



**Outbreak of *Salmonella* Heidelberg and *Staphylococcus aureus* Associated with
Consumption of Gumbo at a Family Party - July, 2013**
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Background

On July 16, 2013, Tri-County Health Department (TCHD) received a call from the Medical Center of Aurora reporting that one person died and several family members and friends became ill with gastrointestinal symptoms after eating a home prepared meal on Saturday, July 13, 2013. The home prepared meal was the only common event among the family members and friends. TCHD conducted an epidemiologic, environmental, and laboratory investigation to identify the source of illness and, if necessary, implement disease control measures. This report describes the findings of the investigation.

Methods

Epidemiologic

Phone interviews were attempted with all attendees of the family meal. The interview gathered the following information: basic demographics, symptoms experienced, symptom onset time, food exposure, and medical treatment received. Proxy interviews were conducted for family members who were unable to complete the interview. Medical records for hospitalized family members were also obtained from Medical Center of Aurora.

A case was defined as a person who ate the home prepared meal on Saturday July 13, 2013, had onset of gastrointestinal illness (≥ 3 episodes of loose stool and/or ≥ 1 episode of vomiting within one 24-hour period), and had laboratory evidence for infection with a foodborne pathogen.

Environmental

The only common meal identified was a gumbo served over rice that was consumed on Saturday, July 13, 2013. The gumbo consisted of chicken, shrimp, crab, sausage, and vegetables. The rice was prepared separately. The meal was prepared in a private home with ingredients purchased from several different grocery stores. No other food items were served at the meal. TCHD Environmental Health Specialists (EHS) and Jefferson County EHS visited the three grocery stores where the products were purchased.

Laboratory

Stool samples were taken from the 7 ill persons and tested at the Colorado Department of Public Health and Environment (CDPHE) and the Centers for Disease Control and Prevention (CDC). Blood samples were taken from two ill persons and tested at CDPHE and the CDC. Selected samples were tested at CDPHE and/or the CDC for *Salmonella* Heidelberg, *Staphylococcus aureus*, *Bacillus cereus* toxin, *Clostridium perfringens* toxin, Shiga-toxin producing *Escherichia coli*, Enterotoxigenic *E. coli*, *Shigella*, *Vibrio cholera*, *Vibrio parahaemolyticus*, and *Vibrio* and *Aeromonas* spp. One person who was exposed but asymptomatic was not tested.

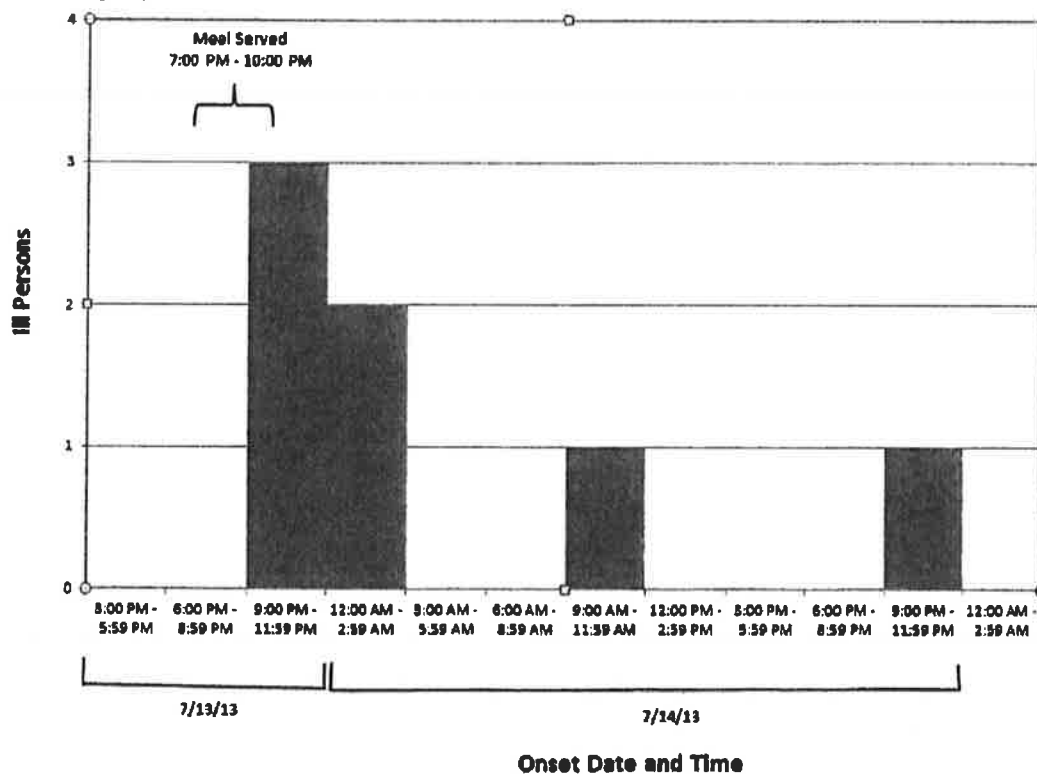
The leftover gumbo and rice was thrown in the trash by the family after the meal. They were collected two days after being discarded and brought to the CDPHE lab for testing; however, the leftovers had been infested with maggots, which made them untestable. Testing of the individual ingredients of the meal was not done.

