SURVEILLANCE REPORT

Salmonellosis

Annual Epidemiological Report for 2019

Key facts

- Salmonellosis is the second most commonly reported gastrointestinal infection, and an important cause of food-borne outbreaks in the EU/EEA.
- In 2019, 89 066 laboratory-confirmed cases of salmonellosis were reported, out of which 139 were fatal.
- The EU/EEA notification rate was 20.0 cases per 100 000 population.
- Salmonellosis notification rates have stabilised in the last seven years after a long period that was marked by a declining trend.
- Young children (0–4 years) had the highest notification rate with 93.3 cases per 100 000 population, eight times higher than in adults (25–64 years).

Introduction

Enteric infections due to *Salmonella* are generally referred to by the term 'salmonellosis' when they are caused by *Salmonella* species other than *Salmonella* Typhi and *Salmonella* Paratyphi. Various animals (especially poultry, pigs, cattle and reptiles) can be reservoirs for *Salmonella*. Humans generally become infected by eating 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.

Methods

This report is based on data for 2019, retrieved from The European Surveillance System (TESSy) on 5 October 2020. 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].

In 2019, 30 EU/EEA countries reported data on salmonellosis. Twenty-six countries reported data using either the 2008 or 2012 EU case definitions for salmonellosis, which are essentially the same.

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

Stockholm, January 2023

Notification of non-typhoidal salmonellosis is mandatory in most of the EU Member States as well as Iceland and Norway. In five Member States, reporting is either voluntary (Belgium, France, Luxembourg and the Netherlands) or based on another system (the United Kingdom[1]). While cases of food poisoning are required to be reported in the United Kingdom, isolation and specification of the organism is voluntary. The surveillance systems for salmonellosis have national coverage in all Member States except in three (France, the Netherlands and Spain). The population coverage in 2019 is estimated to be 48% in France and 64% in the Netherlands. The variation in coverage was taken into consideration when calculating the national notification rates. No information on estimated coverage was provided by Spain, and thus no notification rates were calculated. All countries reported case-based data except Bulgaria, which reported aggregated data. Both reporting formats were included to calculate number of cases, notification rates, disease trends, and age and gender distributions.

In addition to case-based surveillance, ECDC coordinated molecular typing enhanced surveillance of salmonellosis through isolate-based and event-based data collection in 2019. A typing-based multi-country cluster of *Salmonella* was defined as at least two different countries reporting at least one isolate each with matching multiple-locus variable-number tandem repeat analysis (MLVA) profiles for *Salmonella* Typhimurium and *Salmonella* Enteritidis or matching pulsotypes for other *Salmonella* serotypes (*Xba*I restriction enzyme), with the reports a maximum of eight weeks apart. Furthermore, whole genome sequencing (WGS) data were collected ad hoc to support ongoing multi-country investigations.

Epidemiology

For 2019, 30 countries reported 91 233 cases, of which 89 066 were classified as confirmed (Table 1). The notification rate per 100 000 population was 20.0, the same as that of 2018. Out of 63 260 cases with known outcome, 139 were reported to have died, accounting for a case fatality of 0.2%.

The highest notification rates were reported by Czechia (122.2 cases per 100 000 population) and Slovakia (91.6), followed by Hungary (45.6) and Croatia (32.1; Table 1, Figure 1). The lowest rates were reported by Portugal (4.2 cases per 100 000 population). The largest increases in rates from 2018–2019 were observed in Portugal (43%), Cyprus (41%) and Slovenia (32%).

The number of reported cases of salmonellosis in the EU/EEA has been stable from 2015−2019 (Figure 2). Finland was the only Member State reporting a significant decreasing trend ($p < 0.01$) in the last five years (2015–2019). An increasing trend was not observed in any Member State in 2015–2019.

A clear seasonal distribution of salmonellosis cases can be observed by month of reporting, with peaks in August and September (Figures 2, 3).

