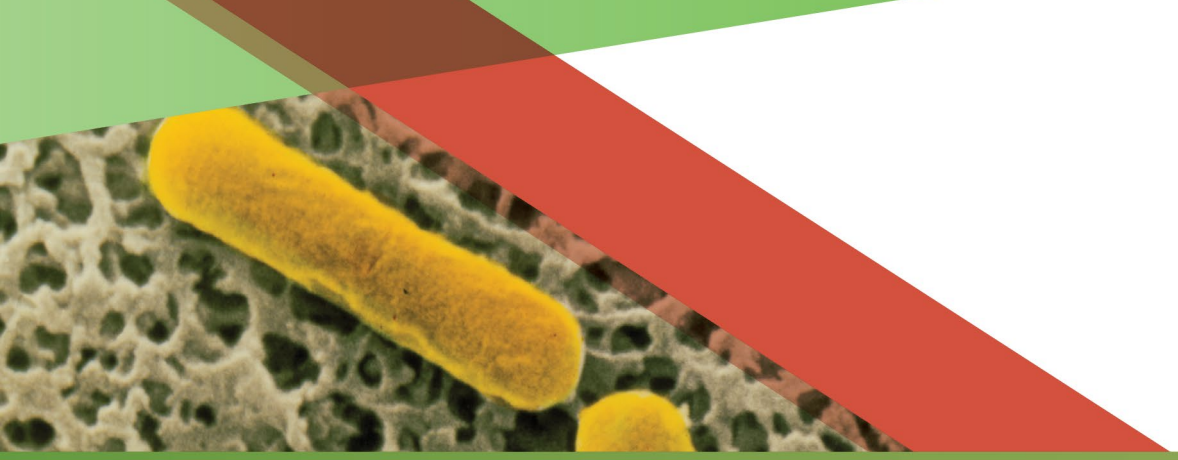


SURVEILLANCE REPORT

Botulism

Annual Epidemiological Report for 2019

Key facts

- In 2019, 30 EU/EEA countries reported 83 confirmed cases of botulism.
- Sixteen EU/EEA countries reported zero cases.
- The overall notification rate was 0.02 cases per 100 000 population.
- Romania notified the highest number of cases (N=23) and presented the highest notification rate (0.12 cases per 100 000 population).

Introduction

Botulism is a serious paralytic illness caused by botulinum neurotoxins (BoNTs) mainly produced by the bacterium, *Clostridium botulinum.* BoNTs are one of the most lethal substances known and are included among potential bio-terrorism threats. Botulinum spores exist widely in the environment, and can grow and produce toxins in anaerobic conditions.

The disease naturally occurs in four different forms: a) food-borne botulism, caused by eating food containing BoNTs, b) intestinal botulism, when botulinum spores germinate within the intestine of adult persons, or c) within the intestine of babies under one year of age (infant botulism), and d) wound botulism, when a wound gets infected by botulinum spores.

There are two other forms of botulism which do not occur naturally: a) inhalation botulism, which is associated with the accidental or deliberate release of BoNTs in the form of aerosols (events such as, bio-terrorism); b) iatrogenic botulism, which is the most recent human-made form of botulism, that may occur as an adverse event after the administration of BoNTs for medical or cosmetic reasons.

Food-borne botulism is the dominant form of the disease. It is most commonly caused by inadequately processed, often home-canned, preserved or fermented foods (e.g. vegetables, meat, or fish). Symptoms of botulism are characterised by descending, flaccid paralysis that can cause respiratory failure. The symptoms may be very severe and require intensive-care treatment as well as the administration of an anti-toxin. Even where these treatments are available, complete recovery usually takes weeks to months, and 5–10% of cases are fatal.

Suggested citation: European Centre for Disease Prevention and Control. Botulism. In: ECDC. Annual Epidemiological Report for 2019. Stockholm: ECDC; 2023.

Stockholm, January 2023

Methods

This report is based on data for 2019 retrieved from The European Surveillance System (TESSy) on 5 November 2021. TESSy is a system for the collection, analysis and dissemination of data on communicable diseases.

