Listeriosis

Annual Epidemiological Report for 2023

Key facts

- In 2023, 30 countries reported 2 993 confirmed listeriosis cases in the EU/EEA – the highest annual number of cases since the start of the EU/EEA-wide surveillance.
- The EU/EEA notification rate was 0.67 cases per 100 000 population.
- The highest rate was detected among people over 64 years old (2.2 cases per 100 000 population).
- The number of confirmed listeriosis cases reported per year is increasing in the EU/EEA.

Introduction

Listeriosis is a disease caused by *Listeria monocytogenes*. Most healthy adults exposed to these bacteria do not develop symptoms. The invasive form of the disease is primarily seen in elderly people, pregnant women, newborns, and adults with a weakened immune system. After an incubation period of about three weeks, pregnant women may experience a self-limiting influenza-like illness, which can potentially impact pregnancy outcomes. Listeriosis in adults with a weakened immune system and in elderly people may lead to meningitis, brain infection, and severe blood infection.

Methods

This report is based on data for 2023 retrieved from The European Surveillance System (TESSy) on 4 September 2024. TESSy is a system for the collection, analysis and dissemination of data on communicable diseases.

For a detailed description of 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].

The notification of listeriosis in humans is mandatory in all EU/EEA countries, except in Belgium. The surveillance systems for listeriosis have full national coverage in all reporting countries except Belgium and Spain. The population coverage is estimated to be 80% in Belgium and 97% in Spain. These proportions were used when calculating the national notification rates for these two Member States. No estimate of population coverage in Spain was provided prior to 2021, so notification rates were not calculated. All countries provide case-based data except Bulgaria, which reported aggregate data.

An aggregated reporting format was included to calculate number of cases and notification rates, as well as disease trends, age and gender distributions when these data were available. For pregnancy-associated cases, only the mother is reported as a case.

Subtyping *L. monocytogenes* is either performed by phenotypic methods where serotypes are assigned or by PCR where corresponding serogroups are assigned or can be derived from whole genome sequencing (WGS) data. These data are compiled in the European Surveillance System (TESSy), where for example serotype 1/2a is combined with data reported as serogroup IIa. EU/EEA countries can report the seven-gene multi-locus sequence type (ST) via case-based data collection. ST for *L. monocytogenes* has a higher discriminatory power than serogroup/serotype. In addition, ST was derived *in silico* from WGS data for countries that routinely submit sequences for WGS-enhanced listeriosis surveillance but did not report STs via case-based data collection.

During 2023, ECDC continued EU/EEA-wide WGS-enhanced listeriosis surveillance through isolate-based data collection, which started in March 2019.

For cluster detection, raw reads or assemblies were submitted by EU/EEA countries. Sequences were analysed at ECDC with BioNumerics version 7.6.3 (Applied-Maths, Sint-Martens-Latem, Belgium). The analysis of raw reads included trimming using the default Bionumerics 7.6.3 settings; *de novo* assembly using SPAdes version 3.7.1; post-assembly optimisation by mapping reads back onto the assembly and keeping the consensus (using MismatchCorrector implemented in SPAdes version 3.7.1). The default settings of BLAST parameters for allele calling were used. Core genome multi-locus sequence typing (cgMLST) analysis was performed using assembly-based allele calling according to the Institut Pasteur scheme [4] in BioNumerics. Isolates were retained in the analysis if at least 1 574 (90%) of the 1 748 core loci were detected.

For multi-country microbiological cluster detection, a cluster of *L. monocytogenes* was defined as a group of isolates from at least two different EU/EEA countries, with a maximum of four differing alleles in cgMLST in single-linkage analysis. This allelic threshold could be modified to further investigate the detected clusters and search for possibly epidemiologically linked isolates.

In addition to the WGS data submitted by the EU/EEA countries for the listeriosis cluster detection in TESSy, ECDC also collects and analyses sequence data in relation to ongoing multi-country outbreak investigations where sequences from non-EU/EEA countries can also be included.

