ANNUAL UPDATE ON ANTIMICROBIAL RESISTANCE (AMR)

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1. Summary

1.1 This information paper provides an update on the FSA's science activities concerning antimicrobial resistance (AMR) in the food chain, conducted since the previous paper was presented to the Board in August 2020. It also sets out how these activities are addressing the food safety section within the wider UK AMR National Action Plan (NAP). Furthermore, this paper provides a summary of the main areas of research and surveillance conducted in the last year (since August 2020) and activities undertaken as part of the FSA's contribution to the NAP. It also covers of the AMR Research and Evidence (R&E) programme, including the formation of the AMR R&E programme steering group, and proposed new AMR-related surveillance and research workstreams.

1.2 Key findings and progress made over the past year include:

- Levels of AmpC/ESBL-producing *Escherichia coli* was found to be very low in UK beef (less than 1%) and pork (less than 2%) during 2015, 2017 and 2018, whilst a decline was observed in retail chicken from 45% in 2016 to 14% in 2018 (paragraph 3.2 and table 1 in annex 2).
- Carbapenemase-producing *E. coli* was not detected in any UK retail beef, pork or chicken, whilst the plasmid-borne *mcr-1* colistin resistance gene is rare (paragraph 3.2 and table 1 in annex 2).
- From 2014 to 2019, the levels of AMR *Campylobacter* detected in UK retail chicken has generally remained unchanged (paragraph 3.2 and figure 1 in annex 2).
- A need has been identified for further AMR surveillance of crops imported into the UK from countries which use antibiotics to treat bacterial plant disease (paragraph 3.3).
- We are funding surveys of AMR bacteria found in UK retail lamb, turkey and battered/breaded poultry products (paragraph 3.2).
- Retail fresh beef mince in Scotland is currently not a major route of AMR transmission from cattle to humans (paragraph 3.2).
- A UK representative survey carried out in July 2021 found that a quarter (26%) of respondents had heard of the term antimicrobial resistance, an increase of 10% since 2016 (paragraph 3.4)

- Fluoroquinolone and tetracycline resistance in *C. jejuni* isolates from human infections has increased from 1997 to 2018 (paragraph 3.5).
- There are evidence gaps on the impact that processing has on the spread of AMR bacteria in meat (paragraph 3.6).
- Thorough cooking has been proven to be effective in killing AMR bacteria food but its impact on AMR genes and their potential uptake by other bacteria is uncertain (paragraph 3.8).
- Our AMR surveillance and research activities have been brought together under the AMR R&E programme and we have prioritised AMR projects for this and next year (paragraphs 6.1 to 6.3).
- We are working towards commissioning surveys of AMR bacteria in UK retail beef, pork, chicken and turkey to commence in this financial year (FY) 2021/22 (paragraph 7.2).

1.3 No specific action is required from the Board other than noting the progress made in AMR-related work over the past year and the proposed future direction of the AMR R&E programme.

2. Introduction

2.1 AMR is a national strategic priority for the UK Government which has led to the development of a new 20-year Vision for AMR and the 5-year National Action Plan (NAP), which runs until 2024. The NAP lays out how the UK will address the AMR challenge and includes a specific section on the importance of better food safety to limit the contamination of foods and spread of AMR. This section emphasises the need to strengthen the evidence base for AMR and food safety through research, surveillance and promoting good practice across the food chain. The FSA is playing its part by continuing to fill evidence gaps on the role that food plays in AMR through the commissioning of research and surveillance.

2.2 Given that we are midway through the NAP, this paper presents an overview of the FSA's research, surveillance and other activities on AMR since the previous update was provided to the Board in August 2020 and how this feeds into addressing the NAP. We have also included information on proposed AMR-related surveillance and research which has been approved by the AMR programme steering group and an update on industry progress in reducing antimicrobial usage in food-producing animals. The paper also provides a forward look in terms of the future direction of AMR food surveillance and how our work is feeding into mitigating the risk of AMR to consumers.

