Clostridium perfringens Food Poisoning Outbreak in Northeast Kansas — December 2006

Report Date
September 19, 2007

Introduction

On December 6, 2006, the Kansas Department of Health and Environment (KDHE) was notified of a potential foodborne illness outbreak. Approximately 12 employees from a Kansas state agency (Agency X) had reported diarrhea and vomiting to a supervisor. This supervisor, in turn, reported the outbreak to the KDHE Office of Surveillance and Epidemiology (OSE). Preliminary information indicated that the ill employees had eaten at a potluck luncheon served at Agency X on the afternoon of December 4, 2006.

With the cooperation of Agency X, KDHE initiated an outbreak investigation on December 6. The purpose of the investigation was to characterize the outbreak, identify the source of illness, and recommend and implement appropriate prevention and control measures.

Background

On December 4, Agency X participated in a potluck luncheon held throughout state office Building A. Building A houses three state agencies, including Agency X, on five floors. Each floor of Building A provided food items for the potluck. Employees from each of the five floors could visit the other floors and consume food items from these floors. Several individuals associated with the outbreak indicated they believed the illness was associated with food served on the fourth floor of Building A.

Most food items served at the potluck luncheon were prepared in private homes, though some were store-bought.

Methods

Epidemiologic Investigation
KDHE conducted a retrospective cohort study among Building A employees to assess exposure to food served during the potluck luncheon and subsequent illness. Study participants were recruited via electronic mail and were asked to complete a self-administered, Internet-based questionnaire (Attachment 1). A reminder e-mail was sent a week later to improve the response rate.

A case for this outbreak was defined as any individual who became ill with diarrhea or

vomiting after consuming food at the potluck luncheon on December 4.

Completed questionnaires were analyzed using SAS® 9.1.3[1]. Aggregate descriptive analyses were performed and odds ratios (OR) and 95% confidence intervals were calculated to assess the association between consumption of individual food items and subsequent illness.

Environmental Assessment
An environmental assessment was not conducted for this outbreak because many of the food items provided for the potluck luncheon were prepared in private homes, and no commercially prepared item was implicated as the source of the outbreak.

Laboratory Analysis
Stool specimens were collected from two ill persons associated with the outbreak. A portion of each fresh stool specimen was cultured for bacteria at the Kansas Department of Health and Environmental Laboratories (KDHEL). Viral detection of norovirus was also conducted at KDHEL. The Minnesota Public Health Laboratory (MPHL), the reference laboratory for KDHEL, conducted additional analyses on the specimens, including viral detection for Astrovirus, Adenovirus, and norovirus. Additionally, MPHL tested the specimens for the presence of bacteria, *Staphylococcus aureus* enterotoxin and *Clostridium perfringens* enterotoxin.

Food items from only one floor of Building A were available for testing. Food samples were collected from each of the leftover food items, and a portion of those samples were submitted to MPHL for testing. The turkey submitted was cultured and tested for the presence of bacteria, *Staphylococcus aureus* enterotoxin, and *Clostridium perfringens* enterotoxin (Attachment 2 includes photos of the turkey).

Results

Epidemiologic Investigation
One hundred eight questionnaires were collected from approximately 200 individuals who worked in the building (response rate 54%). Among the individuals who ate this meal, 21 (19%) met the outbreak case definition.

Gender distribution was similar for cases and non-cases. The median age of cases was 40 years and 44 years for non-cases. The age range for the study population was 24-64 years (Table 1).

TABLE 1. Characteristics of study population (n=108)

		Cases (n =21)	Non-cases (n = 87)	Total (n = 108)
Gender		No. (%)	No. (%)	No. (%)
	Male	10 (48)	33 (45)	43 (45)
	Female	11 (52)	41 (55)	52 (55)
Work Floor				
	1st	1 (4)	23 (96)	24 (25)
	2nd	5 (16)	26 (84)	31 (33)
	3rd	0 (0)	12 (13)	12 (13)
	4th	13 (54)	11 (46)	24 (25)
	5th	2 (50)	2 (50)	4 (4)
Agency				
	X	19 (25)	58 (75)	77 (81)
	Y	2 (50)	2 (50)	4 (4)
	Z	0 (0)	14 (100)	14 (15)
Age, yrs	Median	40	44	43
	Range	24-60	24-64	24-64

