Epidemiologic Approaches to Investigating Multistate Outbreaks in the United States

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The findings and conclusions in this presentation are those of the presenters and do not necessarily represent the views of the Centers for Disease Control and Prevention.
Foodborne Diseases: A Changing Landscape

• More food is centrally produced, so when something goes wrong, people get sick over a wide area

• More food is sold fully cooked, so consumer just has to warm it

• More food is eaten in restaurants, so more people have a hand in preparing our food

• We import more of our food supply, so we depend on the food safety systems in other countries

• Healthy animals can carry germs that make us sick

• New technologies for producing, processing and preparing foods
Foodborne Disease Outbreak Investigations

• Goals:
  – Immediate control of outbreak and prevention of illnesses
  – Provide opportunities to identify gaps in food safety systems

• Effective investigations key to reducing burden of foodborne disease
  – Identify food vehicles and factors which lead to outbreaks
PulseNet: The National Molecular Subtyping Network for Foodborne Disease Surveillance

Public health laboratories

Pulsed Field Gel Electrophoresis patterns

National database at CDC
The Spectrum of Foodborne Disease Outbreaks

Focal scenario
- Large number of cases in one jurisdiction
- Detected by affected group
- Local investigation
- Local food handling error
- Local solution

New dispersed scenario
- Small numbers of cases in many jurisdictions
- Detected by lab-based subtype surveillance
- Multistate/Country investigation
- Industrial contamination event
- Broad implications

These changes make coordination among multiple states and agencies, and countries even more important than before.
Human specimen isolates uploaded to PulseNet USA, and investigated clusters, 1996-2010†

† Data are preliminary and subject to change
Average weekly number* of clusters CDC Outbreak Response Team followed by month and pathogen, February 1, 2008 – December 31, 2010

* Number per week averaged over a month period
CDC’s Outbreak Response Team

- Supports a national network of epidemiologists and other public health officials who investigate outbreaks of foodborne, waterborne, and other enteric illnesses in the United States

- Collaboration between CDC and
  - U.S. State and local health departments
  - U.S. Department of Agriculture (USDA)
  - U.S. Food and Drug Administration (FDA)

- Works in close partnership with PulseNet
  - The national molecular subtyping network for foodborne disease surveillance

- Helps ensure
  - Rapid, coordinated detection & response to multi-state enteric disease outbreaks
  - Promotes comprehensive outbreak surveillance
**Flow of PulseNet Multistate Cluster Investigations**

1. Submission of PFGE patterns by state to CDC PulseNet
2. Cluster identification by CDC PulseNet
3. CDC PulseNet Epi Liaison
4. Epi Investigation
5. Food Vehicle Identified
6. Regulatory Activity
Which Multistate Clusters Should be Given Highest Priority for Further Evaluation?

- The large number of clusters identified by PulseNet currently precludes active investigation of every one
  - CDC capacity issues
    - Cluster investigations last weeks and can require many people
  - State and local health department capacity issues
    - How much effort should be expended to interview cases when state has only a few cases?

- CDC Outbreak Response Team triages each cluster; either
  - CDC monitors, but states not contacted, or
  - CDC contacts states to begin hypothesis generation
Some Features Considered in Triaging Clusters

• Pathogen
  – Severity (botulism v. *E. coli* O157 v. *Salmonella*)
    • Number of deaths or hospitalizations
  – Frequency of serotype or PFGE pattern
    • Distribution over time
    • Geographic distribution

• Person, place and time
  – “Momentum”: the number of ill over time versus baseline
  – Gender and age distribution
  – Geographic distribution by case residence

• Matches to non-human isolates in Pulsenet or VetNet

• External interest
CUSUM Outbreak Detection Algorithm (CODA)

Data as of 08/04/2010
Status of Every Cluster Reviewed at Least Weekly to Determine Which Ones Should Have Further Evaluation and Investigation

• Spectrum of cluster investigations
  – CDC monitoring, but states not contacted
  – CDC contacted states, hypothesis generation ongoing
  – Analytic epidemiologic study planned/underway/completed by state/local partner, CDC involved but not in leading role
  – CDC assumes active role in leading multistate investigation, analytic epidemiologic study planned/underway/completed
  – CDC Emergency Operations Center activated to assist in multistate investigation
<table>
<thead>
<tr>
<th>Year</th>
<th>Pathogen &amp; Food Product</th>
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<tbody>
<tr>
<td>2006</td>
<td><em>E. coli</em> O157 &amp; bagged spinach</td>
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<td>Botulism &amp; commercial pasteurized carrot juice</td>
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<td>2006</td>
<td><em>Salmonella</em> &amp; fresh tomatoes</td>
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<td>2007</td>
<td><em>E. coli</em> O157 &amp; frozen pizza</td>
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<td>2007</td>
<td><em>Salmonella</em> &amp; peanut butter</td>
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<td>2007</td>
<td><em>Salmonella</em> &amp; a vegetarian snack food</td>
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<td>2007</td>
<td><em>Salmonella</em> &amp; dry dog food</td>
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<td>2007</td>
<td><em>Salmonella</em> &amp; microwaveable pot pies</td>
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<td>2007</td>
<td><em>Salmonella</em> &amp; dry puffed breakfast cereal</td>
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<td>2010</td>
<td><em>Salmonella</em> Typhi &amp; frozen mamey fruit pulp</td>
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<td><em>Salmonella</em> &amp; whole, fresh imported papayas</td>
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<td>Multidrug resistant <em>Salmonella</em> &amp; ground turkey</td>
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<td>2011</td>
<td><em>Listeria</em> &amp; cantaloupes</td>
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<td>2011</td>
<td><em>Salmonella</em> &amp; imported pine nuts</td>
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</table>
13 New Food Vehicles Identified in US Multistate Outbreaks since 2006

- bagged spinach
- carrot juice
- peanut butter
- broccoli powder on a snack food
- dog food
- pot pies/frozen meals
- canned chili sauce
- hot peppers
- pepper
- raw cookie dough
- hazelnuts
- whole fresh papayas
- pine nuts

Data Sources: Foodborne Disease Outbreak Surveillance System, CDC Web postings
Some Recent Large US Multi-State Outbreaks of Foodborne Infections, 2006-2011 (n=39)

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Some Challenges in Investigating Multistate Foodborne Disease Outbreaks

• We rely on ill persons recollections from several weeks or even months ago
  – What did the case eat and where did they purchase it?
    • Tends to be food “preference” rather a food “history”
  – Many states do not routinely interview cases and some only do a brief initial interview

• The contaminated product is an “ingredient”
  – It is difficult to identify the source of the outbreak when the contaminant is in a wide range of foods
    • Typically cases are geographically dispersed
    • Contamination can be low level or not evenly dispersed in product(s)
  – It is difficult to trace and recall the many foods affected and to provide easy/quick public guidance
Some Challenges in Investigating Multistate Foodborne Disease Outbreaks - II

• The contaminated product is “stealthy”
  – It is difficult to identify the source of the outbreak when the ill person does not know or readily recall eating the contaminated product
    • Could be an ingredient or a product is commonly consumed with other foods (e.g. hot peppers or sprouts)