2.3 In March 2021, we presented a 'deep dive' paper to the AMR NAP Delivery Board which summarised the progress that has been made towards the food safety theme's commitments within the NAP and our future AMR in food surveillance

plans. We have also reviewed and, where appropriate, modified our commitments within the NAP in light of completed deliverables. This re-emphasises the FSA's long-term commitment in tackling AMR in the food chain.

3. AMR Surveillance and Research

3.1 The FSA is continuing to commission research and surveys to improve our understanding of the role that the food chain plays in the development and spread of AMR which is important within the food safety section of the NAP. A summary of our AMR research and surveillance portfolio since August 2020 is provided in annex 2, which highlights the FSA's main completed, ongoing and newly started AMR projects.

3.2 **Surveillance:** Our AMR surveillance programme has been established for several years, including a focus on retail chicken, pork and beef as part of an EU-harmonised AMR *E. coli* surveillance requirement. A summary of the findings from this rolling surveillance since 2015 is provided in annex 2. In November 2020, the FSA published the latest findings of the EU-harmonised survey of AMR *E. coli* in UK retail beef and pork whilst the findings of Year 5 of the survey of AMR *Campylobacter* in retail chicken was published in June 2021. Resistance to ciprofloxacin was detected in half of the *Campylobacter* isolates detected whilst 61% isolates were resistant to tetracycline. The prevalence of AMR *E. coli* was very low (1%) in UK retail beef and pork tested in 2019 and was similar to the previous surveys in 2015 and 2017. We are also looking at other potential meat sources for AMR. In October 2020, we commissioned a new survey to determine the prevalence of AMR *E. coli* and *Campylobacter* in UK retail fresh lamb and turkey. We also commissioned a UK wide survey of frozen part-cooked breaded and battered poultry which will include testing of *E. coli* isolates for AMR. In June 2021, Food Standards Scotland (FSS) published the findings of a survey on the microbial quality of minced beef on retail sale in Scotland. All isolated pathogens and 100 generic *E. coli* underwent antimicrobial sensitivity testing and whole genome sequencing (WGS) to check for phenotypic and genotypic AMR, respectively. Findings suggest that fresh beef mince on retail sale in Scotland is unlikely to currently be a major foodborne route for transmission from cattle to humans of AMR to critically important antimicrobials.

3.3 **Horizon scanning:** Following reports of increased use of antibiotics to treat bacterial plant diseases, the FSA collaborated with the Department for Environment, Food & Rural Affairs' (Defra) Plant Health team to commission a review of antibiotic use in crops, the associated risk of AMR and research gaps. The review was published in November 2020 and concluded that the risk of AMR arising via crops in the UK is relatively low, given the lack of antibiotic use on crops in this country. However, the possibility of importing AMR bacteria or genes on crops or plant

products treated with antibiotics in countries where they are used or misused is likely higher. There is a need for more quantitative information on antibiotic use in crop agriculture in these countries but also testing of imported plant products for AMR bacteria to fully assess the risk this poses. We are considering whether our future AMR in food surveillance should include fresh produce on retail sale in the UK.

3.4 **Social Science:** In July 2021, we conducted a UK representative survey (of 2,555 respondents) using Ipsos MORI's online i:Omnibus to assess public awareness of AMR. Findings will be triangulated with other sources, including previous runs of the survey, and full details are expected to be published later in year. The report was published in August 2021, however, the key findings include:

- Around a quarter (26%) of respondents had heard of the term antimicrobial resistance, and only 11% had heard of the acronym AMR. Those more likely to have heard of the terms include members of socio-economic groups AB (34% and 17%, respectively) and those with degrees (34% and 13%, respectively).
- Public awareness of antimicrobial resistance has increased by 10% (from 16% in 2016 to 26% in 2021); however, awareness of the acronym AMR has remained unchanged at 11%.
- Of those who had heard of the terms, 57 were unable to explain the difference between antimicrobial and antibiotic resistance. Age appears to be an influencing factor in understanding, with 61% of those over 45 being unable to provide a response, compared to 50% of 16–24-year-olds. Similar proportions were noted in 2019.
- Around 1 in 6 respondents (59%) were aware that overuse of antimicrobials/antibiotics by people contribute to AMR, with lower proportion aware of the risk from use of antimicrobials/antibiotics in farming (47%), from veterinary medicine (44%) and the spread through the food chain (40%).
- When asked how concerned they were about specific risks, respondents were most commonly concerned about antimicrobial/antibiotic resistance from people taking too many antibiotics (70%) and antimicrobial resistance from antibiotics used to treat farm animals (62%).
- Respondents were less concerned about the risk of antimicrobial resistance from food imported from the EU (51%) or produced in the UK (48%), than they were about food imported from countries outside of the EU (58%).