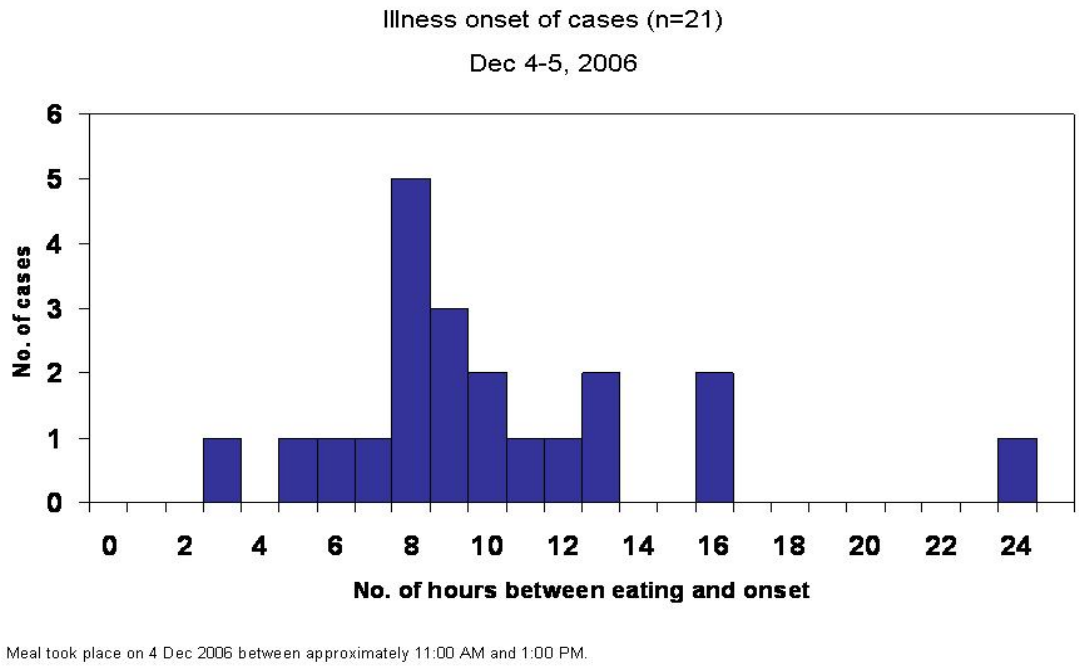
Among the 21 cases, diarrhea was the most frequently reported symptom, followed by stomach cramping, nausea, and vomiting. No one reported seeing a health care provider or being hospitalized for their symptoms (Table 2).

TABLE 2. Features of illness reported by cases (n=21)

Symptom/Outcome	No. (%)
Diarrhea	20 (95)
Stomach cramps	19 (90)
Nausea	6 (29)
Vomiting	3 (14)
Dizziness	1 (5)
Fever	1 (5)
Bloody Diarrhea	0 (0)
Saw Health Care Provider	0 (0)
Hospitalized	0 (0)
Stool Specimen provided	2 (10)

Figure 1 shows that cases had onsets of illness ranging from 3 to 24 hours after the potluck meal was eaten. Forty-three percent (n=9) of the cases experienced illness within eight hours of food consumption, with most cases reporting illness onset at eight hours, as shown by the highest peak.

FIGURE 1. Epidemic Curve



Meal took place on 4 Dec 2006 between approximately 11:00 AM and 1:00 PM.

Among the food items tested statistically, the association between food consumption and subsequent illness was strongest for the turkey served on the fourth floor of Building A. This association was statistically significant (OR=44; 95% confidence interval=5.2-375). Though other food items were associated with illness, the associations were not as strong as that calculated for the turkey, as shown in Table 3.

