

**Outbreak of *Clostridium perfringens* Related Gastrointestinal Illness Associated with the Sacred Heart Turkey Dinner — Cowley County, November 2010**



## **Background**

On Tuesday, November 9, 2010, the Bureau of Epidemiology and Public Health Informatics at the Kansas Department of Health and Environment (BEPHI-KDHE) was notified of a possible foodborne illness outbreak associated with a turkey dinner hosted by the Sacred Heart Catholic Church in Arkansas City, KS. At least 22 individuals reported developing an acute onset of vomiting, abdominal cramping and pain, or diarrhea, to either the parish office or to the City-Cowley County Health Department (CCCHD) after eating at the turkey dinner the evening of November 8 or after taking home food from the dinner and consuming the food later. Initial reports of illness onset ranged from an hour after eating to 15 hours after eating food from the turkey dinner. At this time the suspected etiology was of a bacterial toxin such as *Staphylococcus aureus* or *Clostridium perfringens*. This event has been held annually for approximately 80 years, and attendance has increased recently. It is estimated that between 1,500 and 1,800 persons attended or took home food from this event. BEPHI-KDHE, Kansas Department of Agriculture (KDA), and CCCHD initiated an outbreak investigation to determine the cause of illness, the scope of the outbreak, and to implement prevention and control measures.

## **Methods**

### *Epidemiologic Investigation*

Staff from CCCHD and from BEPHI-KDHE contacted the organizers of the church turkey dinner to determine how many people attended the dinner. No list of attendees was available; only an estimate of total attendance was possible. Preliminary interviews were conducted with those that had initially reported illness on November 9.

Additional ill attendees were identified by self-report by the afternoon of November 9. Because all attendees were served the same meal, a cross-sectional study was designed to identify as many ill attendees as possible and a questionnaire was developed to determine symptoms, incubation period, and to identify specific food items at highest risk for contamination (Appendix A). Because a list of attendees and their contact information was not available, a press release with a link to the survey online as well as contact information for the CCCHD was sent to local media on November 10, encouraging all attendees to respond to the questionnaire. Announcements were also made during services and in the church bulletin on November 14 encouraging attendees to fill out the survey. A case-control study was conducted based on responses to the survey.

### *Case Definition*

A case was defined as someone who consumed food from the turkey dinner, either at the event on November 8 or offsite from carry-out packages, and subsequently became ill with any of the following symptoms: vomiting, abdominal cramping or pain, or diarrhea (3 or more loose stools within a 24-hour period) between 6 and 36 hours after reported consumption of food from the Sacred Heart Turkey Dinner. The incubation period for the case definition was set at 6 to 36 hours based on the initial investigation and reports of illness, which suggested that the suspected pathogen was *C. perfringens*. This was later supported by laboratory testing reported below. A control was defined as someone who consumed food from the turkey dinner, either at the event on November 8 or offsite from carry-out packages, and did not develop any gastrointestinal symptoms within 36 hours.

## *Statistical Analysis*

Descriptive and univariate analyses were performed by graphing the data and assessing the association between specific food exposures and the presence of any of the symptoms listed in the case definition. Odds ratios and 95% confidence intervals were calculated, and associations between illness and food exposures were assessed using the Chi-square test.<sup>1</sup> The imputed odds ratio for risk of illness associated with eating turkey was calculated by adding one person to the category of ill and did not eat turkey since the odds ratio cannot be calculated when there is zero in any category.

## *Environmental Investigation*

Food inspectors from KDA inspected the food preparation site on November 9, 2010. Information on the handling and preparation of all food items was collected and equipment was inspected. Leftover food samples including turkey, green beans, mashed potatoes, gravy, and dressing, were collected for laboratory analysis. BEPHI-KDHE staff met with KDA inspectors to discuss the findings from the environmental inspection.