RESULTS

Epidemiologic

A total of 8 people attended the family party and ate the prepared meal. Six (75%) of the 8 were directly interviewed; one was deceased and 1 was too ill to be interviewed. Seven of the 8 developed illness after eating and met the case definition for an attack rate of 88%. The 7 cases had onsets of illness within 25 hours after consuming the gumbo and rice on Saturday, July 13, 2013. The median incubation period was 5 hours (range: 2.5 - 25 hours) (Figure 1).

Figure 1. Epidemic curve of an outbreak of *Salmonella* Heidelberg and *Staphylococcus aureus* associated with consumption of gumbo at a family party



Over half (4 cases; 57%) of the cases were female. The median age among the cases was 55 years (range: 18 – 57 years). Detailed symptom information was not available for all of the cases due to the inability to interview everyone. For the 5 cases who were able to provide detailed symptom information, the results were as follows: diarrhea (5 cases; 100%), fever (5 cases; 100%), headache (5 cases; 100%), chills (5 cases; 100%), abdominal pain (4 cases; 80%), and dizziness (4 cases; 80%). Of the 6 surviving cases, 5 were admitted to the hospital and 1 was seen at the emergency room. Four of the 5 admitted to the hospital were diagnosed with acute renal failure upon admission. Four of the 5 who were hospitalized were admitted to the ICU during their hospitalization. One person required mechanical ventilation during their hospitalization.

For the 5 hospitalized patients, the median duration of days hospitalized was 4 with a range from 3 to 23 days. The person hospitalized for 23 days was discharged to a skilled nursing facility for follow-up care. The decedent died 42 to 45 hours after developing symptoms. The remaining case who was not hospitalized had diarrhea and a fever for a brief but unknown duration.

While the outbreak was limited to people who consumed the gumbo, there was an illness in a household contact of one of the original ill persons. This person became ill July 22, 2013 with non-bloody diarrhea, fever, vomiting, abdominal cramps, headache, and lethargy. This case did not consume any of the gumbo or any of the components of the gumbo and is presumed to have become ill through person-to-person transmission from an original case. This case was not hospitalized. This was the only known transmission of illness that occurred outside of the original outbreak group. This case was excluded from all data analysis.

Environmental

The meal served consisted of home-made gumbo containing ingredients from several different stores. The gumbo ingredients included king crab and snow crab, shrimp, Andouille sausage, and chicken. All items except for the sausage were purchased prepackaged and frozen. The sausage was prepackaged and fresh. The other ingredients were prepackaged chicken broth, onions, bell peppers, and spices. A variety of prepackaged drinks were also served.

The food was made by one family member. An inspection of the family home was not conducted as it was not deemed to be a public health hazard. The preparation of the gumbo was thoroughly described to TCHD by the family member who prepared it. She stated that she started the cooking process on Thursday night, July 11, 2013, at her own home. That evening she cooked a whole chicken, previously frozen, in a pot of boiling water with spices. She stated she cooked it thoroughly until 'the meat fell off the bone.' After cooking, she let the chicken cool on the counter until she was able to handle it, at which point she de-boned it and put the meat in a pot in the refrigerator. The following day, Friday July 12, 2013, she went to her family member's house, where she prepared the rest of the meal. She cooked bell peppers and onions and assembled the rest of the proteins (shrimp, crab, and sausage), including the pre-cooked chicken, prepackaged chicken broth, and spices, in a large pot. The pot was described as "two times the size of a pasta pot." She stated that she cooked the gumbo to boiling and then turned the heat off and let it cool for a couple of hours. She then put the pot in the refrigerator with a lid on it. A second family member confirmed that the gumbo was in the refrigerator that evening. The following day, Saturday July 13, rice was cooked in a rice cooker and the gumbo was taken out before service and reheated on the stove to boiling. She did not specify how long it was boiling prior to service. The gumbo was served over the cooked rice.