TABLE 3. Association between food item consumed & subsequent illness

	Ate Food Item			Did Not Eat Food Item				
Food Item	**Ill**	**Not Ill**	**(%Ill)**	**Ill**	**Not Ill**	**(%Ill)**	**OR***	**95% CI[§]**
Turkey	20	10	67	1	22	4	**44**	**5.2-375**
Ham	16	14	53	5	18	22	**4.1**	**1.2-14**
Green bean casserole	11	5	69	10	27	27	**5.9**	**1.6-21**
Cream Corn	9	3	75	12	29	29	**7.3**	**1.7-32**
Black Olives	1	3	25	20	29	41	0.5	0.05-5.0
Green Olives	3	6	33	18	26	41	0.7	0.2-3.2
Pickles	6	7	46	15	25	38	1.4	0.4-5.1
Jell-O Salad	3	2	60	18	30	38	2.5	0.4-16
Fruit Salad	4	4	50	17	28	38	1.6	0.4-7.5
Frog Salad	2	2	50	19	30	39	1.6	0.2-12
Rolls	12	5	71	9	27	25	**7.2**	**2.0-26**
Deviled Eggs	7	5	58	14	27	34	2.7	0.7-10
Fresh vegetables	9	9	50	12	23	34	1.9	0.6-6.1
Dip	5	4	56	16	28	36	2.2	0.5-9.3
Carrot Cake	8	5	62	13	27	33	3.3	0.9-12
Snowflake cookies	11	9	55	10	23	30	2.8	0.9-9.0
Baked beans	2	5	29	19	27	41	0.6	0.1-3.2
Meat tray	7	3	70	14	29	33	**4.8**	**1.1-22**
Cheese tray	5	4	56	16	28	36	2.2	0.5-9.3
Mixed nuts	6	5	55	15	27	36	2.2	0.6-8.3
Cheesy potatoes	13	5	72	8	27	23	**8.8**	**2.4-32**
Apple pie	2	7	22	19	25	43	0.4	0.1-2.0
Punch	6	7	46	15	25	38	1.4	0.4-5.1
Pop	0	0	0	21	32	40	n/a	n/a
Ice	1	1	50	20	31	39	1.6	0.1-26

[*] The odds ratio (OR) is the odds of disease among the exposed divided by the odds of disease among the non-exposed.[2§] The confidence interval is an estimated range of values within which the true OR is likely to fall 95% of the time.[2]

Laboratory Analysis

Clostridium perfringens and *Clostridium perfringens* enterotoxin type A were identified in both stool specimens.

Laboratory tests of the turkey food samples were also positive for *C. perfringens* by culture and for *C. perfingens* enterotoxin type A.

PFGE patterns were determined for the *C. perfringens* isolates from the human specimens and from the turkey sample. The patterns for both the specimens and sample were found to be indistinguishable.

Discussion

Food poisoning caused by Type A enterotoxin-producing *C. perfringens* is one of the most common causes of foodborne illnesses. Between 1998 and 2002, 130 outbreaks, accounting for 6,724 illnesses, were reported to the Centers for Disease Control and Prevention (CDC), making *C. perfringens* the third most common cause of foodborne outbreaks where the etiology is known[3]. It is possible, though, that this is an underestimate of the disease burden associated with *C. perfingens* due to the self-limited nature of the illness and the failure of those with symptoms to seek medical help[4].

Symptoms of *C. perfringens* food poisoning, including abdominal cramping, diarrhea and vomiting, usually appear within eight to sixteen hours after ingestion of contaminated food. Symptoms may last for one or two days. Though healthy adults rarely suffer complications or long term effects of the food poisoning, outbreaks of severe disease have been reported[5].

The bacterium *C. perfringens* grows well on meat and poultry products in the absence of oxygen, though it is aerotolerant enough to survive in an oxygen-rich environment for up to 72 hours. Since *C. perfringens* is ubiquitous in the environment, sources of raw meat are occasionally contaminated with this organism, either in the form of vegetative cells or as spores[6]. If meat products contaminated with *C. perfringens* are not appropriately cooked, small amounts of the organism may survive and multiply to food poisoning levels when cooled or stored at improper temperatures (usually between 60°F and 125° F) for a prolonged period of time[7].