## *Laboratory Analysis*

Stool specimens were collected from two ill attendees. Specimens were tested at the Kansas Health and Environment Laboratories (KHEL) for norovirus as well as for *Salmonella spp.*, *Shigella spp.*, Shiga toxin *E. coli spp.* (including O157 and non-O157), *Campylobacter*, *Bacillus cereus*, and *Staphylococcus aureus*.

Food samples were sent to the Public Health Laboratory at the Minnesota Department of Health (PHL-MDH) in St. Paul, MN for *Clostridium perfringens* testing; stool specimens were also sent to PHL-MDH to test for the presence of *C. perfringens* enterotoxin in the stool samples. Turkey was the most likely source of *C. perfringens* since this bacterium is often associated with poultry and cooked meat products. As a result, turkey samples were tested first. The remaining food samples were not tested once turkey samples were found to be positive.

## **Results**

### *Epidemiologic Investigation*

#### *Case Finding*

Based on ticket sales, an estimated 1,500–1,800 people attended. The survey questionnaire was made available from November 10–30, 2010. Individuals could either complete the survey using an online survey tool or call-in to the CCCHD or KDHE hotlines for assistance with the questionnaire. A total of 527 individuals responded to the survey and of those, 519 responded to a question asking whether or not they had become ill and were eligible to be included in the analysis. One hundred eighty-two (182) individuals reported illness, of those 135 (79%) met the definition and were considered cases in the following analyses. Diarrhea (99%) and abdominal cramps (81%) were the most frequently reported symptoms followed by nausea (37%), headache (25%), and muscle aches (21%); see Table 1 below. Two reported seeking medical care for their illness (1.5%), and one individual required hospitalization (0.7%); none reported visiting an emergency department.

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<sup>1</sup> The data analysis for this report was generated using SAS software, Version 9.2 of the SAS System. Copyright © 2002-2008 SAS Institute Inc. SAS and all other SAS Institute Inc. Cary, NC, USA.



### Case-Control Study

Of the 527 individuals who completed the survey, 519 met study inclusion criteria of eating food from the Sacred Heart Turkey Dinner and by answering whether or not they were ill. Of those, 337 (64%) were not ill, and therefore were eligible for inclusion as controls. Of the 182 attendees who reported being ill, 12 did not have complete information on incubation period and could not meet the case definition. Of the remaining 170 ill attendees, 35 had an incubation period greater than 36 hours, which did not meet the case definition, and were excluded from analysis. The distribution of sex and age for both cases and controls included in the study are shown in Table 2.

**Table 2: Characteristics of the study population**

	<b>Cases (n=135) No. (%)</b>	<b>Controls (n=337) No. (%)</b>	<b>Total (n=472) No. (%)</b>
Sex			
Female	80 (59)	198 (59)	278 (59)
Male	55 (41)	139 (41)	194 (41)
Age (yrs)			
Range	3 – 93	1 – 92	1 – 93
Median	53	50	50

The event served a limited menu that was available to all attendees. The menu included turkey, mashed potatoes, dressing, gravy, green beans, cranberry sauce, bread with butter, and a variety of desserts. One hundred percent (100%) of attendees who reported being ill and met case definition – or ‘cases’, as well as 98% of non-ill attendees, who filled out the study survey – or ‘controls’ – reported eating turkey. Specific menu items and meal characteristics were analyzed for association with illness. Of those, eating at the church, as compared to eating food taken home, was statistically associated with illness (Table 3). Additionally, eating mashed potatoes was statistically associated with illness. Mashed potatoes were made with gravy from the turkey, so association with mashed potatoes could point to turkey as the source. Over 99% of all attendees ate turkey; further clouding the association is the likelihood that not all pans of turkey were contaminated. As a result detecting a statistically significant association with turkey was not possible based solely on epidemiologic evidence.

