SURVEILLANCE REPORT

Salmonellosis

Annual Epidemiological Report for 2017

Key facts

- Salmonellosis is the second most commonly reported gastrointestinal infection and an important cause of foodborne outbreaks in the EU/EEA.
- In 2017, 92 649 laboratory-confirmed cases were reported of which 156 were fatal.
- The EU/EEA notification rate was 19.6 cases per 100 000 population.
- Salmonellosis notification rates have stabilised in the last five years after a long period marked by a declining trend.
- The notification rate was highest in young children 0–4 years with 94.1 cases per 100 000 population, eight times higher than in adults 25–64 years.

Methods

This report is based on data for 2017 retrieved from The European Surveillance System (TESSy) on 11 December 2018. The European Surveillance System 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].

In 2017, 30 EU/EEA countries reported data on salmonellosis. Twenty-five countries reported data using either the 2008 or 2012 EU case definitions for salmonellosis, which are essentially the same. Four countries used another definition and one did not specify the definition used. Notification of non-typhoidal salmonellosis is mandatory in most 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). 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 2017 is estimated to be 48% in France and 64% in the Netherlands.

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The variation in coverage was taken into consideration when calculating the national notification rates. No information on estimated coverage was provided by Spain, thus no notification rates were calculated. In Belgium, full national coverage was established in 2015 and rates before this date are not displayed. 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.

In addition to case-based surveillance, ECDC coordinated molecular-typing-enhanced surveillance of salmonellosis through isolate-based data collection in 2017. 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 (XbaI restriction enzyme), with the reports a maximum of eight weeks apart.

Epidemiology

For 2017, 30 countries reported 94 570 cases, of which 92 649 were classified as confirmed (Table 1). The number of notifications in the EU/EEA per 100 000 inhabitants was 19.6, slightly lower than in 2016 and the lowest rate in the five year period 2013–2017. Age-standardised notification rates did not differ substantially from crude rates. Of 62 728 cases with known outcome, 156 were reported to have died, giving a case-fatality rate of 0.25%.

The highest notification rates were reported by the Czech Republic (108.5 cases per 100 000 population) and Slovakia (106.5), followed by Hungary and Lithuania (Table 1, Figure 1). The lowest rate was reported by Portugal. The largest increase in rates from 2016–2017 was observed in Iceland (62%), Ireland (25%) and Portugal (23%).

Of 68 455 cases with known travel history, 10 520 (15%) 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% to 100%, reported in the Czech Republic, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia and Spain. The highest proportions of travel-related cases, ranging from 64–76%, were reported by four Nordic countries: Finland, Iceland, Norway and Sweden.

Among the 8 596 travel-associated cases with known information on probable country of infection, Thailand, Spain, Turkey and India were the most frequently reported travel destinations (14%, 9%, 8% and 6%, respectively).

