The Fleming Fund

UK International Development
Partnership | Progress | Prosperity

Photo credit: **Aga Szydlik**

Multi-country technical assistance approach for strengthening AMR Surveillance in LMICs: Lessons from the Fleming Fund

March 2026

Contents

Acronyms

Africa CDC	Africa Centres for Disease Control and Prevention
AMC	Antimicrobial Consumption
AMR	Antimicrobial Resistance
AMROH	Regional Grant, Antimicrobial Resistance and One Health, including Animal Health, the Environment and Practitioner Engagement
AMS	Antimicrobial Stewardship
AMU	Antimicrobial Use
ASLM	African Society for Laboratory Medicine
BWH	Brigham and Women's Hospital
CAPTURA	Regional Grant, Capturing data on Antimicrobial Resistance Patterns and Trends in Use in Regions of Asia
CPA	Commonwealth Pharmacists Association
DTU	Technical University of Denmark
EQA	External Quality Assurance
EQASIA	Regional Grant, External Quality Assessment Asia
EQuAFRICA	Regional Grant, External Quality Assessment Asia
FAO	Food and Agriculture Organization of the United Nations
GEAR up	Regional Grant, Gender and Equity within Antimicrobial Resistance
GLASS	Global Antimicrobial Resistance and Use Surveillance System
IVI	International Vaccine Institute
IPD	Institute Pasteur de Dakar
LMICs	Low and middle-income countries
LSTM	Liverpool School of Tropical Medicine
MAAP	Regional Grant, Mapping Antimicrobial Resistance and Antimicrobial Use Partnership
NAPS	National Antimicrobial Prescribing Survey
NICD	National Institute for Communicable Diseases of South Africa
NMIMR	Noguchi Memorial Institute for Medical Research
NRLs	National Reference Laboratories
PPS	Point Prevalence Survey
PSE	Public Sector Engagement
QAAPT	Quick Analysis of Antimicrobial Patterns and Trends tool
QWArS	Regional Grant, Qualifying the Workforce for AMR Surveillance in Africa and Asia
RADAAR	Regional Grant, Regional Antimicrobial Resistance Data Analysis for Advocacy, Response and Policy
SeqAfrica	Regional Grant, Whole Genome Sequencing Africa
SPARC	Strategic alignment grant, Surveillance and Prescribing Support for Antimicrobial Stewardship Resource Capacity Building
TACE	Regional Grant, Technical Assistance for Clinical Engagement
TADEU	Regional Grant, Technical Assistance for Data and Evidence Use for Policy
UK	United Kingdom
WGS	Whole Genome Sequencing
WHO	World Health Organization

Authored by **Luna Parry**, **Toby Leslie**, **Sheilla Onasanya and Stanley Fenwick** at Mott MacDonald, the Fleming Fund Management Agent.

We acknowledge the Fleming Fund grantees who shared their data, insights, and experiences for this learning brief through programme reports. Their contributions strengthened the evidence and enriched the understanding captured in these findings.

Executive Summary

Part of the response to the global health threat of antimicrobial resistance (AMR) is to improve surveillance systems globally. Low- and middle-income countries (LMICs) in Africa and Asia bear the greatest burden of AMR due to weaker health systems, higher burden of infectious diseases, and greater reliance on antibiotic use in human and animal health. These countries required support to enhance national surveillance, to better utilise data, and to enhance the use of evidence-based approaches to address the problem of AMR.

The UK government launched the Fleming Fund in 2015, which combined Country, Regional, and Global Grants with a Fellowship Scheme to support countries enhance national surveillance systems according to their own National Action Plan. The Regional Grants takes a collaborative approach, providing multi-country technical assistance to strengthen AMR surveillance systems. This report outlines key achievements of the multi-country approach and some of the key lessons learned.

Achievements

The Fleming Fund's Regional Grant programme strengthened laboratory capacity and workforce development. In combination with the other grant streams, the programme supported over 360 laboratories in establishing and enhancing quality-assured surveillance in Africa and Asia. In doing so, Regional Grants established External Quality Assurance systems, provided advanced training to over 500 professionals in AMR, embedding competencies into national workforce development structures. The Regional Grants developed and deployed digital tools for AMR/C/U data collection, visualisation and management, enabling countries to collect historical and prospective AMR data and integrate it into policy and practice.

The Regional Grants also expanded genomic surveillance, establishing hubs that serve as continental reference points for outbreak investigations and resistance gene tracking. The programme advanced One Health integration, piloted integrated approaches and developed protocols for antimicrobial use (AMU) in livestock and aquaculture, promoted data-driven antimicrobial stewardship (AMS), and mainstreamed Gender and Equity in AMR surveillance programming. They also piloted innovative interventions such as prescribing apps, burden-of-disease protocols to inform clinical practice, and economic costing tools to inform policy and resource allocation. In combination with other grants operating at the country level, these efforts significantly strengthened AMR capacity, surveillance, and data sharing for policy and advocacy across participating countries.

The multi-country technical assistance approach has enhanced organisational capacity, fostered regional networks, and improved production, analysis, sharing and use of AMR data for evidence-based decision-making. These efforts have positioned LMICs in Asia and Africa to better respond to AMR threats through sustainable, country-led systems.

Key lessons

- Early stakeholder engagement and alignment with National Action Plans (NAPs) are critical for coordination, alignment and uptake of technical assistance for sustainability of results.
- Adaptive management and flexibility were essential to navigate shifting priorities and operational challenges.
- A multisectoral approach is needed in the face of varying capacities across human, animal, and environmental health sectors, which require tailored strategies.
- Sustainability: Building national AMR surveillance capacity is a long-term effort requiring integration into national systems and continued funding beyond the Fleming Fund programme closure.

Looking ahead

The Fleming Fund's multi-country technical assistance delivered through the Regional Grant stream has improved AMR capacity and evidence-based practices in LMICs. However, long-term sustainability of this progress depends on securing and mobilising resources, leveraging partnerships, and embedding and integrating AMR interventions into broader health systems to ensure continuity and impact. Failure to maintain these efforts risks reversing hard-won progress. Stakeholders must collaborate to secure continuation and advocate for AMR integration into global and national health agendas.

Regional Grants funded by the Fleming Fund

Grant	Lead grantee Organisation	Area of work	Region
MAAP	ASLM	Strengthen data collection and quality, regional networks for data sharing.	Africa
CAPTURA	IVI	Strengthen data collection and quality, regional networks for data sharing.	Asia
EQASIA	DTU Food	Strengthen quality assurance of bacteriology laboratories & WGS-based AMR surveillance.	Asia
EQuAFRICA	ASLM	Strengthen quality assurance of bacteriology laboratories.	Africa
QWArS	ASLM	Advanced training to improve data quality.	Global
RADAAR	IVI	Support data use in policy and decision- making.	Global
SEQAFRICA	DTU	WGS technical assistance in Africa.	Africa
TACE Africa	FMX	Improving use of data in clinical practice (human health).	Africa
TACE Asia	IVI	Improving use of data in clinical practice (human health).	Asia
TADEU Africa	ASLM	Improve data use for policy.	Africa
TADEU Asia	IVI	Improve data use for policy.	Asia
AMROH	ILRI, CEFAS, Massey University, University of Melbourne	Improve One Health data generation and use and promote the application of AMR/U/C data by animal health practitioners.	Africa, Asia
GEAR-UP	LSTM	Mainstreaming of Gender and Equity across AMR surveillance systems.	Global
WHONET	WHONET	Management and analysis of microbiology laboratory data with specialised software.	Global
SPARC	CPA	Enhancing data use for surveillance and antimicrobial stewardship.	Global

Antimicrobial resistance: The Silent Pandemic

AMR is now widely recognised as a 'silent pandemic', a crisis that has been steadily intensifying out of sight, undermining the core of modern healthcare. In response to this growing threat, the UK government launched the Fleming Fund in 2015, aiming to help control AMR in LMICs across Africa and Asia, where the impact is most severe (Figure 1).

