Food and Agriculture Organization of the United Nations

Centre for Environment, Fisheries & Aquaculture Science | Animal & Plant Health Agency | Veterinary Medicines Directorate

FAO Reference Centre

Annual report

Title of FAO Reference Centre: UK FAO Reference Centre for Antimicrobial Resistance

Name of the institution: Department for Environment, Food and Rural Affairs (Defra)

Country: United Kingdom

Date of report: 23 July 2025

Reporting period: 1 January 2024 – 30 June 2025

Name of the Institute's Responsible Officers and Name of the Reporting Officers:

Institute: Centre for Environment, Fisheries and Aquaculture Science, Defra
Reporting officers: Craig Baker-Austin and Athina Papadopoulou
Website: https://www.cefas.co.uk/

Institute: Animal and Plant Health Agency, Defra
Reporting officer: Roderick M. Card,
Website: https://www.gov.uk/government/organisations/animal-and-plant-health-agency

Institute: Veterinary Medicines Directorate, Defra
Reporting officers: Claire Gilbert and Elizabeth Marier
Website: https://www.gov.uk/government/organisations/veterinary-medicines-directorate

E-mail: faoreferencecentreforamr@vmd.gov.uk

If this report is published on your website, please provide the link: to be confirmed

Please note that this report will be published on the FAO Reference Centres website

Table of Contents

List of figures

List of acronyms

ABBREVIATION	MEANING
AMR	Antimicrobial Resistance
AMU	Antimicrobial Usage
APHA	Animal and Plant Health Agency
AST	Antimicrobial Susceptibility Testing
BHC	British High Commission
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CLSI	Clinical and Laboratory Standards Institute
COP	Community of Practice
CVRI	Central Veterinary Research Institute
DEFRA	Department for Environment, Food and Rural Affairs
ECOFF	Epidemiological Cut Off Value (EUCAST)
ECV	Epidemiological Cut Off Value (CLSI)
EUCAST	The European Committee on Antimicrobial Susceptibility Testing
FAO	Food and Agriculture Organization of the United Nations
FAO – RAP	FAO – Regional office for Asia Pacific
FAO ECTAD	Emergency Centre for Transboundary Animal Diseases
FOAO	Food of animal origin
INFARM	International FAO Antimicrobial Resistance Monitoring
LMIC	Low- and middle-income country
MRL	Maximum Residue Limit
NAP	National Action Plan
NMIS	National Meat Inspection Services - Philippines
OCPP	Ocean Country Partnership Programme
ODA	Official Development Assistance
PT (SCHEME)	Proficiency Testing (Scheme)
RENOFARM	Reduce the Need for Antimicrobials on Farms
TAG	Technical Advisory Group
UAE	United Arab Emirates
UK	United Kingdom
UNGA HLM	United Nations General Assembly High Level Meeting
UPLB	University of the Philippines Los Baños
UNZA	University of Zambia
USA	The United States of America
STEM	Science, Technology, Engineering, and Mathematics
TATFAR	Transatlantic Task Force on Antimicrobial Resistance
RVDF	Residues of Veterinary Drug in Food
VMD	Veterinary Medicines Directorate
VMP	Veterinary Medicinal Products
WAAW	World Antimicrobial Resistance Awareness Week
WOAH	World Organisation for Animal Health

Success story in 100 words

Between January 2024 and June 2025, the UK FAO AMR Reference Centre contributed to tackling AMR globally. We engaged in international collaborations, delivered capacity-strengthening initiatives in LMICs, and supported several FAO initiatives. Our projects involving AMR surveillance, research, and technical support strengthened capabilities in animal health, aquaculture, and the environment in 31 countries across the Americas, Africa, Middle East and Asia-Pacific region. We participated in and organised congresses, workshops, and conferences to foster knowledge exchange and enhance global AMR response. Collaborating with FAO, we secured funding to deliver tailored support on AMR, AMU and residues surveillance in four West African countries.

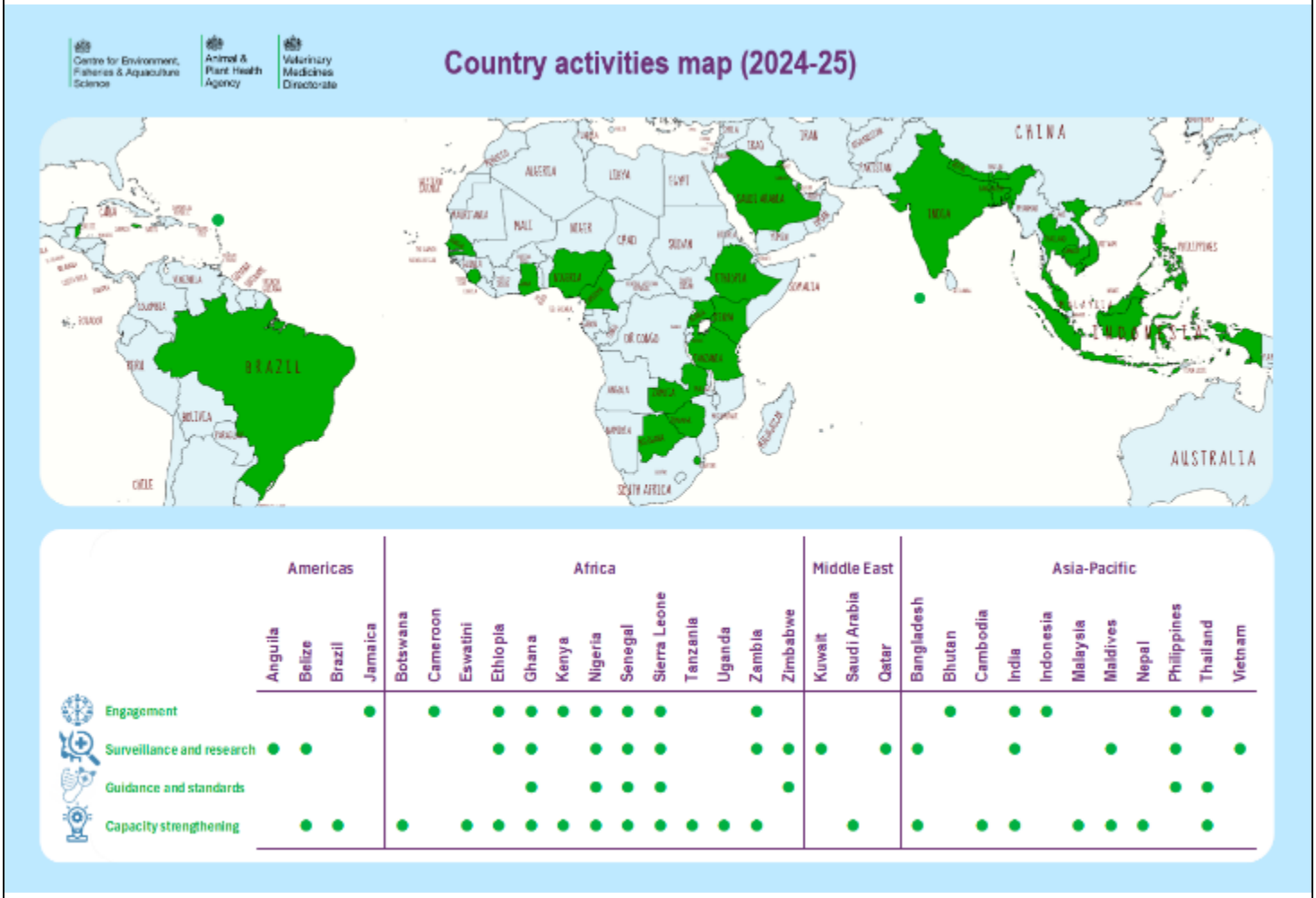


Figure 1. Geographical representations of activities delivered by the RC throughout 2024 and 2025.

Examples of activities per category:

- **Engagement**: Conferences, workshops, meetings, scoping
- **Surveillance & Research**: Laboratory support, research projects, protocol review
- **Guidance & Standards**: Developing guidance or guidelines, policy work, governance, regulation
- **Capacity Strengthening**: Training (whether in the UK or abroad), mentoring fellows, e-learning, supporting postgraduate students

1.0 Introduction

The UK Food and Agriculture Organization (FAO) Reference Centre for Antimicrobial Resistance (AMR) (hereafter the 'Reference Centre', (RC)) is pleased to present its report covering activities from 1 January 2024 to 30 June 2025. This report demonstrates our strong track record of delivery for the FAO and other organisations across several countries, addressing AMR, strengthening surveillance systems, and enhancing technical capabilities, with a focus on long-term sustainability and resilience. Thanks to the continued generous support of the Fleming Fund, the Department for Environment, Food and Rural Affairs (Defra) and other funders, our experts continued to engage widely with partners in many countries, enabling us to deliver significant programmes. We plan to build on these activities in collaboration with our engaged and supportive partners going forward.

1.1 Who we are

The FAO designation acknowledges the broad range of AMR expertise across three executive agencies of Defra: the Animal and Plant Health Agency (APHA); the Centre for Environment, Fisheries and Aquaculture Science (Cefas); and the Veterinary Medicines Directorate (VMD). Our vision is to safeguard animal and human health from the threat of AMR. Our mission is to provide scientific and policy expertise within the global community to tackle AMR in terrestrial and aquatic animals and their environment in a One Health context.

1.2 Our objectives

Figure 2. The four objectives of the UK FAO Reference Centre for AMR

We seek to complement the FAO's programme by supporting member countries in the implementation of their National Action Plans (NAP) on AMR. Our activities are aligned with the FAO Action Plan on AMR (2021–2025), the Quadripartite approach to One Health action on AMR, and the UK's AMR NAP (2024–2029).

We place partnership at the core of our approach and seek to engage with a wide range of partners to deliver activities under four broad categories: engagement, surveillance & research, guidance & standards and capacity strengthening. Activities are underpinned by management and communication functions.

