ADVISORY COMMITTEE ON THE MICROBIOLOGICAL SAFETY OF FOOD

EPIDEMIOLOGY OF FOODBORNE INFECTIONS GROUP (EFIG)

1. The group met on 18 January and 14 June 2019 and the following is a combined summary of the animal and human data and other topics that were discussed at these meetings.

Animal data

Animal *Salmonella* data January – December 2018 and January – March 2019 (provisional data)

2. Key points from the January – December 2018 data and January – March 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 (2017) is available at:

https://www.gov.uk/government/publications/salmonella-in-livestock-production-in-great-britain-2017

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 December 2018, there were 1,090 reports of *Salmonella* from livestock, which is 2% lower than during January - December 2017 (1,116 reports) and slightly higher than during January – December 2016 (1,072 reports).

6. There were eight reports of *S*. Enteritidis during January – December 2018 compared with 13 during the same period in 2017. Reports of *S*. Typhimurium increased slightly compared to January – December 2017 (118 reports vs. 115 reports) and decreased by 4% compared with the same period in 2016 (123 reports). The most common phage types were DT104 (23% of total *S*. Typhimurium reports), DT193 (14% of total *S.* Typhimurium reports) and U288 (17% of total *S*. Typhimurium reports). Reports of monophasic *Salmonella* 4,5,12:i:- fell by 47% compared with January – December 2017 (30 reports vs. 44 reports) and by 49% compared with the same period in 2016 (59 reports). The number of reports of *Salmonella* 4,12:i:- fell by 27% compared with January – December 2017 (37

reports vs. 51 reports) but increased by 12% compared with the equivalent period of 2016 (33 reports).

7. Between January and March 2019, there were 276 reports of *Salmonella* from livestock, which is 42% higher than during January – March 2018 (194 reports) but almost the same as during the equivalent period in 2017 (271 reports).

8. There were five reports of *S.* Enteritidis during January – March 2019. Reports of *S.* Typhimurium increased by 63% compared with January – March 2018 (26 vs. 16 reports) and by 37% compared with the equivalent period in 2017 (19 reports). The most common phage types were DT104 (6 reports; 23% of total *S*. Typhimurium reports) and U302 (5 reports; 19% of total *S*. Typhimurium reports). Reports of monophasic *Salmonella* 4,5,12:i:- increased by 60% (8 vs. 5 incidents) compared with January – March 2017 but fell by 43% compared with the equivalent period in 2017 (14 reports). The number of reports of *Salmonella* 4,12:i: was similar (8 vs. 7 incidents) compared with January – March 2018 and a 60% increase compared with the equivalent period of 2017 (5 incidents). Fourteen of the monophasic incidents (88%) were phage type DT193.

9. The total APHA/Scotland Rural College (SRUC) submissions to the Veterinary Investigation Diagnosis Database (VIDA) between January and December 2018 (49,397) were 14% lower than during January – December 2017 (57,444), and 22% lower than during the equivalent period of 2016 (63,505). Relative to January – December 2017, there were decreases in the number of submissions from the following VIDA 'classes': cattle (21% decrease), sheep (19% decrease), pigs (4% decrease) and miscellaneous (2% decrease). However, there was an increase of 3% in the number of avian submissions.

10. The total APHA/SRUC submissions to VIDA between January and March 2019 (10,990) were 22% lower than during January – March 2018 (14,138), and 38% lower than during the equivalent period of 2017 (17,756). Relative to January March 2018, the number of submissions from all VIDA 'classes', except for birds, decreased: sheep (37% decrease), pigs (26% decrease), cattle (28% decrease) and miscellaneous (41% decrease). The number of submissions from birds during January - March 2019 increased by 57% compared to the equivalent period in 2018.

11. On non-statutory zoonoses, in 2018 APHA, Public Health England (PHE) and Public Health Wales (PHW) were involved in two Verocytotoxigenic-producing *E. coli* (VTEC) O157 on-farm outbreak investigations. One of these involved an open petting farm and the other was follow-up of a couple of cases of human infections thought to be linked to a farm in Wales producing a goat milk product some of which was unpasteurised.

Salmonella National Control Programme (NCP) results 2018 and 2019 (Jan – June 2019)

12. 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.

13. APHA is now doing whole-genome sequencing on selected *Salmonella* isolates from the NCP and PHE has linked some of them to isolates from clusters of human disease. PHE has been sequencing isolates since 2014. It was also noted that there have been more feed-related *Salmonella* isolates since the EU ban on the use of formaldehyde in feed in early 2018.

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 2009-2013 for all countries and 2014-2017 for England, Wales and Northern Ireland were extracted from the previous annual EFIG report.