The Fleming Fund response

The Fleming Fund has sought to address:

- **Limited laboratory capacity:** Under-resourced facilities often lack sufficient trained microbiologists, and the infrastructure needed to perform bacterial culture and antibiotic sensitivity testing effectively.
- **Neglected agricultural surveillance:** Despite high antibiotic use, agricultural systems rarely monitor bacterial infections or resistance, especially in commensal and zoonotic bacteria.
- **Fragmented systems:** Existing surveillance programmes are siloed by disease, poorly integrated, and rarely adopt a cross-sectoral One Health approach.
- **Low data utilisation:** Surveillance data is underused, with minimal demand from policymakers and limited perceived value at all levels.

Multi-country technical assistance was provided by the Fleming Fund to address the challenges identified at inception and to strengthen approaches to the building of country-led surveillance systems.

Figure 1: Reach and coverage of the Fleming Fund

Responding through regional approaches

The Fleming Fund has worked to promote a One Health approach to AMR surveillance in up to 30 low and middle-income countries. Grant streams included Country, Regional and Global Grants as well as a Fellowship Scheme.

Figure 2: Fleming Fund Grant streams

Country Grants

- Continuous improvement and support
- Generating local data and evidence
- Supplies and commodities

Fellowships

- Phase 1 – one cohort
- Phase 2 – one combined cohort
- Alumini

Regional, Global & Strategic alignment Grants

- Technical grants
- Selective support
- Working in multiple countries

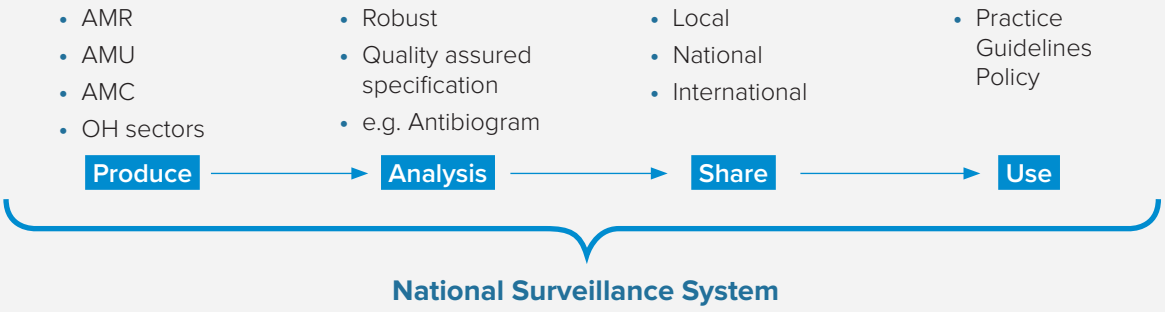
The Fleming Fund operated with three main grant streams, which combined to support a portfolio approach to supporting each country (Figure 2). The Fleming Fund introduced country investment strategies in 2023 to improve coordination between the grant streams as a response to lessons learnt from phase 1 (2018–2022). These strategies provided a detailed analysis of the country context, status of the AMR surveillance system (considering phase 1 investments) and the priority areas to be addressed in each country. It also outlined the contribution and expected milestones for each grant stream in a country.

Regional Grants were designed to provide support in specialist technical areas, where skills and expertise did not already exist at the country level. They addressed specific areas of AMR surveillance where it was clear that a multi-country technical assistance approach would have the greatest impact and provide value for money (VfM). Among these were support to regional quality assurance networks, data and information sharing platforms, as well as initiatives to improve the production, analysis and use of surveillance data in policy and practice (Figure 3).

Strategic Alignment Grants were opportunistic investments which gave the programme the flexibility to fund initiatives as they emerged as priorities. The aim of both types of grants was to establish and enhance regional and global networks that support the development of capacity for AMR surveillance within government systems. This multi-country technical assistance approach was also designed to strengthen the sustainability prospects of the programme by enhancing government ownership as well as regional and global collaborations.

In this section, contributions of the multi-country grants are described to showcase the key outcomes of the technical assistance provided through the Fleming Fund. These contributions are framed against the Theory of Change outcomes of production, analysis, sharing and use of data, as well as contributions to sustainability.

Figure 2: Fleming Fund approach to AMR data



Improving the capacity of laboratories to produce quality AMR data

Laboratories are the backbone of infectious disease surveillance, providing definitive diagnosis to improve care and treatment of patients and animals, and provide surveillance data into local, national and international platforms from human, animal and environmental sources. For AMR, this means culturing and identifying bacteria from samples and accurately measuring the antibiotic susceptibility profile of each culture. The Fleming Fund has supported over 360 laboratories to improve capability, capacity, quality and volume of data on AMR, and has supported analysis of more than 6 million samples by the end of 2025.

However, if laboratories are not producing quality-assured results, the findings of their work can be called into question which undermines the function and cost effectiveness of the system. For this reason, the Fleming Fund invested in three grants to provide technical assistance to support laboratory quality – the External Quality Assessment grants (for Africa and Asia) and a grant aiming to improve and support workforce strengthening across a range of laboratory (and non-laboratory) disciplines.

Qualifying the Workforce for AMR Surveillance in Africa and Asia (QWArS)

The African Society for Laboratory Medicine (ASLM) led a consortium of organisations[1] to deliver competence-based training and capacity development for quality AMR data production. A training package comprised of Epidemiology and Microbiology Training modules was developed, supported by a qualification framework for standardised training and competency assessments for microbiology laboratory practice and surveillance of AMR. QWArS professionals are qualified and registered as AMR experts by Witwatersrand University and the ASLM Academy. When possible, the experts are registered to designations or licensures from national professional councils, allowing them to earn 'Continuing Professional Development' credits. This accreditation ensures that competencies are adequately maintained over time and linked to individual career development. The registry provides governments, professional councils, employers, and the public with confidence in the ability of the registered professional to perform these tasks.

QWArS has produced two cohorts of staff trained on Microbiology and Epidemiology and AMR surveillance in the human, animal and environmental sectors.

536 professionals trained across 17 countries. 301 qualified and registered as AMR surveillance Microbiology or Epidemiology Experts. 58 Master Trainers were capacitated to be able to provide in-country training as part of sustainability, and over 90 Subject Matter Experts were capacitated as regional mentors and supervisors.

The programme seeks long-term sustainability by promoting formal career development and encouraging country adoption. QWArS developed Guidance for Domestication for the training programme, providing a practical roadmap for country adoption and sustainable implementation. A successful example of the domestication of the programme is the Nigeria QWArS initiative, where national stakeholders embarked on a collaborative process to map the QWArS curriculum to the country's Field Epidemiology and Laboratory Training Programme. A country-owned domestication framework was drafted, positioning NiQWArS to embed AMR competencies into Nigeria's health workforce capacity development structures.

1. QWArs Consortium - The African Society for Laboratory Medicine (ASLM), Institut de Recherche en Santé, de Surveillance Epidémiologique et de Formation (IRESSEF), Africa CDC, Fondation Mérieux (FMX, and International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR-B).