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

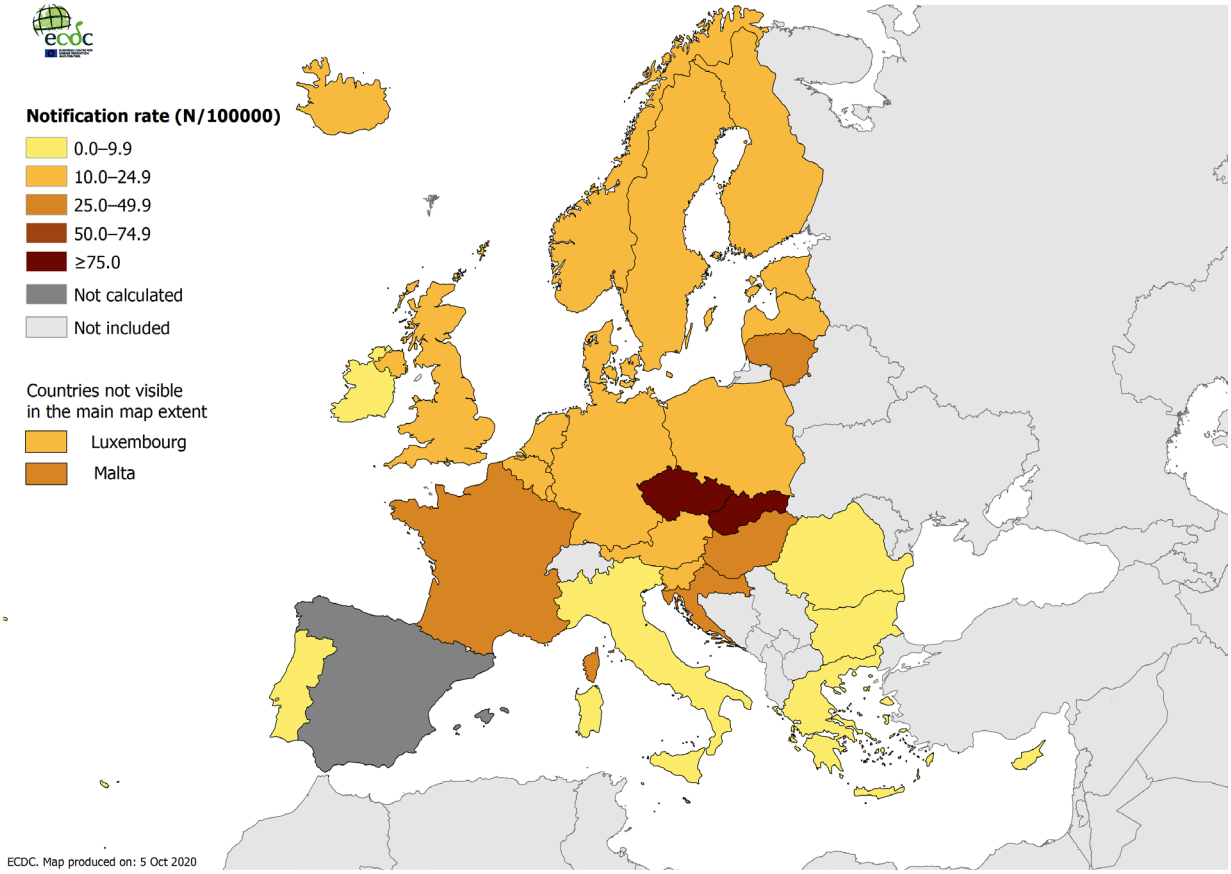
Country	2015		2016		2017		2018		2019		
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate	ASR
Austria	1 544	18.0	1 415	16.3	1 667	19.0	1 538	17.4	1 866	21.1	22.0
Belgium	3 050	27.1	2 699	23.9	2 298	20.2	2 958	26.0	2 527	22.1	21.2
Bulgaria	1 076	14.9	718	10.0	796	11.2	586	8.3	594	8.5	9.0
Croatia	1 593	37.7	1 240	29.6	1 242	29.9	1 323	32.2	1 308	32.1	33.9
Cyprus	65	7.7	77	9.1	59	6.9	44	5.1	62	7.1	6.5
Czechia	12 408	117.7	11 610	110.0	11 473	108.5	10 901	102.7	13 009	122.2	124.2
Denmark	925	16.3	1 081	18.9	1 067	18.6	1 168	20.2	1 119	19.3	18.9
Estonia	112	8.5	351	26.7	265	20.1	314	23.8	150	11.3	11.5
Finland	1 650	30.2	1 512	27.6	1 535	27.9	1 431	26.0	1 175	21.3	22.2
France	10 305	32.3	8 876	27.7	7 993	24.9	8 936	27.8	8 935	27.7	26.9
Germany	13 667	16.8	12 858	15.6	14 051	17.0	13 293	16.1	13 495	16.3	17.0

