SURVEILLANCE REPORT

Salmonellosis

Annual Epidemiological Report for 2020

Key facts

- Salmonellosis is the second most commonly reported gastrointestinal infection, and an important cause of food-borne outbreaks in the EU/EEA.
- In 2020, 53 169 laboratory-confirmed cases of salmonellosis were reported, out of which 61 were fatal.
- The EU/EEA notification rate was 14.2 cases per 100 000 population.
- Salmonellosis notification rates in the last five years, preceding the COVID-19 pandemic, have been stable. The number of cases in 2020 were significantly lower than previously reported numbers, primarily as a consequence of the pandemic.
- The reported case rate was highest in young children (0–4 years) with 76.3 cases per 100 000 population, ten 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 2020, retrieved from The European Surveillance System (TESSy) on 5 November 2021. 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 2020, 29 EU/EEA countries reported data on salmonellosis. No data for 2020 was reported by the United Kingdom (UK) due to withdrawal from the EU since 1 February 2020. Twenty-five countries reported data using either the 2008, 2012 or 2018 EU case definitions for salmonellosis.

Suggested citation: European Centre for Disease Prevention and Control. Salmonellosis. In: ECDC. Annual Epidemiological Report for 2020. Stockholm: ECDC; 2022.

Stockholm, October 2022

Four countries used another case definition and one did not specify the definition they used. 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.

Notification of non-typhoidal salmonellosis is mandatory in most of the EU Member States as well as Iceland and Norway. In four Member States (Belgium, France, Luxembourg and the Netherlands), reporting 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 2020 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. For 2020, Spain has not received data from all the regions that normally report cases, and the case numbers are therefore lower than expected. 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 data collection in 2020. 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, with the reports a maximum of eight weeks apart. Furthermore, whole genome sequencing (WGS) data was collected ad hoc to support ongoing multi-country investigations.

Epidemiology

For 2020, 29 countries reported 53 674 cases, of which 53 169 were classified as confirmed (Table 1). The number of notifications per 100 000 population was 14.2, significantly lower than in 2019. Age-standardised notification rates did not differ substantially from crude rates. Out of 35 715 cases with known outcome, 61 were reported to have died, accounting for a case fatality of 0.17%.

The highest notification rates were reported by Czechia (98.4 cases per 100 000 population) and Slovakia (62.1), followed by Malta (34.2) and Hungary (30.3) – Table 1, Figure 1. The lowest rates (cases per 100 000) were reported by Romania (2.1), Portugal (2.5) and Bulgaria (2.7).

