Outbreak Among Attendees at a Funeral Meal, Sumter County Alabama – July 2013 (AL1307JF6-60a)

Introduction

On July 8, 2013, the environmentalist from Sumter County notified Public Health Area 7 Field Surveillance staff (FSS) of a possible gastrointestinal (GI) foodborne outbreak among individuals who attended a meal after a funeral service two days earlier. The local hospital also reported a surge of patients with GI symptoms. Anecdotal accounts estimated that more than 100 individuals attended the lunch and, within a few hours of eating, approximately 80 individuals became ill with diarrhea, vomiting, and fever. FSS alerted central office Epidemiology (EPI) and an investigation was initiated to determine the source of illness, institute appropriate control measures, and educate the public on future prevention measures.

Methods

FSS interviewed ill individuals to identify possible exposures by using a hypothesis generating questionnaire (HGQ). The HGQ contains questions about travel, animals, water exposure, group gatherings, and associations with daycares or nursing homes. The responses to the nine HGQ indicated the funeral meal was the only common exposure among the ill. EPI developed an electronic outbreak-specific questionnaire (OSQ) to collect information on ill and non-ill individuals who attended the meal following the funeral. The OSQ contained questions related to demographics, food items and drinks served at the lunch, illness onset, and symptoms. Food and drinks included chicken (baked and fried), pulled pork, potato salad, green beans, macaroni and cheese, creamed corn, cake, canned soft drinks, and water.

A case was defined as an individual who ate lunch at the church on July 6 and became ill with GI symptoms within 72 hours. Individuals who ate lunch at the church and did not become ill with GI symptoms were used as controls. A confirmed case was defined as having laboratory-confirmation of the identified organism; persons that became ill with GI symptoms within 72 hours without laboratory confirmation were classified as probable cases.

EPI issued a news release to notify the community of this foodborne outbreak and to encourage symptomatic individuals to seek medical attention. Because attendees were reportedly from several states, EPI issued a nationwide bulletin to alert the epidemiology community through the Epidemic Information Exchange (Epi-X) and to request they report any cases identified to be associated with this outbreak to Alabama.

Food specific relative risks (RR) and p-values were calculated to assess the association between exposures and illness (dichotomous variables) estimated by Fisher's exact test (1). An epidemic curve was plotted and basic descriptive analysis performed using Epi-Info and SAS statistical software.

On July 9, the local environmentalist conducted an inspection of the kitchen, and interviewed the Pastor and two of three individuals who prepared the food at the facility. No leftovers were available for collection at the church. On July 12, the environmentalist returned to the kitchen and collected numerous environmental specimens including samples from the air conditioner table (A/C) and vent, cabinets, counters, outside and inside refrigerator, drawers, faucet, trap, basin drain and sink, handles [microwave, cabinets, oven, and stove], and stove knobs.

Environmental staff collected raw packaged whole chicken from the local grocery store. The available chicken was not from the same lot as the chicken previously purchased. Leftover food was also collected from two residences; however, one leftover plate did not appear to be from the listed items meal served at the church.

FSS collected clinical specimens from several ill individuals to be submitted to the Bureau of Clinical Laboratories (BCL). Based on reported symptoms and incubation period, the BCL tested three clinical specimens for *Staphylococcus aureus* and *Clostridium perfringens* toxins; enteric pathogens (*Salmonella*, *Shigella* and *Escherichia coli*); and norovirus. Additional stool and blood specimens were only tested for enteric pathogens and norovirus. Serotyping and pulsed-field gel electrophoresis (PFGE) pattern analysis was conducted on all isolates.

Table 1. Demographic and Clinical Characteristics Among Individuals Attending a Funeral, Sumter County, Alabama – July 2013.

Feature	Ill (N=38)	Not ill (N=4*)
Age (years)		
Mean (SD)	35.8 (21.5)	65.0 (7.1)
Range	4-75	60-70
Median	35	65
Gender, Male (%)	14 (36.8)	1 (25.0)
Race (%)		
African American	30 (78.9)	4 (100.0)
White/Caucasian	2 (5.3)	--
Ethnicity, Not Hispanic (%)	35 (92.1)	4 (100.0)
Incubation period (in hours)		
Mean (SD)	10.5 (9.7)	
Range	2.5-42.5	
Median	5.8	
Symptoms (yes), (%)		
Diarrhea	38 (100.0)	
Abdominal pain	36 (94.7)	
Nausea	32 (84.2)	
Measured fever (>101.0°F)	31 (81.6)	
Headache	30 (78.9)	
Myalgia/Muscle Aches	30 (78.9)	
Chills	30 (78.9)	
Vomiting	29 (76.3)	
Lethargy	28 (73.7)	
Backache	23 (60.5)	
Gas	15 (39.5)	
Outcome (%)		
Visited ER/Physician	38 (100.0)	
Hospitalized	30 (78.9)	

*Total interviewed: 43 (38 ill, 5 not ill (1 of 5 not ill was not included in the analysis due to lacking exposure history).

