Fishing for Answers: Struggles of Investigating an Unsolved Outbreak of Listeriosis Among a Majority of Patients of Eastern European Background

Amanda Conrad, MPH
Assessment Epidemiologist
Outbreak Response Team
Outbreak Response and Prevention Branch
Centers for Disease Control and Prevention

InFORM 2017

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Cluster Summary

- Cluster of 38 cases from 10 states: CA (6), IL (12), IN, ME, MA (2), MD (3), NJ, NYC (4), OH (2), and PA (6)
- 3 different *Listeria monocytogenes* strains based on wgMLST and PFGE results
- 20 patients with available information reported Eastern European background
- 33 patients shopped Russian or Eastern European stores
- Food and environmental testing yielded 3 environmental swabs and 1 leftover product with strains matching clinical isolates
Patients infected with the outbreak strain of *Listeria monocytogenes* by isolation date and patient isolate WGS strain n=38*

*Two cases from a single mother-infant pair where only the infant’s isolate was sequenced. Mother’s isolate not included in this figure but is assumed to be strain 3.*
Challenge 1: Food Exposures

- Lack of knowledge of Eastern European-style foods and food terminology
- Limited exposures that could be considered culturally-specific on Listeria Initiative (LI) questionnaire
- Difficult to determine which food items were uncommon among patients
  - No background rates for comparison for items like herring and caviar from the LI or the FoodNet Population Survey
  - Supplemental questionnaires were created at various points in the investigation as more items of interest became available
- Patients reported similar foods but brand information was lacking and foods were purchased ready-to-eat or at the deli counter making us suspicious of cross-contamination within store or deli locations
Challenge 2. Whole Genome Sequencing

wgMLST (<All Characters>)

Cluster 1

Cluster 2

9[1-1904]

5[1-9]

5[3-6]
Challenge 3: Combine clusters?

- **Cluster 1**
  - Rare PFGE pattern combinations
  - Cases in IL (5), IN, **OH, PA (2)**

- **Cluster 2**
  - PFGE pattern combinations *new* to the database
  - Cases in ME, MA, NYC (2), **OH, PA (2)**

OH patients receive meals from the same meal delivery service

PA patients shop at the same grocery store location
Challenge 4. Whole Genome Sequencing...Again

Key

Strain 1

Strain 2

Strain 3
Challenge 5: Changing Demographics

- **New states included in the investigation**
  - California (strains 2 and 3)
  - Maryland (strain 2)
  - New Jersey (strain 2)

- **Cases that weren’t Eastern European**
  - Vietnamese (n=2, both strain 2)
  - Hispanic (n=1, strain 1)
Challenge 5: Burnout

- **Investigation length leads to burnout**
  - Cluster closed in July, 2016 and reopened in September, 2017
  - Hard to maintain engagement when efforts seem fruitless

- **Rollercoaster of events**
  - Environmental and food sampling at stores and food producers of interest yielded *Listeria monocytogenes*
  - Isolates did not match cases or were from store environments subject to cross-contamination
Successes

- States were able to share experiences and lessons learned with each other throughout each stage of the investigation.
- Development of a more comprehensive supplemental questionnaire for Eastern European foods that can be used in future investigations.
- Emphasized the importance of home visits with patients and retail inspections where product was purchased.
Acknowledgements

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- Indiana State Department of Health
- Maine Center for Disease Control and Prevention
- Massachusetts Department of Public Health
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- New Jersey Department of Health
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- New York State Department of Health
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  - Alexandr Surin
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  - Laura Gieraltowski
  - Matt Wise
- FDA
Thank you!

For more details on the investigation please stop by the poster session this evening!