[1] The United Kingdom (UK) was a Member State of the European Union (EU) at the time of collating the data for this report. The UK withdrew from the EU on 31 January 2020.

Country	2015		2016		2017		2018		2019		
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate	ASR
Greece	466	4.3	735	6.8	672	6.2	640	6.0	643	6.0	6.3
Hungary	4 894	49.7	4 722	48.0	3 922	40.0	4 161	42.6	4 452	45.6	46.6
Iceland	44	13.4	39	11.7	64	18.9	63	18.1	50	14.0	13.9
Ireland	270	5.8	299	6.3	379	7.9	352	7.3	347	7.1	7.0
Italy	3 825	6.3	4 134	6.8	3 347	5.5	3 635	6.0	3 256	5.4	5.9
Latvia	380	19.1	454	23.1	225	11.5	409	21.1	438	22.8	22.8
Liechtenstein	.	.	.	.	.	.	.	.	.	.	.
Lithuania	1 082	37.0	1 076	37.3	1 005	35.3	779	27.7	736	26.3	26.3
Luxembourg	106	18.8	108	18.7	118	20.0	135	22.4	131	21.3	21.5
Malta	126	28.7	162	36.0	107	23.2	116	24.4	131	26.5	26.7
Netherlands	974	9.0	1 150	10.6	954	8.7	1 061	9.6	1 197	10.8	10.8
Norway	928	18.0	865	16.6	992	18.9	961	18.1	1 092	20.5	20.5
Poland	8 245	21.7	9 718	25.6	8 921	23.5	9 064	23.9	8 373	22.0	22.7
Portugal	325	3.1	376	3.6	462	4.5	302	2.9	432	4.2	4.7
Romania	1 330	6.7	1 479	7.5	1 154	5.9	1 410	7.2	1 383	7.1	7.2
Slovakia	4 841	89.3	5 299	97.7	5 789	106.5	6 791	124.8	4 992	91.6	93.0
Slovenia	401	19.4	311	15.1	275	13.3	274	13.3	362	17.4	17.9
Spain	9 015	-	9 818	-	9 426	-	8 730	-	5 103	-	-
Sweden	2 312	23.7	2 247	22.8	2 280	22.8	2 041	20.2	1 990	19.5	19.3
United Kingdom	9 490	14.6	9 900	15.1	10 105	15.3	9 466	14.3	9 718	14.6	14.4
EU/EEA	**95 449**	**21.0**	**95 329**	**20.4**	**92 643**	**19.6**	**92 882**	**20.0**	**89 066**	**20.0**	**20.2**

