [ ]

During the 4 weeks before your illness (delivery date), did you travel to a state outside your state of residence?
[ ] Yes [ ] No [ ] Unknown

Reason completing case report (initials): [ ]

Source of specimen: BLOOD

Isolated Bacteria LISTERIA MONOCYTOGENES

If specimen collection date is not available, date received in laboratory (mo/day/yr): 06/13/2013

Onset Date: 01/15/13
Routine Follow-up of Reported Cases

10) Source of specimen: BLOOD

11) Isolated Bacteria: LISTERIA MONOCYTOGENES

12) If specimen collection date is not available, date received in laboratory (mm/dd/yr): 06/20/2013

A. Hospital Follow-up:

13) Patient status at the time of specimen collection: ☒ Hospitalized □ Outpatient □ Unknown

B. Health Care:

14) If positive, date of exposure (mm/dd/yr): ____________________________

15) If positive, date of onset (mm/dd/yr): ____________________________

16) Onset date of illness:

17) If applicable, enter laboratory information:

C. Case Investigation:

18) Case entered during audit?: ☒ Yes □ No □ Unknown

19) Case in the case-control study?: ☒ Yes □ No □ Unknown

19a) If no, reason not in case-control study:

20) Is case report complete?: ☒ Yes □ No □ Unknown

21) If yes, date case report completed (mm/dd/yr): 06/25/13

21a) If yes, date case report completed (mm/dd/yr): 06/25/13

21b) Person completing case report (initials): TAW

21c) Person entering case report (initials): TAW
Outbreak Detection

June 27, 2013

- Minnesota Department of Health (MDH)
  - Invasive listeriosis
  - Two Minnesota residents
    - Isolates indistinguishable by two-enzyme pulsed-field gel electrophoresis (PFGE)

![PFGE Image]

<table>
<thead>
<tr>
<th>PFGE-Ascl</th>
<th>PFGE-Apal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MN #1
MN #2
Invasive Listeriosis

• Populations at increased risk
  – Pregnant women
  – Older adults
  – Immunocompromised persons

• Manifestations include meningitis, septicemia, fetal loss

• Incubation period: 3–70 days

• Case fatality rate: 20–30%

• In MN, median number of cases: 7 per year (range, 3 to 19); 12 cases in 2013
Outbreak Investigation

MDH reports cluster

27
10:04

June 2013
Outbreak Investigation

MDH reports cluster

PulseNet Query

10:04

27

1:00p

June 2013
### Cases by Week of Illness Onset (N=5)

<table>
<thead>
<tr>
<th>No. of Cases</th>
<th>May</th>
<th>June</th>
<th>July</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>IN</td>
<td>MN</td>
<td>MN</td>
</tr>
<tr>
<td>2</td>
<td>IL</td>
<td>MN</td>
<td>OH</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Case Characteristics (N=5)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median age, years (range)</td>
<td>55 (31–67)</td>
</tr>
<tr>
<td>Female</td>
<td>4 (80%)</td>
</tr>
<tr>
<td>Pregnant, miscarriage</td>
<td>1</td>
</tr>
<tr>
<td>Hospitalized</td>
<td>5</td>
</tr>
<tr>
<td>Died</td>
<td>1 (Stage IV lung cancer)</td>
</tr>
</tbody>
</table>
Outbreak Investigation

MDH reports cluster

PulseNet Query

Listeria Initiative questionnaire analysis

10:04 1:00p 2:57p

June 2013

27
# Analysis of *Listeria* Initiative Questionnaires

<table>
<thead>
<tr>
<th>State</th>
<th>Food Item</th>
<th>Point of Purchase</th>
</tr>
</thead>
<tbody>
<tr>
<td>IL</td>
<td>Brie, cottage cheese, mozzarella</td>
<td>Grocery store</td>
</tr>
<tr>
<td>IN</td>
<td>Havarti, Brie, blue cheese</td>
<td>Grocery store, IN restaurant</td>
</tr>
<tr>
<td>MN 1</td>
<td>blue cheese</td>
<td>Grocery store</td>
</tr>
<tr>
<td>MN 2</td>
<td>Brie, goat cheese</td>
<td>Grocery store, ND restaurant</td>
</tr>
<tr>
<td>OH</td>
<td>Feta, queso fresco, cottage cheese, mozzarella, cream cheese, goat cheese</td>
<td>Grocery store</td>
</tr>
</tbody>
</table>
Case-Case Analysis of *Listeria* Initiative Questionnaires