England data for *Salmonella, Campylobacter* and *Cryptosporidium* spp were extracted from the laboratory surveillance system SGSS, the laboratory reporting system implemented in 2015. *Listeria* data are from the enhanced *Listeria* surveillance database, STEC data are from the enhanced STEC surveillance database (England only), all of which are Public Health England databases.

Data for Scotland for 2014-2018 were provided by Health Protection Scotland.
Data for Northern Ireland for 2018 were provided by Public Health Agency Northern Ireland.

Data for Wales for 2018 were provided by Public Health Wales for all pathogens excluding STEC, which was obtained from PHE's Gastrointestinal Bacteria Reference Unit Database, GastroDataWarehouse. Previous years' data have been derived from SGSS, therefore caution should be used when interpreting trends.

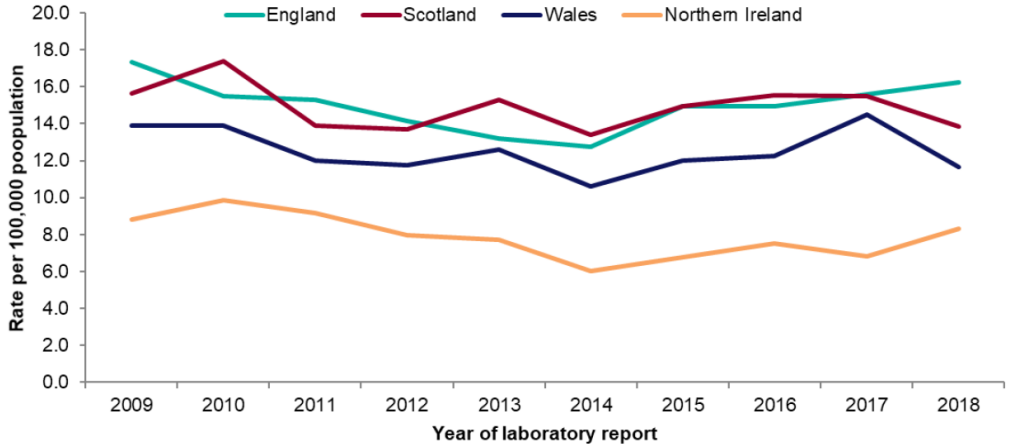
Foodborne outbreak data: England and Wales foodborne outbreak data are from the enhanced foodborne outbreaks surveillance system (electronic Foodborne and non-foodborne gastrointestinal Outbreak Surveillance System, or eFOSS) and data from Scotland are derived from a similar system: ObSurv, the surveillance system for all general outbreaks of IID in Scotland.

Population data
Population data are ONS mid-year estimates; the 2017 mid-year estimate is used for 2018 as the 2018 estimates have not yet been released.

All non-typhoidal *Salmonella* infections

14. There were 10,299 reports of non-typhoidal *Salmonella* in the UK in 2018, a small increase on the 10,089 reported in 2017, increasing the overall UK reporting rate from 15.3 in 2017 to 15.6 in 2018. An increase in the reporting rate was seen in England and Northern Ireland, and a decrease in Scotland and Wales.

Figure 1. Rate of reported non-typhoidal *Salmonella* infections by country per 100,000 population, 2009-2018

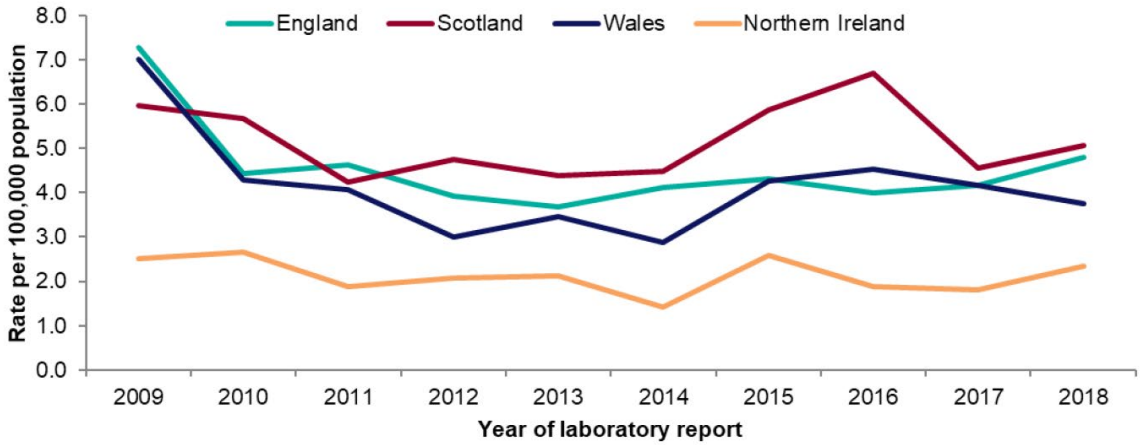


Salmonella serovars

15. Reports of *S.* Enteritidis increased in the UK in 2018 compared to 2017; increases were seen in all countries other than Wales (Figure 2). The number of reported cases increased by 13% in the UK, with the UK reporting rate increasing from 4.1 to 4.7 cases per 100,000 population.

