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Tackling Antimicrobial Resistance through Professional Learning: The Development and Evaluation of the Global AMR Curriculum

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The Open University
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EXECUTIVE SUMMARY	3
SCOPE OF THE REPORT	3
KEY FINDINGS	3
KEY RECOMMENDATIONS	5
1. INTRODUCTION: OVERVIEW OF THE FLEMING FUND	7
2. BACKGROUND TO AND OBJECTIVES OF THE OU GRANT 2	7
2.1. LOGIC MODEL	8
3. DEVELOPMENT OF THE GLOBAL AMR CURRICULUM	12
3.1 DESIGN OF THE MODULES AND PATHWAYS	12
4. DELIVERY, MONITORING, AND EVALUATION OF THE GLOBAL AMR CURRICULUM	18
4.1 METHODOLOGY OF THE MONITORING AND EVALUATION OF THE GLOBAL AMR CURRICULUM	18
4.2 ANALYSIS OF THE DATA GENERATED IN THE EVALUATION OF THE GLOBAL AMR CURRICULUM	22
4.3 SUMMARY AND RECOMMENDATIONS	61
5. PROMOTING CONTEXTUALISED LEARNING AND SUSTAINABILITY	63
5.1 INTRODUCTION	63
5.2 THE AMR SURVEILLANCE TOOLKIT	63
5.3 THE METHODOLOGY TO CO-CREATE THE AMR SURVEILLANCE TOOLKIT	65
5.4 THE EVALUATION OF THE AMR TOOLKIT IN NEPAL AND GHANA	66
5.5 KEY FINDINGS OF THE TOOLKIT TESTING IN NEPAL	69
5.6 KEY FINDINGS FROM THE TOOLKIT TESTING IN GHANA	75
5.7 SUMMARY AND RECOMMENDATIONS	79
REFERENCES	81
ANNEX 1 TERMS OF REFERENCE FOR OU GRANT 2	82
ANNEX 2 GLOBAL AMR CURRICULUM	90
ANNEX 3 MONITORING AND EVALUATION OF THE GLOBAL AMR CURRICULUM	92
ANNEX 4 DATA FROM SURVEYS	112

Executive Summary

Scope of the report

Antimicrobial resistance (AMR) is recognised as one of the most serious global threats to human health in the twenty-first century. AMR is defined as the ability of a microorganism (bacteria, viruses, parasites) to stop an antimicrobial (an antibiotic, antiviral or antimalarial) from working against it (WHO 2020a). Without effective antibiotics, routine medical procedures will be less safe in the future and even minor infections will no longer be treatable. The effects of AMR are predicted to be more acute in resource-limited settings such as in low-to-middle income countries (LMICs) (Seale et al., 2017). However, no country can view itself in isolation and addressing this serious threat to public health is a global priority that requires collective action across all countries (WHO, 2015).

In response to this global threat, the UK Government has established the Fleming Fund that plays a critical role in achieving the resolution of the 68th World Health Assembly, 2015 (WHA A68/20), and in realising the 'Political Declaration of the High-Level Meeting of the United Nations General Assembly (UNGA) on Antimicrobial Resistance, 2016'. The work detailed in this report contributes to the Fleming Fund programme led by the Department of Health and Social Care (DHSC), specifically the objective overseen by Mott MacDonald to improve capacity in AMR surveillance in LMICs. This work is aligned with the World Health Organization's Global AMR Surveillance System (GLASS), which acts as the blueprint for a multi-stakeholder global response to averting a global health crisis caused by AMR (<http://www.who.int/antimicrobial-resistance/global-action-plan/en/>).

The Open University is the Global Learning Partner of the Fleming Fund Management Agent, Mott MacDonald. The OU has been commissioned to develop and implement a Global AMR Curriculum that will help a range of stakeholders in all twenty-four Fleming Fund participating countries increase their knowledge, skills and understanding of AMR. As defined by the grant agreement between the Open University (OU) and Mott MacDonald, the Grant 2 (February 2020 – September 2021) supported the OU to design, deliver and evaluate a Global AMR curriculum as well as support the development of contextualised learning in two Fleming Fund countries: Nepal and Ghana. It draws on the OU expertise in the use of online and digital technology and the utilisation of different pedagogic approaches. Grant 2 builds on evidence generated in an earlier grant the OU had (Grant 1, April 2018 – September 2019) that involved the design and delivery of two pilot learning events in three LMICs (Bhutan, Tanzania and Ghana).

In this report, we draw on the evidence from Grant 2 to inform how human and animal health professionals and policy makers in different countries and work settings made use of information related to AMR and were supported in changing their work practices.

Key findings

The Global AMR curriculum includes 25 modules and 10 distinct pathways, tailored to specific professional roles associated with AMR. To support professionals applying the knowledge they learn through the Fleming Fund online modules and pathways we further co-designed and evaluated the AMR Surveillance Toolkit. Each of these learning resources offered a distinct range of benefits that

were realised through the curriculum design and production processes adapted for Grant 2. The key findings from Grant 2 are summarised below.

- 1. The Global Curriculum offered a free and accessible form of professional development for professionals** whose work is associated with AMR. 25 modules with 10 pathways were released from January to August 2021. 360 students enrolled on 'AMR Surveillance and You' (Target = 250). Participation in all modules generated good levels of activity, completion and student satisfaction. Of those who enrolled on modules, 45% completed module activities (Target = 25%). Of those who completed, 98.7% attempted the quiz. On average 43% of the total number of enrolled students were awarded a Digital Badge (Target =10%). The average satisfaction rate was 78% across all modules (Target = 75%). Platform logs showed that a total of 2,376¹ visitors have accessed the OU Fleming online modules in the reporting period. Across the modules, a total of 8,452 visits took place and the average time a visitor spent on the platform was approximately 32 minutes. Platform logs illustrating the geographic location of visitors show good representation from Fleming Fund participating countries, while evidently the reach of the modules was well beyond this group of countries.
- 2. Participation in the Global AMR Curriculum supported professionals in learning conceptual and relational knowledge about AMR.** Evidence generated suggests that students in the online modules and pathways perceived that they had learned about AMR. They gained confidence about understanding AMR and AMR surveillance and improved their ability to talk with a colleague about AMR. There was some evidence that the AMR Curriculum supported them in learning about relational knowledge (i.e. how each job relates to other roles and tasks). In particular students understood how their role relates to others within the AMR surveillance network. However, there was limited evidence of students learning practical knowledge (e.g. how to analyse AMR data). Of note, the Terms of Reference for Grant 2 placed a focus on conceptual knowledge rather than practical or relational knowledge. Practical and relational forms of knowledge should be further supported through other complementary types of professional development.
- 3. Participation in AMR Toolkit activities provided forms of professional development that complemented the Global AMR Curriculum by supporting inter-professional conversations about AMR work and the local work environment.** Use of the AMR Toolkit provided opportunities for professionals to learn relational knowledge by reflecting on how their work relates to other roles both within and beyond their immediate workplace. Team leads and facilitators reported this led to a recognition that, to improve AMR surveillance, professionals need to work with others, build trust and value ways of working and knowing of others, whilst being mindful of assumptions that professionals have about one another and of the characteristics of their work environment.
- 4. Participation in the AMR toolkit activities encouraged teams of professionals to identify areas of further development, adaptation or change in the local work environment**

¹ Visitors to the modules are counted once per device/browser in the specified timeframe. This figure includes the enrolled users. Total visits to the module refers to the total number of times modules are accessed.

necessary for the uptake of new work practices associated with AMR. There is evidence that all teams participating in the use of the Toolkit initiated small-scale local actions that (potentially) ‘make a big difference’ to their own day to day practice and work environment.

5. **There is evidence that work structures and time constraints limit opportunities for professionals to engage in, or apply, what they learn.** Existing work culture and processes, access to limited resources and busy workloads exacerbated in situations of emergency (i.e. Covid19) hindered participation in the AMR Global curriculum and Toolkit activities and uptake of new AMR surveillance practice. Support from senior management is crucial.
6. **Co-design of the AMR Toolkit with in-country stakeholders led to the development of appropriate learning materials that are relevant to professionals in roles associated with AMR and more applicable to specific workplaces.** The Toolkit was developed and evaluated using a participatory, co-design methodology. This method involved in-country technical leads and team leads/facilitators in twelve healthcare organisations in two LMICs. These stakeholders were involved throughout the design process and contributed resources, case examples from their practice and testimonials to be included in the materials. This type of co-design method can help produce a range of materials that are more relevant for users within LMICs.

Key recommendations

Key recommendations have been identified to guide future work in (potential) subsequent phases of the Fleming Fund to promote a systemic approach to strengthening capacity:

1. **Extend the delivery of the Global Curriculum with complementary forms of AMR development that focus on changing AMR surveillance practice.** The curriculum supports the development of conceptual and (to an extent) relational knowledge. To shift the focus towards changing practice, a broader range of professional learning opportunities should be designed and developed, incorporating different modalities (i.e. online, blended), to support professionals whose work is associated with AMR in all ranks and roles to learn conceptual, practical and relational knowledge.
2. **Encourage policy makers and senior management teams in healthcare organisations to support professionals in developing relational knowledge** – i.e. knowledge around how they work together across professional networks as knowledge of AMR evolves. By finding ways for professionals in different job roles to learn together, continuing professional development (CPD) programmes can support workers to build trust and value ways of working with others.
3. **Encourage policy makers and senior management teams in healthcare organisations to support professionals in developing practical knowledge** – e.g. how to collect a sample, how to analyse data, how to carry out a susceptibility test etc.
4. **Provide alternative ways for professionals to engage in multiple and complementary forms of learning** (see recommendation 1), by ensuring professional development programmes are

flexible, non-formal and non-linear. Programmes should be designed flexibly to encourage professionals to set aside time for professional development. Professionals should also be supported to learn based on their needs and gaps in knowledge and skills.

5. **Work with policy makers and senior management to ensure professionals have incentives to take part in professional learning.** This can be achieved by providing rewards such as CPD accreditation or other employer-generated rewards when modules are completed or when time is spent on professional learning. These rewards could be in the form of Continuous Medical Education (CME) credits that are essential within medical professions and may bring greater recognition and acceptance of the online learning provision. Work with local authorities and institutions such as Universities, Ministries of Health and Ministries of Agriculture to fully endorse and recognise the participation in online and face-to-face activities that form part of professional development.

6. **Encourage local healthcare organisations to run professional development events based around the AMR Global Curriculum and Toolkit.** These events could be adapted to fit specific work-based contexts. This will support the sustainability of learning provision and will emphasise the importance of localised knowledge. Having key influencers as facilitators is an important way to change AMR surveillance practice and organisational policy.

7. **Involve in-country stakeholders at all stages of capacity building projects that lead to the design of knowledge resources and tools.** This ensures CPD programmes build on and value the knowledge of local experts and take into consideration the characteristics of the local work environment.

1. Introduction: Overview of the Fleming Fund

The Fleming Fund is the UK Government's investment to help low- and middle- income countries (LMICs) fight antimicrobial resistance (AMR) by improving surveillance. The Fleming Fund Grants Programme is the largest workstream within the Fleming Fund. Mott MacDonald is the appointed Management Agent for the Fleming Fund Grants Programme. The aim of the Grants Programme is to improve the ability of recipient countries to diagnose drug-resistant infections, and improve data and surveillance to inform AMR policy and practice at national and international levels. The geographic focus of the Fleming Fund Grants Programme is 24 LMICs from Sub-Saharan Africa, and South and South-East Asia. Support to participating countries is provided through three funding channels: Country Grants; Fleming Fellowship Scheme Grants; and Regional Grants.

The Fleming Fund's emphasis on AMR surveillance requires a particular focus on the professional practice of a wide range of individuals with a variety of skills, backgrounds and interests, including laboratory staff, public health professionals, policy makers, clinicians and nursing staff, veterinary professionals and agricultural workers, and pharmacists. There is an urgent need for these professionals to learn about good practices associated with AMR on a mass scale, with accessible learning materials for knowledge and skills development.

2. Background to and Objectives of the OU Grant 2

The Open University UK (the OU) is Mott MacDonald's Global Learning Partner for the Fleming Fund. The OU has been awarded a grant (Grant 2) to design and deliver an AMR curriculum across all Fleming Fund countries. This grant built on an earlier pilot project (Grant 1, April 2018 - September 2020) involving the design and delivery of Learning Events in three LMIC countries: Bhutan, Tanzania and Ghana.