• A broad range of foods can be contaminated
  – It is difficult to identify the source of the outbreak when you don’t ask the ill person about the correct vehicle in a structured interview
    • The contaminated product has never been or rarely implicated in an outbreak previously
Some Challenges in Investigating Multistate Foodborne Disease Outbreaks - III

- There are no clusters of cases at restaurants, events, or food shopping venues
  - Narrow the focus to items consumed at the single meal or purchased at that point of service
  - Facilitate traceback

- Traceback of a suspect food item relies on adequate records all the way to the point of production
  - Co-mingling of product
  - Can be very labor intensive especially with paper-based records
Some Challenges in Investigating Multistate Foodborne Disease Outbreaks - IV

• The contaminated product is commonly consumed by both healthy and ill persons
  – For traditional analytic epidemiologic studies using a comparison (control) population (case-control), you need a large number of cases to find significant statistical associations
    • Importance of narrowing focus to specific type and/or brand
• The PFGE pattern is common and other molecular subtyping methods (e.g. MLVA) are not available or do not increase specificity
  • Cannot distinguish among cases that are likely related to the outbreak and those that are the expected “background”
• Not all enteric disease outbreaks are related to food
  • Animal contact, water, or daycare settings
Lessons Learned in Investigating Multistate Foodborne Disease Outbreaks

- Case patient demographics (age, sex, ethnicity) and geographic/ temporal distribution provide critical clues about the source
- Clusters of cases at restaurants, events, food shopping venues are key
  - Help narrow the focus
  - Facilitate traceback to find commonality across clusters identified
- It is not just asking ill people what they ate, but understanding how food is prepared at menu/ingredient level
Lessons Learned in Investigating Multistate Foodborne Disease Outbreaks (continued)

• Shopper/customer loyalty card information can provide critical clues
  – Quickly search purchase history for suspect products
  – Facilitate traceback

• Surveys of food consumption in the general population can provide a ready comparison
  – Help identify when foods are being consumed in an unusually high rate by ill persons
  – Help identify seasonal and regional variability
An Approach to Investigating Multistate Foodborne Disease Outbreaks Identified by PulseNet

• Start with a structured hypothesis generating questionnaire with standard elements
  – Narrow the focus after first 10 to 20 completed questionnaires
    • Add more questions on type, brand, place of purchase on likely suspects and eliminate questions on those that are not
  – Move quickly to open-ended iterative interviewing if a hypothesis does not emerge

• “Sub clusters” of cases eating at restaurants/events or shopping at grocery stores can be key

• It is critical that public health, regulatory, & industry partners work together as hypothesis emerge & are tested
  – Understanding product distribution can be key
  – Rapid ”hypothesis testing” tracebacks can be key
  – Targeted food product and environmental testing works!
    • Food from case patient homes, points of service, and along path back to point of production
A Gap in Multistate Outbreak Investigation Methods

Limited resources at state and local health departments to conduct interviews

- “Sporadic” illnesses (some may later be shown to be part of outbreaks)
  - In many jurisdictions, patients are not routinely interviewed to collect information on exposures

- Cluster and outbreak illnesses
  - Interviews to probe possible sources may be delayed by other priorities
  - Re-interviews to collect product information may be delayed
  - Questionnaires often not standardized among states
  - Information from questionnaires not put into standard database at all States
  - Information on exposures usually not transmitted electronically to CDC

Contrast with PulseNet, in which lab information on every isolate is stored in a standard database at States, is rapidly transmitted to a national database at CDC, and summary information is available to all participants
FoodCORE: Foodborne Diseases Centers for Outbreak Response Enhancement

- **Three core areas:**
  - Enhancement of public health laboratory surveillance
  - Epidemiological interviews and investigations
  - Environmental health assessments
FoodCORE Goals

- Build collaborative models to conduct rapid, coordinated, centralized and standardized surveillance
- Build capacity for laboratory surveillance, epidemiologic response, and environmental health assessment
- Develop measurable performance indicators
FoodCORE Metrics

- Based on CIFOR guidelines
- Lab and epi criteria
- Evaluate critical points for outbreak response
- Worked with sites to develop full set of metrics
  - 36 total metrics
  - 18 “core” metrics for which all sites report
FoodCORE Summary

- Collaborative effort
- Develop best practices and replicable models for
  - Detection
  - Investigation
  - Response
  - Control
- Laboratory, epidemiological, and environmental health components

Shorten the time to pinpoint how and why contamination occurred in order to limit additional illnesses and prevent future outbreaks
Salmonella Typhimurium Infections Associated with Peanut Products


ABSTRACT

BACKGROUND

Contaminated food ingredients can affect multiple products, each distributed through various channels and consumed in multiple settings. Beginning in November 2008, we investigated a nationwide outbreak of salmonella infections.

METHODS

A case was defined as laboratory-confirmed infection with the outbreak strain of Salmonella Typhimurium occurring between September 1, 2008, and April 20, 2009. We conducted two case-control studies, product "traceback," and environmental investigations.

RESULTS

Among 714 case patients identified in 46 states, 166 (23%) were hospitalized and 9 (1%) died. In study 1, illness was associated with eating any peanut butter (matched odds ratio, 2.1; 95% confidence interval [CI], 1.3 to 3.3) peanut butter-containing products (matched odds ratio, 2.2; 95% CI, 1.1 to 4.7), and frozen chicken products (matched odds ratio, 4.6; 95% CI, 1.7 to 14.7). Investigations of local clusters and single cases associated with nine institutions identified a single institutional brand of peanut butter (renamed brand X) distributed to all facilities. In study 2, illness was associated with eating peanut butter outside the home (matched odds ratio, 3.6; 95% CI, 1.6 to 10.6) and two brands of peanut butter crackers (brand A matched odds ratio, 17.2; 95% CI, 6.0 to 51.5; brand B matched odds ratio, 3.6; 95% CI, 1.3 to 9.8). Both cracker brands were made from brand X peanut paste. The outbreak strain was isolated from brand X peanut butter, brand A crackers, 15 other products. A total of 3191 peanut butter-containing products were recalled between January 10 and April 29, 2009.

CONCLUSIONS

Contaminated peanut butter and peanut products caused a nationwide salmonella outbreak. Ingredients-driven outbreaks are challenging to detect and may lead to widespread contamination of numerous food products.


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PulseNet notified CDC Outbreak Response Team of two multistate clusters of *Salmonella Typhimurium* infections

- Two *Salmonella Typhimurium* clusters?
  - PFGE patterns new, closely related
  - Similar geographic and age distribution
  - PFGE patterns from both clusters as “outbreak strain”
  - Investigations merged
Case Definition

- Laboratory-confirmed infection with outbreak strain of *Salmonella* Typhimurium
- Diarrhea onset date (or isolation date) on or after September 1, 2008
Initial Investigation - Generating Hypotheses
November 2008 – January 2009

• Methods
  – Routine state-specific case interviews
  – Hypothesis generating questionnaire with 471 exposures (foods, beverages, restaurants, and animal contact)
  – Open-ended interviews by some states

• Results
  – Many patients consumed peanut butter of many brands and types
  – Possible association with institutional settings
Minnesota Clusters Provide Clues

• Minnesota Dept. of Health (MDH) identified clusters in 3 institutions
• High proportion reported eating peanut butter
• Institutions had common food distributor
Could Peanut Butter Be the Source?

