SURVEILLANCE REPORT

Salmonellosis

Annual Epidemiological Report for 2022

Key facts

- Salmonellosis is the second most commonly reported gastrointestinal infection in the EU/EEA, and a significant cause of food-borne outbreaks.
- In 2022, 65 967 laboratory-confirmed cases of salmonellosis were reported in the EU/EEA, out of which 81 were fatal – a rate of 15.5 cases per 100 000 population.
- Case numbers rose in 2022 after a significant decline in cases in 2020 as a result of the COVID-19 pandemic, yet were still lower than pre-pandemic levels.
- The reported case rate was highest in young children (0–4 years) with 81.5 cases per 100 000 population, ten times higher than in adults (25–64 years).
- Egg and egg products continue to be the highest risk foods in *Salmonella* outbreaks, although the largest outbreak in the EU/EEA in 2022 was from chocolate.
- Resistance to antimicrobials used in the treatment of severe salmonellosis increased for fluoroquinolones during 2018-2022 but remained low and stable for 3rd generation cephalosporins.

Introduction

Enteric infections due to non-typhoidal *Salmonella* serovars (any other serovar than *Salmonella* Typhi and *Salmonella* Paratyphi) are generally referred to by the term 'salmonellosis'. Various animals (especially poultry, pigs, cattle and reptiles) can be reservoirs for *Salmonella*. Humans usually become infected by eating uncooked or poorly cooked, contaminated food. The incubation period and the symptoms depend primarily on the amount of bacteria present in the food, and the immune status of the infected individual. Most infections cause milder illness such as diarrhoea, stomach pain, and fever although more severe symptoms may develop such as urinary-tract infections, bacteraemia or reactive arthritis. In the case of severe infections, antimicrobial treatment is necessary.

Methods

This report is based on data for 2022 retrieved from The European Surveillance System (TESSy) on 11 October 2023. 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].

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Stockholm, February 2024

In 2022, 30 EU/EEA countries reported data on salmonellosis. Twenty-six countries reported data using either the 2008, 2012 or 2018 EU case definitions for salmonellosis. Compared with the 2008 and 2012 EU case definition, the 2018 EU case definition allows nucleic acid determination for laboratory confirmation and includes a requirement for antimicrobial susceptibility testing and reporting of results. Four countries used another case definition, which was not specified.

Notification of non-typhoidal salmonellosis was mandatory in most EU Member States as well as in Iceland, Liechtenstein, and Norway in 2022. In three Member States (Belgium, France, and the Netherlands), reporting was voluntary. The surveillance systems for salmonellosis had national coverage in all Member States except in three (Belgium, the Netherlands and Spain). The population coverage in 2022 was estimated to be 85% in Belgium, 64% in the Netherlands and 73% in Spain. The variation in coverage was considered when calculating the notification rates. During the peak pandemic year of 2020, Spain did not receive data from all the regions that normally report cases, which may have contributed to lower number of cases than expected. No information on estimated coverage was provided by Spain prior to 2021, thus no notification rates were calculated. All countries report case-based data except Bulgaria which reports aggregated data. Both reporting formats were included to calculate numbers of cases, notification rates, disease trends, and age and gender distributions.

Twenty-nine EU/EEA countries reported antimicrobial resistance data (AMR) for *Salmonella* for 2022. Twenty-seven countries reported phenotypic resistance data (22 as disk zones or MIC values and five as interpretation with clinical breakpoints). Two countries reported whole genome sequences which were analysed by ECDC and interpreted as predicted wild type or predicted non-wild type.

In total, 19 EU/EEA countries provided whole-genome sequencing (WGS) data for 1 273 case isolates reported in 2022 to support ongoing multi-country outbreak investigations or as part of their routine reporting for AMR or for *Salmonella* isolates.

Epidemiology

In 2022, 30 EU/EEA countries reported 66 721 salmonellosis cases, of which 65 967 were classified as laboratory confirmed (Table 1). This was an increase of 5.4% in cases compared to 2021, but still 16.8% lower than in 2019 (UK excluded) before the start of the COVID-19 pandemic. The number of cases per 100 000 population was 15.5. The notification rate was affected by changes in the estimated population coverage in two countries. In France, the surveillance system was estimated to cover 48% of the population in 2018-2021 but from 2022 it covered the whole population. In Belgium, a study found that the surveillance system represented 85% of the population and this coverage was applied from 2022.

The highest notification rates were reported by Czechia (71.9 cases per 100 000 population) and Slovakia (67.5), followed by Malta (38.2), Hungary (33.5), Croatia (27.1) and Spain (25.5) – Table 1, Figure 1. The lowest rates were reported by Portugal (4.0 cases per 100 000 population), Bulgaria (4.5) and Latvia (4.8).