2.0 Areas of collaboration

2.1 Area of collaboration 1.

*Actively contribute to the **network of FAO Reference Centres** for AMR.*

Activity 1. Annual congress: AMR FAO Reference Centre network | September 2024 | Rome

The RC attended the second Congress along with 30 experts from 11 countries and colleagues from FAO HQ and regional AMR leads and welcomed three new countries to the growing network to discuss the progress of activities to tackle emerging AMR issues. The meeting covered FAO long-term ambitions such as for RENOFARM and InFarm; near-term objectives for each Reference Centre; discussion on emerging AMR risks; sharing of experiences and lessons learnt; exploration of opportunities for enhanced collaboration. The RC, together with the Danish Technical University, delivered a presentation describing our capacity strengthening activities.

Figure 3. Annual congress of the AMR FAO Reference Centre network.

Activity 2. Supporting FAO network of AMR Reference Centres and initiatives | 2024-25

The RC provided technical consultancy to the FAO via its membership on the Joint Technical Working Group for i) the development of its 10-year Road Map for FAO Reference Centres for AMR, ii) Second Congress of AMR Reference Centres and iii) AMR Laboratory Innovators Community of Practice (CoP). The RC continued to contribute to the FAO initiatives since stepping down from the Joint Technical Working Group following the Congress in September, including attendance at the Network's bi-monthly call of all FAO Reference Centres for AMR.

Activity 3. Visit from AMR FAO Reference Centre for Senegal | November 2024 | UK

The RC hosted the Head of Senegal's FAO AMR Reference Centre from Institut Pasteur de Dakar in the UK in November 2024. Our guest visited Cefas and APHA's laboratories as well as the VMD to discuss AMR laboratory testing and the UK surveillance programmes for AMR, antimicrobial use (AMU) and residues of veterinary medicines. A visit to the Food and Environment Research Agency laboratory provided insight to testing methodology for antimicrobial residues in food products, and a visit to a poultry abattoir allowed our guest to observe the sample collection process. Opportunities for further collaborations on FAO & AMR projects were explored. Our guest gave a very well-received presentation on 'Tackling antimicrobial resistance and bacterial infection in West Africa: the importance of surveillance and genomics' to over 100 people.

2.2 Area of collaboration 2.

*Make expertise available to contribute to the improvement of **AMR and AMU surveillance and monitoring** capability in countries that are FAO members.*

Activity 1. The West Africa AMR One Health regional grant | 2024-2025 | West Africa

The RC delivered several activities as part of a Fleming Fund regional grant. The West Africa AMROH grant, led by Cefas delivered through a consortium including FAO Subregional Office for West Africa in Senegal, APHA, and the VMD, strengthens AMR surveillance in animal health, aquaculture, and the environment in four countries: Ghana, Nigeria, Senegal, and Sierra Leone. See Case Study.

Activity 2. AMR Community of Practice | 2024-2025 | Virtual

The RC supported the AMR CoP since its inception in 2022. The CoP now includes 160 professionals from 90+ institutions across 36 countries. Its mission is to enhance awareness, foster collaboration, and improve laboratory practices related to AMR. The CoP supports global efforts in food and agriculture sectors to combat AMR and provides a platform for knowledge exchange and professional networking.

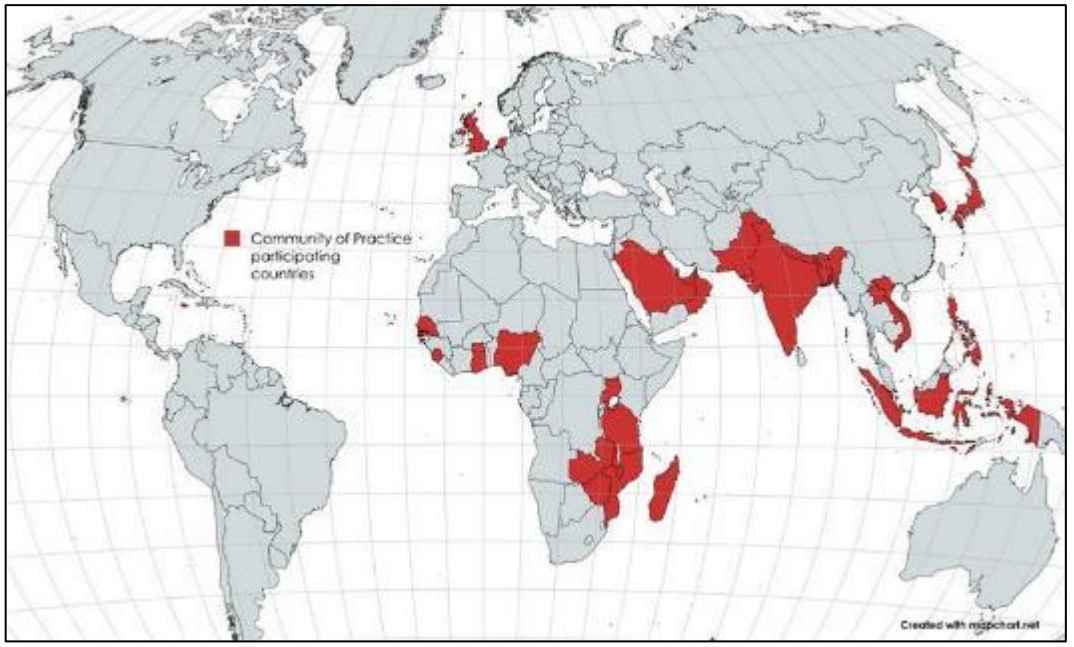


Figure 4. Member countries of the AMR CoP come from institutions in Africa, Asia, Europe, and the Caribbean.

The CoP convened six virtual meetings in the reporting period and attendance ranged from 28 to 58 participants per session. Each meeting, shaped by member feedback to ensure relevance and engagement, featured expert presentations on topics such as AMR surveillance, laboratory capacity strengthening, responsible antibiotic use, and advanced sequencing technologies. Members from various countries shared national experiences and institutional practices. Sessions also included interactive elements, community updates, and announcements about publications, conferences, and funding opportunities.

Several members of the CoP met in person during the 2024 WOHC congress, which allowed for strengthening of professional relationships and discussions of potential collaborations. The CoP continued to serve as a collaborative and supportive environment for professionals working to address AMR challenges globally.

Figure 5. UK RC and members of CoP at the World One Health Congress, Cape Town, September 2024

Activity 3. West Africa One Health AMR Expert Network | 2025 | Virtual

The RC launched the 'West Africa One Health AMR Expert Network Group' in a virtual Kick-Off Meeting in March 2025 with 23 representatives from Ghana, Nigeria, Sierra Leone, and Senegal attending. This Group brings together specialists to collaborate in a series of virtual discussions to identify key challenges affecting AMR surveillance, and propose innovative strategies to enhance data interoperability, policy impact, sustainability, and stakeholder engagement. The first discussion session was held in March and addressed "Multisector approach to surveillance- How can we ensure data interoperability between AMR surveillance systems in human, animal and environmental health sectors?". Preparation of the Expert Network Group involves meetings with a 'Steering Committee', including representatives from each of the four countries to encourage a country led approach.

Activity 4. Surveillance of residues of veterinary drugs in food in Zambia | 2024-2025 | Virtual

The RC provided laboratory methodology training to the Central Veterinary Research Institute (CVRI) in Zambia as part of their plan to setup surveillance of residues of veterinary drugs in food (RVDF) in chicken meat as well as technical support to overcome challenging circumstances.

Activity 5. Sierra Leone fellowship | 2024-2025 | Sierra Leone & UK

The RC mentored Fellows from Sierra Leone in the Fleming Fund Phase 2 Fellowships Scheme, participated in the Virtual Orientation Meeting for Nigeria & Sierra Leone, and joined the Sierra Leone launch meeting in Freetown, fostering collaboration and learning across West Africa and aiding in developing individualised workplans. See Case Study.

Figure 6. Fleming Fellows from Nigeria and Sierra Leone together with colleagues from the AMR-RC and the University of Liverpool during a visit to the APHA.

Activity 6. e-Learning roll outs | 2024-2025 | Virtual

The RC rolled out the bioequivalence e-learning twice, to a total of 52 delegates from agencies in Zanzibar, Tanzania, Brazil, Uganda, and Kenya. The newly developed pharmacovigilance e-learning training programme was successfully completed by cohorts from Kenya, Botswana and Ethiopia. The residues surveillance e-learning was rolled out to 18 attendees from Uganda and Botswana. The online training resources and the live sessions received excellent feedback.

Activity 7. Tailored training delivered in UK laboratory facilities | 2024-2025 | UK

The RC hosted several short-term visits at our UK facilities for scientists, veterinarians, and other experts from partner laboratories and institutes. We provided high-quality tailored one-to-one training to meet our visitors' needs. We employed a 'train-the-trainer' approach to maximise value and enable visitors to deliver follow-on training in their country. We hosted visitors from:

- **Qatar | May 2024**: Partners from the University of Qatar visited the RC as part of our collaboration on *Campylobacter* to exchange knowledge and approaches for the analysis of whole genome sequences and bioinformatics.

Figure 7. Qatar University colleagues visiting the UK, May 2024.

- **Maldives | January 2025**: A partner from University of Maldives visited our laboratories to discuss *Salmonella* serotyping and *Campylobacter* isolation. A series of presentations included an introduction to the UK Reference Centre for AMR, the Ocean Country Partnership Programme, and International AMR Collaboration Case Studies. A delegate from the Maldives National University presented on 'AMR in the Maldives'. Potential future collaborations and funding opportunities in the Maldives were discussed.
- **Anguilla | January 2025**: A scientist from Anguilla received a week's training on how to use a portable laboratory to isolate multiple bacterial targets from environmental waters. A 'Wagtech Potatest Dual' kit was deployed in country and will be used to support outbreak response and to investigate sewage contamination in environmental waters.
- **Sierra Leone & Nigeria | February 2025**: Fleming Fund Fellows from Sierra Leone and Nigeria received training at RC facilities in the UK.

Activity 8. Laboratory-based in-country training courses

The RC delivered several tailored theoretical and practical trainings for laboratory personnel in Ghana, Qatar, Sierra Leone and Zambia on bacterial diagnostics and antimicrobial susceptibility

testing. This included quality control and interpretation of results using internationally recognised standards. Conducting training within home laboratories offers participants invaluable experience, allowing them to work under their own conditions often with limited resources, while adhering to strict safety and quality standards.