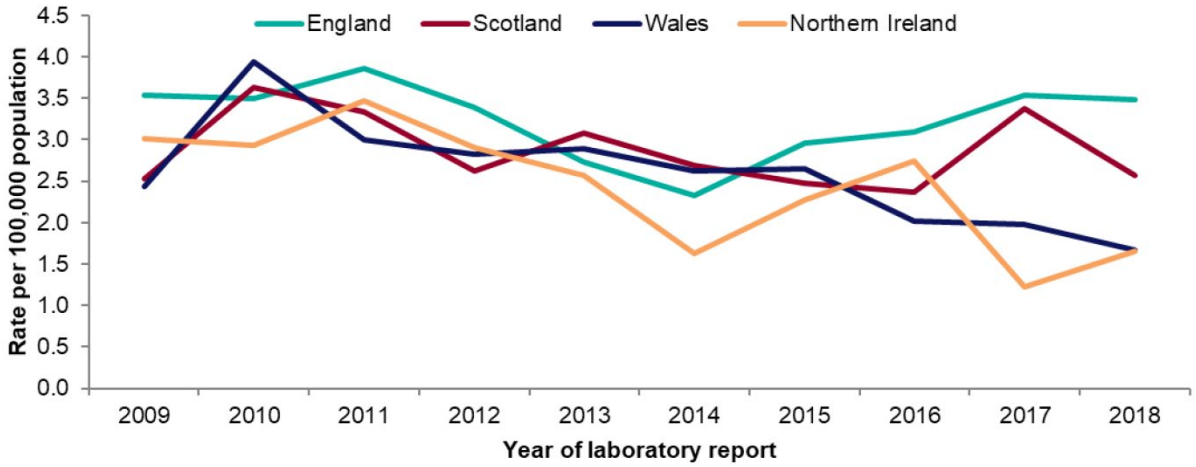
Figure 2. Rate of reported *Salmonella* Enteritidis infections in the United Kingdom and by nation per 100,000 population, 2009-2018

Is



16. A small decrease in the reporting rate of *S.* Typhimurium was seen in 2018 compared to 2017 with a decrease of 73 cases (Figure 3). An increase in reporting rate was seen in Northern Ireland, while the reporting rate decreased in Wales and Scotland and remained the same in England.

Figure 3. Rate of reported *Salmonella* Typhimurium infections by country per 100,000 population, 2009-2018



17. *S.* Enteritidis was the most commonly reported serovar across all constituent countries, comprising 30% of all reported *Salmonella* cases in the UK. Scotland reported a slightly larger proportion of *S.* Enteritidis cases compared to all *Salmonella* spp. reported (37%), compared to 32% in Wales, 29% in England and 28% in Northern Ireland. *S.* Typhimurium comprises 21% of all reported *Salmonella* cases in the UK, with proportions within constituent countries ranging from 10% in Wales to 21% in England. Together *S.* Enteritidis and *S.* Typhimurium constitute 51% of all non-typhoidal Salmonellae reported in the United Kingdom.

18. In addition to *S.* Enteritidis and *S.* Typhimurium, *S.* Newport, *S.* Infantis, *S.* Agona, and *S.* Java were within the top 10 most commonly identified serovars in all four countries in 2018 (Table 1). The top serovars as per table 1 comprise 67% of all reported *Salmonella* infections in England, 62% in Wales, 62% in Scotland and 68% in Northern Ireland.

Table 1. Number of the ten most common non-typhoidal *Salmonella* servars isolated, by country, 2018