The hospitalisation status was reported for 29 712 salmonellosis cases in 2022 and of those, 39.3% had been hospitalised. The countries reporting the highest proportion of hospitalised cases were Romania, Cyprus, Greece and Lithuania (100%, 87.1%, 83.0% and 79.9%, respectively). Specimen type can also be used as an indicator of the severity of infection. Among 48 603 cases with specimen type reported, 93.9% of *Salmonella* isolates were sampled from faeces, 2.4% from blood, 1.6% from urine and the remaining reported as 'other'. Out of 37 301 cases with known outcome, 81 were reported to have died which accounted for a case fatality of 0.22%.

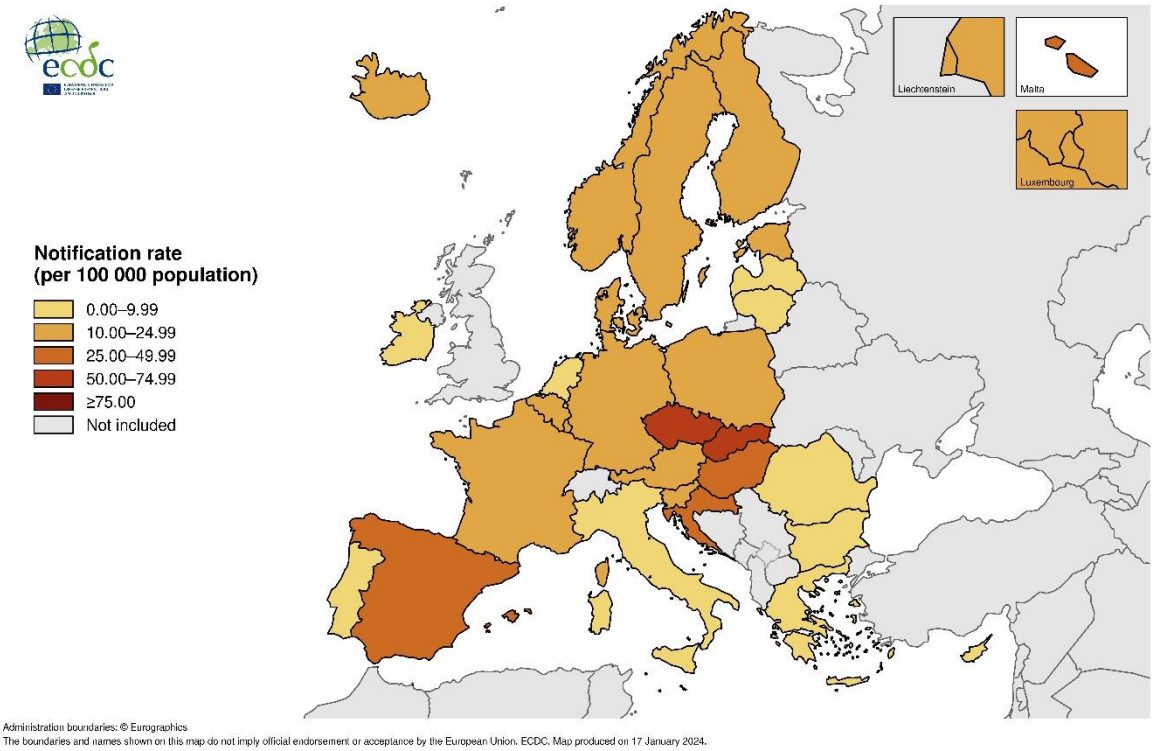
Table 1. Confirmed salmonellosis cases and rates per 100 000 population by country and year, EU/EEA, 2018–2022

Country	2018		2019		2020		2021		2022	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
Austria	1 538	17.4	1 866	21.1	817	9.2	993	11.1	1 192	13.3
Belgium	2 958	26.0	2 527	22.1	1 595	13.8	2 084	18	2 375	24.1
Bulgaria	586	8.3	594	8.5	187	2.7	241	3.5	310	4.5
Croatia	1 323	32.2	1 308	32.1	786	19.4	593	14.7	1 047	27.1
Cyprus	44	5.1	62	7.1	70	7.9	41	4.6	66	7.3
Czechia	10 901	102.7	13 009	122.2	10 516	98.3	9 894	92.5	7 563	71.9
Denmark	1 168	20.2	1 119	19.3	614	10.5	692	11.8	898	15.3
Estonia	314	23.8	150	11.3	91	6.8	112	8.4	134	10.1
Finland	1 431	26.0	1 175	21.3	516	9.3	474	8.6	666	12.0
France	8 936	27.8	8 935	27.7	7 071	21.9	9 315	28.7	11 162	16.4
Germany	13 293	16.1	13 494	16.3	8 664	10.4	8 144	9.8	9 064	10.9
Greece	640	6.0	643	6.0	381	3.6	284	2.7	640	6.1