• Two previous outbreaks
  – Australia, 1998
  – United States, 2006–2007

• *Salmonella* survive for extended periods in high-fat, low-moisture foods

• Peanut roasting should eliminate *Salmonella*
  – No kill step after initial roasting process
First Case-Control Study

• Case-patients (n=70, 12 participating states)
  – Diarrhea onset on or after November 1, 2008
  – Not living in an institutional setting

• Well controls (n=178)
  – Selected by reverse telephone directory
  – Matched by age category and neighborhood
First Case-Control Study Results

- Significant association between illness and consumption of peanut butter (mOR=2.5)
- No association with any brand or roasted peanuts
MDH Investigation Provides More Clues

• 6 more cases in 6 institutions
  – Common brand of peanut butter („Brand A’)

• MDH reported isolation of *Salmonella* from opened container of brand A peanut butter

• FDA investigation of producer: Peanut Corporation of America (PCA) facility in Georgia
Ongoing Patient Interviews

- Several patients had no institutional connection
  - Many did not eat peanut butter in institutions
- Brand A not distributed in States where cases lived
- Many patients reported eating prepackaged peanut butter crackers, specifically Brand B and Brand C
- PCA facility in Georgia produced peanut paste used in variety of peanut butter-containing products
  - Including Brand B and Brand C
Second Case-Control Study

• Cases (n=95, 35 participating states)
  – Diarrhea onset on or after December 1, 2008
  – Not living in institutions

• Well controls (n=399)
  – Selected by reverse telephone directory
  – Matched by age group and neighborhood
<table>
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<tr>
<th>Exposure</th>
<th>Cases (n=95)</th>
<th>Controls (n=362)</th>
<th>mOR* (95% CI)†</th>
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<tr>
<td>Any peanut butter crackers</td>
<td>66%</td>
<td>16%</td>
<td>9.1 (4.9–18.1)</td>
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<tr>
<td>Brand B peanut butter crackers</td>
<td>39%</td>
<td>3%</td>
<td>18.7 (7.6–55.1)</td>
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<td>Brand C peanut butter crackers</td>
<td>16%</td>
<td>3%</td>
<td>4.1 (1.7–10.7)</td>
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<tr>
<td>Peanut butter outside the home</td>
<td>17%</td>
<td>5%</td>
<td>4.3 (1.7–10.6)</td>
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* Matched Odds Ratio, † Confidence Interval
Additional Findings
Colorado Investigation

• 5 cases reported consumption of fresh ground peanut butter
  - Three locations of a health food store chain (Chain X)
• Chain X purchased roasted peanuts for fresh in-store ground peanut butter exclusively from PCA facility in Texas
• FDA District Office initiated inspections at PCA facility in Texas
FDA Inspection Findings

• PCA Georgia Facility
  – Rain water leakage above roasted peanut area
  – Raw peanuts next to roasted peanuts
  – Unclean equipment
  – Peanut roaster not reaching adequate temperature

• PCA Texas Facility
  – Rain water leakage above roasted peanut storage areas
  – Air handling system not sealed
  – Debris from crawl space into production areas
Opened and unopened containers of Brand A peanut butter
Salmonella Typhimurium Outbreak Strain Isolated in...

Intact packages of Brand B peanut butter crackers
Salmonella Typhimurium Outbreak Strain Isolated in Peanut paste from tanker truck
Salmonella Typhimurium Outbreak Strain Isolated in...

Fresh in-store ground peanut butter
Salmonella Typhimurium Outbreak Strain Isolated in Peanut granules
Salmonella Typhimurium Outbreak
Strain Isolated in... 

Peanut butter flavored dog biscuits
3,913 Peanut- and Peanut Butter-Containing Products Recalled

Photo by Dr. Bill Keene
Health Alerts and Consumer Advice

Salmonella

Investigation Update: Outbreak of Salmonella Typhimurium Infections, 2008–2009
Update for April 29, 2009 (FINAL web update)

Today’s Highlights
- The numbers of new cases have declined substantially since the peak in December, but illnesses are still being reported among people who ate the recalled brands of peanut butter crackers after the recall. The outbreak is expected to continue at a low level for the next several months since consumers aware that they have recalled products in their home continue to consume these products, many of which have a long shelf-life.
- Consumers should avoid eating recalled products. (See consumer recommendations below.)
- Case count is 714 in 46 states with latest confirmed, most recent reported illness beginning on March 31, 2009.
- Major national brands of jarred peanut butter found in grocery stores are NOT on the Peanut Corporation of America (PCA) recall list.
- Consumers may use FDA’s online database (http://www.fda.gov) to see if foods are on the recall list. Those without internet access may call 1-800-FDA-INFO (available 24 hours a day, seven days a week) for product recall information.


On November 25, 2008, an epidemiologic assessment began of a growing cluster of Salmonella serotype Typhimurium isolates that shared the same pulsed-field gel electrophoresis (PFGE) pattern in PulseNet. As of January 28, 2009, 529 persons from 43 states (Figure 1) and one person from Canada had been reported infected with the outbreak strain. This report is an interim summary of results from ongoing epidemiologic studies and recall and control activities by CDC, the Food and Drug Administration (FDA), and state and local public health agencies. Confirmed, reported onset of illness dates have ranged from September 1, 2008, to January 16, 2009. A total of 118 patients were reported hospitalized, and the infection might have contributed to eight deaths. Sequential case-control studies have indicated significant associations between illness and consumption of any peanut butter (matched odds ratio [mOR] = 2.53), and specific brands of prepackaged peanut butter crackers (mOR = 12.25), but no association with national brand jarred peanut butter sold in grocery stores. Epidemiologic and laboratory findings indicate that peanut butter and peanut paste produced at one plant are the source of the outbreak. These products also are ingredients in many foods produced and distributed by other companies. This outbreak highlights the complexities of “ingredient-driven” outbreaks and the importance of rapid outbreak detection and investigation. Consumers are advised to discard and not eat products that have been recalled.
Infections with the Outbreak Strain of *Salmonella* Typhimurium, by Week of Illness Onset, United States, 2008–2009 (n=714)

Week of illness onset**

**Some estimated
Infections with the Outbreak Strain of *Salmonella* Typhimurium, United States, 2008–2009 (n=714*)

*1 additional case in Canada
Patient Characteristics (n=714)

- Median age = 16 years (range <1 to 98 years)
- 48% female
- 24% hospitalized
- 9 deaths, infection may have contributed
  - Persons ≥59 years
Conclusions

• Large multistate outbreak caused by contaminated institutional peanut butter and peanut paste
• One of the largest food recalls in U.S.
• Complex "ingredient-driven" outbreak
  – When first detected, source not immediately apparent
  – Rapid investigation of small, local clusters and tracebacks provided critical clues
  – Collaboration among local, state and federal partners facilitated rapid public health actions
Conclusions

• Ongoing interviews of new patients crucial to detect other contaminated products
  – Colorado investigation: traceback to PCA Texas facility

• Investigations drain resources and enhancing capacity at state, local, and federal levels important

