Retrospective Outbreak Investigations Initiated by Product or Environmental Sampling

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Investigation begins with illnesses

Epidemiology identifies a vehicle

Traceback identifies firm

Public Health and Product/Regulatory Actions Occur

Investigation begins with positive product or environmental samples molecularly matched to cases

Epidemiology confirms link

Traditional VS Retrospective Outbreak Investigations
# ROIs and CORE

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<tr>
<th>CORE Mission</th>
<th>CORE Phase</th>
<th>Traditional outbreak investigations</th>
<th>Retrospective Outbreak Investigations (ROIs)</th>
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<tr>
<td>Find the outbreak</td>
<td>Signals</td>
<td>Illness cluster identified first; epi/traceback/lab ID vehicle and responsible firm</td>
<td>Positive product/environ. sample obtained; cases determined by molecular subtyping and epi (exposure info)</td>
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<tr>
<td>Stop the outbreak</td>
<td>Response</td>
<td>FDA Response including Recall, Enforcement Actions and Communications to remove contaminated product from commerce and alert the public</td>
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<tr>
<td>Prevent the Next Outbreak</td>
<td>Post Response</td>
<td>Evaluation of lessons learned from the investigation to develop and implement strategies to prevent future outbreaks and evaluate key findings to effect policy change</td>
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Why Focus on this Now?

• Determining if positive samples relate to human illnesses is not new

• PFGE match not always enough evidence to investigate further, especially for *Salmonella* spp
  ★ Pattern commonality concerns, resource constraints

• Whole genome sequencing (WGS) provides greater resolution to target potential clusters
The Changing Face of Outbreak Detection and Response

• Currently transitioning from the PFGE era to the Whole Genome Sequencing (WGS) era

• Use of WGS to identify clusters (as opposed to PFGE) will result in:
  ★ Identification of more clusters but smaller case counts
  ★ Shift in understanding of what is an outbreak by expanding temporal boundaries, challenging current understanding of “ongoing”
Examples of Past ROIs

- *Salmonella* Braenderup in nut butters (2014)

Salmonella Braenderup in nut butters (2014)

• Environmental samples collected by FDA as part of an inspectional assignment at nSpired Natural Foods
• Cases matching rare PFGE and WGS investigated by CDC/states
  ★ 4/5 cases virtually identical by WGS; 3/4 confirmed to have eaten an nSpired product
• Products recalled, firm voluntary closure, corrective actions initiated
Listeria monocytogenes in Ice Cream (2015)

- Product samples collected by South Carolina
- Initial follow-up coordinated via Center for Food Safety and Nutrition (CFSAN)
  - Transition to CORE Response when 4 KS cases identified with matching rare PFGE patterns and exposure history
- Products recalled, firm shut down, corrective actions initiated
- Identification of novel food/pathogen pair
Why Does this Matter?

- Retrospective Outbreak Investigations support FDA’s implementation of a prevention-centric focus under FSMA
  - Smaller clusters, fewer cases
  - Improved targeting of state and federal resources
  - Enhanced attribution and novel pathogen/commodity pairs identified
Smaller clusters, Fewer Cases: PB History

Traditional Outbreak Investigations

- **Salmonella Tennessee** (Con Agra/Peter Pan PB, 2006/2007): 715 cases, 129 hospitalizations, no deaths
- **Salmonella Typhimurium** (peanut products/PCA, 2008/2009): 714 cases, 166 hospitalizations, 9 deaths
- **Salmonella Bredeney** (Sunland/Trader Joe’s PB, 2012): 42 cases, 10 hospitalizations, 0 deaths
- **Salmonella Braenderup** (nSpire/nut butters, 2014): 6 cases, 1 hospitalization, no deaths
Smaller clusters, Fewer Cases: Ice Cream

How many cases were prevented??
Improved Targeting of State and Federal Resources

- Greater confidence in relationship between human illness and responsible firm
  - Always have laboratory confirmation of the vehicle because ROIs begin with a product or firm

- Avoids some limitations of traditional outbreak investigations
  - Food Exposure collinearity
  - Tracebacks that do not converge (e.g. due to poor food exposure histories)
Enhanced Attribution, Identification of Novel Pathogen/Food pairs

- Ability to attribute “baseline” cases
  - Cases that previously would not have triggered traditional cluster detection methods

- Identification of Novel Pathogen/Food pairs
  - Provides a more refined approach to understanding which foods cause illnesses
  - Increases our understanding of pathogenic microorganisms
  - Leads to novel prevention strategies
Where do we go from here?

• Roles and Responsibilities
  ★ FDA | CDC | States

• Parameters/scope of investigations
  ★ Identifying which potential food/illness groups to investigate for epidemiologic information
  ★ Involves consideration of parameters such as temporal boundaries, molecular subtyping and scalability

• How does this integrate with other major initiatives (FSMA)
Challenges

• Data Interpretation

• Resources
  • Sampling - product and environmental
  • Outbreak investigation and prioritization

• Strength of Evidence
Questions?