External Quality Assessment in Africa and Asia (EQuAFRICA and EQAsia)

The Fleming Fund supports 55 National Reference Laboratories (NRLs) across Asia and Africa in both human and animal health sectors. These laboratories are government-owned facilities designated to uphold high standards in testing and surveillance, and to provide confirmatory testing. NRLs provide quality assurance schemes for the AMR data produced across sentinel surveillance sites. Two grants were therefore implemented to establish sustainable access to external quality assurance (EQA) for NRLs and sentinel sites, one in Africa and one in Asia. In Africa (EQuAFRICA[2]) the consortium is led by ASLM, while in Asia (EQAsia[3]) the Technical University of Denmark (DTU) leads. The two grants provided capacity-building and technical support in microbiology and quality management services (QMS) as well as proficiency testing of samples from sentinel sites and NRLs.

Established External Quality Assurance programmes for AMR surveillance in Africa and Asia, now serve a network of over 360 laboratories across 30 countries.

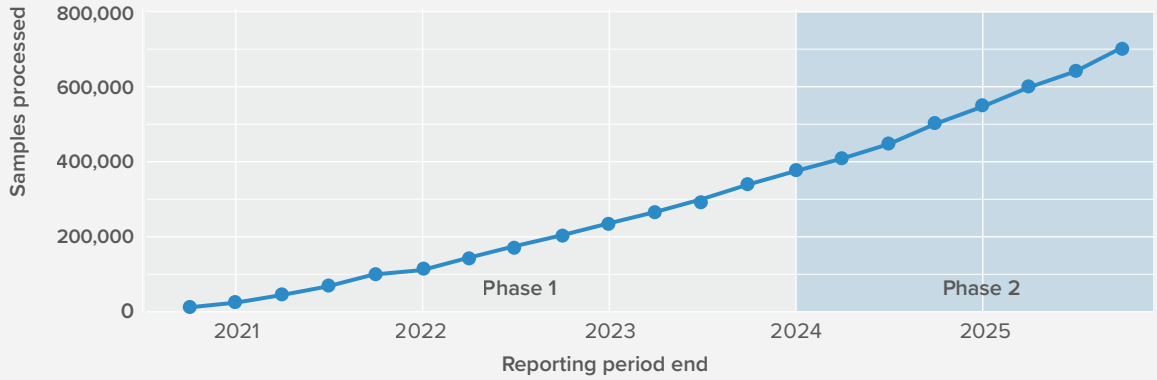
Informatic tools, online training, EQA qualification frameworks, guidelines and resources developed by EQAsia and EQuAfrica have been institutionalised within existing frameworks accessible development capacity at site and national levels.

To consolidate sustainable access to EQA services across Asia, EQAsia supported selected NRLs in Bangladesh and Nepal to become national providers of EQA services at the country level. In a recent article published by the grant[4], six rounds of EQA were completed between 2021 and 2023 with up to 32 participating NRLs showing improvements in their capacity to isolate and correctly identify the majority of the isolates across different panels of the World Health Organization (WHO) Global Antimicrobial Resistance and Use Surveillance System (GLASS), and the Food and Agriculture Organization of the United Nations (FAO) priority pathogens of interest to both the human and animal health sectors.

Similarly, EQuAFRICA developed an AMR EQA qualification framework that outlines in detail all the elements required for the successful establishment of EQA programmes, including defining skills and competencies, infrastructure requirements, governance and operational needs. This framework, along with training materials and a business planning tool, has been provided to priority countries in Africa.

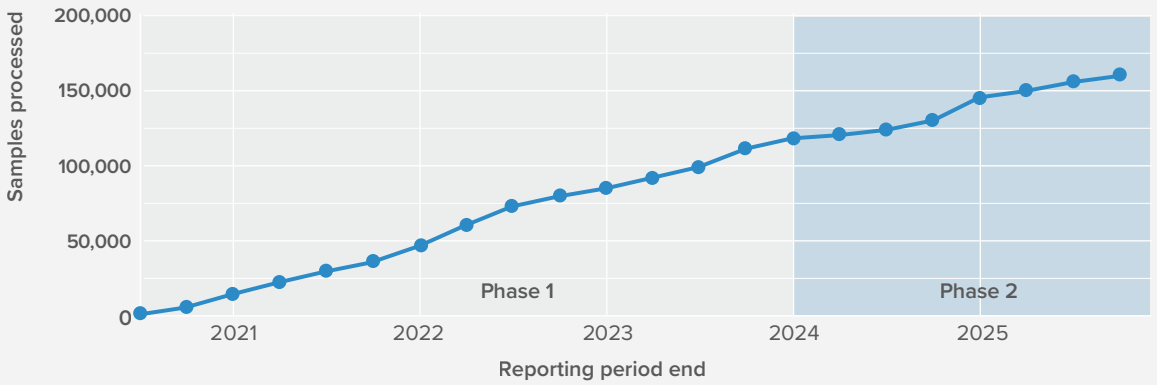
To promote local sustainability, EQuAFRICA capacitated the National Institute for Communicable Diseases of South Africa (NICD), Institute Pasteur de Dakar, Senegal (IPD) and the African Medical and Research Foundation (AMREF) as EQA providers. While EQASIA capacitated the National Institute for Health in Thailand and the Faculty of Veterinary Science Chulalongkorn University, Thailand, to provide training and support to other national surveillance sites in their respective regions.

Figure 3: Number of samples validated by supported NRLs



29 Human Health NRLs

~ 696,000 samples validated since inception



26 Animal Health NRLs

~ 159,000 samples validated since inception

2. Resistance and Mycoses (CHARM) - National Institute for Communicable Diseases (NICD), Institute Pasteur de Dakar (IPD), Technical University of Denmark (DTU), Africa CDC and Amref Health Africa.
3. EQAsia Consortium – National Food Institute, Technical University of Denmark (DTU), The International Vaccine Institute (IVI), Chulalongkorn University Veterinary School (CUVET), National Institute of Health of Thailand (NIH) (WGS Asia), University of Melbourne Doherty Institute.
4. Kostyanev T, Al-Mir H, Prifti K, et al. '**External quality assurance (EQA) network in South and South-East Asia: experience and results from an international EQA programme in One Health sector reference laboratories**', *Journal of Antimicrobial Chemotherapy*, 2025;80(4):1037-1046.

Improving the analysis and visualisation of quality AMR/AMC/AMU data

For data to be used, it must be useful and accessible. Supporting countries and regions to make data accessible to a range of stakeholders means allowing it to be shared, analysed and presented in ways that support policy and practice change.

Many low and middle-income countries have already held significant amounts of AMR data, but this data was largely untapped, remaining in paper format or in spreadsheets stored locally. There was, therefore, a trove of data that was of limited use. Key stakeholders at the country level received support from two regional grants to examine historical trends in AMR data, analyse it, and present the information.

AMR data is complex; to give a flavour of how complex, consider that there are:

- Sources of microbiology data from human health and animal health, covering multiple bacterial species and a panel of drugs to be tested against each (WHO-GLASS has more than 50 combinations in its priority list).
- This data is from multiple sample types (e.g. blood, urine, cerebrospinal fluid) covering multiple clinical conditions (sepsis, urinary tract infections, respiratory illnesses, etc).

In animal health, there is data from different species of animal (e.g. poultry, cattle, swine) and from multiple sources (e.g. farm, abattoir, small-holding, wet market):

- In addition, the microbiology data on antibiotic resistance patterns require data on antimicrobial use and consumption to be examined.

