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A *Clostridium perfringens* Outbreak Traced to Improper Cooking of Prime Rib in Rochester, New York 2011

ABSTRACT

In December 2011, the Monroe County Department of Public Health investigated a report of gastrointestinal illness from two separate parties that had dined at a restaurant on the same day. An environmental and epidemiological investigation identified 17 individuals who met the outbreak case definition. A detailed questionnaire based on the restaurant's menu was administered to patrons from both parties and statistically analyzed. Based on this investigation, it was hypothesized that consuming the prime rib ($P < 0.001$) was associated with becoming ill. The environmental investigation indicated that the prime rib was not cooked to a proper temperature and was held at an improper temperature before being served. A prime rib sample and three stool samples from ill patrons were collected and sent for laboratory testing. *Clostridium perfringens* was identified in all of the samples by the New York State Department of Health (NYSDOH) Wadsworth Laboratory. This outbreak demonstrates the importance of proper food safety techniques for restaurants to prevent illness.

INTRODUCTION

The bacterium *Clostridium perfringens* is a common agent of food poisoning and ranks as the third most prevalent cause of foodborne illness in the United States *(1, 8)*. Common food sources for *C. perfringens* include beef, poultry, and gravies *(2)*. The bacterium grows rapidly at temperatures between 109°F and 117°F, and contamination can occur when foods are prepared in advance and kept warm for long periods of time before being served *(2)*. Illness occurs when contaminated foods are ingested. Once ingested, *C. perfringens* causes illness by releasing toxins in the lower intestinal tract *(5)*. People infected with *C. perfringens* develop gastrointestinal illness (diarrhea and abdominal cramps) and, less commonly, vomiting within 6 to 24 hours after infection *(9)*. This illness is self-limiting, with symptoms lasting less than 24 hours *(9)*. Fatalities are rare but can occur in the very young or elderly.

On the morning of December 12, 2011, the Monroe County Department of Public Health (MCDPH) Food Protection Division was alerted of illness among patrons of a local restaurant. The executive chef called to report

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that they had received reports of illness from two separate parties that had dined at the restaurant on December 10, 2011. This article details the outbreak investigation conducted by MCDPH and highlights the importance of food safety in a restaurant.

METHODS

On Saturday, December 10, 2011, a business was having its annual holiday party in a room on the lower level of the restaurant. Of the 26 people in attendance, 12 reportedly became ill with diarrheal symptoms. On the same date, on the main level dining area, a wedding reception was taking place. Of the 175 people in attendance, two reportedly became ill with diarrheal symptoms. These two distinct parties had shared one commonality, consuming foods made in the same kitchen at the restaurant. This indicated a possible foodborne outbreak associated with this restaurant. MCDPH launched an investigation into this matter.

Environmental investigation

Investigation commenced on December 12, 2011 when MCDPH dispatched a Senior Public Health Sanitarian to meet with the executive chef and the restaurant's manager. In addition, a full inspection of the kitchen and facilities was conducted. The menus for both parties were reviewed. Cooking, preparation and service of all foods on the menu was discussed. No employees had reported being ill. The chef suspected the prime rib, because two of the ribs were served to the holiday party and to the wedding party (only dining tables 1 and 2). A remaining leftover food specimen was collected from an ill patron for laboratory testing.

Epidemiologic investigation

An outbreak case definition was defined as an attendee of either the wedding or office party who ate dinner at the restaurant on December 10 and who became ill with diarrhea, with or without accompanying abdominal pain or nausea, within 48 hours of the parties.

The two parties were in separate rooms; the members of each party were not known to have mixed with one another. MCDPH prepared a standardized questionnaire that included demographics, occupation and consumption of food items at the restaurant on December 10. Party members were also asked about symptoms, hospitalization and household illness. The food items listed in the questionnaire were based on the menu for each party provided by the chef of the restaurant.

The restaurant provided main contacts for the office and wedding parties. The questionnaire was administered to the office party attendees in person by MCDPH sanitarians at the workplace. The wedding contact provided very little access to the guest list and provided only contact information for guests seated at dining tables 1 and 2. The wedding reception attendees were contacted by telephone and asked to answer the questions. From the completed questionnaires, an analysis was performed using Epi Info Version 3.3.2 Two-by-two contingency tables and two-tailed Fisher's exact tests were used to determine *P*-values associated with illness for each common food item. Stool specimens were collected from three individuals who had reported symptoms, two from the wedding and one from the holiday party.

Bacteriologic investigation

Per local protocol, the stool samples were sent to ACM Medical Laboratories, Inc., which cultured for *Salmonella* spp., *Shigella* spp., *Campylobacter* spp., and *E. coli* O157:H7, and to New York State Department of Health's (NYSDOH) Wadsworth Laboratory for stool culture to identify *C. perfringens, Bacillus cereus, or Staphylococcus aureus.* The leftover prime rib was also submitted to the Wadsworth Laboratory for culture. Cultures were performed according to common laboratory procedures for these organisms.

