

ADVISORY COMMITTEE ON THE MICROBIOLOGICAL SAFETY OF FOOD**EPIDEMIOLOGY OF FOODBORNE INFECTIONS GROUP (EFIG)**

1. The group met on 6 December 2019 and the following is a combined summary of the animal and human data and other topics that were discussed at this meeting.

Animal data**Animal *Salmonella* data January – September 2019 (provisional data)**

2. Key points from the January – September 2019 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 (2018) is available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/842917/salm-livestock-prod-gb18.pdf

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 isolation 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 incident 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 a single premises, within a defined time period (usually 30 days).
5. Between January and September 2019, there were 872 reports of *Salmonella* from livestock, excluding chickens and turkeys, which is 13% higher than during January – September 2018 (769 reports) but slightly lower than during the equivalent period of 2017 (884 reports).
6. There were 14 reports of *S. Enteritidis* during January – September 2019 compared with 7 reports during January – September 2018 (4 were in horses, one was in quail and 9 were non statutory species).
7. Reports of *S. Typhimurium* in species other than chickens and turkeys increased by 11% compared with January – September 2018 (80 vs. 72 reports) but decreased slightly compared with the equivalent period of 2017 (85 reports). The most common phage types were DT104 (14 reports; 18% of total *S. Typhimurium* reports), DT193 (12 reports; 15% of total *S. Typhimurium* reports) and U288 (12 reports; 15% of total *S. Typhimurium* reports).

8. Reports of *Salmonella* 4,5,12:i:- in species other than chickens and turkeys increased by 36% (30 vs.22 incidents) compared with January – September 2017 but fell by 21% compared with the equivalent period of 2017 (38 reports). There was an increase of 75% in the number of reports of *Salmonella* 4,12:i:i: (42 vs. 24 incidents) in species other than chickens or turkeys compared with January – September 2018 and a 20% increase compared with the equivalent period of 2017 (35 incidents). Sixty of the monophasic incidents (83%) reported during January – September 2019 were phage type DT193.
9. The total APHA/SRUC submissions to the Veterinary Investigation Diagnosis Database (VIDA) between January and September 2019 was 35,745. This is a 4% reduction compared to the equivalent 2018 period (37,360 submissions) and a decrease of 17% compared to the equivalent 2017 period (42,904 submissions). Relative to 2018, there was a decline in cattle (8%) and sheep (9%) submissions, and a 12% increase in the number of pig submissions. The number of submissions for avian species (5,471 vs. 5,497 submissions) and miscellaneous species (6,615 vs. 6,602 submissions) remained similar compared to the equivalent 2018 period.
10. As the format that the data was presented in has been revised, future updates to EFIG will have specific information relating to isolations from outbreaks.

Animal Feed and *Salmonella*

11. EFIG was updated on the number of *Salmonella* incidents in feed as it was observed at a previous meeting that 2018 numbers were high compared to previous years. This has been linked to the EU ban on the use of formaldehyde. The paper covered the following areas:
 - *Salmonella* in feed and feed ingredients in GB – 2015 to September 2019 by serovar and number of isolations
 - *Salmonella* in compound animal feed in GB – 2015 to September 2019 by serovar and number of isolations
 - *Salmonella* in compound chicken feed in GB – 2015 to September 2019 by serovar and numbers of isolations
12. The data outlined in the paper highlighted the unusual Salmonellas. Members remarked on the benefits of the paper as it was underlined that some of the Salmonellas in the paper could be linked to human infections and it was agreed that future updates should include data on human serovars for comparison purposes.

***Salmonella* National Control Programme (NCP) results 2018 and 2019 (January – September 2019)**

13. An overview of the *Salmonella* NCP results for the above period was provided to the group. NCP testing provides a good indication of the *Salmonella* status of chicken and turkey flocks in the NCP.

14. NCP testing continues to provide a good indication of the *Salmonella* status of chicken and turkey flocks in the NCP.
15. The number of flocks infected with *S. Enteritidis* has increased. These have occurred in two clusters each of which involved a separate common packing centre. In 2019, 14 chicken layer flocks were identified to be infected with *S. Enteritidis* in GB (provisional data). This compared to 7 in 2018 and 6 in 2017. The flocks identified in 2019 were in two clusters (each with 7 flocks). Each cluster involved a separate common packing centre. PHE has linked the *S. Enteritidis* isolates from the layer flocks to human isolates from two separate WGS clusters of human disease cases. Investigations into why infection may have been spread are in progress in association with FSA and LAs. It was noted that APHA, PHE and the FSA are able to quickly identify cases likely to be linked to these incidents because of the use of whole genome sequencing.
16. The number of cases of *S. Enteritidis* in broilers has reduced to date in 2019 and the number of cases of *S. Typhimurium* has increased. The reason for this is not clear but this may be due to increased difficulty of rodent control due to more restrictive regulations on use of rodenticides and the ban on use for formaldehyde in feed.