Grant 2 aimed to help human and animal health professionals and policy makers in different countries and work settings make use of information related to AMR and support them in changing their work practices. It draws on the OU expertise in the use of online and digital technology and the utilisation of different pedagogic approaches.

Specifically, Grant 2 had three main objectives:

1. Curriculum Development – The design of an AMR curriculum and the development of 25 modules, organised in 10 pathways, covering the 9 priority areas for improvement of AMR knowledge and skills identified in Grant 1.
2. Implementation and Delivery – The delivery of the 25 modules across all the Fleming Fund countries and beyond and monitoring their success.
3. Promoting contextualised learning and sustainability – the development and testing of a toolkit to guide professionals in implementing the knowledge they learn through the Fleming Fund modules and pathways in their everyday work.

Grant 2 was implemented from February 2020 to September 2021. This report is the final deliverable of the project and will illustrate and analyse the rationale, approach, activities and achievements of

the project as well as report on the success metrics. It draws on evidence generated during this period to examine the development and monitoring and evaluation of the AMR Global curriculum.

2.1. Logic Model

In Grant 1 we identified several ways AMR surveillance work could be supported by professional learning and development. Our report from the Grant 1 (scoping phase) provided five key recommendations to support the design of the modules and pathways for the global curriculum and three important considerations to support contextualisation of the curriculum in the workplace (see Charitonos et al., 2018). A Logic Model was used to plan how these findings were translated into actions to inform the work within Grant 2, providing an evidence-based approach to developing the global curriculum.

A logic model is a graphic depiction or road map that presents the shared relationships among the resources, activities, outputs, outcomes, and impact of an initiative. It depicts the relationship between the problem identified, the action needed to achieve the intended effects and the evaluation of the outcomes. The Logic Model developed as part of this process was adapted from work to improve health communication in 2019 by Stead and colleagues (Stead et al., 2019).

The Logic Model was used to plan the activities of Grant 2 and evaluate the outcomes. Each problem identified in Grant 1 was assigned an action. The outcomes were evaluated using a range of methods that measured outcomes, detailed in the Logic Model. These methods are reported in Section 4 and section 5 of this report. The actions summarised in the Logic Model led to the creation of a series of legacy resources that support the sustainability of the Fleming Fund work. These include:

1. the AMR Global Curriculum with 25 modules that can be accessed via 10 pathways;
2. the AMR ToolKit with 3 tools to support the impact of the learning from these pathways within the workplace;
3. design principles to support future design of modules and pathways (Charitonos et al., in review);
4. a database of resources that can be reused in future AMR courses (Mcmullan and Harmon, 2021 - see <https://figshare.com/s/132fe1a465b9035b2073>).

Figure 2.1 shows the five findings from Grant 1 that are related to the design of the modules and pathways and the actions taken to address each of these issues:

- Grant 1 provided evidence that there were ***limited opportunities for health professionals in the target countries to engage in professional learning about AMR***. This problem was compounded by the lack of time many professionals have in their workload schedule to learn about AMR but also lack of free and easily accessible professional development opportunities. The actions taken were to provide a set of modules on AMR that take into account the limitations in the ways professionals could access these modules (e.g. time, access to technology).

- The work in Grant 1 pinpointed nine **areas of knowledge about AMR that professionals need to learn** (Charitonos et al, 2018). To address this issue, the global curriculum was designed with 25 modules that emphasised these areas of knowledge.
- Grant 1 provided evidence that **different job roles focus on specific areas of knowledge**. Therefore, the 25 modules were linked as a set of 10 pathways targeted towards people in specific job roles.
- In Grant 1 we identified **a range of resources that could be reused**, rather than recreated, within the modules to avoid duplication and reduce costs. To this end, past OU materials and materials from the online course created in Grant 1 have been repurposed into the current courses wherever possible. The online modules include several examples of where external resources were re-used (rather than whole courses) such as the GLASS country database, the links to EUCAST SOPs and videos. In the AMR Toolkit, Tool 2 in particular reuses materials created by AUSVET. However repurposing external courses was challenging due to rights and platform issues (e.g. content of FutureLearn is not continuously available and requires registration and payment for longer access). Time constraints in the development of the modules did not allow for long rights negotiations, hence the approach followed was to draw on subject matter experts because they could be repurposing their own resources or providing links to other existing resources. An additional reason why repurposing external courses was challenging was that materials in these courses could have been out of date and so there were issues with currency of materials.

What is the problem? <small>Identified from FF Grant 1, Phase 1 report, Nov 2018.</small>	Action needed <small>Identified from FF Grant 1, Phase 1 report, Nov 2018.</small>	Input	Outcomes		
		Activities	Process Evaluation	Outcomes measured	Legacy Output (to support sustainability)
1 Opportunities for professional development are limited.	Increase the number of opportunities for professional learning on AMR. (RQ1/2)	Co-design and deliver a global curriculum of 25 modules co-designed with stakeholder representatives and made available as open, online courses.	Learner experience in the global curriculum.	No of modules delivered. No of people enrolled / completed. Learner demographics. Geographic location. No of downloads. Satisfaction. Badges awarded. Unique/total visitors. Devices used by learners. Demographics (age, gender, qualification, etc)	AMR global curriculum openly available online via the OpenLearn platform.
2 Professionals lack specific knowledge that is critical for good AMR surveillance practice.	Professional learning in nine distinct areas of knowledge need to be prioritised to improve AMR surveillance practice. (RQ1/3)	Modules co-designed with in-country stakeholders to support the nine knowledge areas flagged as important.	Learner experience in specific modules.	Pre & post surveys Platform data.	25 Modules designed to support professionals working in AMR surveillance to learn specific knowledge, including the nine areas of knowledge gaps identified in Grant 1.
3 All professionals need capacity building in ways that are relevant to their role.	Design professional learning opportunities in ways that improve professional practice, tailored for specific job roles. (RQ1/3)	Learner pathways created to tailor learning to specific job roles. 10 pathways designed using learner profiles.	Learner experience in specific learner pathways.	Interviews with learners	Learning pathways designed to support professionals working in specific roles
4 There are a range of existing AMR resources that tend to be reinvented rather than reused.	Where possible, reuse existing AMR resources for professional learning. (RQ1/2)	Promote a culture of reusing existing resources as far as possible.	Module design practice in terms of reusing resources	Interviews with module developers.	Design principles and a database of resources that can be reused in future AMR courses.
5 Social technologies could be better incorporated into learning.	Draw on commonly/ regionally used social apps (eg WhatsApp) to help professionals to connect as they learn. (RQ1)	Promote a culture of adopting social media Apps used by specific communities.	Modules designed such that digital badges could be used to evidence achievements using the local community's preferred social media platform (LinkedIn, Facebook, Twitter etc.)	Interviews with module developers.	Digital Badges

Figure 2.1 Fleming Fund AMR Surveillance Logic Model for Objectives 1 and 2

- In the Grant 1 report, we described how individual countries focus on using different forms of social media (for example WhatsApp) to connect. Modules were designed in ways that enabled professionals to evidence their achievements using digital badges shared using social media applications that are widely used in their country and the local community's preferred social media platform (Linkedin, Facebook, Twitter etc.).

These findings formed the basis for the Objectives 1 and 2 activities reported in Section 3 and 4 of this report.

Objective 3 was focussed on the contextualisation of learning to ensure that the knowledge learned in the modules and pathways was embedded within AMR surveillance work. Grant 1 provided evidence of three significant issues that need to be addressed (Charitonos et al, 2018):

First, health professionals have **limited appreciation that effective AMR surveillance requires networks of people to work together** through inter-professional working.

Second, **ingrained practices, particularly around data, make it difficult to incorporate new forms of practice** into AMR surveillance work.

Third, **existing forms of work may need to be restructured** to allow people to adopt new practices.

The actions to address these three issues were included in the Logic Model (see Figure 2.2):

What is the problem?	Action needed	Input		Outcomes	
		Activities	Process Evaluation	Outcomes measured	Legacy
6 There is limited appreciation that effective AMR surveillance requires networks of people to work together and to understand their role in relation to the overall system.	Provide a tool that can be used by key influencers (eg Team Leads, Lab Managers, etc) to support people in appreciating how their work relates to the work of others in the AMR system. (RQ1/4)	Co-design guidance and activities to support people in understanding local, national and global AMR networks. Design modules in ways that encourages collaborative learning of people with diverse roles (eg policymakers, technicians, managers).	Workshop with influencers using the ToolKit with their teams. Proforma documenting tool use.	Perceived usefulness of the Tool by team leads. Longterm change in practice.	Tool 1: Your role in an AMR surveillance network in Toolkit available via OpenLearn.
7 Ingrained practices make it difficult for people to incorporate emerging AMR surveillance practices into their work.	Provide guidance and activities for key influencers to support professionals in navigating a major change in professional practice. (RQ1/4)	Co-design guidance and activities to support the digitalisation of AMR surveillance.	Workshop with influencers using the ToolKit with their teams. Proforma documenting tool use.	Perceived usefulness of the Tool by team leads. Longterm change in practice.	Tool 2: Dealing with AMR Data in Toolkit available via OpenLearn.
8 AMR Surveillance practices can only be introduced when existing forms of work are restructured.	Provide opportunity to restructure work while learning. (RQ1/4)	Co-design guidance and activities to support teams in reflecting on and changing the workplace.	Workshop with influencers using the ToolKit with their teams. Proforma documenting tool use.	Perceived usefulness of the Tool by team leads. Longterm change in practice.	Tool 3: Reflecting on your work and changing your workplace in Toolkit available via OpenLearn.

Figure 2.2 Fleming Fund AMR Surveillance Logic Model for Objective 3

An AMR Surveillance Toolkit was developed to provide guidance to team leaders and people in positions of authority to help address these issues. The concept of a Toolkit to increase the impact of professional learning and development on work practices and processes is based on previous work led by Littlejohn and colleagues (see Margaryan, Littlejohn & Lukic, 2018). The Toolkit comprises three tools, each co-designed with in-country stakeholders, to address one of the issues identified in Grant 1. The Toolkit co-design and evaluation is reported in Section 5 of this report.

In the following section we draw on the Logic Model to provide evidence that is related to the design of the online modules and pathways.

3. Development of the Global AMR Curriculum

3.1 Design of the modules and pathways

3.1.1 Curriculum design

The Logic Model outlined above identified specific areas and associated actions taken in the development of the global curriculum. An initial framework to inform the design of the curriculum was developed including elements such as target learners/professionals, modules and pathways/study routes. This framework was the outcome of two inter-related processes: first, establishing a good understanding of specific target learners/professionals who would benefit from access to specific areas of knowledge; and second, gleaning information from scoping work and mapping of available AMR-related Open Educational Resources (OERs) in Grant 1² together with mapping of key AMR surveillance publications³ that allowed the identification of 25 specific areas of focus for the modules (see Figure 1 below for an initial course structure). Based on these two parallel processes, we established 10 discrete pathways that consider the needs of key stakeholders in the AMR system, ranging from lab professionals to clinicians and government policy-makers. We mapped these pathways against specific modules: not every profession required every module, but many modules were required by several professions. The initial mapping was later adapted because some versioning of modules and pathways was required to tailor the modules to either human or animal health. The introductory modules could be studied by every professional, then the pathways diverge according to particular interests and/or professional requirements which were mapped based on the needs of target audiences identified during Grant 1. Running through all the modules were themes of the importance and urgency of tackling AMR, and the One Health approach to doing so. Following a few iterations in consultation with Mott MacDonald, a suggested course structure with 25 modules, alongside the suggested pathways were finalised. The modules and pathways are presented in Figures 3.1 and 3.2.

Further to this framework, findings from Grant 1 and the two pilot courses⁴, developed and run in Phase 2 of Grant 1, informed the development six design principles (see Charitonos et al., under review). These principles were applied in the development of authoring guidance documents and curriculum and module specifications used to produce the global curriculum (see Section 3.1.2). An underlying design consideration was for the curriculum to embed opportunities for learners to reflect and consider their professional role and apply their learning within the context of their workplace. The scale of the curriculum and sustainability considerations (i.e. the need to develop materials that would be made available for asynchronous learning after the completion of the project), as well as budget requirements meant that specific features often used in online learning

² See McMullan and Harmon, 2021 - <https://figshare.com/s/132fe1a465b9035b2073>

³ Seale et al., (2017). AMR LMIC roadmap for participation in GLASS https://researchonline.lshtm.ac.uk/id/eprint/4574689/1/4f8dcc9a-5e55-4b36-b513-cfce645fd744_12527_-_anna_seale.pdf; and A protocol for active AMR surveillance in poultry <https://www.flemingfund.org/wp-content/uploads/97eb17b6835316221f4818842f0079a9.pdf>

⁴ i. Online Course, *Understanding Antimicrobial Resistance* <https://www.open.edu/openlearncreate/course/view.php?id=3941>

ii. Blended course, *The Power of Data to Tackle Antimicrobial Resistance* - <https://www.open.edu/openlearncreate/course/view.php?id=3964>

such as online forums could not be incorporated into the modules. Finally, as discussed earlier, repurposing external materials was challenging due to rights and platform issues (e.g. content of FutureLearn is not continuously available and requires registration and payment for longer access), whereas time constraints in the development of the modules did not allow for long rights negotiations.