The One Health WGS System hosted by ECDC and the European Food Safety Authority (EFSA) [5] allows searching for genetically close non-human isolates matching clusters of human isolates. The non-human data constitutes sequence data submitted to EFSA by national food authorities in the EU as well as data from public sequence repositories. For all isolates, genome profiles are calculated from assembled genomes using BSR-Based Allele Calling Algorithm (chewBBACA) version 2.8.5 (https://github.com/B-UMMI/chewBBACA) Institut Pasteur scheme [4] made available by chewie Nomenclature Server at https://chewbbaca.online/species/6. Since the end of 2022, all human isolate clusters detected by ECDC have been used to query the EFSA WGS database system every week using a cut-off of seven differing alleles in cgMLST to at least one isolate in the human cluster.

Epidemiology

In 2023, 2 993 confirmed cases of listeriosis were reported by 30 EU/EEA countries. This is the highest annual number of cases reported since the start of EU/EEA-level surveillance. The EU/EEA notification rate was 0.67 per 100 000 population (Table 1). Germany, France, and Spain had the most reported cases (663, 538, and 428, respectively), corresponding to 54.4% of all cases reported in the EU/EEA. The highest incidence rates were observed in Finland, Sweden, and Portugal (Table 1). Figure 1 illustrates the country-specific rates per 100 000 population.

Table 1. Confirmed listeriosis cases and rates per 100 000 population by country and year, EU/EEA, 2019–2023