• Illnesses could continue if recalled peanut butter-containing products are consumed
  – Long shelf lives, could be in households for extended periods
Salmonella

Salmonella Homepage > Outbreaks > Heidelberg Infections Linked to Ground Turkey

Investigation Update: Multistate Outbreak of Human Salmonella Heidelberg Infections Linked to Ground Turkey

- Case Count Map
- Timeline of Events
- Epi Curve

September 29, 2011

On this Page
- Introduction
- Investigation of the Outbreak
- Clinical Features/Signs and Symptoms
- Recall
- Advice to Consumers, Retailers, and Others
- Key Resources
- CDC’s Role in Food Safety
- Previous Updates

Today’s Highlights
- A total of 129 persons infected with the outbreak strain of Salmonella Heidelberg have been reported from 34 states.
- Collaborative investigative efforts of state, local, and federal public health and regulatory agencies indicate that ground turkey is the likely source of this outbreak.
- Contaminated ground turkey is being recalled from grocery stores but may still be in consumers’ homes.
- Consumers should check their homes for recalled ground turkey products and not eat them; restaurant and food service operators should not serve them.
- The outbreak strain of Salmonella Heidelberg is resistant to several commonly prescribed antibiotics. This antibiotic resistance may be associated with an increased risk of hospitalization or possible treatment failure in infected individuals.
- Timeline of Events: Multistate Outbreak of Salmonella Heidelberg Infections Associated with Ground Turkey—United States, 2011
Salmonella and Poultry

• Commonly found
  – NARMS retail food study identifies *Salmonella* in 10-15% of ground turkey samples
• Not considered an “adulterant” in not-ready-to-eat foods (i.e. ground turkey)
Timeline of Events: Multistate Outbreak of *Salmonella* Heidelberg Infections Associated with Ground Turkey — United States, 2011

**Outbreak Identification, Source Implication and Results of Product Testing**

**May 23**
CDC PulseNet identified multistate cluster of *Salmonella* Heidelberg infections (303 ill persons, 17 states) and began monitoring for additional illnesses. Investigators noted two ground turkey isolates matching the outbreak strain that were uploaded to PulseNet by MN on 4/11/2011 (Retail Sample 1) and NM on 5/11/2011 (Retail Sample 2) as part of NARMS surveillance.

**May 26**
CDC began coordinating a multistate investigation. NM reported Retail Sample 1 was Brand A produced at establishment P-963.

**June 16 – June 21**
Exposure information from 19 ill persons revealed no single food that stood out as a likely source; 3% reported eating multiple brands and types of ground turkey.

**June 21**
CDC asked states to use a turkey-specific questionnaire to further characterize turkey exposures. NM reported Retail Sample 2 was Brand A produced at establishment P-963; another NARMS retail sample (Sample 3 uploaded to PulseNet by NM 6/8/2011) matching the outbreak strain was Brand B.

**June 21 – July 7**
Exposure information from turkey-specific questionnaires collected for 84 ill persons in 6 states: 33% reported consumption of multiple brands and types of ground turkey.

**July 7**
CDC asked states to use an expanded questionnaire to further examine other possible sources in addition to ground turkey.

**July 8 – August 2**
23 ill persons interviewed with expanded questionnaire: 54% reported consumption of ground turkey.

**July 15**
Off reported first results from clinical laboratory indicating the outbreak strain was multidrug resistant.

**July 29**
Tests of leftover ground turkey from the home of an ill person in Ohio yielded *Salmonella* Heidelberg. Laboratory analysis identified two closely related DNA "fingerprint" patterns: one an exact match to the outbreak strain. 23 additional ill persons with *Salmonella* Heidelberg with a closely related DNA "fingerprint" pattern with illness since March included in total number of ill persons.

**August 1**
CDC posted initial web announcement about the investigation.

**August 11**
For more information, visit CDC’s *Salmonella* website: [http://www.cdc.gov/salmonella](http://www.cdc.gov/salmonella)

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For more information, visit CDC’s *Salmonella* website: [http://www.cdc.gov/salmonella](http://www.cdc.gov/salmonella)
Timeline of Events: Multistate Outbreak of Salmonella Heidelberg Infections Associated with Ground Turkey — United States, 2011

Outbreak Identification, Source Implication and Results of Product Testing

May 23
CDC PulseNet identified multistate cluster of Salmonella Heidelberg infections (333 illnesses, 17 states) and began monitoring for additional illnesses. Investigators noted two ground turkey isolates matching the outbreak strain that were uploaded to PulseNet by MN on 4/11/2011 (Retail Sample 1) and NM on 5/11/2011 (Retail Sample 2) as part of NARMS surveillance.

June 16 – June 21
Exposure information from 19 ill persons revealed no single food that stood out as a likely source; 32% reported eating multiple brands and types of ground turkey.

June 21
CDC asked states to use a turkey-specific questionnaire to further characterize turkey exposures. NM reported Retail Sample 2 was Brand A produced at establishment P-963; another NARMS retail sample, 13/21/2011 (Sample 3 uploaded to PulseNet by NM 6/8/2011) matching the outbreak strain was Brand B.

June 21 – July 7
Exposure information from turkey-specific questionnaires collected for 16 ill persons in 6 states: 33% reported consumption of multiple brands and types of ground turkey.

July 7
CDC asked states to use an expanded questionnaire to further examine other possible sources in addition to ground turkey.

July 15
OTT reported first results from clinical laboratory indicating the outbreak strain was multidrug resistant.

July 29
Tests of leftover ground turkey from the home of an ill person in Ohio yielded Salmonella Heidelberg. Laboratory analysis identified two closely related DNA “fingerprint” patterns—one an exact match to the outbreak strain.

August 1
CDC posted initial web announcement about the investigation.

August 11
23 additional ill persons with Salmonella Heidelberg with a closely related DNA “fingerprint” pattern with illness since March included in total number of ill persons.

III persons by week of report to CDC PulseNet

III persons by week of illness onset

Traceback, Regulatory Actions and Recalls

June 1
CDC notified USDA-FSIS. Frequent discussions between both agencies continue throughout the investigation.

July 19
FSIS began first traceback investigation. Product was left over ground turkey from ill person’s household; original packaging not available.

July 19 – August 2
FSIS continued traceback of ground turkey as shopper card details received; purchased from three ill persons linked to 1963.

July 29
FSIS released a public health alert for frozen and fresh ground turkey products.

July 29
FSIS informed Cargill Meat Solutions Corporation about epidemiologic data, information from traceback of ground turkey products, and analysis of distribution records indicating establishment P-963 is a likely, but not definitive, source of this outbreak.

August 1
Cargill Meat Solutions Corporation recalled approximately 36 million pounds of ground turkey products that may be contaminated with Salmonella Heidelberg based on sample results from an intensive in-plant investigation.

August 3
Cargill Meat Solutions Corporation recalled approximately 355,000 pounds of ground turkey that may be contaminated with Salmonella Heidelberg based on sample results from an intensive in-plant investigation.