The Centers for Disease Control and Prevention (CDC) assisted ADPH by testing environmental samples, the raw chicken, and leftovers. Specimens were tested for *Staphylococcus aureus* enterotoxins (A, B, C, D, and E) and *Bacillus cereus* enterotoxins (EIA, RPLA diarrheal). CDC cultured for *S. aureus*, *B. cereus*, *Salmonella,* and *Campylobacter*. PCR testing was performed for staphylococcal enterotoxin genes (A, B, C, D, E, and H), *Shigella* ipaH, ETEC (LT and ST), and shiga toxin-producing *E. coli* (STEC, Stx1, Stx2, eae, and ehxA).

Results

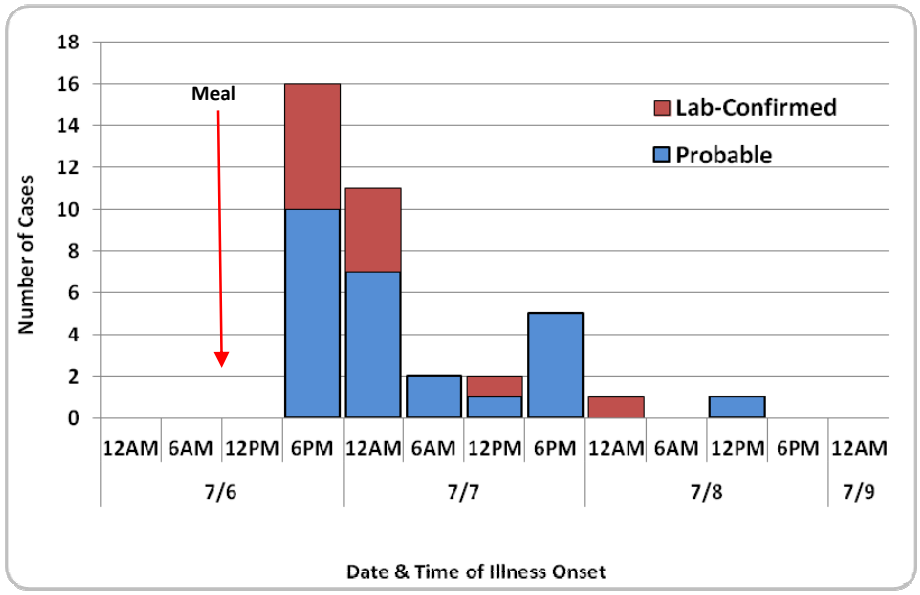
FSS identified 80 individuals that attended the lunch and reported

becoming ill. Of the 80 ill, 9 were initially interviewed with the hypothesis generating questionnaire and 43 were interviewed using the in-depth outbreak-specific questionnaire. One not ill individual, who did not eat the lunch, was excluded from the analysis.

Of the remaining 42 interviewed individuals, 38 (90.5%) were ill and met the case definition; four (9.5%) were not ill. Median age of the ill was 35 years (range: 4-75 yrs); 14 (36.8%) were male; 30 (78.9%) African American/Black, 2 (5.3%) Caucasian/White, and 6 (15.8%) were classified as "Other" race; and 35 (92.1%) were Not Hispanic (Table 1). Median illness onset was 5.8 hours (range: 2.5-42.5 hours). States of residence included Alabama, California, Colorado, Florida, Georgia, Illinois, Kansas, Michigan, Mississippi, Missouri, and Oklahoma.

Twenty-seven (71.1%) of the cases became ill within 12 hours of eating (Figure 1). The shape of the epi-curve is consistent with a point source outbreak. One individual with 42.5 hours disease onset was included in the analysis because the person ate at the lunch and onset was within incubation period for salmonellosis. More than 80% of the people experienced diarrhea, abdominal pain, nausea, and measured fever >101.0° F. All 38 interviewed cases sought medical attention, of which 78.9% were hospitalized (Table 1). One individual, who was not interviewed, but ate at the lunch, was found deceased three days after the meal; friends stated he complained of GI symptoms the day after the lunch.

