Centers for Disease Control and Prevention
Case Studies in Applied Epidemiology
No. 071-908

Botulism in the Republic of Georgia

Participant's Guide

Learning Objectives

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

- Describe the key principles of public health surveillance,
- Analyze surveillance data by time, place, and person,
- Interpret surveillance data,
- Discuss the uses of surveillance.

This case study is based upon surveillance and investigation activities conducted by the Republic of Georgia's National Center for Disease Control (NCDC) with assistance from the U.S. Centers for Disease Control and Prevention. These activities are described in:

Varma JK, Katsitadze G, Moiscrafishvili M, et al. Foodborne botulism in the Republic of Georgia. Emerg Infect Dis 2004;10:1601–1605.

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Part I

In 2001, public health officials in the Republic of Georgia became concerned about a possible increase in the occurrence of botulism in the country. In response, a team of epidemiologists reviewed surveillance data available at Georgia's National Center for Disease Control (NCDC).

Question 1: What is public health surveillance? What is the purpose of public health surveillance?

In Georgia, residents with mild or early symptoms of botulism would usually go to a district hospital. Those living near Tbilisi and those with severe symptoms would likely go to the infectious disease hospital in that city. Botulism is one of the few medical conditions that continues to be treated at public expense since the collapse of the Soviet Union.

When trying to characterize or evaluate a surveillance system, it can be useful as a first step to diagram the flow of data in the system.

Question 2: Draw a chart of the flow of data from local hospitals to the NCDC. Identify the surveillance responsibilities or tasks performed at each level.

The botulism surveillance system in Georgia is a mix of passive and active case reporting.

Question 3: What do the terms *passive* and *active* reporting mean? If local health agency resources were cut so that no staff were available to encourage or seek out reports, which component would be affected – passive or active?

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., blurred 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.

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, the most common vehicles are sausages and smoked or preserved meats; in Japan, the most common vehicle is seafood.

Epidemiologists reviewed the surveillance data available at the National Center for Disease Control in 2002. At total of 39 cases of botulism had been reported in 2002.

Question 4: How would you determine whether the number of cases of botulism reported in 2002 is unusual or represents an increase? How would you determine whether the number of cases of influenza reported this week is unusual?

Part II

The epidemiologists reviewed annual botulism surveillance data dating back to 1980. The surveillance data included not only the number of cases each year, but also the rate and the case-fatality rate (see Table 1).

Table 1. Number and rate (per 100,000 population) and case-fatality rate of reported cases of botulism by year, Republic of Georgia, 1980–2002

Year	Number of Cases	Rate per 100,000	Number of deaths	Case-fatality rate (%)
1980	3	0.06	0	0.0
1981	6	0.12	0	0.0
1982	1	0.02	0	0.0
1983	3	0.06	0	0.0
1984	34	0.65	1	2.9
1985	20	0.38	0	0.0
1986	7	0.13	0	0.0
1987	27	0.51	2	7.4
1988	27	0.50	2	7.4
1989	13	0.24	0	0.0
1990	24	0.44	1	4.2
1991	13	0.24	0	0.0
1992	26	0.48	2	7.7
1993	56	1.04	9	16.1
1994	127	2.36	15	11.8
1995	44	0.82	4	9.1
1996	42	0.78	7	16.7
1997	12	0.22	0	0.0
1998	49	0.91	2	4.1
1999	71	1.39	4	5.6
2000	32	0.64	2	6.3
2001	30	0.66	0	0.0
2002	39	0.89	3	7.7

Question 5: Calculate the mean and median number of cases reported each year. Which is higher? Why? Which measure do you suggest using in a report to be published?

Question 6: Graph the data in Table 1. Draw an arrow at 1991, the year of Georgia's independence from the Soviet Union.

Question 7: Interpret your graph.

Question 8: The graph represents one analysis of surveillance data by time (by year). What other time intervals might you want to assess?

Table 2. Number of reported cases of botulism by month, Republic of Georgia, 1980–2001 and 2002

Month	Number, 1980–2001	Percent, 1980–2001	Number, 2002	Percent, 2002
January	114	17.1	5	12.8
February	80	11.9	1	2.6
March	54	8.1	3	7.7
April	52	7.8	5	12.8
May	16	2.4	1	2.6
June	41	6.1	1	2.6
July	12	1.8	2	5.1
August	10	1.5	–	–
September	29	4.3	1	2.6
October	32	4.8	–	–
November	122	18.3	3	7.7
December	105	15.7	17	43.6

Question 9: Does botulism appear to have a seasonal distribution in Georgia? If so, what might explain this distribution?