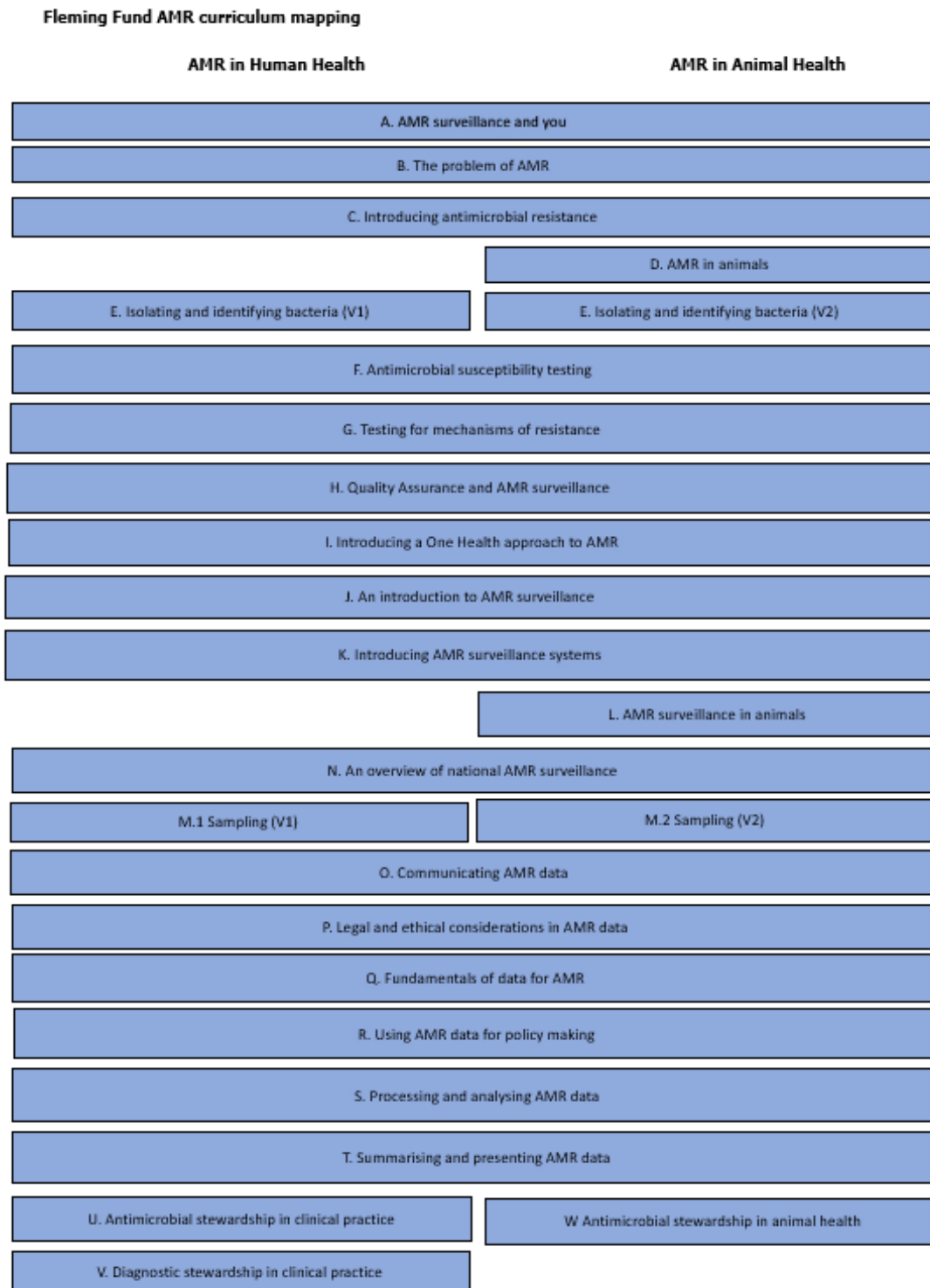


Figure 3.1 Outline and structure of the Global AMR Curriculum

	AMR surveillance and you	The problem of AMR	Introducing antimicrobial resistance	AMR in animals	Isolating and identifying bacteria	Antimicrobial susceptibility testing	Testing for mechanisms of resistance	Quality assurance and AMR surveillance	Introducing a One Health approach to AMR	An introduction to AMR surveillance	Introducing AMR surveillance systems	AMR surveillance in animals	Sampling	An overview of national AMR surveillance	Communicating AMR data	Legal and ethical considerations in AMR data	Fundamentals of data for AMR	Using AMR data for policy making	Processing and analysing AMR data	Summarising and presenting AMR data	Antimicrobial stewardship in clinical practice	Diagnostic stewardship in clinical practice	Antimicrobial stewardship in animal health	TOTAL (approx. study hours in brackets)
LPH	X	X	X		V1	X	X	X	X	X	X					X	X		X					13 (39)
LHA	X	X	X	X	V2	X	X	X	X	X		X				X	X		X				X	15 (45)
SLPH	X	X	X		V1	X	X	X	X	X	X			X	X	X	X		X	X		X		17 (51)
SLPA	X	X	X	X	V2	X	X	X	X	X	X	X			X	X	X	X	X	X			X	19 (57)
CS	X	X	X					X	X		X		V1			X	X	X	X	X	X	X	X	14 (42)
VS	X	X	X	X	V2				X	X	X	X	V2		X	X	X						X	14 (42)
SMC	X	X							X	X	X		V1	X	X	X	X	X	X	X	X	X		15 (45)
SMV	X	X	X	X	V2	X			X	X	X	X	V2		X	X	X	X	X	X	X		X	18 (54)
PM	X	X	X	X					X	X	X	X		X	X	X	X	X	X	X			X	16 (48)
DS	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X				18 (54)

Figure 3.2 Suggested learner pathways in the Global AMR Curriculum

(LPH = laboratory professionals human health, LPA = laboratory professionals animal health, SLPH = senior laboratory professionals human health, SLPA = senior laboratory professionals animal health, CS = clinical services professionals, VS = veterinary service professionals, SMC = senior management clinical, SMV = senior management veterinary, PM = policy makers, DS = data scientists)

3.1.2 Curriculum development

The development of content for the *Tackling Antimicrobial Surveillance course* required module developers with expertise in the fields that are linked with AMR and the context of AMR surveillance or health systems in LMICs, as well as those with experience of developing content for online learning, including an understanding of the OU’s OpenLearn Create platform. Based on the first two criteria, subject matter experts were identified and recruited worldwide in collaboration with Mott Macdonald. In addition to this pool of external consultants, OU staff were also recruited to complement and contribute to the module development process, by bringing to the fore the expertise of developing content for online learning. This expertise in online learning and pedagogy was a key element underpinning the curriculum development. Many of the OU staff also had domain-specific knowledge. Figure 3.1 above shows the final course structure with the 25 modules that were developed as part of the Global AMR Curriculum.

The role of module developers was associated with the authoring and the review of modules, according to broad topics as following: introductory modules, microbiology, surveillance, communicating data, data, stewardship and animal health (see Table 3.1). Distinct teams were formed to address each of these topics and lead the development of several modules, as shown in Table 3.1 below. Teams were organised according to their members’ expertise: each team was composed of an external consultant - subject matter expert, an OU member of staff and an external reviewer. What this approach offered was that the same group of module developers were leading modules, the content of which was to some degree interlinked, either because the modules in the group were at introductory and advanced levels, or because the group included modules on the same subject but targeted at different audiences.

Table 3.1 Module Development teams

#	Module name
Introductory modules	
A	The AMR professional
B	The problem of AMR
C	Introducing AMR
I	Introducing a One Health approach to AMR
Microbiology	
H	Lab quality assurance and GLP for AMR
E	Isolating and identifying bacteria V1 and V2
F	Antimicrobial susceptibility testing
G	Testing for mechanisms of resistance
Surveillance	
K	Introducing AMR surveillance systems
J	An introduction to surveillance
N	An overview of national AMR surveillance
Communicating data	
O	Communicating AMR data to stakeholders
R	Using AMR data for policy making
Data	
Q	Data basics for AMR
P	Legal and ethical considerations in AMR data
S	Processing and analysing AMR data
T	Summarising and presenting AMR data
M	Sampling V1 and v2
Stewardship	
U	Antimicrobial stewardship in clinical practice
V	Diagnostic stewardship in clinical practice
Animal health	
W	Antimicrobial stewardship in veterinary practice
X	Diagnostic stewardship in veterinary practice
D	AMR in animals
L	AMR surveillance in animals

At the start of the course development process, a global authoring workshop was organised, where authors were provided with information on the key findings of Grant 1 and how these findings had informed the design of the global AMR curriculum, the objectives of the course, the target learners as well as practical information on the module development process. Module developers then worked on the basis of a guidance document, produced by the OU Academic Director, that outlined the requirements in terms of style and structure of the module, word count, type of activities, and requirements for the module's final quiz. The authoring of the modules followed a rapid process of module production including several internal and external reviews and approvals, illustrated by Figure 3.3 below.

Specifically, as part of the global AMR curriculum structure (Figure 3.1), the OU Academic Director drafted an initial module specification, which were shared with the module developers. The specification was based on mapping of existing open educational resources (OERs) and materials produced during Grant 1⁵, learner profiles developed during Grant 1 (see Charitonos et al., 2018) and design principles established based on the two pilot courses that were run in Grant 1 (see Charitonos et al., under review). This module specification was agreed with Mott Macdonald (Fig. 3.3, Step 1). For each group of modules, an author workshop was organised (step 2), bringing together the authors, the OU Academic Director (AD) and Mott Macdonald’s experts. During the workshop, the draft specification for all modules of the group was discussed, together with the dates for the submission of the different drafts. The authors then developed the module outline (step 3) which once agreed (step 4) would form the basis for the development of the full module (step 5); the content was then reviewed by the group Critical reviewer (step 6) and the revised version sent to the OU Academic Director (step 7). The final draft was sent to Mott Macdonald’s experts for sign-off (step 8). The final version was then handed over to the OU Learner Discovery Services (LDS) production team approximately 30 days from the start of the process (step 9). The release of the module would normally happen 4-6 weeks after handover to the production team (step 10).

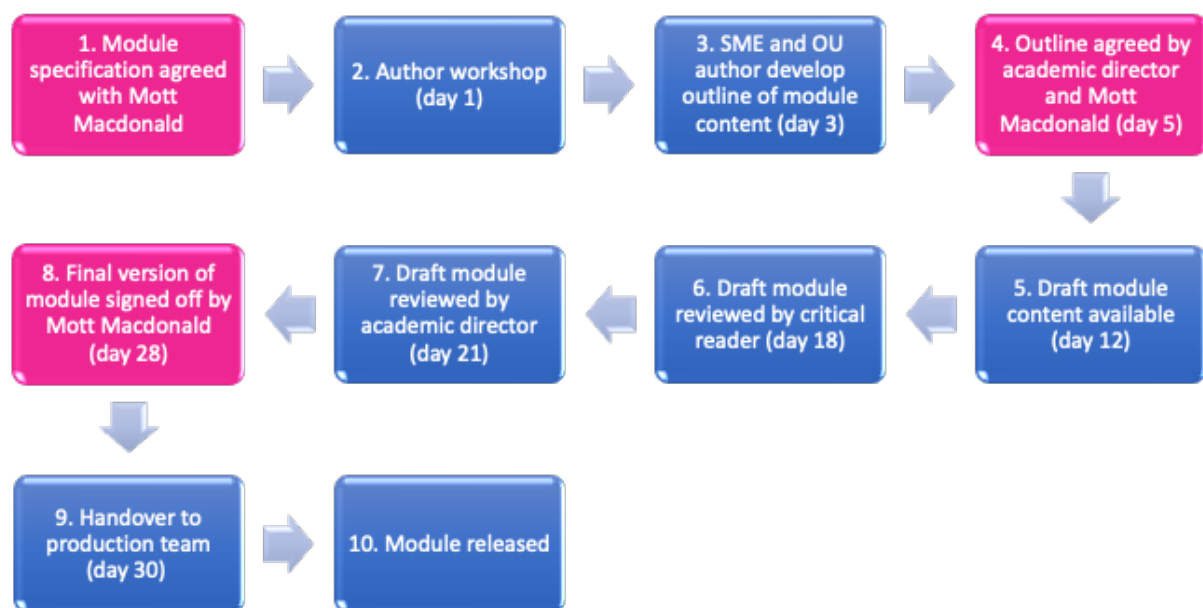


Figure 3.3 Process followed in the module development

The twenty-five modules were released between January and August 2021. Figure 3.4 below shows the dates that the modules were launched, also indicating the period that each module was

⁵ see <https://figshare.com/s/132fe1a465b9035b2073>

available for enrolment within Grant 2. In Annex 2, Table 2A lists the twenty-five modules, their release date and URLs.