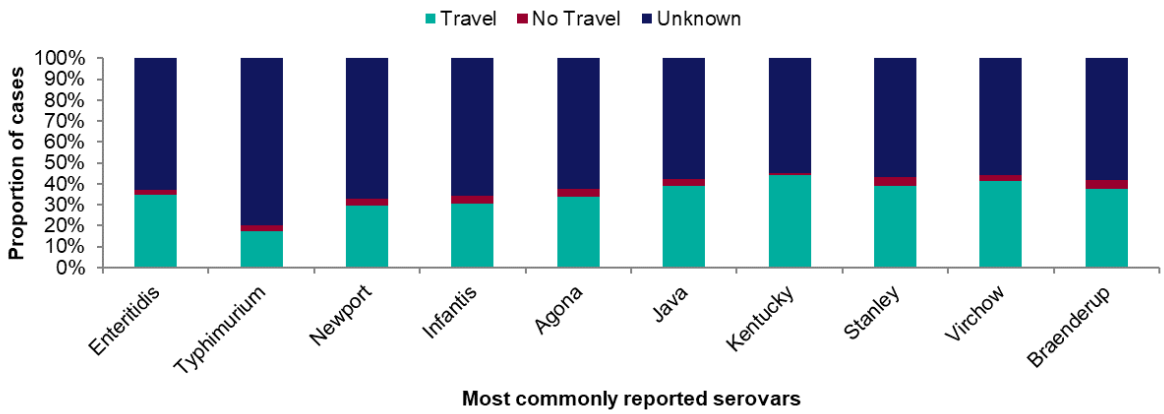
England		Wales		Scotland		Northern Ireland	
Serovar	n	Serovar	n	Serovar	n	Serovar	n
Enteritidis	2663	Enteritidis	128	Enteritidis	275	Enteriditis	44
Typhimurium	1937	Typhimurium	61	Typhimurium	139	Typhimurium	31
Newport	313	Infantis	14	Newport	28	Newport	7
Infantis	241	Stanley	11	Infantis	23	Agona	5
Agona	240	Agona	9	Agona	21	Java	5
Java	161	Newport	8	Stanley	16	Saint-Paul	4
Kentucky	156	Virchow	8	Java	13	Virchow	4
Stanley	156	Java	6	Saint Paul	13	Braenderup	3
Virchow	131	#		Kentucky	11	Infantis	3
Braenderup	118	#		Virchow	10	*	

*No other serovars have more than two cases reported
#No other serovars have more than five cases reported

Travel

19. The serovars with the highest proportion of cases reporting travel prior to infection are *S.* Kentucky (44% of cases reported foreign travel) and *S.* Virchow (41% of cases reported foreign travel) (Figure 4). A greater proportion of *S.* Enteritidis cases reported travel than *S.* Typhimurium cases (35% versus 18%). Excluding *S.* Typhimurium, the proportion of cases reporting travel for the top ten serovars ranged from 29% (*S.* Newport) to 44% (*S.* Kentucky).

Figure 4. Proportion of travel in the ten most common non-typhoidal Salmonella serovars isolated in the UK, 2018

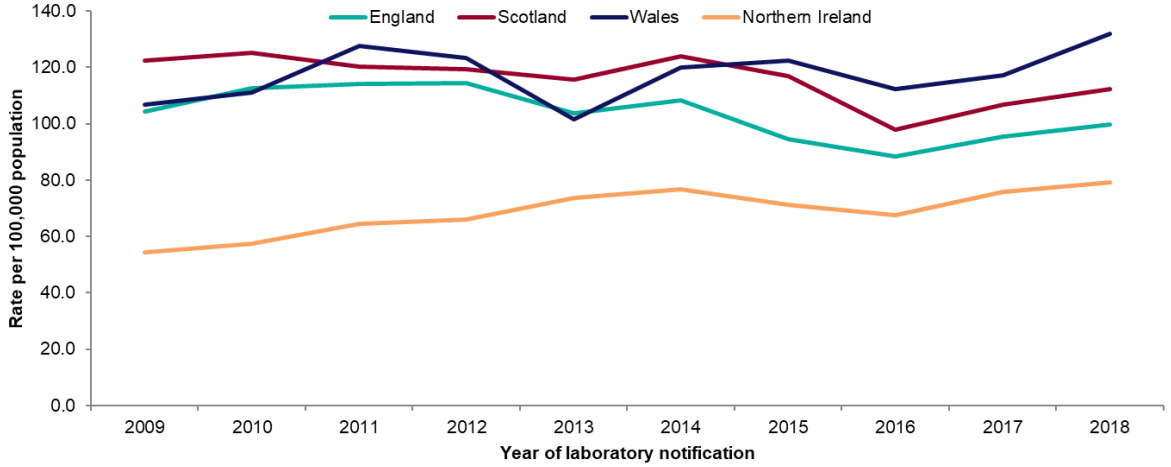


*Serovars included are the ten most commonly reported serovars in the UK and are reported in order of the number of infections

Campylobacter infections

20. The reporting rate for *Campylobacter* has increased in the UK from 96.8 per 100,000 population in 2017 to 101.6 per 100,000 in 2018. The rate of reported *Campylobacter* infections in England has increased from 2016 after a steady decline in the reporting rate since 2012. The reporting rate has also increased across all other countries for the second year in a row (Figure 5). Northern Ireland continues to report rates lower than the rest of the United Kingdom (79.2 cases per 100,000 population).