As of September 21, 2011

For more information, visit CDC’s Salmonella website: http://www.cdc.gov/salmonella
Timeline of Events: Multistate Outbreak of *Salmonella* Heidelberg Infections
Associated with Ground Turkey — United States, 2011

**Outbreak Identification, Source Implication and Results of Product Testing**

**May 23**

CDC PulseNet identified multistate cluster of *Salmonella* Heidelberg infections (303 illnesses, 17 states) and began monitoring for additional illnesses. Investigators noted two ground turkey isolates matching the outbreak strain that were uploaded to PulseNet by MN on 4/11/2011 (Retail Sample 1) and NM on 5/11/2011 (Retail Sample 2) as part of NARMS surveillance.

**Traceback, Regulatory Actions and Recalls**

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1. PulseNet
2. National Antimicrobial Resistance Monitoring System

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As of September 31, 2011 For more information, visit CDC’s *Salmonella* website: http://www.cdc.gov/salmonella
Timeline of Events: Multistate Outbreak of *Salmonella* Heidelberg Infections
Associated with Ground Turkey — United States, 2011

**Outbreak Identification, Source Implication and Results of Product Testing**

**May 23**
CDC PulseNet\(^1\) identified multistate cluster of *Salmonella* Heidelberg infections (30 ill persons, 17 states) and began monitoring for additional illnesses. Investigators noted two ground turkey isolates matching the outbreak strain that were uploaded to PulseNet by MN on 4/11/2011 (Retail Sample 1) and MN on 5/11/2011 (Retail Sample 2) as part of NARMS surveillance.

**May 26**
CDC began coordinating a multistate investigation. MN reported Retail Sample 1 was Brand A produced at establishment P-993.

**June 16 – June 21**
Exposure information from 19 ill persons revealed no single food that stood out as a likely source; 32% reported eating multiple brands and types of ground turkey.

**Traceback, Regulatory Actions and Recalls**

**June 1**
CDC notified USDA-FSIS. Frequent discussions between both agencies continue throughout the investigation.

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\(^1\) PulseNet
\(^2\) National Antimicrobial Resistance Monitoring System

As of September 31, 2011

For more information, visit CDC's *Salmonella* website: [http://www.cdc.gov/salmonella](http://www.cdc.gov/salmonella)
Timeline of Events: Multistate Outbreak of *Salmonella* Heidelberg Infections Associated with Ground Turkey — United States, 2011

**Outbreak Identification, Source Implication and Results of Product Testing**

- **May 23**
  CDC PulseNet identified multistate cluster of *Salmonella* Heidelberg infections (301 persons, 17 states) and began monitoring for additional illnesses. Investigators noted two ground turkey isolates matching the outbreak strain that were uploaded to PulseNet by MN on 4/11/2011 (Retail Sample 1) and NM on 5/11/2011 (Retail Sample 2) as part of NARMS surveillance.

- **May 26**
  CDC began coordinating a multistate investigation. MN reported Retail Sample 1 was Brand A produced at establishment P-963.

- **June 21**
  CDC asked states to use a turkey-specific questionnaire to further characterize turkey exposures. NM reported Retail Sample 2 was Brand A produced at establishment P-963. Another NARMS retail sample (Sample 3 uploaded to PulseNet by NM 6/8/2011) matching the outbreak strain was Brand B.

**Traceback, Regulatory Actions and Recalls**

- **June 1**
  CDC notified USDA-FSIS. Frequent discussions between both agencies continue throughout the investigation.

As of September 31, 2011

For more information, visit CDC’s *Salmonella* website: [http://www.cdc.gov/salmonella](http://www.cdc.gov/salmonella)
Timeline of Events: Multistate Outbreak of *Salmonella* Heidelberg Infections Associated with Ground Turkey — United States, 2011

**Outbreak Identification, Source Implication and Results of Product Testing**

**May 23**
CDC PulseNet identified a multistate cluster of *Salmonella* Heidelberg infections (30 ill persons in 17 states) and began monitoring for additional illnesses. Investigators noted two ground turkey isolates matching the outbreak strain that were uploaded to PulseNet by NM on 4/11/2011 (Retail Sample 1) and NM on 5/11/2011 (Retail Sample 2) as part of NAARMS surveillance.

**May 26**
CDC began coordinating a multistate investigation. MN reported Retail Sample 1 was brand A produced at establishment P-963.

**June 16 – June 21**
Exposure information from 19 ill persons revealed no single food that stood out as a likely source; 32% reported eating multiple brands and types of ground turkey.

**June 21**
CDC asked states to use a turkey-specific questionnaire to further characterize turkey exposures. NM reported Retail Sample 2 was brand A produced at establishment P-963; another NAARMS retail sample (Sample 3) uploaded to PulseNet by NM 6/8/2011 (Retail Sample 2) matching the outbreak strain was brand B.

**June 21 – July 7**
Exposure information from turkey-specific questionnaires collected for 16 ill persons in 6 states; 33% reported consumption of multiple brands and types of ground turkey.

**July 7**
CDC asked states to use an expanded questionnaire to further examine other possible sources in addition to ground turkey.

**Traceback, Regulatory Actions and Recalls**

**June 1**
CDC notified USDA-FSIS. Frequent discussions between both agencies continue throughout the investigation.

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1 PulseNet
2 National Antimicrobial Resistance Monitoring System

As of September 31, 2011

For more information, visit CDC's *Salmonella* website: [http://www.cdc.gov/salmonella](http://www.cdc.gov/salmonella)
Timeline of Events: Multistate Outbreak of *Salmonella* Heidelberg Infections Associated with Ground Turkey — United States, 2011

**Outbreak Identification, Source Implication and Results of Product Testing**

**May 23**
CDC PulseNet identified a multistate cluster of *Salmonella* Heidelberg infections (301 ill persons, 17 states) and began monitoring for additional illnesses. Investigators noted two ground turkey isolates matching the outbreak strain that were uploaded to PulseNet by NM on 4/11/2011 (Retail Sample 1) and NM on 5/11/2011 (Retail Sample 2) as part of NARMS surveillance.

**May 26**
CDC began coordinating a multistate investigation. MN reported Retail Sample 1 was Brand A produced at establishment P-963.

**June 16 – June 21**
Exposure information from 19 ill persons revealed no single food that stood out as a likely source; 32% reported eating multiple brands and types of ground turkey.

**June 21**
CDC asked states to use a turkey-specific questionnaire to further characterize turkey exposures. NM reported Retail Sample 2 was Brand A produced at establishment P-963; another NARMS retail sample (Sample 3 uploaded to PulseNet by NM 6/8/2011) matching the outbreak strain was Brand B.

**June 21 – July 7**
Exposure information from 16 ill persons in 6 states; 33% reported consumption of multiple brands and types of ground turkey.

**July 7**
CDC asked states to use an expanded questionnaire to further examine other possible sources in addition to ground turkey.

