ANTIMICROBIAL RESISTANCE (AMR) PROGRESS

Report by Rick Mumford

For further information, please contact Dr Paul Cook
Email: paul.cook@food.gov.uk, Tel: 0207 276 8950

SUMMARY

1. This paper provides an update on the FSA’s science activities concerning antimicrobial resistance (AMR) and the food chain since the previous paper was presented to the Board in September 2018. It includes updates on:

- the FSA’s role and contribution to the UK’s 5-year AMR national action plan (NAP) from 2019 to 2024 and the UK’s 20-year vision on containing and controlling AMR;
- the FSA’s efforts with respect to current and future AMR research and surveillance;
- the continued efforts by UK industry in reducing sales of antibiotics for food production animals; and
- an update on the Codex ad hoc Intergovernmental Task Force on AMR.

2. In the context of the recent publication of the Government’s 20-year vision on AMR and the 5-year NAP to control and contain AMR, in particular the emphasis on AMR and food safety, the Board is asked to:

- comment and endorse the FSA’s efforts in funding research and surveillance to improve our understanding of the role of the food chain in AMR as highlighted within the NAP;
- comment on the activities of the Codex ad hoc Intergovernmental Task Force on AMR; and
- discuss the progress made by the UK’s food industry to reduce antibiotic usage in food producing animals.

INTRODUCTION

3. AMR is a national strategic priority for government and the FSA is playing its part by continuing to fill the evidence gaps on the role that food plays in this issue. Since the previous Board paper on AMR in September 2018, the FSA has been working with other
government departments to develop a new 20-year vision and national action plan (NAP) for 2019 to 2024 aiming to tackle AMR. Both the long-term vision and NAP were published in January 2019 the latter of which 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 and surveillance, and promoting good practice across the food chain. The NAP also includes AMR in the environment as a key component and we will need consider how this might impact the food chain and vice versa.

4. This paper presents an overview of the new food safety section within the new AMR NAP and an update in terms of how the FSA is informing the new NAP and long-term vision on AMR through its science activities relating to AMR following the update provided to the Board in September 2018. A summary of the FSA's programme of research and surveillance on AMR has been provided under Annex 2. We also provide an update on industry progress in reducing antimicrobial usage in food-producing animals and finally an overview of the Codex ad hoc Intergovernmental Task Force on AMR.

FSA’s role in the UK’s national strategy on AMR

5. 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 AMR NAP (2019 to 2024) which sets out actions to slow the development and spread of AMR with a focus on antimicrobials (further details provided under Annex 1). The vision and NAP build upon the achievements made over the UK’s previous 5-year AMR strategy (2013 to 2018) which includes unprecedented levels of AMR research investment and collaboration, reduced antimicrobials use in humans and animals, development of comprehensive surveillance systems with transparent data and campaigns that have been welcomed by front line staff. The NAP used a ‘One-Health’ approach which spans people, animals, agriculture, food and the environment. The FSA have been and are continuing to contribute to the delivery of the AMR strategy through furthering our understanding of the role of the food chain and AMR and encouraging the food industry to reduce usage of antimicrobials where possible.

6. The FSA have been a key partner in the production of both the vision and NAP documents and have been influential in terms of including a new specific section within the NAP 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 strengthening the evidence to better understand AMR in the food chain in particular:
• Further 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; and
• Research to assess the impact of food processing, especially mild processing techniques, on the presence of AMR bacteria.

7. The NAP also mentions improving and promoting UK food hygiene across the food chain which would lead to reducing exposure to AMR. This would build on our existing ‘4Cs’ messages (cooking, cleaning, chilling and avoiding cross-contamination) which are used by food producers, manufacturers, suppliers, food handlers and consumers. The NAP refers to Codex Alimentarius Commission\(^1\) 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 by 2020. In 2017, Codex established an ad hoc Intergovernmental Task Force on AMR\(^2\) which is aiming to develop a science-based guidance on managing foodborne AMR (see paragraphs 15 and 16).

**FSA’s research and surveillance activities**

8. The FSA is continuing to carry out research and surveys to improve our understanding of the role of the food chain in AMR which is important within the NAP. A summary of our AMR research and surveillance portfolio activities have been provided in Annex 2, which highlights completed and current projects as well as new research ideas.

