ADVISORY COMMITTEE ON THE MICROBIOLOGICAL SAFETY OF FOOD

EPIDEMIOLOGY OF FOODBORNE INFECTIONS GROUP (EFIG)

1. The group met on 27 July 2018 and the following is a combined summary of the animal and human data and other topics that were discussed at the meeting.

Animal data

Animal *Salmonella* data January – December 2017

2. Key points from the January – December 2017 data were highlighted. The data were provisional and related to numbers of incidents rather than flocks or herds. The annual Animal and Plant Health Agency (APHA), reports on *Salmonella* in livestock provide further details including the reasons for collection of this data. The latest report (2016) is available at:

https://www.gov.uk/government/publications/salmonella-in-livestock-production-in-great-britain-2016

3. Although not presented here, some data is available for other pathogens from clinical diagnoses of non-statutory zoonoses and from other infections shared between animals and humans from specimens submitted to APHA and Scotland's Rural College (SRUC) laboratories.

4. An <u>isolation</u> is defined as the report of the first isolate of a given *Salmonella* (defined by serovar, and/or phage type, if available) from the same group of animals on a given occasion. If two submissions from the same group of animals on different dates give the same serovar, this is reported as two isolations. An <u>incident</u> comprises the first isolation and all subsequent isolations of the same serovar or serovar and phage/definitive type combination of a particular *Salmonella* from an animal, group of animals or their environment on single premises, within a defined time period (usually 30 days).

5. Between January and December 2017, there were 1,116 reports of *Salmonella* from livestock, which is 4% higher than during the same period of 2016 (1,072 reports). This increase was mainly due to increases in the number of reports from ducks (275 vs.237 incidents), cattle (336 vs. 320 incidents) and non-statutory species (223 vs. 203 incidents).

6. There were 13 reports *S.* Enteritidis (PT8 (x3), UNTY (x4) plus single incidents of PT4, PT9b, PT13a, PT21c, PT28 and PT33) during January – December 2017. This included 3 isolates from cattle and 1 from ducks.

7. Reports of *S.* Typhimurium were 7% lower compared with the same period in 2016 (115 vs. 123 incidents) but 5% higher than during January – December 2015 (110 incidents). The most common phage types were DT104 (28% of total *S*. Typhimurium reports) and U288 (21% of total *S*. Typhimurium reports) with most reports from pigs and cattle.

8. Reports of *Salmonella* 4,5,12:i:- fell by 25% (44 vs. 59 incidents) compared with January – December 2016, whilst the number of reports of *Salmonella* 4,12:i: increased by 55% (51 vs. 33 incidents). The most common phagetype was DT193, which accounted for 82 of the 95 monophasic incidents (86%). Most isolates of the monophasic strains were from pigs.

9. There were 10% fewer APHA/ SRUC submissions to VIDA between January – December 2017 (57,444 submissions) than during January – December 2016 (63,505 submissions) and 15% fewer than during the equivalent period of 2015 (67,301). Relative to January – December 2016, there was a decline in the number of submissions from cattle (14%), miscellaneous (8%), sheep (5%), pigs (4%) and birds (3%).

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Animal *Salmonella* data January – March 2018 (provisional data)

10. During January – March 2018 the number of reports of *Salmonella* in livestock decreased by 28% in comparison to January – March 2017 and by 11% compared with January – March 2016. There were four reports of *S*. Enteritidis compared with one report during the equivalent period of 2017. Reports of *S*. Typhimurium during January – March 2017 fell by 16% compared with January – March 2017 (16 vs. 19 reports) and by 38% compared with the equivalent period of 2016 (26 incidents). There was also a decrease (64%) in reports of the monophasic strain *Salmonella* 4,5,12:i:- compared with January – March 2017. However, reports of the monophasic strain *Salmonella* 4,12:i:- increased by 40% compared with January – March 2017 (7 reports vs. 5 reports). The most common phage types of *S*. Typhimurium and the two monophasic strains during January – March 2018 were DT104 and DT193.

Salmonella National Control Programme results 2017

11. A summary of 2017 UK *Salmonella* National Control Plan (NCP) results was presented. The results revealed a big difference between layers and broilers in the prevalence of *Salmonella*.

12. Laying chickens: Prevalence of regulated serovars was 0.14% which is lower than the EU target of 2% for adult laying hen flocks. Broilers: prevalence of regulated serovars was 0.01%, which is lower than the EU target of 1% for broiler flocks and prevalence of all serovars was 1.45%. Breeding chicken: prevalence of regulated serovars was 0%, well below the EU target of 1% for adult breeding flocks.