Human Infection Data – Summary of key pathogens for 2018

Trend in laboratory reports

Data sources (human infection data)

Data are provisional and provided from numerous sources; caution is required in interpreting trends over time and differences between countries.

Data from 2010-2018 for all countries were extracted from the previous annual EFIG report.

Data in England in 2019 for *Listeria* are from the enhanced *Listeria* surveillance database, STEC data are from the enhanced STEC surveillance database, foodborne outbreak data are from the foodborne outbreaks surveillance system (eFOSS), and data for *Campylobacter*, *Salmonella* and *Cryptosporidium* are from the Second Generation Surveillance System (SGSS), all of which are Public Health England databases. Data for Wales for non-O157 STEC was extracted from GastroDataWarehouse, the reference laboratory database held by Public Health England.

Data for 2019 for Wales, Scotland, and Northern Ireland were supplied by Public Health Wales, Health Protection Scotland and Public Health Agency Northern Ireland, respectively.

Population data

Population data are ONS mid-year estimates; please note the mid-year estimate for 2018 was also used for 2019.

Rate calculation

As figures used are for the first three quarters of each year, to estimate annual rates the number of infections reported is multiplied by 1.25 prior to rate

calculation. Please note this may lead to inaccurate estimates for pathogens for which seasonal trends are observed.

Data caveats (human infection data – *Salmonella*, *Campylobacter* and *Cryptosporidium*)

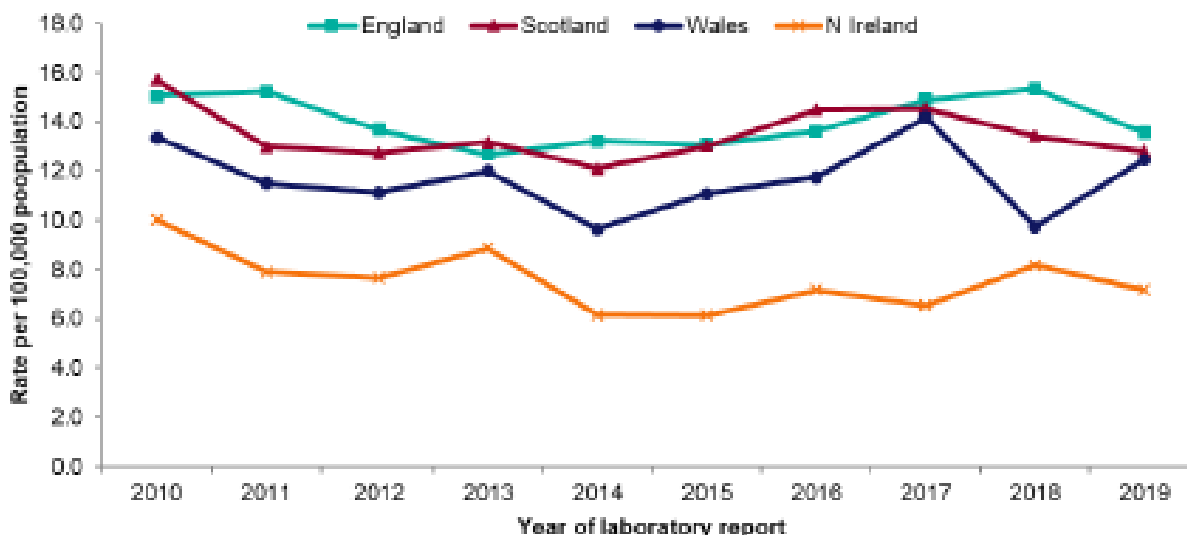
The data reported to EFIG in this quarterly report should be considered as provisional because PHE are currently reviewing the data collection system and carrying out a data validation exercise

Report of annual human infection data for quarters 1-3, 2019

All non-typhoidal *Salmonella* infections

17. There were 7053 reports of non-typhoidal *Salmonella* in quarters 1-3 2019 in the UK, a decrease from the 7825 cases reported in quarters 1-3 of 2018. The decrease in reporting rate comes after a gradual increase in reporting rate from 12.6 cases reported per 100,000 population in 2013 to 14.7 cases reported per 100,000 population in 2018. The decrease in reporting rate was seen in all nations except Wales, where reporting rate increased (Figure 1).