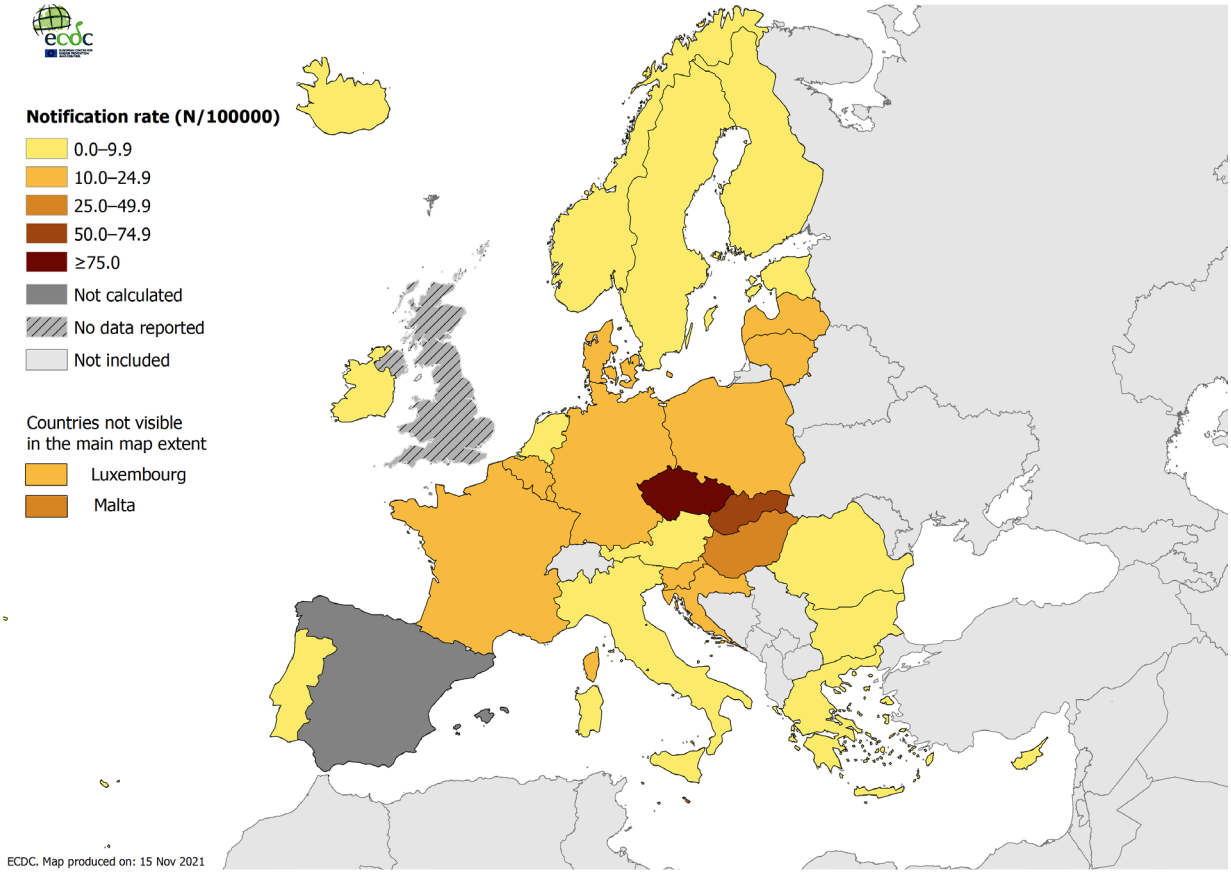
Table 1. Distribution of confirmed salmonellosis cases and rates per 100 000 population by country and year, EU/EEA, 2016–2020

Country	2016		2017		2018		2019		2020		
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate	ASR
Austria	1 415	16.3	1 667	19.0	1 538	17.4	1 866	21.1	817	9.2	9.4
Belgium	2 699	23.9	2 298	20.2	2 958	26.0	2 527	22.1	1 595	13.8	13.4
Bulgaria	718	10.0	796	11.2	586	8.3	594	8.5	187	2.7	2.9
Croatia	1 240	29.6	1 242	29.9	1 323	32.2	1 308	32.1	786	19.4	20.8
Cyprus	77	9.1	59	6.9	44	5.1	62	7.1	70	7.9	8.0
Czechia	11 610	110.0	11 473	108.5	10 901	102.7	13 009	122.2	10 520	98.4	99.7
Denmark	1 081	18.9	1 067	18.6	1 168	20.2	1 119	19.3	614	10.5	10.3
Estonia	351	26.7	265	20.1	314	23.8	150	11.3	91	6.8	6.8
Finland	1 512	27.6	1 535	27.9	1 431	26.0	1 175	21.3	516	9.3	9.6
France	8 876	27.7	7 993	24.9	8 936	27.8	8 935	27.7	7 071	21.9	21.0
Germany	12 858	15.6	14 051	17.0	13 293	16.1	13 495	16.3	8 664	10.4	10.7
Greece	735	6.8	672	6.2	640	6.0	643	6.0	381	3.6	3.9
Hungary	4 722	48.0	3 922	40.0	4 161	42.6	4 452	45.6	2 964	30.3	31.1
Iceland	39	11.7	64	18.9	63	18.1	50	14.0	32	8.8	8.7
Ireland	299	6.3	379	7.9	352	7.3	347	7.1	214	4.3	4.3