13. Breeding turkeys had nil regulated serovars, whereas the EU target is 1%. The prevalence for the non-regulated serovars was 1.99%, which represents only 5 flocks owing to the low number of breeding turkey flocks in the UK. Fattening turkeys: prevalence of regulated serovars was 0.27%, well below the EU target

(1%) for fattening turkey flocks. The prevalence for all serovars in fattening turkeys was 12.6%. The regulated serovars (*Salmonella* Enteritidis, *Salmonella* Typhimurium and its monophasic forms) are controlled because of their public health significance. Results revealed higher levels of non-regulated *Salmonella* in turkeys compared to chicken, but these are predominantly strains of *S*.Derby not thought to be associated with human illness.

Report of annual human infection data for 2017

14. It should be noted that these data are provisional and were extracted from different data sources, therefore caution is required in interpreting trends over time and differences between countries.

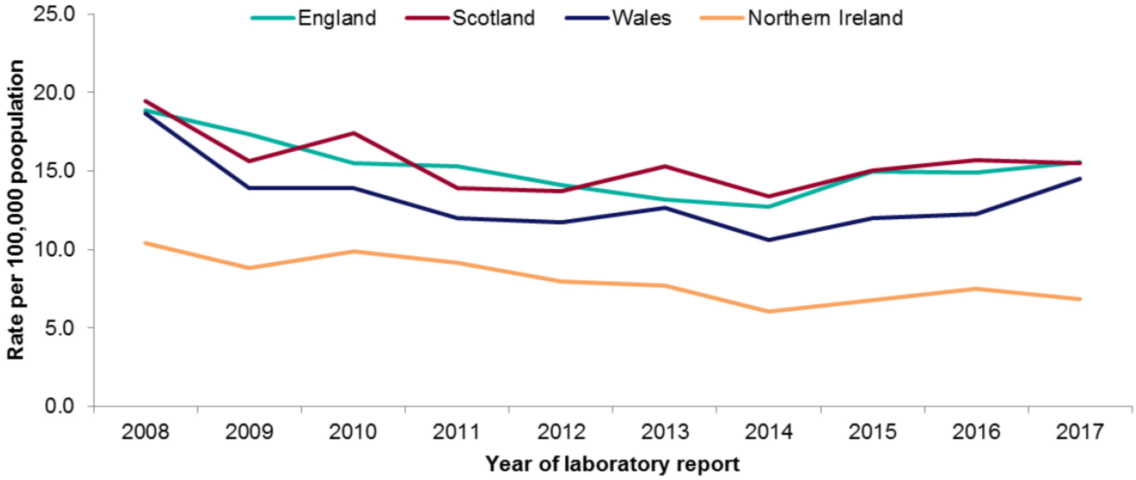
15. England and Wales data for *Campylobacter* and *Salmonella* was extracted from the laboratory surveillance system SGSS, the laboratory reporting system PHE implemented in 2015. *Listeria monocytogenes* data are from the enhanced *Listeria* surveillance database, STEC data are from the enhanced STEC surveillance database (England only), and foodborne outbreak data are from the enhanced foodborne outbreaks surveillance system, all of which are Public Health England databases. Data for Northern Ireland were supplied by the Public Health Agency Northern Ireland and data for Scotland by Health Protection Scotland.

16. Figures 1-7 show the trends for non-typhoidal *Salmonella* infections, *Campylobacter*, *Listeria monocytogenes*, Shigatoxin producing *E.coli* (STEC) O157 and foodborne outbreaks in the UK.

All non-typhoidal *Salmonella* infections

17. The group was informed that there were 10,089 reports of non-typhoidal *Salmonella* in 2017, a small increase from the 9619 reported in 2016 (Figure 1). An increase in the reporting rate was seen in England and Wales, and a decrease in Scotland and Northern Ireland. The overall number of reported infections increased in the UK by 470.