**July 8 – August 2**
23 ill persons interviewed with expanded questionnaire; 54% reported consumption of ground turkey.

**July 15**
OTT reported first results from clinical laboratory indicating the outbreak strain was multidrug resistant.

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**III persons by week of report to CDC PulseNet**

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**III persons by week of illness onset**

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**Traceback, Regulatory Actions and Recalls**

**June 1**
CDC notified USDA-FSIS. Frequent discussions between both agencies continue throughout the investigation.

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As of September 31, 2011

For more information, visit CDC’s *Salmonella* website: http://www.cdc.gov/salmonella
Timeline of Events: Multistate Outbreak of Salmonella Heidelberg Infections
Associated with Ground Turkey — United States, 2011

**Outbreak Identification, Source Implication and Results of Product Testing**

- **May 23**: CDC PulseNet identified a multistate cluster of Salmonella Heidelberg infections (30 ill persons, 17 states) and began monitoring for additional illnesses. Investigators noted two ground turkey isolates matching the outbreak strain that were uploaded to PulseNet by NM on 4/11/2011 (Retail Sample 1) and NM on 5/11/2011 (Retail Sample 2) as part of NARMS surveillance.

- **May 26**: CDC began coordinating a multistate investigation. NM reported Retail Sample 1 was Brand A produced at establishment P-963.

- **June 15**: OFR reported first results from clinical laboratory indicating the outbreak strain was multidrug resistant.

- **June 16 – June 21**: Exposure information from 19 ill persons revealed no single food that stood out as a likely source; 32% reported eating multiple brands and types of ground turkey.

- **June 21**: CDC asked states to use a turkey-specific questionnaire to further characterize turkey exposures. NM reported Retail Sample 2 was Brand A produced at establishment P-963; another NARMS retail sample (Sample 3 uploaded to PulseNet by NM 6/8/2011) matching the outbreak strain was Brand B.

- **July 7**: CDC asked states to use an expanded questionnaire to further examine other possible sources in addition to ground turkey.

- **July 8 – August 2**: 23 ill persons interviewed with expanded questionnaire; 54% reported consumption of ground turkey.

**Traceback, Regulatory Actions and Recalls**

- **June 1**: FSIS began first traceback investigation. Product was left over ground turkey from ill person’s household; original packaging not available.

- **July 19**: FSIS continued traceback of ground turkey as shopper card details received; purchased from three ill persons linked to 1963.

For more information, visit CDC’s Salmonella website: http://www.cdc.gov/salmonella
Timeline of Events: Multistate Outbreak of Salmonella Heidelberg Infections Associated with Ground Turkey — United States, 2011

**Outbreak Identification, Source Implication and Results of Product Testing**

- **May 23**: CDC PulseNet identified a multistate cluster of Salmonella Heidelberg infections (301 persons, 17 states) and began monitoring for additional illnesses. Investigators noted two ground turkey isolates matching the outbreak strain that were uploaded to PulseNet by NM on 4/11/2011 (Retail Sample 1) and NM on 5/11/2011 (Retail Sample 2) as part of NARMS surveillance.

- **June 16 – June 21**: Exposure information from 19 ill persons revealed no single food that stood out as a likely source; 32% reported eating multiple brands and types of ground turkey.

- **June 21**: CDC asked states to use a turkey-specific questionnaire to further characterize turkey exposures. NM reported Retail Sample 2 was Brand A produced at establishment P-963; another NARMS retail sample (Sample 3 uploaded to PulseNet by NM 6/8/2011) matching the outbreak strain was Brand B.

- **June 21 – July 7**: Exposure information from 28 ill persons interviewed with expanded questionnaire; 54% reported consumption of multiple brands and types of ground turkey.

- **July 7**: CDC asked states to use an expanded questionnaire to further examine other possible sources in addition to ground turkey.

- **July 8 – August 2**: 23 ill persons interviewed with expanded questionnaire; 54% reported consumption of ground turkey.

- **July 15**: OR reported first results from clinical laboratory indicating the outbreak strain was multiresistant.

- **July 29**: Tests of leftover ground turkey from the homes of an ill person in Ohio yielded Salmonella Heidelberg. Laboratory analysis identified two closely related DNA “fingerprint” patterns: one an exact match to the outbreak strain.

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**Traceback, Regulatory Actions and Recalls**

- **June 1**: CDC notified USDA-FSIS. Frequent discussions between both agencies continue throughout the investigation.

- **July 19**: FSIS began first traceback investigation. Product was left over ground turkey from ill person’s household; original packaging not available.

- **July 19 – August 2**: FSIS continued traceback of ground turkey as shopper card details received; purchased from three ill persons linked to 1963.

- **July 29**: FSIS released a public health alert for frozen and fresh ground turkey products.

- **July 29**: FSIS informed Cargill Meat Solutions Corporation about epidemiologic data, information from traceback of ground turkey products, and analysis of distribution records indicating establishment P-963 is a likely, but not definitive, source of this outbreak.

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As of September 31, 2011

For more information, visit CDC’s Salmonella website: http://www.cdc.gov/salmonella
Timeline of Events: Multistate Outbreak of *Salmonella* Heidelberg Infections Associated with Ground Turkey — United States, 2011

**Outbreak Identification, Source Implication and Results of Product Testing**

- **May 23**: CDC PulseNet identified multistate cluster of *Salmonella* Heidelberg infections (331 persons, 17 states) and began monitoring for additional illnesses. Investigators noted two ground turkey isolates matching the outbreak strain that were uploaded to PulseNet by MN on 4/11/2011 (Retail Sample 1) and NM on 5/11/2011 (Retail Sample 2) as part of NARMS surveillance.

- **May 26**: CDC began coordinating a multistate investigation. MN reported Retail Sample 1 was Brand A produced at establishment P-963.

- **June 16 – June 21**: Exposure information from 19 ill persons revealed no single food that stood out as a likely source; 32% reported eating multiple brands and types of ground turkey.

- **June 21**: CDC asked states to use a turkey-specific questionnaire to further characterize turkey exposures. NM reported Retail Sample 2 was Brand A produced at establishment P-963; another NARMS retail sample (Sample 3 uploaded to PulseNet by NM 6/8/2011) matching the outbreak strain was Brand B.

- **June 21 – July 7**: Exposure information from turkey-specific questionnaires collected for 16 ill persons in 6 states: 33% reported consumption of multiple brands and types of ground turkey.

- **July 15**: OR reported first results from clinical laboratory indicating the outbreak strain was multiresistant.

- **August 3**: FSIS reported that the source of ground turkey for Brand B Retail Sample 3 was establishment P-963. 50 (59%) of 56 interviewed III persons reported eating any ground turkey prepared at home in the week before illness.

**Traceback, Regulatory Actions and Recalls**

- **June 1**: CDC notified USDA-FSIS. Frequent discussions between both agencies continue throughout the investigation.

- **July 19**: FSIS began first traceback investigation. Product was left over ground turkey from ill person's household; original packaging not available.

- **July 19 – August 2**: FSIS continued traceback of ground turkey as shopper card details received; purchased from three ill persons linked to P-963.

- **July 29**: FSIS released a public health alert for frozen and fresh ground turkey products.

- **July 29**: FSIS informed Cargill Meat Solutions Corporation about epidemiologic data, information from traceback of ground turkey products, and analysis of distribution records indicating establishment P-963 is a likely, but not definitive, source of this outbreak.

- **August 3**: Cargill Meat Solutions Corporation recalled approximately 36 million pounds of ground turkey products that may be contaminated with a multi-drug resistant strain of *Salmonella* Heidelberg.