The results from the epidemiologic study and laboratory testing support the hypothesis that employees working in Building A became ill with *C. perfringens* food poisoning after consuming food served at the potluck luncheon. Statistical analyses indicated that the turkey served on the fourth floor was significantly associated with illness. The odds of becoming ill were 44 times greater among those who reported eating turkey compared to those who did not report eating turkey. Additionally, specimens from ill persons who ate the turkey as well as food samples of leftover turkey tested positive for *Clostridium perfringens* and *Clostridium perfringens* enterotoxin type A.

Unfortunately, it was difficult to definitively determine the environmental factors that contributed to bacterial proliferation, as no environmental assessment could be conducted. It is likely, though, that the turkey was improperly cooled or stored after cooking.

Strengths of the investigation
Both human specimens and food samples were promptly collected and tested, and the laboratory results confirmed the etiology of the outbreak. The use of an Internet-based survey eliminated the need for re-entry of respondent answers into a separate database for analysis. In addition, the communication and collaboration with partners at the state level, internally and externally, promoted a through and successful outbreak investigation.

Limitations of the investigation
Because of the low survey response rate, the risk of illness could not be directly assessed. The investigation was also subject to several biases. Respondents who became ill may have been more likely to complete the survey compared to those who did not become ill. Because several employees indicated that they believed food served on the fourth floor was associated with illness, respondents may have been more likely to report consuming foods on this floor compared to other floors. Furthermore, respondents most likely did not remember everything they ate.

Recommendations

To prevent future outbreaks of *C. perfringens* enterotoxin-associated food poisoning, consumers should be aware of food preparation and food safety practices when preparing food, particularly in large quantities. Ideally, safe food preparation and handling techniques should be reviewed before group events, such as potluck meals. Meats should be thoroughly cooked, eaten while still hot, and reheated to an internal temperature of ≥165°F before serving. Additionally, food not served immediately after cooking should be divided into small quantities and rapidly cooled[5].

Conclusions

The epidemiologic evidence and laboratory results of the stool and food samples confirmed this outbreak to be caused by Type A enterotoxin-producing *C. perfringens*. Improved food handling guidelines directed toward consumers may help prevent similar outbreaks in the future.

Acknowledgements

Agency X staff

Building A employees who participated in the study
Epidemiologic Services Section of the Kansas Department of Health and Environment
Kansas Department of Health and Environment Laboratories
Minnesota Public Health Laboratory

Outbreak Investigators

Minnesota Public Health Laboratory – C Fuller
Kansas Department of Health and Environment – A Hodle, D Neises, C Bañez Ocfemia, DC Hunt

References

1. SAS Institute, Inc., Cary, NC, USA.
2. Last, JM, ed. A Dictionary of Epidemiology. 3rd edition. New York: Oxford University Press, 1995.
3. Centers for Disease Control and Prevention. Diagnosis and Management of Foodborne Illnesses: a Primer for Physicians. MMWR 2001;50(No. RR-2): 12.
4. Evans AS, Brachman PS. Bacterial Infections of Humans: Epidemiology and Control. 3rd edition. Kluwer Academic Publishers; New York. 1998: 119-122
5. Heymann DL. Control of Communicable Diseases Manual. 18th ed. Washington, DC: American Public Health Association, 2004.
6. Crouch E, Golden NJ. A Risk Assessment for *Clostridium perfringens* in Ready-to-Eat and Partially Cooked Meat and Poultry Products. Report for USDA-FSIS. Sept 2005. Available on-line at: http://www.fsis.usda.gov/PDF/CPerfringens_Risk_Assess_Sep2005.pdf
7. Zimomra J, Wenderoth T, Snyder A, Russ R, Peterson ED, et al. *Clostridium perfringens* Gasteroenteritis Associated with Corned Beef Served at St. Patrick's Day Meals—Ohio and Virginia, 1993. MMWR 1994; 43(8): 137, 143-4.

Attachments

1. Outbreak questionnaire
2. Photos of leftover turkey
3. *C. perfringens* fact sheet from US FDA

Kansas Department of Health and Environment
Foodborne Illness Outbreak Survey

The Kansas Department of Health and Environment is investigating reports of illness among Building A employees. To determine the cause of illness, it is important for us to get information from those who became ill as well as those that did NOT become ill. The survey will take about 5 to 10 minutes. All information you provide will be strictly confidential.