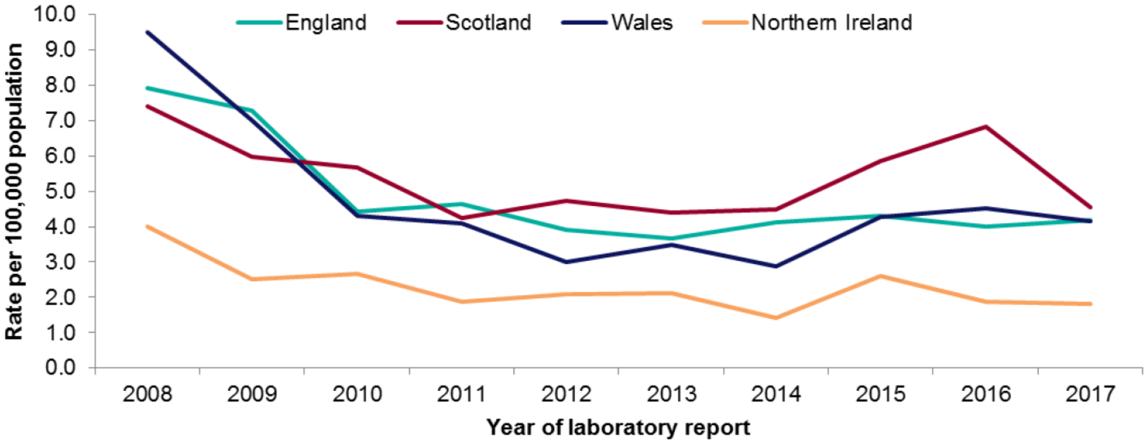
Figure 1. Rate of reported non-typhoidal *Salmonella* infections by country per 100,000 population, 2008-2017



Salmonella serovars

18. Reports of *S.* Enteritidis decreased in the UK, due to decreases across all countries other than England where there was a small increase in cases reported (Figure 2). Scotland reported the largest decrease, with the reporting rate declining from 6.9 to 4.6 per 100,000 population.

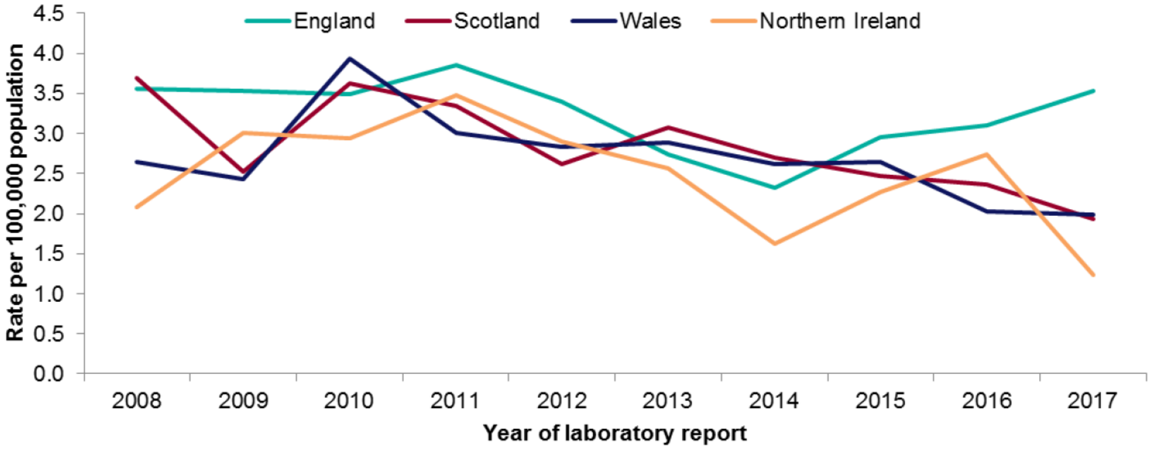
Figure 2. Rate of reported *Salmonella* Enteritidis infections in the United Kingdom and by nation per 100,000 population, 2008-2017



19. An increase in the reporting rate of *S.* Typhimurium was seen in 2017 compared to 2016 with an increase of 201 cases (Figure 3). An increase in reporting rate was seen in England (from 3.1 per 100,000 in 2016 to 3.5 per 100,000 in 2017) for the third year, while the reporting rate remained the same in Wales and decreased in Scotland and Northern Ireland. The number of

reported cases in Northern Ireland decreased by more than half in 2017 as compared to 2016. On the query concerning the increase in the number of cases in England, it was suggested that this could be attributed to two large outbreaks during the year.

Figure 3. Rate of reported *Salmonella* Typhimurium infections by country per 100,000 population, 2008-2017



20. *S.* Enteritidis was the most commonly reported serovar across all constituent countries (Table 1). Wales reported a slightly larger proportion of *S.* Enteritidis cases compared to all *Salmonella* serovars reported (30%), compared to 29% in Scotland, and 27% in England and Northern Ireland. Together *S.* Enteritidis and *S.* Typhimurium constitute 48% of all non-typhoidal Salmonellae reported in the United Kingdom. In addition to these, *S.* Newport, *S.* Infantis, *S.* Stanley and *S.* Java are within the top 10 most commonly identified serovars in all four countries. The top 10 serovars comprise 66% of all reported *Salmonella* infections in England, 60% in Wales, and 69% in Northern Ireland.