9. The FSA has been proactive in identifying evidence gaps in terms of the types and levels of AMR bacteria found in UK retail meats and other foods and are addressing this by commissioning retail surveys. Our AMR surveillance programme has been well established for a number of years and precedes the 5-year NAP. We have been and are continuing to gather data on AMR *Campylobacter* found in UK retail chickens and AMR *E. coli* found in UK retail chicken, pork and beef as part of a larger mandatory EU survey. Through our retail chicken survey and the EU harmonised survey, we now have collected data since 2015 on resistant *Campylobacter* and *E. coli* AMR in retail meats. This is providing an indication on the extent to which these foods are contaminated with AMR bacteria but also to monitor trend of these resistant bacteria over a number of years. Our involvement in the EU harmonised survey AMR *E. coli* in retail meats will

---

allow us to draw comparison with the equivalent data provided by other Member States. We have also been responsive in terms of including new emerging AMR genes within our retail surveys such as the Colistin mcr-1 and mcr-2 genes which have been included since 2015. The data being generated is not only informing our risk assessment and risk management activities but also the wider UK NAP on AMR by strengthening the data on the presence of AMR in UK retail meats.

10. In 2019, the FSA commissioned two AMR research projects. The first is a gathering of information on the impact of established and novel meat processes on AMR bacteria and the transfer of resistance genes; this will address a key evidence gap identified by the ACMSF and the NAP. It is anticipated that the study will identify specific processes within meat manufacture which are of concern and where interventions are required to mitigate these risks. We are also funding a study assessing the burden of AMR genes in ready-to-eat foods (cooked meats, dairy products, seafood and fresh produce) using a metagenomics approach. This will provide new data on the presence of AMR in these foods which was identified as an evidence gap in the 2016 systematic review of AMR bacteria in UK retail foods3.

11. The FSA are currently exploring the option of including metagenomics within the third study of infectious intestinal disease in the UK (IID3 study) as this will allow us to identify not only the diversity of pathogens present in the stool samples of those with IID, but also for the presence of AMR genes. This would provide a unique opportunity to gather UK population-based data on the diversity and carriage of AMR genes in the human gut microbiome and will address a key evidence gap as highlighted within the NAP.

Reducing antibiotics usage in food production animals

12. The food industry has continued to reduce antimicrobial usage in livestock as reported within the latest Veterinary Antimicrobial Resistance and Sales Surveillance (VARSS) report issued by VMD4. In 2017, the sales of veterinary antibiotics for use in food producing animals were 37 mg/kg which represents a 18% drop from 2016 and 40% decrease from 2013.

13. The sales of highest priority critically important antibiotics (HP-CIA) in food producing animals dropped by a further 0.86 tonnes (29%) from an already low level in 2016; an overall drop of 2.35 tonnes (52%) between 2013 and 2017.

14. For pigs, meat poultry, laying hens, gamebirds and dairy sectors, where antimicrobial usage data was available for more than 1 year, the total usage and HP-CIA usage decreased compared to 2016.
FSA’s international activities on AMR

15. Following a successful physical working group in London organised by the FSA and Veterinary Medicines Directorate (VMD), the Codex Alimentarius Commission, the global food safety and quality standards body, agreed in July 2017 to establish a time-limited ad hoc Intergovernmental Task Force on Antimicrobial Resistance (TFAMR) to review the existing Codex code of practice on controlling AMR in the food chain and to establish new guidelines on integrated surveillance for antimicrobial resistance in the food chain. TFAMR is hosted by the Government of the Republic of Korea and chaired by Professor Yong Ho Park of Seoul National University; it has met annually since 2017 and has further meetings scheduled for December 2019 and December 2020, when its term will expire.

16. Professor Park noted in his report to the July 2019 meeting of the Codex Executive Committee that the Task Force has achieved substantive progress and that in order to facilitate further progress and ensure completion of the work to the envisaged timescale the Government of the Republic of Korea will organise further physical working group meetings in advance of each of the two scheduled future meetings. The UK, through its national delegation led by VMD and the active engagement of Steve Wearne of FSA in his role as Codex Vice-Chair, continues to work for progress to be made in this multilateral forum.

