

SURVEILLANCE REPORT

Botulism

Annual Epidemiological Report for 2022

Key facts

- In 2022, 84 confirmed cases of botulism were reported in the EU/EEA.
- Among 30 reporting countries, 17 countries notified zero cases.
- The overall notification rate was 0.02 cases per 100 000 population.
- Malta reported the highest notification rate (0.34 cases per 100 000 population), followed by Romania (0.08 cases per 100 000 population), and Italy (0.05 cases per 100 000 population).
- The highest notification rate was reported in infants, with 0.2 cases per 100 000 population.

Introduction

Botulism is a serious paralytic illness caused by botulinum neurotoxins (BoNTs), which are mainly produced by the bacterium *Clostridium botulinum*, but in rare instances they can also be produced by other *Clostridium* species (e.g. *C. argentinense*, *C. baratii* and *C. butyricum*). BoNTs are one of the most lethal known substances and are included among potential bioterrorism threats. *C. botulinum* spores exist widely in the environment and can grow and produce neurotoxins in anaerobic conditions.

Botulism can occur both naturally and artificially. It occurs naturally in three forms:

- food-borne botulism, an intoxication caused by eating food that contains BoNTs;
- intestinal botulism, caused by the consumption of *C. botulinum* spores, which then germinate into bacteria and release BoNTs within the intestines of adults (adult intestinal toxæmia) or babies under one year of age (infant botulism); and
- wound botulism, caused by *C. botulinum* spores infecting a wound, germinating into bacteria, then releasing BoNTs.

There are two other forms of the disease that do not occur naturally:

- inhalation botulism, caused by inhaling BoNTs that have been accidentally or deliberately released in the form of aerosols (e.g. in bioterrorism events); and
- iatrogenic botulism, the most recent human-made form of botulism, which may occur as an adverse event after the administration of BoNTs for medical or cosmetic reasons.

Food-borne botulism is the most common form of the disease. It is frequently 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 antitoxin. Even where these treatments are available, complete recovery usually takes weeks to months, and 5–10% of cases are fatal.

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Methods

This report is based on data for 2022 retrieved from The European Surveillance System (TESSy) on 5 February 2024. 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 [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 2022, data on botulism were reported by 30 EU/EEA countries. The notification of botulism is compulsory in all reporting countries. Botulism data were collected through surveillance systems with national coverage in all the 30 countries. The following case definitions were used: 15 countries reported using the 2018 EU case definition, three countries reported using the 2012 EU case definition, five countries reported using the 2008 EU case definition, and seven countries reported using other or unspecified/unknown case definitions. Unlike the 2008 and 2012 EU case definitions of botulism, the 2018 EU case definition also covers other species of BoNT-producing *Clostridia* and allows genotypic tests for laboratory confirmation. In addition to TESSy reporting, information from event-based surveillance for botulism clusters or outbreaks with a potential EU dimension was collected through [EpiPulse - the European surveillance portal for infectious diseases \(europa.eu\)](https://ecdc.europa.eu/en/epipulse).

Epidemiology

In 2022, 30 EU/EEA countries reported data on botulism. Among these, 13 countries reported 84 confirmed cases. Seventeen countries reported zero cases (Table 1, Figure 1). The EU/EEA notification rate was 0.02 cases per 100 000 population. The countries with the highest number of confirmed cases were Italy (30 cases), Romania (16 cases), and France (11 cases). These three countries accounted for 68% of the cases reported in the EU/EEA in 2022. The highest notification rate, 0.34 cases per 100 000 population, was reported by Malta, followed by Romania, with 0.08 cases per 100 000 population, and Italy (0.05 cases per 100 000 population). Among the 84 confirmed cases, 54 cases (64%) had known travel information, and three cases were travel-related, having reported travel prior to illness onset.

Among 70 cases (83%) with available species information, all were infected with *C. botulinum*. The BoNT type was reported for 72 of 84 cases (86%). BoNT/B (61 cases; 85%) was most frequently reported, followed by BoNT/A (eight cases; 11%, of which two together with BoNT/B and one with BoNT/E), BoNT/E (two cases; 3%), and BoNT/F (one case; 1%).

In 2022, 48 cases (96%) were reported with information on hospitalisation. Among the 48 hospitalised cases, toxin type was available for 39, of which 30 cases were intoxicated with BoNT/B, three cases with BoNT/A, two cases with BoNT/E, two cases with BoNT/A and B, one case with BoNT/F, and one case with BoNT A and E.