Figure 1. Rate of reported non-typhoidal *Salmonella* infections by country per 100,000 population for quarters 1-3, 2010-2019



Salmonella serovars

18. Reports of *S. Enteritidis* decreased in the UK in quarters 1-3 of 2019 compared to 2018, with decreases in case numbers and reporting rates in all nations other than Scotland, where an increase was reported (Figure 2). The reporting rate for *S. Typhimurium* decreased in 2019 in quarters 1-3 compared to 2018, with case

numbers decreasing from 1717 in quarters 1-3 of 2018 to 1340 in the same period in 2019 (Figure 3). This decrease is partially, but not wholly, due to a decline in case reporting in a large multi-year outbreak of *S. Typhimurium*, which contributed to 166 cases in quarters 1-3 in 2018.

Figure 2. Rate of reported *Salmonella* Enteritidis infections in the UK and by nation per 100,000 population for quarters 1-3, 2010-2019

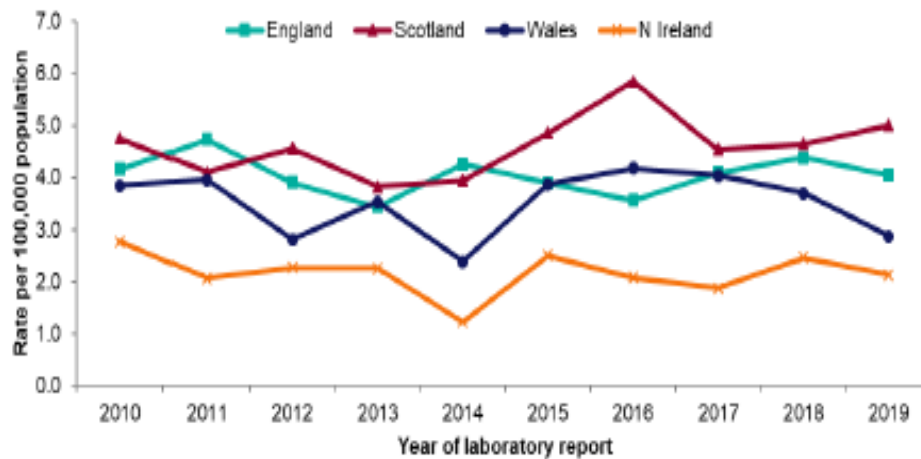
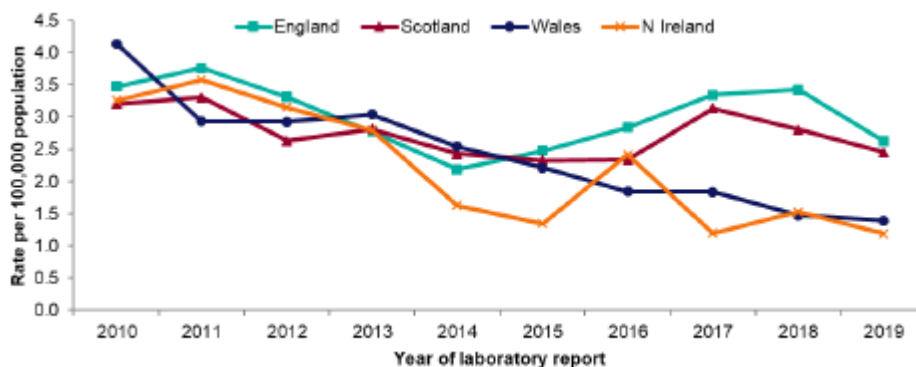


Figure 3. Rate of reported *Salmonella* Typhimurium infections by country per 100,000 population for quarters 1-3, 2010-2019



19. The most commonly reported *Salmonella* serovar in the UK for quarters 1-3 of 2019 was *S. Enteritidis* in all four countries (making up 30% of all non-typhoidal *Salmonella* reports), with *S. Typhimurium* being the second most common (comprising 19% of all reports). *S. Enteritidis* and *S. Typhimurium* combined make up 50% of reported non-typhoidal *Salmonella* cases.

20. The only other serovar all four nations report amongst their top ten most commonly reported serovars is *S. Infantis*. *S. Newport*, *S. Stanley* and *S. Java* were reported by three of the four nations in their top ten most commonly reported serovars (Table 1).

21. It was observed that the outbreaks of *S. Enteritidis* linked to eggs has not had a significant impact on the number of cases in quarters 1-3.