21. The group discussed follow-up work that takes place on non-typhoidal *Salmonella* serovars that are not in the top 10. It was noted that these serovars are still subject to Whole Genome Sequencing (WGS) and trends/potential outbreak events are monitored via SNP typing and/or the exceedance system. It was observed that Public Health Wales were adapting to the use of new testing methods/data collection but refinements to the system are still in progress which may have bearing on the overall UK *Salmonella* picture.

Table 1: Number of the ten most common non-typhoidal Salmonella serovars isolated, by country, 2017

England		Wales**		Scotland		Northern Ireland	
Serovar	n	Serovar	n	Serovar	n	Serovar	n
Enteritidis	2324	Enteritidis	130	Enteritidis	247	Enteritidis	34
Typhimurium	1964	Typhimurium	62	Group B†	113	Typhimurium	23
Newport	346	Newport	18	Typhimurium	105	Infantis	8
Infantis	241	Infantis	14	Saint Paul	24	Mikawasima	6
Agona	210	Hadar	12	Newport	23	Newport	4
Stanley	165	Java	10	Group C1‡	20	Stanley	4
Kentucky	147	Arizonae	9	Infantis	20	Agona	3
Virchow	132	Stanley	7	Java	19	Java	3
Java	121	Corvallis	7	Stanley	16	Saint-Paul	3
Bareilly	94	Agona	6	Group C2#	15	*	

†Group B includes *S.* Agama, Agona, Bredeney, Coeln, Derby, Gloucester, Heidelberg, Indiana, Kiambu, Kimuenza, Mons, Reading, Saint Paul, Schwarzengrund, Stanley, and Typhimurium.

‡Group C1 includes *S.* Braenderup, Cerro, Choleraesuis, Colindale, Concord, Infantis, Larochelle, Livingstone, Mbandaka, Menston, Montevideo, Ohio, Oslo, Riggil, Rissen, Tennessee, Thompson, and Virchow.

#Group C2 includes *S.* Bovismorbificians and Newport

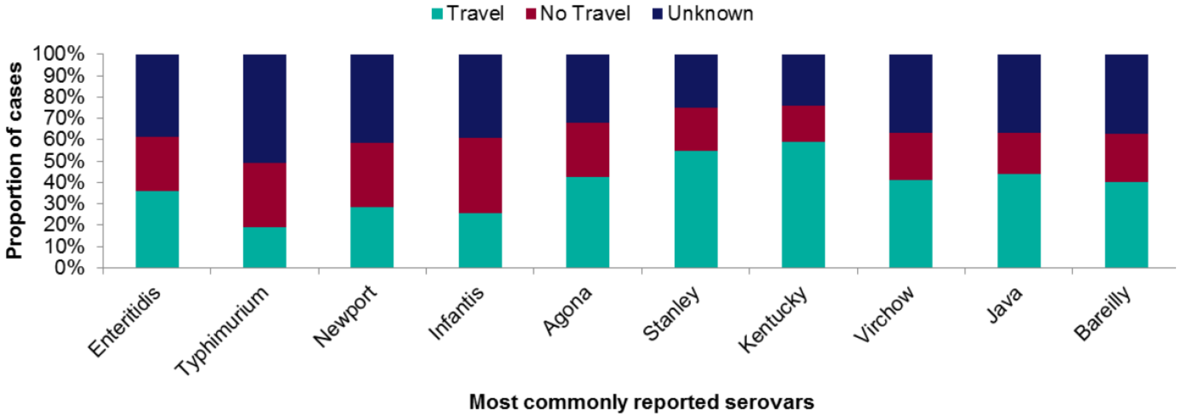
*No other serovars have more than two cases reported

**These data were extracted from SGSS

Travel

22. The serovars with the highest proportion of cases reporting travel prior to infection are *S.* Kentucky (59% of cases reported foreign travel) and *S.* Stanley (55% of cases reported foreign travel) (Figure 4). A greater proportion of *S.* Enteritidis cases reported travel than *S.* Typhimurium cases (36% versus 19%). The serovar with the highest proportion of cases who report not travelling prior to infection is *S.* Infantis (35% of cases).