Among the 84 confirmed cases, 41 cases (49%) were reported with known outcome. Four were reported to have died, resulting in a case fatality of 10%. The deceased cases were in the two oldest age groups (45–64 years and over 65 years). All four deceased cases were intoxicated with BoNT/B. The mode of transmission was known for 35 cases (45%); 33 cases were reported as food-borne. Cases were linked to the consumption of canned food (11 cases), fish (six cases), mixed meat (six cases), vegetables (four cases), other meat or other food (one case each), and unknown (three cases).

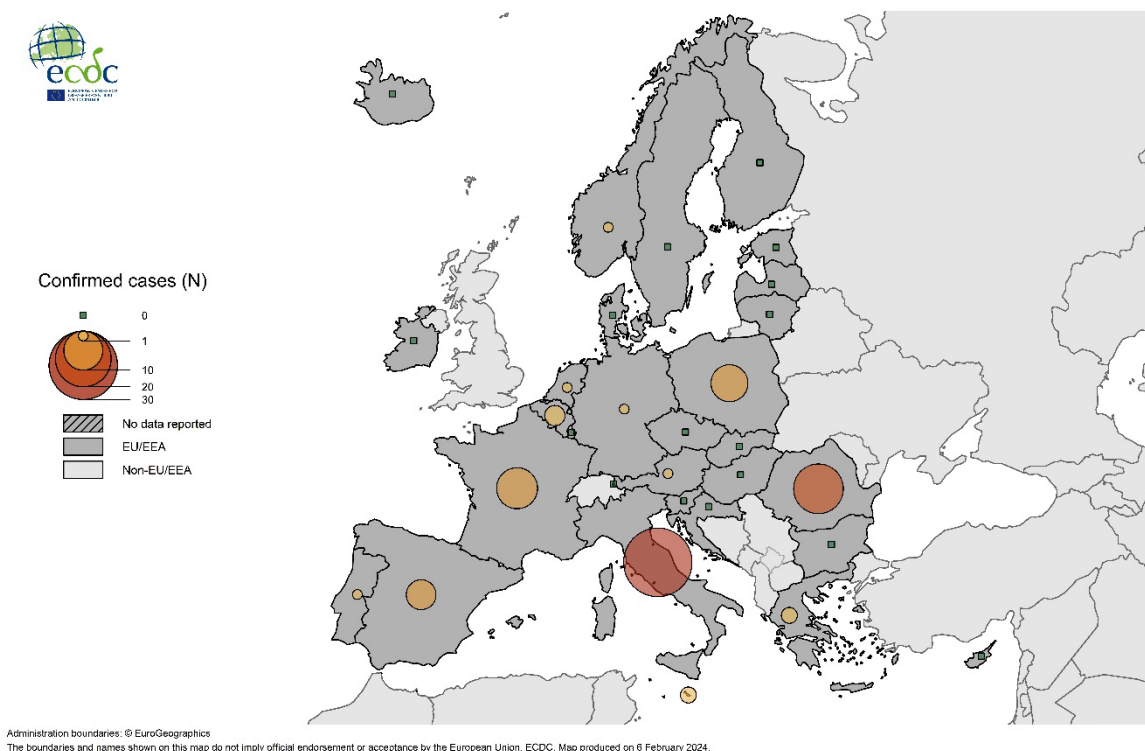
Table 1. Confirmed botulism cases and rates per 100 000 population by country and year, EU/EEA, 2018–2022