The next section documents the metrics and methods used to monitor the success of the Fleming Learning grant managed by the OU in relation to the Global AMR Curriculum.

Modules	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
A - AMR surveillance and you	20-Jan							
B - The problem of AMR	20-Jan							
C - Introducing AMR	20-Jan							
D - AMR in animals					27-May			
E1 (Human Health) - Isolating and identifying bacteria			29-Mar					
E2 (Animal Health) - Isolating and identifying bacteria						24-Jun		
F (Human Health) - Antimicrobial susceptibility testing			29-Mar					
G - Testing for mechanisms of resistance					27-May			
H - Quality Assurance and AMR surveillance		25-Feb						
I - Introducing a One Health approach to AMR		25-Feb						
J - An introduction to AMR surveillance					27-May			
K - Introducing AMR surveillance systems		25-Feb						
L - AMR surveillance in animals					27-May			
M1 (Human Health) - Sampling			29-Mar					
M2 (Animal Health) - Sampling			29-Mar					
N - An overview of national AMR surveillance			29-Mar					
O - Communicating AMR data						24-Jun		
P - Legal and ethical considerations in AMR data						24-Jun		
Q - Fundamentals of data for AMR		25-Feb						
R - Using AMR data for policy making								17-Aug
S - Processing and analysing AMR data			29-Mar					
T - Summarising and presenting AMR data					27-May			
U - Antimicrobial stewardship in clinical practice								17-Aug
V - Diagnostic stewardship in clinical practice					27-May			
W - Antimicrobial stewardship in animal health						24-Jun		

Figure 3.4 Release phases of the online modules

4. Delivery, Monitoring, and Evaluation of the Global AMR Curriculum

4.1 Methodology of the monitoring and evaluation of the Global AMR Curriculum

This section documents the metrics and methods used to monitor the success of the Fleming Learning Grant managed by the OU. The report presented in this section is based on the agreed monitoring targets, as per project monitoring document (Annex 9A), and the underlying consideration and limitations, as illustrated in the Monitoring Targets document submitted with Q3 report and provided in Annex 1.

Ethical approval of the evaluation work was overseen by the OU Research Ethics committee (REC/3991/Charitonos) and followed the University's ethical guidelines.

4.1.1 Key metrics agreed

Three indicators for the project success metrics were agreed in the initial stages of Grant 2. An additional fourth indicator was agreed in June 2021. The four indicators are:

1. Enrolment in module A. 'The 'AMR surveillance and you' module is the first module of all pathways, it was therefore considered a good indicator of the number of people that enrolled in any of the pathways.
2. Percentage of student registrations completing the available modules. This is broken into three following sub-indicators:
 - 2.1 Percentage of learners who are claiming a badge. These are learners who visited every page, and passed the module final quiz;
 - 2.2 Percentage of students who completed each element of the module;
 - 2.3 Number of students who downloaded the course content (in one of the provided alternative formats).
3. Percentage of students who are satisfied with the overall course quality.
4. Number and percentage of learners that obtain a badge out of those who have completed the module and attempted the quiz.

We collected all data from the OU's OpenLearn Create (OLC) platform, where the course/modules are hosted. The indicators for enrolment and completion are found in default platform reports that are downloadable for each of the modules. The third indicator is derived from the 13-statement optional Module Satisfaction survey called 'Your experience of this module' that has been included at the end of each module. These indicators have been reported from April 2021 (except Indicator 4), in correspondence with the availability of the information on the first modules published.

The course is built as a series of independent modules and this is reflected in the indicators, where information is collected on how learners access and use the content per module. Collecting data at the module level was deemed appropriate because within the reporting period of Grant 2, data at the pathways level would not have been available. This was because the final modules were released mid-August 2021, which also marked the completion of the ten pathways (see Figure 3.4 modules and their release dates).

The following section provides a detailed description of the four indicators.

4.1.2 Description of indicators

The OLC data reports hold data from all users, i.e. learners, course creators, reviewers, researchers, and others. For the purpose of reporting the indicators, we only report 'genuine' learners. This means that we excluded all users with special privileges on the platform, such as the course creators, reviewers, and researchers. We also excluded all users with an email address of the Open University.

Indicator 1 - Enrolment Indicator *Enrolment in the module A. "The AMR surveillance and you"-target 250.* This indicator is based on the OLC report called 'Enrolled users report'⁶. This indicator represents the number of participants who enrolled on a module. The target for this indicator was calculated based on the number of Fleming Fund supported sites (i.e. laboratories) and the number of Fleming Fellows.

Indicator 2 - Completion indicator *Percentage of student registrations completing the available modules.* This indicator is broken down into three sub-indicators.

2.1 Badge indicator: Shows the percentage of learners claiming a badge. A learner receives a badge if he/she visited all pages in the module and achieved a score of 50% or more in the module final quiz. The target was set to 10%.

2.2 Activity indicator: Percentage of students, who completed each element of the module. The target was set to 25%.

2.3 Downloads of alternative formats indicator: Number of students that downloaded the course content in an alternative format, such as pdf, Word, or an eBook format and others. This feature allows learners to learn offline for most parts of the course. No target has been set for this indicator.

All of these indicators are based on the platform report called 'OpenLearn completion.

Indicator 3 - Satisfaction indicator *Percentage of students that after completing a module are satisfied with the quality.* This indicator is based on responses to an optional survey included at the end of each module. The indicator is based on the number of learners that either 'strongly agreed' or 'agreed' with the statement 'Overall, I am satisfied with the quality of the module' in the 13-statement survey. We then divided this number by all students that filled out the same question (i.e. the ones that were less satisfied). In addition, the average satisfaction rate per module was calculated. The target was set to 75%. We have included all responses available for all modules in the reporting of this indicator, irrespectively of the number of responses we had. It is recognised thought that the modules with few responses (less than <12), weight the same as the ones with higher responses and this requires careful interpretation (Rantanen, P., 2013).

Indicator 4 - Quiz pass indicator This indicator shows the number of learners that obtain a badge out of those who have completed one module and have attempted the quiz (*i.e. the quiz is in progress or finished*). The indicator is obtained combining three different platform reports, namely the 'OLC Completion' report (for information about module completion and badge status), the 'End-of-module quiz' report of OLC's 'Quiz Grader for quiz information, and the 'Enrolled users' report to restrict the data to the learners outlined in the Enrolment indicator section above. The target for this

⁶ OLC reports are only available to users with special privileges on the platform, such as course owners, course creators and so on.

indicator was set to 75%. This indicator uses as denominator all learners who have started the quiz (there are three possible attempts for the quiz) including those who may be halfway through an attempt or have failed their first or second attempt (these are learners who have not passed yet), and learners who have failed their three attempts.

4.1.3 Methods used in the monitoring and evaluation of the Global AMR curriculum

Analytics report generator – used to aggregate the data generated in the OLC platform. OLC provides for each course and pathway several reports, such as the 'Enrolled users report', the 'OpenLearn completion report', or the 'End-of-module quiz report' and others, which are downloadable as csv/Excel files. To facilitate the analysis of the learner data, a bespoke script (implemented in the statistical software R) gathers the information from all these files and transforms them into an analytics report which shows the values for all discussed indicators for all courses and pathways. These data are presented in Section 4.2.1 and 4.2.2.

OLC platform logs – used to identify trends among visitors to the OU Fleming collection/modules. This is generated automatically on a weekly basis and does not distinguish between enrolled users and visitors. Unique visitors to the course are counted once per device/browser in the specified timeframe and this number is usually higher than the number corresponding to enrolled users. Platform logs include unique and total visitors to the modules, geographic location of the visitors to the modules, average time spent on each of the modules and the devices used to access the modules. The data are reported in Section 4.2.3.

End-of-module satisfaction survey – used to capture students' satisfaction from the modules. It was embedded in each of the 25 modules. The survey consisted of four main questions: the first question, designed on a five-point Likert Scale and comprised of 13 statements (e.g., Overall, I am satisfied with the quality of the module; The language and instructions were clear and easy to follow) was the main satisfaction question. The average rate for each of these statements per module was calculated. We have included all responses available for all modules in the reporting of this data, irrespectively of the number of responses we had. The open-ended questions had a major focus on knowledge application, namely whether or to what extent the students were able to integrate their new knowledge into their day-to-day work and bring changes in their practices. A limitation with the end of module survey is that it appeared in all modules and the low number of learners filling in the survey, especially for modules that have been released in later stages of Grant 2, may be explained by the fact that learners were reluctant to fill in the same survey more than once. The analysis of the end-of-module survey is reported in Section 4.2.4. The number of responses to the end-of-module survey is presented on Table 4D in Annex 4.

Pre- and post-module surveys – the links to both online surveys were shared in the Fleming collection landing page. A link to the post-module survey was also included in selected modules as they were released. Participation in both surveys was voluntary but a key distinction in the two surveys was that while every visitor to the OU Fleming online collection could fill in the pre-module survey, only people who enrolled in the modules were asked to complete the post-module survey. There are no links between the two surveys and it was not possible to track if the same people had filled in both surveys.

- i. Pre-module survey: it included 31 questions divided into six sections, namely “Demographics”, “Workplace”, “Role and Technology use”, “AMR online modules”, “Understanding of Antimicrobial Resistance” and “Expectations from the AMR online modules”. The survey was launched on 4th January 2021 when the first modules went live on the platform and remains open. For the purposes of this report, we are using data that were collected between 4 Jan and 1 August 2021. In total, 451 participants (n=451) completed and consented for their data to be used for reporting purposes. The analysis of the pre-module survey is reported in Section 4.2.5.
- ii. Post-module survey: it included 21 questions in areas such as “experience of online modules”, “the impact of online modules on their work practice” and finally some questions to understand participants’ demographic and professional background. The survey was launched on 4th January 2021 when the first set of Fleming modules were made available online and remains open. Reminders to complete the post-module surveys were sent via email to all enrolled users. For the purposes of this report, we are using data that was collected from 4 Jan until 31s August 2021. In total, 32 participants (n=32) completed and consented for their data to be used for reporting purposes. The analysis of the post-module survey is reported in Section 4.2.6.

Interviews with students – used to generate richer information about how the modules have been received by students, how they organised their learning online, as well as any impact their learning had on their work practice. The invitation to an interview was distributed via email to all survey respondents who expressed willingness to take part in an interview (approx. n=80). Additionally, invitations were sent to students who had completed at least one of the online modules, as per OLC platform data available in July 2021. Further to this, due to limited number of positive responses to these invitations (especially among animal health sector) we reached out to in-country partners in Nepal and Ghana and team leads who led the AMR toolkit activities to recommend members of staff who enrolled on the online modules. Twenty students have responded to an invitation to take part in interviews (n=11 male, n=9 female; n=15 from human health sector, n=5 from animal health sector), representing nine Fleming fund countries. The students had a variety of roles in their organisations: lab scientists (n=4), research assistants (n=5), lab technicians (n=2), vet instructor (n=2), data scientist (n=1), pathologist (n=1), technical officer (n=1), economist health adviser (n=1), microbiologist (n=1), lecturer (n=1) and fishery officer (n=1). All the students (excluding two) had prior experience of learning online. All the interviews were conducted online from 8 July to 20 August 2021 (average time: 39 minutes). The analysis of the student interview data is reported in Section 4.2.7.

All the interviews were transcribed, and the transcriptions were transferred to QSR NVivo 12 qualitative coding software for analysis. As thematic analysis is an iterative process (Braun & Clarke, 2006), NVivo 12 was employed to systematically organize the themes emerging through the analysis. Similar approach was employed to analyze qualitative responses to the end-of-module satisfaction survey, pre-module survey and the post-module survey.