The cook denied having gastrointestinal illness in the week prior to preparing the meal. She also stated no one in her household had any gastrointestinal illness the week before the meal. She stated she typically washed her hands before food preparation and after handling raw meat.

Tri-County Health Department visited the two grocery stores in its jurisdiction on July 18, 2013. The prepackaged crab legs and shrimp were frozen at the time of the inspection. The prepackaged Andouille sausage was 38°F- 41°F at the time of the inspection. The store managers at both stores stated that they take temperatures of the food upon receiving, but did not have the temperatures recorded. Jefferson County Public Health visited the grocery store in its jurisdiction on July 19, 2013 to attempt to identify the brand of chicken that was purchased, as the purchaser did not know.

Laboratory

Laboratory results for *Salmonella* Heidelberg and *Staphylococcus aureus* from CDPHE and CDC as well as case information is presented in Table 1. All available laboratory results for the named pathogens are presented. CDC has criteria for the number of specimens it will test from each outbreak, so if the lab results are not given, testing was not conducted. CDPHE also tested stool from five people for *Bacillus cereus* toxin and *Clostridium perfringens* toxin. All five samples were negative for both. The CDC tested five stool samples and one blood sample for *B. cereus* by culture. All six samples were negative. The CDC also tested for Shiga-toxin producing *Escherichia coli*, Enterotoxigenic *E. coli*, *Shigella*, *Vibrio cholera*, *Vibrio parahaemolyticus*, and *Vibrio* and *Aeromonas spp* through PCR. All samples tested were negative.

Table 1: CDPHE and CDC test results for *Salmonella* Heidelberg and *Staphylococcus aureus*

Case	Age	Sex	Incubation Period (Hours)	Hospitalized	ICU	Specimen Type	S. Heidelberg Culture		S. aureus culture		CDPHE S. aureus toxin*	CDC S. aureus enterotoxin genes (PCR) on isolates
							CDPHE	CDC	CDPHE	CDC		
1	57	F	2.5	Y	Y	Stool	+	+	-	-	†; c	
						Blood	+	+	-	-		
2†	57	M	5	N	N	Stool	+		-		-	
						Blood		+		-		
3	18	F	25	N	N	Stool	+		-		-	
4	19	M	13	Y	Y	Stool	+		-	+	†; c	†; a
5‡	51	F	5	Y	Y	Stool	+		-	-	†; c	
6	55	M	4	Y	Y	Stool	+		-	+	†; c	-
7	57	F	4	Y	N	Stool	-		+	+	†; c	-

*letter indicates enterotoxin type; †decedent; ‡mechanical ventilation required

A stool sample from the household contact case also tested positive for *S. Heidelberg*.

DISCUSSION

Epidemiologic data clearly indicate a point source outbreak occurring after consumption of a single meal. While some of the individual members of the group were family members and lived in the same house, this meal was the only common event among all members of the group. None of the cases reported gastrointestinal illness in the week prior to the family meal including the cook. The high attack rate among people who consumed the meal and the similarity in type and severity of symptoms further implicate this meal as the causative event. Analysis of the individual components of the meal

to identify a single causative food item was not possible as the only food items were gumbo and rice, and everyone present ate both of these items.

Conclusions about the process which allowed for bacterial growth in the gumbo can only be made based on the cook's recollection of the food preparation. Bacterial pathogens, including *Salmonella* and *Staphylococcus aureus*, grow most rapidly in the temperature zone between 41°F and 140°F. While the cook did not immediately put the gumbo in the refrigerator, she did not describe leaving the food on the counter for an extended period of time and household members did not report seeing the food on the counter overnight. However, the gumbo was cooked to boiling the night before the party and then left in a large pot to cool in the refrigerator overnight prior to being reheated. The size of the pot described by the cook as well as the density of the gumbo could have prevented the food in the center of the pot from cooling below 41°F completely or quickly enough to prevent bacterial growth.