For a detailed description of the methods used to produce this report, please refer to the 'Methods' chapter in the 'Introduction to the Annual Epidemiological Report' [1].

An overview of the national surveillance systems is available online [2].

A subset of the data used for this report is available through ECDC's online 'Surveillance Atlas of Infectious Diseases' [3].

For 2019, data on botulism were reported by 30 EU/EEA Member States. The notification of botulism is mandatory in all reporting countries and covers the entire population. No surveillance system for botulism exists in Liechtenstein. Three countries reported data using the 2018 EU case definition for botulism, 12 countries reported in accordance with the 2012 EU case definition, eight countries used the 2008 EU case definition, and the remaining seven countries used previous or other/unspecified case definitions.

Epidemiology

In 2019, 30 EU/EEA countries reported 83 confirmed cases of botulism. The EU/EEA notification rate was 0.02 cases per 100 000 population (Table 1). The countries with the highest number of confirmed cases were Romania (23), Italy (13), and France (10). These three countries accounted for 55.4% of the confirmed cases reported in the EU/EEA. The highest notification rate, 0.12 cases per 100 000 population was reported by Romania, followed by Lithuania with 0.04 cases per 100 000 population. Nine countries reported between one and six confirmed cases each, and sixteen countries reported zero cases.

Out of 61 cases with known data on hospitalisation, 73.5% all were hospitalised. Out of 58 cases with known outcome (69.9%), two were reported to have died, resulting in a case fatality rate of 3.4%.

In 2019, the two toxin types reported were: BoNT/A (10%) and BoNT/B (90%).

Table 1. Distribution of confirmed botulism cases and rates per 100 000 population, by country and year, EU/EEA, 2015–2019

Country	2015		2016		2017		2018		2019		
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate	ASR
Austria	4	0.05	3	0.03	4	0.05	1	0.01	2	0.02	0.02
Belgium	2	0.02	0	0.00	0	0.00	0	0.00	1	0.01	0.01
Bulgaria	2	0.03	0	0.00	0	0.00	0	0.00	0	0.00	0.00
Croatia	5	0.12	1	0.02	0	0.00	1	0.02	1	0.02	0.02
Cyprus	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.00
Czechia	0	0.00	0	0.00	1	0.01	0	0.00	0	0.00	0.00
Denmark	2	0.04	0	0.00	2	0.03	11	0.19	0	0.00	0.00
Estonia	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.00
Finland	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.00
France	15	0.02	18	0.03	4	0.01	7	0.01	10	0.01	0.02
Germany	3	0.00	14	0.02	3	0.00	7	0.01	8	0.01	0.01
Greece	0	0.00	0	0.00	2	0.02	0	0.00	0	0.00	0.00
Hungary	3	0.03	5	0.05	5	0.05	5	0.05	2	0.02	0.02
Iceland	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.00
Ireland	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.00

Country	2015		2016		2017		2018		2019		
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate	ASR
Italy	20	0.03	37	0.06	21	0.03	26	0.04	13	0.02	0.02
Latvia	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.00
Liechtenstein	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lithuania	2	0.07	0	0.00	2	0.07	1	0.04	1	0.04	0.03
Luxembourg	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.00
Malta	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.00
Netherlands	0	0.00	2	0.01	0	0.00	0	0.00	0	0.00	0.00
Norway	13	0.25	1	0.02	2	0.04	1	0.02	1	0.02	0.02
Poland	18	0.05	18	0.05	14	0.04	14	0.04	6	0.02	0.02
Portugal	6	0.06	3	0.03	3	0.03	0	0.00	2	0.02	0.02
Romania	0	0.00	15	0.08	13	0.07	15	0.08	23	0.12	0.12
Slovakia	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.00
Slovenia	0	0.00	0	0.00	0	0.00	1	0.05	0	0.00	0.00
Spain	2	0.00	6	0.01	6	0.01	3	0.01	8	0.02	0.02
Sweden	0	0.00	1	0.01	4	0.04	1	0.01	0	0.00	0.00
United Kingdom	15	0.02	0	0.00	1	0.00	0	0.00	5	0.01	0.01
EU/EEA	**112**	**0.02**	**124**	**0.02**	**87**	**0.02**	**94**	**0.02**	**83**	**0.02**	**0.02**