Country	2018		2019		2020		2021		2022	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
Hungary	4 161	42.6	4 452	45.6	2 964	30.3	3 298	33.9	3 249	33.5
Iceland	63	18.1	50	14.0	32	8.8	53	14.4	42	11.2
Ireland	352	7.3	347	7.1	214	4.3	173	3.5	340	6.7
Italy	3 635	6.0	3 256	5.4	2 713	4.5	3 768	6.4	3 302	5.6
Latvia	409	21.1	438	22.8	296	15.5	218	11.5	90	4.8
Liechtenstein	NDR	NRC	NDR	NRC	NDR	NRC	7	17.9	5	12.7
Lithuania	779	27.7	736	26.3	419	15.0	281	10.1	234	8.3
Luxembourg	135	22.4	131	21.3	93	14.9	133	21.0	161	24.9
Malta	116	24.4	131	26.5	176	34.2	249	48.2	199	38.2
Netherlands	1 061	9.6	1 197	10.8	695	6.2	862	7.7	1 027	9.1
Norway	961	18.1	1 092	20.5	441	8.2	389	7.2	712	13.1
Poland	9 064	23.9	8 373	22.0	5 192	13.7	7 708	20.4	6 054	16.1
Portugal	302	2.9	432	4.2	262	2.5	361	3.5	412	4.0
Romania	1 410	7.2	1 383	7.1	408	2.1	518	2.7	1 010	5.3
Slovakia	6 791	124.8	4 992	91.6	3 385	62.0	4 439	81.3	3 669	67.5
Slovenia	274	13.3	362	17.4	214	10.2	185	8.8	384	18.2
Spain	8 730	NRC	5 087	NRC	3 526	NRC	6 168	17.8	8 832	25.5
Sweden	2 041	20.2	1 990	19.5	825	8.0	933	9.0	1 128	10.8
EU/EEA (30 countries)	**83 416**	**21.0**	**79 331**	**20.9**	**53 163**	**14.2**	**62 610**	**16.7**	**65 967**	**15.5**
United Kingdom	9 466	14.3	9 718	14.6	NDR	NRC	NA	NA	NA	NA
EU/EEA (31 countries)	**92 882**	**20.0**	**89 049**	**20.0**	**53 163**	**14.2**	**NA**	**NA**	**NA**	**NA**

Source: Country reports.
NDR: No data reported.
NRC: No rate calculated.
NA: Not applicable.
No data for 2020-2022 were reported by the United Kingdom, due to its withdrawal from the EU on 31 January 2020.

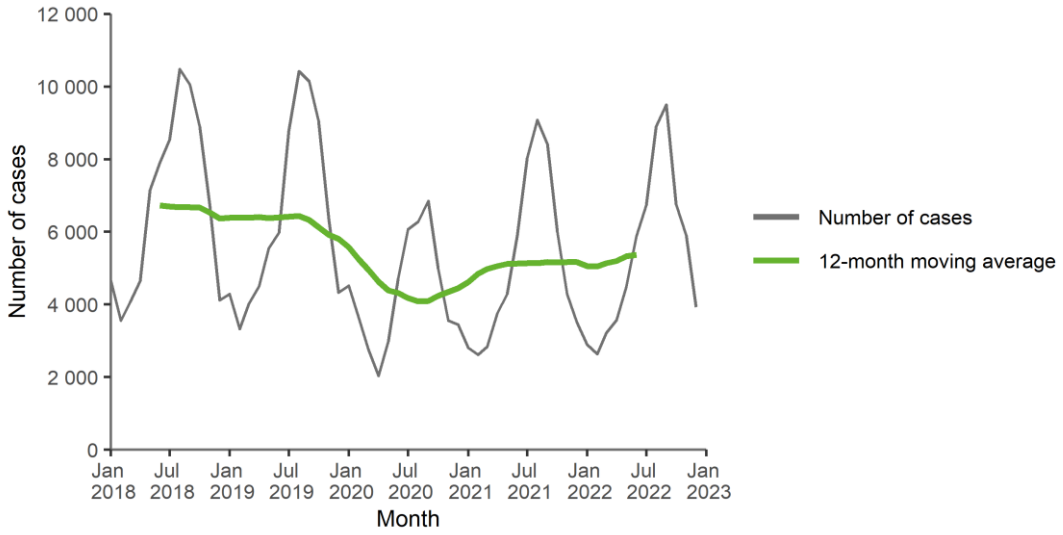
Figure 1. Confirmed salmonellosis cases per 100 000 population by country, EU/EEA, 2022