Country	2016		2017		2018		2019		2020		
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate	ASR
Italy	4 134	6.8	3 347	5.5	3 635	6.0	3 256	5.4	2 713	4.5	4.9
Latvia	454	23.1	225	11.5	409	21.1	438	22.8	296	15.5	15.3
Liechtenstein	.	.	.	.	.	.	.	.	.	.	.
Lithuania	1 076	37.3	1 005	35.3	779	27.7	736	26.3	419	15.0	-
Luxembourg	108	18.7	118	20.0	135	22.4	131	21.3	93	14.9	14.9
Malta	162	36.0	107	23.2	116	24.4	131	26.5	176	34.2	35.0
Netherlands	1 150	10.6	954	8.7	1 061	9.6	1 197	10.8	695	6.2	6.2
Norway	865	16.6	992	18.9	961	18.1	1 092	20.5	441	8.2	8.1
Poland	9 718	25.6	8 921	23.5	9 064	23.9	8 373	22.0	5 192	13.7	14.1
Portugal	376	3.6	462	4.5	302	2.9	432	4.2	262	2.5	2.8
Romania	1 479	7.5	1 154	5.9	1 410	7.2	1 383	7.1	408	2.1	2.1
Slovakia	5 299	97.7	5 789	106.5	6 791	124.8	4 992	91.6	3 387	62.1	62.7
Slovenia	311	15.1	275	13.3	274	13.3	362	17.4	214	10.2	10.3
Spain	9 818	-	9 426	-	8 730	-	5 087	-	3 526	-	-
Sweden	2 247	22.8	2 280	22.8	2 041	20.2	1 990	19.5	825	8.0	7.9
United Kingdom	9 900	15.1	10 105	15.3	9 466	14.3	9 718	14.6	-	-	-
EU-EEA	**95 329**	**20.4**	**92 643**	**19.6**	**92 882**	**20.0**	**89 050**	**20.0**	**53 169**	**14.2**	**14.2**

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, 2020

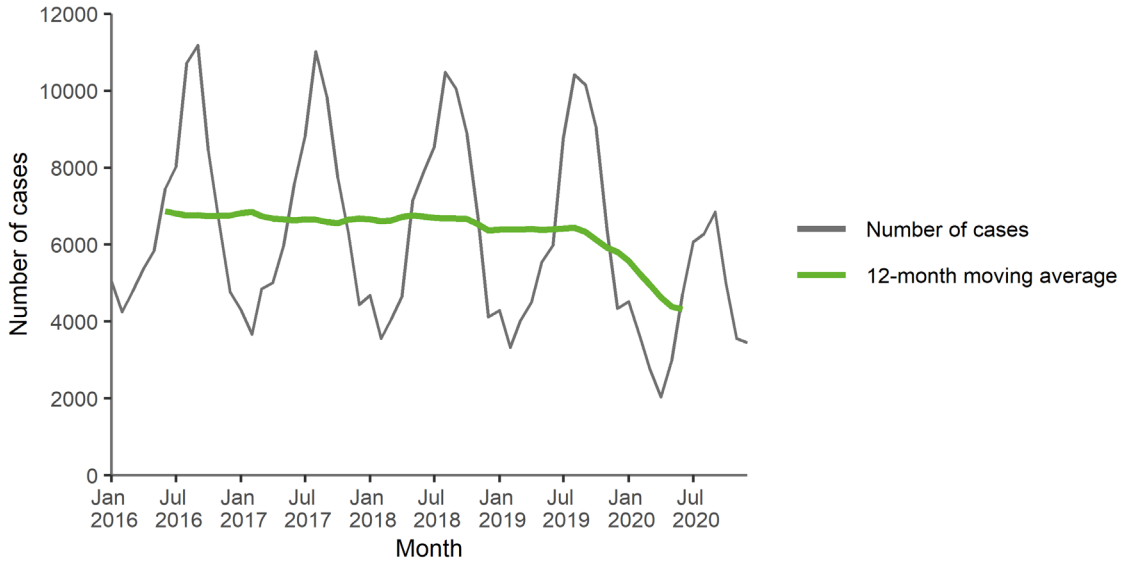


Source: Country reports from Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden.