To make sense of the data from a wide variety of sources and assess the importance of this information to public and animal health, it was essential to provide support for countries to better manage, analyse and present data to the relevant audiences. This was achieved through three regional grant streams:

Capturing data on Antimicrobial Resistance Patterns and Trends in Use in Regions of Asia (CAPTURA)

Led by the International Vaccine Institute (IVI), CAPTURA[5] focused on supporting Fleming Fund countries to improve AMR, antimicrobial consumption (AMC) and AMU data quality and quantity, analysis and dissemination. To achieve this, the grant:

- Developed the Quick Analysis of Antimicrobial Patterns and Trends tool (QAAPT[6]), a free, web-based tool for visualising antimicrobial resistance data. QAAPT is designed for use by decision makers such as healthcare professionals, national AMR coordinators, microbiologists, technologists, and practitioners involved in AMR surveillance or microbiology laboratory. QAAPT integrates with the WHO Collaborating Centre for Surveillance of Antimicrobial Resistance (WHONET) and live surveillance dashboards or health/laboratory information systems. CAPTURA provided free access and delivered training on the **QAAPT** platform to stakeholders in all Fleming Fund priority countries in Asia. Uptake has been strong – highlighted by commitments from Bhutan, Bangladesh and Nepal to use QAAPT for advanced data analysis and participation of four other countries in QAAPT training programmes.
- Supported the implementation of the National Antimicrobial Prescribing Survey (NAPS). NAPS analyse antimicrobial prescribing practices across participating hospitals and care facilities. Delivered through a web-based platform, the NAPS enables consistent data collection and supports comparison and benchmarking across hospitals. NAPS also provides feedback at the individual prescriber level, becoming a central tool in the formation of rational usage policies and protocols. The NAPS was piloted in Bhutan, Bangladesh and Nepal, and the tool is available free of cost to all three countries beyond the end of the programme. Bhutan has committed to continuing NAPS with funding from their national budget. Finalised an Antimicrobial Resistance Surveillance, Response, Monitoring, and Evaluation framework in collaboration with the Institute of Epidemiology Disease Control & Research in Bangladesh. The framework aims to support national level coordination for site reporting and feedback mechanisms and data driven antimicrobial stewardship.

In Bangladesh, out of the 506 patients sampled, 446 had prescriptions for antibiotics. Prescription practices were found to be challenged by limited clinical documentation, outdated treatment guidelines, and technical barriers related to data entry.

- Convened consultative workshops on Private Sector Engagement (PSE). The workshop introduced an evidence-based PSE strategy, fostering discussions on best practices and encouraging cross-country learning. As a result, a PSE regional guide was developed to help Ministries of Health and stakeholders to develop country-specific plans for engaging the private sector to combat AMR. The guide outlines four key objectives: data utilisation, responsible prescribing, ethical supply chains, and innovative approaches to prevention, providing actionable strategies to leverage private sector reach and expertise in support of national AMR efforts.

5. CAPTURA consortium – International Vaccine Institute (IVI), Brigham and Women's Hospital (BWH), SwipeRx (mClinica), University of Melbourne National Centre for Antimicrobial Stewardship (NCAS), Heidelberg Institute for Global Health (HIGH) Heidelberg University.
6. **Quick Analysis of Antimicrobial Patterns and Trends (QAAPT) web-based tool for AMR data visualisation**.

Whole Genome Sequencing (WGS) Africa – SeqAfrica

In response to a major gap in global coverage in the collection and use of genomic data on AMR, the Fleming Fund developed a term of reference to improve collection and analysis of WGS data across Africa. As a result, the regional grant SeqAfrica[7], led by DTU, focused on strengthening and expanding capacity for WGS and bioinformatics across Africa. SeqAfrica established and strengthened five regional sequencing sites in Africa to process bacterial isolates from across the continent, enabling outbreak investigations and tracking of resistance genes across human, animal, and environmental sectors under a One Health approach.

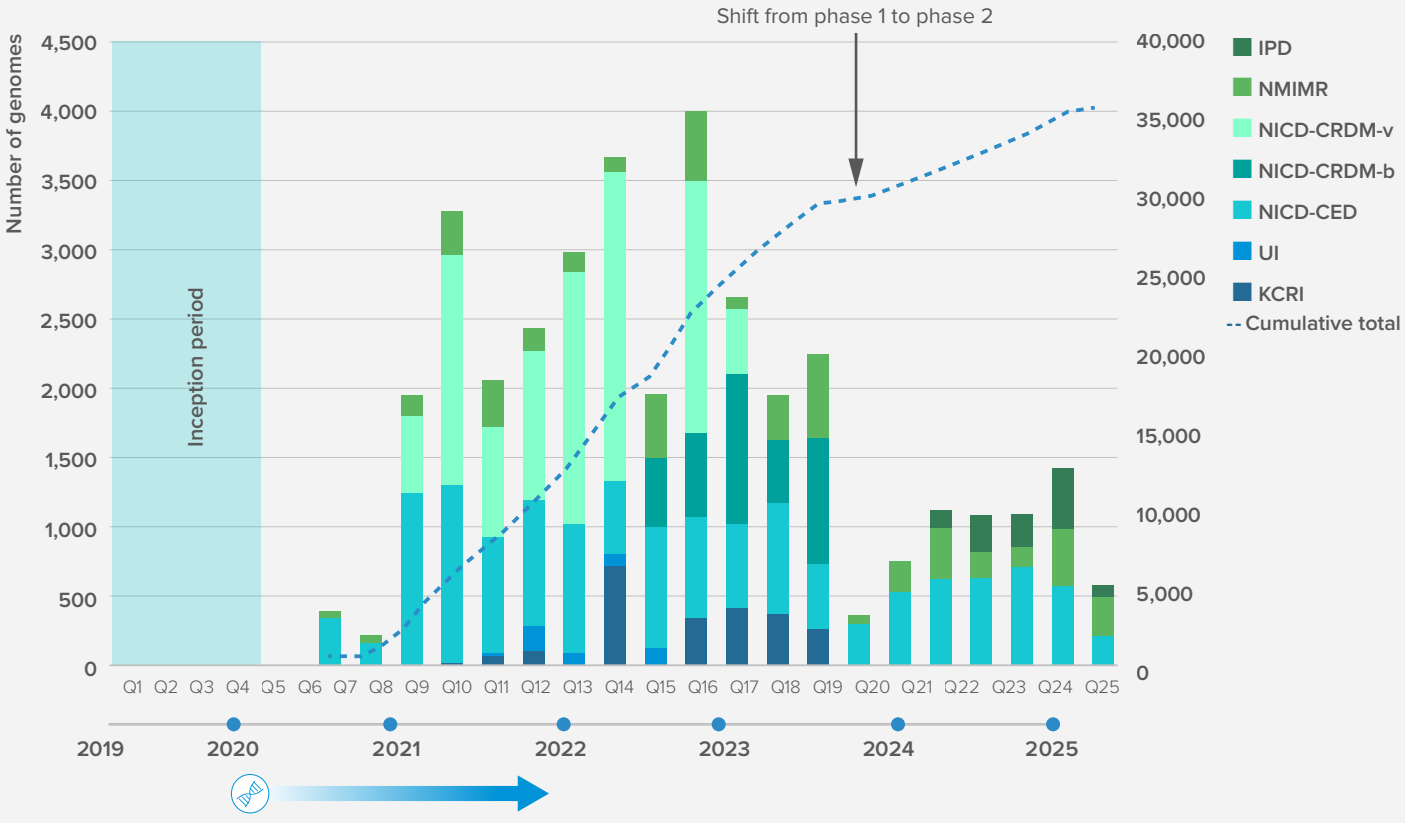
SeqAfrica also provides technical assistance, training, and simulated exercises. The project aims to reduce reliance on external sequencing services, build local expertise, and foster sustainable genomic surveillance infrastructure in Africa.