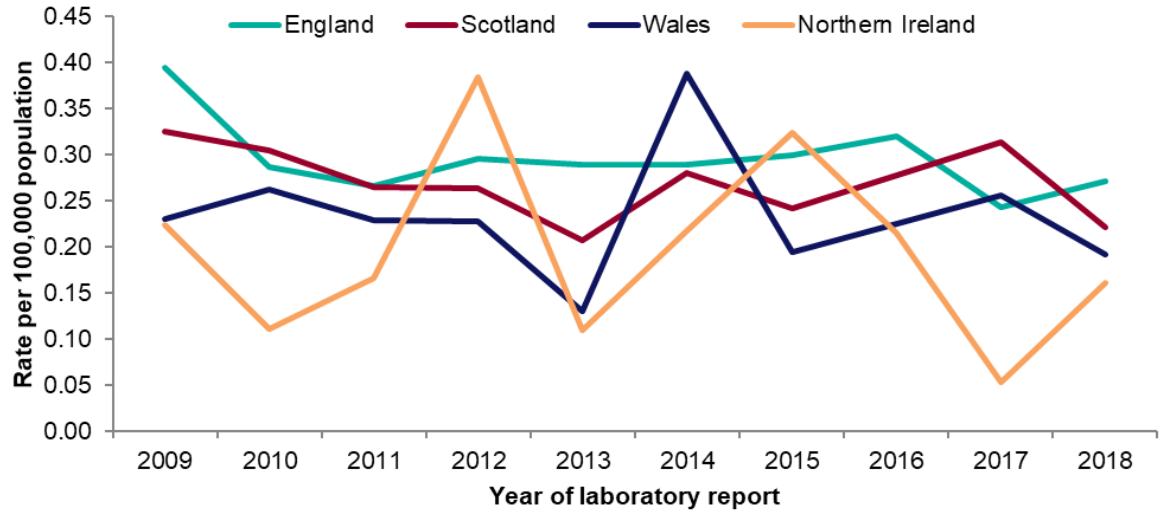
Figure 5. Rate of reported *Campylobacter* infections by country per 100,000 population



Listeria infections

21. There was an increase in the number of reported *Listeria monoctyogenes* infections in 2018 by 11 cases compared to 2017, after a considerable decrease in 2017 compared to 2016 (Figure 6), however small numbers limit meaningful trend interpretation.

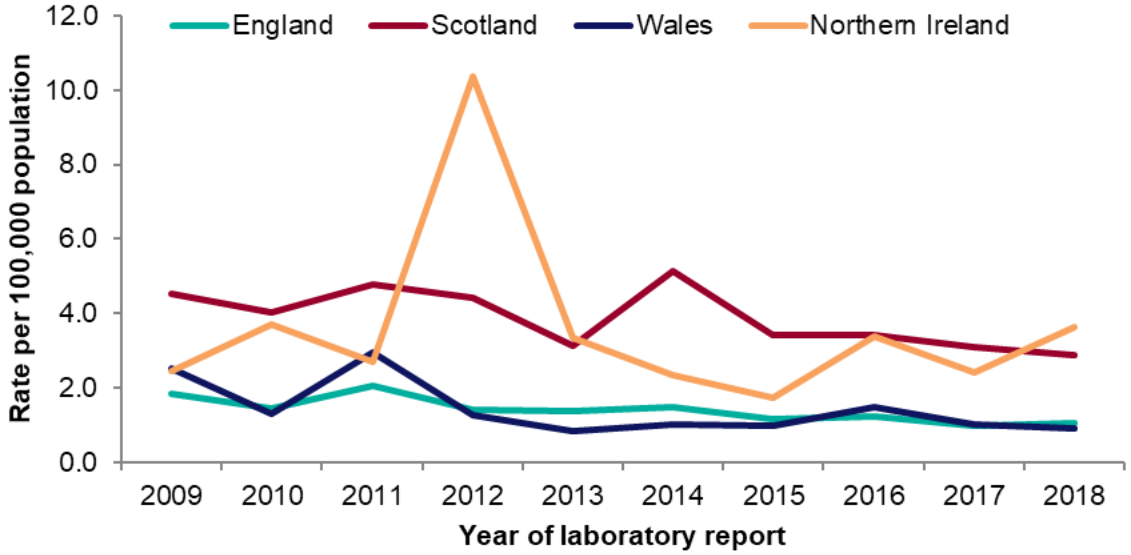
Figure 6. Rate of reported Listeria monocytogenes infections by country per 100,000 population, 2009-2018



STEC Infections

22. Reports of STEC O157 in the UK increased from a rate of 1.2 cases per 100,000 population in 2017 to 1.3 cases per 100,000 population in 2018 (Figure 7). Increases were reported in England and Northern Ireland, while decreases were reported in Wales and Scotland. Despite the increase in reporting rate in England in 2018 compared to 2017, the trend of a lower reporting rate since 2015 compared to previous years has continued.