Question 10: By what variables other than time would you want to analyze the surveillance data?

Part III

The following tables provide additional data on occurrence of botulism in Georgia by time, place, and person.

Table 3. Number of reported cases of botulism by region by year, Georgia, 1980–2002

Year	Tbilisi	Ajara	Kakh	Imeri	S. Kartli	Kv. Kartli	Gur	SamJav	Mts-Mt	R-L	Poti	Sam	Total
1980	3	0	0	0	0	0	0	0	0	0	0	0	3
1981	5	0	1	0	0	0	0	0	0	0	0	0	6
1982	1	0	0	0	0	0	0	0	0	0	0	0	1
1983	2	0	0	0	0	1	0	0	0	0	0	0	3
1984	12	0	4	0	3	15	0	0	0	0	0	0	34
1985	13	0	4	0	0	3	0	0	0	0	0	0	20
1986	4	0	2	0	1	0	0	0	0	0	0	0	7
1987	15	0	6	2	0	3	0	0	1	0	0	0	27
1988	17	0	7	1	0	2	0	0	0	0	0	0	27
1989	5	0	1	0	0	7	0	0	0	0	0	0	13
1990	17	0	3	1	0	3	0	0	0	0	0	0	24
1991	10	0	0	0	0	3	0	0	0	0	0	0	13
1992	11	0	11	0	4	0	0	0	0	0	0	0	26
1993	43	0	2	0	0	1	0	0	10	0	0	0	56
1994	83	0	0	28	1	14	0	0	1	0	0	0	127
1995	22	0	8	0	2	11	0	0	1	0	0	0	44
1996	21	16	0	0	0	4	0	0	1	0	0	0	42
1997	6	1	3	0	0	2	0	0	0	0	0	0	12
1998	25	4	3	3	0	14	0	0	0	0	0	0	49
1999	22	0	4	1	23	14	5	1	1	0	0	0	71
2000	10	0	2	6	0	9	3	0	2	0	0	0	32
2001	11	5	3	5	0	4	1	0	1	0	0	0	30
2002	9	4	9	1	3	13	0	0	0	0	0	0	39

Table 4. Rate* of reported cases of botulism by region by year, Georgia, 1980—2001 and 2002

Year	Tbilisi	Ajara	Kakh	Imeri	S. Kartli	Kv. Kartli	Gur	SamJav	Mts-Mt	Rac-Lech	Poti	Sam	Total
1980	0.3	0	0	0	0	0	0	0	0	0	0	0	0.06
1981	0.4	0	0	0	0	0	0	0	0	0	0	0	0.12
1982	0.1	0	0	0	0	0	0	0	0	0	0	0	0.02
1983	0.2	0	0	0	0	0.2	0	0	0	0	0	0	0.06
1984	1.0	0	0.9	0	0	2.5	0	0	0	0	0	0	0.65
1985	1.1	0	0.9	0	0	0.5	0	0	0	0	0	0	0.38
1986	0.3	0	0.5	0	0.2	0	0	0	0	0	0	0	0.13
1987	1.3	0	1.4	0.2	0	0.5	0	0	0.7	0	0	0	0.51
1988	1.3	0	1.6	0.1	0	0.3	0	0	0	0	0	0	0.50
1989	0.4	0	0.2	0	0	1.2	0	0	0	0	0	0	0.24
1990	1.3	0	0.7	0.1	0	0.5	0	0	0	0	0	0	0.44
1991	0.8	0	0	0	0	0.5	0	0	0	0	0	0	0.24
1992	0.9	0	2.6	0	1.0	0	0	0	0	0	0	0	0.48
1993	3.2	0	0.5	0	0	0.2	0	0	7.1	0	0	0	1.04
1994	6.1	0	0	3.4	2.3	2.3	0	0	0.7	0	0	0	2.36
1995	3.7	0	1.8	0	0.5	1.8	0	0	0.7	0	0	0	0.82
1996	1.5	3.9	0	0	0	0.7	0	0	0.7	0	0	0	0.78
1997	0.5	0.3	0.7	0	0	0.3	0	0	0	0	0	0	0.22
1998	0.8	1.0	0.7	0.4	0	2.3	0	0	0	0	0	0	0.91
1999	0.4	0	0.9	0.1	6.0	2.2	3.1	0.04	0.7	0	0	0	0.39
2000	0.7	0	0.5	0.7	0	1.1	1.9	0	1.4	0	0	0	1.64
2001	0.8	1.2	0.7	0.6	0	1.0	0.6	0	0.7	0	0	0	0.66
2002	0.9	1.1	2.2	0.1	1.0	2.2	0	0	0	0	0	0	0.89