As of September 31, 2011

For more information, visit CDC's *Salmonella* website: http://www.cdc.gov/salmonella

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1. PulseNet
2. National Antimicrobial Resistance Monitoring System
Timeline of Events: Multistate Outbreak of *Salmonella* Heidelberg Infections Associated with Ground Turkey — United States, 2011

**Outbreak Identification, Source Implication and Results of Product Testing**

- **May 23**
  - CDC PulseNet identified multistate cluster of *Salmonella* Heidelberg infections (301 ill persons, 17 states) and began monitoring for additional illnesses. Investigators noted two ground turkey isolates matching the outbreak strain that were uploaded to PulseNet by MN on 4/11/2011 (Retail Sample 1) and NM on 5/11/2011 (Retail Sample 2) as part of NARMS surveillance.

- **May 26**
  - CDC began coordinating a multistate investigation. MN reported Retail Sample 1 was Brand A produced at establishment P-963.

- **June 1**
  - CDC notified USDA-FSIS. Frequent discussions between both agencies continue throughout the investigation.

- **June 16 – June 21**
  - Exposure information from 19 ill persons revealed no single food that stood out as a likely source; 32% reported eating multiple brands and types of ground turkey.

- **June 21 – July 7**
  - Exposure information from turkey-specific questionnaires collected for 88 ill persons in 6 states; 33% reported consuming multiple brands and types of ground turkey.

- **July 7**
  - CDC asked states to use an expanded questionnaire to further examine other possible sources in addition to ground turkey.

- **July 15**
  - Of the 22 ill persons interviewed with expanded questionnaire, 54% reported consumption of ground turkey.

- **July 25**
  - Tests of leftover ground turkey from the home of an ill person in Ohio yielded *Salmonella* Heidelberg, Laboratory analysis identified two closely related DNA “fingerprint” patterns and were an exact match to the outbreak strain.

- **August 1**
  - CDC posted initial web announcement about the investigation.

- **August 11**
  - 23 additional ill persons with *Salmonella* Heidelberg with a closely related DNA “fingerprint” pattern with illness since March included in total number of ill persons.

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**Traceback, Regulatory Actions and Recalls**

- **June 19**
  - FSIS began first traceback investigation. Product was left over ground turkey from ill person's household; original packaging not available.

- **July 19 – August 2**
  - FSIS continued traceback of ground turkey as shopper card details received: purchased from three ill persons linked to 1963.

- **July 29**
  - FSIS released a public health alert for frozen and fresh ground turkey products.

- **July 29**
  - FSIS reported that the source of ground turkey for Brand B Retail Sample 3 was establishment P-963. 50 (54%) of 95 interviewed ill persons reported eating any ground turkey prepared at home in the week before illness.

- **August 3**
  - FSIS reported that the source of ground turkey for Brand A Retail Sample 3 was establishment P-963. 36 (59%) of 60 interviewed ill persons reported eating any ground turkey prepared at home in the week before illness.

- **September 11**
  - Cargill Meat Solutions Corporation recalled approximately 185,000 pounds of ground turkey that may be contaminated with *Salmonella* Heidelberg based on sample results from an intensive in-plant investigation.

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As of September 11, 2011

For more information, visit CDC's *Salmonella* website: [http://www.cdc.gov/salmonella](http://www.cdc.gov/salmonella)
Median number of days from onset of illness to:
- submission of a PFGE pattern to PulseNet was 16 days (range 5-54 days)
- an initial interview by a state/local health department was 32 days (range 9-136 days),
Salmonella

Investigation Update: Multistate Outbreak of Human Salmonella Enteritidis Infections Associated with Shell Eggs

September 20, 2010

Investigation of the Outbreak

Today’s Highlights
- From May 1 to September 14, 2010, approximately 1,808 illnesses were reported that are likely to be associated with this outbreak.
- Now Available: Timeline: Multistate Outbreak of Salmonella Enteritidis (SE) Infections Associated with Shell Eggs, United States, 2010. [PDF - 427KB]

CDC continues to collaborate with public health officials in multiple states, the U.S. Food and Drug Administration (FDA), and the U.S. Department of Agriculture’s Food Safety and Inspection Service to investigate a nationwide increase in Salmonella Enteritidis (SE) infections with an indistinguishable pulsed-field gel electrophoresis (PFGE) pattern: JEG01.0001L. This is the most common PFGE pattern for SE in the PulseNet database. Investigators are using DNA analysis of SE bacteria obtained through diagnostic testing to identify cases of illness and restaurant or event clusters (where more than one ill person with the outbreak strain has eaten) that may be part of this outbreak. Because the SE PFGE pattern commonly occurs in the United States, some of the cases identified may not be related to this outbreak.

Investigation of the Outbreak

In July 2010, CDC identified a nationwide sustained increase in the number of Salmonella Enteritidis isolates with PFGE pattern JEG01.0001L. This PFGE pattern was detected in an outbreak of Salmonella Enteritidis infections in May 2010, identified as outbreak related by PulseNet in June 2010.

Contact CDC
- CDC-INFO

Quick Links
- Diseases & Conditions
- A-Z Index
- Report a Foodborne Illness
- DFBMD Home
- Salmonella Information

http://www.cdc.gov/salmonella/enteritidis/index.html
Salmonella Enteritidis (SE)

- 6,000 to 7,000 laboratory confirmed infections each year
  - ~18% of all U.S. salmonellosis

- Outbreaks often associated with chicken or eggs
  - Silent infection of ovary of hen
  - Healthy hens
  - Eggs can be internally contaminated
Shell Egg Regulation

- Shell eggs regulated by US Food & Drug Administration (FDA)
  - SE regulation initially proposed in 2004
- Prevention of *Salmonella* Enteritidis in Shell Eggs During Production, Transportation, and Storage
  - Prevent SE contamination of eggs during production
  - Prevent further growth during transportation, storage
  - Require record keeping of compliance and testing results
- Rule became effective on July 9, 2010
  - Producers with 50,000+ hens compliant
OUTBREAK DETECTION

n = 1,639

Week Isolate Reported
Number of SE Pattern 4 Isolates Reported to PulseNet, U.S., 2010

Number of Isolates Reported by Week

- Week Isolate Reported
- 5-year baseline mean

Number of Isolates

Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec

0   | 50  | 50  | 50  | 50  | 200 | 200 | 200 | 200 | 200 | 200 | 200
Number of SE Pattern 4 Isolates Reported to PulseNet, U.S., 2010

Number of Isolates

Week Isolate Reported

n = 3,578

5-year baseline mean
Number of SE Pattern 4 Isolates Reported to PulseNet, U.S., 2010

Surplus incidence
n = 1,939

Week Isolate Reported

5-year baseline mean
Challenges

- **SE pattern 4 most common PFGE pattern**
  - 40-50 cases reported weekly to CDC
  - Case definition based on PFGE subtype has high probability of including non-outbreak cases

- **SE often associated with chicken or eggs**
  - Both commonly consumed
  - Eggs “steal” ingredient in many prepared dishes
  - Case-control study of sporadic cases unlikely to identify source
Investigation Strategy

- Focused on restaurant or event clusters
  - Narrows focus to specific set of exposures
  - Menu items, food preparation practices
  - Facilitates traceback to common source
CLUSTER INVESTIGATIONS
Restaurant or event clusters, April 10-November 30, 2010
Restaurant or event clusters, April 10-November 30, 2010