The various tools used in the monitoring and evaluation of Grant 2 are provided in Annex 3.

4.2 Analysis of the data generated in the evaluation of the Global AMR curriculum

4.2.1 Platform analytics per module

All the pathways (n=10) and modules (n=25), as agreed in Grant 2, were released within the reporting period (see Figure 3.4 for release dates). Table 4.1 below presents data generated in response to the metrics agreed with Mott MacDonald for all the modules in the OU Fleming collection. This data were collected on 1st September 2021 and data reported here was accurate at the point of collecting it.

At the time of writing this report, the highest number of students have enrolled in the first introductory module 'AMR Surveillance and You' (n=360) which exceeds the target set of 250 enrolled students in this module. The next two modules with the highest number of enrolments are 'The problem of antimicrobial resistance' (n=140) and 'Introducing Antimicrobial resistance' (n=98). All modules with the highest number of enrolled students (>40 students; Antimicrobial susceptibility testing, Introducing AMR surveillance systems and Introducing a One Health approach to AMR) were released in the first phase of the launch of the Global Curriculum (Jan – March 2021) (see Fig. 3.4 and Annex 2, Table 2A), which might explain why modules that were released in the final stages of the project have fewer students enrolled. It was also observed that module enrolments were affected by promotional work taking place from Mott MacDonald (for example for the launch of the collection). Overall, platform analytics show that there were 454 'unique' students enrolling across modules (i.e. counting person A only once, independently if person A signed up to several modules).

With regards to the percentage of students completing the activities, in most modules (n=19) this lies between 35% to 60%. The average percentage of the students across modules that have completed the activities is 45%, which shows that almost one in two of the enrolled students have completed the activities. Table 4.1 shows that among the students who completed the activities, the majority also completed the quiz and claimed and received a badge. The average percent of students receiving a badge is 43%.

In terms of percentage of students attempting and completing the quiz in each module, from the quiz-pass indicator in Table 4.1 we can see that almost all students who completed the activities and attempted the quiz were successful students who received a badge. This table also shows that in a few modules, a number of students might have not completed all the activities but were still attempting the quiz (e.g. Module AMR surveillance in animals, An introduction to AMR surveillance). Even if a student could successfully complete the quiz, s/he could not claim a badge because part of the requirements was to complete all the activities in the module.

With regards to the percentage of students that are satisfied after completing the modules, this is 78%, which exceeds the target set of 75%. This rate is calculated on the module level, after averaging all the responses collected in the end-of-module satisfaction survey in each module. Table 4.1 shows that there are six modules with 100% satisfaction rates, whereas the satisfaction percentage is between 60% to 90% in half of the modules (n=12). Only three modules have a satisfaction rate of less than 60%. Of note, some of these modules, especially the ones that were released in later stages of the project, had few responses in the end-of-module survey.

Table 4.1 Platform analytics per module*

Code	Modules	Release date	No of Enrolled users	% of students completing the activities	% of Badges awarded	% of students completing quiz	% of students attempted the quiz after completing the activities	% of students after completing a module are satisfied with the quality	Downloads
5356	AMR surveillance and You	20 Jan	360	39	NA	NA	NA	71	230
6549	AMR surveillance in animals	27 May	10	20	20	30	100	100	1
6547	An introduction to AMR surveillance	27 May	22	68	68	77	100	57	24
6551	An overview of national AMR surveillance	29 Mar	14	50	50	50	100	67	6
6542	Antimicrobial resistance in animals	27 May	23	61	61	70	100	46	8
6560	Antimicrobial stewardship in animal health	24 Jun	5	60	60	60	100	no data	no data
6558	Antimicrobial stewardship in clinical practice	17 Aug	3	0	0	0	no data	no data	no data
5594	Antimicrobial susceptibility testing	29 Mar	54	35	35	41	100	71	20
6552	Communicating AMR data to stakeholders	24 Jun	10	40	40	50	100	67	no data
6559	Diagnostic stewardship in clinical practice	27 May	2	50	50	50	100	no data	5
6554	Fundamentals of data for AMR	25 Feb	37	43	43	43	100	80	1
6546	Introducing a One Health approach to AMR	25 Feb	44	32	32	39	100	88	29
6548	Introducing AMR surveillance systems	25 Feb	45	40	40	49	100	78	13
5554	Introducing antimicrobial resistance	20 Jan	98	37	37	43	100	59	111
6849	Isolating and identifying bacteria (animal health)	24 Jun	17	35	35	53	100	67	6

6543	Isolating and identifying bacteria (human health)	29 Mar	33	49	42	46	88	75	85
6553	Legal and ethical considerations in AMR data	24 Jun	12	58	58	67	100	100	10
6556	Processing and analysing AMR data	29 Mar	20	35	35	40	100	80	7
6545	Quality assurance and AMR surveillance	25 Feb	29	31	31	31	100	100	15
5624	Sampling (animal health)	29 Mar	17	35	35	59	100	100	51
6550	Sampling (human health)	29 Mar	16	44	38	38	100	100	1
6557	Summarising and presenting AMR data	27 May	11	36	36	55	100	67	21
6544	Testing for mechanisms of resistance	27 May	16	38	31	31	83	no data	23
6447	The problem of antimicrobial resistance	20 Jan	140	84	56	56	100	62	51
6555	Using AMR data for policy-making	17 Aug	3	100	100	100	100	100	4

**Data accurate as of 01 September 2021*

In terms of number of downloads, with the exception of three modules for which no data was available at the time of writing this report, Table 4.1 further shows that most modules have been downloaded at least once if not several times⁷. The top three modules with the highest number of downloads include: AMR surveillance and You (n=230), The problem of antimicrobial resistance (n=111) and Isolating and identifying bacteria (human health) (n=85). Opting for downloading the content might show that the students preferred studying the materials offline. An implication for students who opted for the offline modality was that they could not demonstrate that they completed all the activities and as a result they could not complete the quiz or claim a badge and this might have affected the analytics collected from the platform.

4.2.2 Platform analytics per pathway

All ten pathways were completed by mid-August 2021. Although information about the pathways were available in the OLC platform, many modules in each pathway were not available while the global AMR curriculum was under development. At the same time, communication about the OU Fleming collection had focused on the release of the modules. As a result, many students might have been unaware of the possibility of enrolling on a pathway.

Table 4.2 Platform analytics per pathway*

Pathways	Number of enrolled users	Number of students who received a statement of participation
Pathway of AMR for a clinical services professional	21	0
Pathway of AMR for a laboratory professional in animal health	15	2
Pathway of AMR for a laboratory professional in human health	54	3
Pathway of AMR for a senior laboratory professional in animal health	8	1
Pathway of AMR for a senior laboratory professional in human health	24	0
Pathway of AMR for a senior management clinical services professional	4	0
Pathway of AMR for a senior management veterinary services professional	10	1
Pathway of AMR for a veterinary services professional	20	1
Pathway of AMR for data scientists and epidemiologists	45	4
Pathway of AMR for policy-makers	16	1

*Data accurate as of 01 September 2021

⁷ This number shows the number of times particular file formats have been downloaded but it does not show if that is multiple downloads by the same person or single downloads by individual people.

Table 4.2 above presents the total number of learners that have enrolled in each pathway. It also shows the total number of students that have received a statement of participation. A statement of Participation is provided to a student who enrolls in a pathway and completes all the modules included in that pathway. This data were collected on 1st September and data reported here was accurate at the point of collecting it.

At the time of writing this report the highest number of students (n=54) were enrolled in the ‘Pathway of AMR for a laboratory professional in human health’, while the ‘Pathway of AMR for a senior management clinical services professional’ has the lowest number of enrolled students (n=4). Table 4.2 further indicates that at least one student in seven pathways (n=7) have received their ‘Statement of Participation’. Data associated with the pathways were not part of metrics agreed with Mott. This data is included as it offers some insights which may be explored further in the coming months.

4.2.3 Platform logs

At the time of writing this report⁸, a total of 2,376⁹ visitors have accessed the OU/Fleming modules (January to October 2021). Across the modules, a total of 8,452 visits took place while the average time a visitor spent on the platform was approximately 32 minutes (see Table 4.3). As Figure 4.1 shows, most visits took place between February and March 2021 (19.3%) and between June and July 2021 (38.4%). This seems to coincide with the release of promotional materials by Mott MacDonald and DHSC. A fifth of the visitors (21.1%) visited the modules through the Fleming Fund official website, while three quarters (77.5%) typed or bookmarked the Fleming OU online collection web address.



Figure 4.1 Visits to the OU Fleming modules

⁸ Data accurate as of 18 October 2021.

⁹ Visitors to the module are counted once per device/browser in the specified timeframe. This figure includes the enrolled users. Total visits to the module refers to the total number of times the module is accessed.

The majority of the visits (82%) took place in a non-mobile device (i.e. desktop, PC, laptop – see “other” in Table 4.3), followed by visits on a mobile phone (16.8%), which shows that learners could access the materials using a range of devices. Eighteen out of twenty-four of the Fleming Fund countries are represented among the Top 25 geographic locations of visitors to the OU Fleming modules (Table 4.3). Visitors from the Fleming Fund countries consist almost half the visitors to the platform (47.3%).

Table 4.3 Platform Logs across all OU Fleming online modules

Total Visitors	Total visits	Average time spent	Devices used	Geographic location of visitors (top 25 countries)		
				Fleming Fund countries	LMICs	Rest of world
2,376	8,452	31:52	Other (82%); mobile phone (16.8%); tablet (1.3%).	Nigeria (14.8%) Ghana (7.2%) Nepal (3.8%) Pakistan (2.9%) Kenya (2.6%) Bangladesh (2.4%) Cambodia (2.2%) India (1.9%) Timor-Leste (1.4%) Uganda (1.2%) Malawi (1.2%) Bhutan (1.1%) Tanzania (1.1%) Vietnam (0.8%) Senegal (0.7%) Papua New-Guinea (0.7%) Eswatini (0.7%) Myanmar (0.6%)	Malaysia (3.4%) Benin (1.3%) Cameroon (1%)	UK (16.3%) Australia (3.4%) USA (5%) South Korea (0.9%)

**Data accurate as of 18 October 2021*

When examining the platform logs per module, the highest number of visitors are reported in the first introductory module ‘AMR Surveillance and You’. This module had 1322 visitors (incl. the enrolled users) and 3078 total visits. The next two most visited modules are ‘The Problem of Antimicrobial Resistance’ (n=413 visitors, n=1145 total visits) and ‘Introducing antimicrobial resistance’ (n=327 visitors and n=962 total visits) (see Table 4.4). These three modules were released in the first phase of the launch of the Global AMR Curriculum.