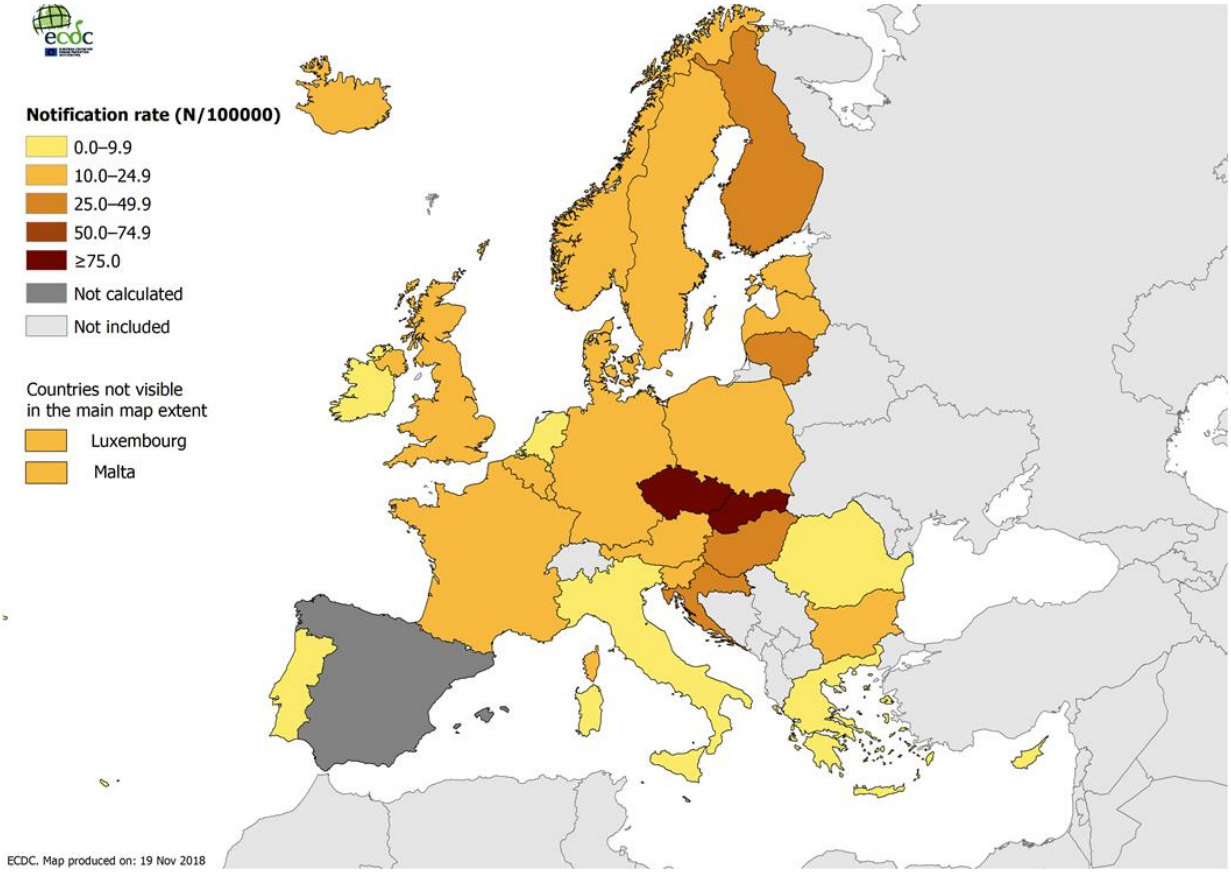
Table 1. Distribution of confirmed salmonellosis cases by country and year, EU/EEA, 2013-2017

Country	2013		2014		2015		2016		2017			
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Confirmed cases	Rate	ASR	Reported cases
Austria	1 404	16.6	1 654	19.4	1 544	18.0	1 415	16.3	1 667	19.0	19.5	1 672
Belgium	2 528	-	2 698	-	3 050	27.1	2 699	23.9	2 298	20.2	19.4	2 298
Bulgaria	766	10.5	730	10.1	1 076	14.9	718	10.0	796	11.2	12.0	798
Croatia	0	0.0	1 494	35.2	1 593	37.7	1 240	29.6	1 242	29.9	31.2	1 250
Cyprus	79	9.1	88	10.3	65	7.7	77	9.1	59	6.9	6.9	59
Czech Republic	9 790	93.1	13 255	126.1	12 408	117.7	11 610	110.0	11 473	108.5	110.7	11 705
Denmark	1 137	20.3	1 124	20.0	925	16.3	1 081	18.9	1 067	18.6	18.3	1 067
Estonia	183	13.9	92	7.0	112	8.5	351	26.7	265	20.1	20.2	279
Finland	1 984	36.6	1 622	29.8	1 650	30.2	1 512	27.6	1 535	27.9	29.5	1 535
France	8 927	28.4	8 880	28.1	10 305	32.3	8 876	27.7	7 993	24.9	23.8	7993
Germany	18 696	23.2	16 000	19.8	13 667	16.8	12 858	15.6	14 052	17.0	17.8	14 268
Greece	414	3.8	349	3.2	466	4.3	735	6.8	672	6.2	6.6	675
Hungary	4 953	50.0	5 249	53.1	4 894	49.7	4 722	48.0	3 922	40.0	41.5	4 103
Iceland	48	14.9	40	12.3	44	13.4	39	11.7	64	18.9	19.9	64
Ireland	326	7.1	259	5.6	270	5.8	299	6.3	379	7.9	7.8	415
Italy	5 048	8.5	4 467	7.3	3 825	6.3	4 134	6.8	3 347	5.5	5.8	3 348
Latvia	385	19.0	278	13.9	380	19.1	454	23.1	225	11.5	11.5	234
Liechtenstein	.	.	.	.	.	.	.	.	.	.	.	.
Lithuania	1 199	40.3	1 145	38.9	1 082	37.0	1 076	37.3	1 004	35.3	35.8	1 004
Luxembourg	120	22.3	110	20.0	106	18.8	108	18.7	118	20.0	20.0	118
Malta	84	19.9	132	30.7	126	28.7	162	36.0	107	23.2	23.4	107
Netherlands	979	9.1	970	9.0	974	9.0	1 150	10.6	954	8.7	8.7	954
Norway	1 361	26.9	1 118	21.9	928	18.0	865	16.6	992	18.9	18.8	992
Poland	7 315	19.2	8 042	21.2	8 245	21.7	9 718	25.6	8 924	23.5	24.5	9 711
Portugal	167	1.6	244	2.3	325	3.1	376	3.6	462	4.5	5.0	470
Romania	1 302	6.5	1 512	7.6	1 330	6.7	1 479	7.5	1 154	5.9	5.9	1 270
Slovakia	3 807	70.4	4 078	75.3	4 841	89.3	5 299	97.7	5 789	106.5	109.3	6 092
Slovenia	316	15.3	597	29.0	401	19.4	311	15.1	275	13.3	13.5	275

