Outbreak of *Salmonella* Enteritidis Associated with a Restaurant in Kentucky, 2016

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Reportable Diseases Section
Salmonella

- Aerobic gram-negative rod
- >2500 serotypes
- Estimated to cause annually in U.S.
  - 1 million illnesses
  - 19,000 hospitalizations
  - 380 deaths
- 600-650 cases/year in Kentucky
Background

- Kentucky is a decentralized, home-rule state
- Local health jurisdiction staff investigate individual cases and outbreaks:
  - Public Health/Communicable Disease Nurses
  - Regional Epidemiologists
  - Environmentalists
  - Epidemiology Rapid Response Team (ERRT)
- State-level staff coordinate and provide additional capacity during large/complex outbreak investigations
Outbreak Notification

- On February 2, 2016, the Estill County Health Department (ECHD) was contacted by a concerned mother
- She had eaten at a new local restaurant (Restaurant A) on January 29 and her symptoms began approximately 48 hours later
- Stated that she knew of others who had eaten there at the same time and were also sick
- Local investigation was launched
Estill County, Kentucky
Initial Investigation - Day 1

- Restaurant manager was contacted
- Environmental assessment conducted that evening
  - Inspection
  - Interviews
  - Food preparation, food handling, employee hygiene practices
Initial Investigation - Day 2

- Detailed interview with initial case conducted
- Local ED and hospital alerted to possible outbreak
- Identification of additional cases
Initial Investigation - Day 3

- KDPH and Regional Epidemiologist notified of the possible outbreak
- 19 ill restaurant patrons interviewed
  - 9 PCR-positive for *Salmonella*
- Local news media interest
- Social media attention
Initial Investigation - Day 4

- Conference call with local and state staff
  - 39 ill restaurant patrons interviewed
    - 16 PCR-positive
    - 3 hospitalizations
  - Meal dates 1/21, 1/26, 1/28-1/29.
  - 2 employees were ill during that period.
Epidemiologic Investigation

- Case definition, line list, epi curve
- Foodborne/Waterborne Illness Investigation Form
- Outbreak-specific questionnaire
  - Based on menu items
- Case-control study
  - Ill diners and well meal companions
Environmental Investigation

- Environmental Assessments
- Employee Interviews and Stool Collection
- Employee Schedules
- Food Sample Collection
- Traceback Analysis
  - Coordination with FSIS
Laboratory Investigation

- Coordinated testing of clinical and food samples
- Isolation
- Serotyping
- Pulsed-field Gel Electrophoresis (PFGE)
- Whole Genome Sequencing (WGS)
Results - Epidemiologic

- Case definition: Any individual or close contact of an individual who ate at or visited Restaurant A January 10-February 6, 2016, who exhibited signs or symptoms consistent with *Salmonella* or had a laboratory test positive for *Salmonella*. 
# Results - Epidemiologic

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Number (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Case Classification</strong></td>
<td></td>
</tr>
<tr>
<td>Confirmed</td>
<td>50 (59)</td>
</tr>
<tr>
<td>Probable</td>
<td>29 (34)</td>
</tr>
<tr>
<td>Suspect</td>
<td>6 (7)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>34 (40)</td>
</tr>
<tr>
<td>Female</td>
<td>51 (60)</td>
</tr>
<tr>
<td><em><em>Age Range in Years (Median</em>)</em>*</td>
<td>7-82 (37*)</td>
</tr>
<tr>
<td><strong>Hospitalized</strong></td>
<td>13 (15)</td>
</tr>
<tr>
<td><strong>Deaths</strong></td>
<td>0 (0)</td>
</tr>
</tbody>
</table>
Confirmed, Probable, and Suspect Cases by Date of Onset

Date of Illness Onset

- Frequency
- Suspect
- Probable
- Confirmed
Results - Epidemiologic

- Case control study
- 61 cases, 56 controls interviewed

<table>
<thead>
<tr>
<th>Food Item</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>P-Value</th>
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</thead>
<tbody>
<tr>
<td>Fried Pickle Spears</td>
<td>3.0</td>
<td>1.2-8.1</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Philly Cheese Steak</td>
<td>3.3</td>
<td>1.1-10.6</td>
<td>.02</td>
</tr>
<tr>
<td>Grilled Chicken</td>
<td>3.9</td>
<td>1.1-16.9</td>
<td>.01</td>
</tr>
</tbody>
</table>
Results - Environmental

- Multiple environmental assessments were conducted
- Restaurant voluntarily closed for 3 weeks during the inspection
- Employee stool testing
  - 2 employees tested positive for *Salmonella* by culture
- Food Sample Testing:
  - 3/5 chicken samples tested positive for *Salmonella*
  - FSIS Inspector conducted an onsite investigation
Results - Laboratory (PFGE)

- Clinical Samples:
  - Primary outbreak strain *Salmonella* Enteritidis JEGX01.0023
  - Two isolates yielded other patterns (JEGX01.0034 and JEGX01.1118).

- Food Samples:
  - Two chicken samples yielded *Salmonella* Enteritidis JEGX01.0021
  - A third chicken sample tested positive for *Salmonella* Derby
# Results - Laboratory (WGS)

**Salmonella ser. Enteritidis cluster 1602KYJEG-1 (JEGX01.0023)**

The methods used in the analysis of these sequence data are preliminary and remain under validation. Please email nce@cdc.gov if you plan to use/distribute this phylogeny further.

<table>
<thead>
<tr>
<th>WGS_id</th>
<th>SourceState</th>
<th>PFGE-Xba-pattern</th>
<th>Outbreak</th>
<th>SourceType</th>
<th>SourceSite</th>
<th>IsolateDate</th>
<th>ReceivedDate</th>
<th>UploadDate</th>
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<tbody>
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<td>PNUSAS001717</td>
<td>KY</td>
<td>JEGX01.0023</td>
<td>1602KYJEG-1</td>
<td>Human</td>
<td>Stool</td>
<td>2/7/2016</td>
<td>2/15/2016</td>
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<td>Human</td>
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<td>2/10/2016</td>
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<td>2/16/2016</td>
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<td>2/18/2016</td>
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<td>Human</td>
<td>Stool</td>
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<td>2/18/2016</td>
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</tbody>
</table>

*The hqSNP analysis had phages masked, an external reference of CP007251, and was generated with Lyve-SET version 1.1.4f. Reads were cleaned with CG Pipeline (options: --no-singletomes & --no-singletons/ --min_avg_quality 25), SNPs were called with Varscan, and Lyve-SET was run with the following options: minimum coverage: 20, min alternative fraction: 0.95, and allowed flanking: 5 bp.*
Conclusion

- Restaurant reopened February 27
  - Deep cleaning
  - Food Handler’s Safety Class for all employees
- No new cases reported
- Outbreak declared over on March 30.
- Despite a thorough investigation, no source was identified
- Use of WGS to analyze isolates
Challenges

- Size of outbreak/LHD staff
- Unusual snowfall
- Laboratory Testing
- Communication
- Media Attention
Acknowledgments

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**FSIS**
Questions?

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