Country	2018		2019		2020		2021		2022	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
Austria	1	0.01	2	0.02	1	0.01	1	0.01	1	0.01
Belgium	0	0.00	0	0.00	1	0.01	0	0.00	3	0.03
Bulgaria	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Croatia	1	0.02	1	0.02	1	0.02	0	0.00	0	0.00
Cyprus	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Czechia	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Denmark	11	0.19	0	0.00	0	0.00	6	0.10	0	0.00
Estonia	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Finland	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
France	7	0.01	10	0.01	11	0.02	7	0.01	11	0.02
Germany	7	0.01	8	0.01	3	0.00	6	0.01	1	0.00
Greece	0	0.00	0	0.00	0	0.00	0	0.00	2	0.02
Hungary	5	0.05	2	0.02	0	0.00	1	0.01	0	0.00
Iceland	0	0.00	0	0.00	1	0.27	0	0.00	0	0.00
Ireland	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Italy	26	0.04	13	0.02	46	0.08	32	0.05	30	0.05
Latvia	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Liechtenstein	NDR	NRC	NDR	NRC	NDR	NRC	0	0.00	0	0.00
Lithuania	1	0.04	1	0.04	1	0.04	0	0.00	0	0.00
Luxembourg	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Malta	0	0.00	0	0.00	0	0.00	0	0.00	2	0.38
Netherlands	0	0.00	0	0.00	0	0.00	0	0.00	1	0.01
Norway	1	0.02	1	0.02	1	0.02	0	0.00	1	0.02
Poland	14	0.04	6	0.02	6	0.02	5	0.01	9	0.02
Portugal	0	0.00	2	0.02	1	0.01	1	0.01	1	0.01
Romania	15	0.08	23	0.12	6	0.03	11	0.06	16	0.08
Slovakia	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Slovenia	1	0.05	0	0.00	0	0.00	0	0.00	0	0.00
Spain	3	0.01	8	0.02	3	NRC	13	0.03	6	0.01
Sweden	1	0.01	0	0.00	0	0.00	2	0.02	0	0.00
EU/EEA (30 countries)	94	0.02	77	0.02	82	0.02	85	0.02	84	0.02
United Kingdom	0	0.00	5	0.01	NDR	NRC	NA	NA	NA	NA
EU/EEA (31 countries)	94	0.02	82	0.02	82	0.02	NA	NA	NA	NA

Source: country reports; NDR: no data reported; NRC: no rate calculated; NA: not applicable.

No data from 2020 onwards were reported by the United Kingdom, due to its withdrawal from the EU on 31 January 2020.

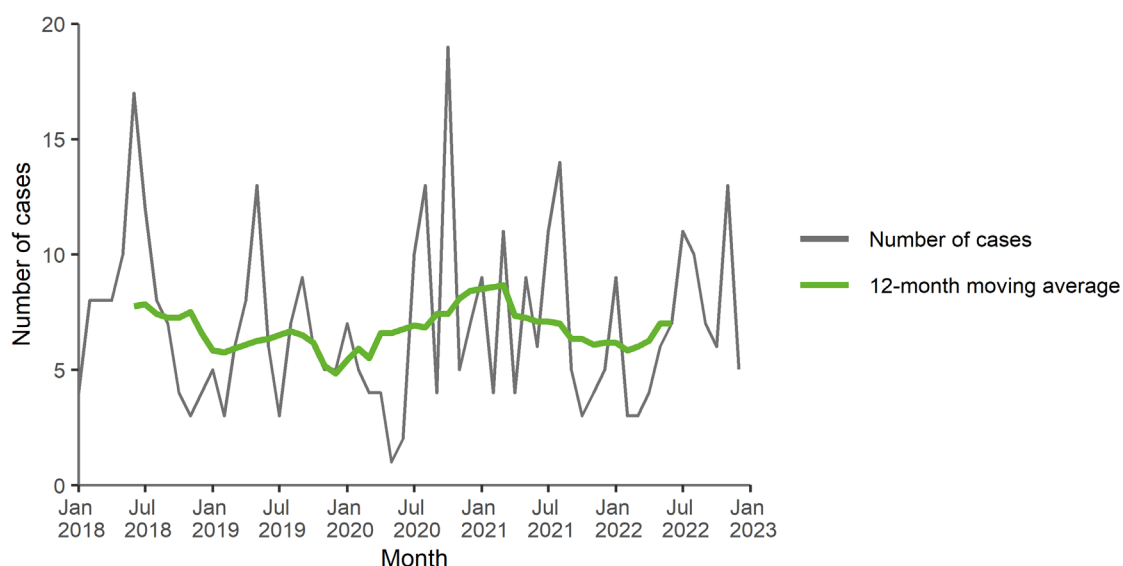
Figure 1. Confirmed botulism cases by country, EU/EEA, 2022