Country	2013		2014		2015		2016		2017			
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Confirmed cases	Rate	ASR	Reported cases
Spain	4 537	-	6 633	-	9 015	-	9 818	-	9 426	-	-	9 426
Sweden	2 842	29.7	2 211	22.9	2 312	23.7	2 247	22.8	2 280	22.8	22.8	2 280
United Kingdom	8 465	13.2	8 099	12.6	9 490	14.6	9 900	15.1	10 108	15.4	15.1	10 108
EU/EEA	**89 162**	**20.4**	**93 170**	**20.7**	**95 449**	**21.0**	**95 329**	**20.4**	**92 649**	**19.6**	**19.9**	**94 570**

: no data reported -: no rate calculated.

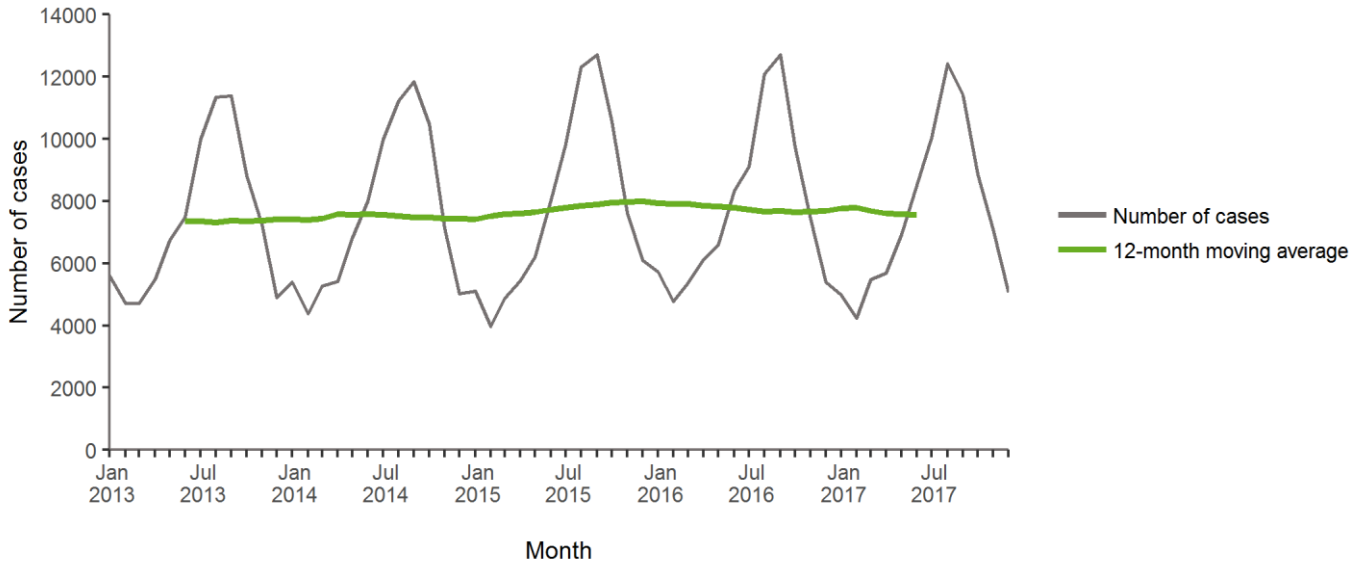
Figure 1. Distribution of confirmed salmonellosis cases per 100 000 population by country, EU/EEA, 2017