Figure 7. Rate of reported STEC O157 infections by country per 100,000 populations, 2009-2018



23. Table 2 represents the number of cases detected with the 10 most commonly detected STEC serogroups across the UK in 2018. Serogroup O26 is the most commonly detected non-O157 serogroup in the UK.

Table 2. Number of the ten most commonly reported STEC serotypes among clinical infections in the United Kingdom and by country, 2018*

Serotype	England	Wales	Scotland	Northern Ireland	United Kingdom
O157	585	28	156	68	837
O26	102	8	34	14	158
O91	66	6	1	0	73
O146	65	4	3	0	72
O128AB	35	4	2	0	41
O103	21	1	6	2	30
O113	22	0	2	0	24
O117	23	0	1	0	24
O76	18	2	1	0	21
O145	17	1	12	6	18

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

Cryptosporidium infections

24. This was the first time that human *Cryptosporidium* data was reported to EFIG.

25. In 2018, the highest rates were seen in Northern Ireland and Wales. The reason for this difference requires further investigation but may be as a result of the introduction of PCR, changes to diagnostic testing protocols or differential exposure to risk factors for infection. It should also be noted that numbers of laboratory reports show distinct inter-year variation and a bimodal seasonality that is species specific.

26. The *Cryptosporidium* Reference Unit genotypes all isolates referred to them from laboratories in England and Wales and it is expected that these data will be reported to EFIG on a routine basis forthwith.

Foodborne outbreaks

27. In 2018, 46 foodborne outbreaks were reported to national surveillance systems in England, Wales, Scotland and Northern Ireland (Figure 8) compared to 40 reported in 2017. There were 1652 affected individuals, 863 of which were laboratory confirmed, and 63 reported hospitalisations. There were three reported deaths, one associated with a *Salmonella* outbreak and two associated with a *Clostridium perfringens* outbreak. *Salmonella* and Norovirus were the most commonly implicated pathogens (10/46, 22%) reports for each pathogen, with *Campylobacter* the third most commonly reported causative pathogen (8/46, 17%). The majority of foodborne outbreaks occurred in the food service sector (37/46, 80%), followed by community (7/46, 15%).

Figure 8. Number of outbreaks attributed to specific pathogens reported in the UK, 2009-2018

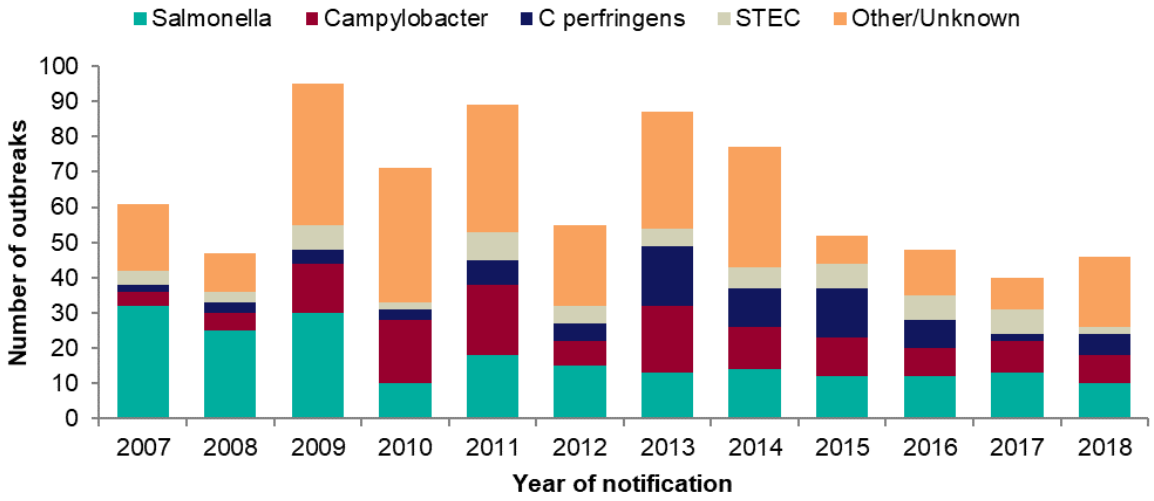


Table 3. Number of outbreaks attributed to specific pathogens reported in the UK, 2018