The cook stated she reheated the gumbo to boiling prior to service. Reheating to boiling could kill the *Staphylococcus aureus* bacteria but would not kill the heat-stable toxin it produces. Boiling temperatures should also be enough to kill *Salmonella*, which should die above 165 °F. However, the cook was also unsure how long the gumbo was boiled prior to service. The size of the pot could have prevented the entire gumbo from reaching temperatures hot enough to kill bacterial pathogens.

There are a number of ways that bacteria could have been introduced into the gumbo. The food items included in the gumbo could have been contaminated with *Salmonella* when purchased. Poultry is a common source of *Salmonella* bacteria, and chicken was an ingredient in the gumbo; however, there was no leftover chicken available for testing. The frozen seafood included in the gumbo was not tested because it is not typically associated with *Salmonella* contamination and because temperature abuse during the cooking and cooling process was suspected as a factor contributing to the amplification of bacteria. *Staphylococcus aureus* is ubiquitous in the environment and could have been on a food item or introduced by the cook. It would not be unusual to find both bacteria on food items; however, they both require an environment which enables them to survive and grow to pathogenic levels to cause illness.

The incubation period and symptoms described by the family meal group are consistent with both *Staphylococcus aureus* and *Salmonella* infection. The short incubation period is typical of *Staphylococcus aureus* infections. Staphylococcal toxins are fast acting, sometimes causing illness in as little as 30 minutes. Symptoms usually develop within one to six hours after eating contaminated food. Patients typically experience several of the following: nausea, vomiting, stomach cramps, and diarrhea. Transmission primarily occurs through ingestion of food containing soil or feces that has been held at a temperature that permits multiplication of the bacteria.

Based on the CDPHE and CDC *Staphylococcus aureus* testing results, there is evidence that the majority of ill persons in this outbreak had *Staphylococcus aureus* intoxication in addition to *Salmonella* infection. The rapid onset of illness and symptoms described also support both etiologies. Different testing methods were used to detect *Staphylococcal aureus* enterotoxin which resulted in detection of two different enterotoxins (type C at the CDPHE Lab and type A at the CDC Lab). Further discussion among CDPHE Laboratory and CDC Laboratory experts is needed to better interpret why different testing methodology resulted in detection of two different *Staphylococcal aureus* enterotoxins.

Salmonellosis is a bacterial disease caused by *Salmonella* species and characterized by gastroenteritis with fever, headache, abdominal pain, diarrhea (sometimes bloody), nausea, and sometimes vomiting

lasting for several days. Dehydration may be severe in infants and the elderly; death is uncommon. Salmonellosis is generally considered a food borne disease transmitted through contaminated food; however, person-to-person transmission via the fecal-oral route can also occur, especially when diarrhea is present. Although it is rare for humans to be chronic carriers of the bacteria, persons with mild or unrecognized cases of salmonellosis and diaper-aged infants pose a risk for spreading infection. The incubation period for salmonellosis is usually 12–36 hours, but can range from 6 to 72 hours. Persons shed the organism throughout the course of infection, usually several days to several weeks. A prolonged but temporary carrier state can last for months, especially among infants. In addition, antibiotic treatment is not recommended except in severe cases of illness because it may prolong the duration of shedding. The severity of disease is related to the serotype, number of organisms ingested, and host factors. Thousands of *Salmonella* serotypes are pathogenic for both animals and humans. Normally, 100 to 1000 *Salmonella* organisms are required to cause infection, but a lower infectious dose is possible.

The mechanism behind the severity of illness in this outbreak is currently unknown. It is possible that the inoculum of one or both pathogens was very large; this could not be assessed due to the inability to conduct food testing. Host factors such as underlying medical conditions, medications being taken, or genetic differences can contribute to variations in physiological response. However, the relatively large number of affected persons and the fact that they were not all related makes it less likely that host factors are the best explanation. It is also possible that the strain of one or both of the pathogens were especially virulent; further laboratory studies on the patient isolates would provide additional insight. Finally, while infection with either pathogen usually does not result in extended hospitalization or death, the physiological response to dual infections is not well understood. Coinfection with these two pathogens may have produced a more severe spectrum of illness due to an interaction that has not yet been elucidated.