We are including questions on awareness and understanding of AMR as part of Wave 5 of our flagship social research survey 'Food and You 2' and will be reporting on this at the end of 2022. We are also repeating the questions previously asked in Wave 2 of our Small and Micro Food Business Operator Annual Tracking Survey, which explore awareness amongst those who directly prepare food. It is

anticipated that Wave 3 field work will commence in autumn and report in January 2022.

3.5 **Source tracing:** In July 2021, we published a report on the sources of human *Campylobacter* infections in the UK which also analysed *Campylobacter* isolates from people, food and animals for AMR. The findings confirmed that chickens are the likely source for the majority of human cases of *Campylobacter*, followed by other animals such as sheep, pigs and cows. In terms of AMR, a rise in fluoroquinolone and tetracycline resistance in *C. jejuni* isolates from human infections was seen between 1997 and 2018. Fluoroquinolone resistance was more frequent in *C. jejuni* isolates from chicken than from other animals, whilst tetracycline resistance was more frequent in poultry and pig isolates than ruminants. Resistance to macrolides and aminoglycosides has remained low.

3.6 **Understanding spread:** In October 2020, we published the findings of a critical review on impact of secondary meat production on AMR bacteria in meat and meat products. The review confirmed that there are gaps in our knowledge concerning AMR in this area and many of these are due to the many ways in which AMR is reported. A major barrier to meta-analyses of published studies is that different isolation and AMR determination methodologies have been used. Another gap identified was the role biofilms play in AMR transmission, their community composition and their role as a physical barrier to effective sanitation (we are currently funding a study on AMR in biofilms formed during meat processing). Another area that was identified as a potential risky area for AMR was starter cultures for fermented meats and that finding ways to reduce this risk could be useful.

3.7 **Capability building:** The FSA are co-funding a 5-year (2017-2022) research fellowship with the Quadram Institute, which is using a combination of metagenomic sequencing, bioinformatics and statistical approaches to investigate the diversity, epidemiology, sources and spread of bacteria (including non-pathogens) and AMR genes in food. Different types of foods have been examined including chicken, pork, leafy greens, salmon and prawn products. The time remaining for this well-advanced fellowship is focussed on bioinformatic analysis and a pipeline of manuscripts in preparation for publication. We will work closely with Dr Mather and the Quadram Institute in communicating the outputs and impact of this research fellowship as it enters its final year.

3.8 **Strategic research:** We are continuing to carry out several AMR-related strategic research projects to help us better understand AMR burden, risk and control:

- The FSA are in the process of commissioning a third population-based study of infectious intestinal disease in the UK (IID3 study). This study is expected to

include WGS of isolates from human cases to identify the variety of AMR genes in pathogens causing human disease. Looking ahead there may be further opportunities to examine IID3 material, as well as archived material from the IID1 and IID2 studies which were carried out in the mid-1990s and 2008/2009 respectively. Work is expected to begin on the main IID3 study in late 2021.

- In August 2021, the FSA published the findings of a critical review assessing the impact of heat treatment on antimicrobial resistant genes (ARGs) and potential uptake by other 'live' bacteria. This study confirmed that cooking (70ºC for 2 minutes, or equivalent) would be effective in killing AMR bacteria found on food. The data on whether ARGs can survive cooking is very sparse and not comparable whereas no studies were identified which confirmed uptake of ARGs following heat treatment by other bacteria. This remains an area of uncertainty that may warrant further investigation.