**Table 3: Exposure Information**

<b>Exposure</b>	<b>Frequency N (%)</b>		<b>Odds Ratio</b>	<b>95% CI*</b>	<b>P-Value</b>
	<b>Cases (N=135)</b>	<b>Controls (N=337)</b>			
<b>Ate at the Church</b>	<b>67 (50)</b>	<b>122 (36)</b>	<b>1.74</b>	<b>1.14 – 2.65</b>	<b>0.007</b>
Turkey	135 (100)	330 (98)	2.86	0.36 – 129.98	0.31
<b>Mashed Potatoes</b>	<b>133 (99)</b>	<b>316 (94)</b>	<b>4.42</b>	<b>1.05 – 39.32</b>	<b>0.03</b>
Dressing	123 (91)	306 (91)	1.03	0.49 – 2.29	0.92
Gravy	125 (93)	310 (92)	1.09	0.49 – 2.59	0.83
Green Beans	119 (88)	311 (92)	0.62	0.31 – 1.29	0.15
Cranberry Sauce	91 (68)	250 (74)	0.72	0.47 – 1.14	0.14
Bread and Butter	120 (89)	291 (86)	1.26	0.66 – 2.53	0.46
Desserts	113 (84)	269 (80)	1.28	0.74 – 2.28	0.36

## *Environmental Investigation*

The kitchen where the food for the turkey dinner was prepared, held, and served, was inspected on November 9, 2010. Additionally, interviews were conducted with the event organizers to understand how and where food was prepared and how it was held prior to serving. The kitchen where food was held prior to the event was a commercial grade kitchen used by the parish school for lunches. However, not all the food was prepared on site. Turkeys were prepared in homes of parishioners, and drippings from the gravy for making gravy and mashed potatoes, were all made in home kitchens and brought to the church kitchen prior to the event, as were desserts. Some dishes were prepared on site; side dishes such as green beans and bread and butter were all prepared in the on-site kitchen. As a result, control over all aspects of the preparation process was not possible. Additionally, actual preparation and serving were not observed since this was a one-time event. Instead, interviews were used to understand the process. Several critical issues were identified:

- (1) One hundred turkeys were purchased frozen and delivered to the kitchen on Nov 5, 2010, thawed in the refrigerators over the weekend and handed out to parishioners after services on Sunday, November 7, to be prepared in their homes. Thawing in a commercial refrigerator should be acceptable. However, the high volume of turkeys may have led to extended periods of time out of the refrigerator during the distribution process, and control over the turkeys was not possible once they left the church premises.
- (2) Instructions for cooking the turkeys that were handed out to volunteers did not specify adequate cooking temperature of at least 325° F, instead suggesting overnight cooking at 275° F, and did not describe how to check for a proper internal temperature of at least 165° F. Turkeys may not have been cooked to an adequate internal temperature.
- (3) Turkeys were cooked in the home by parishioners; all turkeys were brought to the school kitchen the morning of November 8, during a 2 hour window. There was no control over how long they were unrefrigerated on the trip from the home kitchen to the school kitchen. Turkeys were processed once transported to the kitchen and the deboned meat then placed in warming pans. The extended transportation and processing time of turkeys most likely allowed for cooling to occur. Deboned meat from the turkeys was comingled and placed in 5 large pans, magnifying the likelihood of a single contaminated turkey affecting more people.
- (4) Proper hand hygiene practices were followed and gloves were worn during deboning according to reports – once in the on-site kitchen.
- (5) Improper food storage was also a potential factor in this outbreak. Turkey pans were kept over warmers for approximately 8-10 hours until the turkey dinner began at 6 pm. However, as described in the interview, turkeys were not reheated before being placed in warming pans so this was not an adequate storage strategy. Food needs to be reheated to 165° F prior to hot holding or an adequate temperature of  $\geq 135^{\circ}$  F will not be maintained. Another approach would have been to chill the turkeys for storage until the event. The Kansas 2005 Food Code states that hot foods should be cooled to 70° F within 2 hours of cooking and to 41° F within 6 hours of cooking. Properly chilled foods can be served without reheating. One attendee reported that cold foods were not served cold and hot foods were not served hot; everything was just warm.
- (6) Gravy was made from drippings collected in the home during cooking and brought to the supper, and was mixed in with the mashed potatoes and the stuffing. The drippings were collected from the turkey. Since the turkey preparation described above had evidence of several instances of temperature abuse, it is likely the gravy was also a vehicle for transmission in this outbreak.