Phase 2 saw an expansion of the project network and sequencing capacity for AMR surveillance to sentinel sites in three pilot countries: Ghana (six sites), South Africa (six sites) and Senegal (two sites). Through focus on long-read DNA sequencing devices such as MinION[8], these pilot projects worked to produce genomic surveillance data to inform policy and public health responses. SeqAfrica developed online training resources, protocols and analytical tools for long-read sequencing, which will remain available on the DTU website after the programme's closure for use by bioinformaticians at the participating sites. With the skills gained through the MinION pilots and the available online resources, these sites should be able to continue genomic surveillance with their own resources.

More than 36,000 sequences have been generated, and the programme also contributed to genomic surveillance of COVID-19.

Of these, over 80% of genomes have been uploaded to public or semi-public databases. Thereby, contributing to global understanding of AMR from a previously under-represented region.

Figure 4: Number of genomes per quarter generated by SeqAfrica partners



Source: SeqAfrica Fleming Fund 2025 learning summit poster presentation

To date, SEQAfrica has supported sequencing of around 35,000 isolates across the sequencing sites. Most of these were held in biorepositories in Fleming Fund (and other) supported countries. These were submitted into the sequencing service with data being made available in a public database for AMR genomes. This has critically increased the available data on AMR genomics in Africa. Part of ongoing work was to provide WGS services into the surveillance system in a more prospective way, and a total of 549 genomes from the Fleming Fund supported surveillance sites have been analysed with the datasets and analyses shared with the country.

7. SeqAfrica consortium – National Food Institute, Technical University of Denmark (DTU), Institute Pasteur de Dakar (IPD), Noguchi Medical Research Institute (NMIMR), The National Institute for Communicable Diseases of South Africa (NICD) Centre for Enteric Diseases (CED).
8. MinION is a portable DNA/RNA sequencing device developed by Oxford Nanopore Technologies (ONT). It uses nanopore sequencing technology to read genetic material in real time, offering a compact, USB-powered platform for labs and fieldwork.

Five regional sequencing centres have been supported throughout the life of the SeqAfrica Regional Grant:

- The National Institute of Communicable Diseases of South Africa (NICD)
- The University of Ibadan in Nigeria
- The Kilimanjaro Clinical Research Institute (KCRI) in Tanzania
- The Noguchi Memorial Institute for Medical Research (NMIMR) in Ghana
- The Institute Pasteur Dakar (IPD) in Senegal

To sustain the WGS skills and knowledge received from the training, SeqAfrica initiated a Community of Practice on WGS for AMR surveillance. This network fosters knowledge sharing and research collaborations. While funding for sustained WGS for AMR surveillance will vary across the two regions, there is evidence to suggest that the improved capacity of these centres has positioned them as go to WGS experts. For instance, NICD was approached by other external funders, including the Wellcome Trust, to provide WGS training to various sites. Other centres are also exploring internal funding streams; for example, NMIMR plans to provide a fee-based course on AMR and has already provided training funded by the Africa Centres for Disease Control and Prevention (Africa CDC) and others.

The needs in Asia were very different to those in Africa, requiring support to create linkages and centres of excellence, so in Asia, SeqAsia supported the National Institute for Health, Chulalongkorn University, and the sentinel site Songkla University in Thailand. The comprehensive training covered WGS, Bioinformatics and Genetic Epidemiology.

Managing and analysing microbiology data with WHONET

WHONET is free software developed by the WHO Collaborating Centre for Surveillance of Antimicrobial Resistance at the Brigham and Women's Hospital (BWH) in Boston, Massachusetts. The software allows for the standardisation of data collection, collation, and reporting of microbiology laboratory data to enhance management and analysis. The WHONET software is available in 54 languages and supports local, national, regional, and global surveillance efforts in over 130 countries worldwide. The WHONET grant has provided support to 23 low- and middle-income Fleming Fund-supported countries, building workforce capacity through training, technical support, and software development. The BWH team has built the capacity of key in-country staff (national data managers and network laboratories) in the use of WHONET software through centralised, tailored training for AMR data management, which can be replicated (using the Train-the-Trainer approach). Massive Open Online Courses (MOOCs) and a WHONET webinar series further support the training. To sustain the capacity-building efforts and software use, the grant provided a WHONET web package software, maintenance and introduction of new features such as Backlink software development, use of automation tools, DHIS2 interoperability, language improvements, along with technical support and a WHONET discussion forum.

The project has focused on expanding the use of WHONET software for integration of human and animal health laboratory data into local, national, regional, and global surveillance initiatives, rolling out WHONET software to private sector laboratories, updating and enhancing the WHONET user interfaces, optimising prospective data collection processes, rolling out advanced WHONET analysis features and new reporting features, and further training of trainers on the use of the software and technical support.

Encouraging AMR surveillance data sharing for decision-making

The complexity of AMR and AMU/C data means that its use for decision-making is not straightforward (see section 3). 'Decision-makers' are a broad group, made up of practitioners (such as clinicians, pharmacists, veterinarians and farmers) and policymakers (whether these are formulating hospital-level policies and treatment guidelines, national plans, or key national policies aimed at managing human health, animal health, and the environment). Making data accessible to this broad range of stakeholders in a format that is of greatest use to them was a critical component of the Fleming Fund's investment.

Mapping Antimicrobial Resistance and Antimicrobial Use Partnership (MAAP)

MAAP[10], led by ASLM, has contributed to an improvement in AMR/AMC/AMU data quality and quantity, analysis and dissemination in Africa. In phase 1 of the project, MAAP collected retrospective AMR/AMC data from 14 African countries. The results have been published on the Africa CDC website.[11] In phase 2, MAAP has utilised the phase 1 data outputs to support enhanced approaches to monitoring surveillance sites and system performance, facilitating improvements in surveillance management, and contributing to strategic planning for surveillance system enhancements. The MAAP project also developed several tools and resources to help strengthen surveillance capacity. These resources include two continental analyses and guidance, and a data repository platform[11].

10. MAAP consortium – The African Society for Laboratory Medicine (ASLM), West African Health Organization (WAHO), East, Central and Southern Africa Health Community (ECSA), Africa CDC.
11. **MAAP Country Reports**.

MAAP developed the AMR Surveillance Guidance for the African Region[12]. The guidance is a blueprint for the collection, management and analysis of data for AMR, AMC and AMU. The guidance aims to enhance national capacity to detect, monitor, and respond to AMR by structuring and standardising practices and promoting collaboration through a One Health approach. Endorsed by Africa CDC, the continental blueprint is helping countries align their national efforts with regional and global strategies, encouraging them to adapt it to their priorities for a coordinated AMR response.

Additionally, MAAP, in partnership with Africa CDC, developed and launched the Africa Landmark Report on Antimicrobial Resistance (AMR).[13] The landmark report is a comprehensive analysis of the AMR situation in Africa, highlighting the most affected areas and key driving forces, providing key insights and actionable recommendations for the AMR response. It was launched ahead of the 2024 United Nations High-Level Meeting on AMR. The MAAP efforts resulted in the integration of country AMR data into the Africa AMR Surveillance Network. Findings of the MAAP retrospective data analysis have been published in scientific journals[14].