Ghana

- *National Food Safety Laboratory | February 2024 | Accra*

The RC provided microbiology training to 10 scientists on *Salmonella* serotyping and antimicrobial sensitivity testing (AST) and met with the Ghanaian Chief Veterinary Officer and other stakeholders.

- *Sentinel animal health laboratories & environmental health laboratory | July 2024 | Accra*

The RC, in partnership with the Ghanaian animal health AMR Reference Laboratory, the 'National Food Safety Laboratory', trained 14 staff from seven sentinel sites including an environmental monitoring laboratory to build capacity for the isolation, identification, and susceptibility testing of bacteria.

Figure 8. AST training of staff from sentinel laboratories in Ghana.

- *National Food Safety Laboratory | February 2025 | Accra*

The RC supported the delivery of the Defra Animal Health Systems Strengthening project to complement ongoing efforts. The RC delivered training on *Salmonella* serotyping and AST, met with delivery partners, and visited the veterinary laboratory at Kumasi which undertakes sentinel AMR surveillance, to scope support needs.

Qatar

- *University of Qatar | February 2024 | Doha*

The RC supported a three-day laboratory training course titled 'Essentials and Advanced Hands-on Techniques in *Campylobacter* Foodborne Disease' lead by the University of Qatar and the APHA National Reference Laboratory for *Campylobacter*. Sixteen staff members from human and animal health laboratories participated. The course covered the isolation, identification, characterisation, and AST of *Campylobacter*. Over 40 scientists attended the classroom components of the course.

Figure 9. Workshop on Campylobacter *foodborne disease at the Biomedical Research Centre in Qatar, March 2024*

Sierra Leone

- *Central Veterinary Laboratory | April 2025 | Makeni*

The RC supported delivery of classroom and laboratory-based training in partnership with the Central Veterinary Laboratory, Sierra Leone Fleming Fellows, Sierra Leonian colleagues, FAO, and the British High Commission (BHC). The course delivered training to 18 scientists and technicians from Sierra Leonian animal and public health laboratories on microbiology and AST.

Figure 10. Participants at the training held at the Central Veterinary Laboratory.

Zambia

- *Central Veterinary Research Institute (CVRI) | January 2024 | Lusaka*

The RC provided training on the isolation and AST of *Salmonella* and *Klebsiella* as well as in sampling methods on poultry farm using bootswabs; a technique that is both quicker and more sensitive than previously used methods. The RC met with collaborators from FAO-ECTAD, CVRI, BHC and the University of Zambia (UNZA).

Activity 9. Collaborative Projects on AMR surveillance and Research | 2024-2025

The RC undertook joint collaborative projects with scientists and laboratories in several countries to address evidence gaps relevant to AMR and potential risks to veterinary or public health. This approach enhanced research capacity through improved skills in confirmatory testing, AST, whole genome sequencing and bioinformatics. These partnerships generated high-quality data and analyses, providing new insights to inform future surveillance and research protocols and assess risks to humans from the food chain. The RC leveraged the expertise and resources of our home agencies, such as the FAO Reference Centre for Bivalve Mollusc Sanitation (Cefas), WOAH Collaborating Centre for Emerging Aquatic Animal Diseases (Cefas), the *Campylobacter* National Reference Laboratory (APHA), WOAH Collaborating Centre for Risk Analysis & Modelling (APHA), and the WOAH Reference Laboratory for Salmonellosis (APHA).

The RC worked with the FAO in Ghana and Zambia to support the implementation of its Farmer Field School programmes. Through joint collaborative projects undertaken in partnership with FAO and the National Reference Laboratories, we investigated the prevalence of AMR in indicator and zoonotic bacteria on the poultry farms involved.

Collaborative projects were undertaken with partners from Anguilla, Belize, Bangladesh, Ethiopia, Ghana, Kuwait, Maldives, Nigeria, Philippines, Qatar, Vietnam, Zambia, and Zimbabwe.

Example from Bangladesh

The RC and WorldFish colleagues in Bangladesh conducted a pilot study in two major wet markets in Dhaka city. The aim was to assess the occurrence and characteristics of *Escherichia coli* and non-typhoidal *Salmonella* spp. (NTS) in tilapia (*Oreochromis niloticus*) and shrimp (*Penaeus monodon*). Fifty-four individuals of each species were collected. The bacteria identity was confirmed

by PCR, and antimicrobial susceptibility was tested using the Kirby – Bauer disc diffusion method. Some isolates were sequenced with Oxford Nanopore Technology for the presence of antimicrobial resistance determinants. *E. coli* was present in 60–74% of tilapia muscle tissue and 41–44% of shrimp muscle tissue. *Salmonella* spp. was found in skin (29%) and gills (26%) of tilapia, and occasionally in muscle and intestinal samples of shrimp. The *E. coli* had several multilocus sequence typing and serotypes and limited AMR determinants. One *E. coli* (BD17) from tilapia carried resistance genes for beta-lactams, quinolones, and tetracycline. This study assessed the potential food safety and health risk to consumers from aquatic retail products at two major wet markets in Dhaka city. The finding highlights the need to improve hygienic practices and sanitation standards at markets.

Example from Nigeria

Studies undertaken in Nigeria with our partners have highlighted the presence and AMR profiles of *Salmonella* in both indigenous and commercial poultry systems, underscoring potential public health concerns. In North Central Nigeria, *Salmonella* was detected in 6.8% of indigenous poultry droppings and 3% of water samples, with 23 diverse serovars identified. Although overall AMR was low, multidrug-resistant strains and 20 AMR gene markers were found. In contrast, a study in Oyo State in Southwestern Nigeria revealed a higher farm-level *Salmonella* occurrence (48%) in commercial poultry, with 70% of isolates resistant to fluoroquinolones and widespread multidrug resistance. Additionally, 52% of farms harboured extended-spectrum beta-lactamase-producing *E. coli*, with some evidence of inter-farm bacterial transmission. These findings contributed to the Nigerian National Action Plan for AMR and underscore the importance of ongoing surveillance and interventions in the poultry sector.

Example from Vietnam

The RC published a collaborative study on the prevalence, AMR and genomic diversity of *Campylobacter* spp. in retail chicken meat in Hanoi. Of 120 samples from traditional markets and supermarkets, 38.3% were positive for *Campylobacter*, predominantly *C. coli*. All isolates were resistant to ciprofloxacin, nalidixic acid, and tetracycline, and most *C. coli* strains were multidrug resistant. Whole genome sequencing identified resistance genes and clonal complexes linked to both poultry and human infections. This is the first comprehensive genomic study of *Campylobacter* AMR in Vietnam, supporting a One Health approach to tackling a key source of human infection.

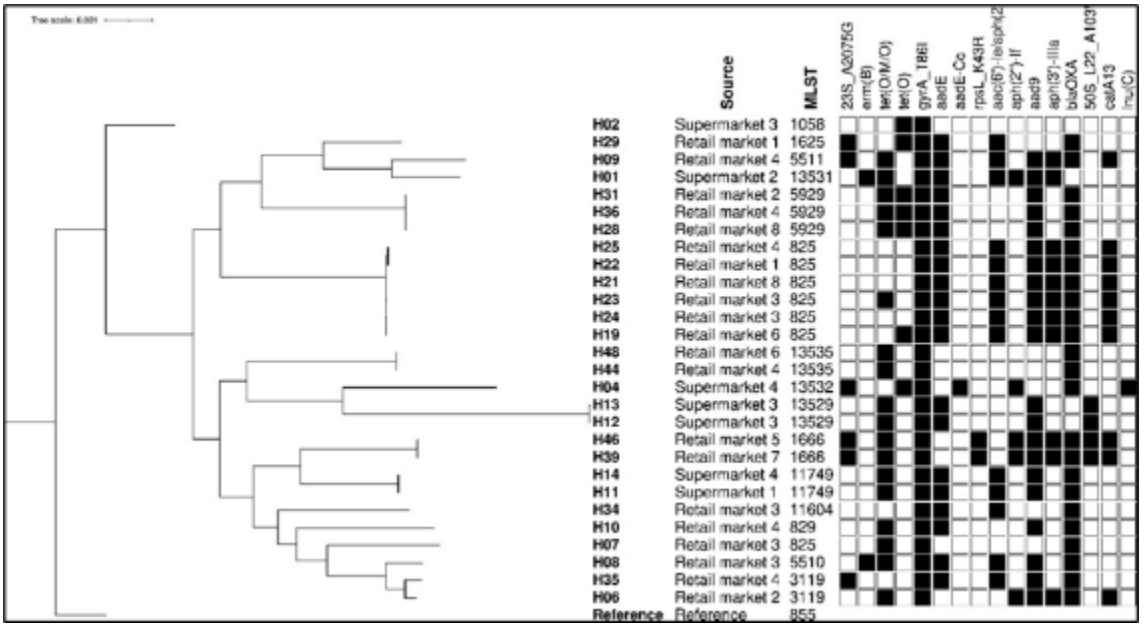


Figure 11. Phylogenetic tree of C. coli *isolates from retail chicken meat in Hanoi, showing carriage of AMR genes and point mutations [Huong et al. 2024]*

Activity 10. Other activities

- The RC provided online technical support to Bhutan on the testing of veterinary drug residues in animal feed.
- The RC provided representation on the Alumni Network Steering Committee, established to support Fleming Fellows after graduation from the programme. Through this representation, the RC worked with other mentors, fellows, and the management teams at Mott MacDonald and the Fleming Fund to support to the Alumni.

2.3 Area of collaboration 3.

*Make expertise available to contribute to the improvement of **antimicrobial use practices** in countries that are FAO members.*

Activity 1. Prequalification for Medicines project | 2024-2025 | Global

The RC collaborated with FAO to deliver the Prequalification for Medicines (PQm) project which explored the potential value of an assurance scheme for veterinary medicinal products (VMPs). A stakeholder consultation was conducted, involving pharmaceutical companies, procurement organisations, national regulatory authorities and the private sector, to determine challenges affecting the availability of good quality VMPs in LMICs. Interviews were conducted online and during visits to Zambia, Ethiopia and Kenya to determine whether a prequalification scheme would be beneficial and viable. A full report is expected to be available during 2025.