Table 1. Number of the ten most common non-typhoidal *Salmonella* serovars isolated, by country, quarters 1-3, 2019

England		Wales		Scotland		Northern Ireland	
Serovar	n	Serovar	n	Serovar	n	Serovar	n
Enteritidis	1812	Enteritidis	72	Enteritidis	218	Enteritidis	32
Typhimurium	1180	Typhimurium	35	Typhimurium	107	Typhimurium	18
Newport	185	Infantis	5	Infantis	22	Bredeney	3
Infantis	141	Java	4	Newport	18	Infantis	3
Agona	132	Oranienburg	4	Stanley	15	Bovis-Morbificans	2
Stanley	98	Virchow	4	Java	12	Newport	2
Virchow	93	Kottbus	3	Braenderup	7	Stanley	2
Kentucky	91	Mbandaka	3	Agona	8		
Java	88	Braenderup	2	Kentucky	8		
Bareilly	80			*			

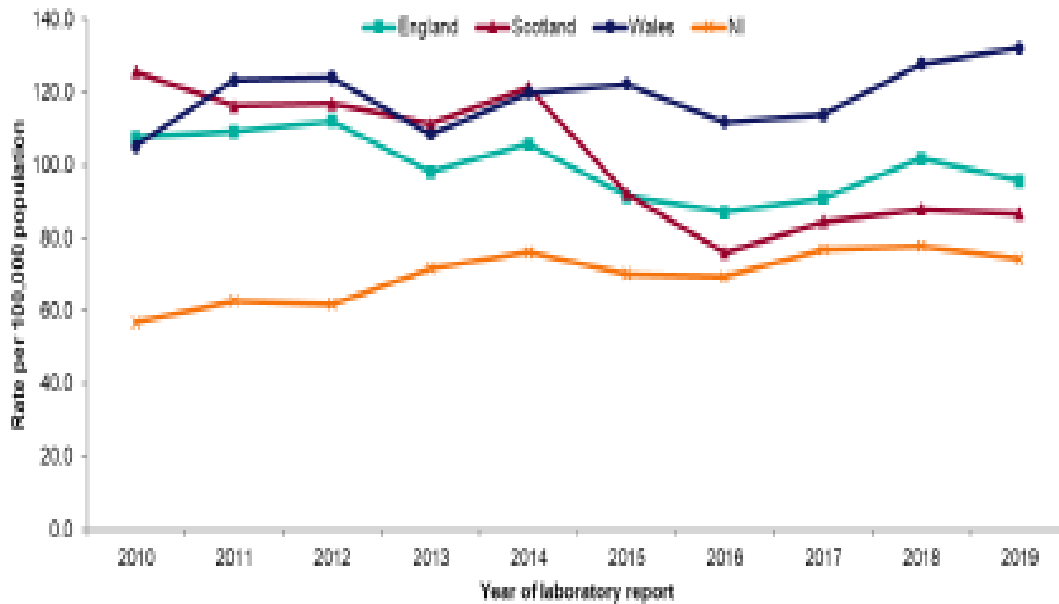
*All other serovars had 7 or fewer reports.

***Campylobacter* infections**

22. The reporting rate for *Campylobacter* decreased in the UK from 103.0 per 100,000 population in quarters 1-3 of 2018 to 97.8 per 100,000 in quarters 1-3 of 2019 (Figure 4). This decrease comes after the increase in reporting seen in 2018 compared to 2015-2017, although the reporting rate is still higher than in those three years. The reporting rate decreased in all nations except for Wales, which saw an increase in reporting rate to the highest rate seen in any nation from quarters 1-3 of 2010-2009 (132.2 cases per 100,000 population). The gap in reporting rates between Northern Ireland and the other countries has narrowed in recent years due to a consistently increasing trend in reporting rate over the last ten years, although a slight decrease was seen in this rate in quarters 1-3 of 2019.

23. As it was observed that reporting rate decreased in all countries except for Wales, members discussed if this was an artefact. The group noted that PHW was investigating the reasons why numbers were going up in Wales (it was mentioned that recent increases has been observed in North Wales and in the Cardiff area). Reporting rate in Northern Ireland also generated discussion as the numbers were catching up with England, Wales and Scotland (for about 10 years there was big difference between Northern Ireland and the other UK countries). Following discussion, it was agreed to have regional breakdown of *Campylobacter* cases (over a 10-year period) in the four 4 UK countries as it was felt this may shed some clues on what may be influencing the fluctuation in the number of cases.