ASLM created a GitHub Repository for AMR, AMC and AMU Data Analysis Standardisation and Automation Process, with free access to all 14 participating countries in Africa.

Through access to the tool and training, MAAP is building self-sustaining pools of in-country users capable of analysing AMR data and producing reports for key stakeholders, including policymakers.

Regional Antimicrobial Resistance Data Analysis for Advocacy, Response and Policy (RADAAR)

Led by IVI, RADAAR[15] focused on improving data-sharing at the country and regional levels to support evidence-based policymaking for AMR. Through its work, the grant has built and strengthened capacity to improve AMR data analysis, sharing and use, and translation of AMR/AMU/AMC data and evidence into effective and implementable policies.

RADAAR worked with national stakeholders to strengthen national/regional capacity to translate AMR data evidence into effective policies through the development of Evidence Briefs for Policy (EBPs) and knowledge translation products for AMR Policy advocacy. Stakeholders were trained to use their own national AMR data and evidence and transform it into policy briefs.

The RADAAR project launched its Policy Advocacy Online Learning Platform in November 2025. The open-source platform follows an easily accessible, practical, step-by-step approach, with six self-paced modules: Policy Prioritisation, Policy Development, Governance & Resource Mobilisation, Community Engagement, Framing and Communicating AMR, and Policy Implementation. The training is based on RADAAR's 'Advocacy to Drive AMR Policy: A Country Guide' which was co-developed in phase 1 with regional and global AMR experts and stakeholders, through a series of technical consultations, focus group discussions and key informant interviews.

The online modules provide critical training primarily for national and subnational-level AMR stakeholders who can potentially influence policymakers to adopt and/or develop policies to address AMR, in line with the NAPs for AMR. The training will be available on the IVI website, even after the close of the Fleming Fund.

Whole Genome Sequencing (WGS) Africa – SeqAfrica

Genomic data produced by SeqAfrica (section 3.2) are regularly uploaded to public (i.e. National Centre for Biotechnology Information database; European Nucleotide Archive; and EnteroBase) or semi-public (e.g. Global Initiative on Sharing Avian Influenza Data) databases and shared with the countries where the isolates originated from. This data serves as a bio-archive and provides a valuable resource for surveillance efforts. The regional sequencing centres, NICD and NMIMR, participate in regular meetings with national AMR platform representatives and other public health stakeholders to share WGS results and inform public health and policy actions. In Ghana, the NMIMR team is using data from the national pilot study to inform the work of the national technical working group on AMR surveillance. Furthermore, the NMIMR team is building a digital AMR Dashboard to provide near-real-time sequencing results to all national stakeholders. In South Africa, NICD has used the genomic data to present current trends and provide data for decision-making related to antibiotic prescriptions, AMU and infection prevention and control.

11. **MAAP Regional network (GitHub) for AMR, AMU, and AMC data analysis and reporting**.
12. Antimicrobial Resistance Surveillance Guidance for the African Region, first edition. ASLM, Africa CDC, ECSA-HC, WAHO. 2024.
13. 'Voicing African Priorities on the Active Pandemic: African Union AMR Landmark Report', Africa CDC.
14. Ondoa, Pascale et al. '**Bacteriology testing and antimicrobial resistance detection capacity of national tiered laboratory networks in sub-Saharan Africa: an analysis from 14 countries**'. Lancet Microbe. 2025 Jan; 6(1): 100976.
    Osena, Gilbert et al. '**Antimicrobial resistance in Africa: A retrospective analysis of data from 14 countries**', 2016-2019. PLoS Medicine. 2025 Jun 24;22(6): e1004638.
15. RADAAR consortium - International Vaccine Institute (IVI), World Health Organization (WHO) Evidence-Informed Policy Network (EVIP-Net), Brigham and Women's Hospital (BWH), and OW DataLEADS.

Technical Assistance for Clinical Engagement (TACE) Africa and Asia

Two regional grants were established to contribute to improving the use of diagnostic services and AMR/U/C and burden data in clinical practice. These are TACE Africa[16] and TACE Asia[17], led by Fondation Mérieux and IVI, respectively. The TACE grants provided technical input and training on diagnostic stewardship, use of laboratory services and use of locally produced data to revise national recommendations for AMS and develop evidence-based policies. Among the capacity building efforts, TACE Asia developed a Clinical Engagement Plan, delivering training to selected countries, and a regional training workshop on Advanced clinical engagement for countries in Asia. The TACE efforts in Asia led to the establishment of AMS, infection prevention control and/or diagnostic stewardship committees in the participating sites. Furthermore, in Bhutan and Nepal, the Clinical Engagement Plan has been institutionalised in selected hospitals, with a country commitment to continue its implementation.

Both TACE grants developed and piloted Burden of Disease study protocols, and data is being collected and analysed in selected countries. Both grants developed a set of tools and resources to support protocol implementation in Asia (ACORN Lite[18]) and Africa (BALANCE[19] and BARNARDS[20]). These protocols and supporting resources have been introduced to all Fleming Fund country grantees in both continents, and training on protocol implementation (data collection, analysis and presentation of results) has been provided, building capacity for AMR burden estimation at the country level. The quantification of the burden of resistant infections is an important driver of change at policy level. In Kenya and Nigeria, AMR burden data generated at the BALANCE and BARNARDS sites is regularly shared by on-site microbiologists with clinicians and nurses to inform treatment practices. TACE Africa and Asia also developed an Antimicrobial Stewardship (AMS) and consumption toolkits for data collection, analysis and interpretation, including a Point Prevalence Survey (PPS) Dashboard prototype, PPS/AWARE[21]; its user guide for PPS result interpretation can be used for making a stewardship plan of action, which has been piloted and introduced to Fleming Fund-supported countries.

Technical Assistance for Data & Evidence Use regional grants (TADEU) Asia and Africa

TADEU Asia[22] and TADEU Africa[23] conducted assessments of the costs and outputs of AMR surveillance in selected countries. This data will help countries identify key cost drivers for establishing and operating effective surveillance and highlight potential areas for cost savings and efficiency. Both grants developed an AMR surveillance micro-costing tool to collect the data; these tools have been shared widely. The lead grantees, ASLM (Africa grant) and IVI (Asia grant), have provided training, guidance and technical support to country grantees on how to use the tool, building in-country capacity to conduct their own economic studies to understand the financial implications of AMR surveillance and inform country resource allocation and prioritisation. The costing tool is Excel-based, user-friendly, and both grantees have made arrangements for the tool and supporting materials to be available beyond the end of the programme: ASLM will host the tool on the ASLM website, and IVI have developed an app that allows users to use the tool without the need for a server.

Surveillance and Prescribing Support for Antimicrobial Stewardship Resource Capacity Building (SPARC)

The Strategic Alignment Grant SPARC, led by the Commonwealth Pharmacists Association (CPA), focused on improving surveillance and prescribing of antimicrobial medicines. SPARC worked to enhance the Fleming Fund priority countries' access to treatment guidelines through the rollout of a Prescribing Companion App and building workforce capability for data-driven AMS decision-making through antimicrobial AMU PPS, and Continuous Quality Improvement for AMS.

