Feedback from operational stakeholders who manage or respond to outbreaks is that they are often too busy to review literature or obtain relevant background information to assist them with acute response. Unlike a traditional analytical outbreak investigation report, ***Watching Briefs*** *are intended as a rapid resource for public health or other first responders in the field on topical, serious or current outbreaks, and provide a digest of relevant information including key features of an outbreak, comparison with past outbreaks and a literature review. They can be completed by responders to an outbreak, or by anyone interested in or following an outbreak using public or open source data, including news reports.*

Watching brief

Title	*Botulism outbreak in Russia connected to readymade salads*
Authors	Damian Honeyman, Adriana Notaras, David Heslop and C Raina MacIntyre
Date of first report of the outbreak	Open-source intelligence from EPIWATCH® first identified the outbreak on 15 June 2024 (1).
Disease or outbreak	Botulism caused by *Clostridium botulinum* neurotoxin

Origin (*country, city, region*)	The Russian Federation
Suspected Source (specify food source, zoonotic or human origin or other)	Initial reporting suggested a foodborne outbreak connected to a brand of fish 'Lobio salad' (2). Further epidemiological investigations identified an additional 'tuna, bean and apple salad' from the same food delivery company (3).
Date of outbreak beginning	The exact date is unknown and estimated to be early June 2024
Date outbreak declared over	The last open-source report was on 30 July 2024; no official report has declared the outbreak over.
Affected countries & regions	Cases spread across 11 regions in the Russian Federation (4).
Number of cases (specify at what date if ongoing)	The first report on 15 June 2024 identified 10 cases that were all in intensive care (1). By 16 July 2024, 417 cases were reported (4).
Clinical features	The clinical features of the known cases have not been reported except for the first fatality; however, at the outbreak's peak on 20 June 2024, at least 172 cases were hospitalised, and 43 required mechanical ventilation (5). The

	first fatality reported symptoms of feeling unwell, dizziness and loss of coordination before being hospitalised (6). Confirmatory laboratory testing is required to diagnose botulism, as many differential diagnoses exist for adults and infants (7). In adults, these can include Guillain-Barre syndrome, myasthenia gravis, and cerebrovascular accidents (CVA) (7). In infants, they can include sepsis, meningitis, and electrolyte-mineral imbalance (7). There are eight distinguishable *Clostridium botulinum* neurotoxin serotypes (A, B, C [C_1 C_2], D, E, F and G) (8). Type A is the most potent toxin, followed by toxin type B and F (8). Types A, B, E and (rarely) F are known to cause illness in humans, and types C and D are known to cause illness in birds and mammals (9, 10). Early symptoms of *Clostridium botulinum* intoxication may be non-specific with gastrointestinal features such as nausea, vomiting, abdominal cramps and diarrhoea (11). Neurological symptoms then develop with cranial nerve involvement with patients describing blurred vision, photophobia, ptosis and diplopia (11). Intoxication progression exhibits bulbar nerve dysfunction with dysphagia, dysarthria and dysphonia (11). Whilst the signs and symptoms evolve over hours to days, the intoxication presents in a symmetrical and descending pattern with muscle weakness which affects proximal before distal neuromuscular synapses (11, 12).
Mode of transmission (dominant mode and other documented modes)	The mode of transmission in this outbreak is foodborne, with reports linking the source of the outbreak to popular salads from manufacturers "LokalKitchen" (service "Kitchen on the District") and "Savon-K" (1, 2, 3, 6, 13, 14). Exposure to botulinum neurotoxin occurs via five main routes:

	- Foodborne As reported in the current outbreak, foodborne botulism occurs through the consumption of foods that have been contaminated with botulinum toxin. The common sources of foodborne botulism are homemade foods that have not been properly canned, preserved or fermented (15), leading to Clostridia species' growth and botulinum neurotoxin production. The delay to first onset of symptoms for foodborne botulism ranges from 18 hours to 36 hours (16). - Wound Exposure occurs through spores entering a wound, growth of *Clostridia* bacteria, and production and systemic absorption of toxin (15). This form of exposure can occur due to injectable drug use, but historically more commonly following wound contamination after traumatic injury or failure of surgical sterility during invasive procedures (15). This delay to first onset of symptoms varies between 7 to 21 days and depends on the growth rate of bacteria within contaminated wounds (16). - Infantile Infant botulism occurs when *Clostridium botulinum* spores are ingested, leading to colonisation and replication in the intestinal tract, which then produces botulinum toxin (17). Infants less than 12 months of age have several factors that increase their risk, such as having an immature immune system as well as an immature gut physiology and underdeveloped gut microbiota (18). - Iatrogenic Botulinum toxins have a wide spectrum of both therapeutic and cosmetic indications for use (19). Yet, when too much of the toxin is injected during procedures, iatrogenic botulism can occur (15).

	- Adult intestinal toxaemia This form of intoxication is similar to infant botulism as being an intestinal toxaemia (20). This form is also known as adult intestinal colonisation, which occurs when spores enter an adult's intestines, grow, and produce the toxin (15). Cases have been reported in adults without a history of gastrointestinal problems. However, evidence shows the majority of cases have previously occurred in patients with a history of bowel or gastric surgery, bowel abnormalities or recent antimicrobial or antibiotic use, which may disrupt normal intestinal flora (20). - Inhalational Inhalational botulism does not occur naturally. Intoxication occurs after aerosolised *Clostridium botulinum* toxins are inhaled through mucosal membranes after accidental or deliberate contamination (21). Accidental contamination with the toxin has only been described through laboratory exposure (22). The deliberate dissemination of *Clostridium botulinum* toxin has previously been described when the Japanese cult 'Aum Shrinrikyo' failed in their attacks to aerosolise and spray the toxins (23). Typically, symptoms develop between 12 and 72 hours after inhalation in these events.
Demographics of cases	Of the 417 cases, only demographics for the two fatalities are available. The first case who died in hospital on 24 June 2024 was a 21-year-old male from Kostroma who contracted botulism in Nizhny Novgorod (6). The male reportedly became unwell between 12-15 June and called an ambulance on 16 June; he was then treated in an intensive care unit and given mechanical ventilation (6). The second fatality, a 24-year-old male from Dzerzhinsk, became unwell and was hospitalised on 17 June 2024 and died on 28 June 2024 (13).
Case fatality rate (CFR)	Two deaths from the outbreak have been reported from a total of 417 cases (CFR 0.48%).

Complications	The most serious complication of botulism is death. However, significant morbidity is experienced. Although the CFR in this current outbreak is 0.48%, the recognised CFR for foodborne botulism intoxication is 5-10% (24). Although some foodborne outbreaks have reported varying CFR from 3.5%-21.9% in Ukraine (25) to 66.7% in Nigeria (26). This exposure event has resulted in numerous individuals requiring mechanical ventilation, though the exact demographics of these people have not been reported. Those with gastrointestinal conditions and weakened immune systems, including infants and the elderly, often experience more severe symptoms, which may lead to requiring mechanical ventilation (27, 28). Prolonged mechanical ventilation has a significant morbidity and mortality and, in this event, may result in additional mortality. For survivors of botulism, intensive rehabilitation coupled with a slow recovery is typical. Patients can require prolonged hospitalisation and rehabilitation for up to and sometimes more than a year (12, 29). As botulism intoxication worsens, paralysis extends throughout the body, initially affecting the cranial nerves and then gradually peripheral nerves. Involvement of the thoracic musculature and diaphragm results in respiratory depression and/or failure (12). Patients with severe intoxication usually require intensive care admission with ventilatory support. While suppression of normal respiration is what causes death in the initial phase of the disease, death in the latter phase of hospital admission is often the result of secondary complications of prolonged intensive care treatment and mechanical ventilation such as sepsis, deconditioning and immune dysfunction (12). An indirect complication of botulism exposure events is the often-large number of patients requiring high acuity care. This can place substantial pressure on healthcare staff and resources. Additionally, resources such as