For more information, contact CDC
1-800-CDC-INFO (232-4636)

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.
An Unsolved Listeriosis Cluster Among Patients of Eastern European Background, 2015-2016

The Hunt for the Red Herring

Vasudha Reddy, HaeNa Waechter, Michelle Boyle, Emily Harvey, Yvette Khachadourian, Amanda Conrad
Listeriosis surveillance

• Health departments have timely and complete surveillance
• Rapid and complete hypothesis generating interviews
  • Complete questionnaires forwarded to CDC
• Follow-up to ensure that isolates are forwarded to PHLs
• Rapid PFGE and WGS is performed at PHLs or CDC

• Outbreak investigations are challenging
  • Difficult to obtain food histories simply over the phone (long incubation period and patients are very ill)
  • Alternate approaches to collect data are often necessary
Hypothesis Generation

- Cases are interviewed with standard form that mostly covers previously implicated foods
- Ethnic link among the cases identified early on
  - Ethnic groups live in the same area and there are many stores that target products from those groups
  - People travel to these neighborhoods to shop for ethnic foods
- Developed an Eastern European supplemental form with the help of knowledgeable staff
- Arranged to do home visits
Field Visits

• Home visits
  • Re-interviewed patients if possible
  • Took photos of remaining ready-to-eat food in the home
  • Collected food for testing

• Retail establishment visits
Maryland

- Local outbreak identified 9/9/2016
  - Onset 7/1/2016-8/28/2016
  - 3 cases from same county with matching PFGE and highly related WGS
  - All Eastern European

- Home visit
  - Collected frozen food for testing (samples were positive for *Lm* outbreak strain)
  - Prompted testing at place of purchase

- Shopping excursion with 1 of the cases
  - 2 state and 1 local health epidemiologist
  - Purchased products likely consumed before onset
  - Photographed as many products as possible
  - retail samples positive for *Listeria* species, not *monocytogenes*
Massachusetts

• Local cluster identified 2/1/2016
  • 2 MA cases and 1 ME case shopped at same Eastern European Market in MA

• Obtained detailed food histories with the help of the hospital IP as an interpreter

• Shopping dates and last 4 digits of credit card
  • Establishment identified specific items purchased

• Market visits
  • Positive food and environmental samples
  • Required the establishment to cease all food operations and hire a professional cleaning company
New York City

- Local cluster identified 1/19/2016
  - 4 cases with onset 12/24/2015-2/12/2016
- Visited homes with Russian speaking environmental health colleagues
  - Food samples obtained from patient’s home
  - Obtained shopper card numbers that were available
- Requested shopper card records from Store E
  - Management refused to provide records
  - NYC DOHMH general counsel served subpoena to market and records were released
Pennsylvania

- 6 cases with onset date 11/20/2015 to 2/8/2016
  - Interviewed with focused questionnaire
  - Obtained receipts directly from patients or stores
- Inspected two Eastern European markets in Philadelphia that cases identified
  - Obtained shopper card records
  - Collected food samples and environmental swabs
Food Items of Interest

<table>
<thead>
<tr>
<th>Food Item</th>
<th>Cases, N (%)</th>
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<tbody>
<tr>
<td>Smoked fish</td>
<td>11/30 (37)</td>
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<tr>
<td>Herring</td>
<td>12/18 (67)</td>
</tr>
<tr>
<td>Ready-to-eat food prepared in store*</td>
<td>17/30 (57)</td>
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<tr>
<td>Cheese</td>
<td>30/34 (88)</td>
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<td>Farmer’s, tvorog, or cottage cheese</td>
<td>19†</td>
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<tr>
<td>Deli-sliced cheese</td>
<td>6†</td>
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<tr>
<td>Deli meat</td>
<td>28/31 (90)</td>
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<tr>
<td>Tongue or organ meat</td>
<td>6†</td>
</tr>
<tr>
<td>Deli-sliced meat</td>
<td>10†</td>
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</tbody>
</table>

* Includes but not limited to store prepared salads (e.g., Olivier, potato, cabbage, cucumber, artichoke, or eggplant), kholodets, and pelmeni.