In terms of the time spent on each of the modules, Table 4.4 suggests that most visitors have spent on average 46 min in each visit on the site, which shows that their visit was prolonged. An exception to this seems to be the module ‘An introduction to AMR surveillance’ where the average time spent was approx. 13 min. This might also be linked to the low levels of student satisfaction reported in this module (57%, Table 4.1)

Table 4.4 Platform Logs per module

Course code	Modules	Release date	Visitors	Total visits	Geographical locations (top ten countries)	Average time spent	Devices used
5356	AMR surveillance and You	20 Jan	1322	3078	Nigeria, United Kingdom, Ghana, Cambodia, Malaysia, Nepal, Kenya, Benin, Pakistan and Papua New Guinea	00: 28:59	Other, mobile, tablet
6549	AMR surveillance in animals	27 May	73	193	United Kingdom, Australia, Nigeria, Ghana, Tanzania, Timor- Leste, Cambodia, Germany, United States, and Malaysia	00:52:09	Other, mobile
6547	An introduction to AMR surveillance	27 May	111	280	United Kingdom, Nigeria, Benin, Cambodia, Australia, Papua New Guinea, Ghana, Taiwan Region, Germany and Zimbabwe	00:13:06	Other, mobile, tablet
6551	An overview of national AMR surveillance	29 Mar	68	143	United Kingdom, Cambodia, Australia, Germany, Nigeria, Ethiopia, Cameroon, Hungary, Senegal, and Guinea	00:46:48	Other, mobile
6542	Antimicrobial resistance in animals	27 May	145	341	United Kingdom, Timor-Leste, Nigeria, Malaysia, Cameroon, Australia, Ghana, Kenya, United States, and Bhutan	00:48:20	Other, mobile, tablet
6560	Antimicrobial stewardship in animal health	24 Jun	69	260	United Kingdom, Australia, Nigeria, Senegal, Malaysia, Timor-Leste, Tanzania, New Zealand, Cambodia and Ghana	00:45:47	Other, mobile, tablet
6558	Antimicrobial stewardship in clinical practice	17 Aug	26	96	United Kingdom, Ireland, Uganda, Cambodia, Berlin, Cameroon and Ethiopia	00: 43:14	Other, mobile
5594	Antimicrobial susceptibility testing	29 Mar	252	674	United Kingdom, Pakistan, Nigeria, Australia, Papua New Guinea, Benin, Kenya, Lao People's Democratic..., Timor-Leste, and Cambodia	00:41:35	Other, mobile, tablet
6552	Communicating AMR data to stakeholders	24 Jun	170	54	United Kingdom, Nigeria, Australia, Tanzania, Senegal, Germany, Cambodia, Timor Leste, South Korea, and Cameroon	00:54:05	Other, mobile phone
6559	Diagnostic stewardship in clinical practice	27 May	65	149	United Kingdom, Nigeria, Australia, United States, Tanzania, Cameroon, Nepal, Timor- Leste, Germany and Swaziland	00:40:59	Other, mobile phone
6554	Fundamentals of data for AMR	25 Feb	176	386	United Kingdom, Ghana, Australia, Nigeria, Benin, Cambodia, India, United States, Bhutan, and Belgium	00:41:49	Other, mobile, tablet
6546	Introducing a One Health approach to AMR	25 Feb	212	411	United Kingdom, Nigeria, Cambodia, Benin, Nepal, Malaysia, Cameroon, Australia, South Korea and Bangladesh	00:50:44	Other, mobile, tablet
6548	Introducing AMR surveillance systems	25 Feb	210	471	United Kingdom, Ghana, Timor- Leste, Papua New Guinea, Australia, Benin, Nigeria, United States, Cameroon, and Cambodia	00:44:51	Other, mobile, tablet

5554	Introducing antimicrobial resistance	20 Jan	327	962	United Kingdom, Nigeria, Timor-Leste, Papua New Guinea, Cambodia, Ghana, Bhutan, Australia, Nepal and Benin	00:44:57	Other, mobile, tablet
6849	Isolating and identifying bacteria (animal health)	24 Jun	56	247	United Kingdom, Nigeria, Australia, Cameroon, Ghana, Cambodia, Mexico, Bhutan, Tanzania and Philippines	00:54:25	Other, mobile
6543	Isolating and identifying bacteria (human health)	29 Mar	172	391	United Kingdom, Nigeria, Cambodia, Australia, Kenya, Benin, Ghana, Germany, Uganda and Bangladesh	00:47:22	Other, mobile, tablet
6553	Legal and ethical considerations in AMR data	24 Jun	63	149	United Kingdom, Australia, Nigeria, Benin, Cambodia, Senegal, South Korea, Singapore, Vietnam, and Germany	00:56:20	Other, mobile
6556	Processing and analysing AMR data	29 Mar	106	277	United Kingdom, Bhutan, Ghana, Benin, Cambodia, Timor-Leste, Senegal, Nigeria, Australia and Tanzania	00:51:42	Other, mobile, tablet
6545	Quality assurance and AMR surveillance	25 Feb	142	306	United Kingdom, Nigeria, Ghana, Benin, Australia, Myanmar, Kenya, Timor-Leste, United States, and Bangladesh	00:50:37	Other, mobile, tablet
5624	Sampling (animal health)	29 Mar	79	166	United Kingdom, Timor-Leste, Australia, Ghana, Nigeria, Senegal, Switzerland, Philippines, South Korea and Hungary	00:50:35	Other, Mobile
6550	Sampling (human health)	29 Mar	74	136	United Kingdom, Ghana, Cambodia, Nigeria, Germany, Australia, Taiwan Region, United States, Timor-Leste, and Cameroon	00:52:29	Other, mobile
6557	Summarising and presenting AMR data	27 May	79	203	United Kingdom, Ghana, Australia, Cambodia, Senegal, South Korea, Nigeria, Tanzania, Switzerland, and Malaysia	00:49:33	Other, mobile, tablet
6544	Testing for mechanisms of resistance	27 May	81	256	United Kingdom, Benin, Uganda, Kenya, Nigeria, Malaysia, Australia, Nepal, Singapore, Germany	00:52:13	Other, mobile phone
6447	The problem of antimicrobial resistance	20 Jan	413	1145	United Kingdom, Nigeria, Ghana, Cambodia, Papua New Guinea, Benin, Timor-Leste, Nepal, Malawi and Kenya	00: 46:30	Other, mobile, tablet
6555	Using AMR data for policy-making	17 Aug	28	96	United Kingdom, Cambodia, South Korea, Singapore, Switzerland Cameroon, Malaysia and Ethiopia	00: 50:28	other

**Data accurate as of 13 September 2021*

Regarding the geographical location of the visitors to the modules, Table 4.4 shows the top ten countries and suggests that the Fleming Fund participating countries were represented in the geographic location of the unique visitors to the modules. The UK is featured prominently in this list which might reflect that many of the project stakeholders are based in the UK but also the interest that might have been generated following the distribution of promotional materials from Mott/DHSC during the reporting period.

With regards to the digital devices used to access the modules, the platform logs indicate that visitors to the platform were using a variety of devices. This points that learners were able to access the materials on their phones or tablets. The category 'other' in Table 4.4 include any other digital devices such as laptop and desktop computer. The order used to present the three categories in the table indicate the frequency the category appears in the data.

4.2.4 End-of-module survey

An end-of-module survey was embedded in each of the modules to help capture students' views about their learning from the modules and any impact of the modules on their work practice. . The number of responses to the end-of-module survey is presented on Table 4D in Annex 4.

Other than the statement related to satisfaction (see Table 4.1), the end-of-module survey comprised of 12 additional statements, that are presented in Table 4.5. This table indicates the overall percentage of students who agreed with these statements. Most statements share high ratings of agreement of over 70%. The two statements with the higher level of agreement are about time requirements to take the modules being appropriate (77.1%), which points to good design of the modules, as well as the statement that the respondent would use what s/he learned in the module in his/her daily work which points to the connection between theory and practice (77.48%). The statement with the lower rate of agreement is related to the module developing practical skills (69.14%), an aspect however which was not part of the OU Terms of Reference in Grant 2 for the development of the Global AMR Curriculum.

The evidence generated in the open-ended questions in the end-of-module survey suggests that the modules have contributed to five categories:

First, the modules helped students gain new knowledge and improve awareness and understanding about AMR, as illustrated in the following quotes¹⁰:

"After taking part in this online module, I have some unexpected information related to antibiotic in food production both crop and meat production. I have never heard of that issues before, so it made me change the way how I think about AMR".

¹⁰ We have left the responses in the survey as gathered, no amendments to language used. Excerpts selected are prototypical for all the other (similar) feedback on the points raised.

“ [...] the completion of this module AMR data collection, management and analysis. I have from now on a deep understanding of the value of inferential statistical methods and how to interpret results to provide valuable information for evidence-based decision making.”

“This module has improve my knowledge in antimicrobial resistance because in past I don't know how the microbes in an organ become resistance to the antibiotic, for now I can understand the process that antibiotics become resistance in an animal.”

Table 4.5 Overall percentages of students' agreements in the end-of-module survey

Statements	Percentage
The amount of time required to take the module was appropriate for my personal circumstances	77.1
It was easy to navigate the module website to access the learning materials	76.43
The language and instructions were clear and easy to follow	75.19
Sufficient opportunities were provided to check my understanding on the module	73.52
The module was relevant to my job role and workplace	75.48
The module showed me how I can do certain activities at work (e.g., doing a test, entering data or making critical decisions)	69.14
The module helped me to identify areas of improvement at my workplace or solve workplace problems	69.43
I was able to link the module to my previous experience and/or knowledge	76.67
My level of understanding about AMR has improved compared to before taking this module	75.48
During the module I had opportunities to reflect on what was taught and/or talk to my colleagues about it	72.76
It is very likely that I'll use what I learned in this module in my daily work	77.48
I have a clear idea about my next module choice	70.67

**Data accurate as of 20 September 2021.*

This newly acquired knowledge also seemed to have an impact on the perceived levels of confidence students were reporting:

“I was hesitant to talk about AMR with colleagues as I felt I lack in-depth knowledge about the subject matter. Thanks to this course, I'm slowly gaining confidence as I learn more about AMR.”

Third, students indicated that the modules motivated them to carry on learning about AMR and share their knowledge with others:

“This module gave me a lot of inspiration how to teach/explain AMR to people who have limited knowledge about bacterial infections/diseases and antimicrobials e.g., to farmers”;

“During one of our meetings this week on outlining our priorities for 2021, I was able to contribute and explain why we need to collaborate with already existing international bodies working on AMR”.

Fourth, the evidence generated indicated that a few students had already made some changes in their work practice because of participating in the online modules while others expressed intentions to act in the future:

“I have dispensed antimicrobials and counselled the patient on use of antimicrobials for infection. Emphasized more on rational use of antibiotics and risk of AMR. I am happy that i made them aware of AMR and superbugs.”

“This module has increased my understanding of mode of action of different antibiotics and this will help me in choosing the most appropriate antibiotic to treat skin infection in my everyday practice”;

“I will be using CLSI breakpoints from now on. Also, I will be careful with interpreting the inhibition zone.”

In terms of the quality of the modules, most of the respondents to the survey appreciated the quality, associated with good structure, practical examples and resources available: *“The course was simple and easy to follow with a lot of real- life examples”*; *“The course is structured very well and the explanation and visual aids used are very easy to understand and absorbed the information”*. More specifically, many students reported that the videos and the quiz have been very helpful for them.

4.2.5 Analysis of pre-survey

This section presents data generated in the [pre-module survey](#) (see Annex 3). In total, 451 visitors to the OU Fleming online collection (19% of all visitors – see Table 4.3) completed the pre-survey and consented for their data to be used for reporting purposes¹¹. There was no requirement to have enrolled on a module to be able to take part in the pre-survey

4.2.5.1 Demographic information

Gender and Age - The analysis of surveys shows that 55% of participants were male and 44% female. The majority of the participants aged between 35 and 44 years old followed by 25-34 and 45-54 age groups. Only 7% of participant aged below 25 and a small minority fell into 55-64 age group (Table 4.6).

Qualifications - Considering the highest level of participants' education, the majority (34%) had a master's degree while 26% possessed an undergraduate degree. A small number of participants also

¹¹ Note that 21% of respondents were Fleming Fellows.

held a PhD or EdD (14%) followed by participants who had a diploma (6%) or a certificate (2%). This suggests that nearly half of participants were educated to a postgraduate level (Table 4.6 and Annex 4, Figure 4A).

Table 4.6 Participants' demographic information

Category	Findings	
Gender	Male	55%
	Female	44%
	Prefer not to say	1%
Age	35-44	40%
	25-34	36%
	45-54	14%
	Under 25	7%
	55-64	3%
Qualification	MA/MSc	34%
	BA/BSc	26%
	Other	17%
	PhD/EdD	14%
	Diploma	6%
	Certificate	2%

English proficiency level - Since the online modules are offered in English, the participants were also asked about their proficiency in English to check if their engagement with the modules would be affected by the language. The results suggest that most learners had a good level of proficiency in understanding, reading, writing and speaking English, as the below Table 4.7 shows:

Table 4.7 Participants' English proficiency

	Understanding English	Speaking English	Reading in English	Writing in English
Very confident	63%	54%	68.5%	57%
Mostly confident	30%	36%	26%	35%
Not very confident	1%	2%	0.5%	2%
Slightly confident	6%	8%	5%	6%

Country of residence – Respondents to the survey were from 53 different countries. Table 4.8 shows the top 15 participating countries. As can be seen, 10 out of 15 countries are Fleming countries with the highest number of participants from the West Africa region. This aligns well with the findings from the analysis of the platform logs (see Table 4.3). For the full list of countries, please see Annex 4, Table 4A.

Computer literacy - Participants were asked about their level of computer literacy to establish if accessing and engaging with an online course would cause an issue. Most participants indicated that

they are very (52%) or mostly (39%) confident in using computers and technology and only a minority reported low level of computer literacy (9%).

