Centers for Disease Control and Prevention
Case Studies in Applied Epidemiology
No. 054-D11

A Cluster of Botulism Cases in Uzbekistan

Student's Guide

Learning Objectives

After completing this case study, the participant should be able to:

- Assess whether an increase in the number of apparent cases represents an outbreak,
- Optional: Describe some of the features that are consistent with an intentional or an unintentional exposure that results in an outbreak,
- Describe some of the decisions that must be made before going to the field to conduct a field investigation,
- Develop and apply a case definition in a field investigation,
- Calculate and compare exposure-specific attack rates to identify possible vehicles.

HSPH Homework: Hand in answers to Questions 4, 12, and 16, plus additional homework assignment.

This case study is based on an investigation conducted by Zokir Inamov with assistance from Simon Ajeeilat of the CDC Central Asia Region office and Field Epidemiology Training Program. The investigation was presented at the Global TEPHINET Meeting in Beijing in November 2004.

This case study was developed by Richard Dicker in 2005 for the Threat Agent Detection and Response project.

Part I

Between January 2 and January 5, 2004, at least ten persons presented to the district hospital in Kasansai, Uzbekistan with drooping eyelids, double or blurred vision, difficulty swallowing, and breathing difficulty. Some patients had muscle weakness. Most had begun to experience these symptoms on January 1. Physicians at the hospital thought that the clinical presentations were consistent with botulism.

Figure 1: Map of Uzbekistan

Question 1: Would you call this situation an outbreak? (What additional information might you need before calling a cluster of cases an outbreak?

Outbreaks of botulism are not uncommon in Uzbekistan. From 1998 through 2003, the number of outbreaks of botulism ranged from 16 to 37, affecting from 41 to 89 persons (Table 1).

Table 1: Number of cases of botulism in Uzbekistan by year of registration, 1998–2003

Year	Number of outbreaks	Number of cases	Number of deaths
1998	28	89	0
1999	16	41	0
2000	37	65	0
2001	18	67	2
2002	20	53	1
2003	28	67	11

The hospital notified the public Rayon Sanitary Epidemiologic Service, where the local FETP trainee was affiliated.

Question 2: If you had taken the call, what kinds of questions might you have asked to further characterize the situation?

Botulism is a potentially severe, paralytic illness caused by toxins of the spore-forming bacterium *Clostridium botulinum*. Illness is characterized by marked fatigue, weakness and vertigo, followed by cranial nerve dysfunction (e.g., drooping eyelids, blurred or double vision, difficulty swallowing and speaking) and symmetric descending flaccid paralysis. Death can result from respiratory failure. Foodborne botulism, the most common form, is caused by eating food containing preformed botulinum toxin. The diagnosis can be confirmed by demonstration of botulinum toxin in stool or gastric secretions or serum.

While botulism is not common, it is more common in Russia and some other countries of the former Soviet Union than elsewhere in the world.

C. botulinum spores are ubiquitous in soil worldwide. They are frequently recovered from honey, and can be found in the intestinal tracts of animals, including fish. Foodborne botulism occurs when *C. botulinum* grows and produces toxin in food which is then eaten without sufficient heating to inactivate the toxin. This occurs most commonly in lightly preserved foods such as fermented, salted, or smoked fish and meat products and in improperly processed home-canned or home-bottled low acid foods such as vegetables. In Europe, most cases are due to sausages and smoked or preserved meats; in Japan, to seafood.

C. botulinum is considered a Category A bioterrorism agent.

Question 3: What are the major public health concerns raised by these presumed cases of botulism in Kasansai?

Question 4: What diseases are considered most likely to be caused by acts of bioterrorism? What distinguishes a Category A from a Category B agent?

Question 5: What features of an outbreak might help public health officials to distinguish an outbreak caused by an intentional act of terrorism from a non-intentional ("naturally occurring") one? (Hint: think about characteristics of the hosts, agent, environmental, and other contextual considerations.)

All of the patients had attended a social gathering held in one household on December 31, 2003.

Question 6: Is this worth investigating? Why or why not? What are some of the other common reasons for conducting a field investigation?

The local trainee from the Central Asia Region Field Epidemiology Training Program decided to conduct an epidemiologic study to determine the cause of the outbreak.

Question 7: Arrange the following steps of an outbreak investigation in the appropriate conceptual order.

___ Communicate findings
___ Compare epidemiologic study findings with lab and environmental studies
___ Develop hypotheses
___ Confirm the existence of an epidemic
___ Test hypotheses epidemiologically
___ Identify and count cases systematically (record in line listing)
___ Prepare for field work / Identify potential investigation team and resources
___ Implement control measures
___ Maintain surveillance to monitor trends and evaluate control measures
___ Perform descriptive epidemiology, orienting the data by time, place, person
___ Construct a working case definition
___ Verify the diagnosis
___ Reconsider, refine, and re-evaluate hypothesis

Before departing for the field investigation, the investigators had to make many decisions and preparations, which could be grouped under the headings of Epidemiologic Issues; Supplies and Equipment; Investigative Team Composition, Roles, and Responsibilities; and Administrative Issues.