The number of reported cases of salmonellosis in the EU/EEA had been stable from 2016–2019. In 2020, a marked decrease in the number of cases was seen on a monthly basis from March onward (Figures 2, 3) compared to the previous years. All but two countries (Cyprus and Malta) reported a decrease in the number of cases.

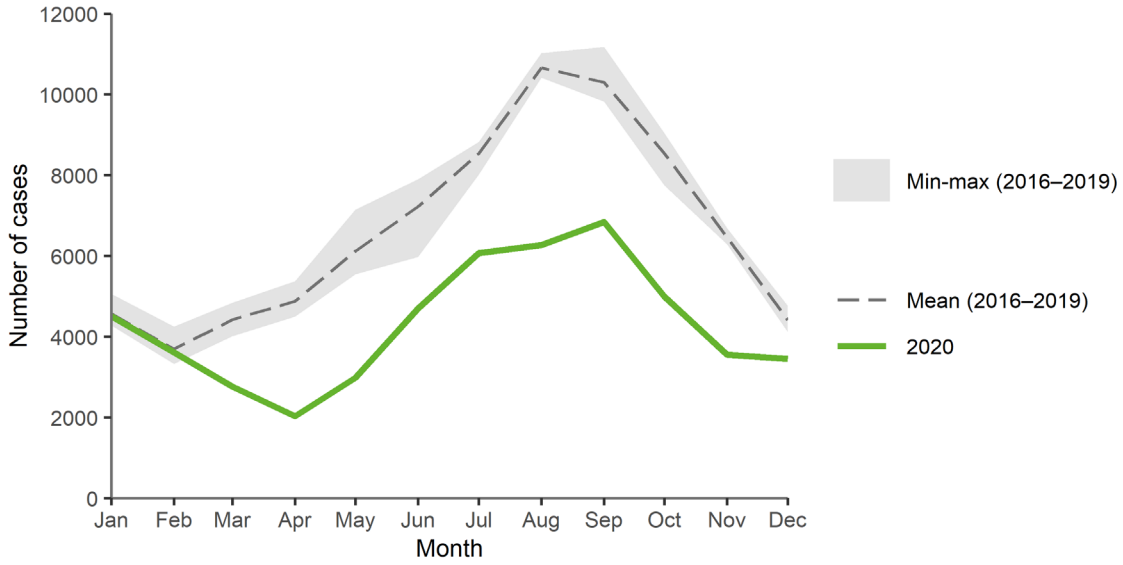
There is a clear seasonal distribution of salmonellosis cases by month of reporting, with peaks in August and September (Figures 2, 3).

Figure 2. Distribution of confirmed salmonellosis cases by month, EU/EEA, 2016–2020



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.