ECDC and DG-SANTE UK visit

17. In May 2018, officials from the European Centre of Disease Prevention and Control (ECDC) and European Commission’s Directorate General for Health and Food Safety (DG-SANTE) carried out 10-day UK visit following the invitation by the competent authorities to assist them in the review of their national strategy for tackling AMR based on a ‘One Health’ approach. A report of this visit is being produced.

CONCLUSIONS

18. In the context of recent publication of the Government’s 20-year vision on AMR and the 5-year NAP to control and contain AMR in particular the emphasis on AMR and food safety, the Board is asked to:

- **comment and endorse** the FSA’s efforts in funding research and surveillance to improve our understanding of the role of the food chain in AMR as highlighted within the NAP;
- **comment** on the activities of the Codex *ad hoc* Intergovernmental Task Force on AMR; and
• **discuss** the progress made by the UK’s food industry to reduce antibiotic usage in food producing animals.

---

**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 delivery of the NAP through furthering our understanding of the role of the food chain and AMR and encouraging food industry to reduce usage of antimicrobials where possible.

The previous 2013-2018 AMR strategy came to an end last year 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 to develop a new UK’s 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, in January 2019, its vision 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 nine 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 vision⁵.

**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)⁶ 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\textsuperscript{7}, 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 that the existing 10\% target), a renewed commitment to halve healthcare associated Gram-negative blood stream infections (including \textit{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 need for and unintentional exposure to antimicrobials, optimising 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 (cooking, cleaning, chilling and avoiding cross-contamination) which are used by food producers, manufacturers, suppliers, food handlers and consumers. The NAP

\textsuperscript{7} Health family includes all bodies, organisations and agencies that contribute to the nation’s health. This would include NHS England, NHS Improvement, Public Health England, Department of Health and Social Care, Medicines and Healthcare products Regulatory Agency, National Institute for Health and Care Excellence, the Food Standards Agency, etc.
mentions Codex Alimentarius Commission\(^8\) 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 by 2020. In 2017, Codex established an *ad hoc* Intergovernmental Task Force on AMR\(^9\) which is aiming to develop a science-based guidance on managing foodborne AMR (see paragraph 14 and 15).


ANNEX 2

Update on the FSA’s programme of research and surveillance on AMR

This section summarises FSA efforts with respect to AMR research and surveillance, highlighting both completed, current work and new research ideas. 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 on tackling AMR by improving our understanding of AMR in the food chain.

**Surveillance completed since September 2018:**

- FS102109: Year 3 of the EU harmonised survey of AMR E. coli on retail meats: Beef & Pork findings.
- FS102121: Year 3 of the survey of AMR in Campylobacter jejuni and Campylobacter coli from retail chilled chicken in the UK.

Further research and survey reports are expected to be published later this year.

**Current research and surveillance:**

FS101013: *Campylobacter* source attribution and AMR

The FSA are funding a study which will establish for human *Campylobacter* infections in rural and urban populations and provide a reference dataset for the principle food and animal sources. This will be used to develop and implement attribution to food animals and other sources, mapping the sources of human infection. The data will also provide reference datasets to inform the evaluation of the impact of specific interventions in the food chain aimed at reducing human infections.

The FSA has expanded the scope of this project to analyse the existing *Campylobacter* sequences collected between 2009 and 2015 for the presence of AMR genes. Sequencing of older human *Campylobacter* isolates (from 2003 to 2009) will provide information on trends in AMR over time and this data-rich resource supports models to track the sources and reservoirs of AMR in *Campylobacter* which will help define key risk factors. We anticipate publishing the final report towards the end of the year.

---

10 https://acmsf.food.gov.uk/sites/default/files/amrtaskandfinish2.pdf
FS101185: Quadram Institute Fellowship update

The FSA is co-funding a 5-year Research Fellowship (2017-2022) with the Quadram Institute, Norwich which the FSA contributes to via the Strategic Evidence Fund. The Research Fellow, Dr Alison Mather, is investigating food chain transmission of AMR, the relative contribution of imported vs domestic food and the role of non-pathogenic bacteria in food as a potential reservoir for AMR. This involves sampling of retailed foods in a defined geographical region, comparison with contemporaneous samples from animals and humans in the same region, over the same period (in collaboration with PHE and APHA), and utilisation of sequencing to evaluate the prevalence, diversity, source attribution, etc. of pathogens and AMR.