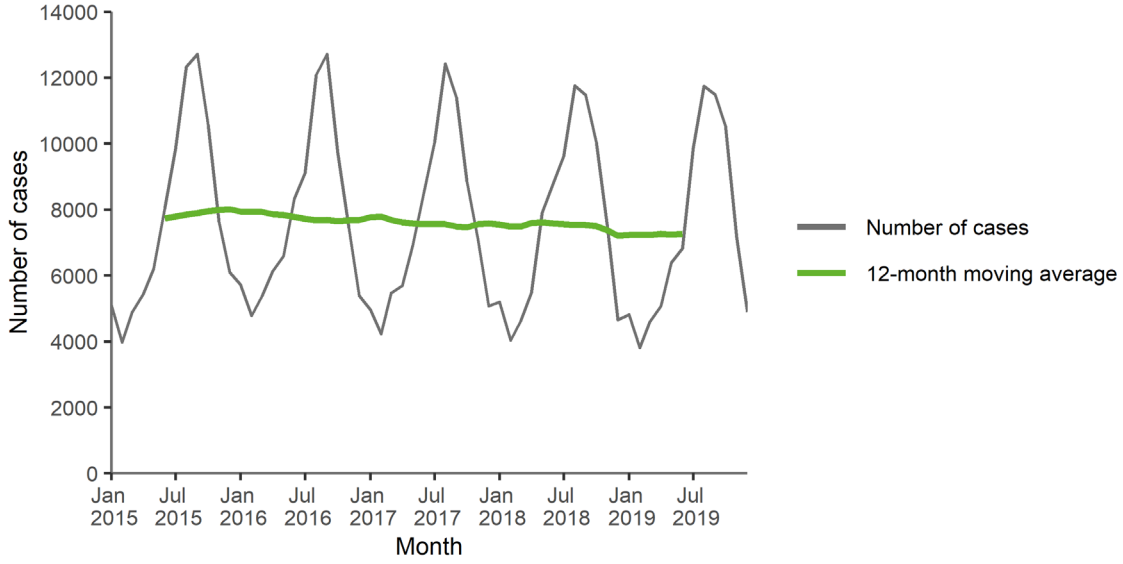
Source: country reports
ASR: age-standardised rate
.: no data reported
-: no rate calculated

Figure 1. Distribution of confirmed salmonellosis cases per 100 000 population by country, EU/EEA, 2019



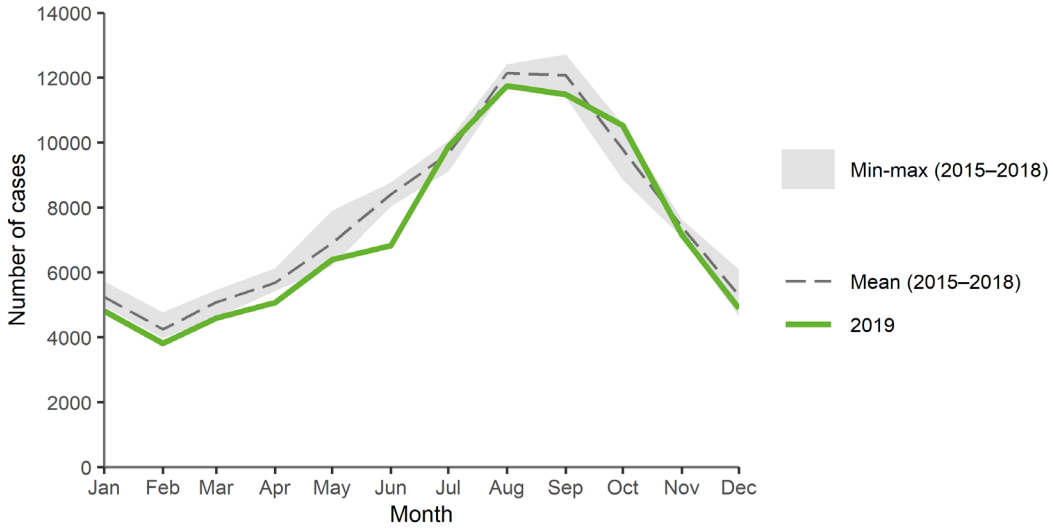
Source: Country reports from Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, the United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

Figure 2. Distribution of confirmed salmonellosis 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, the United Kingdom.