1. Last Name: _____ 2. First Name: _____

3. Street address (home):_____

4. Zip code: _____ 5. Home phone:_____ 6. E-mail: _____

7. Age: _____Years **8. Sex:** ❑ Male ❑ Female

9. Indicate on which floor you work in the Building A: ❑ 1st ❑ 2nd ❑ 3rd ❑ 4th ❑ 5th

10. Indicate for which agency you work:

❑ Agency X

❑ Agency Y

❑ Agency Z

11. Did you eat any foods or drinks, even a little bit, as part of the potluck on Monday, December 4, 2006?
❑ Yes ❑ No → **If no, skip to question 28.**

12. Approximately what time did you eat? Time ____:_____ ❑ a.m. ❑ p.m.

13. Did you eat any items from the 1st floor of Agency X?
❑ No **(If no, please skip to question 14)**

❑ Yes **(If yes, please indicate which items below.)**

	Yes	**No**	**Can't remember**
Bean dip	❑	❑	❑
Chips	❑	❑	❑
Shrimp	❑	❑	❑
Dip (for shrimp)	❑	❑	❑
Hot chicken wings	❑	❑	❑
Hot chicken dip	❑	❑	❑
Crackers (for hot chicken dip)	❑	❑	❑
Fresh vegetables from tray	❑	❑	❑
Fresh fruit from tray	❑	❑	❑
Dried beef dip	❑	❑	❑
Crackers for dried beef dip	❑	❑	❑
Spinach dip	❑	❑	❑
Bread for spinach dip	❑	❑	❑

Meat from meat and cheese tray	❑	❑	❑
Cheese from meat and cheese tray	❑	❑	❑
Pinwheels	❑	❑	❑
Mini cheesecake desserts	❑	❑	❑
Pop / soda	❑	❑	❑
Ice	❑	❑	❑

Other? Please specify:

14. Did you eat any items from the 1st floor of Agency Z?

❑ No (If no, please skip to question 15)

❑ Yes (If yes, please indicate which items below.)

	Yes	No	Can't remember
Rib tips	❑	❑	❑
BBQ meat balls	❑	❑	❑
BBQ little smokies	❑	❑	❑
BBQ beef	❑	❑	❑
BBQ sauce	❑	❑	❑
Potato casserole	❑	❑	❑
Potato salad	❑	❑	❑
Baked beans	❑	❑	❑
Fresh vegetables	❑	❑	❑
Dip for fresh vegetables	❑	❑	❑
Chips	❑	❑	❑
Buns	❑	❑	❑
Tortilla roll-ups	❑	❑	❑

Other? Please specify:

15. Did you eat any items from the 2nd floor?

❑ No (If no, please skip to question 16)

❑ Yes (If yes, please indicate which items below.)

	Yes	No	Can't remember
Roast beef	❑	❑	❑
Turkey	❑	❑	❑
Pastrami	❑	❑	❑
Ham	❑	❑	❑
Potato salad (homemade)	❑	❑	❑
German Potato salad (homemade)	❑	❑	❑
Potato salad (from Sam's Club)	❑	❑	❑
Rolls	❑	❑	❑
Baked beans	❑	❑	❑
Pickles	❑	❑	❑
Ketchup	❑	❑	❑
Mustard	❑	❑	❑
Miracle Whip	❑	❑	❑
Mayonnaise	❑	❑	❑

Cheese slices	❑	❑	❑
Deviled eggs	❑	❑	❑
Fresh vegetables from tray	❑	❑	❑
Chips Ahoy cookies	❑	❑	❑

Other? Please specify:

16. Did you eat any items from the 3rd floor?

❑ No (If no, please skip to question 17)

❑ Yes (If yes, please indicate which items below.)

