SURVEILLANCE REPORT

Annual Epidemiological Report for 2016

Salmonellosis

Key facts

- Salmonellosis is the second most commonly reported gastrointestinal infection and an important cause of foodborne outbreaks in the EU/EEA.
- In 2016, 95 326 laboratory-confirmed cases were reported out of which 134 were fatal.
- The EU/EEA notification rate was 20.4 cases per 100 000 population.
- Salmonellosis notification rates have stabilised in the last five years after a long period that was marked by a declining trend.
- The reported case rate was highest in young children 0–4 years with 89.9 cases per 100 000 population, seven times higher than in adults 25–64 years.

Methods

This report is based on data for 2016 retrieved from The European Surveillance System (TESSy) on 15 March 2018. TESSy is a system for the collection, analysis and dissemination of data on communicable diseases.

For a detailed description of methods used to produce this report, 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 2016, 30 EU/EEA countries reported data on salmonellosis. Twenty-four 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 two did not specify their definition. The disease is under mandatory notification in 25 countries, voluntary in four and one country has a surveillance system that is categorised as 'other'.

Surveillance systems for salmonellosis have national coverage in all Member States except in France, the Netherlands and Spain. In 2016, population coverage was estimated to be 48% in France and 64% in the Netherlands. Variation in coverage was taken into consideration when calculating notification rates. No information on estimated coverage was provided by Spain, so no notification rates were calculated.

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Stockholm, March 2019

In addition to case-based surveillance, ECDC coordinated molecular typing enhanced surveillance of salmonellosis through isolate-based data collection in 2016. 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 (starting from June 2016) or matching pulsotypes for other *Salmonella* serotypes (*Xba*I restriction enzyme), with the reports a maximum of eight weeks apart.

Epidemiology

For 2016, 30 countries reported 96 835 cases, of which 95 326 were classified as confirmed (Table 1). The number of notifications per 100 000 inhabitants was 20.4, similar to 2015. Age-standardised notification rates did not differ substantially from crude rates. Of 52 878 cases with known outcome, 134 were reported to have died, giving a case fatality of 0.25%.

The highest notification rates were reported by the Czech Republic (110.0 cases per 100 000 population) and Slovakia (97.7), followed by Hungary (48.0) and Lithuania (37.3; Table 1, Figure 1). The lowest rate was reported by Portugal (3.6 cases per 100 000). The largest increase in rates from 2015–2016 was observed in Estonia (213%) and Greece (59%).

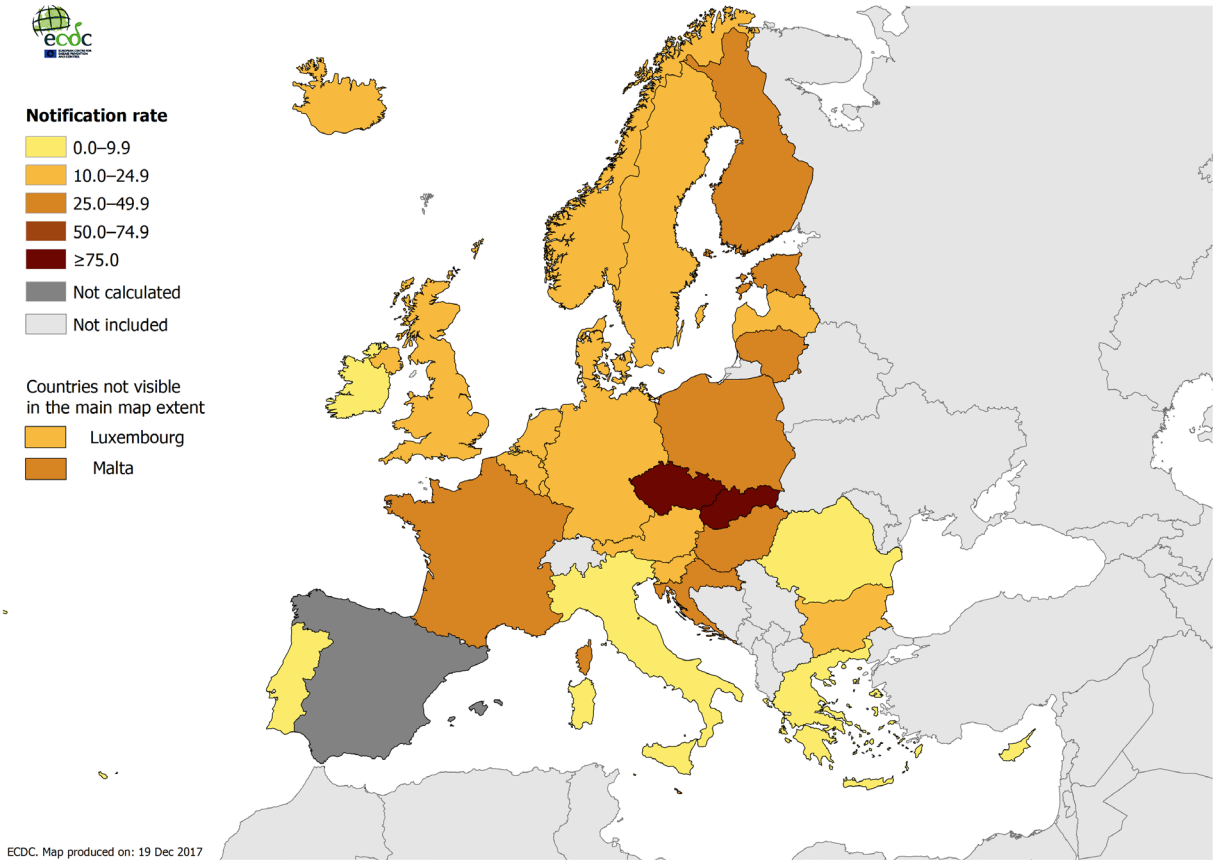
Of 61 014 cases with known travel history, 9 908 (16%) were reported as travel-associated. The proportions of domestic and travel-associated cases varied between countries, with the highest proportions of domestic cases ranging from 93% to 100% reported in the Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, the Netherlands, Portugal, Romania, Slovakia and Spain. The highest proportions of travel-related cases were reported by three Nordic countries: Finland (79%), Norway (78%) and Sweden (71%). Among the 8 337 travel-associated cases with known information on probable country of infection, Thailand, Turkey and India were the most frequently reported travel destinations (16%, 10% and 6% respectively), followed by two EU Member States: Spain (6%) and Greece (4%).