	mechanical ventilators, intensive care staff, specialised consumables and resources will be rapidly depleted leading to compromises in botulism case management and broader impacts on health service provision (12). The diagnosis of botulism, which can often be confused with other neurological presentations, is frequently delayed (12). Diagnostic uncertainty between more commonly seen neurological conditions, such as Guillain-Barre syndrome, or other conditions, such as drug overdose, is common, leading to delays in accessing lifesaving treatment (12).
Available prevention	The recommended prevention for botulism infection depends on the likely route of exposure to botulinum neurotoxin (30). Where the risk of exposure is via ingestion due to failure of food preservation, pasteurisation or sterility, prevention includes the following: - Abiding by safe canning guidelines - Follow recommended storage of canned and fermented food and vegetables in oil, including keeping them refrigerated after opening - Heat-sterilise food products such as homemade canned goods - Avoiding raw or unpasteurised foodstuffs (e.g. honey), particularly for vulnerable demographics such as infants - Throw out food if unsure as to how it has been prepared (30). To prevent wound botulism: - Debridement, decontamination, dressing and covering of wounds (30). To prevent iatrogenic botulism: - This form of botulism intoxication occurs as an adverse event following therapeutic or cosmetic procedures; therefore, the only

	preventative measures are monitoring drug formulation, dose and delivery during administration (31). To prevent infant botulism: - Honey which may harbour spores should not be given to infants (32) - Restrict newborn babies from direct contact with soil (33). - Taking meticulous care when preparing, handling and storing solid foods (33).
Available treatment	Antitoxin therapy and supportive care with mechanical ventilation are the recommended botulism intoxication treatment pathways (11). Two antitoxins are available: Equine-derived Heptavalent Botulinum Antitoxin (BAT) and Botulism Immune Globulin Intravenous (Human) (BIG-IV) also known as BabyBig. BAT covers the seven possible strains that could cause botulism following exposure including inhalation (i.e. deliberate or accidental due to bioterrorism or similar incident) exposure (34). BIG-IV is available to treat infant botulism serotypes A or B (11). Usually, one dose of antitoxin is required for treatment; however, secondary doses may be used if symptoms persist or the patient relapses (11). Rapid administration of the antitoxin has been shown to reduce severe symptoms and length of intensive care treatment (12, 35). Antitoxin should be administered if an index of clinical suspicion is high or intelligence suggests deliberate or accidental exposure or laboratory studies confirm exposure. Treatment is often delayed due to diagnostic uncertainty with other similarly presenting neurological conditions, and therefore, botulism should not be discounted as a diagnostic possibility until definitively ruled out (12, 29). Supportive care with mechanical ventilation and close monitoring is extremely effective for patients with botulism intoxication and has been shown to reduce the risk of death (12, 35).

Comparison with past outbreaks	Botulism outbreaks in the Russian Federation appear to be occurring regularly in 2024. Days before this outbreak, on 13 June 2024, a single case was detected in a man from the Leningrad region who had eaten canned fish (36). Earlier, a larger outbreak was detected in the Volgograd region, where from the beginning of 2024 up to 29 May, ten people were poisoned after eating dried fish; nine of those were reportedly fatal (37). Another outbreak was reported on 16 April 2024, with two cases linked to salted mushrooms purchased at a retail chain in the Irkutsk region (38). Four residents from the Rostov region were diagnosed with botulism in a report dated 29 March 2024 after consuming poisoned homemade mushroom and vegetable preserves (39). A husband and wife reportedly also died in mid-March 2024 in an intensive care unit in the Altai region, although these deaths were suspected to be botulism and not officially reported as their cause of death (40). In February 2024, a further five residents from the Tambov region were poisoned by mushrooms, only two were reported as botulism-related (41). Also, in February, two more cases were identified in the Dnepropetrovsk region after consuming dried and smoked fish and the second canned food from a garbage bin (42). One case was registered in the Lyve district at the beginning of February 2024, though no source was identified (43). The current outbreak surpassed all recent outbreaks stated here by a substantially high number, with over 400 human cases. The key difference between the current outbreak and previous outbreaks is this outbreak started from a commercial food supplier, whereas previous outbreaks were often from homemade products.
Unusual features	Previous outbreaks were small, with cases in 2024 ranging from one to ten. These outbreaks were often linked to homemade fermented and preserved foods. Whereas the current outbreak is linked to a commercial food supplier. The products in question were ready-made salads and tinned beans, which should have undergone food and safety testing at the commercial facility. Yet, the outbreak spread to eleven regions, suggesting spread through the