RESULTS

Environmental investigation

Two suspect meals were served from the same kitchen to two separate parties, a holiday party in the downstairs party room of the restaurant and a wedding party in the main dining area on the first floor. The overlapping menu items were as follows: cheese and vegetable display with crackers, 12 oz. prime rib of beef (served with a horseradish cream sauce and au jus), chicken stuffed with Andouille sausage (served with a sweet corn cream sauce), cornbread, and vegetable Napoleon with a balsamic reduction and a basil oil. Upon review of the food preparation with the executive chef, the prime rib preparation was a cause for concern.

The chef stated that he prepared six prime ribs on Friday, December 9, 2011. The chef coated the ribs with three cups of chopped garlic, dusted ground pepper over the garlic and then layered it with kosher salt. The ribs were placed in a convection oven set at 400°F for 30 minutes. This seared the outside of the ribs. The ribs were then placed in an alto sham (an oven used to cook meats and hold them at low temperatures) set at 225°F for 2½ hours and held at 120°F until the next day (Saturday), when they were served. This procedure allowed for a holding time of 12+ hours. Furthermore, interviews with the chef revealed that the final cook temperature was 110°F, a full 20°F below the required 130°F *(7)*.

Epidemiologic investigation

A total of 201 people from two separate parties, a wedding (n = 175) and an office party (n = 26), ate at the restaurant on Saturday December 10. The wedding party had dinner at approximately 6 p.m. The office party had dinner at approximately 7 p.m. Except

for the meals at this restaurant, the members of both parties had no other known common meal or other common contacts.

The wedding party was comprised of 175 individuals, of whom 6 responded to the questionnaires. These six individuals were seated at tables 1 and 2, which received the suspected prime rib. The median age of the respondents was 35 years with a range of 27–39. Three males and three females responded. All six of the respondents met the case definition.

The office party was comprised of 26 individuals, of whom 16 responded to the questionnaires. The median age of the respondents was 35 years, with a range of 19–65. Seven males and 9 females responded. Eleven of the sixteen respondents met the case definition, giving an attack rate of 69% (11/16).

Of the 22 people interviewed, 17 (77%) indicated that they had had gastrointestinal symptoms, consisting of diarrhea (100%), abdominal cramps (41%), nausea (24%) and chills (18%). Additional symptoms reported included headache, body aches and sweats. The average incubation period was 12 hours (range: 7 to 14 ½ hours) *(Fig. 1)*. The average duration of symptoms was 14 hours (range: 4 to 37 hours). No one who was ill was admitted to a hospital.

Analysis of the menu histories that were common among both parties confirmed the hypothesis of the chef at the restaurant that the prime rib was associated with the illness *(Table 1)*. The prime rib had a value of $P < 0.001$ and an attack rate of 100%. Based on the food history questionnaires, none of the ill patrons ate the two other common menu items: the Andouille chicken stuffed with Andouille sauce with sweet corn cream and Vegetable Napoleon with balsamic reduction and basil oil.

Bacteriologic investigation

The laboratory results indicated that the three stool cultures were positive for *C. perfringens*. The leftover prime rib was also positive for *C. perfringens*. These results were obtained through a laboratory method detailed by A.H.W. Hauschild *(4)*. The plates used to isolate *C. perfringens* from food and stool at Wadsworth Laboratory are prepared in house from a dehydrated Difco SFP agar base supplemented with cycloserine to a final concentrate of 40 mg/ml. The traditional biochemical tests used to identify *C. perfringens* at the time of this testing were also prepared in house. PFGE testing is not routinely performed for *C. perfringens* at Wadsworth, so there are no data to indicate if the isolates were a genetic match. The samples tested negative for *Salmonella* spp., *Shigella* spp., *Campylobacter* spp., *E. coli* O157:H7, *Bacillus cereus* and *Staphylococcus aureus*.