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

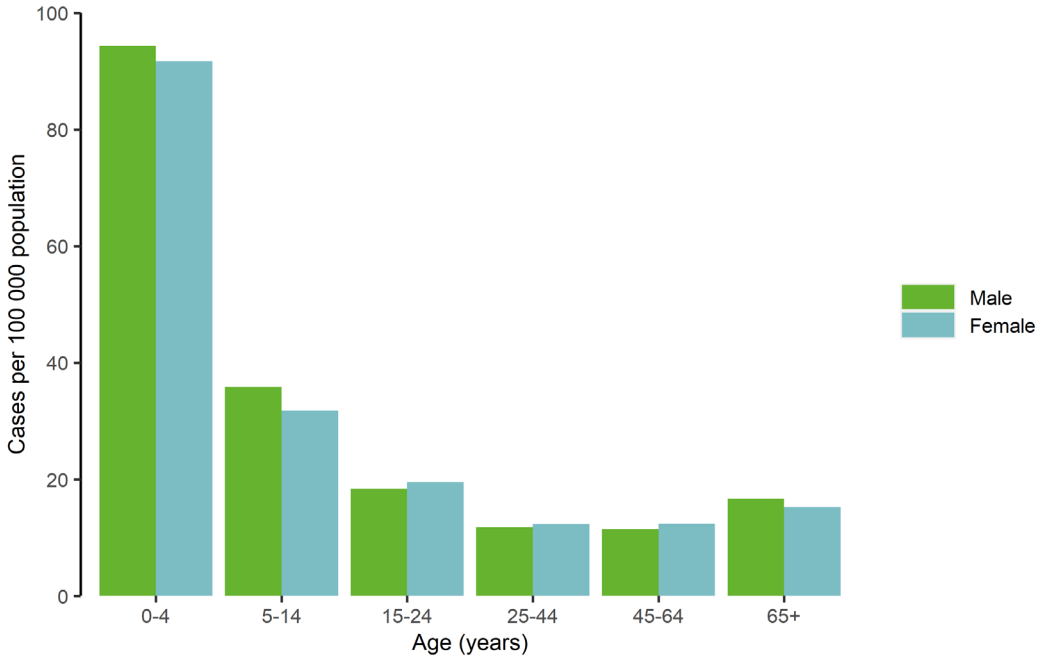


Source: Country reports from Austria, Belgium, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, the United Kingdom.

The highest notification rate of salmonellosis was observed among young children (0–4 years), with 93.3 cases per 100 000 population (Figure 4). The rate in young children was almost three times higher than in older children, and eight times higher than in adults (25–64 years). In certain countries, the rate among young children was about 25–50 times higher than the rate in adults (25–44 years): Italy (27 times), Cyprus (28 times), Poland (28 times), Greece (30 times), and Portugal (44 times). The proportion of hospitalisation varied from 23.5% to 96%. In Cyprus and Greece, the proportions of hospitalised cases were very high (96% and 85% respectively), while salmonellosis notification rates were low (<10 per 100 000 population).

There were no differences in the notification rates between males and females overall.

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



Source: Country reports from Austria, Belgium, 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, the United Kingdom.

Out of 67 682 cases with known travel history, 10 754 (16%) were reported as travel-associated. The proportions of domestic and travel-associated cases varied between countries, with the highest proportions of domestic cases, ranging from 95–100%, reported in Croatia, Czechia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Slovakia and Spain. The highest proportions of travel-associated cases, ranging from 64–79%, were reported by four Nordic countries: Denmark, Finland, Iceland and Norway. Among the 8 526 travel-associated cases with known information on probable country of infection, Türkiye, Thailand, Egypt, Spain and India were the most frequently reported travel destinations (12%, 8%, 8%, 5% and 5% respectively).

Information on *Salmonella* serovars was available for 90.2% of the total number of confirmed cases from 27 Member States (Bulgaria did not report case-based serovar data), Iceland and Norway. As in previous years, the three most commonly reported *Salmonella* serovars in 2019 were: *S*. Enteritidis (50.3%), *S*. Typhimurium (11.9%) and monophasic *S*. Typhimurium (1,4,[5],12:i:-) (8.2%). These represented 70.3% of the 79 300 confirmed human cases with known serovars in 2019. The proportion of these three serovars was at the same level as in 2017 and 2018. This proportion also equalled that of *S*. Infantis, which was the fourth most commonly reported serovar. The fifth most commonly reported serovar, *S*. Newport decreased by 20.0% compared with 2018. Serovar *S*. Mikawasima increased by 92.1% and 137.1% compared with 2018 and 2017, respectively. In 2019, there was a multi-country outbreak of *S*. Mikawasima (see the section, 'Outbreaks and other threats'). This serovar became one of the 20 most commonly reported serovars in 2019, replacing serovar *S.* Brandenburg.