## Laboratory Analysis

Stool specimens tested negative for norovirus, for *Salmonella spp*, *Shigella spp*, Shiga-toxin *E. coli spp*. (including O157 and non-O157), and *Campylobacter*, at KHEL. The stool specimens and food samples were all negative for *Bacillus cereus* and for *Staphylococcus aureus*. Of the food samples collected during the inspection on November 9, 2010, only the turkey was tested initially. The turkey collected from the dinner was positive and grew a toxin-producing strain of *C. perfringens*; the cultured strain produced enterotoxin A. Both stool specimens tested positive for *C. perfringens* enterotoxin A, grew *C. perfringens* in culture, and were indistinguishable from each other and from the strain cultured from the turkey by pulse-field gel electrophoresis (PFGE) performed at PHL-MDH. The PFGE patterns from the turkey (M2010032662-1) and from the two case-patient stool specimens (M2010036296-1 and M2010036261-1) are shown in Figure 2.

**Figure 2: PFGE of the Turkey and two case-patients *C. perfringens* isolates**



## Discussion

This was an outbreak of *C. perfringens* gastrointestinal illness associated with the Sacred Heart Church Fundraiser Dinner in Arkansas City, Cowley County. Attendees who became ill had consumed food either at the dinner held on November 8, 2010 or from carry-out packages. Based on epidemiologic evidence, mashed potatoes were associated with illness. Eating food at the dinner was significantly associated with illness as compared to taking food home for later consumption. This may be because food taken home was more likely to be reheated, potentially reducing the risk for exposure or illness. However, storing and reheating can also increase the risk of exposure to *C. perfringens*, so risk would only be reduced if proper reheating was carried out in the home. The association of turkey and illness was not found to be statistically significant as a result of the overwhelming consumption of turkey by all attendees; however, the odds ratio (OR) of 2.86 is an indication that turkey may have been associated with illness. Based on epidemiologic evidence alone, it is difficult to determine a significant association because 100% of ill attendees and 98% of those not reporting illness ate the turkey.

This was a yearly event associated with a non-profit entity; as a result the kitchen and site inspection was for informative and not regulatory purposes. Additionally, it was not possible to observe the food preparation or serving procedures. The inspection revealed several areas of concern related to how the turkey was prepared. Given the likely temperature abuse during food handling, cooking, storage, and serving, the turkey was the main food implicated from analysis of the food handling processes reported, and only turkey samples were analyzed for presence of *C. perfringens*, although samples were also collected of mashed potatoes, green beans, stuffing, and gravy. *C. perfringens* was cultured from the turkey and the isolated bacteria subsequently tested positive for enterotoxin A. It is possible that other foods were also contaminated from contact during preparation or inclusion of turkey drippings into the mashed potatoes or gravy. However, further testing of other food sources was not indicated once a positive sample was detected. Detection of *C. perfringens* in the turkey supports the observation of food

handling errors as the likely source of this outbreak. Over 99% of individuals ate the turkey; therefore the epidemiologic investigation could not conclusively identify turkey as the source of the outbreak. However, the combination of improper handling and confirmatory laboratory results from food and from case-patients indicates that the turkey was the main vehicle in this foodborne illness outbreak.