Figure 4. Proportion of travel in the ten most common non-typhoidal *Salmonella* serovars isolated in the UK*, 2017

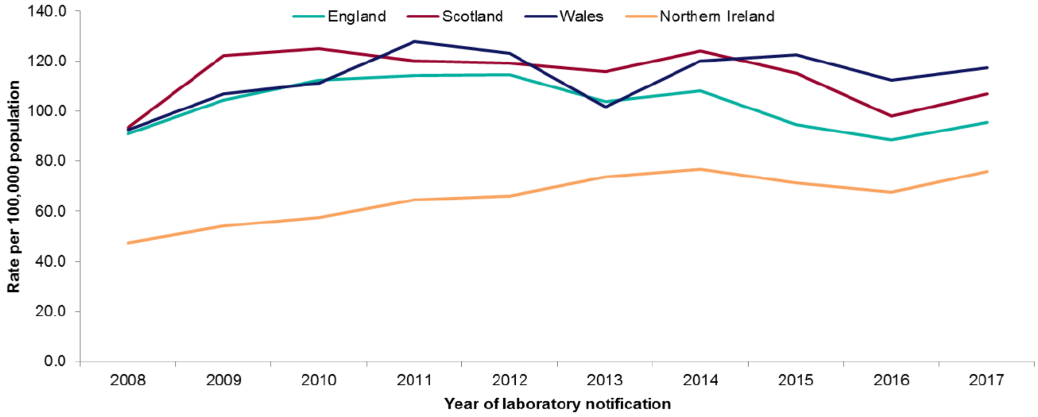


* Serovars included are the ten most commonly reported serovars in the UK and are reported in order of the number of infections

Campylobacter infections

23. The reporting rate for *Campylobacter* has increased in the UK from 89.8 per 100,000 population in 2016 to 96.8 per 100,000 in 2017 (Figure 5). The rate of reported *Campylobacter* infections in England has increased from 2016 to 2017 after a steady decline in the reporting of cases from 2012. The reporting rate has also increased across all other countries. Northern Ireland continues to report rates lower than the rest of the United Kingdom (76.0 cases per 100,000 population). The largest increase in reporting rate was in Scotland (from 98.0 cases per 100,000 population in 2016 to 106.8 cases per 100,000 population in 2017).

Figure 5. Rate of reported *Campylobacter* infections by country per 100,000 population, 2008-2017

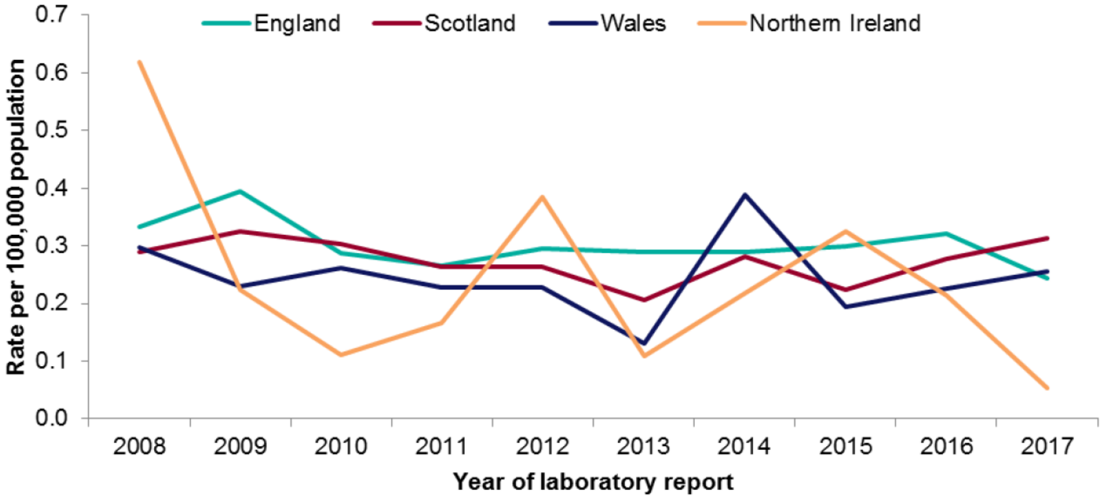


24. Members noted the narrowing gap in the reporting rate of cases in Northern Ireland compared to the other UK countries.

Listeria infections

25. There was a decrease in the number of reported *Listeria monocytogenes* infections in 2017 by 42 cases compared to 2016 to the lowest number of cases reported in the last ten years however small numbers limit meaningful trend interpretation (Figure 6).

Figure 6. Rate of reported *Listeria* infections by country per 100,000 population, 2008-2017



STEC infections

26. Reports of STEC O157 in the UK decreased from a rate of 1.5 cases per 100,000 population in 2016 to 1.2 cases per 100,000 population in 2017 (Figure 7). Decreases were reported by all UK countries, with the largest decrease in reporting rate in Northern Ireland (decreasing from 3.4 per 100,000 population in 2016 to 2.4 per 100,000 population in 2017), although small numbers in Northern Ireland limit interpretation of this trend. The reporting rate for the UK overall is the lowest it has been in the last 10 years and follows a year on year decline in STEC serogroup O157 in England particularly since 2015.