4. Relevant international activities on AMR

4.1 Codex Alimentarius' Task Force on AMR (TFAMR) is in the late stages of revising the Code of Practice (CoP) to Minimise and Contain Foodborne AMR and developing new Guidelines on Integrated Surveillance (GLIS). Although there is substantial effort required to finalise the GLIS text, it is hoped that this will be adopted at the Codex Alimentarius Commission meeting in November this year following the TFAMR8, which is scheduled for October. The UK is co-chair of the electronic working group tasked with revising the CoP and the text is mostly agreed.

5. Reducing antibiotic usage in food production animals

5.1 The 2019 Veterinary Antimicrobial Resistance and Sales Surveillance (VARSS) report was published by the Veterinary Medicines Directorate (VMD) in November 2020. The report highlighted the significant progress made in reducing sales of veterinary antimicrobials in recent years but noted that further year-on-year reductions may be harder to achieve. In the 2019 report, there was a small increase of 1.5mg/kg (5%) for use in food producing animals compared to 2018 sales data. This still represents a 45% decrease in sales compared to 2015 data.

5.2 In June 2021, the European Food Safety Authority (EFSA), the European Medicines Agency (EMA) and the European Centre for Disease Prevention and Control (ECDC) published the 3rd report of the integrated analysis of the consumption of antimicrobial agents and occurrence of AMR in bacteria from humans and food-producing animals in the EU/ EEA (JIACRA III). The report is based on data from 2016, 2017 and 2018 provided by both EU MS (which at the time included the UK) and states of the European Economic Area (such as Iceland, Norway). The report found that significant fall in antibiotic use in food-producing animals across the EU, suggesting that measures taken at country level to reduce use are effective.

6. Developing a future AMR Research and Evidence (R&E) programme

6.1 A new approach has been implemented in the Science, Evidence and Research Division for the management of FSA research into programmes based on the Areas of Research Interest (ARIs). This involves the coordination of our research into a given area so that it is considered as a programme of work rather than as individual projects, enabling oversight for all upcoming and ongoing work within each individual programme and across other programmes, ensuring a cohesive and joined up approach.

6.2 Central to the AMR programme is the appointment of a Technical Lead who has overall responsibility for the programme delivery, with support from the Strategic Programme Coordinator, who provides central programme coordination and support. A fundamental element for guiding the AMR programme direction is the establishment of a steering group which has membership from across the FSA, including the devolved nations. The first AMR programme steering group meeting was held in June 2021 and was used to plan and prioritise a list of proposed AMR-related projects (both surveys and research) for the current year and beyond, and thus providing assurance that the work proposed meets both the FSA's and wider UK Government AMR strategic needs. We have spent £760k on the AMR R&E programme in FY 2020/21 whilst we currently estimate to spend a further £700k in FY 2021/22.

6.3 The Advisory Committee on the Microbiological Safety of Food (ACMSF) sub-group on AMR met in May 2021 and their views were sought on the FSA's current portfolio of AMR surveillance of retail meat and a proposed new survey of AMR *E. coli*, *Campylobacter* and *Salmonella* in UK retail chicken and turkey which is scheduled for 2022.

7. Future surveillance of AMR bacteria in UK retail meats

7.1 Since 2015, the FSA has funded surveillance of AMR in UK retail meats under Commission Decision 2013/652/EU. Following EU exit, Decision 2020/1729 on the monitoring and reporting of AMR zoonotic and commensal bacteria came into force on 1 January 2021, which required the continued monitoring of AMR in retail meats in MS. Whilst Great Britain is not required to mirror the surveillance in the EU legislation, we have decided, that in the interim, our AMR surveillance should be aligned as closely as possible to the EU survey requirements. This will produce up-to-date AMR data for UK retail meats which is broadly comparable with data from other MS and could inform future trade discussions with the EU and other countries.

7.2 We anticipate commissioning a survey of AMR *E. coli* in UK retail beef and pork with sampling taking place between October and December 2021. It is important that this 2021 survey will, where possible, follow the EU survey requirements as we are in a transition period moving from EU legislation-led surveys to a UK/Great Britain approach. We are also exploring commissioning a new survey of AMR *E. coli*, *Campylobacter* and *Salmonella* in chicken and turkey on retail sale in the UK. The need for this survey was supported by both the members of the ACMSF AMR sub-group and the FSA's AMR programme steering group.