Year	England and Wales	Scotland	Northern Ireland	United Kingdom*
Salmonella	9	5	0	10
S. Enteritidis	2	1	0	2
S. Typhimurium	4	1	0	4
Campylobacter	8	0	0	8
C. perfringens	6	0	0	6
Norovirus	9	1	0	10
STEC O157	2	2	0	2
Shigella sonnei	1	0	0	1
Other/unknown	9	0	0	9

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

Recent epidemiology *Cryptosporidium* spp in England and Wales

28. EFIG received a presentation on the epidemiology of *Cryptosporidium* in the food chain. The areas it covered include:

- History
- Life cycle
- Burden of enteric protozoa in the context of other IID
- Age and sex distribution
- Risk factors
- Cryptosporidium seasonality
- Evidence of foodborne transmission
- *Cryptosporidium* and food
- Outbreaks report to EFOSS 1992-2017
- International outbreak of *C.hominis* – 2012
- Control measures
- *Cryptosporidium* survival of chlorine disinfection
- Detection of *Cryptosporidium* in food
- Action EURO-FBP Coat Action

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29. The group noted that:

- *Cryptosporidium* is the fourth most common cause of IID in England and Wales.
- Efforts by the water industry since 2000 resulted in fewer cases, particularly in the first half of the year.
- Foodborne outbreaks occur but are infrequent.
- Lack of techniques to inform knowledge about presence throughout the food chain makes validation of risk assessment and industry controls difficult.
- Molecular characterisation is currently selective and retrospective – shift to routine and prospective use is needed for effective surveillance.
- Whole Genome Sequencing (WGS) has the potential to increase strain discrimination (PHE intends to employ WGS for detection to establish if *C parvum* was more prevalent in the food chain)
- Surveillance, typing and bioinformatics support are essential.

Estimating the burden of gastrointestinal disease in Scotland: C*ampylobacter* data linkage

30. EFIG was updated by Health Protection Scotland (HPS) on the above ongoing study funded by Food Standards Scotland (FSS) and National Health Service Scotland. The study is linking laboratory data (including demographic information) for all confirmed cases of infectious intestinal disease (IID) to deprivation, hospitalisation, cancer, mortality, and prescribing data to estimate the burden of IID by pathogen and determine risk factors and clinical outcomes. The presentation covered the following areas:

- Anticipated outcomes
- Generic linkage timeline
- Limitations
- Laboratory Reports (Laboratory Reports of *Campylobacter*, 2013-2017 by Sex)
- Hospitalisation Percentage of *Campylobacter* Cases (Hospitalised by Age Band)
- Hospitalisation Demographics (Percentage of *Campylobacter* Cases Hospitalised by Sex)
- Hospitalisation and Deprivation (Proportion of *Campylobacter* Cases Hospitalised by Deprivation)
- Seasonality (Seasonality of Laboratory Reports and Hospitalisations)
- Length of Stay (Length of Stay for Hospitalisations for a *Campylobacter* Related Condition)
- Length of Stay (Lab Results and Hospitalisations by Age Band and Mean)
- Same Day Discharge (Same Day Discharge Cases, Age Band and Sex)
- Long Stay (Long Stay Cases (>10 days), Age Band and Sex)
- Antibiotic Prescribing (Antibiotic Prescribing Proportions Pre and Post Lab Report)
- Sequelae
- Estimating Costs to NHS
- Costs Pathway

Food Surveillance

Public Health England

31. PHE updated the group on the activities of their Food, Water and Environment Microbiology Services which include the following studies:

32. ***Salmonella* contamination of Betel leaf:** McLauchlin J, Aird H, Andrews N, Chattaway M, de Pinna E, Elviss N, Jørgensen F, Larkin L, Willis C. Public health risks associated with *Salmonella* contamination of imported edible betel leaves: analysis of results from England, 2011-2017. Int J Food Microbiol 2019;298:1-10.

33. **Study 66. An Assessment of the Safety of Frozen Fruit and Vegetables: Preliminary analysis of results:** ECDC/EFSA reported in July 2018 that frozen sweetcorn was the likely source of an outbreak in five countries, including the UK. This study aimed to assess the microbiological safety of foods that have recently been associated with *Listeria monocytogenes* contamination and withdrawal by some major supermarkets of frozen vegetables because of concerns about links with cases of listeriosis in Europe.