27. The number of the ten most commonly reported STEC serotypes among clinical infections across the UK in 2017 are: O157, O26, O91, O146, O103, O145, O128AB, O117, O38 and O111 (Table 2). Population incidence was not taken into account in the calculations as serogroups other than O157 are under reported due to current frontline testing methods which do not detect all STEC serogroups. Serogroup O26 is the most commonly detected non-O157 serogroup in the UK.

Figure 7. Rate of reported STEC O157 infections by country per 100,000 population, 2008-2017

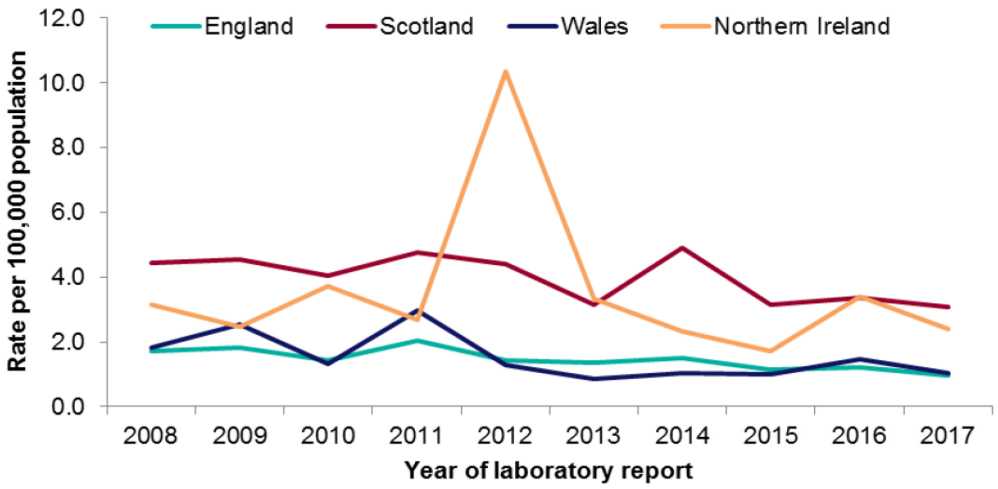
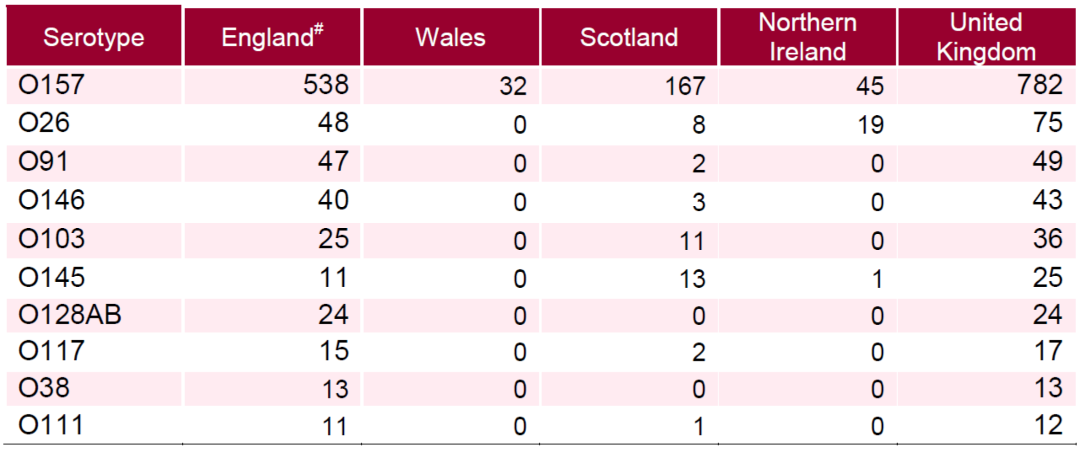


Table 2: Number of the ten most commonly reported STEC serotypes among clinical infections in the United Kingdom and by country, 2017*



Serotype	England#	Wales	Scotland	Northern Ireland	United Kingdom
O157	538	32	167	45	782
O26	48	0	8	19	75
O91	47	0	2	0	49
O146	40	0	3	0	43
O103	25	0	11	0	36
O145	11	0	13	1	25
O128AB	24	0	0	0	24
O117	15	0	2	0	17
O38	13	0	0	0	13
O111	11	0	1	0	12

*Testing for non-O157 STEC infections varies by laboratory; totals presented do not represent the prevalence of infections in the population.

Multiple serotypes are recovered from some patients and these figures include two individuals infected with more than one non-O157 STEC strain.