7.3 As part of the Northern Ireland Protocol (NIP), Northern Ireland (NI) have to comply with Commission Decision 2020/1729. The FSA in NI is currently developing a retail sampling programme to comply with the specific requirement of this regulation, as the EU is considering NI as an individual MS.

7.4 Controls and official sampling of products of animal origin at Border Control Posts (BCPs) is a Defra/Animal & Plant Health Agency (APHA) lead. However, surveillance of AMR may be carried out by BCPs based on the recommendations for surveillance sampling set out by the National Monitoring Plan (NMP) sampling priorities for 2021-22 issued by the FSA.

ANNEX 1: UK'S 20-YEAR VISION AND 5-YEAR ACTION PLAN (NAP) ON AMR

Addressing the public health threat posed by AMR is a national strategic priority for the UK and led to the Government publishing both a 20-year vision of AMR and a 5-year (2019 to 2024) AMR NAP which sets out actions to slow the development and spread of AMR with a focus on antimicrobials. The NAP takes a 'One-Health' approach which spans people, animals, agriculture and the environment. The FSA have and are continuing to contribute to the delivery of the NAP through furthering our understanding of the role of the food chain in AMR and encouraging the food industry to reduce usage of antimicrobials where possible. The Welsh Government have made their own plan to combat AMR in Wales which will contribute to the NAP.

The previous 2013-2018 AMR strategy came to an end in 2018 and has led to many achievements including seeing unprecedented levels of AMR research investment and collaboration, reduced antimicrobials use in humans and animals, development of comprehensive surveillance systems with transparent data and resources and campaigns that have been welcomed by front line staff. This strategy has been evaluated by the London School of Hygiene and Tropical Medicine (LSHTM) and the evaluation is now subject to peer-review prior to publication. Since the previous Board paper on AMR in September 2018, the FSA has been continuing to work with other partners across Government to develop a new UK 20-year vision on AMR and NAP for 2019 to 2024 aiming to tackle AMR.

The UK's 20-year vision for controlling and containing AMR

In recognition that no country could tackle AMR in a single 5-year span, the UK Government published its vision in January 2019, which re-emphasised sustained efforts to contain and control AMR in the UK by 2040. The UK's vision is to see AMR contained and controlled by 2040 but recognises that the UK cannot tackle AMR alone. Therefore, this will require a co-ordinated 'One-Health' action across all sectors (humans, animals, the environment and food) worldwide. The UK is committed to contribute to the global AMR effort through:

- A lower burden of infection and better treatment of resistant infection
- Optimised use of antimicrobials with good stewardship across all sectors
- New diagnostics, therapies, vaccines and interventions in use and accessed by all.

By 2040, using surveillance, research, awareness and education activities underpinned by regulation, investment and advocacy, the UK aims to build on its achievements from the 2013-2018 AMR strategy and fulfil 9 long-term ambitions for change which are; to continue to be a good global partner, drive innovation, minimise infection, provide safe and effective care to patients, protect animal health and welfare, minimise environmental spread, support sustainable supply and access, demonstrate appropriate use and

engage the public. Further details under each ambition are available in the 20-year vision.

The UK's 5-year national action plan (NAP) to tackle AMR from 2019 to 2024

Whilst the UK has made progress in reducing its use of antimicrobials in humans and significantly in animals the last 5 years, drug-resistant infections in humans have increased by 35% from 2013 to 2017 with resistant infections estimated to contribute to over 2,000 deaths in this country each year. To tackle this, the UK Government launched in January 2019 its 2019-2024 national action plan (NAP) to contain and control AMR in human health, food animals, the environment and the food chain. The 5-year NAP takes a comprehensive 'One-Health' approach across humans, animals, agriculture the environment and food. The NAP and vision were co-developed across Government departments, Agencies, the Health Family (all bodies, organisations and agencies that contribute to nation's health), the administrations in Scotland, Wales and Northern Ireland, and with input from a wide range of stakeholders. All sectors, not just Government, will be expected to play their part.