S. Enteritidis infections that were acquired within the EU have been stable in 2015–2019, after several years of an increasing trend. *S*. Enteritidis infections are predominantly acquired in the EU, more frequently than other serovars. A seasonal trend, mimicking the general salmonellosis seasonal trend (Figure 2) was observed for confirmed *S*. Enteritidis infections acquired in the EU in 2010–2019, with more cases reported during the late summer months.

Molecular typing enhanced surveillance

In 2019, four countries submitted *Salmonella* MLVA typing data, prompting 24 multi-country molecular typing cluster investigations (MTCIs).

The three most commonly reported MLVA profiles were 3-11-10-NA-211, 3-14-8-NA-211 and 3-14-11-NA-211 for *S*. Typhimurium, and 2-10-7-3-2, 3-9-5-4-1 and 2-11-7-3-2 for *S.* Enteritidis.

In addition, 18 countries provided whole genome sequencing (WGS) data to support ongoing multi-country outbreak investigations.

Outbreaks and other threats

An outbreak of *Salmonella* Poona linked to the consumption of infant formula based on rice proteins was identified in France [4, 5]. The symptom onset ranged between August 2018 to February 2019. As of March 2019, it affected infants and children in France (30 cases), Belgium (one case) and Luxembourg (one case). The suspected infant formula was produced in Spain. However, tests performed on implicated batches were all negative. This might have happened due to the challenging matrix of the formula, uneven contamination of *Salmonella*, and/or low levels of contamination. The products were recalled and withdrawn, and public health warnings issued. Salmonellosis outbreaks linked to powdered infant formula have also been previously reported by several countries with a variety of *Salmonella* serotypes. Following basic hygiene rules on preparation, handling and storage of infant formula could prevent infections. The outbreak also illustrates the strengths of a sensitive surveillance system where isolates are routinely typed by WGS.

Norway identified a cluster of the rare serotype, *Salmonella* Agbeni in February 2019 [6]. In total, 56 cases were identified between December 2018 to March 2019. Exotic dried fruits from a specific distributer were identified as the source for the outbreak, both via epidemiological investigation and outbreak strain identification. A specific dried fruit mix was voluntarily recalled from the market in March 2019 by the Norwegian distributor. The outbreak was characterised by unusual severe clinical presentations, where 21 of the 56 cases were hospitalised.

An outbreak of monophasic *Salmonella* Typhimurium sequence type (ST) 3478, was identified in Sweden in September 2019 [7]. In total, 82 geographically spread cases were identified in Sweden between August and October. The epidemiological curve showed a pattern of a point source outbreak with a short shelf-life food vehicle. Interviews and a case control study showed that small tomatoes were the likely vehicle for infection, with a strong epidemiological link. The outbreak strain had an unusual phenotypic feature. The strain lacked the characteristic black pigmentation on traditional growth agar medium (H2S-negative). All clinical microbiological laboratories in Sweden were alerted of the unusual pigmentation, as *Salmonella* colonies could otherwise go unnoticed.

Several EU/EEA countries have repeatedly reported a temporal trend of increases in cases infected with *Salmonella* Mikawasima in the latter part of the year, with a peak in reporting usually between September to December. No specific source has so far been identified for these events. However, it is likely that the vehicle is simultaneously distributed in different EU/EEA countries. In October 2019, an increase of *S.* Mikawasima cases were reported to the Epidemic Intelligence Information System (EPIS) platform of ECDC. As of November 2019, a total of 192 cases were reported: the UK (138 cases), Sweden (33 cases), France (18 cases), Denmark (two cases) and Ireland (one case). Portugal had also noted an increase in *S.* Mikawasima cases. This specific *S.* Mikawasima strain was not the same variant which had been identified in previous years [8, 9].