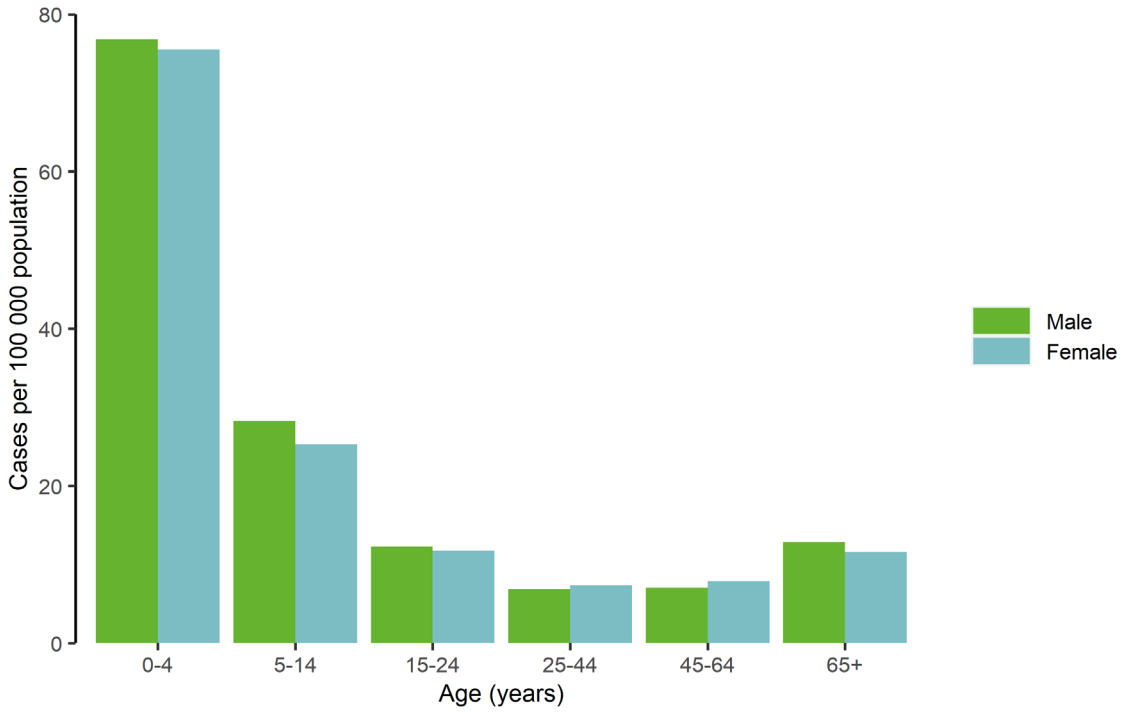
Figure 3. Distribution of confirmed salmonellosis cases by month, EU/EEA, 2020 and 2016–2019



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.

The highest notification rate of salmonellosis was observed among young children (0–4 years), with 76.3 cases per 100 000 population (Figure 4). The rate in young children was almost three times higher than in older children, and ten 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 among adults (25–44 years): Greece (26 times), Italy (29 times), Poland (43 times) and Portugal (52 times). In Cyprus and Greece, the proportions of hospitalised cases were very high (83–86%), 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, 2020



Out of 38 150 cases with known travel history, 1 768 (4.6%) were reported as travel-associated, the lowest rate ever reported. 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, Germany, Greece, Hungary, Latvia, Malta, the Netherlands, Poland, Portugal, Slovakia and Spain. The highest proportions of travel-related cases, ranging from 47–52%, were reported by three Nordic countries: Finland, Norway and Sweden.

Among the 1 080 travel-associated cases with known information on probable country of infection, Thailand, Spain and Egypt were the most frequently reported travel destinations (19%, 8% and 5% respectively).

Information on *Salmonella* serovars was available for 80% of the total number of confirmed cases from 25 Member States (Bulgaria and Poland did not report case-based serovar data). As in previous years, the three most commonly reported *Salmonella* serovars in 2020 were *S.* Enteritidis (49%), *S.* Typhimurium (12%) and monophasic *S.* Typhimurium (1,4,[5],12:i:-) (11%). The proportion of these three serovars was at the same level as in 2019 and 2018, as was *S.* Infantis, which was the fourth most commonly reported serovar.

Molecular typing enhanced surveillance

In 2020, three countries submitted *Salmonella* MLVA typing data, prompting five multi-country molecular typing cluster investigations (MTCI). In addition, 15 countries provided whole-genome sequencing (WGS) data to support ongoing multi-country outbreak investigations.