Figure 1. Epidemic Curve Depicts Symptoms Onset Date and Time of Individuals (N=38) Involved in an Outbreak at a Church Event, Sumter County - Alabama, July 2013.



Analysis of the food intake indicated individuals who ate green beans were 27% more likely to become ill than individuals who did not eat green beans (RR=1.27, p- value=0.035). However, only 60.5% of the ill reported eating green beans. The lowest attack rate associated with any consumed food was 90% (Table 2).

The environmentalist reported that three individuals prepared food on July 5 and 6 for the lunch meal. The interview revealed that the day before the lunch, approximately 44 whole chickens were bought and cut into 352 pieces at a local grocery store and placed back into their original cases then transported in the bed of a private pickup truck to the church's kitchen. The ride took less than five minutes. The same day, all of the chicken was washed twice by two individuals in the kitchen sink. The procedure took approximately one hour and a half. Once cleaned, the raw chicken was placed back into the sink with fresh water during the seasoning process. Half of the chicken (176 pieces), reserved for frying, was placed into the crisper drawers of the refrigerator, with the exception of one pan that could not fit into the crisper drawers. This pan of raw chicken was placed on the bottom shelf of the refrigerator. The other 176 pieces were baked at 350^{o} F in three large sheet pans in the oven (Appendix 2, picture 3), for an undetermined amount of time.

Table 2. Food Exposure Attack Rate and Relative Risk Among Individuals Involved in an Outbreak at a Church Meal Event, Sumter County - Alabama, July 2013.

Food Items Served	Ate Specified Food			Did not Eat Specified Food		Relative Risk (p-value)
	Ill	Not Ill	Attack Rate	Ill	Not Ill	
Fried chicken	21	2	91.3	17	2	1.02 (0.4)
Baked chicken	18	2	90.0	20	2	0.99 (0.4)
Pulled pork	12	1	92.3	26	3	1.03 (0.4)
Any chicken	37	4	90.2	1	0	0.9 (0.9)
Other meat	0	0	N/A	38	4	N/A
Any sauce/gravy	0	0	N/A	38	4	N/A
Green beans	23	0	100.0	15	4	**1.27 (0.04)**
Potato salad	27	2	93.1	11	2	1.1 (0.576)
Macaroni and cheese	29	1	96.7	9	3	1.29 (0.06)
Cake	23	2	92.0	15	2	1.04 (0.4)
Sweet tea	0	0	N/A	38	4	N/A
Unsweet tea	0	0	N/A	38	4	N/A
Lemonade	0	0	N/A	38	4	N/A
Other beverage(s)/soda	27	1	96.4	11	3	1.23 (0.1)
Bottled water	3	1	75.0	35	3	0.81 (0.3)
Lemon	0	0	N/A	38	4	N/A
Ice	3	0	100.0	35	4	1.11 (0.7)

In order to accelerate the cooling process, the baked chicken was placed on the table in front of the window unit air conditioner to cool for approximately one hour and a half (Appendix 2, picture 4). After cooling at room temperature, the baked chicken, still on the sheet pans, was placed in the residential refrigerator. The cooks could not recall whether the raw chicken was above the baked chicken or below the baked chicken. The potatoes were then sliced on a separate countertop than the chicken; but after they were cooked, they were drained in the same sink where the raw chicken was washed earlier. While the potatoes were cooking, several eggs were boiled in a separate pot. Once the eggs were cooked and peeled, they began to make the potato salad. The potato salad was then placed in two bowls on the top shelf of the refrigerator.

The macaroni and cheese not only included macaroni pasta and cheese, but also included milk and eggs. The macaroni noodles were cooked and drained in the sink where the chicken was washed. Several raw eggs were whipped with the milk and then stirred with the macaroni and cheese. The macaroni mixture was then placed on the bottom shelf of the refrigerator. Additionally, ham hocks for the green beans were prepared on the stovetop and placed in the refrigerator. It is unknown whether any of the prepared foods were covered before being placed in the refrigerator.

On the morning of July 6, the day of the funeral service, the green beans were cooked with the precooked ham hocks. The premixed macaroni mixture and cheese was placed in the oven to bake. Creamed corn was also prepared and baked (details unknown). The baked chicken was reheated in the oven at 400^{o}F (reheating time unknown) while raw chicken was fried in a commercial fryer (Appendix 2, picture 3). Both were then placed on a steam table with the green beans, macaroni and cheese, and creamed corn (Appendix 2, picture 6). Potato salad was removed from the refrigerator and served one bowl at a time. In addition to the food items prepared at the church, other individuals brought food that included pulled pork barbeque, potato salad, and dressing. The cooler's temperature was 46^{o}F when the environmentalist visited the kitchen on July 9.