Source: Country reports

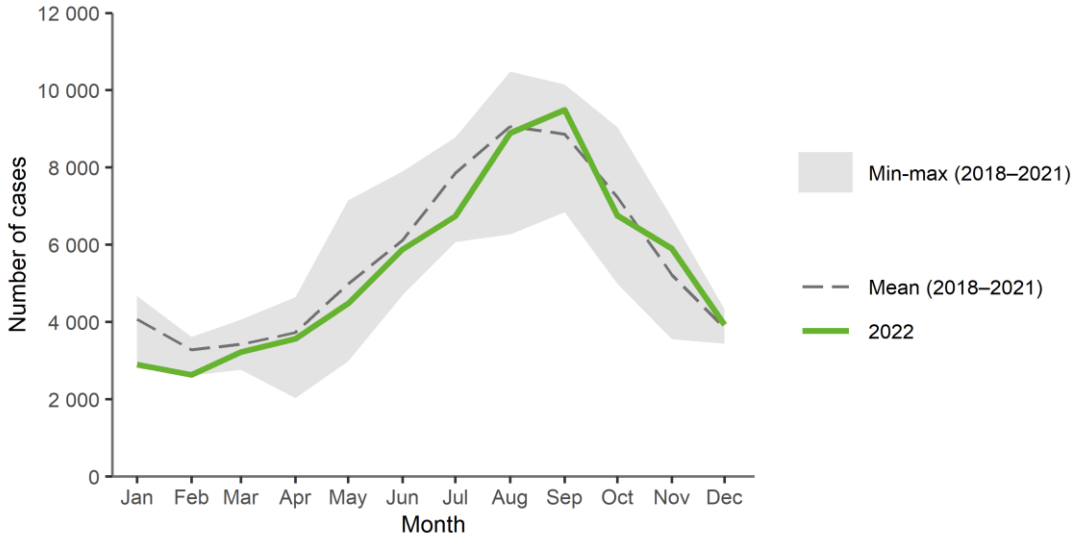
Salmonellosis cases follow a clear seasonal pattern, with a peak in July to September (Figures 2 and 3). The effect of the COVID-19 pandemic on the number of reported cases of salmonellosis in the EU/EEA was evident with a marked drop in cases in 2020. However, the number of cases increased in 2021 and increased further in 2022, although numbers were still lower than those observed in 2018–2019. While no increasing or decreasing trend in salmonellosis cases was observed at the EU level in 2018-2022, five countries observed a significant ($p<0.05$) decreasing trend (Denmark, Germany, Finland, Latvia, and Sweden). No Member State reported a significant increasing trend.

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



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, Sweden.

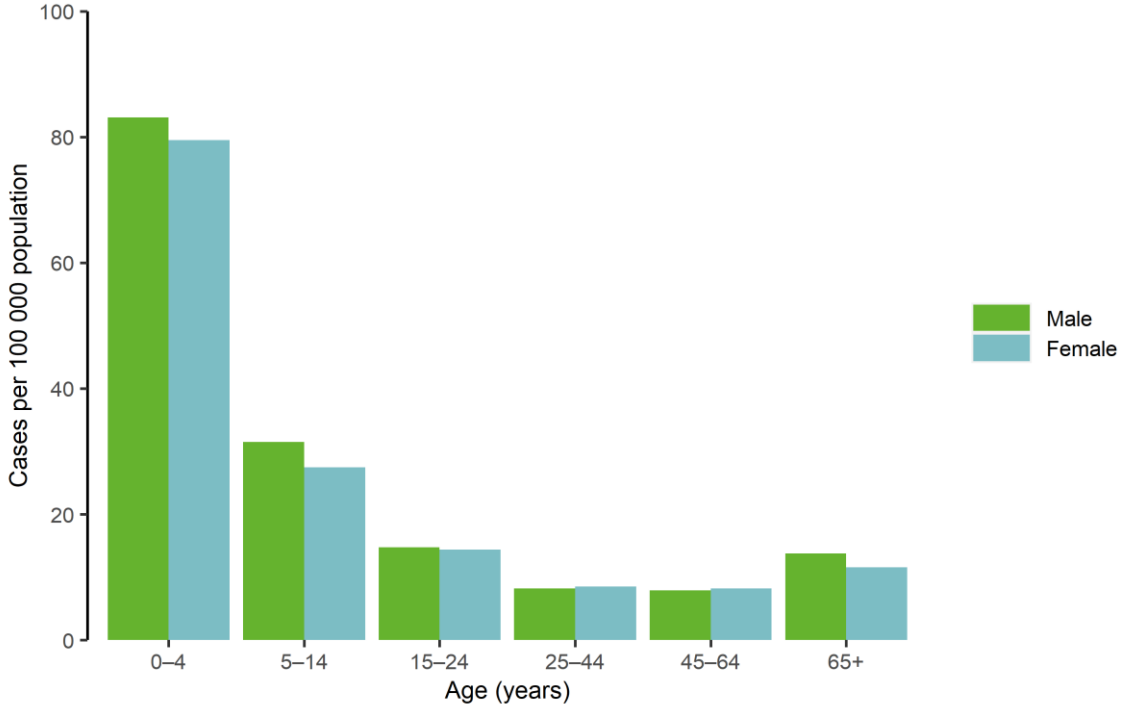
Figure 3. Confirmed salmonellosis cases by month, EU/EEA, 2022 and 2018–2021



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, Sweden.