Figure 12. PQM project. Stakeholder interviews in Ethiopia and Kenya, October 2024

Activity 2. Postgraduate programme | 2023-2025 | Zambia

The RC's collaborative postgraduate programme with the UNZA has continued to flourish. This programme provides academic scholarships for PhD and MSc students and supports AMR-related research at the UNZA School of Veterinary Medicine. UNZA students and a senior academic visited the VMD for a training and knowledge exchange programme in February 2025. The programme is being expanded to offer additional MSc scholarships for the next year, and the RC commissioned further research projects related to AMR and veterinary medicines.

Figure 13. UNZA visit to the VMD, February 2025

Figure 14. UNZA visiting a farm in the UK, February 2025

Activity 3. Training on quality and efficacy of VMPs | February 2024 | UK

The RC provided Pharmaceutical Assessor training covering assessment of the quality, efficacy, environmental safety, user safety, and consumer safety of VMPs for delegates from Botswana and Rwanda in February 2024 in the UK.

2.4 Area of collaboration 4.

*Provide expert **technical services to the FAO**.*

Activity 1. Collaborative meetings with FAO country teams | 2024-2025 | various

The RC collaborated closely and in strong partnership with numerous FAO country teams. Their expertise and deep understanding at the country level are invaluable in ensuring that the support provided and activities undertaken by the RC are well-aligned with existing programmes and responsive to the needs of local stakeholders.

Activity 2. FAO-RAP Guidelines 6 | 2024-2025 | Virtual & Bangkok

The RC continued its contribution to the drafting of the FAO Regional Office for Asia and the Pacific (RAP): "Regional Guideline for Monitoring and Surveillance of Antimicrobial Residues in Foods of Animal Origin". This guideline brings together international standards to help countries establish monitoring systems for antimicrobial residues. The revised draft was discussed during a second consultation held in Bangkok in January 2025. The group aims to finalise the guideline in 2025 to strengthen regional monitoring efforts.

Figure 15. Second consultation on the FAO-RAP Guideline 6, Bangkok, January 2025

Activity 3. Progressive Management Pathway for AMR | February 2024 | Virtual

The RC reviewed the FAO-PMP-AMR manual available online. The FAO-PMP-AMR is a guide to assist countries to put NAPs into action. The progressive approach enables specific sectors to make step-by-step improvements toward the sustainable use of antimicrobials and management of AMR.

Activity 4. RENOFARM activities and launch | April 2024 | China

The RC attended the FAO webinar on the introduction to RENOFARM on 11 January 2024. Subsequently, the RC presented the UK's progress on its activities supporting the reduction of AMU at the launch of FAO RENOFARM, focusing on reducing the need for antibiotic use on farm. The event included a bilateral meeting with the Chinese Institute of Veterinary Drug Control (CIVDC), fostering international collaboration and knowledge exchange in veterinary drug use management and sustainable farming practices.

Activity 5. FAO-RAP regional benchmarking workshop on AMR | May 2024 | Thailand

The RC contributed to the FAO-RAP quadripartite meeting attended by over 100 participants. Representatives from nine Asia-Pacific countries presented their AMR surveillance capabilities across animal, human, aquaculture, and environmental sectors. The group evaluated strengths and resources, identifying immediate next steps for support, and discussed priorities to enhance One Health integrated surveillance in the region.

Activity 6. ATLASS-RVDF tool pilot | June 2024 | UK

The RC piloted the ATLASS-RVDF tool by evaluating the UK's mechanisms and capacity for the surveillance of antimicrobial residues. It provided a comprehensive list of constructive feedback to the FAO to help enhance the tool.

Activity 7. Membership to FAO-RAP's CoP on Prudent AMU in Animals

The RC attended virtual meetings and provided feedback on several ongoing CoP initiatives, including the virtual "AMR Tackle Box", an online platform for veterinarians in the Asia-Pacific region. This resource offers practical, accessible tools to support improved AMU, especially in resource-limited settings across Asia.

Activity 8. Additional provision of expert technical services

- The RC wrote feedback and provided an assessment on the FAO consultation on "Livestock and Antimicrobial Use: The Economic Cost of Phasing-Out Growth Promoters | January 2024 | Virtual
- FAO technical consultation on integrated surveillance of AMR | April 2024 | Virtual

2.5 Area of collaboration 5.

*Contribute **to raising awareness on AMR** internationally.*

Activity 1. Participation in international meetings and seminars

- Fleming Fellow Symposium | March 2024 | Virtual

The RC provided a member to the Fellows' Symposium Organising Committee, who gave advice and guidance for the theme, structure, and functioning of the Symposium. The RC also delivered a presentation, provided feedback from the symposium survey, and chaired the final discussion session. The March Fleming Fellows Symposium was attended by 95 people to discuss how the Fellowships deliver 'Expertise with Impact'.

- UNGA High-Level Meeting (HLM) on AMR | pre and post September 2024 | USA

The RC actively contributed to preparatory activities leading up to the United Nations General Assembly High Level Meeting (UNGA HLM). The Political Declaration on AMR, adopted by Member States, outlines ambitious commitments across the One Health spectrum, notably in animal health. Key commitments include meaningfully reducing antimicrobial use in agrifood systems and ensuring the prudent and responsible use of antimicrobials in animal health. The RC continued to support the Quadripartite and contributes to priority global AMR initiatives.

- WOAH General Session AMR side events with WOAH Delegates | May 2024 & 2025 | Paris, France

The RC supported and regularly engaged with the World Organisation for Animal Health (WOAH) on AMR. During both 2024 and 2025 General Sessions, RC staff co-hosted impactful side events to discuss, with WOAH Delegates, AMR collaboration and activities.

- World One Health Congress | September 2024 | South Africa

The RC attended the 8th World One Health Congress in Cape Town, South Africa (20 to 23 September 2024) and delivered an oral presentation summarising its work titled 'Working internationally to support local action on antimicrobial resistance'. Posters on collaborative projects undertaken with partners in Africa and Asia were also presented. The RC supported the attendance of a Fleming Fellow Alumnus from the University of Ibadan (Nigeria). The Fellow presented five posters at the conference and was able to network extensively and update their knowledge.

- Fleming Fund Pan Regional Grants Learning Event | September 2024 | South Africa

The RC attended this pre-WOHC meeting, which offered the opportunity to network with other Fleming Fund Grantees and share challenges, learnings & insights.

Figure 16. World One Health Congress, Cape Town, September 2024

- Codex Committee on Residues of Veterinary Drugs in Foods | October 2024 | USA

The RC attended the Codex Committee on Residues of Veterinary Drugs in Foods in Nebraska to provide technical support to the discussions that led to the adoption of MRLs to the Codex Alimentarius. The RC agreed to take over the chair of the electronic-working group (EWG) which gathers experts and stakeholders to work together remotely to develop technical documents and provide input on various Codex standards and guidelines.

- SeqAfrica Metadata webinar | October 2024 | Virtual

The RC presented on “How to choose the right metadata to make your genomic data useful” using published examples from the APHA of impactful use of Whole Genome Sequencing data to inform research, surveillance, and interventions for animal or public health. This followed an invitation from the Danish FAO Reference Centre for AMR, which lead the SeqAfrica programme.

- Fleming Fellows Symposium | November 2024 | Virtual

The RC provided a member for the Organising Committee, as for March 2024, who again contributed advice and guidance on the theme, structure, and overall execution of the Symposium. The Fleming Fellows Symposium was attended by 158 attendees.

- Other international engagements

The RC attended and actively contributed to several other international meetings to promote the responsible use of veterinary medicines and raise awareness on AMR as listed below:

- Technical AMR Roundtable | March 2024 | Dublin, Ireland
- One Health Approach conference | March 2024 | UAE
- Wellcome Sanger conference: “Antimicrobial Resistance – Genomes, Big Data and Emerging Technologies” | March 2024 | UK
- ECDC-Sciensano joint meeting | May 2024 | Brussels, Belgium
- Antimicrobial Resistance in Aquaculture | May 2024 | Qingdao, China.
- TATFAR | May and June 2024 | Virtual
- United Nations Environmental Programme | June 2024 | Switzerland
- Regional Workshop on AMU and AMR in Aquaculture | November 2024 | Singapore.
- 4th International Conference in Microbial Ecology | November 2024 | Sweden
- Antimicrobial Resistance Conference | November 2024 | UAE.

- Microbiology Society meeting "Knocking out AMR" | December 2024 | UK
- Microbiology Society Conference | April 2025 | Liverpool, UK
- FAO Global Agrifood Biotechnologies Conference | June 2025 | Italy

Activity 2. Workshops and Symposia delivered

Workshop: West African Regional AMR workshop | February 2024 | Ghana

The RC delivered a workshop to representatives from Ghana, Nigeria, Senegal, and Sierra Leone, making significant progress on mapping the AMR surveillance landscape and conducting a needs assessment. The RC also chaired a meeting for the West African AMR One Health (AMROH) grant, attended by colleagues from the Fleming Fund animal health country grants (Ghana, Nigeria, Senegal, and Sierra Leone), FAO representatives, and the West African Fleming Fund Regional Coordinator. The meeting advanced efforts to align regional grant delivery with national priorities and identified key areas for regional coordination.

Workshop: Surveillance of antimicrobial residues | March 2024 | Zambia

The RC delivered a one-day workshop to 40 attendees to raise awareness on the importance of responsible use of veterinary medicines and risks associated with antimicrobial residues in food of animal origin (FOAO). The RC facilitated a two-day discussion which subsequently took place with 30 attendees working on developing Zambia's own sampling plan for the surveillance of residues.

Workshop: LMIC priorities to inform the UNGA HLM on AMR | April 2024 | India

The RC took part in a workshop organised by the Centre for Science and Environment in India to discuss the priorities of LMICs to tackle AMR. Report.