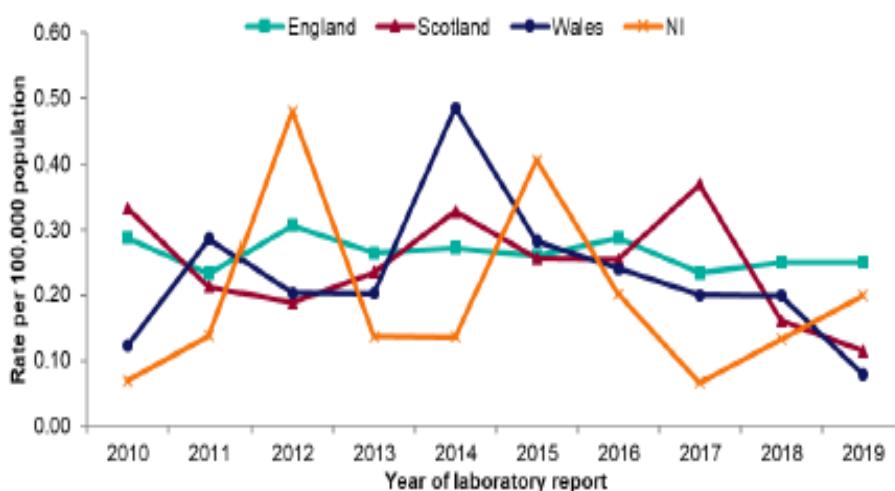
Figure 4. Rate of reported *Campylobacter* infections by country per 100,000 population for quarters 1-3, 2019



Listeria infections

24. The number of reported cases in the UK has remained relatively stable since 2010, however small numbers limit meaningful trend interpretation (Figure 5). Four fewer cases were reported in quarters 1-3 of 2019 compared to quarters 1-3 of 2018.

Figure 5. Rate of reported *Listeria* infections by country per 100,000 population for quarters 1-3, 2010-2019



STEC Infections

25. STEC O157 incidence in the UK decreased in quarters 1-3 2019 after an increase in quarters 1-3 of 2018 (Figure 6). Decreases in cases were reported by

all countries other than Scotland, where one additional case was reported compared to last year.

26. Table 2 shows the number of cases reported with the most commonly detected STEC serogroups across the constituent countries in the UK in quarters 1-3 of 2019.

27. Population incidence was not presented/calculated as serogroups other than O157 are likely to have been under-detected; STEC culture methods are specific to serogroup O157 and the majority of front-line laboratories have not yet implemented molecular testing (PCR to detect toxin genes and genes specific to other serotypes). In England, approximately 15% of frontline laboratories have developed this capacity to date. With this caveat, O26 is the most commonly detected non-O157 serogroup in England, Scotland and Northern Ireland.

Figure 6. Rate of reported STEC O157 infections by country per 100,000 populations for quarters 1-3, 2010-2019

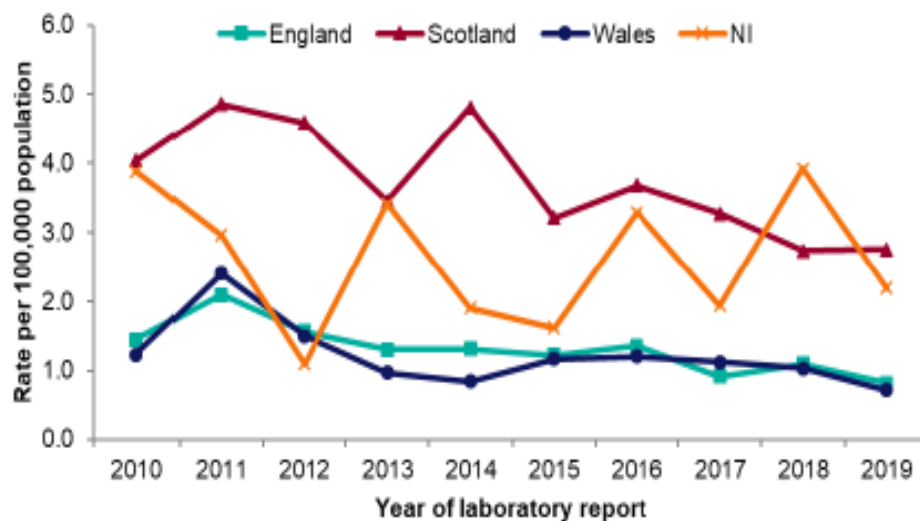


Table 2. Number of the most commonly reported STEC infections by serogroup* by country for quarters 1-3, 2019