Table 1. Distribution of confirmed salmonellosis cases by country and year, EU/EEA, 2012-2016

Country	2012		2013		2014		2015		2016			
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Confirmed cases	Rate	ASR	Reported cases
Austria	1 773	21.1	1 404	16.6	1 654	19.4	1 544	18.0	1 415	16.3	17.2	1 415
Belgium	3 101	28.0	2 528	22.7	2 698	24.1	3 050	27.1	2 698	23.9	22.9	2 698
Bulgaria	839	11.5	766	10.5	730	10.1	1 076	14.9	718	10.0	10.8	719
Croatia	0	0.0	0	0.0	1 494	35.2	1 593	37.7	1 240	29.6	30.3	1 259
Cyprus	90	10.4	79	9.1	88	10.3	65	7.7	77	9.1	8.3	77
Czech Republic	10 056	95.7	9 790	93.1	13 255	126.1	12 408	117.7	11 610	110.0	113.5	11 809
Denmark	1 207	21.6	1 137	20.3	1 124	20.0	925	16.3	1081	18.9	18.8	1 081
Estonia	249	18.8	183	13.9	92	7.0	112	8.5	351	26.7	26.5	358
Finland	2 210	40.9	1 984	36.6	1 622	29.8	1 650	30.2	1 512	27.6	28.7	1 512
France	8 705	27.8	8 927	28.4	8 880	28.1	10 305	32.3	8 876	27.7	26.8	8 876
Germany	20 493	25.5	18 696	23.2	16 000	19.8	13 667	16.8	12 858	15.6	16.8	12 963
Greece	404	3.6	414	3.8	349	3.2	466	4.3	735	6.8	7.0	756
Hungary	5 462	55.0	4 953	50.0	5 249	53.1	4 894	49.7	4 722	48.0	50.2	5 101
Iceland	38	11.9	48	14.9	40	12.3	44	13.4	39	11.7	12.4	39
Ireland	309	6.7	326	7.1	259	5.6	270	5.8	299	6.3	6.2	301
Italy	4 829	8.1	5 048	8.5	4 467	7.3	3 825	6.3	4 134	6.8	7.0	4 138
Latvia	547	26.8	385	19.0	278	13.9	380	19.1	454	23.1	23.8	472
Liechtenstein	.	.	.	.	.	.	.	.	.	.	.	.
Lithuania	1 762	58.7	1 199	40.3	1 145	38.9	1 082	37.0	1 076	37.3	37.4	1 076
Luxembourg	136	25.9	120	22.3	110	20.0	106	18.8	108	18.7	19.3	108
Malta	88	21.1	84	19.9	132	31.0	126	29.3	158	36.4	37.6	158
Netherlands	2 199	20.5	979	9.1	970	9.0	974	9.0	1 150	10.6	10.7	1 150
Norway	1 371	27.5	1 361	26.9	1 118	21.9	928	18.0	865	16.6	16.9	865
Poland	7 959	20.9	7 315	19.2	8 042	21.2	8 245	21.7	9 718	25.6	-	10 032
Portugal	185	1.8	167	1.6	244	2.3	325	3.1	376	3.6	3.9	443
Romania	698	3.5	1 302	6.5	1 512	7.6	1 330	6.7	1 479	7.5	7.6	1 499
Slovakia	4 627	85.6	3 807	70.4	4 078	75.3	4 841	89.3	5 299	97.7	99.9	5 651
Slovenia	392	19.1	316	15.3	597	29.0	401	19.4	311	15.1	15.7	311
Spain	4 224	-	4 537	-	6 633	-	9 015	-	9 818	-	-	9 819
Sweden	2 922	30.8	2 842	29.7	2 211	22.9	2 312	23.7	2 247	22.8	23.3	2 247
United Kingdom	8 812	13.9	8 465	13.2	8 099	12.6	9 490	14.6	9 902	15.1	15.0	9 902
EU/EEA	**95 687**	**22.1**	**89 162**	**20.5**	**93 170**	**20.8**	**95 449**	**21.0**	**95 326**	**20.4**	**20.3**	**96 835**