The NAP plan was designed to build on the achievements of the previous 2013-2018 strategy on AMR and has set itself several challenging targets including a world-first target to cut drug-resistant infections by 10% by 2025, a 15% reduction of antimicrobial use in humans by 2024 (going further than the existing 10% target), a renewed commitment to halve healthcare-associated Gram-negative blood stream infections (including *E. coli*) by 2023/24, and a renewed commitment to reduce antimicrobial use in animals by 25% by 2020, with new objectives for individual animal sectors to be set by 2021. The plan focuses on 3 ways of tackling AMR, which are reducing the need for and unintentional exposure to antimicrobials, optimising the use of antimicrobials and investing in innovation, supply and access.

The NAP includes a specific section emphasising the need for better food safety to help limit the contamination of foodstuffs and spread of resistance. This links to the long-term vision's ambitions of minimising infection and engaging the public on AMR. The section highlights the need for more evidence to better understand AMR in the food chain in particular:

- More research on the diversity and burden of AMR genes in foods and the gut microbiome to help quantify the AMR intake through food in the UK diet and inform risk assessments for foodborne AMR.
- Need for a comprehensive surveillance system of the food chain that can provide robust data to monitor the emergence, spread and decline of AMR in real-time and to exchange and compare genetic data across the world.
- As recommended by the Advisory Committee on the Microbiological Safety of Food (ACMSF), more research to assess the impact of food processing, especially mild processing techniques, on the presence of AMR bacteria.

The NAP also mentions improving and promoting UK food hygiene across the food chain which would lead to reduced exposure to AMR. This would include building on our existing '4Cs' messages (**c**ooking, **c**leaning, **c**hilling and avoiding **c**ross-contamination) which are used by food producers, manufacturers, suppliers, food handlers and consumers. The NAP mentions Codex Alimentarius Commission expanding its code of practice for food chain factors on minimising and containing AMR and to develop new guidelines on integrated surveillance for AMR in the food chain. In 2017, Codex established an *ad hoc* Intergovernmental Task Force on AMR (TFAMR) which is aiming to develop a science-based guidance on managing foodborne AMR.

In June 2021, the Global Coalition on Aging (GCOA) published the 2021 AMR Preparedness Index which examines how well countries are meeting their commitments to addressing the global crisis in AMR. The UK was ranked as the top-performing of 11 countries assessed, scoring highly in most areas and particularly on its national strategy.

ANNEX 2: UPDATE ON THE FSA'S PROGRAMME OF RESEARCH AND SURVEILLANCE ON AMR

This section summarises the FSA's efforts with respect to AMR research and surveillance, highlighting both completed, current work and new research projects. Our new and continuing AMR research and surveillance programme has been influenced by the recommendations of the ACMSF 'Task and Finish' Group report and will inform the UK 5-year national action plan (NAP) on tackling AMR by improving our understanding of AMR in the food chain.

EU-harmonised survey of AMR *E. coli* in retail beef, pork and chicken

In 2014, the European Commission (EC) had set up a 7-year mandatory Member States surveillance programme of pathogens within the slaughterhouse environment which VMD are leading on in the UK. As the Competent Authority on food (in England, Wales and Norther Ireland), the FSA has been leading on an additional component of this survey by sampling and testing of fresh retail beef, pork and chicken in the UK for *E. coli* prior to testing for AMR of particular concerns which include Extended Spectrum Beta Lactamase (ESBL-), AmpC- and carbapenemase-producing *E. coli*, and also colistin resistant *E. coli*. Sampling of the different meat types alternates annually, with beef and pork being sampled in 2015, 2017 and 2019, whilst chicken was sampled in 2016, 2018 and 2020. In total, 315 samples of each meat type are collected in their respective years.