Table 4.8 Participants' country of origin

Country	Findings
1 Nigeria*	38%
2 Ghana*	11%
3 Nepal*	6%
4 Cambodia	6%
5 Bangladesh*	4%
6 Malaysia	4%
7 Pakistan*	3%
8 UK	3%
9 Thailand	2%
10 Papua New Guinea*	2%
11 Kenya*	2%
12 Tanzania*	1%
13 Cameroon	1%
14 Vietnam*	1%
15 Timor-Leste*	1%

**indicates Fleming Fund countries*

Finding out about the Fleming online modules - We also checked how participants were informed about the Fleming online modules and it was found that most participants were informed about them by a colleague (29%) which might indicate that enrolled users were recommending the modules to others. "WhatsApp groups", "Fleming Fund emails and newsletters", and "professional distribution lists" were other means through which participants were informed about the modules. Table 4.9 provides more details in this regard.

Table 4.9 Ways through which participants were informed about the Fleming online modules

Information source	
From a colleague	29%
From a WhatsApp group	16%
From the Fleming fund email/newsletter/website	15%
From my professional group distribution lists	14%
From AMR networks in my country	8%
From social media (e.g., Twitter, Facebook)	7%
Other	6%
the notice board in my organisation	4%
From the Open University website	1%

4.2.5.2 Workplace information and work experience in AMR

Information about the workplace among the respondents to the survey was also collected to gain an understanding of the ways the participants potentially may use knowledge and skills gained from the Fleming modules in their workplace or practice.

Employment and sectors - The data revealed that 82% of participants were in employment at the time of visiting the OU Fleming online collection while 3% preferred not to provide such information. Nearly half of the employed participants were working in the capital city (55%) and 37% in urban areas. Only 9% of participants' organisation was based in rural areas. The distribution of these organisations in terms of their sector is presented in Figure 4.2. As can be seen, most participants worked in human health sector (43%) followed by the animal health sector (37%). Compared to these two sectors, there were fewer participants from agriculture and livestock (11%) or environment (5%) sectors.

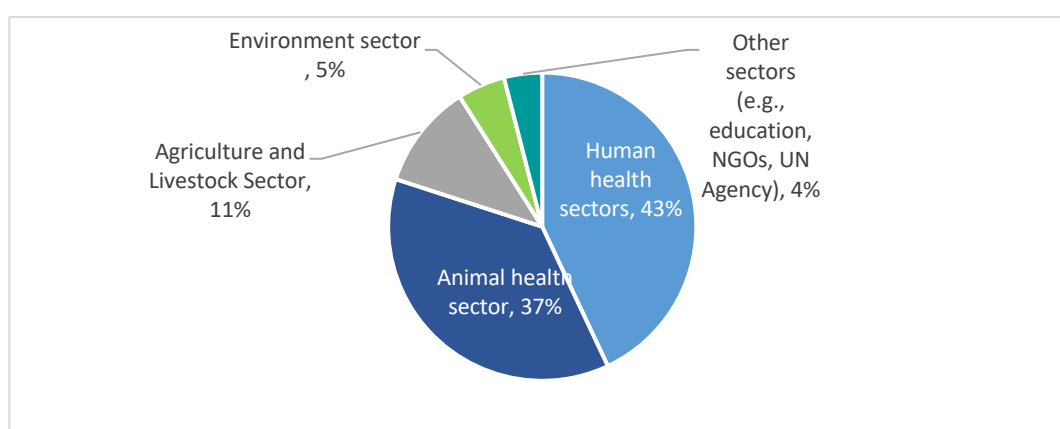


Figure 4.2 Work sectors represented in the survey responses

Roles - Based on data from those participants who provided a title for their roles and where the role¹² was reported by more than one person, the following roles were recognised for survey participants. Participants' responses were not always clear as some participants used general phrases such as "coordination", "evaluator", "regulator" or "Feed, farm, food". Table 4.10 shows the top fifteen responses. Similarly, Table 4.11 presents the units within an organisation where these roles were mainly based (see Annex 4, Table 4B, Table 4C for a full list of roles and units).

Table 4.10 Work roles of the respondents in the pre-survey

Role	Number
Lecturer, senior lecturer or professor	31
Research officer, assistant and fellows	27
Laboratory scientist	18
Veterinary Officer	17

¹² There were many roles that were stated by one participant only. A few examples are: Bio security regulator, Fleming Fund programme Lead, livestock officer, Poultry Pathologist, Animal quarantine officer, Anaesthesiologist, Tuberculosis Diagnostics Specialist, Global Health Manager, National One health Expert and First Responder.

AMR-related roles	16
Consultant	13
Pharmacist and pharmacy assistant	13
Lab technicians	12
Vet technicians	12
Veterinarian	12
Epidemiologist	11
Microbiologist	11
Manager or director	10
Head of lab or lab manager	7
Medical doctor	7

Table 4.11 Units where the respondents were based

Unit	Number
Microbiology	118
Bacteriology	60
Other	36
Public health	25
Epidemiology	21
Clinical services	20
Veterinary clinic	13
Serology	11
Research unit or centre	10
Diagnostic, prevention and treatment	9
Animal health	9
Pathology	9
Pharmacy	9
Medicine	8
AMR Surveillance	8

Professional experience in the health sector - Most participants had minimum 3 years of working experience. Nearly equal percentage of participants had between 3-8 years and 9-14 years of experience. Interestingly, equal number of participants were placed at the two extreme ends of the experience scale, i.e. 11% have had worked less than 2 years in the health sector and 11.5% had more than 20 years of experience.

AMR surveillance networks - From the surveys it was also established that more than half of participants (57%) are working in the organisations that are part of their country AMR surveillance network. 22% of participants confirmed that their organisation is not part of the AMR national surveillance network while 19% did not know about their organisation status. A minority of 1% would prefer not to share such information. Of note that, 68% of organisations which are not currently part of the national AMR network in their country have future plans to do so.

Use of technology - A final piece of information about participants' workplace was related to their *Use of technology to perform their duties*. Surveys revealed that nearly all of participants use technology, however, to varying degree. Most participants (91%) use technology multiple times a day to fulfil their duties. 4% of them use it once a day or 2 to 3 times per week. A minority of 3% reported that they use technology rarely, i.e. once or twice per month (see Figure 4.3).

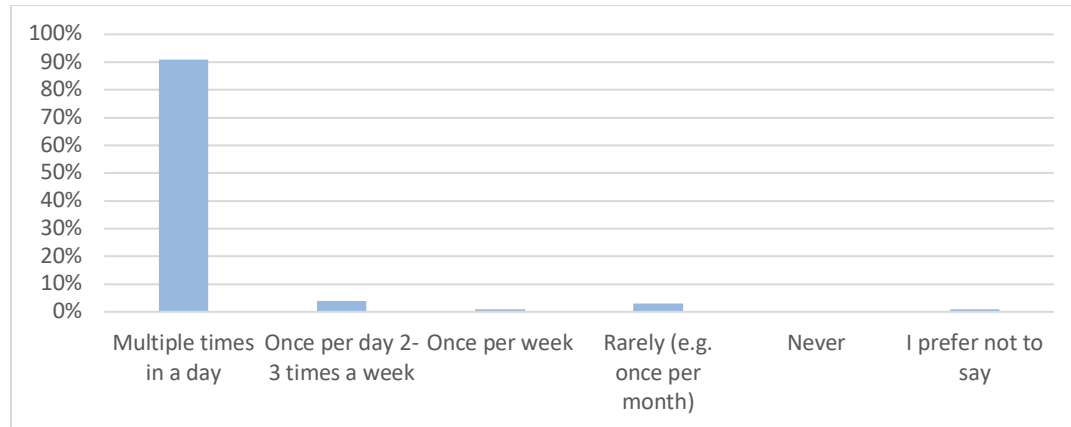


Figure 4.3 Use of technology by participants for their work

4.2.5.3 Learning experience and Fleming online modules

The Section 5 of the pre-survey was designed to gain an understanding of learners' previous learning experience (online and related to AMR), their motivation to enrol on the modules and the potential barriers to their learning. Additionally, the questions aimed to elicit some information about the ways in which modules would benefit participants.

Previous online learning experience - The responses showed that the majority of participant (66%) did not have any previous experience of online leaning and Fleming online course was their first experience. This suggests that participants may have required more time to familiarise themselves with online learning and to navigate their way through online modules and pathways. 32% of participants experienced online learning previously and 2% were not able to remember any information in this regard.

Previous AMR training or professional development - Considering previous training on AMR, most participants (66%) indicated that they took training opportunities while for a small number of participants (32%), Fleming course was their first AMR related professional development training.

Motivation to enrol on Fleming online modules - Responses to the survey revealed several motivations for engaging with the online modules. Table 4.12 summarises top ten reasons participants mentioned for enrolling on the modules. The most frequently cited motivation was "improving knowledge and learning more about AMR". Some examples of participant's responses are: "To gain knowledge about AMR and its consequences in our health"; "I started my KAP study on AMR last couple of years and now working on AMR PPS in the country, I think I do need to learn more in this area to sharpen my knowledge to be able to work with other experts"; "Want to have a more in-depth knowledge of antimicrobial resistance. The certificate is also an added bonus".

Table 4.12 Participants' motivation to enrol on the course

Motivation	Instances (n)
To improve my knowledge and to learn more about AMR	230
Personal interest	57
Being involved in AMR related activities	39
For professional development and capacity building	39
For education and research purposes	28
To improve my practice	26
Flexibility and accessibility of online modules	22
For career progression or	12
Suggested by others	11
Work/fellowship requirements	11

Another frequently cited reason was “personal interest” in AMR or AMR related activities. Statements such as “*personal interest*”, “*curiosity to understand more on the subject*” and “*my interest in AMR*” are a few examples from the participants’ responses. Most of other top 8 motivations (e.g. being engaged in AMR activities, to improve my practice, for professional development) were related to participants’ career. An interesting finding regarding participant’s motivation was related to online delivery. Some participants stated that the main reason for enrolling on the modules was the flexibility and accessibility that online learning provided to them.

“Online learning is more feasible, low-cost and most of them are free. There is no barrier for everyone to learn by online platform. We can learn without interfering our current job. That is why, I usually choose online learning platform”;

“It is comfortable and flexible for me as a public servant, while working I can study.”

“I realised it is the easiest and more convenient means to acquire professional knowledge and skills, especially with the current restrictions of traveling and social distancing due to Covid-19 pandemic”.

Potential benefits from participation in the online modules - the pre-survey also examined how participation in the Fleming modules would benefit participants. Five main areas of benefits were identified in their responses, as following: i. Gain knowledge about AMR; ii. Gain access to resources about AMR; iii. Gain knowledge about AMR surveillance systems; iv. Learn about One Health approach; and v. learn about data processing for AMR. Other potential benefits of Fleming modules are presented in Figure 4.4.

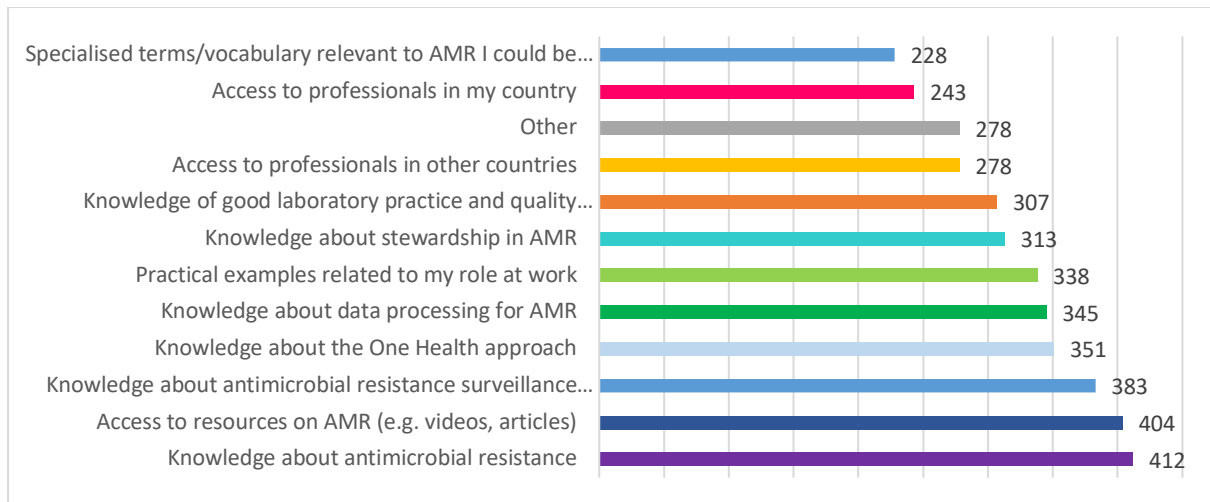


Figure 4.4 Potential benefits of Fleming modules for participants¹³

AMR knowledge and level of confidence about AMR and related activities - Participants’

knowledge about AMR and their confidence in performing AMR-related activities were assessed in the pre-survey. The knowledge, skills and activity categories were considered based on the findings from Fleming Fund Grant 1. As Table 4.13 shows, there are four areas that participants feel mostly or very confident about AMR: “recognising AMR as a global issue”, “recognising AMR as a local issue”, “your organisation’s role in relation to AMR” and “the way their role contributes to tackle AMR”. The responses show participants feel least confident in *using data in AMR surveillance*, which is area that scored very low by most participants. Similarly, participants expressed low confidence in *using specialised terms and vocabulary relevant to AMR*. The two other areas that obtained a low confidence score by participants are *their current knowledge and understanding of AMR* and *Talking to their colleagues about AMR*. These self-reported results suggest that participants require AMR-related professional development training to enhance their knowledge and skills.