Source: country reports

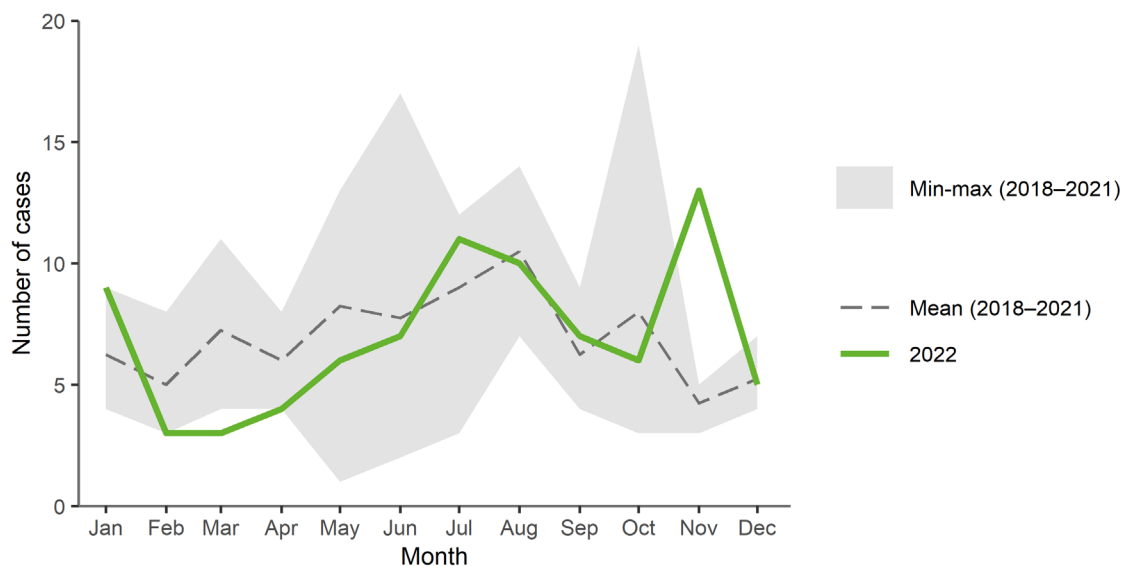
From 2018 to 2022, the number of botulism cases and the rate per 100 000 population in the EU/EEA remained stable (Table 1, Figure 1). Consistent with previous years, data from 2022 also show irregular, random peaks, rather than seasonality (Figure 2 and 3). In 2022, the highest increase in botulism cases was observed in November, which was different compared with the previous four years (Figure 3).

Figure 2. Confirmed botulism cases by month, EU/EEA, 2018–2022



Source: country reports from Austria, Belgium, Bulgaria, 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, and Sweden.

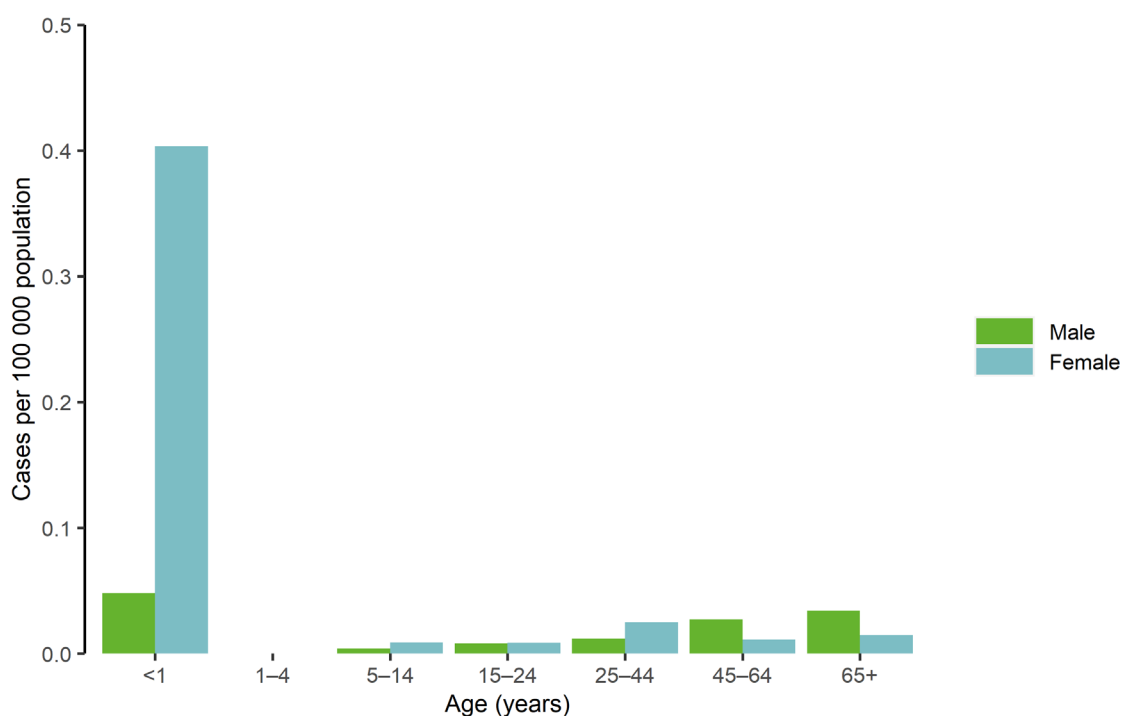
Figure 3. Confirmed botulism cases by month, EU/EEA, 2022 and 2018–2021



Source: country reports from Austria, Belgium, Bulgaria, 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, and Sweden.