Question 8: Before departing, what decisions and preparations in these four categories must be made?

Investigators determined that a total of 24 persons had attended the social gathering. Seven persons were all members of the inviting family. The 17 others were invited guests. The social gathering took place in early afternoon.

No additional cases of botulism were identified in the community.

The investigators decided to develop a case definition.

Question 9: What is a case definition?

Question 10: Based on the symptoms described earlier and a bioassay (available for only 9 of 17 patients), develop a case definition.

Question 11: What is a line listing? What would you include in your line listing for this outbreak?

The clinical part of the line listing shown in Table 2 displays the presence or absence of symptoms and the results of laboratory testing for 17 patients.

Table 2: Partial line listing of suspected botulism cases, Kasansai, Uzbekistan, January 2004

Patient ID	Drooping eyelids	Double vision	Blurred vision	Difficulty swallowing	Difficulty breathing	Time of Onset	Bioassay	Meets case definition?
17	Y	Y	Y	Y	Y	1/1	Positive	_____
18	Y	Y	Y	Y	Y	1/2	Negative	_____
19	Y	Y	Y	Y	Y	1/1	Negative	_____
21	Y	Y	Y	Y	Y	1/1	Negative	_____
22	Y	Y	Y	Y	Y	1/1	Positive	_____
24	Y	Y	Y	Y	Y	1/1	Positive	_____
20	Y	Y		Y	Y	1/1	Positive	_____
23	Y	Y		Y	Y	1/1	Positive	_____
8	Y		Y	Y		1/3	not done	_____
9		Y	Y	Y		1/1	not done	_____
16		Y	Y	Y		1/1	Negative	_____
1			Y	Y		1/3	not done	_____
2			Y	Y		1/3	not done	_____
3			Y			1/2	not done	_____
4			Y			1/4	not done	_____
7				Y		1/1	not done	_____
10				Y		1/5	not done	_____

The investigators decided to use the following case definition:

- PERSON: Any visitor who attended the social on December 31
- PLACE: Any
- TIME: onset January 1 or later
- CLINICAL, **Possible**: Onset since January 1 of any one of the following symptoms:
  - drooping eyelids
  - double vision
  - blurred vision
  - difficulty swallowing
  - difficulty breathing

  CLINICAL, **Probable**: Onset since January 1 of any three of the listed symptoms
  CLINICAL, **Confirmed**: Same as Probable plus positive bioassay test for botulism

Question 12: Using the data in Table 2 and the case definition used by the investigators, indicate whether each patient met the confirmed, probable, or possible case definition, or did not meet the case definition.

Question 13: What additional information would you like to have to characterize the descriptive epidemiology of this outbreak?

Question 14: What is an epidemic curve?

Part III

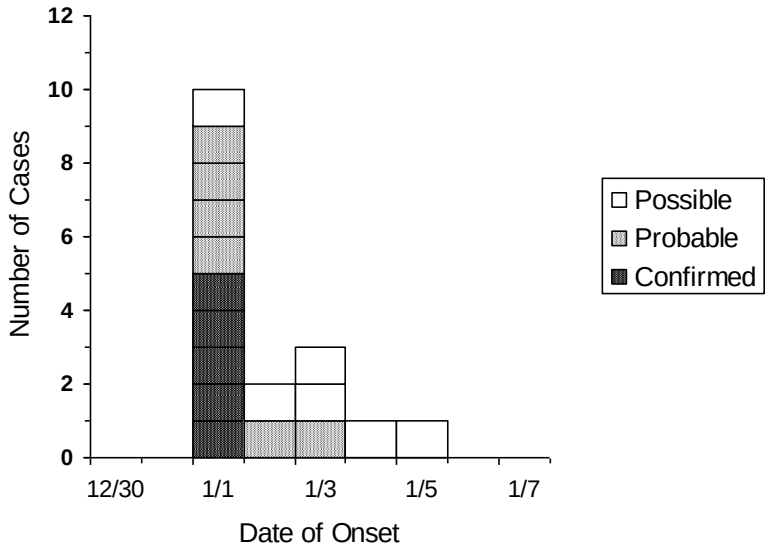
The social gathering took place in early afternoon on December 31. Sixteen of the 17 guests were male, whereas only 3 of the 7 host family members were male. None of the host family members became ill. Confirmed and probable cases were older, on average, than suspect and non-cases (Table 3). Four of five confirmed cases died, but no one else did.

Table 3: Age, sex, and outcome of attendees of the social gathering by case definition status, botulism outbreak, Kasansai, Uzbekistan, January 2004

	Confirmed Case	Probable Case	Possible Case	Non-case
Number	5	6	6	7
Median age (years)	44	42	35	33
Sex, male (%)	100%	83%	100%	43%
Died (%)	80%	0%	0%	0%

Figure 2 shows the epidemic curve by case definition category, using 1-day intervals on the X-axis. Recall that the social gathering occurred in early afternoon on December 31, and that the usual incubation period for botulism is 18–36 hours. However, symptoms can occur as early as six hours or as late as 10 days after exposure.