Outbreaks and other threats

In June 2020, the UK reported a cluster of 65 cases of *Salmonella* Enteritidis in ECDC's EPIS (the Epidemic Intelligence Information System), with the first sampling dates from September 2018. In total, nine EU/EEA countries were involved in this multi-country outbreak where 193 cases were reported. Fifty percent of the cases were children ≤ 18 years. Questionnaires indicated poultry products, specifically the consumption of frozen breaded chicken products as the possible source of infection. Five batches of non-ready-to-eat poultry products (e.g. breaded chicken) from Poland tested positive for the outbreak strain as confirmed by WGS. Withdrawals and recalls were implemented as control measures for the products that tested positive for the outbreak strain, and as precautionary measures for other products involved in the traceability of the event. A public communication was published to advise consumers to cook frozen poultry products thoroughly and to practice good hygiene in kitchens at home. The poultry products were all intended to be cooked before being eaten [4].

Sweden reported an outbreak of *S*. Newport linked to cooked crayfish in dill brine with a duration between July to November 2019. However, in 2020 and 2021, two additional cases with the outbreak strain were identified, where one of the cases reported having eaten crayfish within the incubation period. This exemplifies the difficulty of completely removing the risk of contaminated foods with long shelf lives [5].

Denmark reported of a patient with *Salmonella* Kottbus positive for *bla*NDM-1 in November 2020. The patient had inoperable lung cancer, and had been hospitalised because of fever, abdominal pain and diarrhoea for several weeks. *Salmonella* Kottbus was isolated from a stool sample, and it was shown to be NDM-positive. By selective plating, two additional isolates were identified to be NDM-positive, an *Escherichia coli* and a *Citrobacter freundii*. The *bla*NDM-1 was identified in all three isolates and was carried on the same plasmid. The origin of the infection or the specific bacteria that first obtained the plasmid carrying the carbapenem resistance could never be determined [6].

Antimicrobial resistance was commonly observed in *Salmonella* isolates from humans in 2020. However, only a smaller fraction of the bacteria was resistant to both the critically important antimicrobial classes – fluoroquinolones and third-generation cephalosporins [7]. 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.

Discussion

Salmonellosis remains the second most common zoonosis in humans in the EU/EEA. After the significant decrease in salmonellosis cases observed from 2007 to 2014, the incidence was stable between 2015 and 2019. However, the number of cases in 2020 were significantly lower than in previous years, primarily as a consequence of the COVID-19 pandemic. All but two countries reported a decrease in the number of cases. Factors mentioned by countries resulting in lower case numbers were, people avoiding seeking medical care for mild symptoms due to risk of exposure to COVID-19 in healthcare facilities, limited laboratory capacity due to reallocation of resources to SARS-CoV-2, fewer restaurant visits, increased hand washing, less travel due to travel restrictions, etc.

Notification rates for salmonellosis in humans vary between Member States, reflecting variations in, for example, 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 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 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 may mainly capture the most severe infections.

Overall, the majority (58%) of the reported salmonellosis food-borne outbreaks were caused by *S*. Enteritidis as in previous years. The four most frequently implicated food vehicles in strong-evidence salmonellosis food-borne outbreaks were 'eggs and egg products', followed by, 'pig meat and products thereof' and 'bakery products', as in previous years [8].

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 2020. These typing methods are continuously being replaced by 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 World Health Organization (WHO) [9, 10].

Since 2019, it is possible to report whole genome sequencing-derived resistance determinants for *Salmonella* via isolate-based data collection. Testing of the quality of predicted resistance has also become a part of the EQA (external quality assessment) panels for *Salmonella*, which are offered to laboratories with national reference functions within the EU/EEA with support from ECDC. In 2020, two countries (Ireland and Sweden) reported predicted resistance data to TESSy. With the increasing use of WGS in many Member States as the method of choice for serotype determination and cluster analysis, the resistance determinants could also be derived from the WGS data, specifically for countries with limited data from the 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), and could be an efficient tool for antimicrobial resistance (AMR) surveillance within the EU/EEA.

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 main source of human salmonellosis reported from outbreaks in Europe is food [12]. Egg and egg products continue to be the highest risk foods in *Salmonella* outbreaks [8]. Proper *Salmonella* control measures at the primary production level and sufficient laboratory capacity are prerequisites to reduce *Salmonella* prevalence in food-producing animals.

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