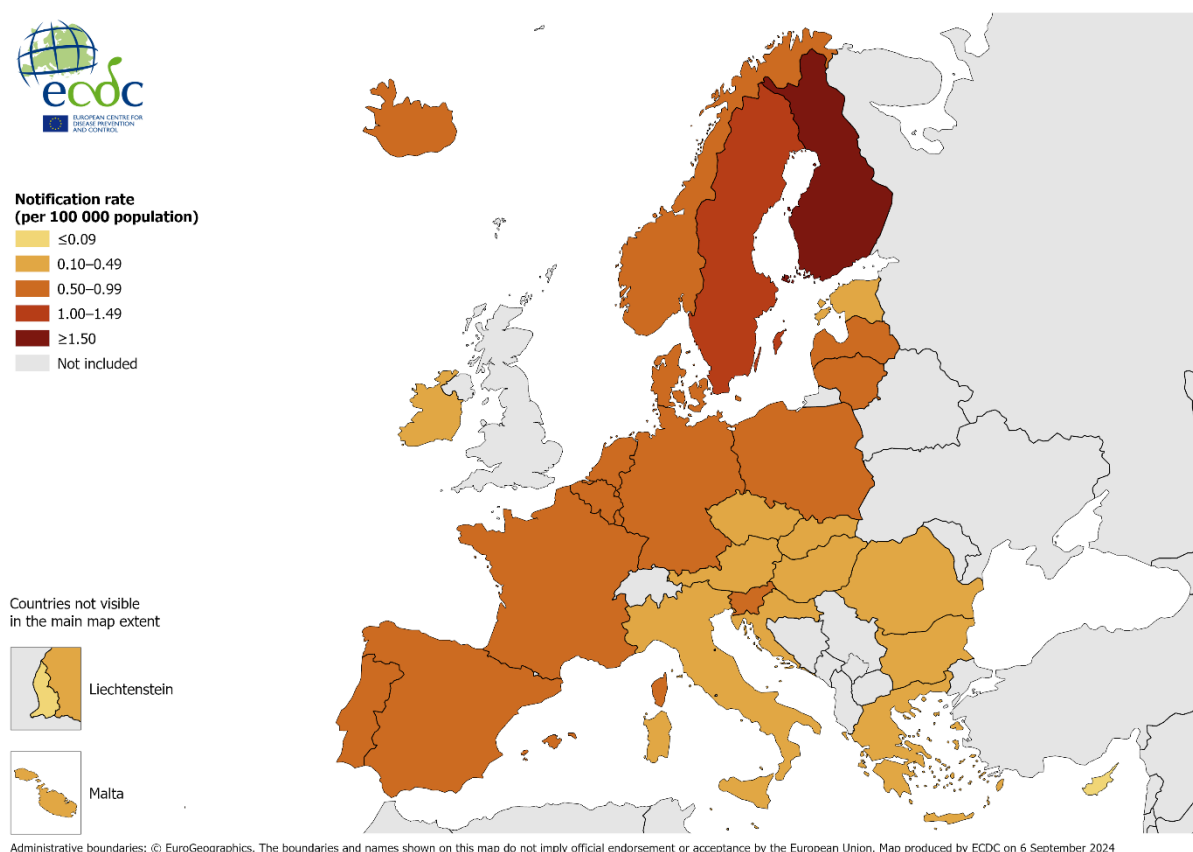| Country	2019		2020		2021		2022		2023	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
Austria	38	0.43	41	0.46	38	0.43	47	0.52	37	0.41
Belgium	66	0.72	54	0.59	68	0.74	87	0.94	84	0.89
Bulgaria	13	0.20	4	0.06	3	0.05	5	0.08	15	0.23
Croatia	6	0.15	5	0.13	8	0.21	5	0.13	6	0.16
Cyprus	1	0.11	2	0.23	1	0.11	1	0.11	0	0.00
Czechia	27	0.25	16	0.15	24	0.23	48	0.46	44	0.41
Denmark	61	1.05	43	0.74	62	1.06	86	1.46	53	0.89
Estonia	21	1.59	3	0.23	5	0.38	11	0.83	5	0.37
Finland	50	0.91	94	1.70	70	1.26	69	1.24	92	1.65
France	373	0.55	334	0.50	435	0.64	451	0.66	538	0.79
Germany	571	0.69	546	0.66	562	0.68	549	0.66	663	0.79
Greece	10	0.09	20	0.19	21	0.20	7	0.07	31	0.30
Hungary	39	0.40	32	0.33	35	0.36	64	0.66	46	0.48
Iceland	4	1.12	4	1.10	5	1.36	2	0.53	3	0.77
Ireland	17	0.35	6	0.12	14	0.28	17	0.34	18	0.34
Italy	202	0.34	155	0.26	230	0.39	385	0.65	231	0.39
Latvia	6	0.31	8	0.42	10	0.53	8	0.43	11	0.58
Liechtenstein	NDR	NRC	NDR	NRC	0	0.00	0	0.00	0	0.00
Lithuania	6	0.21	7	0.25	7	0.25	13	0.46	20	0.70
Luxembourg	3	0.49	4	0.64	4	0.63	4	0.62	4	0.61
Malta	5	1.01	5	0.97	0	0.00	1	0.19	2	0.37
Netherlands	103	0.60	90	0.52	86	0.49	94	0.53	95	0.53
Norway	27	0.51	37	0.69	20	0.37	30	0.55	39	0.71
Poland	121	0.32	57	0.15	120	0.32	142	0.38	240	0.65
Portugal	56	0.54	47	0.46	57	0.55	63	0.61	99	0.94
Romania	17	0.09	2	0.01	11	0.06	14	0.07	21	0.11
Slovakia	18	0.33	7	0.13	13	0.24	25	0.46	21	0.39
Slovenia	20	0.96	26	1.24	19	0.90	20	0.95	16	0.76
Spain	504	NRC	191	NRC	355	0.77	437	0.95	428	0.92
Sweden	113	1.10	88	0.85	107	1.03	125	1.20	131	1.25
EU/EEA (30 countries)	**2 498**	**0.50**	**1 928**	**0.43**	**2 390**	**0.54**	**2 810**	**0.63**	**2 993**	**0.67**
United Kingdom	154	0.23	NA	NA	NA	NA	NA	NA	NA	NA
EU/EEA (31 countries)	**2 652**	**0.46**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Source: Country reports.
NDR: No data reported.
*NRC: No rate calculated.*
NA: Not applicable.
No data were reported by the United Kingdom since 2020, due to its withdrawal from the EU on 31 January 2020.

Figure 1. Confirmed listeriosis cases per 100 000 population by country, EU/EEA, 2023

Administrative boundaries: © EuroGeographics. The boundaries and names shown on this map do not imply official endorsement or acceptance by the European Union. Map produced by ECDC on 6 September 2024

In EU/EEA countries that consistently reported listeriosis cases from 2019 to 2023, there was a decrease in the number of cases between 2019 and 2020, followed by an increase in cases thereafter (Figure 2).