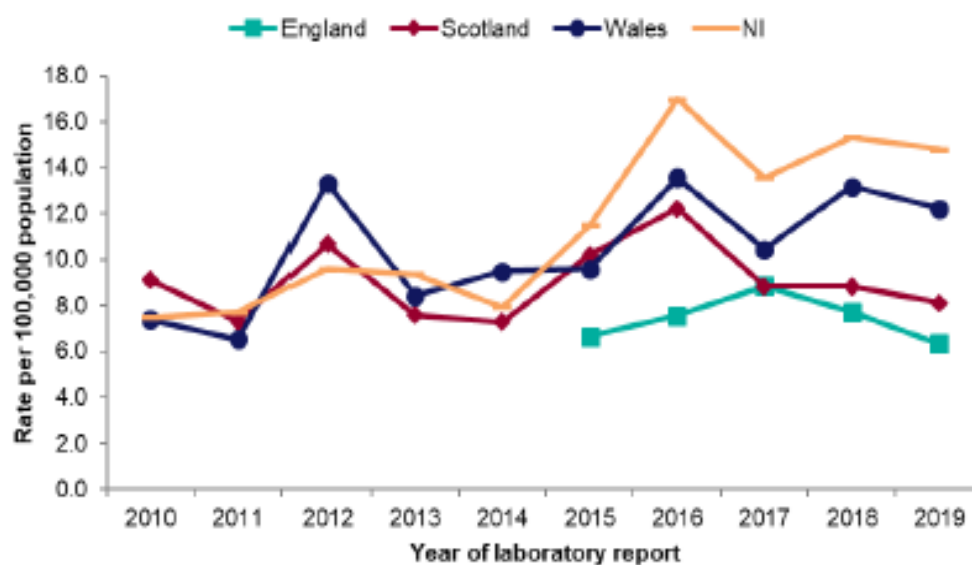
England		Wales		Scotland		Northern Ireland	
Serogroup	n	Serogroup	n	Serogroup	n	Serogroup	n
O157	369	O26	21	O157	120	O157	33
O26	58	O157	18	O26	18	O26	14
O146	58	O146	11	O125	6	O55	1
O91	47	O91	8	O145	6		
O103	19	O128ab	6	O55	3		
O128ab	16	O111	5	O103 [†]	2		
O113	15	O113	3	O111 [†]	2		
O76	14	O123	3	O112 [†]	2		
O117	11	O156	3	O128 [†]	2		
O111	11	O16	3	O146 [†]	2		
O145	11	*		O165 [†]	2		

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

***Cryptosporidium* infections**

28. *Cryptosporidium* species incidence in the UK decreased in quarters 1-3 of 2019 compared to the same period in 2018, representing a downward trend in reporting rate since 2017. This is the lowest rate of cases reported for quarters 1-3 since data were available for all four nations in 2015. Reporting rate decreased in all four nations.

Figure 7. Rate of *Cryptosporidium* species infections by country per 100,000 populations for quarters 1-3, 2010-2019



Foodborne outbreaks

29. In quarters 1-3 of 2019, 40 foodborne outbreaks were reported to eFOSS in England and Wales and to Health Protection Scotland and Public Health Agency Northern Ireland (Table 3). The pathogen implicated in the largest number of outbreaks was Norovirus (14/40 outbreaks, 35%), followed by *Salmonella* (7/40 outbreaks, 18%).

Table 3. Number of foodborne outbreaks attributed to specific pathogens reported by country*, quarters 1-3, 2019

Pathogen	England and Wales	Scotland	Northern Ireland
<i>Salmonella</i>	7	0	0
<i>S. Enteritidis</i>	2	0	0
<i>S. Typhimurium</i>	1	0	0
<i>Campylobacter</i>	1	0	0
<i>C. perfringens</i>	5	0	0
STEC	2	1	0
<i>Cryptosporidium</i>	0	0	0
Norovirus	14	0	0
<i>Listeria</i>	2	1	0
Other/Unknown	5	0	1

*National outbreaks may be counted twice if reported by multiple countries

Foodborne outbreak investigations

EFIG received a presentation from the FSA incidents team on the challenges of food outbreak management.

30. The group noted that:

- There were ongoing negotiations with the EU on future access to Rapid Alert System for Food and Feed (RASFF) following exit from the EU.
- The FSA has agreed a Standard Operating Procedure with PHE that whenever there is a microbiological incident the food business operation concerned should be encouraged to share any available isolates with PHE. This would enable PHE to analyse the isolates and sequence them as this would bring efficiency to food chain investigations.
- PHE FWE and the FSA are having ongoing discussions on the workings of the Official Control Regulations in relation to food and feed
- Although the number of outbreaks highlighted in the presentation may appear to be small, significant amount of resource was needed from the FSA and other agencies in dealing with them.
- The FSA has reviewed and revised its outbreaks/incidents handling approach to make it consistent and efficient.