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

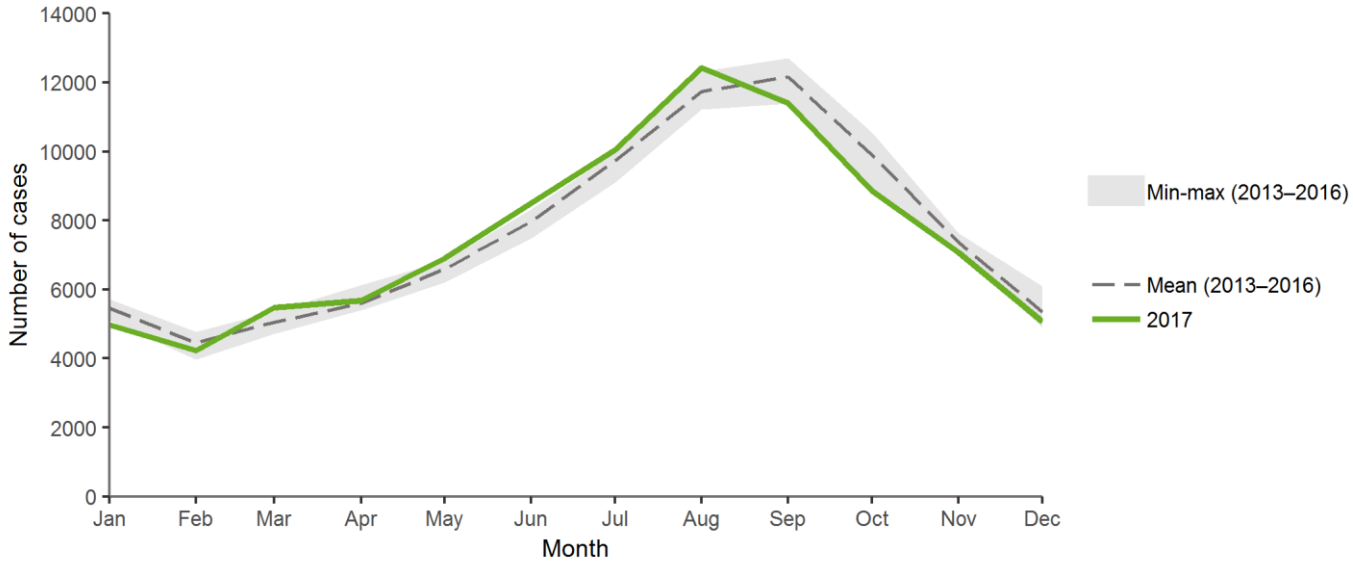
The number of reported cases of salmonellosis in the EU/EEA was fairly constant from 2013–2017 (Figure 2). Statistically significant increasing trends during this period were observed in seven Member States (Greece, Estonia, Poland, Portugal, Slovakia, Spain and the United Kingdom), while decreasing trends were observed in three (Finland, Italy and Germany). 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, 2013–2017