In 2023 the vast majority (96.6%) of listeriosis cases were hospitalised (1 538 of the 1 592 cases for which the information was available), as was the case in previous years. The outcome was reported for 1 739 cases, 340 (19.6%) of whom died.

Listeriosis cases typically peak during the summer months, as observed in 2023. The monthly case numbers for listeriosis were higher than the mean of previous years in all months, particularly March and October (Figure 3).

Figure 2. Confirmed listeriosis cases by month, EU/EEA, 2019–2023
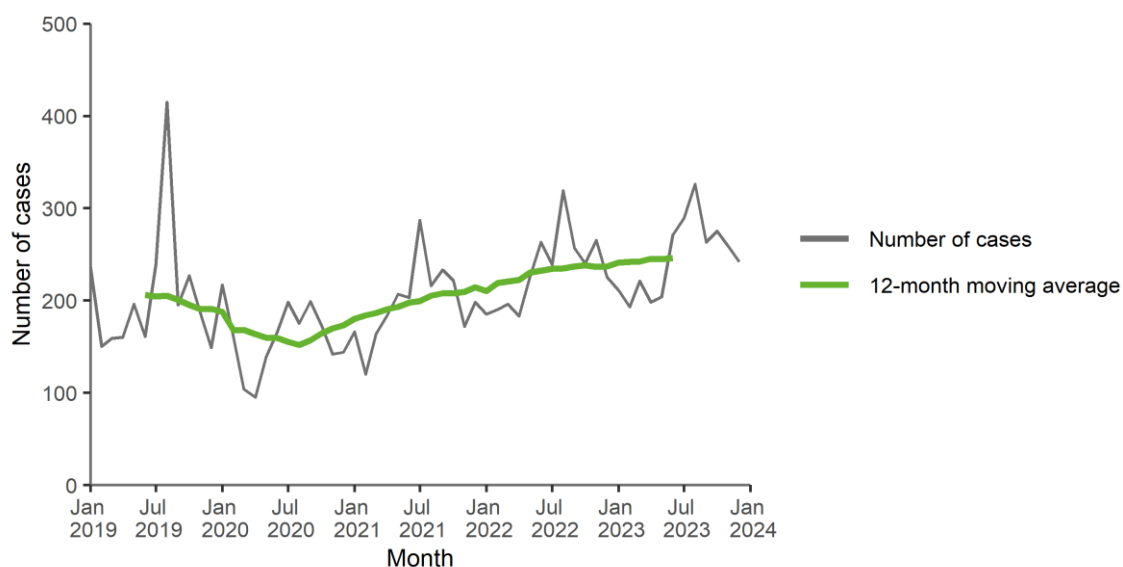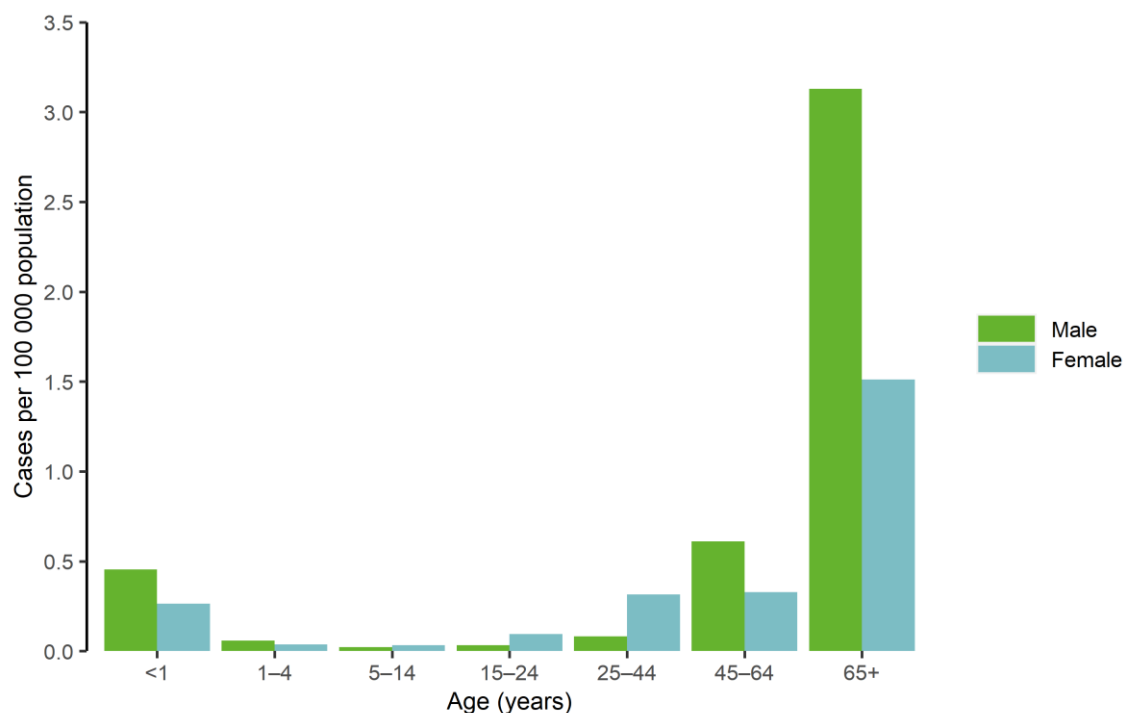