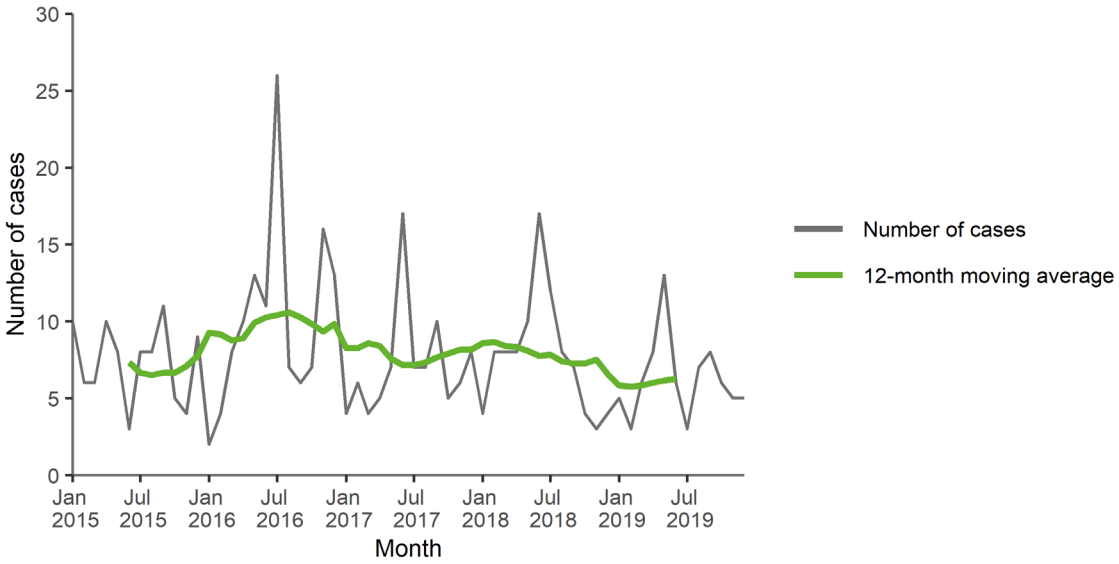
Source: country reports
ASR: age-standardised rate
ND: no data reported

Figure 1. Distribution of confirmed botulism cases by country, EU/EEA, 2019

Source: Country reports from Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.

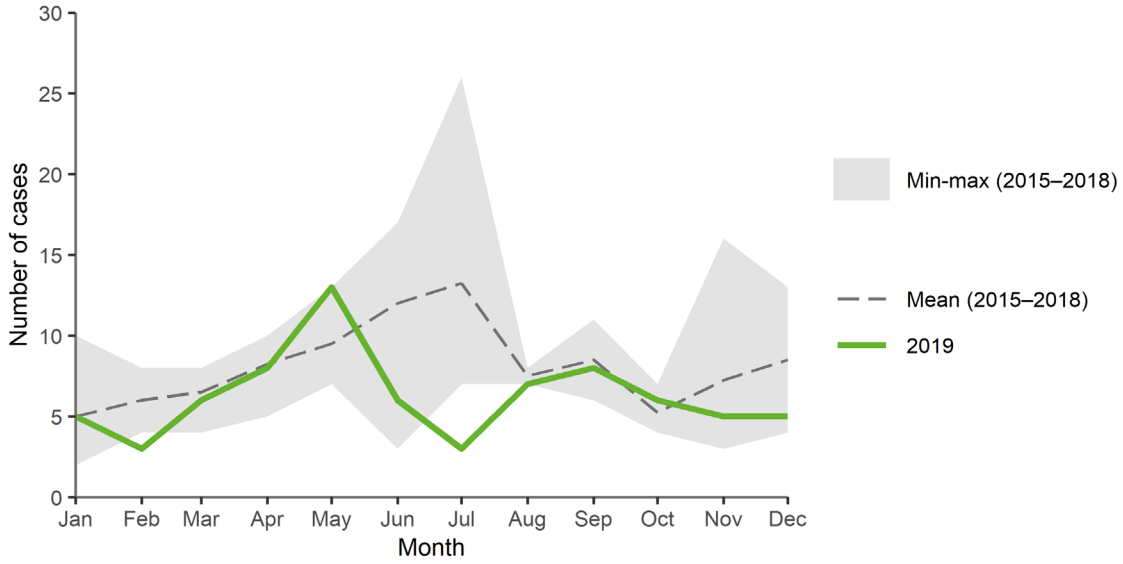
From 2015 to 2019, the trend of botulism cases in the EU/EEA remained stable (Table 1, Figure 2). Consistent with previous years, data from 2019 does not show seasonality but irregular, random peaks (Figure 3).