† Denominator data unavailable because cases may not have been specifically asked or details were provided by questionnaires and shopper card records.
Challenges

• Long incubation period
• Obtaining accurate product and information and descriptions
• Cooperation of case patients
• Language (communication and labeling of products)

• Definitive source not identified
  • Possible cross contamination of ready-to-eat foods
Successes

• Strong communication and coordination across local, state, and federal colleagues

• Ability to collect good information through field visits to help guide food and environmental sampling and testing

• Responding immediately to any single case or cluster identified among Eastern Europeans regardless of subtyping
  • 3 new cases in NYC reported in October 2017
Conclusion

• Illustrates the importance of working closely with lab, epi, and environmental health colleagues at local, state, and federal level

• Visiting homes and obtaining purchase records as soon as possible is important

• Necessary to provide more education to food retail and processing firms to prevent Lm contamination is necessary
Thank you to all Epidemiology, Laboratory, and Environmental Health colleagues who worked on these investigations

• California Department of Health
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• Indiana Department of Health
• Maine Department of Health
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• New Jersey Department of Health
• NYC Department of Health and Mental Hygiene
• New York State Department of Health
• Ohio Department of Health
• Pennsylvania Department of Health
• Philadelphia Department of Health
• CDC
• FDA
Thank you!

Please stop by our posters (P-069 and P-070) for more details on the investigation!
Environmental Assessments

*L. monocytogenes*

Eastern European Foods

D’Ann L. Williams, DrPH – Maryland Department of Health
Brandi Hopkins, MPH – Massachusetts Department of Public Health
David Nicholas, MPH - New York State Department of Health

November, 2017
Outline

• MA/MD/NY investigations
• Environmental investigation and samples collected
  – Retail
  – Leftover product sampling
  – Swabbing
• Laboratory results
• Actions
• Challenges
• Opportunities
MD/MA/NY Investigations

- Eleven environmental assessments
  - Two in Massachusetts
    - 1 retail establishment
    - 2 rounds of sampling
  - Six in NY
    - 5 retail firms
    - 1 home
  - Three in MD
    - 2 retail locations
    - 1 home location
  - No specific food item in common
Retail Sampling

93 retail food samples collected

- MA – 51 samples collected
- NY – 12 samples, 3 firms
- MD – 30 samples, 2 firms
  - Deli meats
  - Store produced salads
  - Cheeses, dairy, butter
  - Canned fish
  - Caviar
  - Smoked and salted fish
Leftover Product Sampling

• 15 home food remnant samples
  – 5 MD and 10 NY
  – Deli meats, cheese
  – L.M strain identified in only 1 sample (MD)
Environmental Swabbing

98 environmental swabs collected
- MA – 68
- MD – 30

- Focus areas
  - Slicers
  - Deli cases, refrigerators
  - Condensation pan
  - Cutting boards
  - Handles and knobs

- 10 positive for L. spp
- 14 positive for LM
  - 3 related to outbreak strain (MA)
Actions

- Facility inspection LHD/State
- Provided FDA/USDA Listeria guidance documents
- Require thorough cleaning of facility, equipment
- Discard defective, heavily soiled equipment
- Remove uncleanable, unapproved surfaces
- Reinspection
- Resampling before clearance for reopening
Challenges

- Time frame between consumption, onset, report, investigation
- Response
- Poor recall, food history
- Cooperation of case patients
- Cooperation of firms
- Language (communications and labeling)
- Product descriptions/imports
- Documentation for source and sales
- Listeria spp. vs Listeria monocytogenes
- Lab results
- Remediation and facility clearance
- Risk communication and education
Opportunities

- Investigation participation and knowledge and experience
- Identification of product and reservoir of outbreak strain
- Add to current knowledge about reservoirs and potential future sampling directions
- Sampling proficiency
- Risk Communication and Food Safety Education for food supply firms and regulators
- Networking with other agencies
Recurring clusters and outbreaks require quick response to and require a seamless collaboration between RRT, EPI and the Labs.

Difficult to connect clinical with environmental samples.

Lab research indicate that Listeria may be present in “communities”, what determines survival, reservoirs, product vulnerability, collection efficiency.

Laboratory enrichment can cause interference by non-pathogenic species preventing L. mono detection.

Laboratory results may be difficult to interpret, required regulatory actions are unclear.