Symposium: National Meat Inspection Service | July 2024 | Philippines

The RC co-organised a research and training symposium held in partnership with the Department of Agriculture in the Philippines. The RC delivered presentations on AMR surveillance, the importance of residues monitoring and the UK's mechanisms to monitor AMU in animals. A total of 400 participants attended, including 44 in person and 356 online.

Workshop: Hands on AST, sequencing and bioinformatics training for aquatic bacteria | November 2024 | India

The RC co-delivered a hands-on workshop with FAO Reference Centres for AMR and Aquaculture Biosecurity and experts from Istituto Zooprofilattico Sperimentale delle Venezie titled 'Utilising microbiome and genomic resources for understanding and mitigating antimicrobial resistance in the One Health context' during the World Antibiotics Awareness Week (WAAW) 2024 at Nitte University in Mangalore, India. Fifty participants from South and Southeast Asia received training on AST for bacteria species relevant to the aquaculture sector, sequencing techniques and bioinformatic analysis of sequencing data. The RC supported the attendance of four participants: Bangladesh (2), Ethiopia (1) and Zambia (1). This workshop was an excellent example of collaboration between the FAO RC for AMR and FAO RC for AMR and Aquaculture Biosecurity.

Figure 17.Participants at the hands-on AST, sequencing and bioinformatics training for aquatic bacteria, November 2024, India.

Figure 18. Participants recording results from AST training during the hands-on AST, sequencing and bioinformatics training for aquatic bacteria, November 2024, India.

Workshop: One-Health Day | February 2025 | UK

The RC hosted a One Health AMR meeting at APHA Weybridge attended by 31 Fleming Fund Fellows from Eswatini, Nigeria, and Sierra Leone. The meeting featured delegates from UK government agencies including: APHA, Cefas, the VMD, and UK Health Security Agency. These delegates shared insights and learnings from their work in addressing the threat of AMR in the UK and internationally. This provided actionable insights for Fellows to inform the design and implementation of initiatives to tackle AMR in their home nations.

Figure 19. One Health Day attended by Fleming Fund Fellows from Sierra Leone, Nigeria and Zimbabwe

Workshop: Surveillance of residues | February 2025 | Ghana

The RC delivered a one-day workshop in Accra in collaboration with the FAO and the BHC, to strengthen the surveillance of RVDF of animal origin in Ghana. The event gathered 42 delegates from 23 organisations, including Ghanaian ministries, research institutes, laboratories and the animal sectors, to discuss the importance of the responsible use of veterinary medicines and the risks associated with their residues in food. This workshop contributed to supporting the FAO's capacity assessment for testing and monitoring RVDF in Ghana.

Figure 20. Workshop on surveillance of antimicrobial residues, Ghana, February 2025

Symposium: Fleming Fund Fellows from Ghana and Zimbabwe | June 2025 | Virtual

The RC hosted a virtual meeting for ten Fleming Fund Fellows each from Ghana and Zimbabwe, supported by London School of Hygiene and Tropical Medicine as the lead mentor organisation. The session aimed to share UK ambitions, practical implementation insights, and global partnerships tackling AMR, while fostering collaboration and enriching Fellows' workplans.

Activity 3. UK Youth engagement | April 2025 | UK

The RC continued its 'Science, Technology, Engineering, and Mathematics' (STEM) outreach efforts in a local UK school, to support the FAO and other UN organisations in recognising the vital role of youth engagement in tackling antimicrobial resistance. In April 2025, we delivered an interactive workshop titled "Germs, Bugs, and Superbugs" to approximately 100 Year 4 pupils (ages 8 to 9). Through hands-on demonstrations and engaging activities, students learned about microbes, disease transmission, and the concept of antimicrobial resistance.

> *"I didn't know bacteria could be good and bad! It was so cool using the special equipment to see how germs spread."*
> (Insights from a pupil attending the STEM engagement)

Activity 4. Other types of visits organised

Visit: Scoping visit | January 2024 | China

The RC, supported by the British Embassy in Beijing, visited China to share expertise and enhance cooperation on tackling AMR in food-producing animals, aiming to strengthen scientific and technical support between the two countries.

Visit: Jamaican Veterinary Services Division | January 2024 | UK

The RC presented an overview of the UK AMR Surveillance to a representative from the Veterinary Services Division in Jamaica. The representative has joined our AMR CoP.

Visit: Chinese Academy of Agriculture Sciences | May 2024 | UK

The RC presented its work on AMR and animal disease control to a Chinese delegation who visited the Deputy Chief Veterinary Officer and Deputy Chief Scientific Advisor at Defra.

Visit: Scoping visit | July 2024 | Philippines

The RC conducted scoping visits and meetings with key Philippine institutions including the Research Institute for Tropical Medicine, the National Meat Inspection Service, the College of Veterinary Medicine at the University of the Philippines Los Baños (UPLB) and the Philippine Carabao Center in Los Baños to develop opportunities for continued scientific and technical collaborations.

Visit: Ministry of Marine Affairs and Fisheries (MMAF) | March 2025 | Indonesia

The RC undertook a scoping visit to Indonesia and assessed the laboratory capacity of Fish and Environmental Health Testing Centre (BPKIL) to host an aquatic animal AST training workshop and explore future collaborations.

V**isit: Strengthening visit and project presentation | March 2025 | Philippines**

The RC held follow-up project discussions and lab tours with current and potential collaborators from UPLB and four Department of Agriculture agencies. At UPLB, a presentation titled “Antibiotic Resistance, Serotyping, and Genomic Characterisation of *Salmonella* spp.” was delivered to around 150 veterinary students, faculty, and professionals.

2.6 Area of collaboration 6:

*Provide technical support through **external quality assessment and proficiency testing schemes.***

Activity 1. PT Scheme for antimicrobial residues testing in Food Of Animal Origin (FOAO) | 2024-2025

The RC contacted countries interested in participating in a PT Scheme for antimicrobial residue surveillance in FOAO. Although the timing was not suitable, the RC gathered valuable information from 32 laboratories in 16 LMICs on their laboratory capacity for testing antimicrobial residues and provided technical support for Ethiopia’s method accreditation.

Activity 2. PT Scheme for antimicrobial susceptibility testing of Escherichia coli

The RC supported good laboratory practice and the generation of quality assured AMR data in LMICs through the provision of a PT scheme for the AST of *Escherichia coli*. The scheme was developed and validated in-house for disc diffusion and broth microdilution according to EUCAST and Clinical and Laboratory Standards Institute (CLSI) interpretative criteria. Delivered by VETQAS, APHA's independent and ISO/IEC 17043 accredited PT service, the scheme provided participating laboratories with *E. coli* isolates for analysis. Laboratories were encouraged to analyse these as part of their routine laboratory work and report their AST results and interpretations to the scheme organisers. Participants received a report comparing their results and interpretations with the expected outcomes. Regular participation in PT schemes supported external quality assessment and provided evidence of competent performance to regulators and accreditation bodies.

Africa and Asia | January and October 2024

The RC supported the distribution of the *E. coli* AST Proficiency Testing scheme PT0199 to participating laboratories in Africa, and Asia in January 2024. Thirty-seven laboratories from 22 countries returned results, and a written report and analysis was provided to all participants. We supported a second distribution in October 2024. On this occasion, 40 laboratories from 20

countries returned results, and a report provided. Most laboratories performed well, with 32 (80%) obtaining a concordant score ≥80% and of these nine (23%) obtained a concordant score of ≥95%. There was a strong correlation between the use of approved control strain ATCC 25922 and good performance: median error rate of 5.7% for laboratories reporting the expected results for the control strain versus 21.7% for laboratories not using the control strain.

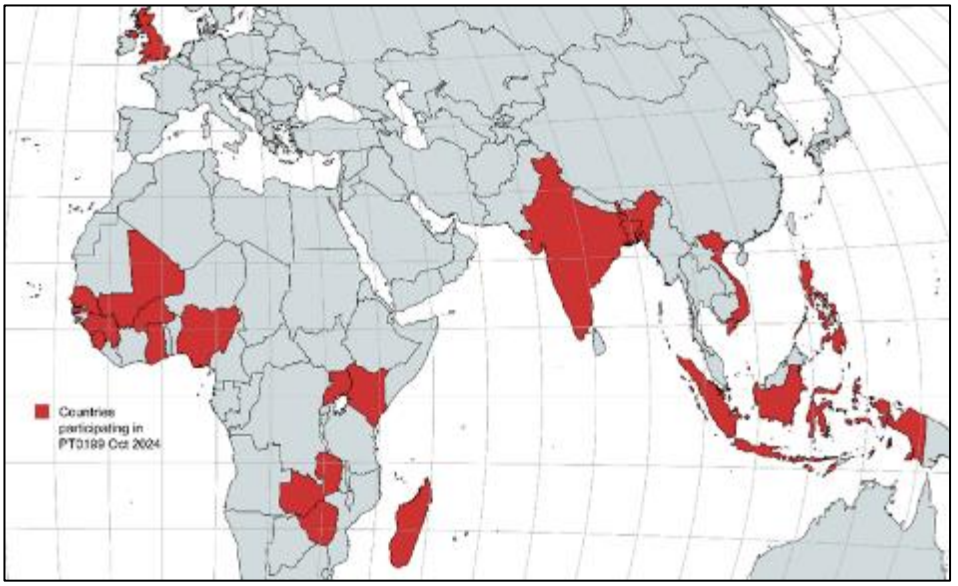


Figure 21. Countries of the laboratories who participated the October 2024 PT Scheme

Central Asia | April 2024

The RC supported FAO projects aimed at strengthening laboratory capacity in Central Asia by assisting with the enrolment of laboratories from the region in the *E. coli* AST PT distribution in April 2024. In collaboration with VETQAS, the RC provided guidance documentation for enrolment and result submission, which FAO translated into the language of the intended audience. The RC analysed the results of this PT distribution and identified potential areas for performance strengthening for the laboratories.