Figure 2: Number of cases of botulism by date of onset, Kasanai, Uzbekistan, January 2004



Question 15: Mark the time of the social gathering on the epidemic curve. Interpret the epidemic curve.

Investigators hypothesized that one or more foods eaten at the social gathering must have harbored C*lostridium botulinum* toxin and was the cause of the outbreak. They administered a questionnaire to all 24 of the people (or to their proxies) who attended the social gathering, asking which foods they had eaten. Table 3 summarizes the results.

Table 3: Foods consumed by persons attending the social gathering, botulism outbreak, Kasansai, Uzbekistan, January 2004

Patient/ Person ID	Probable or Confirmed Case?	Bread	Pechak kand	Plov*	Quince jam	Tsamsa†	Tomatoes/ Cucumber	Vegetable Paste	Tea
17	Confirmed	Y	Y	Y	n	n	Y	n	Y
18	Probable	Y	n	Y	n	n	Y	n	Y
19	Probable	Y	n	Y	Y	Y	Y	Y	Y
21	Probable	Y	Y	Y	n	Y	Y	n	Y
22	Confirmed	Y	Y	Y	Y	Y	Y	Y	Y
24	Confirmed	Y	n	Y	Y	Y	Y	n	Y
20	Confirmed	Y	n	Y	n	Y	Y	Y	Y
23	Confirmed	Y	n	Y	Y	Y	Y	n	Y
8	Probable	Y	n	Y	n	Y	Y	n	Y
9	Probable	Y	n	Y	Y	Y	Y	n	Y
16	Probable	n	n	n	n	n	Y	n	n
1	Possible	Y	Y	Y	Y	Y	Y	Y	Y
2	Possible	Y	n	n	Y	Y	n	Y	Y
3	Possible	Y	n	Y	n	Y	Y	n	Y
4	Possible	Y	Y	Y	n	Y	Y	n	Y
7	Possible	Y	n	Y	n	Y	Y	n	Y
10	Possible	n	n	n	n	n	Y	n	n
5	not a case	Y	n	Y	n	n	n	n	Y
6	not a case	Y	n	Y	Y	Y	Y	n	Y
11	not a case	Y	n	Y	n	Y	Y	n	Y
12	not a case	Y	n	Y	n	Y	n	Y	Y
13	not a case	Y	n	Y	n	Y	Y	n	Y
14	not a case	Y	n	Y	n	n	n	n	Y
15	not a case	Y	n	Y	n	Y	n	n	Y

* Plov = mixture of fried or boiled meat, onions, carrots, rice
† Tsamsa = stuffed dumpling, similar to samosa

Question 16: Using the data in Table 3, complete the following attack rate table for those who did and did not eat each food. Group the confirmed and probable cases as cases, and the suspect and non-cases as non-cases.

	Exposed Persons				Unexposed Persons				
Food	Ill	Well	Total	Attack Rate	Ill	Well	Total	Attack Rate	Ratio of Attack Rates
Bread	10	12	22	46%	1	1	2	50%	0.9
Pechak kand	_____	_____	_____	_____	_____	_____	_____	_____	_____
Plov	_____	_____	_____	_____	_____	_____	_____	_____	_____
Quince	_____	_____	_____	_____	_____	_____	_____	_____	_____
Tsamsa	_____	_____	_____	_____	_____	_____	_____	_____	_____
Tomato and Cucumber	_____	_____	_____	_____	_____	_____	_____	_____	_____
Veg. paste	_____	_____	_____	_____	_____	_____	_____	_____	_____
Tea	_____	_____	_____	_____	_____	_____	_____	_____	_____

Question 17: Which food do you think is most likely to have caused the outbreak? Why?

Part IV — Conclusion

Botulism outbreaks are commonly traced to improperly preserved vegetables and meats. In this outbreak, *Clostridium botulinum* type B and its toxin were detected in the leftovers of the home-canned tomatoes with cucumbers served at the gathering. *Clostridium botulinum* type B and its toxin were also detected in other home-canned food items that were not served at the gathering, but were not detected in any of the other foods served at the gathering.

Local officials arranged to destroy the remaining contaminated home-canned foods, and discussed offering health education messages about procedures for safe home canning of foods.

References / Reading — Botulism

1. Sobel J. Botulism. Clin Infect Dis 2005;41:1167–1173.

2. Bossi P, Tengell A, Baka A, et al. Bichat guidelines for the clinical management of botulism and bioterrorism-related botulism. Eurosurveillance 2004;9:E13–14.

3. Centers for Disease Control and Prevention (CDC). Botulism in the United States, 1899–1996: Handbook for epidemiologists, clinicians, and laboratory workers, Atlanta, GA: CDC, 1998.