Through the Prescribing Companion App, healthcare professionals working in human or animal health have access to a core repository of standard antimicrobial treatment guidelines

The SPARC Prescribing Companion App won the UK Health Security Agency's Antibiotic Guardian Awards in the 'Animal Health, Agriculture and Food Supply' category. 95% of the annual survey respondents recommended the App due to its relevance and ease of use for health workers. To date, the App's user base is over 100,000 human and animal health workers, with Uganda notably leading with over 8,000 users. This growth is due to extensive engagement, including App launch and promotion events across all participating countries, reaching over 3,600 participants from both the human and animal health sectors.

16. TACE Africa consortium – Fondation Merieux (FMX), Ineos Oxford Institute, University of Oxford (UoOx), St George's, University of London (SGUL) ADILA Group.
17. TACE Asia consortium - The International Vaccine Institute (IVI), University of Oxford, ACORN Group (UoOx), St. George's University of London (SGUL) ADILA Group.
18. **A Clinically Oriented Antimicrobial Resistance Network (ACORN) Lite protocol.**
19. **BALANCE protocol**.
20. **BARNARDS protocol**.
21. The PPS/AWARE dashboard is an interactive online reporting tool used in the healthcare setting, specifically relating to the Global Point Prevalence Survey (Global-PPS) of antimicrobial prescribing. It is used to track and report data on antibiotic use and the adherence to the World Health Organization (WHO) AWaRe (Access, Watch, Reserve) classification of antibiotics.
22. TADEU Asia consortium – International Vaccine Institute (IVI), eSHIFT Partner Network.
23. TADE Africa consortium – African Society for Laboratory Medicine (ASLM), School of Veterinary Medicine, University of Zambia (UNZA SVM), eSHIFT Partner Network.

and other prescribing resources at the point of care. SPARC worked with key stakeholders and governments of each country, building networks and partnerships to promote App use.

SPARC App champions conducted in-person training targeting pharmacists and other prescribers on how to use the App. Over 2,000 health professionals have received training, equipping them with knowledge to utilise the app to improve prescribing practices. The App is currently commissioned in 17 countries.

To foster the country-level AMU data generation and encourage its usage for action, SPARC rolled out the Data for Action initiative in selected countries. SPARC built capacity for AMU surveillance through training workshops on AMU PPS data collection and analysis, and Continuous Quality Improvement for AMS and the use of data for practitioners' behaviour change. To help sustain post-training engagement, SPARC established structured peer-learning mechanisms, such as in-country communities of practice and learning webinars. These resources serve as ongoing technical and peer support hubs where course participants and in-country consultants can seek clarification, share resources, and showcase progress.

Integration of One Health principles: Antimicrobial Resistance One Health (AMROH) grants

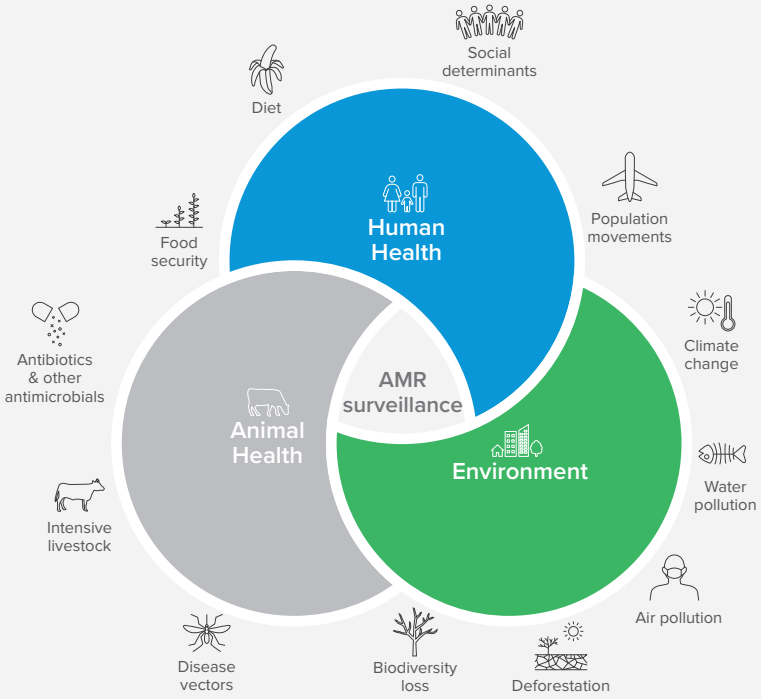
Four regional AMROH (AMR One Health) grants were established to support animal health, One Health, environment and practitioner engagement. The focus of the AMROH grants was on providing increased technical support to improve AMR and AMU surveillance data production, analysis and use from across the One Health sectors (including aquaculture), and to develop and pilot integrated One Health surveillance approaches. The grants also sought to improve the use of AMR/U/C data by animal health practitioners (farmers, veterinarians, para veterinarians, agrivet services etc.) and supported the improved use of antibiotics in agriculture.

The grants have resulted in the development and review of surveillance protocols for animal species other than poultry, including aquaculture species, and in the strengthening of environment and aquaculture laboratories through staff training. For example, in Laos, AMROH South East Asia reviewed and contributed to the finalisation of standard operating procedures and protocols to implement AMR surveillance in poultry, aquaculture and environment. AMROH South Asia supported the country grantee in Pakistan, **DAI**, in developing the strategy and protocol for AMR surveillance in aquaculture, which has been approved and endorsed by the Ministry of National Food Security. AMROH East and Southern Africa contributed to the development of surveillance strategies and protocols for beef and dairy surveillance in Zambia and Malawi, and aquaculture in Tanzania. AMROH West Africa contributed to the AMR Surveillance and strategy documents in Sierra Leone and Nigeria. Successes have been achieved in data analysis and use, and practitioner engagement.

During the life of the Fleming Fund a considerable amount of data has been generated, chiefly from the human and animal health sectors, but with increasing amount acquired from the newly supported environment sector. Analysis and use of the data, in particular integration of the data across sectors and use of integrated data to inform policies, required reinforcement. The AMROH grants focused on data analysis and use through country and regional workshops, with participants from all sectors sharing information and discussing outcomes. These data analysis workshops and subsequent technical support from the AMROH grantees have generated data that has informed national AMR surveillance efforts such as the development of guidelines for AMU in cattle in Indonesia, the development of practitioner engagement programmes in Bangladesh, Nepal and Bhutan, development of treatment guidelines and essential medicines lists in Timor Leste, Papua New Guinea, Kenya, Zambia, Malawi and in Uganda, and development of biosecurity guidelines for caged aquaculture in Tanzania. These guidelines have been distributed to government stakeholders in each country for their implementation and use.

Another success story is around practitioner engagement, promoting the rational sale and use of antibiotics within the animal health sector, including veterinarians, para-veterinarians, agri-vet businesses and farmers. Initiatives included the development of training packages for agri-vet businesses, the development of standard treatment guidelines and essential veterinary medicine lists and farmer engagement on farm biosecurity and rational use of antibiotics.

Figure 5: The One Health approach



A farmer engagement programme in Nepal run by AMROH South Asia[24] was very successful, with 20 poultry farmers and their farms supported to improve conditions to reduce the need for antibiotics, and to use diagnostic services to determine appropriate antibiotics for use if required. Additional support in this area was provided to dairy farmers to reduce the impact of mastitis and antibiotics to treat the condition, and to aquaculture farmers to reduce the use of antibiotics to control fish diseases.