Foodborne outbreaks

28. Members noted that in 2017, 40 foodborne outbreaks were reported to eFOSS in the UK compared to 48 reported in 2016 (Figure 8; Table 3). There were 1425 cases, 840 of which were laboratory confirmed, and 167 reported hospitalisations, an increase in reported hospitalisations by 50 cases compared to 2016. There were three reported deaths from two *Salmonella* outbreaks, compared to 0 deaths reported in 2016. There was one additional *Salmonella* outbreak reported in 2017 compared to 2016, with more diversity in the serovars of reported outbreaks than in 2016 where 8/12 reported outbreaks were *S.* Enteritidis (compared to two in 2017). There were

reductions in the number of outbreaks reported of norovirus (from ten outbreaks in 2016 to five in 2017) and in *C. perfringens* (from eight outbreaks in 2016 to two in 2017).

29. *Salmonella* was the most commonly implicated pathogen (13/40, 33%), with *Campylobacter* the second most commonly reported causative pathogen (9/40, 23%). The four outbreaks comprising other/unknown were unknown (viral aetiology suspected) (2), *Bacillus cereus* (1) and hepatitis A (1). Almost half of foodborne outbreaks occurred in the food service sector (19/40, 48%), followed by community (13/40, 33%). Of the food service sector outbreaks, the majority of these occurred in restaurants, pubs and takeaways (15/19, 79%).

30. There was discussion on the impact of the various interventions on the number of foodborne illnesses. It was pointed out that although there were different interventions for the respective pathogens their effectiveness should result in a reduction in the number of cases.

Figure 8. Number of outbreaks attributed to specific pathogens reported in the UK, 2008-2017

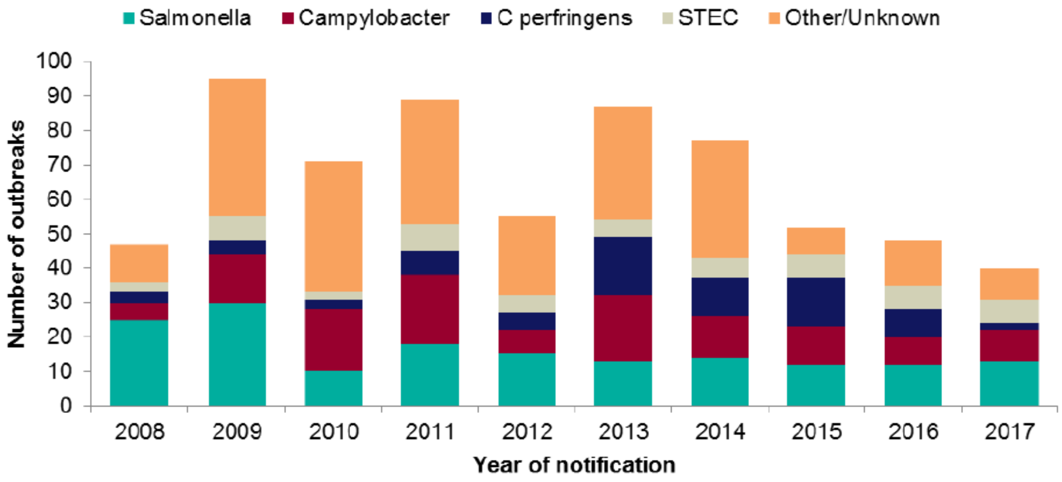


Table 3: Number of outbreaks attributed to specific pathogens reported in the UK, 2017

Year	England and Wales	Scotland	Northern Ireland	United Kingdom*
Salmonella	13	3	0	13
S. Enteritidis	2	1	0	2
S. Typhimurium	5	0	0	5
Campylobacter	9	0	0	9
C. perfringens	2	0	0	2
Norovirus	3	1	2	5
STEC O157	5	0	0	5
STEC non-O157	2	2	0	2
Other/unknown	3	1	0	4

*Number of outbreaks reported exceeds total number for the UK as national outbreaks with cases in both Scotland and England/Wales reported separately

Update on application of whole genome sequencing for *Salmonella* outbreak investigations

31. PHE updated the group on how whole genome sequencing (WGS) has been employed for *Salmonella* outbreak investigations since April 2014. It was explained that sequences are analysed by SNP typing and receive a “SNP address”, a typing scheme which allows PHE to identify cases which are closely genetically related to one another. The group noted that PHE has over 30,000 *Salmonella* sequences in its database (a lot of genetic information is available for comparison).

32. The presentation covered key features of WGS such as:

- Detection of microbiological linked isolates (WGS provides evidence of a strong microbiological link between isolates, it is possible to infer a common source of contamination but not vehicle of infection).

- Better detection of multi-vehicle outbreaks (examples were provided how WGS is being used in identifying food isolates from different vehicles within outbreaks).