Testing conducted by BCL identified heavy growth of *Salmonella Heidelberg* in 23 clinical specimens (Appendix 1). Norovirus, shiga toxin, and campylobacter testing were not detected or isolated from five of five clinical specimens. Pulsed-field gel electrophoresis (PFGE) pattern analysis determined 100% matches JF6X01.0022 PFGE-XbaI-pattern in 23 clinical specimens. CDC confirmed *Salmonella* Heidelberg in the 23 clinical samples. *S. aureus* coagulase (+) enterotoxin D was positive in one clinical sample. Blood and stool specimens from the deceased individual isolated identical *S. Heidelberg*.

Among the 28 environmental samples collected and tested at CDC, the potato prep counter tested positive for *S. aureus* coagulase (+) and *S. aureus* enterotoxin D. Samples from the faucet and faucet handles, oven stove handle, and stove knobs were culture positive for *B. cereus*. *Salmonella* was not isolated from any of the environmental samples.

Among the leftover food plate samples from one residence, a chicken plate was positive for *S. aureus* enterotoxin D, and *B. cereus* enterotoxin diarrheal. In addition, *S. aureus* coagulase positive and *S.* Heidelberg were isolated. The leftover food samples collected from the deceased individual's residence, which included apple pie and chicken bones, were positive for *S.* Heidelberg; however, these items were not from the funeral meal. The raw whole chicken collected from the grocery was culture positive for *B. cereus*.

Given the high rate of hospitalizations and after *S. Heidelberg* was confirmed as the etiologic agent, EPI issued a news release offering recommendations to prevent spreading salmonellosis in the community by reinforcing strict hand hygiene, and washing with soap and water, or hand sanitizer if soap and water were not available. EPI also developed a two-page flyer with tips on how to avoid food cross contamination and posted it on EPI's Web page.

Discussion/Conclusions

Disease onset analysis depicted an incubation period shorter than expected for salmonellosis (2.5 hours) with a high rate of hospitalization that appeared to be due to the interaction between toxin-producing pathogens (*S. aureus* and/or *B. cereus*) and *Salmonella* ingested in high doses. BCL reported *Salmonella* "heavy growth" in multiple clinical specimens. *S. aureus* releases toxin (enterotoxins A-E) that is highly resistant to heat that can interact with *Salmonella* resulting in a superantigen effect (2). This superantigen effect would explain the short incubation period given that laboratory testing performed at BCL and CDC isolated *Salmonella, S. aureus,* and *B. cereus*.

Salmonella organisms, gram-negative bacilli with more than 2,600 serotypes, cause a wide spectrum of illness ranging from asymptomatic gastrointestinal tract carriage to acute gastroenteritis, bacteremia, and major generalized infections including infection of the brain to even cause death from septicemia (3). More than 80% of the individuals with salmonellosis in this outbreak developed diarrhea, abdominal pain, nausea and fever, consistent with the common clinical manifestations of an acute gastrointestinal infection by *Salmonella*. In addition to the superantigen effect, the severity of the symptoms may be attributable to a large infective dose, high virulence of the *Salmonella* isolate, and/or compromised host defenses, e.g., weak immune systems such as adults over 65 years old, immunosuppressive conditions, hemoglobinopathies (including sickle cell disease), malignant neoplasms, human immunodeficiency virus (HIV) infection, impaired gastric acidity-H2 blockers, antacid use, history of gastrectomy, and achlorhydria (4). In this outbreak, the mean age of the not ill individuals was higher than the mean age of the ill group, 65.0 and 35.8 years, respectively. Data on comorbities or immune suppressive conditions were not collected.

The epidemic curve depicted a common point source of infection. Although the green beans exhibited the only statistically significant association at 95% confidence level, the findings from the environmental assessment indicate that the culprit of the outbreak was unlikely only one food item. Contributing factors associated with this outbreak were likely a mixture of cross contamination, contaminated equipment and/or utensils, improper holding temperatures, and improper food storage placement. Usage of gloves while preparing food was not reported.

Recent recommendations on food safety advise food handlers to not wash raw chicken (5). If cooked properly, the germs on the chicken will be killed during the cooking process. However, during rinsing, the germs on the raw chicken are likely to splash on nearby preparation surfaces. As mentioned above, the raw chicken was thoroughly washed twice prior to cooking.