Source: Country reports from Austria, Belgium, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.

Figure 3. Confirmed listeriosis cases by month, EU/EEA, 2023 and 2019–2022
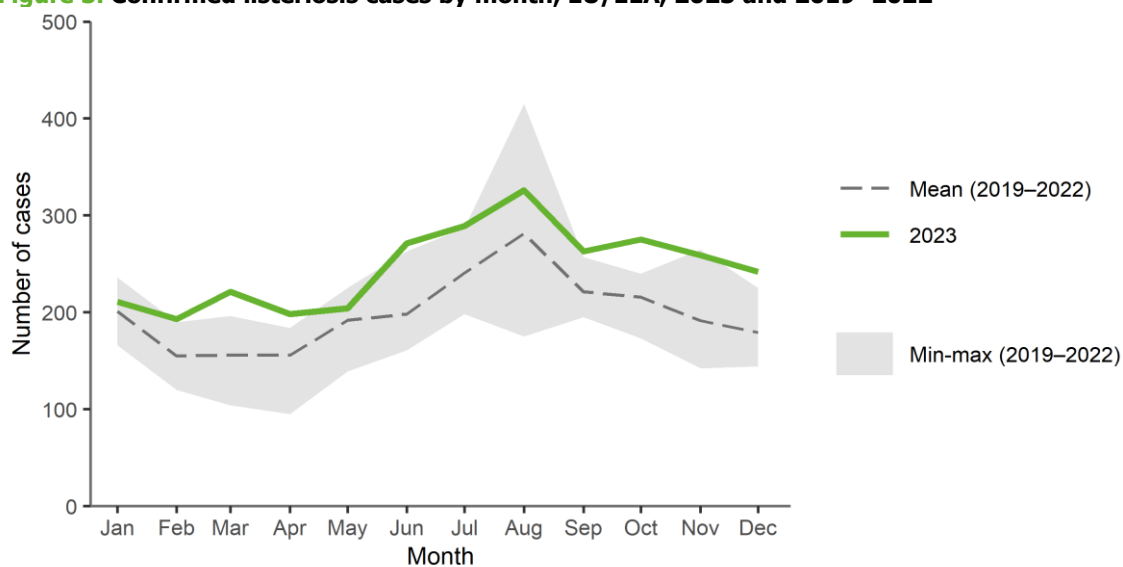
Source: Country reports from Austria, Belgium, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.

Of those confirmed listeriosis cases with available information on gender (N=2 992), 58.4% were males and 41.6% were females, corresponding to a male-to-female ratio of 1.4:1. The most affected age group were those over 64 years of age (2 116 cases; 70.8%, notification rate: 2.2 per 100 000 population). In 2023, 107 pregnancy-associated listeriosis cases were reported. Of these, 15 resulted in miscarriage or a fatal outcome for the newborn (pregnancy outcome was reported for 41.1% of pregnancy-associated cases).