Activity 3. PT Scheme for antimicrobial susceptibility testing of veterinary pathogens | February 2025 | Seven countries

The RC developed and validated a PT scheme for the antimicrobial susceptibility testing of eight bacterial species associated with bovine mastitis. The RC undertook a trial distribution in February 2025 for nine laboratories from seven countries. The distribution was provided by VETQAS. To date five laboratories have returned results. These data are currently being analysed and the PT report is expected in 2025.

Activity 4. Establishing interpretive criteria (ECOFFs & ECVs) for AST relevant to aquatic bacteria species

The RC partnered with twelve international collaborators to establish interpretive criteria for AST in aquatic bacteria species relevant to aquaculture. Interpretive criteria are very limited for aquatic bacteria pathogens in contrast to bacteria species infecting humans and terrestrial animals. The RC and the international partners recognising the importance of available cut off points for AST on aquatic bacteria, worked to bridge this gap the past five years. This work supported the development of international standards and strengthens global food safety and public health testing frameworks. Additionally, this activity showcased the collaboration between the UK and German FAO RC for AMR. This year, we focused on the generation of interpretive criteria both for minimal inhibitory concentration (MIC) and disc diffusion methods for the bacteria species *Vibrio parahaemolyticus.* This pathogen is a significant cause of foodborne illness in humans and a major concern in aquaculture, where it contributes to disease outbreaks and economic losses. These

newly established criteria have been endorsed by CLSI and EUCAST. The manuscript can be accessed in publications.

2.7 Area of collaboration 7:

*Provide technical support to countries to strengthen governance by **advising on regulation and legislation** on AMR and AMU.*

Activity 1. Veterinary Medicines Regulatory Agency Self-Assessment tool (VMRA-SAT) | 2024-2025 | Africa

The RC piloted a self-assessment tool in Rwanda, Botswana and Zambia. The pilots aimed to help regulatory agencies for veterinary medicines assess themselves against defined standards, establish their baseline, and identify strengths and weaknesses. Agencies provided feedback on the tool's clarity and software usability which were reviewed and acted upon. The RC held workshops in Tanzania, Kenya and Uganda to introduce the tool to regulators and train them on its use for conducting self-assessments of their regulatory activities.

3.0 List of publications

3.1 Peer-reviewed publications

Huong LQ, **Chisnall T**, **Rodgers JD**, **Cawthraw SA**, **Card RM**. (2024) Prevalence, antibiotic resistance, and genomic characterisation of *Campylobacter* spp. in retail chicken in Hanoi, Vietnam. Microb Genom. Jan;10(1):001190. doi: 10.1099/mgen.0.001190. PMID: 38294872; PMCID: PMC10868608.

Rheman S, Hossain S, Sarker MS, Akter F, Khor L, Gan HM, **Powell A**, **Card RM**, Hounmanou YMG, Dalsgaard A, Mohan CV, Bupasha ZB, Samad MA, **Verner-Jeffreys DW**, Delamare-Debouteville J. (2024) Nanopore sequencing for identification and characterization of antimicrobial-resistant *Escherichia coli* and *Salmonella* spp. from tilapia and shrimp sold at wet markets in Dhaka, Bangladesh. Front Microbiol. Mar 7;15:1329620. doi: 10.3389/fmicb.2024.1329620. PMID: 38516018; PMCID: PMC10956512.

Davies AR, **Chisnall T**, Akter S, Afrad MMH, Sadekuzzaman M, Badhy SC, Hasan MZ, Rahman MT, **Smith RP**, **Card RM**, Brum E and Chowdhury MGA. (2024) Genomic characterisation of *Escherichia coli* isolated from poultry at retail through Sink Surveillance in Dhaka, Bangladesh reveals high levels of multi-drug resistance. Front. Microbiol. 15:1418476. doi: 10.3389/fmicb.2024.1418476

Sati, N.M, **Card, R.M**, Barco, L, Muhammad, M, Luka, P.D, **Chisnall, T**, Fagbamila, I.O, Cento, G, Nnadi, N.E, Kankya, C, et al. (2024) Antimicrobial Resistance and Phylogenetic Relatedness of *Salmonella* Serovars in Indigenous Poultry and Their Drinking Water Sources in North Central Nigeria. Microorganisms, 12, 1529. https://doi.org/10.3390/microorganisms12081529

Smith P, **Joseph A**, **Baker-Austin C**, Kang N, Baron S, Le Devendec L, Jouy E, **Chisnall T**, **Davies AR**, Schwarz S, Feßler AT, Ahrens T, Jahnen J, Alter T, Fleischmann S, Hammerl JA, Jäckel C, Gieseker CM, Crosby TC, Kittel EC, Miller RA, Alexander T, Carranza K, Burbick CB, Ching B, Soh JH, Chng YR, Wong WK, Fernandez CJ, Chang SF, **Verner-Jeffreys D**, **Powell A**. (2024) Epidemiological cut-off values for *Vibrio parahaemolyticus* calculated from minimal inhibitory concentration data generated at 35 and 28°C. Dis Aquat Organ. Dec 12;160:127-134. doi: 10.3354/dao03831. PMID: 39665310.

Adetunji VO, **Davies A**, **Chisnall T**, Ndahi MD, Fagbamila IO, Ekeng E, Adebiyi I, Falodun OI, **Card RM.** (2025). Genomic Diversity and Antibiotic Resistance of *Escherichia coli* and *Salmonella* from Poultry Farms in Oyo State, Nigeria. *Microorganisms*, *13*(6), 1174. https://doi.org/10.3390/microorganisms13061174

Bloomfield, SJ, Palau, R, Janecko, N, **Baker-Austin, C**, & Mather. AE. (2025). Association of antimicrobial resistant *Vibrio* and species pathogenic to humans with aquacultured seafood, Food Microbiology, Volume 132, 104819.

Katsande P, **Davies A**, **Chisnall T**, Vhoko-Tapesana K, Willcocks S, S Majuru CS, Mubau T, Stabler RA, **Card RM**. (2025) Dissemination of Extended-Spectrum Beta-Lactamase producing Escherichia coli in poultry in Zimbabwe. Microbial Genomics, in press.

Pyatt AZ, Eckford S, Joseph N, Borriello SP and **Oyati O** (2025) Veterinary medicinal product regulation in sub-Saharan Africa: identifying barriers and opportunities for enhancing VMP regulatory systems. Front. Vet. Sci. 12:1532098. doi: 10.3389/fvets.2025.1532098.

3.2 Oral presentations

Claire Gilbert, UNZA postgraduate programme, to Zambian AHSS group, UK. 4 March 2024

Rod Card, Survey Results and Group Discussion. Fleming Fellows' Symposium, UK. 8 March 2024

Rod Card, Antimicrobial Resistance and One Health Grant (AMROH). Ghana Country Grant Launch Meeting, Virtual. 11-13 March 2024

Claire Gilbert, Pharmacovigilance for veterinary medicines. Presented to ZAMRA, Lusaka, Zambia. 24 June 2024

Alistair Davies, Long Read Genome Sequencing. NMIS Symposium, Philippines, virtual, 10 July 2024

Alistair Davies, Quality Control for Antimicrobial Susceptibility Testing. NMIS Symposium, Philippines, virtual, 10 July 2024

Elizabeth Marier, Importance of responsible use of veterinary medicines and the risk of their residues in FOAO, NMIS Symposium, Philippines, virtual, 10 July 2024

Fraser Broadfoot, AMR and animal health, NMIS Symposium, Philippines, virtual, 10 July 2024

Meg Rawlins, Salmonella Surveillance and National Control Programme in the UK. NMIS Symposium, Philippines, virtual, 10 July 2024

Ramon Maluping, Assessing AMR in Animals at Slaughter in the Philippines. NMIS Symposium, Philippines, virtual, 10 July 2024

Rod Card, An introduction to the APHA and its work on AMR. NMIS Symposium, Philippines, virtual, 10 July 2024

Tom Chisnall, Whole Genome Sequencing and analysis. NMIS Symposium, Philippines, virtual, 10 July 2024

Rod Card, Animal and Plant Health Agency (APHA). Fellowship orientation meeting, virtual. 6 August 2024

Rod Card, **Craig Baker-Austin, Claire Gilbert, Elizabeth Marier,** Joint Presentation on Capacity Strengthening. Second Annual Congress of FAO Reference Centres for AMR, Rome, Italy 19 September 2024

Tom Chisnall, Working internationally to support local action on antimicrobial resistance. World One Health Congress, South Africa. 20-23 September 2024

Rod Card, How to choose the right metadata to make your genomic data useful. SeqAfrica Webinar, 21 October 2024

Athina Papadopoulou, Establishing a marine monitoring programme to assess AMR: Case studies from international and national programmes in UK. Regional Workshop on AMU and AMR in Aquaculture in Singapore. 30 October 2024.

Athina Papadopoulou, Active and Passive surveillance for AMR for ornamental fish and Trout

using the UK case study. Regional Workshop on AMU and AMR in Aquaculture in Singapore. 30 October 2024.

Athina Papadopoulou, Generating data for epidemiological cutoff points. Utilising microbiome and genomic resources for understanding and mitigating antimicrobial resistance in the One Health context in India, November 2024.

Athina Papadopoulou, Introduction to UK's FAO Reference Centre for AMR. Utilising microbiome and genomic resources for understanding and mitigating antimicrobial resistance in the One Health context in India, November 2024.

Craig Baker-Austin, Utilising shellfish as sentinels for environmental AMR. Microbiology Society meeting "Knocking out AMR" in London. December 2024.