Stool specimens were collected from two of the case-patients. In addition to finding enterotoxin A in both stool specimens, *C. perfringens* was also isolated. PFGE was conducted on *C. perfringens* isolated from turkey and from the stool specimens; all PFGE patterns were indistinguishable. No other pathogens or toxins were detected from either the food samples or from the stool specimens. It is possible that our case definition may have missed some ill attendees who reported an incubation period of longer than 36 hours; however, the incubation period of *C. perfringens* is typically 6-24 hours. While there is potential for misreporting of time both for eating the food and for onset of symptoms, the large number of people (N=35) reporting illness who did not meet case definition may also be the result of a concurrent gastrointestinal illness in the community that was not reflected in the stool samples obtained. When the results from laboratory testing of both turkey and of stool samples are also considered, the OR of 2.86 is more convincing. The combination of laboratory results and epidemiologic evidence support turkey as the source of this outbreak.

This outbreak was likely caused by *C. perfringens* contaminated turkeys that were not cooked and handled in an adequate manner to prevent the bacterial growth. Reported food handling practices gave ample opportunity for temperature abuse of the food served at the church supper. Epidemiologic evidence implicated the mashed potatoes, which contained gravy drippings from the cooked turkeys, and suggested turkey as a source. The ill attendees had symptoms and incubation periods consistent with *C. perfringens*, and the laboratory results from both food and from ill attendees confirmed this pathogen as the cause of the outbreak.

Foodborne illness associated with *C. perfringens* is due to ingestion of large numbers of spores that can survive normal cooking temperatures and further replicate once foods are temperature abused through improper heating and chilling practices or improper reheating to appropriate temperatures before serving. These cells can survive stomach acids and will then sporulate in the small intestine. Symptoms are caused by the enterotoxin that is produced in the small intestine and subsequently released. Illness is characterized by diarrhea and abdominal pain with an incubation period of around 8-24 hours. Because this is not a true infection, fever is rare, as was seen in our investigation. Consistent with our population, symptom resolution is typically within 24 hours of onset, although residual symptoms such as abdominal cramping may last for an additional one to two days.<sup>ii</sup>

*Clostridium perfringens* intoxication has been implicated in many outbreaks before. Typically, outbreaks associated with *C. perfringens* have been connected to cooked meat and poultry products. Often, improper storage with food held for long periods while cooling at non-refrigerated storage temperatures is the main contributing factor. A characteristic of *Clostridium* is that it can grow rapidly when present in food.<sup>ii</sup> Inadequate cooking temperatures followed by inadequate cooling are optimal for growth, although proper reheating can reduce the burden. In this case, all three points of potential pathogen control – cooking, cooling and holding, and reheating – were improper. Raw foods can contain vegetative cells of *C. perfringens* making temperature abuse of prepared foods a major concern in the prevention of outbreaks of disease, especially when large numbers of people are being served.

Cooking for large numbers of people is a difficult task to accomplish without proper training on food handling, cooking, and serving methods. Several critical issues were identified in the interviews and in the environmental investigation of the food preparation processes. These included improper cooking

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<sup>ii</sup> Labbe RG, Juneja VK. (2002). *Clostridium perfringens*. In: Cliver DO, Riemann HP, editors. Foodborne Diseases, 2nd ed. (pp. 119-126). London: Academic Press, 2002.

recommendations, lack of oversight during the cooking and transportation of the turkeys, as well as issues related to food handling and proper temperature control during transportation, storage and serving. Because of this, recommendations were made to limit the size of the event in the future, and to either have the event catered by a licensed company or to prepare all foods in the church kitchen in small batches ahead of time so that food quality and safety could be closely monitored. Preparing foods on-site would require proper monitoring of food temperatures during cooking, cooling, storage, and reheating prior to hot-holding or serving. If on-site preparation is done at future events, resources are available through the K-State Extension Food Safety website (<http://www.ksre.ksu.edu/foodsafety/>).