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

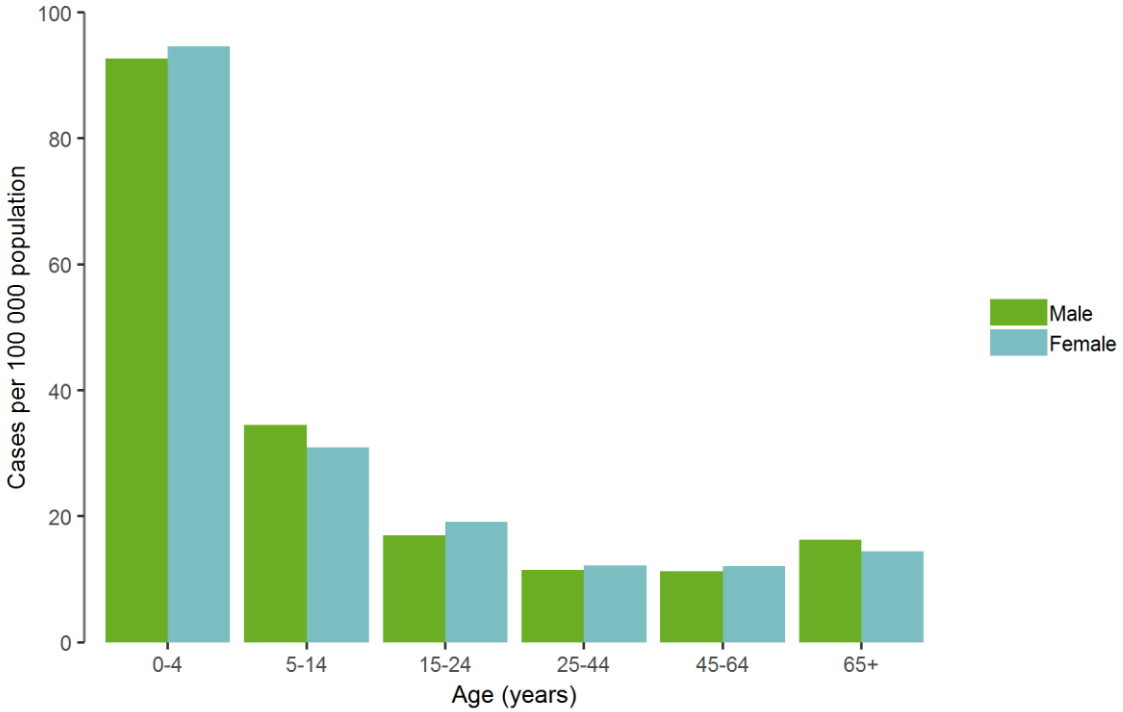
Figure 3. Distribution of confirmed salmonellosis cases by month, EU/EEA, 2017 and 2013–2016



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

The highest notification rate of salmonellosis was observed among young children 0–4 years, with 94.1 cases per 100 000 population (Figure 4). The rate in young children was almost three times higher than in older children and eight times as high as 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 of age: Cyprus (27 times), Greece (26 times), Italy (33 times), Poland (25 times) and Portugal (49 times). In Cyprus, Greece and Portugal, the proportions of hospitalised cases were very high (72–85%), while salmonellosis notification rates were low (<10 per 100 000). 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, 2017



Molecular-typing-enhanced surveillance

In 2017, 15 countries submitted *Salmonella* typing data prompting 78 multi-country molecular typing cluster investigations (MTCIs; all of them based on MLVA). One *S.* Enteritidis MTCI (MLVA profile 3-9-5-4-1) was escalated to an urgent inquiry after whole genome sequencing (WGS)-confirmation of the clonality of a subcluster involving four countries. No common vehicle of infection was identified.

The three most commonly reported MLVA profiles were 3-19-11-NA-311, 3-13-10-NA-211 and 3-12-9-NA-211 for *S.* Typhimurium and 2-10-7-3-2, 3-10-5-4-1 and 3-11-5-4-1 for *S.* Enteritidis.

Outbreaks and other threats

The multi-country outbreak of *S.* Enteritidis associated with contaminated eggs from Poland identified in 2016 [4] continued in 2017. By 28 November 2017, an additional 196 WGS-confirmed and 72 probable cases (based on MLVA type) had been reported by eight EU/EEA countries since February 2017, adding to the 340 WGS-confirmed and 374 probable cases reported by 16 EU/EEA countries in 2016 and 2015 [5]. Just as in 2016, the peak in cases was in September.

An outbreak of *Salmonella* Agona linked to the consumption of infant formula (powdered milk) began in France in August 2017. As of 11 January 2018, the outbreak had affected 39 infants (children <1 year of age): 37 in France, one in Spain and one in Greece [6]. Seven different brands of infant formula from a single processing company in France were identified as the vehicles of infection. As a precautionary measure, the processing company decided to recall and/or withdraw all products manufactured at the implicated factory since 15 February 2017, affecting products distributed to 13 Member States and 54 third countries.