There was no difference in salmonellosis notification rates by gender in the EU/EEA (male-female ratio 1:1). By age, the highest notification rate was observed among young children (0–4 years), with 81.5 cases per 100 000 population (Figure 4). The rate in young children was three times higher than in older children, and 10 times higher than in adults (25–64 years). The countries with the largest difference in the rates between young children in the 0–4-year age group and adults in the 25–44-year age group by increasing order of magnitude were: Cyprus, Italy, Greece, Bulgaria, Portugal and Poland. In these countries the rates were 25–40 times higher in children than in adults.

Figure 4. Confirmed salmonellosis 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, Sweden.

Out of 44 680 cases with known travel history, 4 617 (10.3%) were reported as travel associated. This was an increase from 3.5% in 2021 which was the year of the lowest rate of travel-associated cases ever reported to TESSy. Among countries providing travel status for at least half of their cases, the highest proportion of travel-related cases was observed in Iceland (62.9%), Finland (50.7%) and Norway (43.8%).

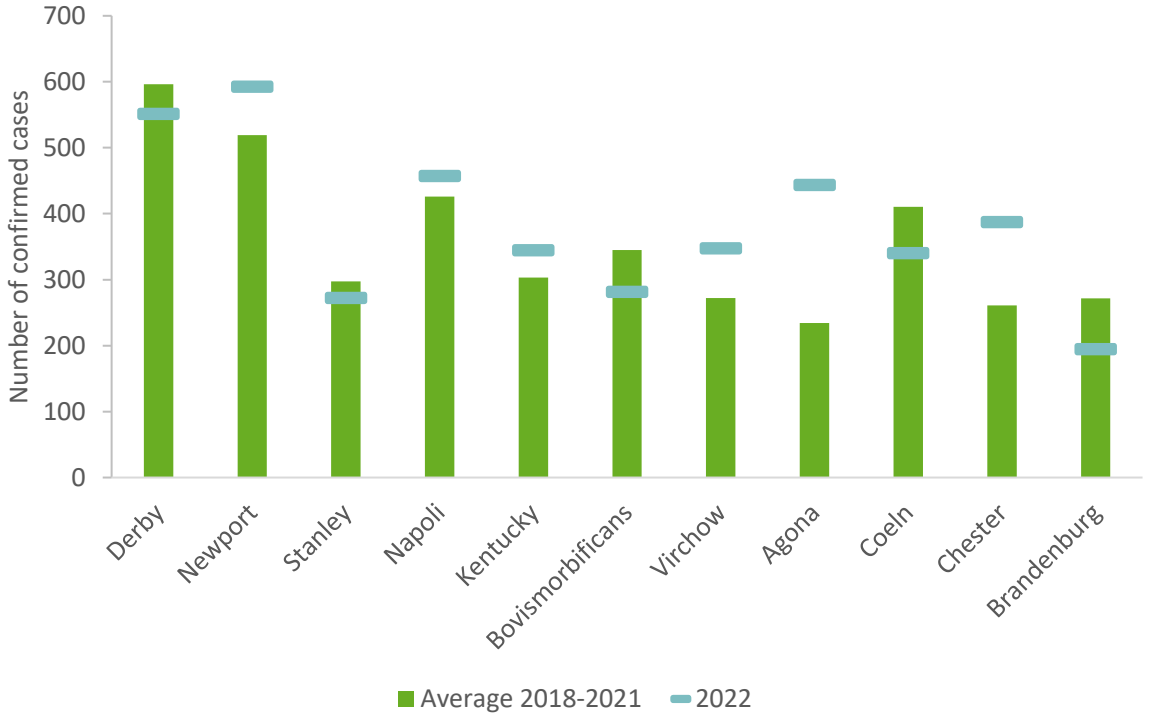
Among the 4 391 travel-associated cases with information on the probable country of infection, Türkiye, Egypt, Spain and Morocco were the most frequently reported travel destinations (accounting for 18.2%, 8.0%, 6.3% and 5.0% of travel-related cases, respectively).