Elizabeth Marier, Surveillance of antimicrobial residues in food of animal origin: the UK, FAO-RAP guideline workshop, Bangkok, in-person, 27 January 2025

Elizabeth Marier, The building blocks of a residue surveillance programme, Workshop: Strengthening RVDF surveillance in Ghana, Accra, in-person, 10 February 2025

Alistair Davies, Dissemination of Extended-Spectrum Beta-Lactamase producing *Escherichia coli* in poultry in Zimbabwe. Microbiology Society Conference, Liverpool, UK, 31 March 2025

Fraser Broadfoot, AMR surveillance, antimicrobial sales, use and stewardship. Presented to Zambian AHSS group visiting VMD, in-person, 15 May 2025

Claire Gilbert, AMR policy; global and national perspectives. Presented to Zambian AHSS group visiting VMD, in-person, 15 May 2025

Rod Card, AMR Research and Surveillance at APHA, Ghana and Zimbabwe Fellows Symposium, virtual, 4 June 2025

Jennifer Dow, The UK National Action Plan on Antimicrobial Resistance, Ghana and Zimbabwe Fellows Symposium, virtual, 4 June 2025

Athina Papadopoulou, Establishing passive AMR surveillance for UK trout, Ghana and Zimbabwe Fellows Symposium, virtual, 4 June 2025

Tom Chisnall, Introduction to the UK FAO Reference Centre for AMR, Ghana and Zimbabwe Fellows Symposium, virtual, 4 June 2025

Craig Baker-Austin, Hotspots of AMR in the aquatic environment, Ghana and Zimbabwe Fellows Symposium, virtual, 4 June 2025

Andy Powell, Setting epidemiological cut-off values for Vibrio parahaemolyticus, Ghana and Zimbabwe Fellows Symposium, virtual, 4 June 2025

Ramon P. Maluping. Antibiotic resistance, serotyping and genomic characterisation of Salmonella spp. isolated from slaughtered animals in the Philippines. Philippine College of Poultry Practitioners Inc. (PCPP) Scientific Conference on Food Safety 2025, plenary speaker. Quezon City, The Philippines, virtual, 6 June 2025.

3.3 Poster presentations

Athina Papadopoulou*, **Nicola Coyle,** Isobel Smith, Niamh Langford, **Ben Maskrey**, **Michael Teixeira**, Edel Light, **David Verner-Jeffreys**. Antimicrobial resistance surveillance in imported ornamental fish. Antimicrobial Resistance - Genomes, Big Data and Emerging Technologies, Cambridge, UK, 13-15 March 2024.

Ramon P. Maluping, **Alistair Davies***, Remedios F. Micu, **Thomas Chisnall**, Evelyn E. Embestro, Mary Ann Escoto, Mildred A. Padilla, **Roderick Card**. Genomic Characterisation and Prevalence of Extended-Spectrum Beta-Lactam (ESBL) and Colistin resistance in *Escherichia coli* isolated from broiler chickens in dressing plants in The Philippines. Antimicrobial Resistance - Genomes, Big

Data and Emerging Technologies, Cambridge, UK, 13-15 March 2024.

Tom Chisnall*, Luu Quynh Huong, **John D. Rodgers**, **Shaun A. Cawthraw**, **Roderick M. Card**. Prevalence, antibiotic resistance, and genomic characterisation of Campylobacter spp. in retail chicken in Hanoi, Vietnam. Antimicrobial Resistance - Genomes, Big Data and Emerging Technologies, Cambridge, UK, 13-15 March 2024.

Muhammad Usman Zaheer*, Jaap A. Wagenaar, Mary Joy N. Gordoncillo, Jutanat Srisamran, Roosmarijn E. C. Luiken, **Ramon Maluping**, Domingo Caro III and David Sutherland, Guide to strengthen monitoring and surveillance of AMR in animal farm environment: fostering a one health approach to integrated AMR surveillance. 7th Environmental Dimension of Antimicrobial Resistance Conference (EDAR7), Montreal, Quebec, Canada, 26-31 May 2024

Claire Gilbert*. United Kingdom FAO Reference Centre for AMR postgraduate programme in Zambia. Second Annual Congress of FAO Reference Centres for AMR, Rome, Italy 19 September 2024.

Ramon P. Maluping*, **Thomas Chisnall**, **Alistair Davies**, Remedios F. Micu, Evelyn E. Embestro, Alyssa Mae R. Portes, Rosette G. Dela Cruz, Mary Ann Escoto, **Jaromir Guzinski**, **Roderick Card**. Whole-Genome Sequencing Analysis of Non-Typhoidal Salmonella Isolated from Animals at Slaughter in the Philippines Provides Insights into Circulating Serovars and Antimicrobial Resistance Genotypes of One Health Significance. World One Health Congress, Cape Town, South Africa, 20-23 September 2024.

Victoria Adetunji*, **Alistair Davies**, **Tom Chisnall**, Ahmad Ibrahim Al-Mustapha, **Roderick Card**. Antibiotic susceptibility and Genomic diversity of non-verotoxigenic *E. coli* O157:H7 in food products from Oyo State, South-West Nigeria. World One Health Congress, Cape Town, South Africa, 20-23 September 2024.

Athina Papadopoulou*, John Worswick, Shafiq Rheman, Sabrina Hossain, Naher Kamrun, Habibur, M., Eric Brum, Jerome Delamare-Debouteville, **David Verner-Jeffreys**. Developing a Participatory Biosecurity Training Module for finfish aquaculture in Bangladesh. World One Health Congress, Cape Town, South Africa, 20-23 September 2024.

Athina Papadopoulou*, Nicola Coyle, Catherine Harris, Hanan A. Al-Sarawi, Nazima Habibi, Saif Uddin, **Will J.F. Le Quesne**. Antimicrobial resistance in *Escherichia coli* isolates in Kuwait: A baseline marine and freshwater survey. World One Health Congress, Cape Town, South Africa, 20-23 September 2024.

Andrew W. Joseph*, **Craig Baker-Austin**, **Athina Papadopoulou**, **Andy Powell**, Ben Maskery, David Walker, Edel Light. Monitoring AMR in Aquatic Animals and the Environment: Developing Methodology for AMR and Antibiotic Residue Screening'. EcotoxicoMic 2024 Conference, Gothenburg, Sweden, 12-14 November 2024.

Ini Adebiyi*, Hemanti Patel, **Alistair Davies**, Catherine Ryan, Nandini Shetty, Colin Brown, **Roderick M. Card**, Katie L Hopkins. Prevalence and characterization of extended-spectrum beta-lactamase-producing *Escherichia coli* from hospital patients and poultry farmers in Ibadan, Oyo State. ESCMID Global, Vienna, Austria,11-15 April 2025.

Idowu Oluwabunmi Fagbamila*, **Tom Chisnall**, Mwapu Dika Ndahi, **Alistair R Davies**, Victoria O Adetunji, Eme Ekeng, Ajayi Olawunmi, Ini Adebiyi, Nancy Sati, Hemanti Patel, Rene S Hendriksen, Jens Kirk Andersen, **Roderick M Card**. Non-Typhoidal *Salmonella* Sequence Analysis from Poultry Farms in Plateau State, North Central Nigeria. International Symposium on *Salmonella* & Salmonellosis, St. Malo, France, 23-25 June 2025.

3.4 Blogs, online reports and other social media communication

Video | WAAW | Fraser Broadfoot | 18-24 November 2024 | LinkedIn video

Video | WAAW | Jen Dow | 18-24 November 2024 | LinkedIn video

Video | WAAW | Aisling Glennie | 18-24 November 2024 | LinkedIn video

Video | WAAW: VMD AMR Research Symposium | 14 November 2024 | UK | weblink

Video | Self-Assessment tool | Natalie Jackson & Noel Joseph | April 2025 | LinkedIn video

Video | UNZA postgraduate programme | Claire Gilbert & Eeva Forde | 26-29 April 2025 | LinkedIn1, LinkedIn2, LinkedIn3

Blog | World One Health Congress | Various | 20-23 September 2024 | Weblink

Blog | Filling gaps in our understanding of antimicrobial resistance to safeguard animal and human health | Francesca Martelli | 20 November 2024 | Weblink

Blog | Combatting antimicrobial resistance through global training | Rod Card | 21 November 2024 | Weblink

Blog | UNZA-VMD postgraduate programme: Improving antimicrobial stewardship in Zambia | Sannah Malik and Claire Gilbert | 22 November 2024 | Weblink

Blog | UNZA-VMD postgraduate programme: evaluating prescribing practices for treating mastitis in cattle | Sannah Malik and Claire Gilbert | 22 November 2024 | Weblink

Blog | World AMR Awareness Week - working together to tackle the global challenge | Andrew W. Joseph and Athina Papadopoulou | 22 November 2024 | Weblink

Blog | Joining forces for a safer future: Qatar University, and APHA's research on food-borne pathogens and antimicrobial resistance | Sandra Laborda Anadon | 25 November 2024 | Weblink

Post | Improve regulation to enhance access to quality veterinary products | July 2024 | LinkedIn

Leaflet | Pharmacovigilance e-learning | Claire Gilbert & Eeva Forde | December 2024 | LinkedIn

4.0 List of main achievements

The RC has undertaken extensive work in several key areas to help countries strengthened their knowledge, expertise and mechanisms to AMR, AMU and RVDF surveillance. To showcase some of our significant achievements, we wrote detailed case studies for three notable projects:

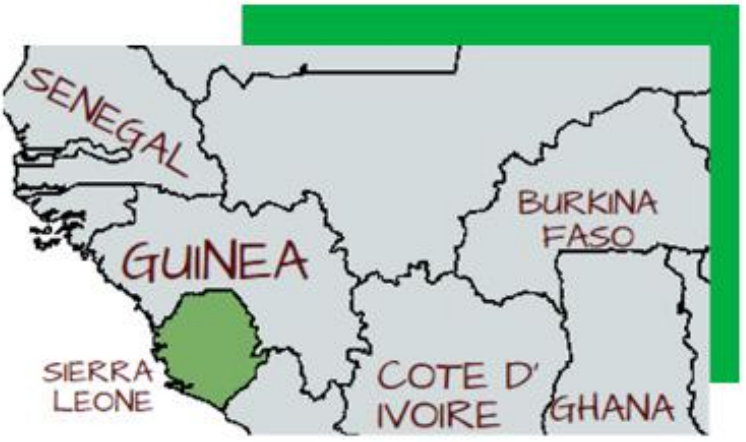
[1] The Fleming Fund fellowship in Sierra Leone

[2] The Fleming Fund AMROH West Africa regional grant collaboration

[3] Surveillance activities for residues of veterinary drugs in food of animal origin

These case studies highlight our impactful contributions and the breadth of our efforts.