Since the September 2018 Board update, Dr Mather has continued to meet interim goals to achieve the overall project objectives. Well supported by her post-Doctoral team, more than 1,000 field samples have now been collected for analysis from a range of raw chicken, pork, leafy green, salmon and prawn products. This marks a transitional phase as emphasis shifts from sample collection to analysis and subsequent reporting. The value of the Fellowship is further realised by the research community engagement it facilitates. This includes:

- A presentation of Dr Mather’s research at the Scientific Advisory Committee (SAC) ‘Discovery Day’ held 13th June 2019
- Dr Mather with the Director of Quadram Institute, Professor Ian Charles, met with the FSA Chief Scientific Adviser on 30th July 2019 to discuss future research priority areas of research interest, including scoping proposals for Doctoral training studentships aligned to the FSA’s core mission.
- The FSA’s Microbiological Risk Assessment Team, are planning a Quadram Institute visit in September 2019 to engage with the wider research community there, exploring opportunities for further exchange of information and expertise.

FS102109: EU harmonised survey of AMR E. coli on retails: Chicken (Year 4), Beef & Pork (Year 5)

In 2014, the European Commission set-up a 7-year mandatory Member States surveillance for specific pathogens within the slaughterhouse environments. The FSA is leading on an additional component of this survey by sampling retail meats (beef, pork and poultry) in the UK for E. coli prior to testing for AMR traits of particular concern. We anticipate publishing the final report for Year 4 (chicken) in November 2019 to coincide with World Antibiotic Awareness Week. Year 5 (beef and pork) of the survey is ongoing and we anticipate publishing the findings in Autumn 2020.

FS102121: A survey of AMR in Campylobacter jejuni and Campylobacter coli from retail chilled chicken in the UK (Year 4 and 5)
The FSA are carrying out a survey of *Campylobacter* contamination in fresh, whole UK produced chilled chicken at retail sale. Like previous years, a subset of the *Campylobacter* isolates from the retail chicken survey were tested for their resistance to a range of antimicrobial agents. We anticipate publishing a report for Year 4 of the survey in October 2019 whilst a report covering Year 5, which is currently ongoing, is expected to be published in Autumn 2020.

**FS301059: Impact of food processing on AMR bacteria in meat and meat products**

The FSA are funding a review of the literature on the impact that established and novel secondary meat processes have on AMR bacteria and the impact on the transfer of antimicrobial resistance genes (AMG). This review is addressing a key recommendation from the ACMSF ‘Task and Finish’ Group and will feed into the UK cross-government AMR strategy 2019-2024 by providing information on the role meat processing plays in the development and spread of AMR bacteria. This study started in January 2019 and we anticipate receiving the final report in early 2020.

**FS301050: Assessing the burden of AMR genes in ready-to-eat foods**

The FSA’s previous surveillance activities have focused on the prevalence of AMR genes in retail raw meats in the UK. The FSA-funded systematic review of AMR bacteria in UK retail foods\(^1\) identified lack of data on the presence of AMR genes in ready-to-eat (RTE) foods on retail sales in the UK. To address this, the we have commissioned a study to assess the burden of AMR genes in selected RTE foods (FS301050). This study will use metagenomics to estimate the nature and magnitude of human exposure to AMR genes via consumption of certain categories of RTE foods (cooked meats, dairy products, seafood and fresh produce). This study started in February 2019 and due to report in 2021.

**New research areas:**

**FS301058: IID3 study**

We are in the process of scoping out the third study of intestinal infectious disease in the UK (IID3) which aims to re-estimate the burden of IID in the UK. As part of this study, we are looking to include using metagenomics alongside other approaches to identify pathogens present in stool samples, as well as looking for AMR genes in both infected and healthy individuals. This would provide us with a unique opportunity of gathering useful UK

population-based estimates of the diversity and carriage of AMR genes in the human gut microbiome.

FS307021: The microbiological colonisation of microplastic and significance to the food chain

The FSA is asking for a critical review on the types of microorganisms that colonise both nano- and microplastics (NMPs), the key pathways by which these could potentially enter the food chain and the microbiological risk posed to consumers via this route. The review will also gather information on AMR bacteria which can potentially colonise the NMPs and the risk they pose to public health via the food chain. We anticipate this study starting in the next few months.