Microbial surveillance

Serovars

Information on *Salmonella* serovars and serogroups was available for 83.1% of confirmed cases from EU/EEA countries. As in previous years, the four most commonly reported *Salmonella* serovars in 2022 were *S.* Enteritidis (48.9%), *S.* Typhimurium (10.6%), monophasic *S.* Typhimurium 1,4,[5],12:i:- (10.2%) and *S.* Infantis (2.2%). Except for monophasic *S.* Typhimurium, where 4% more cases were reported, these were all reported at lower levels in 2022 compared to the average number of cases reported in 2018-2021 (UK excluded),. The number of cases of the 5th–15th most common serovars in 2022 are presented in Figure 5. During the last five years (2018–2022), 108 different serovars were identified in over 100 cases each. Twenty-six of these serovars had their highest case numbers reported in 2022. For ten of these (Agona, Ajiobo, Ball, Blockley, Chester, Mbandaka, Pomona, Senftenberg, Schwarzengrund, *S. enterica* subsp. II (*salamae*)) multi-country or national outbreaks were reported in the European surveillance portal for infectious diseases – EpiPulse, or in national reports (see the section, 'Outbreaks and other threats'). In comparison, for the serovars with more than 100 cases in 2018–2022, seven serovars were reported at their lowest level in 2022.

Figure 5. Number of confirmed salmonellosis cases for the 5th-15th most common serovars in 2022 and comparison with the average during 2018-2021, EU/EEA



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, Sweden.

Antimicrobial resistance

Note that the analysis in this section was done using epidemiological cut-off values (ECOFFs) and thus describes microbiological/acquired resistance which does not take antimicrobial dosing into account. The clinical resistance is often lower.

Antimicrobial resistance was commonly observed in *Salmonella* isolates from humans in 2022 with multidrug resistance in 22.1% of the isolates (resistance to at least three of the nine monitored antimicrobial classes). Among the investigated serovars, multidrug resistance was most common in monophasic *S.* Typhimurium (68.2%), *S.* Kentucky (63.7%) and *S.* Infantis (49.7%). Resistance to the critically important antimicrobial classes for treatment was 18.9% to fluoroquinolones and 1.2-1.4% to third-generation cephalosporins, however, only a small fraction (0.9%) of the isolates were resistant to both. The proportion of isolates resistant to fluoroquinolones increased significantly in 10 out of 26 countries in the period 2018–2022. This was particularly visible in *S.* Enteritidis (10/24 countries), but also in *S.* Typhimurium (6/23 countries) and in monophasic *S.* Typhimurium (5/16 countries). Statistically significant decreasing trends were observed in resistance to ampicillin and tetracycline in twelve and eleven EU/EEA countries, respectively. For ampicillin, the decrease was most evident in *S.* Typhimurium (9/23 countries) and *S.* Enteritidis (6/24 countries), and for tetracycline, in *S.* Typhimurium (8/23 countries). The proportion of extended-spectrum β-lactamase (ESBL)-producing *Salmonella* isolates was at a low but stable level in 2018–2022 (identified in 0.6-0.9% of tested isolates).

The clones of multidrug resistant and ESBL-producing *Salmonella* that have been under special observation at the EU-level in the last years increased again in 2022 after a decline in reported cases in 2020-2021. Two countries reported 23 domestic cases, or cases without information on travel status, with *S.* Infantis carrying *bla*$_{\text{CTX-M-1}}$ of which Italy accounted for 22 cases; four countries reported eleven cases of *S.* Infantis with *bla*$_{\text{CTX-M-65}}$, either without information on travel status or with reported travel (one to South America and one to Southeast Asia); and five countries reported fifteen cases of *S.* Kentucky with *bla*$_{\text{CTX-M-14b}}$ (new designation *bla*$_{\text{CTX-M-243}}$), of which only one was reported to be travel associated (to North Africa). The majority of *S.* Kentucky *bla*$_{\text{CTX-M-14b/CTX-M-243}}$), cases were related to a hospital outbreak in Sweden where accidental transmission occurred via a contaminated gastroscopic instrument [4]. Five carbapenem-resistant isolates were reported by three countries in 2022, of which three cases of *S.* Haifa with *bla*$_{\text{OXA-48-like}}$ in Malta belonged to the same cluster, with the only common denominator being they were admitted to the same healthcare facility (R. Abela, Mater Dei Hospital, Malta, personal communication 21 August 2023). Levels of azithromycin resistance were low (<1%).

Outbreaks and other threats

In 2022, 39 outbreaks with *Salmonella* infections were reported in EpiPulse. These were launched by twelve EU/EEA countries (32 outbreaks) and two non-EU countries (the UK and the United States) (seven outbreaks). Most outbreaks were reported on *S.* Enteritidis (eight), monophasic *S.* Typhimurium (seven) and *S.* Typhimurium (six). Twenty-four outbreaks were multi-country, and two resulted in a joint ECDC-EFSA Rapid Outbreak Assessment in 2022, while two outbreaks with peaks in 2022 were reported and subsequently identified as multi-country (including rapid outbreak assessments) in 2023.