An outbreak of a new serovar of *Salmonella enterica* subspecies *enterica* with antigenic formula 11:z41:e,n,z15, initially detected in Greece, affected 47 individuals in five European Union countries between March 2016 and March 2017 [7]. Epidemiological and microbiological evidence linked some of the outbreak cases to a sesame paste produced by a Greek manufacturer. The sesame seeds used for the production of the sesame paste were traced back to a West African country. After the withdrawal of the implicated sesame paste in March and April 2017, no new cases were reported.

A multi-country outbreak of infections with *S*. Enteritidis phage types 56 and 62, MLVA profile 2-11-3-3-2 and 2-12-3-3-2, delineated through WGS analysis, was identified in 2017 with historical cases dating back to 2014 [8]. Five Member States reported 314 confirmed cases in 2017 and four other EU/EEA countries reported historical isolates, all clustering in three closely related 5-SNP single linkage clusters. Investigations by Public Health England showed that the outbreaks could be associated with the consumption of poultry products, i.e. meat or eggs. A large proportion of cases with known travel history during the incubation period had travelled to Spain and the second most commonly visited country was Portugal.

Discussion

Salmonellosis remains the second most common zoonosis in humans in the EU/EEA and the significant decrease observed from 2004–2013 appears to have levelled off in the following years. The largest increases in country-specific notification rates from 2016–2017 were observed in Iceland, Ireland and Portugal. The increase in Iceland could partly be attributed to an outbreak of monophasic *S*. Typhimurium [9]. In Ireland, an outbreak with *S*. Brandenburg accounted for 35 laboratory-confirmed cases and an additional 37 probable cases associated with several parties which obtained buffet food from the same catering premises [10]. In Portugal, cases with *S*. Enteritidis accounted for 2/3 of the increase in salmonellosis cases in 2017. The reason for the increase is unknown but based on travel histories of cases in the *S*. Enteritidis outbreak linked to Polish eggs, it seems Portugal was also affected by this outbreak [5].

In 2017, *Salmonella* was the most common cause of foodborne outbreaks, accounting for 24% (1 241) of all reported foodborne outbreaks [11]. Eggs and egg products continued to be the most commonly identified vehicles in these outbreaks. In the two largest multi-country outbreaks investigated in 2017, eggs were either confirmed or suspected to be the source. In both outbreaks, WGS analysis was used to identify cases, revealing also significant numbers of historical cases dating back one or more years. Such persistent clusters from continuous exposure sources may require other types of control measures and longer periods of follow-up compared to point source outbreaks, as exemplified by the outbreak linked to Polish eggs where the implemented measures seem to have only been partially effective in reducing the number of cases over time [12]. The benefits of WGS in identifying linked cases in different countries and suspected food sources has led to a rapid increase in its use in individual Member States, at the EU level and internationally and is promoted by ECDC, PulseNet International and WHO [13–14].

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 for parents to take children to see a doctor 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. 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 [15]. Rather than correlating with the reported national incidence of Salmonella infections, seroincidence correlated with prevalence data of *Salmonella* in laying hens, broilers and slaughter pigs, as assessed in EU baseline surveys by EFSA. Seroincidence also correlated with Swedish data on the country-specific risk of travel-associated salmonellosis [15]. One output of the 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 [16].

Antimicrobial resistance was commonly observed in *Salmonella* isolates from humans in 2017, but only a smaller fraction of the bacteria were resistant to both of the critically important antimicrobial classes: fluoroquinolones and 3rd generation cephalosporins [17]. Clones of multidrug-resistant and/or extended-spectrum β-lactamase (ESBL)-producing *Salmonella*, however, are of increasing concern as they 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 foodstuffs and animals used for food production, animal trade between countries, the proportion of travel-associated cases and the quality and coverage of surveillance systems.

Egg and egg products continue to be the highest risk foods in *Salmonella* outbreaks, as clearly exemplified by the extensive *S*. Enteritidis outbreak that started in 2016 and continued in 2017 [5,12]. Proper *Salmonella* control measures at the primary production level and sufficient laboratory capacity is a prerequisite to reduce *Salmonella* prevalence in food-producing animals.

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