Figure 4. **Confirmed listeriosis cases per 100 000 population, by age and gender, EU/EEA, 2023**

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.

Microbial surveillance

In 2023, 17 EU/EEA countries reported serotype and serogroup data (Austria, Belgium, Czechia, France, Germany, Greece, Hungary, Ireland, Lithuania, Luxembourg, the Netherlands, Norway, Portugal, Romania, Spain, Sweden, and Slovenia). The most common serogroup was IVb (47.8%), followed by IIa (41.7%), IIb (9.0%), and IIc (1.6%) of the cases with available data of serotype or serogroup (42.8%; 1 282/2 993 cases). Data completeness improved markedly from the previous year, when serotype or serogroup were reported for only 23.3% of cases by 14 EU/EEA countries.

In 2023, eight EU/EEA countries (Austria, Estonia, Hungary, Ireland, Luxembourg, Norway, Sweden, and Slovenia) reported ST data for 247 isolates through TESSy case-based reporting. In addition to these, the ST could be determined *in silico* from WGS data submitted by Belgium, Finland, Portugal, and Spain for a total of 428 isolates. In total, 22.6% (675 isolates) of the confirmed cases had information on ST. The most common ST was ST1 (n=99) similar to 2022 and 2021, when the ST data collection started. The second and third most common STs were ST37 (n=58) and ST7 (n=39).

WGS-enhanced surveillance

Nine EU/EEA countries (Austria, Belgium, Finland, Iceland, Luxembourg, Portugal, Slovenia, Spain, and Sweden) submitted *L. monocytogenes* WGS data to TESSy for 790 isolates during 2023. In addition, seven countries (Denmark, Germany, France, Italy, the Netherlands, the United Kingdom, and the United States) submitted sequence data to contribute to ongoing multi-country outbreak investigations from 114 isolates. When analysed against all sequences available in TESSy, ten new multi-country clusters were identified during the year. Additionally, 282 isolates matched with multi-country clusters that were detected before 2023.

By the end of 2023, TESSy data included 161 multi-country clusters, comprising 1 358 isolates, with a median of four isolates per cluster (range 2–98), and a median of two countries per cluster (range 2–10). The median cluster duration (time from the oldest to the newest isolate) was 2.9 years (range from 1 day to 14.8 years) for the 141 clusters with available date information for the first and last isolate.

In total, 64 of the 161 multi-country clusters (39.8%) had matching non-human isolates at the end of 2023. Of these, 490 isolates were derived from national food safety authorities and 539 from public sequence repositories. The detected multi-country clusters including non-human isolate matches can be visualised by submitters with human isolates in the same cluster through the Molecular Typing Tool in EpiPulse (https://epipulse.ecdc.europa.eu/typing/explore/).

Figure 5. Number of *Listeria monocytogenes* isolates in genomic multi-country clusters* (n=161) detected by the end of 2023
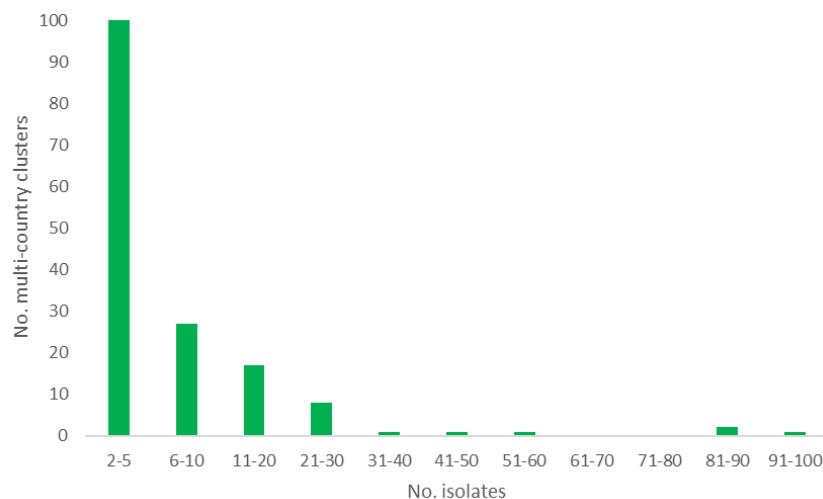
*All isolates within four alleles from at least one other isolate in the cluster by cgMLST.