- Cases associated with this cluster compared to sporadic cases reported to the *Listeria* Initiative from 2004 to 2013
  - Association with soft cheese consumption
    - OR=10.8 (1.8 - ∞)

- All patients were re-interviewed using a supplemental cheese questionnaire
Outbreak Investigation

June 2013

MDH reports cluster

PulseNet Query

LI questionnaire analysis

Supplemental questionnaire MN 1

Supplemental questionnaire MN 2

Supplemental questionnaire IL

Reviewed LI questionnaire IN

10:04 1:00p 2:57p 2:27p 3:00p 4:10p 5:50p

June 2013
# Cheese Exposure Ascertainment

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<tr>
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<th>Retail Location</th>
<th>Type of Cheese</th>
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<tbody>
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<td>MN 1</td>
<td>MN grocer A, location X</td>
<td>Blue Cheese</td>
</tr>
<tr>
<td>MN 2</td>
<td>Cheese plate served at ND restaurant</td>
<td>Manchester, Gruyere, cheddar cheese, blue cheese, Company A Les Frères</td>
</tr>
</tbody>
</table>
Cheese Exposure Ascertainment
Restaurant Cheese Tray

- Permission from ND Department of Health
- Called ND restaurant
  - List of cheeses served
  - Rotation of cheeses (how long each cheese lasted at the restaurant)
  - Invoices for cheeses on the cheese tray
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<tr>
<td>IN</td>
<td>Cheese plate served at IN restaurant</td>
<td>Stilton, Taleggio, goat cheese, Manchego, Triple Cream, Company A Les Frères</td>
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## Cheese Exposure Ascertainment

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Outbreak Investigation

- MDH reports cluster
- PulseNet Query
- LI questionnaire analysis
- Supplemental questionnaire MN 1
- Supplemental questionnaire MN 2
- Reviewed LI questionnaire IN
- Additional matching isolates

June 2013

Food/Environmental Isolate (55)

- **Food/Environmental Isolate**
- **Food/Environmental Isolate, Company A (29)**

![Graph showing the number of isolates by year from 1998 to 2013. The y-axis represents the number of isolates, and the x-axis represents the year of isolate collection. The graph highlights spikes in the number of isolates in specific years.](image-url)
Company A

- Family owned dairy farm and creamery
- Located in Wisconsin
- Produces 5 varieties of cheese made from pasteurized milk:
  - Petit Frère
  - Petit Frère with Truffles
  - Les Frères
  - Mozzarella
  - Mascarpone
Outbreak Investigation

MN2, IL, IN linked to Company A cheese

MDH reports cluster

Cheese samples submitted for testing

27 28 29 30 1
June  July
Outbreak Investigation

MN2, IL, IN linked to Company A cheese

MDH reports cluster

Cheese samples submitted for testing

Supplemental questionnaire OH

27 June
28 June
29 June
30 June
1 July
3 July
## Supplemental Cheese Questionnaire

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</tr>
<tr>
<td>OH</td>
<td>Cheese plate served in OH restaurant</td>
<td>Company A Les Frères</td>
</tr>
</tbody>
</table>
Outbreak Investigation

MN2, IL, IN linked to Company A cheese

MDH reports cluster

Cheese samples submitted for testing

Supplemental questionnaire OH

Food testing results

June 27

June 28

June 29

June 30

July 1

July 3
Results Cheese Testing
(Enzyme-linked Immunoassay)

July 3

• 14 retail cheese samples submitted for testing
• 3 samples were positive for *L. monocytogenes*
  - 1 wedge of Petite Frère with Truffles, Grocer A location X
  - 2 wedges of Les Frères, Grocer A location Y
Product Distribution Chain