FLEMING FUND FELLOWSHIP IN SIERRA LEONE



ENGAGEMENT

The RC continues to play an active role in the Fleming Fund Fellowship programme, contributing to capacity building and collaborative research.

PHASE 2: FELLOWSHIP IN SIERRA LEONE

In 2024, the RC joined a grant led by the University of Liverpool to mentor five animal health Phase 2 Fleming Fellows from Sierra Leone. One of our mentors is an epidemiologist from APHA's WOAH Collaborating Centre for Risk Analysis and Modelling. This Grant includes Phase 2 Fellows from Nigeria, and we have been able to leverage networks and insights from our Phase 1 Fellowship partnerships in Nigeria. We participated in the kick-off virtual Orientation Meeting in August 2024 and joined the in-person workshop alongside the University of Liverpool team in Sierra Leone in October 2024. Through these workshops and regular meetings with Fellows we have supported the development of individualised workplans, tailored to Fellows' professional needs. The RC supported the UK visit by Fellows in February 2025, joining workshops and providing specialist 1:1 training, mentoring and networking opportunities.

During their UK visit the Flemming Fellows from Nigeria and Sierra Leone joined a One Health AMR meeting the RC hosted APHA Weybridge. This featured presenters from various UK government agencies, including the UK Health Security Agency, that shared insights and practical examples of how they address AMR in the UK and globally. Happily, we were also able to secure the attendance of Fleming Fellows from Eswatini, who were visiting their UK hosts at St. George's, University of London, over the same period. In total 31 Fellows from three countries attended and a representative from each nation gave well received presentations on AMR initiatives and actions plans in their country.

PHASE 1: FELLOWS COLLABORATION

The RC continues to collaborate with Phase 1 Fellows and together we have produced a valuable portfolio of research outputs, including peer-reviewed publications, conference posters, and oral presentations. These contributions include work on antimicrobial resistance in people, poultry and environmental sources in Nigeria, with findings shared at major international events such as the World One Health Congress and ESCMID Global. Indeed, the RC supported the attendance of a Nigerian Fleming Fellow alumnus at the 2024 World One Health Congress. Through these outputs, Fellows and mentors have helped advance One Health research and provided evidence to inform AMR strategies. Additionally, we have continued the collaboration with Aquaculture Fellows from Phase 1 to complete data analysis and publish peer-reviewed publications on AMR and AMU in Ghana.

PROGRAMME GOVERNANCE & EVENTS

The RC provides representation on the Fleming Fund Alumni Network Steering Committee, supporting Fellows post-graduation in collaboration with Mott MacDonald and the Fleming Fund. Additionally, the RC contributed to the organisation and delivery of two successful Fellows' Symposia in 2024.

Fourth Symposium (March 2024): Attended by 95 participants, focused on the theme 'Expertise with Impact'. An RC representative served on the Organising Committee and chaired the final discussion session having given a presentation on participant survey results and illustrating how Fellows' activities map against the Fleming Fund Theory of Change.

Fifth Symposium (November 2024): Attended by 158 participants, with sessions led by Fellows, mentors, and others. The theme was 'Importance of our Values' and provided an opportunity to reflect on the programme's core values of country ownership, sustainability, alignment, One Health, and gender and equity. The RC again provided a member of the Organising Committee, contributing to the event's structure and thematic development.

FLEMING FUND AMROH WEST AFRICA REGIONAL GRANT COLLABORATION

INTRODUCTION

The West Africa Antimicrobial Resistance One Health (AMROH) grant is a Fleming Fund Regional Grant led by Cefas and delivered through a consortium including FAO Subregional West Africa Office in Senegal, APHA, and VMD. Funded by the UK Department of Health and Social Care, AMROH supports Fleming Fund Country Grants by strengthening AMR surveillance across animal health including aquaculture and environment sectors. There are several AMROH grants targeted at LMIC regions e.g. West Africa, East Africa, SE Asia etc. The grant the RC leads targets four West African countries—Ghana, Nigeria, Senegal, and Sierra Leone.

APPROACH

The holistic approach is designed to develop and pilot integrated One Health surveillance programmes that address the interconnectedness of human, animal, and environmental health in AMR. A key component of AMROH's strategy is to promote regional collaboration through harmonised training, surveillance protocols, and SOPs. Additionally, it supported a PT scheme for *E. coli* and AST training to terrestrial, aquatic and environmental experts working at laboratories that are undertaking the national AMR surveillance and are supported by FF. We have established an expert network group to facilitate regional collaboration, knowledge exchange, and the development of practical recommendations for AMR and AMU monitoring and offered feedback for national surveillance protocols and strategy for AMR. We also raised awareness on the importance of antimicrobial residues surveillance. We take a regional perspective to harmonise surveillance efforts in West Africa and assist the generation of comparable results at country, regional and global level. By fostering a collaborative ethos, AMROH enables countries to share knowledge, resources, and best practices, thereby strengthening the overall capacity to combat AMR.

MISSION

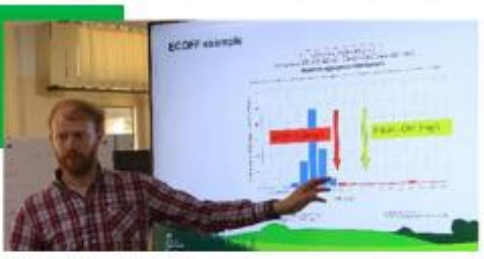
Enhance production, analysis, and use of AMR and AMU data to inform policy and drive behavioural change.

RECENT OUTCOMES

Recent milestones include workshops on antimicrobial residues in Ghana, antimicrobial susceptibility testing (AST) training in Ghana and Sierra Leone, and the feedback on the surveillance strategies in Ghana and Senegal.

IMPACTS

The impact of AMROH extends beyond immediate surveillance improvements. By embedding One Health principles into national systems, AMROH fosters sustainable, evidence-based responses to AMR threats. This approach not only enhances the capacity of individual countries but also contributes to regional stability and health security. The grant's emphasis on data-driven decision-making ensures that policies and interventions are grounded in reliable evidence, leading to more effective and targeted actions. The RC attended and presented at the Fleming Fund Pan Regional Grants Learning Event in Cape Town at a pre-World One Health Congress meeting. We have been able to ensure excellent alignment of activities to drive value for money and impact.



CONCLUSION

AMROH is an excellent example of regional leadership in AMR surveillance. Its comprehensive approach addresses the multifaceted nature of AMR, recognising that effective solutions require collaboration across sectors and borders. By strengthening surveillance systems, building capacity, and promoting regional cooperation, AMROH is helping to make significant strides in the fight against AMR in West Africa.

RESIDUES OF VETERINARY DRUGS IN FOOD OF ANIMAL ORIGIN (FOAO)

BACKGROUND

Veterinary drugs are vital for maintaining animal health and welfare, but their residues in FOAO can pose health risks, such as allergies, and act as a driver for AMR. To ensure food safety and protect consumers, robust legal frameworks, responsible antimicrobial use and effective monitoring programmes are needed. However, countries do need to develop their technical capacity and generate data to inform policymakers, veterinarians, and animal producers. In 2024-25, the Reference Centre collaborated with countries to enhance their awareness and strengthen their skills through a series of customised activities.

ACTIVITIES

Technical support

We provided customised **training** in Zambia to develop its laboratory methodology for testing veterinary medicine residues in chicken. We provided technical advice on methodology to Bhutan and Senegal and delivered topical presentations in the Philippines.

We raised awareness via a national **workshop** in Zambia and Ghana. We helped Ghana assess its capacity for surveillance of antimicrobial residues using the FAO's ATLASS-RVDF* tool. We supported Zambia in developing a national sampling plan for several animal sectors.

Whilst our **E-Learning on veterinary medicine residues** course can be self-directed, we delivered expert-facilitated online live sessions to learners from Botswana and Uganda to enhance their learning experience and answer technical questions.

Resources

We collaborated with FAO-RAP to progress the drafting of the **Regional Guideline 6**: Monitoring and Surveillance of Antimicrobial Residues in Foods of Animal Origin. We helped facilitating the second regional consultation in Thailand to generate feedback, and we provided technical knowledge to edit the text accordingly.

We surveyed LMICs to identify capability and availability in taking part in **Proficiency Testing Schemes** and offered interested Fleming Fund-supported countries options to participate in such schemes.

Visits

We welcomed a delegate from Senegal to introduce the UK's residues surveillance programme, explain testing protocols and demonstrate sampling methods in poultry abattoirs.

CHALLENGES

- **Infrastructure:** need to improve infrastructure and power supply, equipment maintenance, and the procurement of consumables in-country.
- **Policy:** need to increase awareness amongst policymakers, identify sustainable financial plans, and strengthen legislation for control of veterinary drugs.
- **Knowledge:** need to increase in-country scientific evidence and standardise methodology for different types of equipment.

*Residues of veterinary drugs in food

VISION

- **Engagement**: Raise awareness among stakeholders in LMICs about responsible use of veterinary medicine, risks posed by their residues in food and the implications of a monitoring programme.
- **Study Programmes**: Develop study programmes to generate data, identify training needs and strengthen regulatory framework for food security and safety.
- **Proficiency Testing**: Enrol countries in PT schemes based on their capacity and needs.

5.0 List of any major changes in staff

During the period, there were some staff changes, with new personnel joining Cefas, and an additional team member joining APHA.

6.0 Comments and remarks

6.1 Acknowledgements and funding

We would like to thank our partners in the countries and organisations with whom we have worked for their ongoing support and engagement. We would like to express our sincere appreciation and gratitude for their outstanding support and commitment.

We also wish to thank the FAO, its AMR Reference Centre secretariat, and the FAO staff and teams for their support and collaborative approach.

We gratefully acknowledge our funding partners for their ongoing support:

- The Department for Environment, Food and Rural Affairs (Defra)
- The Fleming Fund, Department for Health and Social Care (DHSC)
- Defra Official Development Assistance (Defra ODA)
- The Fleming Fund Fellowship programme
- The Foreign, Commonwealth and Development Office (FCDO)
- Bill and Melinda Gates Foundation
- Food and Agriculture Organization (FAO)
- Mott MacDonald