Table 1 provides a summary of the AMR *E. coli* found in UK retail beef, pork and chicken since 2015, with including the findings of Year 4 (2018; chicken), which was published in November 2020 and Year 5 (2019; beef and pork), which was published in June 2021. The findings indicated that the prevalence of AmpC/ESBL-producing *E. coli* in UK retail beef (<1%) and pork is very low (<2%). In contrast, the prevalence of AmpC/ESBL-producing *E. coli* in retail chicken is much higher. However, there appears to be a decline in AmpC/ESBL-producing *E. coli* in chicken from 45% in 2016 to 13.6% in 2018. It should be noted that a similar study carried out in 2013-14 by Randall et al 2017 detected 65% prevalence for ESBL-producing *E. coli* in UK retail chicken. This suggests that tighter controls on antimicrobial usage by the poultry industry might be having a positive impact in terms of reducing AMR *E. coli* in UK retail chicken, although further work is needed to fully explore this. It is encouraging that carbapenemase-producing *E. coli* were not detected in any of the beef, pork and chicken samples tested. Whilst colistin resistant *E. coli* was detected in some of the meats tested, the presence of transferrable plasmid-borne *mcr-1* colistin was rare.

Table 1: AmpC/ESBL, carbapenem-producing and colistin (include *mcr-1* gene) resistant *E. coli* found in UK retail beef, pork and chicken from 2015 to 2020 (information provided by the APHA).

Year	Sample type	AmpC/ESBL phenotype[a]	Carbapenem resistant	Colistin resistant[b]	*mcr-1* gene
2015	Beef	0.64%	0%	ND	ND
2015	Pork	1.92%	0%	ND	ND
2016	Chicken	45.1%	0%	2.9%	0%
2017	Beef	0.64%	0%	12.4%	0.32%
2017	Pork	0.32%	0%	14.8%	0%
2018	Chicken	13.6%	0%	4.2%	0%
2019	Beef	0.35%	0%	7.6%	0%
2019	Pork	1.05%	0%	8.07%	0%

ND – not determined

[a] – Isolates that grew on MacConkey agar containing 1 mg/L cefotaxime

[b] – Isolates that grew on MacConkey agar containing 2 mg/L colistin

FS102121: Survey of AMR *Campylobacter* in UK retail chicken

Since 2014, the FSA has been carrying out a survey of *Campylobacter* contamination found on whole, fresh, UK-produced chilled chicken on retail sale. Each year, an additional analysis was carried out where a random subset of the *Campylobacter* isolates was further tested for their resistance to a range of antimicrobial agents. The findings of Year 5 of the *Campylobacter* (including AMR) retail chicken survey were published in June 2021 and provide evidence that AMR *Campylobacter* is present on UK-produced chicken sold in non-major retailers. The proportion of AMR *Campylobacter* isolates and multi-drug resistant *Campylobacter* (resistant to 3 or more unrelated antimicrobial classes) found in UK-produced retail chicken in Year 5 (August 2018 to July 2019) is similar to those reported for previous survey years (Figure 1). However, caution is needed when comparing findings due to differences in the sampling point (from major supermarkets to non-major retailers) and also methodological differences (moving from phenotypic testing towards using of whole genome sequencing to detect AMR). In addition, nalidixic acid was not tested for in Year 5 rather than it not being detected. We anticipate publishing Year 6 (2019-2020) of this survey in Autumn 2021.