	Yes	No	Can't remember
Little smokies	❑	❑	❑
Chips	❑	❑	❑
Dip	❑	❑	❑
Chex Mix	❑	❑	❑
Meat from meat and cheese tray	❑	❑	❑
Cheese from meat and cheese tray	❑	❑	❑
Cheese ball	❑	❑	❑
Crackers	❑	❑	❑
Fresh vegetables from tray	❑	❑	❑
Carnitas (pork), **with** green peppers and onions	❑	❑	❑
Green peppers (pork), **without** green peppers and onions	❑	❑	❑
Tortillas	❑	❑	❑
Chili	❑	❑	❑
Cheese (for chili)	❑	❑	❑
Fritos (for chili)	❑	❑	❑
Jalapeno peppers	❑	❑	❑
Saltine crackers	❑	❑	❑
Baked potato soup	❑	❑	❑
Chicken and noodles	❑	❑	❑
Tex Mex soup	❑	❑	❑
Spaghetti	❑	❑	❑
Layered Caribbean chicken salad	❑	❑	❑
Cheese cake	❑	❑	❑
Pop / soda	❑	❑	❑
Punch	❑	❑	❑

Other? Please specify:

17. Did you eat any items from the 4th floor?

❑ No (If no, please skip to question 18)

❑ Yes (If yes, please indicate which items below.)

	Yes	No	Can't remember
Turkey	❑	❑	❑
Ham	❑	❑	❑

Green Bean Casserole	❑	❑	❑
Creamed Corn	❑	❑	❑
Black olives	❑	❑	❑
Green Olives	❑	❑	❑
Pickles	❑	❑	❑
Jello Salad	❑	❑	❑
Fruit Salad	❑	❑	❑
Frog-eyed salad (pasta, pineapple, mandarin oranges)	❑	❑	❑
Rolls	❑	❑	❑
Deviled eggs	❑	❑	❑
Fresh vegetables from tray	❑	❑	❑
Dip	❑	❑	❑
Carrot cake	❑	❑	❑
Snowflake cookies	❑	❑	❑
Baked beans	❑	❑	❑
Meat from meat / cheese tray	❑	❑	❑
Cheese from meat / cheese tray			
Mixed nuts	❑	❑	❑
Cheesy potatoes	❑	❑	❑
Apple pie	❑	❑	❑
Punch	❑	❑	❑
Other? Please specify:			

18. Did you eat any items from the 5th floor?

❑ No (If no, please skip to question 19)

❑ Yes (If yes, please indicate which items below.)

	Yes	**No**	**Can't remember**
Sex in a Pan chocolate cake	❑	❑	❑
Cinnamon rolls	❑	❑	❑
Cup cakes	❑	❑	❑
Apple cake	❑	❑	❑
Upside down gingerbread cake	❑	❑	❑
Cookies	❑	❑	❑
Cheesecake	❑	❑	❑
Rice Crispy treats	❑	❑	❑
Chocolate covered pretzels	❑	❑	❑
Chocolate peanut butter snacks	❑	❑	❑
Cinnamon sticks	❑	❑	❑
Mints	❑	❑	❑
Peanuts	❑	❑	❑
Cherry pie pudding	❑	❑	❑
Pumpkin cake	❑	❑	❑
White chocolate mini pie	❑	❑	❑
Other? Please specify:			

19. Did you bring any food to the potluck?

❑ No (If no, please skip to question 20)

❑ Yes (If yes, please indicate which items in the space provided below.)

_____

_____

20. Did you become ill after you ate? ❑ Yes ❑ No →**If no, skip to question 28**

21. When did you start feeling ill? Date ____/____/_____ Time ____:_____ ❑ a.m. ❑ p.m.
MM DD YYYY

22. What was your first symptom? _____

23. Did you have any of the following symptoms?

Nausea?	❑ Yes	❑ No	❑ Don't know
Vomiting?	❑ Yes	❑ No	❑ Don't know
Stomach cramps?	❑ Yes	❑ No	❑ Don't know
Diarrhea? (more than 3 loose stools in a 24 hour period)	❑ Yes	❑ No	❑ Don't know
If yes, number of stools in 24 hours? _____			
Bloody diarrhea?	❑ Yes	❑ No	❑ Don't know
Dizziness?	❑ Yes	❑ No	❑ Don't know
Fever?	❑ Yes	❑ No	❑ Don't know