Educate retail and processing firms on preventative measures given the increasing number of foodborne reservoirs.
Questions/Comments

D’Ann L. Williams
410-767-2633
dann.williams@maryland.gov

Brandi Hopkins
617-983-6731
brandi.hopkins@state.ma.us

David C. Nicholas
518-402-7600
david.nicholas@health.ny.gov
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• New York City Department of Health and Mental Hygiene
• New York State Department of Health
• New York State Department of Agriculture and Markets
• CDC
• FDA
Outbreaks with unknown etiology – all for nothing?

Brooke M. Whitney, PhD
FDA Coordinated Outbreak Response & Evaluation Network
Response Team 1
November 8, 2017
CORE Response Timeline

January 15, 2016
• CORE Signals began evaluating
• 7 cases in 4 states

January 21, 2016
• Transferred to CORE Response Team 1
• The initial signal was for deli products, specifically cheese and fish
• Cases were of Eastern European background

May 4, 2016
• CORE Response activities end
• Source remained unknown
• 23 cases (22 hospitalized, 2 fetal losses, and 1 death) in 7 states
Response Activities

Multiple State Samples
• One state sample matched by PFGE and WGS to one outbreak strain
• Sample from a retail location

Import Alert
• Additional firm added to an import alert
• Not definitively linked to the outbreak

Three FDA firm investigations
• *Listeria monocytogenes* identified at two firms during response
• No PFGE or WGS link to clinical cases, but laboratory links to other firms identified

Three product recalls
• Occurred as a result of FDA investigations
• None definitively linked to the outbreak
FDA Visits

During response
• FDA visited firms linked to the outbreak through traceback evidence (4 firms)

After outbreak response ended
• FDA continued to visit firms that were identified by links to firms of interest
• Other firms according to previously planned assignments

The following firms mentioned are related by product type and geography to the outbreak, but the available evidence does not support that they’re directly related to the outbreak.
Manufacturer G

October 2015 Warning Letter
- Related to seafood HACCP violations
- Issued prior to Response timeframe

December 2016 Recall
- Various RTE herring products
- Issued after Response timeframe
- Result of environmental sampling at the firm
- *Listeria monocytogenes* identified at firm

CORE Response
July 2016 Recall
- Recall of herring salads
- Due to FDA identifying *Listeria monocytogenes* at the firm

September 2016
- FDA suspended firm’s food facility registration
- “Widespread and persistent *Listeria* contamination”
- FDA Form 483 publicly available
Manufacturer D

September 2016 Recall
- Smoked salmon recalled
- FDA identified *Listeria monocytogenes* at the firm

CORE Response

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</table>
April 2016 Recall
- Product tested positive for *Listeria monocytogenes*
- Imported herring products
- Foreign firm added to Import Alert 16-39

November 2016 Recall
- Product tested positive for *Listeria monocytogenes*
- Imported fish products (not herring)
- Foreign firm added to Import Alert 16-39
Summary

- No definitive vehicle identified related to clinical clusters.
- Several firms of interest were identified for FDA follow-up.
- Multiple FDA actions were taken to protect public health; including, but not limited to:
  - Multiple firm investigations
  - 7 recalls
  - 2 firms added to Import Alert 16-39
  - 1 Suspension of registration
Acknowledgements

- FDA Office of Regulatory Affairs (ORA)
  - Office of Food & Feed Operations
  - Division of Import Operations
  - Office of Regulatory Science
  - Philadelphia District Office
  - Detroit District Office
  - Cincinnati District Office
  - Chicago District Office
  - New York District Office
  - New England District Office

- FDA Center for Food Safety and Applied Nutrition (CFSAN)
  - Office of Compliance
  - Office of Food Safety
  - Office of Analytics and Outreach
  - Office of Regulatory Science
  - Office of Applied Research and Safety Assessment

- Centers for Disease Control and Prevention
  - Division of Foodborne, Waterborne, and Environmental Diseases

- State and Local Partners
  - Pennsylvania Department of Agriculture
  - New York Department of Agriculture and Markets
  - New York State Department of Health
  - New York City Department of Health and Mental Hygiene
  - Massachusetts Department of Health

- FDA Coordinated Outbreak Response and Evaluation Network