Table 5. Number and rate* of reported cases of botulism by age and sex, Georgia, 1980–2001 and 2002

Sex, Age Group	Number, 1980–2001	Rate, 1980–2001	Number, 2002	Rate, 2002
Male, Age <10 years	24	0.24	0	0
Male, Age 10–19 years	42	0.45	2	0.49
Male, Age 20–29 years	67	0.75	7	1.88
Male, Age 30–39 years	71	0.81	3	0.82
Male, Age 40–49 years	53	0.92	1	0.32
Male, Age 50–59 years	45	0.68	4	1.89
Male, Age 60–69 years	26	0.52	5	2.21
Male, Age ≥70 years	5	0.22	0	0
Female, Age <10 years	18	0.19	0	0
Female, Age 10–19 years	46	0.51	8	2.05
Female, Age 20–29 years	61	0.67	3	0.85
Female, Age 30–39 years	72	0.76	2	0.50
Female, Age 40–49 years	49	0.77	1	0.29
Female, Age 50–59 years	49	0.65	0	0
Female, Age 60–69 years	29	0.45	2	0.73
Female, Age ≥70 years	10	0.20	1	0.36

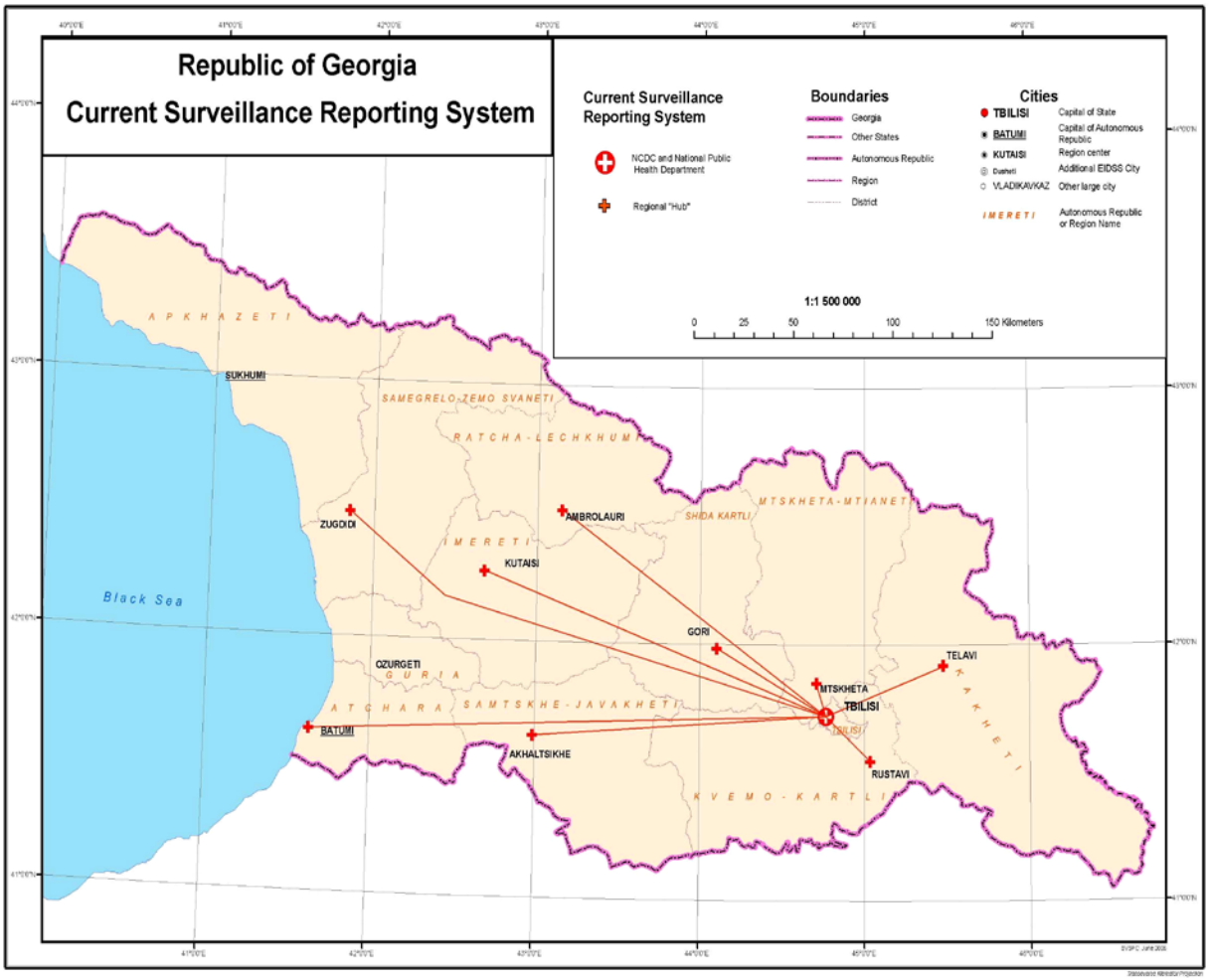
* per 100,000 population

Table 6. Number and rate* of reported cases of botulism by ethnicity, Georgia, 1980–2001 and 2002

Ethnicity	Number, 1980–2001	Rate, 1980–2001	Number, 2002	Rate, 2002
Georgian	500	0.66	17	0.46
Azerian	62	0.92	8	2.81
Armenian	4	0.04	1	0.40
Russian	65	0.87	13	19.2

* per 100,000 population

Figure 1. Map of Georgia by Region



Question 11: Analyze the botulism data in Table 3 and Table 4 by region.

Most of Tblisi's vegetables and fruits (including canned and preserved) are supplied from the nearby districts of Kakheti and Kvemo Kartli in eastern Georgia.

Question 12: Summarize the person data in Tables 5 and 6.

Question 13: Interpret your results.

Investigators observed the home preservation process and found that the methods used in eastern and western Georgia differed. Overall, many families inadequately sterilized equipment, preserved uncooked vegetables, and failed to use pressure cookers. Salt, vinegar and spices were often added but usually in small amounts.

Public health officials who looked at the data in the previous tables understood that most surveillance systems are not perfect. In particular, they wondered about differences in the sensitivity of the system in different districts. And they noted that two areas of Georgia, Samegrelo and Racha-Lechkhumi, reported no cases of botulism at all from 1980 to 2001.

Question 14: What is meant by sensitivity of a surveillance system?

Question 15: What could account for no cases being reported from these areas?

Question 16: How might you evaluate the absence of reports from these areas?