MN Case
- Restaurant (ND)
  - Distributor A

IN Case
- Restaurant (IN)
  - Supplier

OH Case
- Restaurant (OH)
  - Distributor B

MN Case
- Grocer National
  - Distributor C

Company A
Outbreak Investigation

MN2, IL, IN linked to Company A cheese

MDH reports cluster

June 27

June 28

June 29

June 30

July 1

July 3

Cheese samples submitted for testing

Supplemental questionnaire OH

Positive cheese samples

PRESS RELEASE AND RECALL
Press Release and Recall

July 3

- MDH/MDA issued a joint press release warning consumers not to eat Company A Les Frères, Petit Frère, Petit Frère with Truffles
- Company A issued a voluntary nationwide recall of Les Frères, Petit Frère, Petit Frère with Truffles
- Inspection of the cheese-making facility revealed substantial sanitary deficiencies
  - Led to *Listeria* contamination during the cheese-making process
“I Think We Bought the Petit Frère with Truffles”

July 6

• MDH received a call from the proxy of the deceased MN case
  – “I think we bought the Petit Frère with Truffles at the same time we bought the blue cheese”
  – Purchased cheese with credit card

• Contacted MN Grocer A
  – Credit card transaction numbers
  – Date of transactions
  – Amount of transactions
# Credit Card Statement

<table>
<thead>
<tr>
<th>Trans Date</th>
<th>Post Date</th>
<th>Card Reference Number</th>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>03/05</td>
<td></td>
<td>5542950EHRP1N5BY8M</td>
<td></td>
<td>$100.00</td>
</tr>
<tr>
<td>03/11</td>
<td></td>
<td>7541823EN0681BAJXM</td>
<td></td>
<td>$75.50</td>
</tr>
<tr>
<td>03/12</td>
<td></td>
<td>5541734ERTAXGHAYVM</td>
<td></td>
<td>$8.60</td>
</tr>
<tr>
<td>03/12</td>
<td></td>
<td>1 DLX</td>
<td></td>
<td>$24.00</td>
</tr>
<tr>
<td>03/05/02</td>
<td></td>
<td>5541734ERTAXGHJ1YM</td>
<td></td>
<td>$29.00</td>
</tr>
<tr>
<td>14/03/12</td>
<td></td>
<td>1 DL V</td>
<td></td>
<td>$310.00</td>
</tr>
<tr>
<td>03/22</td>
<td></td>
<td>5548077F161AMH6QGM</td>
<td></td>
<td>$362.75</td>
</tr>
<tr>
<td>03/24</td>
<td></td>
<td>5548077F30374WWYDM</td>
<td></td>
<td>$77.62</td>
</tr>
<tr>
<td>03/28</td>
<td></td>
<td>7541823F706B05BEAM</td>
<td></td>
<td>$38.74</td>
</tr>
<tr>
<td>03/29</td>
<td></td>
<td>0541019F92LR7T9PMJ</td>
<td></td>
<td>$139.03</td>
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<tr>
<td>03/29</td>
<td></td>
<td>5550036F900YNEB6LM</td>
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<td>$28.59</td>
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<tr>
<td>03/29</td>
<td></td>
<td>5531658F9MH8Q6J08M</td>
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<td>$35.76</td>
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<tr>
<td>03/30</td>
<td></td>
<td>8534914FAWGNGR886M</td>
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<td>$55.96</td>
</tr>
<tr>
<td>04/01</td>
<td></td>
<td>2524780FB00GF2QWM</td>
<td></td>
<td>$75.50</td>
</tr>
<tr>
<td>Category</td>
<td>Item</td>
<td>Quantity</td>
<td>Price per Unit</td>
<td>Total</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------------</td>
<td>----------</td>
<td>----------------</td>
<td>---------</td>
</tr>
<tr>
<td>Bakery FS</td>
<td>Baguette Demi</td>
<td>1</td>
<td>$1.25</td>
<td>$1.25</td>
</tr>
<tr>
<td>Grocery</td>
<td>Taylors Tea</td>
<td>1</td>
<td>$4.79</td>
<td>$4.79</td>
</tr>
<tr>
<td>Imported Cheese</td>
<td>Cashel Blue</td>
<td>0.40 lb</td>
<td>$22.99/lb</td>
<td>$9.20</td>
</tr>
<tr>
<td></td>
<td>Les Freres</td>
<td>0.39 lb</td>
<td>$15.99/lb</td>
<td>$6.24</td>
</tr>
</tbody>
</table>
# Supplemental Cheese Questionnaire