Salmonella accounted for 17.9% of all reported food-borne outbreaks in the EU during 2019 [10]. The vast majority (72.4%) of the salmonellosis food-borne outbreaks were caused by *S.* Enteritidis. The four most implicated food vehicles in strong-evidence salmonellosis food-borne outbreaks were, 'eggs and egg products', followed by 'bakery products', 'pig meat and products thereof' and 'mixed food', as in previous years.

Discussion

Salmonellosis remains the second most common zoonosis in humans in the EU/EEA. After a significant decrease in salmonellosis cases observed from 2004–2013, the incidence appears to have levelled off in the following years. In 2019, only one Member State (Finland) reported a decreasing trend in the last five years, whereas all other Member States reported stable, flat trends during 2015–2019.

Notification rates for salmonellosis in humans vary between Member States. This reflects variations in the quality, coverage and disease-severity focus of the surveillance systems, practices in sampling and testing, prevalence in the food-producing animal population, food and animal trade between Member States, and the proportion of travel-associated cases. Some of the countries reporting the lowest notification rates for salmonellosis had the highest proportions of hospitalisation, suggesting that the surveillance systems in these countries are focused on the most severe cases. This also underlines the variation in national surveillance systems.

The fact that the salmonellosis rate in young children is eight 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 on getting sick, and for doctors to take 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 might have mainly captured the most severe infections. The degree of under-ascertainment and under-reporting of salmonellosis in the EU/EEA is generally high and varies by country, as shown in a large European study on salmonellosis seroincidence [11]. Rather than correlating with the reported national incidence of *Salmonella* infections, seroincidence correlated with the prevalence data of *Salmonella* in laying hens, broilers and slaughter pigs. The prevalence data was assessed in EU baseline surveys by the European Food Safety Authority (EFSA). One output of this study was a seroincidence tool that can be used to estimate the frequency of exposure to *Salmonella*, which is much closer to the true incidence of salmonellosis in the population than the reported number of cases [12].

The decreasing trend of using MLVA or pulsed-field gel electrophoresis (PFGE) as typing-based methods to assess multi-country clusters and as tools in outbreak investigations continued in 2019. These typing methods are continuously being replaced by whole genome sequencing (WGS) in individual Member States. This is also reflected in the outbreak reports and the urgent inquiries in EPIS. The benefits of using WGS in facilitating the identification of linked cases in different countries and suspected food sources is promoted by ECDC, PulseNet International and the World Health Organization (WHO) [13, 14].

Antimicrobial resistance was commonly observed in *Salmonella* isolates from humans in 2019. However, only a smaller fraction was resistant to both the critically important antimicrobial classes: fluoroquinolones and third-generation cephalosporins [15]. Clones of multi-drug resistant and/or extended-spectrum β-lactamase (ESBL)-producing *Salmonella* are however of increasing concern, as these seem to be spreading across Europe.

Public health implications

The rates of non-typhoidal salmonellosis vary between EU/EEA countries, reflecting differences in prevalence in food and animals used for food production, animal trade between countries, the proportion of travel-associated cases, and the quality and coverage of surveillance systems. The previously decreasing trend of confirmed cases has stabilised since 2014. *S.* Enteritidis infections accounting for 50% of the reported serovars also stabilised in 2015–2019, after several years of an increasing trend, reflecting the dominance of this serovar in *Salmonella* infections in the EU/EEA.

Salmonella remains the most frequently detected agent in food-borne outbreaks. Eggs and egg products continue to be the highest risk foods in *Salmonella* outbreaks. Proper *Salmonella* control measures at the primary production level and sufficient laboratory capacity are prerequisites to reduce *Salmonella* prevalence in food-producing animals.