If yes, highest temperature? _____°F

Please indicate any other symptoms: _____

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

If yes, provide name and phone number:_____

25. Were you hospitalized? ❑ Yes ❑ No

If yes, where? _____

26. Was a stool specimen collected? ❑ Yes ❑ No

27. Are you still ill? ❑ Yes ❑ No

If no, when did you recover? Date _____ Time _____

28. Did anyone else in your household eat food from the potluck meal (i.e., either attended the meal or eaten food you may have taken home)?

❑ Yes ❑ No

29. Has anyone else in your household been ill with nausea, vomiting, or diarrhea since 7 days before the potluck (i.e., since Monday, November 27th) and today? ❑ Yes ❑ No

If yes, relationship:_____ Date illness began:____/_____/_____
MM DD YYYY

30. Do you have other comments or information you would like to share?

_____

_____

Thank you for completing the survey.

Photos of Leftover Turkey Served at Potluck

U.S. Food and Drug Administration
Department of Health and Human Services
CENTER FOR FOOD SAFETY AND APPLIED NUTRITION
FDA Home Page | CFSAN Home | Search/Subject Index | Q & A | Help

Bad Bug Book

Foodborne Pathogenic Microorganisms and Natural Toxins Handbook

Clostridium perfringens

CDC/MMWR | NIH/PubMed | Agricola

1. Name of the Organism:
Clostridium perfringens

Clostridium perfringens is an anaerobic, Gram-positive, sporeforming rod (anaerobic means unable to grow in the presence of free oxygen). It is widely distributed in the environment and frequently occurs in the intestines of humans and many domestic and feral animals. Spores of the organism persist in soil, sediments, and areas subject to human or animal fecal pollution.

2. Nature of Acute Disease:

Perfringens food poisoning is the term used to describe the common foodborne illness caused by *C. perfringens*. A more serious but rare illness is also caused by ingesting food contaminated with Type C strains. The latter illness is known as enteritis necroticans or pig-bel disease.

3. Nature of Disease:

The common form of perfringens poisoning is characterized by intense abdominal cramps and diarrhea which begin 8-22 hours after consumption of foods containing large numbers of those *C. perfringens* bacteria capable of producing the food poisoning toxin. The illness is usually over within 24 hours but less severe symptoms may persist in some individuals for 1 or 2 weeks. A few deaths have been reported as a result of dehydration and other complications.

Necrotic enteritis (pig-bel) caused by *C. perfringens* is often fatal. This disease also begins as a result of ingesting large numbers of the causative bacteria in contaminated foods. Deaths from necrotic enteritis (pig-bel syndrome) are caused by infection and necrosis of the intestines and from resulting septicemia. This disease is very rare in the U.S.

Infective dose--The symptoms are caused by ingestion of large numbers (greater than 10 to the 8th) vegetative cells. Toxin production in the digestive tract (or in test tubes) is associated with sporulation. This disease is a food infection; only one episode has ever implied the possibility of intoxication (i.e., disease from preformed toxin).

4. Diagnosis of Human Illness: Perfringens poisoning is diagnosed by its symptoms and the typical delayed onset of illness. Diagnosis is confirmed by detecting the toxin in the feces of patients. Bacteriological confirmation can also be done by finding exceptionally large numbers of the causative bacteria in implicated foods or in the feces of patients.

5. Associated Foods: In most instances, the actual cause of poisoning by *C. perfringens* is temperature abuse of prepared foods. Small numbers of the organisms are often present after cooking and multiply to food poisoning levels during cool down and storage of prepared foods. Meats, meat products, and gravy are the foods most frequently implicated.

6. Relative Frequency of Disease: Perfringens poisoning is one of the most commonly reported foodborne illnesses in the U.S. There were 1,162 cases in 1981, in 28 separate outbreaks. At least 10-20 outbreaks have been reported annually in the U.S. for the past 2 decades. Typically, dozens or even hundreds of person are affected. It is probable that many outbreaks go unreported because the implicated foods or patient feces are not tested routinely for *C. perfringens* or its toxin. CDC estimates that about 10,000 actual cases occur annually in the U.S.