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

Outbreaks and other threats

In 2023, 12 listeriosis events were launched in EpiPulse by six different EU/EEA countries, ECDC, and one non-EU/EEA country. For seven of these, no EU/EEA multi-country aspect was identified. A probable source was reported for four of the five multi-country events, involving *L. monocytogenes* strains ST1, ST9, ST10, ST87, ST155, ST504, and ST1607 (one of these events involved four different STs). The probable sources were ready-to-eat fish products for three events, and cooked black olives for one. A joint ECDC-EFSA Rapid Outbreak Assessment was published for one of the events linked to *L. monocytogenes* ST155 in ready-to-eat fish products [6].

In 2023, 21 foodborne listeriosis outbreaks were reported to EFSA annual zoonoses data collection by ten EU/EEA countries, involving 163 cases [7,8]. This represents a decrease of 17 outbreaks (45% decrease) compared to 2022. Information on the serovar was available for seven reported outbreaks: serovar IVb for five and 1/2a for two outbreaks. Information on ST was available for five outbreaks (ST1, ST4, ST8, ST10, and ST91). A food vehicle was reported in all nine strong-evidence foodborne outbreaks: three outbreaks were linked to fish and fish products, two to ready-to-eat pig products, and one each to cheeses made from cows' milk, cooked ham, cows' milk and table olives [7,8].

Discussion

Listeriosis is on the rise in Europe, with the number of cases reaching an all-time high in 2023 within the EU/EEA since the start of the reporting in 2007. A gradual increase in listeriosis cases was observed across all EU/EEA countries from 2019 to 2023, with statistically significant upward trends reported, and no country showing a decreasing trend [7].

Listeriosis is one of the food- and waterborne diseases under EU surveillance with the highest number of hospitalisations and fatal cases [7]. The EU surveillance of listeriosis captures severe, invasive forms of the disease, which mainly affects older and immunocompromised people as well as pregnant women and infants. Listeriosis can also manifest in milder forms causing gastrointestinal symptoms, but these cases are usually not diagnosed and notified in EU/EEA countries.

In 2023, nine countries reported sequence data for the EU/EEA-wide WGS-enhanced listeriosis surveillance, which is a notable improvement from 2022 when only five countries submitted data. Since the beginning of WGS data reporting to TESSy, 27 EU/EEA countries and the United Kingdom had provided sequence data by the end of 2023. Microbiological multi-country clusters detected from these data show that although these clusters tend to be small and affect only a few countries, they often persist for several years, and even decades. Data on decade-lasting microbiological clusters possibly deriving from persistent sources have also been published by Dutch researchers [9].

Microbiological cluster detection efforts combined with other relevant data, such as sequences from food isolates and exposure data from trawling interviews of cases/relatives, could help locate sources of infection and allow for the implementation of control measures to reduce the EU/EEA burden of this severe disease.

The launch of the ECDC-EFSA One Health WGS System in 2022 speeds up the sequence sharing and analysis process, and facilitates hypothesis generation from microbiological comparisons during multi-country outbreaks. The inclusion of non-human WGS data from public sequence repositories gives global context to the analyses. By the end of 2023, more than one-third of the multi-country human clusters had matches with non-human data.

Public health implications

Due to the high severity of listeriosis among vulnerable people (i.e. elderly people, pregnant women, newborns, and adults with a weakened immune system) and the increasing proportion of older people within the EU/EEA, the highest ever case number and population-adjusted notification rate at the EU/EEA level are concerning and call for more attention to the prevention and control of the disease and outbreaks. Raising awareness of listeriosis and risky foods, such as ready-to-eat fish and meat products, is important among populations vulnerable to developing a more severe form of the disease. It is also important to note that even foods that comply with the EU food safety criteria for *L. monocytogenes* can cause disease in these populations. Furthermore, supranational cross-sectorial collaboration between public health and food safety officials, including sequence data-sharing, is essential for addressing the occurrence of infections caused by persistent *L. monocytogenes* strains.

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