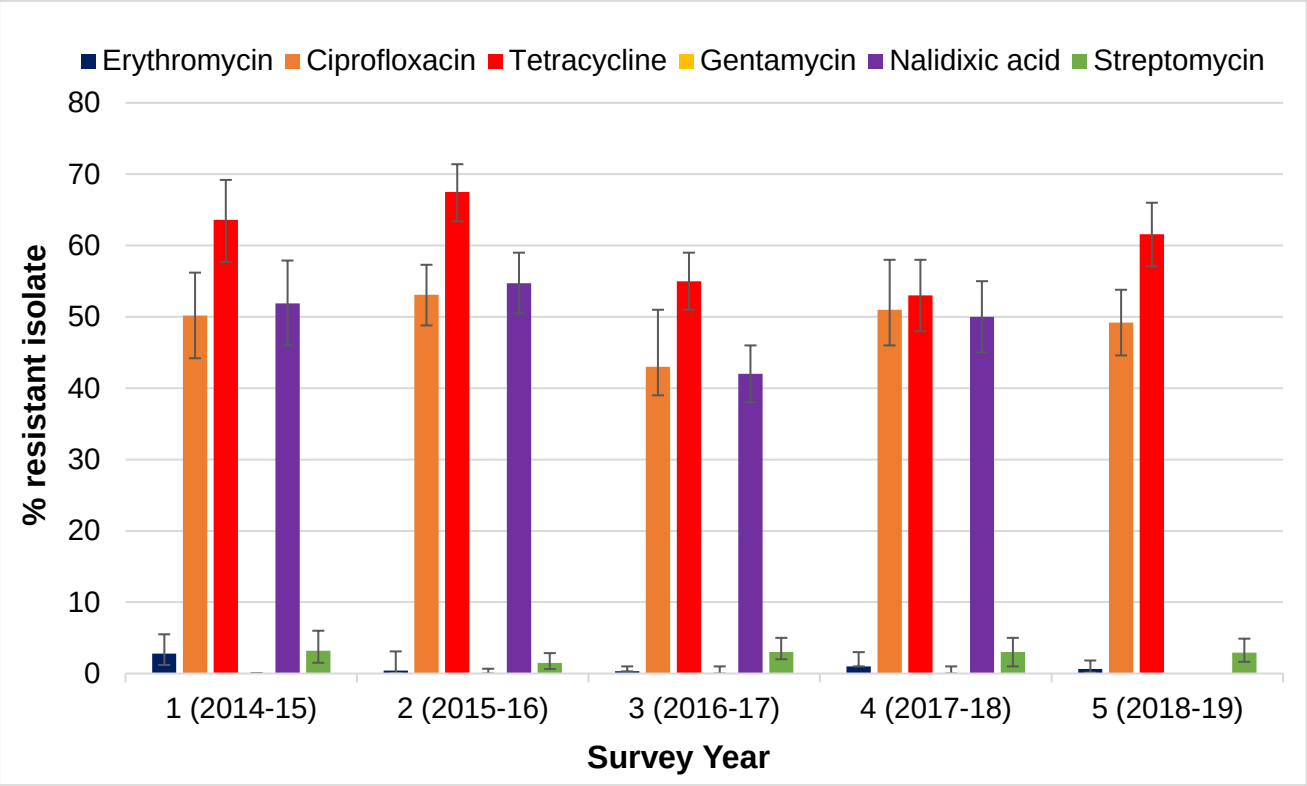

Figure 1: Percentage of total AMR *Campylobacter* isolates (includes 95% confidence intervals) found in UK retail chicken from Year 1 (2014-15) to Year 5 (2018-2019). Please note that resistance to nalidixic acid was not screened for in 2019.

Survey of microbial quality of beef mince on retail sale in Scotland

Food Standards Scotland (FSS) conducted a survey investigating the microbial quality of beef mince on retail in Scotland. All successfully isolated pathogens (3 Salmonella spp. and 35 STECs), 13 *stx* negative *E. coli* O157's and 100 generic *E. coli* underwent antimicrobial sensitivity testing (AST) and WGS to check for phenotypic and genotypic AMR respectively. The majority (92%; 139/151) of isolates were susceptible to all the antibiotics tested against them. Evidence for AMR, as indicated by a phenotypic non-susceptibility to one or more of the antibiotic active substances used in the AST, was identified in 12 of the 151 (8%) isolates tested. Evidence for AMR was most frequently found to single, commonly used, first-line active substances that have a long history of use in ruminant populations, such as tetracycline and ampicillin. None of the isolates were susceptible to any of the critically important antimicrobials that were tested for by disc diffusion. The WGS helped to clarify the situation with regard to an apparent lack of phenotypic susceptibility to colistin for the *Salmonella* Dublin isolate. It was confirmed that this was not a cause for concern as there were no colistin *mcr* genes present and this is a recognised phenomenon for this type of isolate. The full report was published in June 2021, with findings suggesting that fresh beef mince on retail sale in Scotland is unlikely to currently be a major foodborne route for transmission from cattle to humans of AMR to critically important antimicrobials.