Human *Escherichia coli* O121 Infections Linked to Frozen Snack Foods — U.S., 2013

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San Antonio, TX
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Shiga Toxin-producing *Escherichia coli* (STEC) Infections

- Cause ~175,000 illnesses, 2,400 hospitalizations, and 20 deaths annually in the U.S.
- Acquired from different sources—meat, produce, unpasteurized dairy products, animal contact
- Causes diarrheal illness in humans
  - Bloody diarrhea
  - Hemolytic uremic syndrome (HUS)
Outbreak Detection

- On February 7, 2013 PulseNet identified 5 STEC O121 isolates with indistinguishable PFGE patterns reported from 5 states
  - AL, MS, SD, WA, WI

- Novel PFGE pattern to PulseNet database

- CDC initiated multistate investigation

• Data are preliminary and subject to change •
Outbreak Case Definition

- Illness in patient with STEC O121 infection
- Illness onset* on/after December 30, 2012
- PFGE pattern indistinguishable from outbreak strain

*Isolation date if onset date unavailable

- Data are preliminary and subject to change •
Identifying Source of Outbreak

- In early interviews, patients reported eating a variety of frozen foods

- Standardized hypothesis-generating questionnaire used to uniformly assess common exposures, including frozen food items initially reported by patients

- Interview results were compared to the 2006 FoodNet population survey
  - Survey of general population in 10 FoodNet sites across US
  - Foods consumed in 7 days prior to interview
Frozen Food Signal Strengthened

- Patients continued to report frozen food consumption

- 7/7 (100%) reported any frozen food
  - 5/7 (71%) reported frozen bites or rolls
  - 2/5 (40%) reported Brand A mozzarella bites/sticks

- 2006 FoodNet population survey
  - No similar comparison variable for frozen bites or rolls
  - 28% ate frozen dinners/entrees
  - 25% ate frozen pizza

*Data are preliminary and subject to change*
Single Interviewer Iterative Approach

- CDC requested permission to interview newly identified cases or re-interview selected older cases.

- New questionnaire focusing on frozen foods along with open-ended component to capture unidentified exposures.

- Single interviewer strategy employed:
  - Compare responses across interviews
  - Hone in on infrequently mentioned, unusual exposures
  - Drill down on identified commonalities

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Leftover Product

- March 15th – CDC interviews mother of a New York patient with leftover frozen foods in freezer
  - Brand A mini chicken quesadillas
  - Brand B chicken patties

- Leftover food items sent to New York state laboratory for testing

Data are preliminary and subject to change •
Brand A Signal Strengthens

- Investigators continue to interview cases
- Brand A products identified with increasing frequency
- 7/12 ate one of several Brand A frozen food products
  - 3/7 mini quesadillas
  - 2/7 mozzarella sticks
  - 2/7 Philly cheese steaks
  - 1/7 mozzarella bites

• Data are preliminary and subject to change •
Recall #1

- New York state lab isolates STEC O121 outbreak strain from leftover Brand A mini chicken quesadillas
  - Produced at Plant A in GA

- March 28th – company recalls ~196,222 pounds of Brand A partially baked frozen foods produced at Plant A

• Data are preliminary and subject to change •
Investigation Continues

- CDC continues to interview cases
- FSIS and FDA inspect Plant A
- Leftover Brand A mini pizza slices identified in patients’ homes in Texas and New York
  - Produced at Plant A, but at different times
  - Lot code on bag indicated mini pizza slices from New York were not covered by the recall

• Data are preliminary and subject to change •
Recall #2

- April 3rd – FSIS laboratory isolates STEC O121 outbreak strain from leftover Brand A mini pizza slices from TX patient’s home

- April 4th – Recall expanded out of “abundance of caution”
  - Everything produced at Plant A from July 1, 2011 to March 29, 2013
  - Products manufactured under 3 different brand names (including Brand A)
  - >10.5 million pounds of recalled frozen food products

• Data are preliminary and subject to change •
Investigation Findings at Plant A

- Flour identified as most likely contaminated ingredient
  - Common ingredient among all the food items reported by ill persons
  - Hazard Assessment and Critical Control Points Plans (HACCP) did not account for potential STEC contamination of dry ingredients (including flour)

- Flour and other ingredient sampling negative for STEC

- Company voluntarily suspended production at Plant A until improvements made
## Patient Characteristics (n=35)

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<th>n/N</th>
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<tr>
<td>Female</td>
<td>21/35</td>
<td>60</td>
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<tr>
<td>Hospitalized</td>
<td>9/29</td>
<td>31</td>
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<td>HUS</td>
<td>2/29</td>
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<td>Death</td>
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- Median age: 17 years (range 1–75 years)

*Data are preliminary and subject to change*
Persons infected with STEC O121 by state (n=35)

- Data are preliminary and subject to change

- 1-2 cases
- ≥3 cases

Map showing the distribution of infections across states.
Epidemic curve for STEC O121 (n=35)

Number of persons

Date of Illness Onset

- Data are preliminary and subject to change -
Brand A Products Reported by Patients

- Mini pizza slices
- Mini chicken quesadillas
- Philly cheese steaks
- Mozzarella sticks
- Mozzarella bites

• Data are preliminary and subject to change •
Product Preparation

- Cooking instruction varied by product
  - Conventional oven, toaster oven, microwave, home fryer
  - Microwave instructions based on 1100 watt
  - “Half bag” and “full bag”

- Practices among patients
  - 2/9 conventional oven
  - 7/9 microwave
    - 4/7 didn’t know oven wattage
    - Some placed “a few” pieces in microwave to cook
  - None let food thaw before cooking

- Data are preliminary and subject to change
Conclusions

- Epidemiologic and laboratory investigations linked outbreak to Brand A frozen food products
- Iterative, open-ended interviewing critical to identifying outbreak vehicle
- Isolation of outbreak strain from leftover product greatly increased speed of solving outbreak
- Contaminated flour suspected source of outbreak, but no smoking gun
Discussion

- Contaminated flour source of other outbreaks
  - 2008 – *Salmonella Typhimurium* linked to uncooked baking mixture in New Zealand
  - 2009 – STEC O157:H7 linked to ready-to-bake cookie dough

- Firm’s HACCP plans didn’t account for potential STEC contamination of flour

- Implicated frozen food products not ready-to-eat and required further cooking by consumer
  - Unclear if recommended cooking methods sufficient to kill outbreak strain
  - Not all patients adequately followed package instructions
Recommendations

- Public health/regulatory agencies – increase awareness among food producers that raw flour could be a potential source of STEC

- Food manufacturers – label packaging appropriately
  - Place prominent labeling on products that must be cooked thoroughly
  - Include recommended wattage in microwave cooking instructions

- Consumers – cook foods thoroughly according to package directions
## Acknowledgments

### State and Local Health Departments

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### USDA-FSIS

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Office of Public Health Service

Compliance and Investigations Division, OPEER

Office of Public and Consumer Affairs

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FDA District Offices – ATL, DEN, NOL, CHI, CIN, MIN

Center for Food Safety and Applied Nutrition
Thank You

For more information please contact Centers for Disease Control and Prevention
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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.