Gender and Equity mainstreaming: GEAR up grant

The regional grant GEAR up[25], led by the Liverpool School of Tropical Medicine (LSTM) focused on mainstreaming Gender and Equity approaches across the Fleming Fund programme. The grantee completed a Global Landscape Scoping review on intersectional inequities and AMR with a focus on LMICs. Through this analysis, GEAR up identified key themes related to gender, equity, and AMR across One Health sectors in the Fleming Fund priority countries. The data outputs were used to inform the areas of work, opportunities, and priority activities to be conducted in each country, as part of the mainstreaming response. A manuscript showcasing the findings of the analysis has been published in the Nature Communications journal.[26] Additionally, GEAR up built countries' capacity through technical assistance, training, and access to tools and resources for integrating Gender and Equity into AMR programming and surveillance systems at the country level.

Figure 6: GEAR up presenting the findings of the Global Landscape Scoping Review

The event brought together global experts to discuss how gender norms and inequities shape exposure to AMR risks, access to treatment, and the effectiveness of interventions. Attendees included country stakeholders, Fleming Fund grantees, the Quadripartite and other regional/ global stakeholders.

GEAR up supported Uganda in integrating Gender and Equity into the AMR National Action Plan. Through workshops on gender, equity, and intersectionality, GEAR up strengthened the country grantee and national AMR Technical Working group capacity to review Uganda's AMR National Action Plan (2024-2029) and surveillance tools with a gender and equity lens. GEAR up also engaged with country stakeholders to strengthen collaboration with Uganda's National One Health Platform, AMR Secretariat, and implementing partners with a view to ensuring long-term integration of these principles in AMR programming.

In addition, the GEAR up consortium reviewed urinary tract infections (UTI) and AMC/AMU data, including gender-disaggregated data that highlighted differences in infection rates between men and women. This data was shared during meetings and workshops with key country stakeholders to build stakeholder engagement and integrate gender-sensitive approaches into future data collection and analysis efforts. All the tools and resources developed by GEAR up will be hosted as open access on their website/blog and on the LinkedIn Community of Practice (CoP), and links will be shared with all Fleming Fund priority countries. The lead grantee LSTM has committed to hosting and maintaining the GEAR up **website** and CoP for ten years.

24. AMROH SA consortium – University of Melbourne (UoM), Institute of Environmental Science and Research Limited (ESR), AgResearch Ltd, Dutch National Institute for Public Health and the Environment (RIVM), Utrecht University, World Fish, Charles Sturt University and The Brooke Hospital for Animals.
25. GEAR up consortium BRAC James P Grant School of Public Health (Bangladesh), University of Health and Allied Sciences (Ghana), LVCT Health (Kenya), HERD international (Nepal), Centre for Sexual Health and HIV/AIDS Research (Zimbabwe), Pamoja Communications Ltd (UK). It is led by the Liverpool School of Tropical Medicine (UK).
26. Davis, K., Limato, R., Monga, M. et al. '**Antimicrobial resistance, equity and justice in low- and middle-income countries: an intersectional critical interpretive synthesis**', *Nature Communications*, 16, 9078 (2025).

Conclusion and key lessons

Regional Grants have been an integral part of the Fleming Fund Programme, with a successful track record in providing tailored technical assistance and building Communities of Practice that will continue. They were initially designed to provide a multi-country approach to providing technical assistance to national surveillance systems for subjects where the multi-country approach was considered necessary. At the country level, this meant that, alongside country grants and fellowships, several regional grants were operating. For this reason, each individual Regional Grant contributed in its specific area to complete a holistic approach at the level of the country. This collaborative approach, using a unified plan (Country Investment Strategy) allowed multiple grants to work together towards the same set of goals and outputs.

The most significant achievement of the Regional and Strategic Alignment Grants has been the development of human resource capacity, enabling production, analysis, and use of AMR surveillance data for policy development and decision-making at the national and regional levels. Furthermore, regional grantees successfully established and strengthened national and regional networks for AMR/AMC/AMU surveillance and worked with multiple stakeholders to enhance regional coordination and collaboration across regions to support AMR data sharing. Key lessons learnt include:

Early in-country engagement is crucial for timely endorsement and uptake of AMR interventions. Those offering technical assistance must earn the trust of national stakeholders for the project to be a success. At times, grantees were faced with an understandable reluctance to share data or critical information needed for project implementation. More importantly, implementers must ensure they involve all the relevant stakeholders and that expectations for the collaboration are realistic. The need to align with the NAPs was important, but resulted in lengthy negotiations and planning, which further complicated and delayed project execution.

Grants that were continuously implemented from phase 1 into phase 2 had a broader scope and established a clear framework and pathway for programme delivery, and therefore a higher likelihood of sustained impact. These grants offered standardised services to multiple countries, proving their replicability. Hence, these strategies could be packaged as a ‘ready-to-go’ interventions for future potential donors. Examples are the EQA networks and proficiency testing schemes in Africa and Asia, as well as the QWArS training programme. These ‘standard’ services could be easily adapted and integrated into existing or new programmes and initiatives.

Implementation variability and adaptive management are critical for achieving the expected outcomes. As countries’ priorities and needs change, a great degree of coordination and collaboration is needed to align their interventions and adapt to the changing context. Grantees faced challenges that hindered implementation, including government processes and approvals, country and site readiness, staff turnover, budget constraints and changes, supply chain and procurement bottlenecks, natural disasters, and political unrest. Adaptive strategies were needed to fulfil the agreed contributions and services with the countries. In some instances, grantees had to adjust methodologies for project delivery on a case-by-case basis. Examples of adaptive strategies included:

- Shifting activities from countries where engagement and approval were not progressing to more engaged countries.
- Changing from in-person to remote training.
- Translation of resources and training materials to local languages.
- Increasing the number of training participants by including lab management staff to promote uptake.

Furthermore, grantees encountered capacity differences across the One Health Sectors that had to be considered, highlighting a need for a tailored multi-sectoral approach to tackling AMR.

Building capacity for national AMR surveillance requires time. Institutional change takes time and involves deep collaboration and significant resources to effect change. The first phase of the programme invested in scoping studies and data gathering to understand the needs of national AMR surveillance systems. In the second phase, country investment strategy negotiation processes such as country commissioning, developing work plans, in-country approval processes and stakeholder engagements added complexity. Despite these challenges, the regional grants have successfully strengthened organisational capacity for AMR surveillance across multiple countries to some degree. Successful stories include the adoption of the QWArS training in Nigeria (NiQWArS), the use of genomic surveillance data to inform policy in Ghana, and the incorporation of a Gender & Equity in the National Action Plan for AMR in Uganda.

However, to ensure the capacity built is sustained over time, resources and efforts are required to effectively integrate the structures, knowledge and resources into existing systems at the country level. To support surveillance activities, the regional grantees have built networks and developed resources, and most of them have committed to keeping these resources available for a fixed period after the Fleming Fund programme closes, hosting them on their own organisational platforms. But, after this period, minimal maintenance costs will need to be covered. Grantees and local stakeholders would need to seek additional funding to maintain these resources and sustain the capacity built.

Overall, the Fleming Fund multi-country approach to technical assistance has supported national efforts in LMICs to tackle AMR by enhancing organisational capacity, knowledge, and evidence-based practices. However, many of these countries may face challenges in securing the resources needed to maintain these efforts. Scaling down or withdrawing support before ensuring the sustainability of these interventions could jeopardise the progress made and diminish the impact achieved so far.

Implementers, beneficiaries and stakeholders must work together to identify opportunities to leverage on and secure continuation, as well as potential AMR funding sources, from existing and future donors. Advocating for the integration of AMR interventions into other programmes and initiatives related to human health and animal health services is vital to ensure that the key outcomes of the regional grants are maintained beyond the duration of the Fleming Fund programme.