The largest multi-country outbreak detected in the EU/EEA in 2022 was linked to the consumption of chocolate contaminated with *S.* Typhimurium ST34. The outbreak was first reported by the UK in February and then grew in numbers each week. It mostly affected children below 10 years of age, and some cases had severe clinical symptoms like bloody diarrhoea. About 40% of cases were hospitalised. Based on epidemiological and microbiological investigations, specific chocolate products from a Belgian chocolate factory were identified as likely vehicles of infection. The factory was closed in April and product recalls were launched globally. As a result of the control measures, the number of new cases declined rapidly [5]. As of 15 July 2022, when the last epidemiological update was made, 455 laboratory confirmed cases had been identified in 17 countries globally, including 401 cases in 13 EU/EEA countries and the UK [6, 7]. As cases were identified using WGS, a method not routinely performed in all countries, the true number of cases was most likely higher. Two different *S.* Typhimurium strains were identified in the outbreak. The one which caused the majority of cases was multidrug resistant to seven antimicrobial classes and resistant to two types of disinfectants, but remained susceptible to antimicrobials used in the treatment of salmonellosis.

A cross-border outbreak of *S.* Mbandaka ST413 affecting seven EU/EEA countries, the UK and Israel with 196 cases linked by WGS, was first reported by the UK in May 2022. The first cases in this cluster fell ill in September 2021. Nineteen cases were hospitalised, five cases had septicaemia and one case died. Based on case interviews, ready-to-eat (RTE) chicken products and/or fresh chicken meat were the likely vehicles of infection. As several of the RTE products consumed had very similar names, it was not possible to identify with certainty the brand and producer. The epidemiological data and microbiological evidence indicated there were several active sources through different food distribution chains, with a likely common source higher up in the chicken supply chain [8].

A multi-country outbreak of *S.* Senftenberg ST14 infections possibly linked to cherry-like tomatoes was detected in 2023, with the first cases falling ill in August 2022. The outbreak involved 92 cases in eleven EU/EEA countries, the UK and the United States. Seventy percent of the cases were female, and one case died. Most cases were reported between October 2022 and March 2023, with a decline in the number of countries with exposure after December 2022. In three of the affected countries, case interviews identified cherry-like tomatoes as the most common food exposure among cases [9].

A persistent cross-border outbreak of *S.* Virchow ST16 was identified in 2023 with a peak in cases in the last quarter of 2022, although the first cases were reported in2017. The outbreak affected at least five EU/EEA countries, the UK and the United States with a total of 210 cases identified via WGS. France accounted for more than half of the cases. A majority of cases were linked to local restaurants serving chicken kebab meat [10].

A cross-border outbreak of *S.* Agona involving more than 100 cases from three EU/EEA countries and the UK was identified in November 2022. Extensive investigations, including case-control studies, in Norway, the most affected country, concluded that cucumbers from another EU country was the most probable source [11].

Among the national salmonellosis outbreaks reported to EpiPulse, the largest was detected in Slovenia where more than 130 cases of *S.* Enteritidis were identified in a point source outbreak in November 2022. Steak tartare from a specific producer was eventually identified as the source and was confirmed by matching food isolates [12].

Suspected or confirmed sources among the other outbreaks detected in 2022 were e.g. minced meat, contact with small turtles, kebab meat, watermelons [13], and tahini. However, in several outbreaks no source could be identified or only a more general exposure was identified e.g. eating in takeaway restaurants or travel to specific destinations.

Other outbreaks reported to EpiPulse in 2022 involving serovars that observed a peak in 2022 (see section 'Serovars' above) were: *S.* Ajiobo – a national outbreak linked to goat cheese milk, *S.* Ball – a multi-country outbreak with no source confirmed but undercooked hamburgers suspected, *S.* Blockley – a national outbreak with no source identified, *S.* Pomona – a national outbreak with no source identified, *S.* Schwarzengrund – a multi-country outbreak with imported black pepper as the suspected source, *S. enterica* subsp. II (salamae) – a national outbreak with animal contact as the suspected source.

The increase in cases of *S.* Chester presented in Figure 5 was mainly attributed to Germany, where an outbreak of 40 cases linked to cut spring onions was identified, [14].

Among the food-borne outbreaks reported to the European Food Safety Agency (EFSA) in 2022, *Salmonella* accounted for the largest proportion (17.6%) as in previous years [15]. The number of outbreaks caused by *Salmonella* increased by 31.2% compared with 2021, gradually returning to pre-pandemic levels. *S*. Enteritidis accounted for 395 of 513 (77.0%) *Salmonella* outbreaks with strong evidence, followed by *S*. Typhimurium and monophasic *S*. Typhimurium, with a large increase observed in the latter due to each country reporting on their own part of the large outbreak related to chocolate. The most frequently implicated food vehicles in strong-evidence salmonellosis food-borne outbreaks in 2022 were, 'eggs and egg products', followed by 'mixed foods', 'pig meat and products thereof', 'chocolate', 'meat and meat products' and 'broiler meat and products thereof' [16]. The most common setting of strong evidence *Salmonella* outbreaks was domestic premises (94 outbreaks) followed by restaurants, pubs, street vendors, takeaways etc. (48 outbreaks).