.: no data reported
-: no rate calculated.

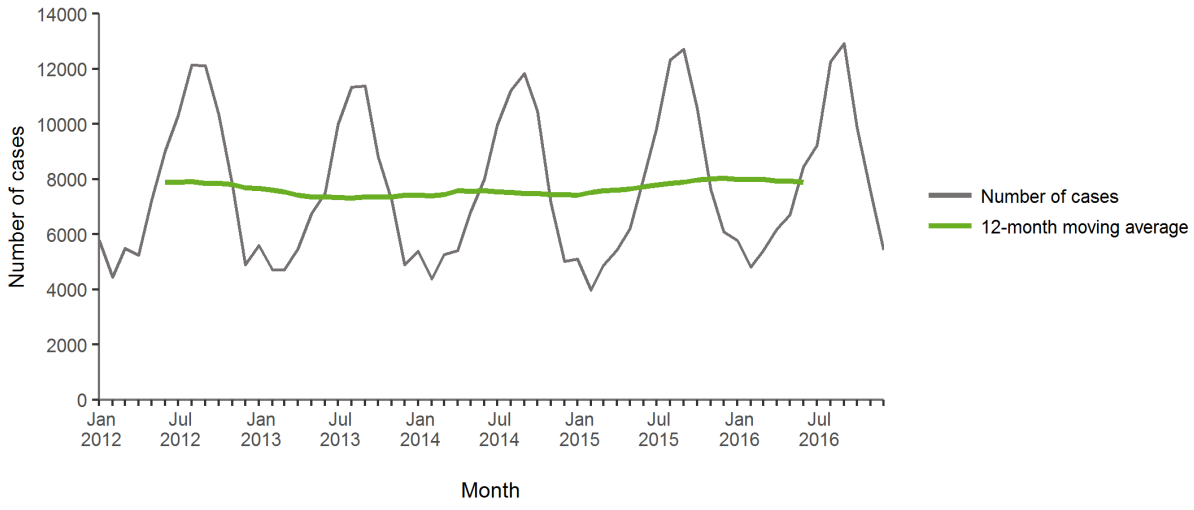
Figure 1. Distribution of confirmed salmonellosis cases per 100 000 population by country, EU/EEA, 2016



Source: Country reports from Austria, Belgium, Bulgaria, Croatia, Cyprus, the 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.