Figure 2. Distribution of confirmed botulism cases by month, EU/EEA, 2015–2019



Source: Country reports from Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.

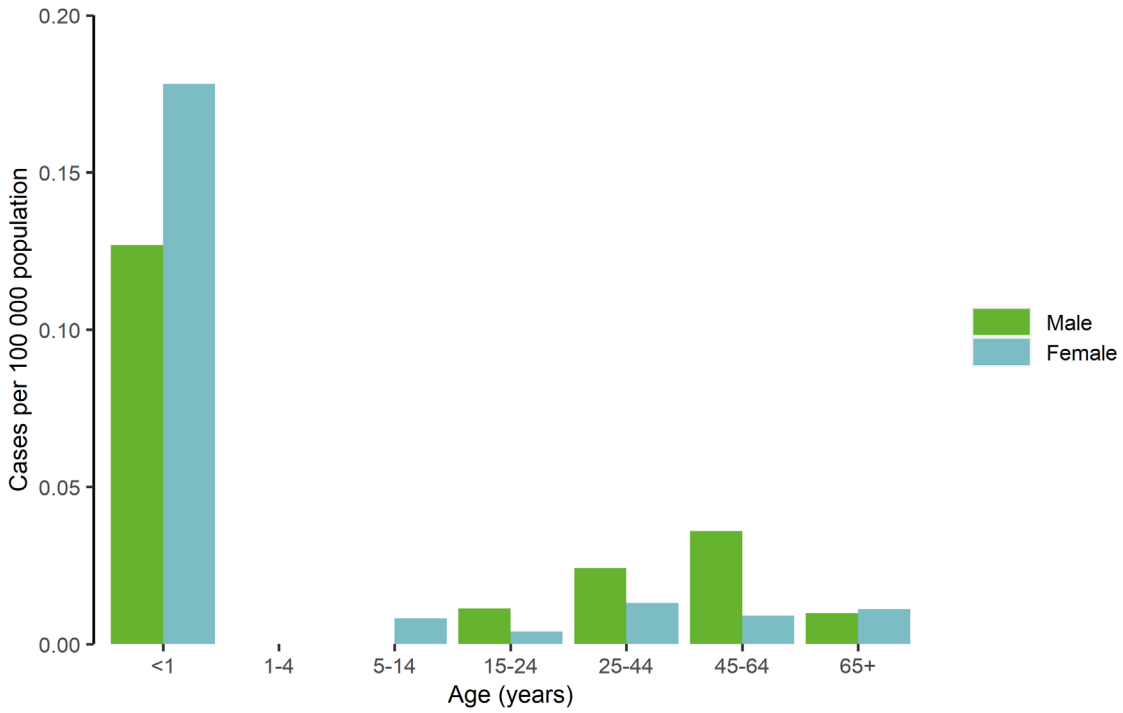
Figure 3. Distribution of confirmed botulism cases by month, EU/EEA, 2019 and 2015–2018



Source: Country reports from Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.

All the 83 confirmed cases were reported with sex. Among them, 63.9% were male and 36.1% were female, with a male-to-female ratio of 1.6:1. The majority of cases (65.1%) were reported among adults between 25–64 years of age. However, the highest notification rate was reported in infants under one year of age, both in males and females (0.13 and 0.18 cases per 100 000 population, respectively; Figure 4).