After conducting a medical record review in low incidence areas, the public health officials determined that only three cases could be attributed to failure to report by either a physician or an epidemiologist. Additional cases were not found, either because the incidence was indeed low, or because patients with mild symptoms fail to seek care, or patients with severe illness die before receiving medical attention.

The intensive analysis of surveillance data by health officials was prompted by concern over a possible increase in disease occurrence. Looking at surveillance data to detect sudden changes in disease incidence is one way health officials use such data.

Question 17: How else can/should surveillance data be used?

All of the botulism events (clusters and sporadic cases) were suspected or confirmed to be foodborne. The most commonly implicated food was home-preserved vegetables, accounting for 80% of the events. Other implicated foods included fish (12%) and other smoked meat (2%). Among events involving home-preserved vegetables, the most commonly implicated vegetables were tomatoes (15%), peppers (15%), celery leaves (13%), eggplants (13%), and combination of vegetables (13%).

Question 18: Given that a majority of cases of botulism were traced to improperly home-canned food, what public health action might you suggest?

Question 19: How might you evaluate the impact of your public health action?

Conclusion

Based on the results of this extensive investigation, educational brochures were developed and distributed to the public. These brochures had four aims: (1) to increase awareness that improperly home-preserved food can cause a serious disease (botulism), (2) to provided advise on safer methods of food preservation (3) to encourage thorough heating of home-preserved vegetables, and (4) to inform that free medical care for botulism is available in Georgia. In addition to this health education program targeting the public, training of epidemiologists was conducted to refresh awareness of the disease, its clinical features, and prevention measures.

Despite these measures, the numbers of botulism cases in Georgia have not declined. Thirty-nine cases were reported in 2003, 41 cases were reported in 2004, and 35 cases were reported during the first 10 months of 2005.

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