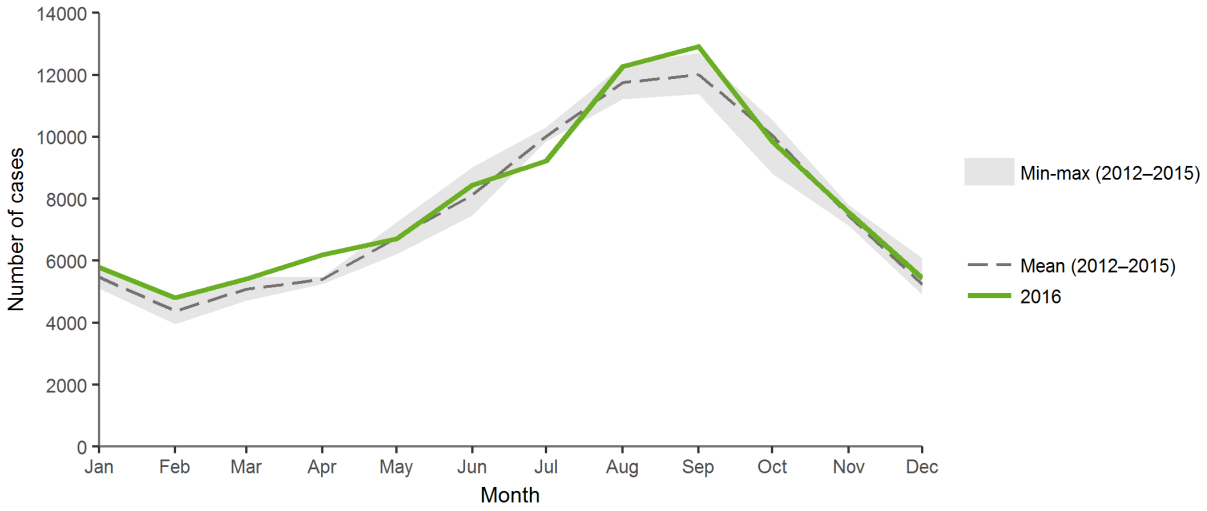
The number of reported cases of salmonellosis in the EU/EEA was fairly constant from 2012–2016 (Figure 2). Statistically significant increasing trends during this period were observed in seven Member States (Greece, Malta, Poland, Portugal, Romania, Slovakia and Spain), while decreasing trends were observed in five countries (Denmark, Finland, Germany, Norway and Sweden). 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, 2012–2016



Source: Country reports from Austria, Belgium, Croatia, Cyprus, the 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.

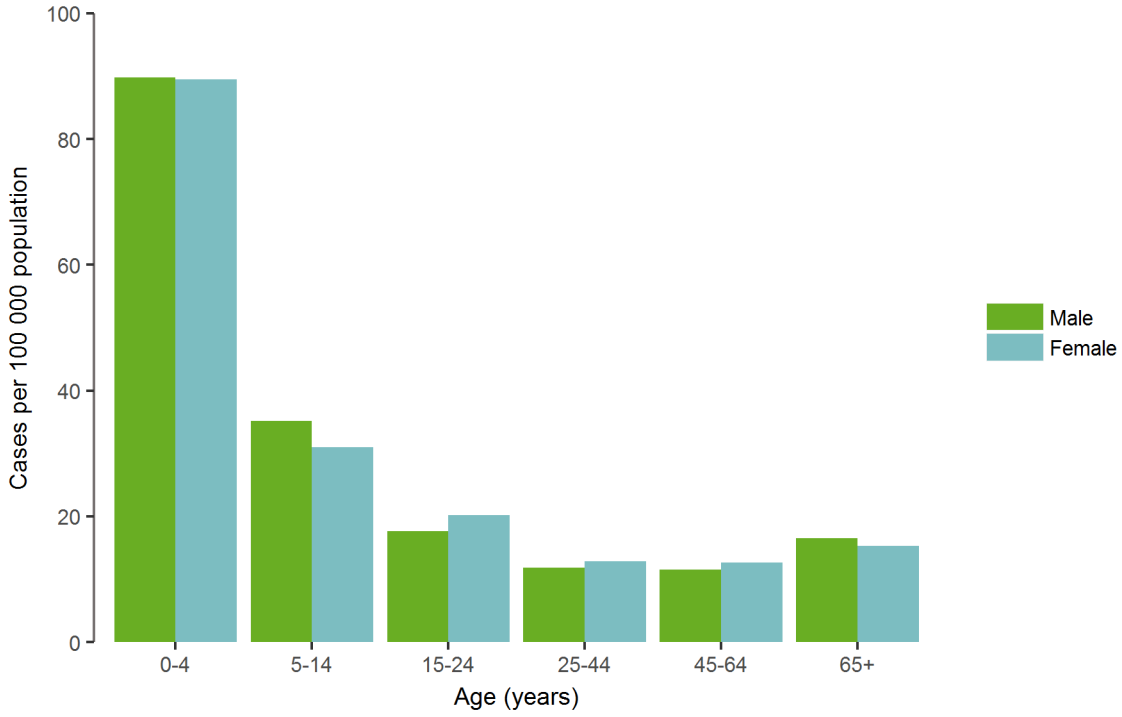
Figure 3. Distribution of confirmed salmonellosis cases by month, EU/EEA, 2012–2015 and 2016