Food Surveillance

Public Health England

31. PHE update the group on the activities of their Food, Water and Environment Microbiology Services which include the following studies:
32. Microbiological quality of raw drinking milk and unpasteurised dairy products: results from England 2013-2019 (McLauchlin J, Aird H, Elliot A, Forester E, Jorgensen F, Willis C. Submitted to *Epidemiology and Infection*) and study 66 An assessment of the safety of frozen fruit and vegetables (report in progress). The aim of the study of the microbiological quality of raw drinking milk and unpasteurised dairy products was to review microbiology results from testing 2,500 raw drinking milk and dairy products made with unpasteurised milk examined in England between 2013 and 2019. Samples were collected as part of incidents of contamination, investigation of infections or as part of routine monitoring and were tested using standard methods for a range of both pathogens and hygiene indicators.
33. It was reported that study 68: microbiological quality of raw milk cheeses is ongoing until 2020.

Food Surveillance in Scotland

Survey of minced meat at retail

34. The group noted Food Standard Scotland's ongoing survey of minced meat. This one-year microbiological survey of minced beef on retail sale started January 2019. Project is contracted to Scotland's Rural College to undertake a survey to generate baseline data on the significant microbiological pathogens and hygiene indicator organisms present in beef mince on retail sale in Scotland.
35. A total of 1000 minced beef samples are being collected from randomly selected retailers across a range of geographic locations in Scotland. These samples are being analysed for a range of microbiological pathogens (STEC (including *E. coli* O157 and non-O157), *Campylobacter* and *Salmonella*) and hygiene indicator organisms (ACC and generic *E. coli*).
36. Antimicrobial resistance screening (AMR) are also be undertaken for any pathogens detected and a subset of 100 isolates of generic *E. coli*.
37. It was noted that the project will report its findings in the summer of 2020.

Food Surveillance in Wales

38. Public Health Wales updated the group food surveillance activities in Wales. Sampling is undertaken by local authorities with samples submitted to Public Health Wales FWE laboratories. Recent surveys include:
39. **Targeted Survey 2019. Pre-packed sandwiches:** Survey commenced in October 2019 and will run until April 2020. It was noted that pre-packed sandwiches and rolls are sold in many retail premises across Wales with small

convenience stores often selling low priced pre-packed sandwiches. Shelf life specified for such sandwiches can vary depending on the producer. The possibility of the sandwiches not stored correctly during transport or at the store was highlighted which could lead to the levels of micro-organisms increasing during the shelf life to unsatisfactory levels. A previous study of these products showed 73% of were satisfactory 19% were borderline and 8% were considered unsatisfactory.

40. **Welsh Food Microbiological Forum (WFMF) revised food “norms”.** Members were informed of the publication of the latest edition of WFMF food norms. This edition cover shopping basket data from 2009-2018. It was noted that this database now spans 1995-2018 and currently numbers 36,536 individual datasets and twenty different food types. The database has been used to create tables that illustrate the general microbiological quality of ready-to-eat food sampled in Wales, focussing on the proportion of foods that are either satisfactory, borderline or unsatisfactory according to the most recent guidelines for food sampled from the point of sale or service (PHE’s RTE food guidelines also guides the process). Data is broken down by food type and by organism. Their purpose is to provide Local Authorities and other organisations with an interest in food safety, with “real” data on the microbiological quality of food that the public in Wales consume.
41. **Shopping basket 15a.** Members noted this survey covers the following foods: Pâté (All types e.g. Meat, Fish, Vegetarian). Cakes containing fresh cream; Rice-based mixed salads (pre-packed & self-service. Open salad items (not pre-wrapped e.g. self-service. Sliced cooked meats-all types (poultry, beef, pork, fermented meats, hot and cold smoked products). Coleslaw. Pre-packed and self-service. RTE smoked fish. Loose delicatessen cheeses (not pre wrapped). Processed fruit (e.g. peeled and cubed fruit salads) for direct consumption. Sandwich fillers (Pre-packed and self service)