- Phylogenetic assessment alongside epidemiology and food chain evidence (significance of phylogeny was highlighted as it provides a full genetic picture of the relatedness of isolates to each other; examples of how it allows further analysis of cases that meet an outbreak case definition was highlighted).

- Improved monitoring of effectiveness of interventions (examples of how strain discrimination from WGS allows monitoring of intervention effectiveness was provided).

33. In conclusion it was noted that WGS is a powerful tool in combination with epidemiology, food chain and veterinary investigations but has also revealed challenges health agencies did not have to deal with in the past such as how to cope with long term “drip drip clusters”. Members recognised the importance of a ‘One Health’ approach in tackling foodborne illness matters. It was mentioned that PHE was working on a *Salmonella* WGS outbreak investigation guidance document as well as an egg sampling guidance document.

34. In the ensuing discussion, it was noted that the EFSA guidance on the reporting of foodborne outbreaks did not take account of the implementation of WGS. Although there is agreement on the enhanced strength of evidence provided by WGS, it was pointed out that when determining strong/weak evidence in outbreak reporting, further consideration and potentially inclusion in the EFSA guidance of microbiological evidence based on WGS was required.

Food surveillance

35. PHE updated the group on their recent food surveillance activities.

36. **Co-ordinated studies for 2017-18.** Study 60 – imported edible whole leaves collected at retail sale in England in 2017 with an emphasis on betel and curry leaves: Microbiological quality with respect to *Salmonella*, Shiga-toxin-producing *E.coli* (STEC) and levels of *Escherichia coli* (*J. Appl. Microbiol*. 2018; in press.

Study 62 – Chilled RTE food with a focus on those with an eastern European origin.
Study 63 – Ovens used to slow cook meat joints to test for *Salmonella*.

37. PHE Food Water and Environmental Microbiology Laboratories (FW&E) undertake tests for the presence of *Salmonella* in consignments of imported chicken for Port Health Authorities (PHAs) which are collected at Border Inspection Posts. Cases of non-compliance with EU requirements led to an increase in the amount of testing requested by PHAs for imports from third countries which has resulted in the recovery of *Salmonella* from consignments of raw or salted from a few countries.

38. It was reported that PHE test approximately 25,000 samples for the presence of *L.monocytogenes* in food and environmental samples collected in England. Isolates of *L.monocytogenes* are collected from >95% of the cases of listeriosis and, together with those from food, are now characterised by whole genome sequencing. A review of outbreaks showed that the collection of foods independently of outbreak investigations and the comparison of isolates of *L.monocytogenes* with those recovered from listeriosis patients was the most frequent method of identifying the implicated food vehicle.

39. More associations are being detected with the application of WGS and this took place in the recent investigations associated with frozen corn. WGS also make associations more likely to be identified across national borders. Associations between foods and cases are likely to occur through the sequences being available in the public domain.

Food Surveillance Scotland

40. The group noted the co-ordinated food sampling programme for Scotland for 2017/2018 and 2018/19. Food Standard Scotland has identified 14 microbiological and chemical sampling priorities to target in Scottish Local Authority sampling grants programme for 2018/19. FSS are currently in the process of commissioning a “Microbiological Survey of Minced Beef on Retail Sale in Scotland”. The project is expected to begin in the autumn of 2018 and report in spring 2020.

Food Surveillance in Wales

41. Members received an update on the food surveillance activities in Wales. It was noted that food sampling in Wales is co-ordinated by the Welsh Food Microbiological Forum (WFMF). Sampling is undertaken by local authorities with samples submitted to Public Health Wales FWE laboratories. Recent activities include a school meals survey, a continuing shopping basket survey, and a planned repeat survey of ice-creams and Gelato.

Antimicrobial resistance

42. EFIG received an update on AMR activities in relation to the FSA. The group noted that:

    - The FSA's survey of antimicrobial resistance in bacteria in chicken and pork has been completed and the survey report is expected to be published late summer/autumn 2018.

    - The report produced by the ACMSF fixed-term task and finish group on AMR (AMR in the food chain research questions and potential approaches) is available on the FSA website. The report was discussed at the FSA Board meeting on 19 September 2018.

    - Early in 2018 ECDC and DG Santé officials visited the UK to discuss AMR issues, looking at the UK's One Health approach in relation to AMR.

    - Work is underway to refresh the current UK AMR strategy 2013 – 2018. The new strategy will consider the areas of food safety and the environment and there will be an implementation plan for the next 5-year period.

43. ACMSF Members are invited to comment on the recent trends in animal and human data and other subjects discussed by EFIG at the July 2018 meeting.

Secretariat
October 2018