Source: Country reports from Austria, Belgium, Croatia, Cyprus, the 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 89.9 cases per 100 000 population (Figure 4). The rate in young children was almost three times higher than in older children and seven times as high as in adults 25–64 years. In certain countries, the rate among young children was about 30–60 times higher than the rate among adults 25–44 years: Bulgaria (28 times), Cyprus (62 times), Greece (34 times), Italy (29 times), Latvia (34 times) and Portugal (34 times). In Cyprus, Greece, Portugal and Romania, the proportions of hospitalised cases were very high (74–88%), 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, 2016



Molecular typing enhanced surveillance

In 2016, 16 countries submitted *Salmonella* typing data prompting, 82 multi-country molecular typing cluster investigations (MTCIs; 81 based on MLVA and one on PFGE). Two MTCIs with uncommon *S.* Typhimurium MLVA profiles (3-17-10-NA-211 and 4-12-9-7-211) were escalated to 'urgent inquiries', but no possible sources of infection were identified.

The three most commonly reported MLVA profiles were 3-12-8-NA-211, 3-13-9-NA-211 and 3-12-9-NA-211 for *S.* Typhimurium and 2-10-7-3-2, 2-9-7-3-2 and 3-10-5-4-1 for *S.* Enteritidis.

Outbreaks and other threats

A multi-country outbreak of *S.* Enteritidis involving 14 EU/EEA countries associated with contaminated eggs from Poland was confirmed by epidemiological, microbiological and WGS analysis in 2016. A total of 218 cases were confirmed by WGS and another 252 probable cases by MLVA. Cases peaked in September, then steadily decreased from the end of 2016 to the beginning of 2017 [4]. The decrease was possibly due to extended control measures implemented in Poland in the autumn of 2016. However, cases increased again after February 2017, with a new peak in September 2017 [5].

A persistent common source multi-country outbreak of *Salmonella* Enteritidis phage type 8 infection was identified in 2016 after it had been ongoing in the United Kingdom (275 cases) and Denmark (3 cases) for several years [6]. Cases were associated with exposure to pet reptiles, in particular corn snakes, and feeder mice. Additional EU/EEA countries where the implicated feeder mice were distributed may have also been affected by the outbreak.

Germany observed a statistically significant increase in *S.* Stourbridge in 2016 with a high proportion of hospitalised cases and two deaths. An investigation could not confirm that cases in other countries were linked to the event [7].

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 recent years. In 2016, *Salmonella* was the most common cause of foodborne outbreaks, accounting for 22% of all reported foodborne outbreaks (1 067) [8]. Eggs and egg products continued to be the most commonly identified vehicles in these outbreaks and were also the source in the large multi-country outbreak linked to eggs from Poland [4–5]. In 2016, Poland reported 26 breeding flocks of *Gallus gallus* (1.4%) and 169 laying hen flocks (7.2%) positive for *S.* Enteritidis, which was by far the highest proportions of *S.* Enteritidis-positive flocks in the EU [8]. The large egg outbreak affected at least 14 EU/EEA countries and possibly even more since the outbreak case definition was based on typing methods (WGS and MLVA) not yet applied in all countries. Considering the benefits of whole genome sequencing in facilitating the identification of linked cases in different countries and suspected food sources, its use in foodborne outbreak investigations is expected to increase rapidly and is promoted by ECDC, PulseNet International and WHO [9–10].

The largest increases in notification rates from 2015–2016 were observed in Estonia and Greece. The increase in Estonia could be attributed to two outbreaks, one of which was not foodborne (person-to-person transmission), with a large number of illnesses (personal communication by email, J. Epštein, Estonian Health Board, July 2017). In Greece, there have been efforts to increase the reporting of cases in recent years. However, since the large increase in 2016 was mainly in one serotype, *S.* Enteritidis, there could be other explanations to this observation (personal communication by email, T. Georgakopoulou, Hellenic Centre for Disease Control and Prevention, October 2017).

The fact that the salmonellosis rate in young children is seven 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 [11]. 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 [11]. 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 [12].

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 in 2016 that continued in 2017 [5]. Proper *Salmonella* control measures at the primary production level and sufficient laboratory capacity is a prerequisite to reduce *Salmonella* prevalence in food-producing animals. As stated by EFSA, premature relaxation of effective control measures implemented to date in laying hen farms, in particular the implementation of vaccination programmes and the application of strict farm hygiene controls, should be avoided [8].

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