Figure 4. Distribution of confirmed botulism cases per 100 000 population, by age and sex, EU/EEA, 2019



Source: Country reports from Austria, Belgium, Bulgaria, Croatia, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.

Outbreaks and other threats

No national or multi-country botulism threats were reported in 2019, through ECDC's Epidemic Intelligence Information System for Food- and Waterborne Diseases and Zoonoses (EPIS-FWD).

Discussion

Botulism is a rare disease in the EU/EEA, but it still occurs sporadically and as small clusters of various disease forms. Botulism case numbers reported by national surveillance schemes were stable in 2015–2019. Four countries (France, Italy, Poland and Romania) reported the highest annual number of botulism cases in the last five years. Recent studies showed the most common sources of botulism were: cured ham and other pork/boar meat products in France [4], home-canned vegetables in Italy [5], homemade, canned fish or pork products, and mixed or unknown types of canned meat in Poland [6], and home-preserved, canned pork and ham products in Romania [7].

Seven food-borne botulism outbreaks were reported in 2019 to the annual zoonoses data collected by the European Food Safety Authority (EFSA) [4]. These outbreaks were small (2.4 cases on an average) and involved 17 cases in five countries (France, Italy, Poland, Romania and Spain). The food vehicles reported in five strong-evidence outbreaks were: pork/homemade smoked ham (two outbreaks), vegetables (two outbreaks), and mixed or other food (one outbreak) [8].

Botulinum neurotoxins (BoNTs) are mainly produced by *C. botulinum,* but more rarely, are also produced by other *Clostridium* species (*C. argentinense, C. baratii* and *C. butyricum*). Most cases of human botulism are caused by BoNT types A, B or E, and rarely by type F. In the EU/EEA, BoNT type B, followed by type A, caused the majority (98%) of the human cases, whereas BoNT type E and F were recorded in 2% of the cases reported in TESSy in 2015–2019. Type F was identified in infant botulism mostly in very young infants, and in intestinal botulism in adults. It presents more rapid and severe illness than the illnesses caused by BoNT types A and B [9].

Human botulism form and incidence are variable according to the reporting countries, and depend notably on the dietary habits and culinary traditions of preparing food. *Clostridia* can be found in various food products both raw and cooked, mainly in the form of spores. Spores can germinate to form vegetative cells and produce BoNTs under suitable environmental conditions e.g. during the processing of food. Food-borne botulism is most commonly caused by canned food, often homemade or from small-scale producers. Ready-to-eat food products, which are minimally processed and eaten without heating are also of concern [10].

While food-borne intoxications may occur more commonly, other forms of the diseases are sporadically reported as well. In the EU/EEA, the most affected age group are infants below six months of age. Different from food-borne botulism, infant botulism occurs due to the ingestion of *C. botulinum* spores, which germinate into bacteria and release toxins in the gut when the natural defences in the intestines of infants have not fully developed. Cases of wound botulism among people who inject drugs (PWID) are also sporadically reported. In some European countries, this is the most commonly reported form of botulism.

Botulism outbreaks are rare but are public health emergencies that require rapid recognition to identify the disease source(s) and distinguish outbreak type(s) to prevent additional cases. Successful treatment depends significantly on early diagnosis and the rapid administration of the botulinum antitoxin. The differential diagnosis of botulism includes a number of neuromuscular diseases or central nervous system disorders. Considerable efforts are needed to specifically diagnose the rare forms of botulism, such as infant and wound botulism.

Public health implications

In order to reduce the number of cases, preventive measures should be strengthened by adopting a multidisciplinary approach that takes into account all routes of intoxication. Care should be taken when canning food, either commercially or at home, to make sure *C. botulinum* spores are destroyed by sufficient heat treatment before storage and consumption. Traditionally, infant botulism has been associated with the consumption of honey, and is the only avoidable known source of exposure. The development of filters for people who inject drugs to remove spore-forming bacteria may open a new way to reduce the incidence of infections in this risk group [11].