7. Course of Disease and Complications: The disease generally lasts 24 hours. In the elderly or infirm, symptoms may last 1-2 weeks. Complications and/or death only very rarely occur.

8. Target Populations: Institutional feeding (such as school cafeterias, hospitals, nursing homes, prisons, etc.) where large quantities of food are prepared several hours before serving is the most common circumstance in which perfringens poisoning occurs. The young and elderly are the most frequent victims of perfringens poisoning. Except in the case of pig-bel syndrome, complications are few in persons under 30 years of age. Elderly persons are more likely to experience prolonged or severe symptoms.

9. Food Analysis: Standard bacteriological culturing procedures are used to detect the organism in implicated foods and in feces of patients. Serological assays are used for detecting enterotoxin in the feces of patients and for testing the ability of strains to produce toxin. The procedures take 1-3 days.

10. Selected *Literature references can be found at the links below.*

http://vm.cfsan.fda.gov/~mow/chap11.html

Outbreaks:

MMWR 43(8):1994	Clostridium perfringens is a common infectious cause of outbreaks of foodborne illness in the United States, especially outbreaks in which cooked beef is the implicated source. This report describes two outbreaks of *C. perfringens* gastroenteritis following St. Patrick's Day meals in Ohio and Virginia during 1993. In November, 1985, a large outbreak of *C. perfringens* gastroenteritis occurred among factory workers in Connecticut. Forty-four percent of the 1,362 employees were affected. Four main-course foods served at an employee banquet were associated with illness, but gravy was implicated by stratified analysis. The gravy had been prepared 12-24 hours before serving, had been improperly cooled, and was reheated shortly before serving. The longer the reheating period, the less likely the gravy was to cause illness. Since December 1981, FDA has investigated 10 outbreaks in 5 states. In two instances, more than one outbreak occurred in the same feeding facility within a 3-week period. One such outbreak occurred on 19 March 1984, involving 77 prison inmates. Roast beef served as a luncheon meat was implicated as the food vehicle and *C. perfringens* was confirmed as the cause by examining stools of 24 patients. Most of the patients became ill 8-16 hours after the meal. Eight days later, on 27 March 1984, a second outbreak occurred involving many of the same persons. The food vehicle was ham. Inadequate refrigeration and insufficient reheating of the implicated foods caused the outbreaks. Most of the other outbreaks occurred in institutional feeding environments: a hospital, nursing home, labor camp, school cafeteria, and at a fire house luncheon.
Morbidity and Mortality Weekly Reports	**For more information on recent outbreaks see the Morbidity and Mortality Weekly Reports from CDC.**

11. Education and Background Resources:	*Literature references can be found at the links below.*
Loci index for genome Clostridium perfringens	Available from the GenBank Taxonomy database, which contains the names of all organisms that are represented in the genetic databases with at least one nucleotide or protein sequence.
12. Molecular Structural Data:	None currently available.

CDC/MMWR

The CDC/MMWR link will provide a list of Morbidity and Mortality Weekly Reports at CDC relating to this organism or toxin. The date shown is the date the item was posted on the Web, not the date of the MMWR. The summary statement shown are the initial words of the overall document. The specific article

of interest may be just one article or item within the overall report.

NIH/PubMed

The NIH/PubMed button at the top of the page will provide a list of research abstracts contained in the National Library of Medicine's MEDLINE database for this organism or toxin.

AGRICOLA

The AGRICOLA button will provide a list of research abstracts contained in the National Agricultural Library database for this organism or toxin.

mow@cfsan.fda.gov
January 1992 with periodic updates

Bad Bug Book | Foodborne Illness

CFSAN Home | CFSAN Search/Subject Index | CFSAN Disclaimers & Privacy Policy | CFSAN Accessibility/Help
FDA Home Page | Search FDA Site | FDA A-Z Index | Contact FDA

FDA/Center for Food Safety & Applied Nutrition
Hypertext updated by mow/las/dav/ear June 14, 2006