### **Attachments**

Appendix A – Sacred Heart Turkey Dinner Questionnaire

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Kansas Health and Environmental Laboratory

Sacred Heart Church

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## Appendix A: Sacred Heart Turkey Dinner Questionnaire

Kansas Department of Health and Environment  
Foodborne Illness Outbreak Investigation  
Sacred Heart Turkey Dinner, November 8, 2010

We are investigating gastrointestinal illnesses among individuals who may have eaten food from the Sacred Heart Turkey Dinner in Arkansas City on or after November 8.

To determine the cause of illness and to prevent future occurrences, we are collecting information from individuals who became ill as well as from those that did NOT become ill. Your participation is completely voluntary, and any information you provide will be kept strictly confidential.

Did you eat food from the Sacred Heart Turkey Dinner on or after November 8th?  Yes  No

If NO: Thank you for your cooperation.

If YES: Continue to Question 1

1. Last Name: \_\_\_\_\_ First Name: \_\_\_\_\_ 2. Phone: (\_\_\_\_) \_\_\_\_ - \_\_\_\_\_

3. County: \_\_\_\_\_ 4. Age: \_\_\_\_\_ Years 5. Sex:  Male  Female

6. What date and time did you eat the food from the turkey dinner?  
Date \_\_/\_\_/\_\_ Time \_\_:\_\_\_  a.m.  p.m.

7. Did you eat the meal at Sacred Heart?  Yes  No

8. Did you take food home or have food brought to you from the Sacred Heart Dinner?  
 Yes  No

Now I am going to ask you about the food that was served at this dinner. Please answer yes to the items that you ate and no to the ones that you did not eat

9. Food Items

Turkey	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Mashed Potatoes	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Dressing	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Gravy	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Green Beans	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Cranberry Sauce	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Buttered Bread	<input type="checkbox"/> Yes	<input type="checkbox"/> No

10. Did you have any desserts?  Yes  No  
If yes, please list \_\_\_\_\_

11. If you ate dinner at the church what did you drink at the dinner? \_\_\_\_\_

12. If you ate dinner at the church did you have ice in your drink?  Yes  No

13. Did you become ill after you ate  Yes  No → If no, skip to 19

14. When did you start feeling ill? Date \_\_\_\_/\_\_\_\_/\_\_\_\_ Time \_\_\_\_:\_\_\_\_  a.m.  p.m.

15. What was your first symptom? \_\_\_\_\_

16. Did you have any of the following symptoms?

- |  |                              |                             |                                     |
|--|------------------------------|-----------------------------|-------------------------------------|
| Nausea?  | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Don't know |
| Vomiting?  | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Don't know |
| Stomach cramps?  | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Don't know |
| Diarrhea? (more than 3 loose stools in a 24 hour period) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Don't know |
| Bloody diarrhea?   | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Don't know |
| Muscle Aches?  | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Don't know |
| Headache?  | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Don't know |
| Fever?   | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Don't know |

Please indicate any other symptoms: \_\_\_\_\_

17. Did you see a doctor or other healthcare professional for this illness?  Yes  No

18. Did you go to the emergency room for this illness?  Yes  No

19. Were you hospitalized?  Yes  No  
If yes, how many days? \_\_\_\_\_

20. Are you still ill?  Yes  No  
If no, when did you recover? Date \_\_\_\_\_ Time \_\_\_\_\_

21. Did anyone else in your household eat food from the Sacred Heart Turkey Dinner?  
 Yes  No

If yes, may we interview them?

(Please complete a separate questionnaire for each person even if they did NOT become ill)

22. If you know of other individuals that ate at the Sacred Heart Turkey Dinner would you provide the contact information for them so that we may interview them also?  Yes  No

- |            |              |                                  |                             |
|------------|--------------|----------------------------------|-----------------------------|
| Name _____ | Phone: _____ | Ill <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Name _____ | Phone: _____ | Ill <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Name _____ | Phone: _____ | Ill <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Name _____ | Phone: _____ | Ill <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Name _____ | Phone: _____ | Ill <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Name _____ | Phone: _____ | Ill <input type="checkbox"/> Yes | <input type="checkbox"/> No |