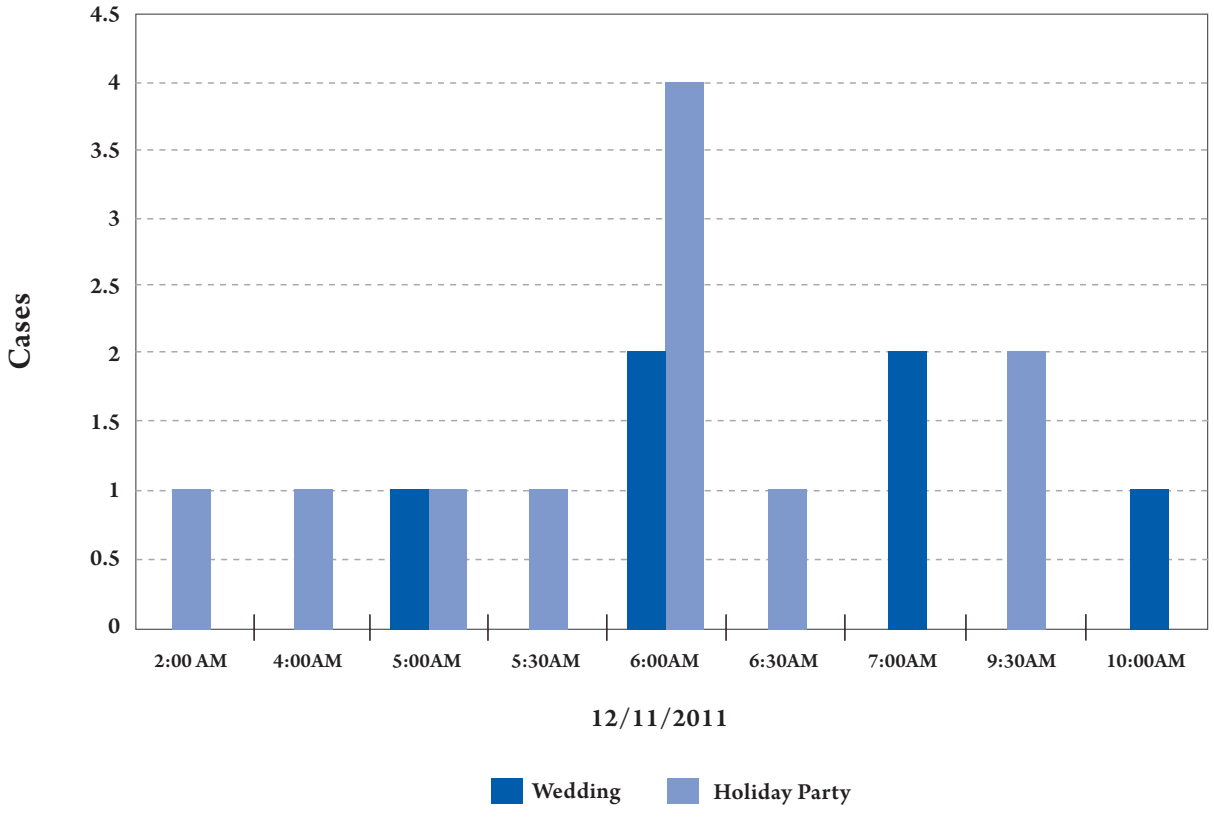

FIGURE 1. Epidemiological curve for onset of illness of restaurant guests in December 2011

Table 1. Attack rates for overlapping food items that both parties consumed at dinner at restaurant on December 10, 2011

	Ate					Did not eat				
Common Food Items				**Attack Rate**					**Attack Rate**	
Between Parties	**Ill**	**Not Ill**	**Total**	**Attack Rate (%)**		**Ill**	**Not Ill**	**Total**	**Attack Rate (%)**	***P*-Value**
Prime Rib of Beef....	17	0	17	100		0	5	5	0	*<0.001
Cheese and Vegetable....	8	5	13	62		9	0	9	100	0.053
Andouille Chicken Stuffed with Andouille Sauce with Sweet Corn Cream and Cornbread....	0	0	0	N/A		17	5	22	77	N/A
Vegetable Napoleon with Balsamic Reduction and Basil Oil....	0	2	2	0		17	3	20	85	*0.043

*Statiscally Significant

DISCUSSION

Several factors played a role in this outbreak. *C. perfringens* is a spore-forming bacterium often found on raw meat *(6)*. Most likely, the prime rib was tainted with *C. perfringens* when it was delivered to the restaurant. Proper cooking with sufficient heat would have destroyed the organism; however, in this case the chef made two mistakes that contributed to the outbreak.

NYSDOH requires specific cooking temperatures for beef. Rare roast beef is to be heated to an internal temperature of 130°F unless otherwise ordered by the consumer *(7)*. This temperature is adequate to kill bacteria such as *C. perfringens.* In the case of *C. perfringens*, not only is the cooking "kill" step important, but the holding temperature is also significant, because the spores are able to survive, and germinate, after which the bacteria can grow at a holding temperature that is too low. It should be noted that the bacteria grow very rapidly between 109°F and 117°F *(5)*.

Cooking the prime rib to 110°F did not provide a temperature high enough to destroy the bacterium. In addition, by holding the ribs for 12+ hours at a temperature range that did not exceed 110°F, vegetative cells of *C. perfringens* were able to multiply, thereby increasing the number of spores generated and leading to an infectious dose for the consumers.

A limitation to this investigation was that the wedding party denied access for the entire guest list to MCDPH. It is unknown if other tables besides #1 and #2 experienced gastrointestinal illness. We will not know if the four other prime ribs that were served at the wedding were contaminated with *C. perfringens.*

This case illustrates the importance of following proper food safety techniques. It also is a reminder that pathogenic organisms in most cases cannot be seen, smelled or tasted. All the guests reportedly enjoyed eating the prime rib. Additionally, it serves notice to the food service industry that we must recognize that raw meats have the potential to be contaminated with naturally occurring microorganisms. Spores from *C. perfringens* can survive and germinate in improperly prepared food *(3)*. Therefore; raw meats must be prepared in a manner that will destroy such organisms. Monitoring holding time in addition to temperature as a means of control will effectively prevent infectious doses from developing.

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