Cluster
n = 29
Median 4 laboratory-confirmed cases
Suspect Food Items in Clusters

- **8 case-control studies**
  - 7 implicated eggs
  - 1 inconclusive

- **2 cohort studies**
  - 1 implicated eggs
  - 1 inconclusive

- **19 food histories**
  - 6 identified exposure to eggs
  - 1 identified exposure to chicken dishes
  - 1 identified exposure to ill food handlers
  - 11 inconclusive
Suspect Food Items in Clusters

- Eggs as main ingredient
  - Breakfast tacos
  - Omelet

- Eggs as stealth ingredient
  - Vietnamese sandwiches
  - Tofu pancake
  - Seafood tofu hot pot

- Common source of eggs determined for 17 clusters
  - Difficulties identifying suppliers
TRACEBACK INVESTIGATIONS
Restaurant or event clusters, April 10-November 30, 2010

Egg suppliers identified for 17 clusters; WCE was an egg supplier in 15 (88%) of these clusters.
Number of SE Pattern 4 Isolates Reported to PulseNet, U.S., 2010

Number of Isolates vs Week Isolate Reported

FDA inspects Producer A

Week Isolate Reported

Number of Isolates
REGULATORY ACTION & RECALLS
Number of SE Pattern 4 Isolates Reported to PulseNet, U.S., 2010

~600 samples, 11 positives
FDA Inspectional Observations

<table>
<thead>
<tr>
<th>District Office Address and Phone Number</th>
<th>Date(s) of Inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDA Kansas City District Office</td>
<td>8/12/10-8/30/10</td>
</tr>
<tr>
<td>11630 W 80th St</td>
<td></td>
</tr>
<tr>
<td>Lenexa, KS 66214-3340</td>
<td></td>
</tr>
<tr>
<td>(913) 752 2100</td>
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</tbody>
</table>

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<thead>
<tr>
<th>Name and Title of Individual to Whom Report is Issued</th>
<th>FEI Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3006481643, 3004792793, 3005280357, 30047927952, 3006481709, 3003073159</td>
</tr>
</tbody>
</table>

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<tr>
<th>Firm Name</th>
<th>Street Address</th>
<th>Type of Establishment Inspected</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2674 Highway 59</td>
<td>Shell Egg Manufacturer</td>
</tr>
</tbody>
</table>

During an inspection of your firm we observed:

This document lists observations made by the FDA representatives (s) during the inspection of your facility. They are inspectional observations and do not represent a final agency determination regarding your compliance. If you have an objection regarding an observation or have implemented, or plan to implement corrective action in response to an observation, you may discuss the objection or action with the FDA representative (s) during the inspection or submit this information to FDA at the address above. If you have any questions, please contact FDA at the phone number and address above.

Observations listed below cover inspections of your egg laying farms/plants inspected from 08/12/2010 through 08/30/2010. Inspections of Layers 1, 3 and 6 included record review and environmental assessments of all houses. Inspections of Layers 2 and 4 included record review of all houses and environmental assessments for Layer 2 – Houses 7 and 11 and Layer 4 – House...
Manure... approximately 4 feet high to 8 feet high...
FDA Inspectional Observations

Manure… approximately 4 feet high to 8 feet high…

The outside access doors…had been pushed out by the weight of the manure…
Manure... approximately 4 feet high to 8 feet high...

The outside access doors...had been pushed out by the weight of the manure...

Live and dead flies too numerous to count...
FDA Inspectional Observations

DEPARTMENT OF HEALTH AND HUMAN SERVICES
FOOD AND DRUG ADMINISTRATION

DISTRICT OFFICE ADDRESS AND PHONE NUMBER
FDA Kansas City District Office
11630 W 80th St
Lenexa, KS 66214-3340 (913) 752 2100

DATE(S) OF INSPECTION
8/12/10-8/30/10

FEI NUMBER
3006481643, 3004793793, 3005280357

NAME AND TITLE OF INDIVIDUAL TO WHOM REPORT IS ISSUED

TO: [Redacted]

FIRM NAME
[Redacted]

STREET ADDRESS
2674 Highway 89

CITY, STATE AND ZIP CODE
[Redacted]

TYPE OF ESTABLISHMENT INSPECTED
Shell Egg Manufacturer

DURING AN INSPECTION OF YOUR FIRM WE OBSERVED:

THIS DOCUMENT LISTS OBSERVATIONS MADE BY THE FDA REPRESENTATIVE(S) DURING THE INSPECTION OF YOUR FACILITY. THEY ARE INSPECTIONAL OBSERVATIONS, AND DO NOT REPRESENT A FINAL AGENCY DETERMINATION REGARDING YOUR COMPLIANCE. IF YOU HAVE AN OBJECTION REGARDING AN OBSERVATION OR HAVE IMPLEMENTED, OR PLAN TO IMPLEMENT CORRECTIVE ACTION IN RESPONSE TO AN OBSERVATION, YOU MAY DISCUSS THE OBJECTION OR ACTION WITH THE FDA REPRESENTATIVE(S) DURING THE INSPECTION OR SUBMIT THIS INFORMATION TO FDA AT THE ADDRESS ABOVE. IF YOU HAVE ANY QUESTIONS, PLEASE CONTACT FDA AT THE PHONE NUMBER AND ADDRESS ABOVE.

Observations listed below cover inspections of your egg laying farms/plants inspected from 08/12/2010 through 08/30/2010. Inspections of Layers 1, 3 and 6 included record review and environmental assessments of all houses. Inspections of Layers 2 and 4 included record review of all houses and environmental assessments for Layer 2 — Houses 7 and 11 and Layer 4 — House...
Two live rodents were observed...
FDA Inspectional Observations

Two live rodents were observed...

Liquid manure was observed streaming out...
Number of SE Pattern 4 Isolates Reported to PulseNet, U.S., 2010

Producer A: 228 million
Number of SE Pattern 4 Isolates Reported to PulseNet, U.S., 2010

Week Isolate Reported

Producer A: 152 million
Number of SE Pattern 4 Isolates Reported to PulseNet, U.S., 2010

Producer B: 170 million
Number of SE Pattern 4 Isolates Reported to PulseNet, U.S., 2010

Number of Isolates

Week Isolate Reported

550 million shell eggs recalled
Egg Distribution

- Packaging and repackaging under different labels common
  - Breakage during transportation
- Complicated distribution
  - “Farm A eggs” were produced by Producer A and Producer B, and packaged by Farm X in 6-egg, dozen-egg, 18-egg and 2 ½ dozen-egg cartons, in 2 ½ dozen and 5-dozen egg sleeves, in 15-dozen bulk cubes and in 30-dozen cases
- Producer A sold under 13 brand names
- Producer B sold under 3 brand names
Conclusions

- More than 56,000 sickened
  - 1 laboratory-confirmed case: 29 unreported cases

- Nationwide outbreak caused by shell eggs
  - Shell eggs important vehicle for SE infection
  - First recall of shell eggs in the United States

- Focus on restaurant and event clusters critical to outbreak response
Thank you

The findings and conclusions in this presentation are those of the author and do not necessarily represent the views of the Centers for Disease Control and Prevention.