<table>
<thead>
<tr>
<th>State</th>
<th>Retail Location</th>
<th>Type of Cheese</th>
</tr>
</thead>
<tbody>
<tr>
<td>MN 1</td>
<td>MN grocer A, location X</td>
<td>Blue Cheese, <strong>Company A Les Frères</strong></td>
</tr>
<tr>
<td>MN 2</td>
<td>Cheese plate served at ND restaurant</td>
<td>Manchester, Gruyere, cheddar cheese, blue cheese, <strong>Company A Les Frères</strong></td>
</tr>
<tr>
<td>IL</td>
<td>Chain grocer</td>
<td><strong>Company A Les Frères</strong></td>
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<tr>
<td>IN</td>
<td>Cheese plate served at IN restaurant</td>
<td>Stilton, Taleggio, goat cheese, Manchego, Triple Cream, <strong>Company A Les Frères</strong></td>
</tr>
<tr>
<td>OH</td>
<td>Cheese plate served in OH restaurant</td>
<td><strong>Company A Les Frères</strong></td>
</tr>
</tbody>
</table>
July 7, PFGE Testing Results — Les Frères

MN Patient 1
MN Patient 2
Petit Frère with Truffles
Les Frères
Conclusion and Discussion

- Multistate outbreak of listeriosis linked to pasteurized soft cheeses that were likely contaminated during or after the cheese-making process
  - Pasteurization eliminates *Listeria* in milk
  - *Listeria* contamination can occur after pasteurization
- Using credit/debit card information to retrieve itemized receipts from grocers can be a useful tool in the absence of shopper loyalty cards
Conclusion and Discussion

Thorough exposure ascertainment was key to solving this outbreak quickly, and to actually solving it!

• Interviewing cases and case’s proxy promptly
• Calling cases back for more information
• Aggressively pursuing leads on exposures from other sources
  • Cheese plate details from restaurant
  • Store receipt from credit card information
Conclusion and Discussion

• Solved with very few cases
• Did not wait for CDC to determine if the number of cases was “above baseline”
• Following leads even when each jurisdiction only had 1 or 2 cases
• Did not rely on cases’ memory alone
• Team work
Notes from the Field: Multistate Outbreak of Listerialis Linked to Soft-Ripened Cheese — United States, 2013

Weekly
April 4, 2014 / 63(13);294–295

Mary J. Choi, MD1,2, Kelly A. Jackson, MPH3, Carlota Medus, PhD1, Jennifer Beal, MPH4, Carrie E. Rigdon, PhD5, Tami C. Cloyd, DVM4, Matthew J. Forstner5, Jill Ball6, Stacy Bosch, DVM3, Lyndsay Botticchio, MPH7, Venessa Cantu, MPH8, David C. Melka9, Wilette Ishow10, Sarah Slett8, MS11, Kari Irvin, MS4, Matthew Wise, PhD3, Cheryl Tarr, PhD3, Barbara Mahon, MD3, Kirk E. Smith, DVM, PhD1, Benjamin J. Silk, PhD3 (Author affiliations at end of text)

On June 27, 2013, the Minnesota Department of Health notified CDC of two patients with invasive *Listeria monocytogenes* infections (listeriosis) whose clinical isolates had indistinguishable pulsed-field gel electrophoresis (PFGE) patterns. A query of PulseNet, the national molecular subtyping network for foodborne disease surveillance, identified clinical and environmental isolates from other states. On June 28, CDC learned from the Food and Drug Administration's Coordinated Outbreak Response and Evaluation Network that environmental isolates indistinguishable from those of the two patients had been collected from Crave Brothers Farmstead Cheese during 2010–2011. An outbreak-related case was defined as isolation of *L. monocytogenes* with the outbreak PFGE pattern from an anatomic site that is normally sterile (e.g., blood or cerebrospinal fluid), or from a product of conception, with an isolate upload date during May 20–June 28, 2013. As of June 28, five cases were identified in four states (Minnesota, two cases; Illinois, Indiana, and Ohio, one each). Median age of the five patients was 58 years (range: 31–67 years). Four patients were female, including one who was pregnant at the time of infection. All five were hospitalized. One death and one miscarriage were reported.
Questions or Comments?

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