Co-ordinated Food Sampling Programme in Scotland 2019/20

34. Food Standards Scotland (FSS) is proposing to fund sampling of food on retail sale to test for microbiological and chemical priorities in Scottish Local Authority sampling grants programme for 2019/20. The sampling will be undertaken by Local Authorities from July/August 2019 until 31 March 2020. The 14 provisional priority areas for targeting are:

Priority	Description	Analysis Required
1	Raw shell eggs of non-UK origin	*Salmonella*
2	Ready-to-eat salmon products of non-UK origin	Listeria monocytogenes (enumeration)
3	Raw duck meat and raw duck livers	Hygiene indicators, *E. coli*, *Campylobacter* and *Salmonella*
4	Pasteurised cheeses	Hygiene indicators, *E. coli* *Listeria monocytogenes, S. aureus*, *Salmonella*, STEC, pH and Aw
5	Unpasteurised cheeses	Hygiene indicators, *E. coli* *Listeria monocytogenes*, *S. aureus*, *Salmonella*, STEC, pH and Aw
6	Cucumbers and tomatoes of non-UK origin	Hygiene indicators, *E. coli*
7	Imported Tahini products and sesame seeds	*Salmonella*
8	Dried spices	Colouring (testing to included water and oil soluble colouring agents)
9	Dried figs and raisins of non-UK origin	Aflatoxin B1, B2, G1 & G2 on figs and ochratoxin A on raisins
10	Nuts of non-UK origin (to include groundnuts, almonds, pistachios, hazelnuts, brazil nuts)	Aflatoxin B1, B2, G1 & G2
11	Saffron	Adulteration
12	Vegan sandwiches and cakes	Milk proteins (cost based on testing for casein)

13	Nut-free meals	Presence of nuts (price includes testing for peanuts, almonds and cashews)
14	Low-cost meat preparations and meat products	Speciation, to include horse cost based on screening using ELISA and confirmation of fails using PCR. £280 for ELISA screening + £300 for each confirmation by PCR (based on 2 species)

Survey of minced meat at retail

35. A microbiological survey of minced beef on retail sale in Scotland started in January 2019 and will run for 12 months. This project is contracted to Scotland 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.

36. A total of 1000 minced beef samples will be collected from randomly selected retailers across a range of geographic locations in Scotland. These samples will be 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*).

Food Surveillance in Wales

37. 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:

38. **School meals survey.** The report found that whilst there were some increases in microbiological hygiene indicators compared with findings reported in 2007, the food served in schools across Wales presented a relatively low risk. The report also recommended that foods served in schools continue to be monitored and that an adequate number of foods are sampled from a wide range of schools and school types.

39. **Survey of ice-creams and gelato.** This survey was completed at the end of September 2018 with over 200 samples submitted; a full analysis of the results is awaited. This is to be repeated in 2019 for ice creams and gelato served by scoop and to include slush dispensed by machine, with an extended time scale.

40. **Shopping Basket surveys.** The term shopping basket is used in this context to describe a list of clearly defined food types that are sampled from randomly selected premises by Local Authorities in Wales for the same period.

41. Selection of food types for the shopping basket is carried out by the members of the Welsh Food Microbiological Forum and the justification for inclusion was based

upon the results of local food surveys, national food studies or epidemiological information that suggested a link between food-borne disease and a particular food type.

42. **Targeted Survey 2018-19.** This survey of frozen fruit and vegetables is in response to the recent withdrawal by some major supermarkets of frozen vegetables because of concerns about links to cases of listeriosis in Europe.
43. This survey commenced in October 2018 and ended in April 2019, targeting any type of frozen fruit or vegetables available from producers, catering establishments, supermarkets and other retail outlets. A report on the survey findings is in preparation.

44. **Targeted survey 2019.** This survey of mobile vendors commenced in May 2019 designed to:

- Assess the microbiological quality of foods sold
- Assess water quality
- Assess hygiene of surfaces

45. The survey includes:
    - Mobile vendors selling at large outdoor events
    - Mobile vendors at other locations,
        - Trading at a roadside
        - Retail park carpark

46. Samples include:
    - Any food sample, except salad
    - Samples of water available to the vendor
    - 10 x 10 cm swab of work surface

Antimicrobial Resistance (AMR)

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

- Plans were being put in place for reporting progress on the new cross government strategy on AMR (Tackling AMR 2019-2024: The UK's five-year national action plan) was published in January 2019. The action plan includes sections on food safety and the environment.

- FSA's ongoing studies to assess the burden of antimicrobial resistance genes in selected ready-to-eat foods and a review of the impact of food processing on AMR.

- FSA/Quadram Institute, Norwich funded research fellow investigating food chain transmission of AMR, the relative contribution of imported vs domestic food and the role of non-pathogenic bacteria in food as an AMR reservoir.

Action

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

Secretariat
June 2019