The gender was known for all reported cases: 49% were male and 51% were female, with a male-to-female ratio of 0.9:1. The highest notification rate reported was among infants under one year of age, both in males and in females (0.05 and 0.4 cases per 100 000 population, respectively) (Figure 4). The highest number of cases (66 of 83 cases; 80%) was reported among adults in the age groups over 25 years.

Figure 4. Confirmed botulism cases per 100 000 population, by age and gender, EU/EEA, 2022



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

Outbreaks and other threats

One national outbreak of botulism type A was reported to the EpiPulse in June 2022. Two serious cases among adults were investigated in March and May where the suspected source of infection was the consumption of a refrigerated ready-to-eat meat and vegetable dish that was meant to be heated prior to consumption.

In 2022, seven food-borne botulism outbreaks – of which two were considered strong-evidence outbreaks – were reported to the annual zoonoses data collected by the European Food Safety Authority (EFSA). A total of 20 human botulism cases were involved in these outbreaks, of which 10 were hospitalised; no deaths were reported. Mixed food was reported as the main food vehicle category in the strong-evidence outbreaks where the causative agent was *C. botulinum* [4].

Discussion

The number of botulism cases reported by national surveillance systems in the EU/EEA remained stable from 2018 to 2022. Botulism is a relatively rare but severe disease in the EU/EEA with high mortality. Cases continue to occur sporadically and more than half the total number of cases per year were reported by one to three countries in the last five years. The presentation of different forms of human botulism cases, along with disease incidence, vary between countries depending on dietary habits, culinary traditions and food preparation methods. In 2022, the highest annual number of cases were reported by Italy, Romania, and France similar to the last five years. Studies in these countries have shown that the most common source of botulism in Italy was home-canned vegetables [5] in Romania home-preserved canned pork and ham products [6] and in France canned foods and home-made products [7].

Botulinum neurotoxins are mainly produced by the bacterium *C. botulinum*, but in rare instances they can also be produced by other *Clostridium* species (e.g. *C. argentinense*, *C. baratii* and *C. butyricum*). In the EU/EEA, from 2018 to 2022, BoNT type B caused the majority (85%) of human cases, followed by type A (11%). In contrast, BoNT type E and F were recorded in only 3% and 1% of cases respectively. Type F typically presents with a more rapid and severe illness than those caused by other BoNTs.

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 [8].

While the food-borne form of botulism is most common, other forms of the disease, such as wound botulism among people who inject drugs, are sporadically reported. In some European countries, wound botulism is the most commonly reported form of botulism.

In the EU/EEA, the most affected age group are infants below one year of age as was the case also in 2022. In contrast to food-borne botulism, infant botulism occurs due to the ingestion of *C. botulinum* spores, which germinate into bacteria and release BoNTs in the gut when the natural defences in the intestines of infants have not fully developed. Even though infants are the most affected group, all the fatalities from botulism occurred among the two oldest age groups (45–64 years and over 65 years). Botulism outbreaks are rare, with only one national outbreak reported to ECDC and seven food-borne botulism outbreaks, of which two were considered strong-evidence outbreaks, reported to EFSA in 2022. Botulism outbreaks are always public health emergencies that require rapid recognition to identify the disease sources and distinguish outbreak types to prevent additional cases. Successful treatment strongly depends on early diagnosis and rapid administration of botulinum antitoxin. The differential diagnoses of botulism include several neuromuscular diseases and central nervous system disorders.

Public health implications

To reduce the number of botulism cases, preventive measures should be strengthened by adopting a multidisciplinary approach that considers all routes of infection and intoxication. Care should be taken when canning food, either commercially or at home, to make sure that *C. botulinum* spores are destroyed by sufficient heat treatment before storage and consumption. Traditionally, infant botulism has been associated with the consumption of honey. The development of filters for people who inject drugs to remove spore-forming bacteria may reduce the incidence of intoxication in this risk group [9].

Symptoms of botulism vary depending on the type of toxin, the age and pre-existing conditions of the patient, and the amount of toxin consumed. As these symptoms are not disease-specific, diagnosis can be challenging. Food-borne outbreaks due to BoNT type F are of concern because bivalent AB antitoxin and trivalent ABE antitoxin may lack the required effectiveness for the treatment of type F botulism, which can rapidly progress to respiratory failure requiring ventilation support [10]. Of note, 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 bioterrorism threats in preparedness and response activities.

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