References

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

2. European Centre for Disease Prevention and Control (ECDC). Surveillance systems overview for 2019. Stockholm: ECDC; 2019. Available at: Surveillance systems overview for 2019 (europa.eu)

3. European Centre for Disease Prevention and Control (ECDC). Surveillance Atlas of Infectious Diseases. Stockholm: ECDC; 2019.
Available at: http://atlas.ecdc.europa.eu/public/index.aspx?Dataset=27&HealthTopic=46

4. European Centre for Disease Prevention and Control (ECDC) and European Food Safety Authority (EFSA). Joint rapid outbreak assessment: Multi-country outbreak of *Salmonella* Poona infections linked to consumption of infant formula. Stockholm, Parma: ECDC, EFSA; 12 March 2019.
Available at: https://www.ecdc.europa.eu/en/publications-data/rapid-outbreak-assessment-multi-country-outbreak-salmonella-poona-infections

5. Jones G, Pardos de la Gandara M, Herrera-Leon L, Herrera-Leon S, Varela Martinez C, Hureaux-Roy R, et al. Outbreak of *Salmonella enterica* serotype Poona in infants linked to persistent *Salmonella* contamination in an infant formula manufacturing facility, France, August 2018 to February 2019. Euro Surveill. 2019 March;24(13):1900161. Available at: https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2019.24.13.1900161

6. Johansen TB, Brandal LT, MacDonald E, Naseer U, Stefanoff P, Røed MH, et al. Exotic dried fruits caused *Salmonella* Agbeni outbreak with severe clinical presentation, Norway, December 2018 to March 2019. Euro Surveill. 2021 Apr; 26(14):2000221. Available at: https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2021.26.14.2000221

7. Colombe S, Jernberg C, Löf E, Angervall AL, Mellström-Dahlgren H, Dotevall L, et al. Outbreak of unusual H2S-negative monophasic *Salmonella* Typhimurium strain likely associated with small tomatoes, Sweden, August to October 2019. Euro Surveill. 2019 Nov; 24(47):1900643.
Available at: https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2019.24.47.1900643

8. Whitworth, J. *Salmonella* outbreak hits several countries; EU officials release few details. Seattle, Washington: Food Safety News; 8 November 2019.
Available at: https://www.foodsafetynews.com/2019/11/salmonella-outbreak-affects-several-eu-countries/

9. Folkhälsomyndigheten. *Salmonella* (Europa, September–November 2019) (*in Swedish*). 9 January 2020.
Available at: Salmonella (Europa, september-november 2019) — Folkhälsomyndigheten (folkhalsomyndigheten.se)

10. European Food Safety Authority (EFSA) and European Centre for Disease Prevention and Control (ECDC). The European Union One Health 2019 Zoonoses Report. EFSA Journal. 2021 Jan; 19(2):6406.
Available at: https://www.ecdc.europa.eu/sites/default/files/documents/zoonoses-EU-one-health-2019-report.pdf

11. Mølbak K, Simonsen J, Jørgensen CS, Krogfelt KA, Falkenhorst G, Ethelberg S, et al. Seroincidence of Human Infections With Nontyphoid *Salmonella* Compared With Data From Public Health Surveillance and Food Animals in 13 European Countries. Clin Infect Dis. 2014 Dec 1;59(11):1599-606.
Available at: https://academic.oup.com/cid/article/59/11/1599/412479

12. European Centre for Disease Prevention and Control (ECDC). Seroincidence calculator tool. Version 2.0.0. Stockholm: ECDC; 2018. Available at: http://ecdc.europa.eu/publications-data/seroincidence-calculator-tool

13. Nadon C, Van Walle I, Gerner-Smidt P, Campos J, Chinen I, Concepcion-Acevedo J, et al. PulseNet International: Vision for the implementation of whole genome sequencing (WGS) for global food-borne disease surveillance. Euro Surveill. 2017 Jun 8:22(23):30544.
Available at: http://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2017.22.23.30544

14. World Health Organization (WHO). Whole genome sequencing for foodborne disease surveillance: landscape paper. Geneva: WHO; 2018. Available at: https://www.who.int/publications/i/item/789241513869

15. European Food Safety Authority (EFSA) and European Centre for Disease Prevention and Control (ECDC), 2020. The European Union Summary Report on Antimicrobial Resistance in zoonotic and indicator bacteria from humans, animals and food in 2018/2019. EFSA Journal 2021;19(4):6490.
Available at: https://www.ecdc.europa.eu/en/publications-data/EU-summary-report-antimicrobial-resistance-zoonoses-2018-2019