General discussion on food surveillance

42. EFIG discussed how surveillance priorities are decided in England and Wales (FSS did not attend the meeting).
43. PHW representative confirmed that Wales have a forum comprising of PHW, food laboratories and local authorities where discussions and decisions are made on foods to monitor/test for organisms. This forum meets quarterly. Members noted that priorities are decided by looking at foods that have been historically identified for surveys (due to specific reasons) and assessments are made whether to repeat the survey, foods that have attracted interest because of particular concerns including problem foods, foods that have not been surveyed before and the need to expand the knowledge base in relation to the safety of foods consumed by members of the public. It was added that local food safety problems could also trigger surveillance on a particular food.
44. PHE reported that PHE FWE has a food hygiene focus group which includes the FSA. This group consider public health priorities in deciding foods to monitor/test. They have yet to consider the priorities for 2020. STEC in flour is a

strong contender for 2020. It was noted that some of the data collected on STEC has been on the back of previous incidents.

45. The group discussed the importance of having up-to-date food surveillance information.

Antimicrobial resistance

46. The group noted the UK Government/FSA's AMR activities:

- The FSA Board were updated at its September 2019 meeting on FSA activities in relation to AMR and how it was contributing to the New Cross Government Strategy on AMR (Tackling AMR 2019-2024). The UK's five-year national action plan was published in January 2019 and includes sections on food safety and the environment.
- UK Veterinary Antibiotic Resistance and Sales Surveillance Report (UK-VARSS 2018) was published in October 2019. Report revealed further reductions in UK veterinary antibiotics sales and use. A 53% reduction in sales of antibiotics for food-producing animals over the last four years, coupled with a 68% reduction in sales of highest priority critically important antibiotics in the same period.
- Reports to be published in early 2020 include: Levels of AMR *Campylobacter* in retail chicken and EU survey findings of *E.coli* in chicken.

Feedback from international scientific meetings

47. The group received feedback from attendees at the following conferences.

48. The **20th *Campylobacter*, *Helicobacter* and Related Microorganisms Conference.**

Keynote speech from Brendan Wren (London School of Hygiene and Tropical Medicine)

- *Campylobacter* is more adaptable to the environment than originally thought
 - Biofilm formation and perhaps coccoid formation and survival in amoebae may be contributing to persistence of *C. jejuni* in the environment
 - RrpA and RrpB which influence bacterial responses to oxidative and aerobic stresses may be "contributory factors" to *C. jejuni* survival/virulence
- Virulence factors are still not fully understood despite 30 years of research!

Use of WGS

- Many laboratories have now implemented whole genome sequencing (WGS) for typing *Campylobacter* with several presentations describing results from source attribution studies. These still pointing to chicken as the major source of human infection.

- Results of source attribution from FSA Sentinel Surveillance Project 2015-2018 were presented by Noel McCarthy.
- Several presentations describing the use of WGS and bespoke bioinformatic algorithms to detect antimicrobial resistance mechanisms in strains of *C. jejuni* and *C. coli* isolated from different food sources.
 - Prevalence of AMR detected through the use of the PHE bioinformatic pipeline from WGS results produced from isolates from the FSA Sentinel Surveillance Project 2015-2018 were presented by Craig Swift highlighting the dramatic increase in resistance to ciprofloxacin in isolates from human infection over the last 20 years from 5% to 45% and in resistance to tetracycline from 21% to 42%. Resistance to Erythromycin resistance has remained very low.

Outbreak investigation

- Highly resistant strain of *C. jejuni* implicated in a national outbreak in the USA linked to puppies. It was believed the outbreak started as a result of prophylactic treatment of puppies by a national distributor allowing for the selection of a highly virulent strain.

49. The 20th International Symposium on Problems of Listeria and Listeriosis.

Key points noted include:

- Haemolytic isolates of *L.innocua* have been characterised to possess some of the *L. monocytogenes* virulence factors. Whilst less virulent *in vitro* than *L.monocytogenes* it was stated that public health authorities may want to reconsider the current advice on *L.innocua*.
- The conference noted reports of the persistence of *Listeria* in a factory environment over 17 years
- US trade associations gave two presentations pushing for a relaxation of the zero tolerance '0 in 25g, rule for *Listeria* and will be producing a white paper in the coming months
- Many developed countries have moved to some form of whole genome sequencing analysis within the past few years, although methodologies vary, with many countries using cgMLST instead of SNPs. CgMLST is thought to be less discriminatory than SNP analysis.
- United States and Canada seeing more outbreaks of *Listeria* in fresh produce since they have introduced WGS
- Conference discussed the misconception on the meaning of metagenomics and metabarcoding

Action

50.ACMSF Members are invited to comment on the recent trends in animal and human data and other subjects discussed by EFIG at their December 2019 meeting.

**Secretariat
January 2020**