	food supply (44). Canned food is often implicated in botulism outbreaks, and the salads may have contained canned items. The commercial food supplier has been forced to cease trading for 90 days. Law enforcement officers have detained the company's head, commercial director, and cook; all were under house arrest for an undisclosed time period(13).
Critical analysis	Although botulism outbreaks are rare, they can be life-threatening, some people require mechanical ventilation in intensive care units whilst some cases go on to die even with artificial airway support. Botulism outbreaks are growing in frequency across the world; a recent outbreak in the Lviv Oblast in Ukraine in June saw seven cases, all linked to homemade canned meat (45). Furthermore, in June 2024, ten cases were detected in an outbreak in California, USA, after eating canned foods, two cases were hospitalised in an intensive care unit (46). An outbreak connected to mayonnaise in May 2024 saw 75 cases and one death in Saudi Arabia (47). Over 400 people have been identified as confirmed cases, making it the largest in Russia in 25 years. In 1999, an outbreak of botulism caused 180 cases and was linked to dried fish in salad (4). Although the outbreak affected 11 regions, the true extent of the outbreak may never be known. This may be due to cases not requiring hospitalisation or potential illnesses and deaths attributable to other causes. Furthermore, whilst many seek help when unwell, not everyone does. Additionally, cases may exist beyond borders, and their symptoms may develop beyond the normal incubation period for foodborne botulism, and they may recover without requiring medical treatment. Some people exhibiting mild symptoms may have been hospitalised without testing for botulism toxin exposure. Additionally, there were limited public information available on the cases and minimal information on the two fatalities. During the broad media campaign limited people came forward (48). Yet when the Federal Service for the

	Oversight of Consumer Protection and Welfare “Rospotrebnadzor” went door-to-door more cases appeared in people who knew they were unwell but believed it would pass without medical intervention (48). An investigation by ‘Rospotrebnadzor specialists’ who specialise in food safety control and prevention of foodborne diseases in the Russian Federation stated food preparation was inadequate and one of the food production points was unregistered (48). The implicated company violated procedures relating to both the storage temperature regime and the canning recipe which has allowed botulism spores to grow and the lack of testing due to the illegality of the food provider allowed contaminated food to be sold publicly (48). The size and spread of the outbreak raise concerns about food health and safety regulations in the Russian Federation. Commercial kitchens distributing food products should follow regulations and regularly test products. One report in 2022 from Roscontrol, an independent consumer watchdog in Russia who conducts laboratory testing on consumer products found 60 per cent of products failed to meet standards (49). Furthermore, the ongoing Russia-Ukraine war will be contributing to food insecurity and rising food prices which ultimately forces people to turn to cheaper and lower quality products (49). These factors suggest there may be issues with food supply chains including testing and surveillance in the Russian Federation that may have contributed to this outbreak. Furthermore, in light of the mass outbreak the Prosecutor General’s Office called for an immediate inspection of all ready-to-eat food producers for compliance testing of sanitary standards and food storage rules (50). As a consequence of the outbreak, the food service company was shut down, and the investigative committee opened a criminal case against the

	implicated company. Three of the company's staff were placed under house arrest. Foodborne outbreaks associated with inadequate canning and preservation of foods as discussed have contributed from small to large ranging outbreaks of botulism throughout history. The Russian Federation is familiar with these outbreaks. Whilst food producers who may be regulated but are going unchecked continue to operate, there is an ongoing risk of future large-scale outbreaks.
Key questions	1. What food and safety regulations are in place to regularly test commercial products in Russia? 2. Should the food supplier undergo stricter controls on foods? 3. How can Open-source intelligence (OSINT) help inform consumers and the community about such outbreaks? 4. Which botulinum neurotoxin was responsible for this outbreak? 5. What has driven this significant rise in cases, increased public health surveillance, reporting, or insufficient food safety procedures?
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