Symptoms of botulism vary depending on the type of toxin, the age and pre-existing conditions of patients, and the amount of toxin consumed. As these symptoms are not disease-specific, changes in appearance can make diagnosis challenging. Food-borne outbreaks due to BoNT type F are of concern because bivalent AB antitoxin and trivalent ABE antitoxins may lack the required effectiveness for the treatment of type F botulism, which may rapidly progress towards respiratory failure requiring ventilation support [12]. Preparedness for the treatment of type F botulism with heptavalent antitoxin is approved in the EU/EEA.

Due to the extremely high potency of the toxin, botulism is included among potential bio-terror threats in preparedness and response activities.

References

1. European Centre for Disease Prevention and Control (ECDC). Introduction to the Annual Epidemiological Report. Stockholm: ECDC; 2019. Available at: http://ecdc.europa.eu/annual-epidemiological-reports/methods

2. European Centre for Disease Prevention and Control (ECDC). Surveillance systems overview for 2019. Stockholm: ECDC; 2019. Available at: https://www.ecdc.europa.eu/en/publications-data/surveillance-systems-overview-2019

3. European Centre for Disease Prevention and Control (ECDC). Surveillance Atlas of Infectious Diseases. Stockholm: ECDC; 2019.
Available at: https://atlas.ecdc.europa.eu/public/index.aspx?Dataset=27&HealthTopic=7

4. Rasetti-Escargueil C, Lemichez E, Popoff MR. Human Botulism in France, 1875–2016. Toxins (Basel). 21 May 2020;12(5):338. Available at: https://www.mdpi.com/2072-6651/12/5/338

5. Anniballi F, Auricchio B, Fiore A, Lonati D, Locatelli C.A, Lista F, et al. Botulism in Italy, 1986 to 2015. Euro Surveill. 15 June 2017;22(24):pii=30550.
Available at: https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2017.22.24.30550

6. Czerwiński M, Czarkowski MP, Kondej B. Foodborne botulism in Poland in 2017. Przegl Epidemiol. 2019;73(4):445-450. Available at: https://pubmed.ncbi.nlm.nih.gov/32237694/

7. Marincu I, Bratosin F, Vidican I, Cerbu B, Suciu O, Turaiche M, et al. Foodborne Botulism in Western Romania: Ten Years' Experience at a Tertiary Infectious Disease Hospital. Healthcare (Basel). 2 September 2021;9(9):1149. Available at: https://www.mdpi.com/2227-9032/9/9/1149

8. European Food Safety Authority (EFSA) and European Centre for Disease Prevention and Control (ECDC). The European Union One Health 2019 Zoonoses Report. EFSA Journal. 19 January 2021;19(2):6406.
Available at: https://efsa.onlinelibrary.wiley.com/doi/full/10.2903/j.efsa.2021.6406

9. Mazuet C, Legeay C, Sautereau J, Bouchier C, Criscuolo A, Bouvet P, et al. Characterization of *Clostridium Baratii* Type F Strains Responsible for an Outbreak of Botulism Linked to Beef Meat Consumption in France. PLoS Curr. 2017 Feb 1;9:ecurrents.outbreaks.6ed2fe754b58a5c42d0c33d586ffc606.
Available at: https://pubmed.ncbi.nlm.nih.gov/29862134/

10. Benevenia R, Arnaboldi S, Dalzini E, Todeschi S, Bornati L, Saetti F, et al. Foodborne botulism survey in Northern Italy from 2013 to 2020: Emerging risk or stable situation? Food Control. February 2022; Volume 132, 108520. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0956713521006587

11. Alhusein N, Scott J, Kasprzyk-Hordern B, Bolhuis A. Development of a filter to prevent infections with spore-forming bacteria in injecting drug users. Harm Reduction Journal. 2016 Dec 1;13(1):33.
Available at: https://harmreductionjournal.biomedcentral.com/articles/10.1186/s12954-016-0122-1

12. Tréhard H, Poujol I, Mazuet C, Blanc Q, Gillet Y, Rossignol F, et al. A cluster of three cases of botulism due to *Clostridium baratii* type F, France, August 2015. Euro Surveill. 2016;21(4):pii=30117.
Available at: https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2016.21.4.30117