The findings in this report are subject to several limitations. Almost all interviewees were ill hospitalized individuals; few non-ill were identified. Cross contamination opportunities prevented epidemiologic analysis from implicating a single food item. Environmental sampling of kitchen surfaces was performed four days after the meal and after the church staff conducted deep cleaning. In addition, leftover food found in the homes of two cases may have been contaminated after taking the meals home or during transportation.

In conclusion, a multiple-organism outbreak occurred among individuals attending a funeral meal in Sumter County. Food was most likely cross contaminated spanning preparation and storage. Approximately 100 individuals were exposed, of which 80 were reported to be ill. Of the 80 ill, 78.9% were hospitalized. A total of 43 individuals were interviewed; 38 ill and four not ill included in the analysis. *S. Heidelberg* was isolated and toxins-producing pathogens *S. aureus* and *B.cereus* were positive.

This investigation demonstrates the need for implementation of effective food safety and extensive use of effective measures to prevent foodborne diseases cross contamination and processing at social gatherings especially when the kitchen area is not "adapted" for high volumes of food preparation as was this case.

Of note: During the outbreak investigation, CDC received an outbreak report from Colorado that appeared to share several aggressive clinical manifestations as well as the XbaI pattern JF6X01.0022. There was concern that this outbreak (1307ALJF6-1) from Alabama might be related to an outbreak in Colorado (1307COJF6-1) associated with a family-gathering and cases from a multi-state cluster (1306MLJF6-3). CDC evaluated dendogram MLVA patterns, i.e., genetic relationships, from 25 isolates from the three groups, including 18 isolates from Alabama's outbreak. CDC also performed whole genome sequence for *S. Heidelberg* for 11 specimens. This additional analysis provided assurance that the *S. Heidelberg* organisms isolated from the outbreaks and cluster were not related (Appendix 3).

Recommendations

Several recommendations were provided by the Alabama Department of Public Health. Recommendations included improving food safety education for volunteers at the church and reducing the spread of illness.

References

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2. Le Loir Y, Baron F, Gautier M. *Staphylococcus aureus* and food poisoning, review. Genet. Mol. Res. 2 (1): 63-76, 2003.
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5. Drexel University. Don't Wash Your Chicken! http://drexel.edu/dontwashyourchicken. January 31, 2014.

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Mississippi: Mississippi Department of Health
Colorado: Colorado Department of Health

Appendices

- Appendix 1. Sample Laboratory Report
- Appendix 2. Environmental Sample Pictures
- Appendix 3. Genome Sequencing

Appendix 1. Sample Laboratory Report from a Salmonella Outbreak Among Individuals Attending a Funeral, Sumter County, Alabama – July 2013.

Alabama Department of Public Health

Bureau of Clinical Laboratories

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P.O. Box 244018
Montgomery, AL 36124-4018
(334) 260-3400

Mobile Laboratory
757 Museum Drive
Mobile, AL 36608
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www.adph.org/bcl

Report To EPIDEMIOLOGY DIV
ADPH RSA TOWER EPIDEMIOLOGY DIV
201 MONROE STREET SUITE 1310
MONTGOMERY, AL 36130

Patient Information

Name

Date of Birth
Gender
Race
LIMS Patient ID

Sample Information

Sample ID (MRN)
Lab ID
Chain of Custody
Specimen Source Stool
OUTBREAK ID AL1307-60A

Date Collected 7/8/2013
Date Received 7/9/2013 08:43 AM
Date Reported 7/12/2013 11:05 AM
Performing Facility Montgomery Lab

Test/Observation	Result	Method / Ref Range
-- ENTERIC PATHOGENS ---		
SALMONELLA	Salmonella serotype I Heidelberg	Solid and Broth-Based Media

Friday, July 12, 2013 11:05:08 AM
Page 1 of 1

Appendix 2. Kitchen Distribution Pictures Taken by Environmental After Visiting the Facility Related with a Salmonella Outbreak at Among Individuals Attending a Funeral, Sumter County, Alabama – July 2013.

Kitchen Distribution

Picture 1

Picture 2

Kitchen Distribution

Picture 3

Picture 4

Kitchen Distribution

Picture 5

Picture 6

Appendix 3. Genome Sequencing Performed by CDC on Clinical, Food and Environmental Specimens Related with a Salmonella Outbreak Among Individuals Attending a Funeral, Sumter County, Alabama – July 2013.