Discussion

Salmonellosis remains the second most common food-borne infection in the EU/EEA. A stable notification rate of salmonellosis was observed at the EU/EEA level from 2015 to 2019, followed by a significant drop in cases in 2020, as a result of the COVID-19 pandemic. However, in 2021 cases started to rise again as COVID-19 restrictions were lifted. In 2022, cases continued to increase but were still below pre-pandemic levels.

Notification rates for salmonellosis in humans varies between EU/EEA countries, reflecting variations in, for example, quality, coverage and disease-severity focus of the surveillance systems, practices in sampling and testing of patients, prevalence of *Salmonella* in the food-producing animal population, origin of food imported from other countries, differences in food-consumption practises, and the proportion of cases related to travel. Compared to 2021, when the proportion of travel-related cases was the lowest ever reported to TESSy, travel-related cases increased to 10.2% in 2022.

The fact that the salmonellosis rate in young children was ten times higher compared with adults may be explained by a higher proportion of symptomatic infections among young children, an increased likelihood of parents taking children to see a doctor when sick, and increased likelihood of doctors taking samples. Certain countries with very large differences between the rates of young children and adults also reported high proportions of hospitalised cases. This indicates that surveillance systems in those countries may mainly capture the most severe infections.

Salmonella is the most common cause in foodborne outbreaks reported to ECDC via EpiPulse and to EFSA in the foodborne outbreak reporting. Eggs and egg products remain the most common source in these outbreaks. In 2021, an increase in the number of outbreaks related to vegetables and fruit was recorded. In 2022, these were less common in reporting to EFSA, although several multi-country or national outbreaks related to vegetables or fruit were identified in EpiPulse. The largest *Salmonella* outbreak detected in the EU in 2022 was caused by chocolate. Thanks to rapid investigations and action by authorities in the countries and at EU level, the source of the outbreak could be identified and communicated before Easter when the consumption of these products among children was expected to increase considerably. This very likely prevented many additional infections.

Mild infections with *Salmonella* should be treated with fluid and electrolyte replacement, and not with antimicrobials. Some infections might however become more severe. In 2.4% of cases reported to the EU/EEA in 2022, the infection had resulted in bacteraemia. Fluoroquinolones and macrolides (azithromycin) are the primary treatment for severe infections in adults (for children, cephalosporins would be used instead of fluoroquinolones). In case of invasive infections, intravenous cephalosporins are recommended [17]. Fluoroquinolone resistance in non-typhoidal *Salmonella* subspecies. from humans have increased in the last few years in the EU/EEA, mostly observed in *S*. Enteritidis, a serovar mainly associated with eggs and poultry, but more recently also in *S*. Typhimurium and monophasic *S*. Typhimurium, more commonly associated with pigs. In 2020, high to very high resistance to fluoroquinolones was observed in isolates recovered from broilers, fattening turkeys and poultry carcasses/meat [18]. Resistance to third-generation cephalosporins and macrolides remains low in isolates from both humans and poultry.

Compared to previous years, a large proportion of the outbreaks reported to EpiPulse (24/39) were identified as multi-country (cases in at least two countries). This can be attributed to the increased use of WGS in EU/EEA countries. The benefits WGS in facilitating the identification of linked cases in different countries and suspected food sources is promoted by ECDC, PulseNet International and World Health Organization (WHO) [19, 20]. The ECDC and EFSA One Health WGS system which was fully implemented in July 2022 [21] has already proven to be very useful in identifying matches between food isolates and those from cases in foodborne outbreaks.

With the increasing use of WGS as the method of choice for serotype determination and cluster analysis in many EU/EEA countries, resistance determinants could also be derived from WGS data, specifically for countries with limited data from phenotypic testing. The methodology also has the benefit of allowing harmonised data analysis and interpretation between both countries and sectors (for example, the food sector). It could be an efficient tool for AMR surveillance within the EU/EEA, not the least for the monitoring of emerging antimicrobial resistances of relevance to public health. For this reason, ECDC implemented centralised analysis of resistance determinants from sequencing data, which was in place for the data call in 2023. Two countries used this facility in 2023.

Public health implications

The rates of salmonellosis vary between EU/EEA countries, reflecting differences in prevalence in food, and animals used for food production, animal and food trade between countries, the proportion of travel-associated cases, and the quality and coverage of surveillance systems.

Eggs and egg products continue to be the highest risk foods in *Salmonella* outbreaks [15], although several larger outbreaks from non-animal food sources were identified in 2022. Proper *Salmonella*-control measures at the primary production level and sufficient laboratory capacity are prerequisites to reduce *Salmonella* prevalence in food-producing animals. Cross-sectorial collaboration is also key to successful identification and control of sources in foodborne outbreaks, and for future prevention of new cases.

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