Expectations from Fleming online modules – Participants were asked to outline their expectations from the Fleming online modules. Responses show that most participants expected to:

- Gain more knowledge and understanding about AMR, AMR surveillance and in some cases One Health approach or update their knowledge;
- Learn how to tackle AMR;
- Learn how to collect, analyse, interpret and report AMR data;
- Develop new skills or improve the existing ones;
- Network (and collaborate) with colleagues from other organisation/countries.

¹³ 1st statement in the graph is “Specialised terms/vocabulary relevant to AMR I could be using in my job”; 5th statement is “Knowledge of good laboratory practice and quality management systems” and 10th statement is “Knowledge about antimicrobial resistance surveillance system” (see Annex 3, pre-survey).

Table 4.13 Participants' perceived level of confidence about AMR knowledge and related activities

Knowledge, skill, or activity	Not at all	Not very	Slightly	Mostly	Very
your current knowledge and understanding of antimicrobial resistance	4%	42%	42%	11%	
talking to a colleague about antimicrobial resistance	1%	5%	38%	38%	17%
the ways your work role contributes to tackling AMR	2%	6%	27%	41%	24%
your organisation's role in relation to AMR	2%	7%	24%	34%	33%
the significance of AMR as a global issue	1%	3%	15%	28%	53%
the significance of AMR as an issue locally	2%	4%	19%	29%	46%
your current knowledge and understanding of AMR surveillance	3%	8%	47%	32%	10%
your current use of specialised terms and vocabulary relevant to AMR	3%	13%	43%	31%	10%
Using data in AMR surveillance	8%	25%	42%	18%	7%

Potential changes as the result of engaging with Fleming modules - Participants also described changes they could occur because of taking part in the online modules. Their responses formed 8 categories of potential changes as shown in Table 4.14. The majority of participants expected that the modules would improve their knowledge and current practices or work. They were also hoping that the modules help them enhance an existing skill or help them develop new ones. A smaller group of participants expected the modules to enable them to communicate AMR-related matter better and with more confidence. This aspect as can be seen in the below example varied based on participants' current roles: *“Reporting and dissemination of AMR information to clinicians and other members of the medical team on regular basis”*; *“Better communicating to our partners, the role of animal holdings' biosecurity and infectious animal diseases regarding the One Health approach”*; *“My ability to communicate scientifically about AMR issues”*; and *“understand more about concept of AMR and communicate more effectively with counterpart”*.

Table 4.14 Potential changes after taking part in the Fleming online modules

Expectation	Instances (n)
Improved knowledge and understanding	96
Improved work or current practice	92
Improved current skills or acquired new ones	80
Better communicating AMR-related matters to relevant partners or stakeholders	33
Better understanding of how to reduce AMR	22
Gaining more confidence	20
Knowing how to collect, understand and manage AMR data	17
Improved research around AMR	13
Others	26

A similarly key expected change was “increased confidence”. However, some participants were specific about areas in which they hoped to be more confident:

“Confidence in not using antibiotics where not needed”

“My confidence about creating AMR awareness”

“my confidence in impacting my knowledge on AMR to farmers”

“be more confident to protect my opinion about AMR”

“be confident about including more AMR surveillance interventions to our approach which has mainly been focused on Stewardship and Infection prevention & control”

Enablers and barriers of applying learned knowledge or skills to work - Finally, the survey elicited what may encourage or inhibit participants from applying what they would learn from the Fleming modules to their day-to-day work. The answers from those who specified factors revealed a wide variety of enablers and barriers; the most common that are mentioned by more than 5 participants are summarised in Tables 4.15 and 4.16. Many participants (n=60) did not provide a response to this question other than “nothing”, “none”, “not sure”, “unknown” or “N/A”.

In addition to factors summarised in Table 4.15, “training and development opportunities”, “participants contribution to AMR activities within their organisation” and “gained confidence” as a result of engaging with the Fleming online modules were other enabling factors stated by a few participants. Based on data in Table 4.15, it can be concluded that a combination of personal factors such as motivation to tackle AMR or sharing AMR knowledge, as well as factors associated with the work environment such as leadership support or availability of resources are likely to support participants to use what they have learned from the online modules in their workplace.

In relation to factors that inhibit participant to apply their learning to their work, many participants (n=80) were not able to identify any barriers at the time of completing the survey. A number of participants identified a few potential barriers which are summarised in Table 4.16 with an accompanying example.

Table 4.15 Enablers of applying learned knowledge from Fleming online modules to work/practice

Enablers	Instances (n)	Examples
Improved or new knowledge	57	<i>“My improved knowledge is definitely encouraging”;</i> <i>“Better and proper knowledge on AMR will definitely encourage me to apply it at my workplace for better results”.</i>
Availability of resources (equipment, funding, human resources)	38	<i>“Availability of lab equipment and consumables.”;</i> <i>“Having the right tools to work with”;</i> <i>“Funds to expand tests to include monitoring animals for Antimicrobial residue”.</i>
Motivation to tackle AMR	25	<i>“AMR is a serious issue and in the laboratory, I see highly resistant pathogens every day. I see many patients having trouble getting better due to those pathogens and some already died. Seeing this problem encourage me to learn more and try my best to help on AMR issues”;</i> <i>“The quest to eliminate antimicrobial resistance”.</i>
Leadership and organisation support and involvement	20	<i>“Support from leadership will enable me to apply the new skills”;</i> <i>“Institutional support and management political will”;</i> <i>“Support from management in my workplace”.</i>
Colleagues who understand AMR and an enabling working environment	14	<i>“When most of the staff in my workplace also acquire good knowledge and skills relating to AMR”;</i> <i>“Colleagues who understand AMR knowledge”;</i> <i>“Enabling environment. Inhibition will arise from lack of advocacy on AMR”.</i>
Share AMR knowledge with others and raise awareness about it	10	<i>“learning new strategies and information to share with partners”;</i> <i>“Awareness in the community regarding AMR may encourage me to practice these skills”;</i> <i>“Proper enlightenment of farmers and my clients on the importance of judicious use of antibiotics will help me to apply my new skills on AMR”.</i>
Collaboration with others (e.g. AMR working groups, industrial partners)	8	<i>“Industrial collaborations will encourage me to learn more about AMR and help them control it”;</i> <i>“opportunity to collaborate with international partners”;</i> <i>“Collaboration with other colleagues who knows the implication of AMR and are ready to apply the new innovation and ideas.”</i>
Fleming online modules	6	<i>“This online course will encourage me.”</i> <i>“No inhibition, this study is an encouragement enough.”</i>

Table 4.16 Barriers of applying learned knowledge from Fleming online modules to work/practice

Disablers	Instances (n)	Examples
Lack of resources (human, funds, equipment)	62	<i>“Lack of facilities to use the knowledge and skills I acquire from this course will be a major inhibiting factor”;</i> <i>“If my organization does not provide the necessary equipment and consumables needed to work”;</i> <i>“Funds to expand tests to include monitoring animals for Antimicrobial residue”.</i>
Lack of relevant stakeholders’ awareness or interest in AMR	22	<i>“Lack of awareness regarding AMR among our patient may inhibit me to apply knowledge.”;</i> <i>“Ignorance of colleagues”;</i> <i>“Getting non-health related people to understand the concept of AMR”.</i>
Organisational policies, structure and procedure	17	<i>“Maybe inhibited by the protocols and bureaucracy that are supposed to be followed at my workplace.”;</i> <i>“Poor organization structure”;</i> <i>“Organisational policy”.</i>
Lack of support from leadership or colleagues	17	<i>“The bosses may not want me to apply to things that we do at work”;</i> <i>“The level of authority and responsibilities. I can suggest to my upper-level managers, but they are the one who permit the practice or not”;</i> <i>“Lack of support from the management of the hospital”.</i>
Time	10	<i>“I will be inhibited by time constraints”;</i> <i>“Time and human resource constraints”.</i>
Lack of policy and guidelines (at organisational, local or national level)	7	<i>“Lack of good policies on ground”;</i> <i>“[lack of] Proper policy and guidelines on its use”;</i> <i>“Policy hurdles which are not updated timely”.</i>
Lack of AMR data	5	<i>“Proper policy and guidelines on its use and lack of data on AMR”;</i> <i>“...needs attention especially in developing countries where no data is available. e.g., Nepal”;</i> <i>“availability of data and the understanding on the principles of AMR management”.</i>

4.2.6 Analysis of post-surveys (n=32)

The post-survey was available in specific modules and unlike the pre-survey that could be completed by everyone who visited the Fleming online collection, the post-survey was open only to enrolled learners who had participated in at least one module. Note that no links can be made between the respondents in both surveys.

The [post module survey](#) (see Annex 3) included 21 questions asking enrolled students about their “experience of online modules”, “the impact of online modules on their work practice” and finally some questions to understand participants’ demographic and professional (work) background. In total 32¹ participants (9% of the enrolled users in Module A ‘AMR Surveillance and You’) completed the survey and consented for their data to be used for reporting purposes. These were people who completed one or more Fleming Fund modules. This section reports the main findings from the surveys.

4.2.6.1 Demographic and background information

Gender and age - The analysis of the surveys shows that more than half of participants (53%) who completed one or more Fleming Fund online modules were female and 47% male which indicates a relative gender balance. Equal numbers of participants (n=9) fall within the two age groups of 25-34 and 35-44 and only 1 participant was aged between 45-54 years old. There was no participant over 65 years old and 5 participants were aged under 25.

Qualifications - The majority of participants hold an undergraduate degree (31%), followed by participants who possess a PhD or EdD (25%) and a master’s degree (22%). This shows that most participants who completed the module(s) are educated to a post-graduate level. A small number of participants (9%) have a diploma or a secondary school certificate (3%). 9% of participants also indicated that they are PhD candidates (see Annex 4, Figure 4B).

Table 4.17 Participants’ country of residence

Country	Number
1 Ghana*	7
2 Nigeria*	6
3 Nepal*	5
4 Timor-Leste*	3
5 Papua New Guinea*	2
6 Pakistan*	1
7 Bangladesh*	1
8 Kenya*	1
9 Myanmar *	1
10 Uganda*	1
11 Cambodia	1
12 France	1
13 Hungary	1
14 Benin	1

*Indicates Fleming Fund countries

Country of residence - Participants who completed the online modules were from 14 different countries. As can be seen in Table 4.17, 10 out of 14 countries are Fleming countries and from the West Africa followed by the South Asia region.

English proficiency level - Since the online modules are offered in English, the participants were asked about their proficiency in English to check if their engagement with the modules was affected by the language. The results suggest that most learners had a good level of proficiency in understanding, reading, writing and speaking English, as the below Table 4.18 shows:

Table 4.18 Perceived English proficiency among survey respondents

	Understanding English	Speaking English	Reading in English	Writing in English
Very confident	53%	37%	53%	41%
Mostly confident	37.5%	44%	44%	53%
Not very confident	-	-	-	-
Slightly confident	9.5%	19%	3%	6%

Computer literacy - Similarly, participants were asked about their level of computer literacy to check if accessing and engaging with the online modules has been an issue for their learning. Most participants indicated that they are very (50%) or mostly (41%) confident in using computers and technology and only a minority reported low level of computer literacy (9%).

4.2.6.2 Workplace information and work experience in AMR

Information about participants' workplace was also collected and the data showed that 81% of participants were in employment while 16% did not have a job. A small group of participants (3%) did not provide any information in this regard. More than half of the employed participants were working in the capital city (58%) and 27% in urban areas. Only 15% of participants' organisation was based in rural areas. The distribution of these organisations in terms of their sector is presented in Figure 4.5. As can be seen, most participants worked in human health sector (45%) followed by the animal health sector (32%). Compared to these two sectors, there were fewer participants from agriculture and livestock (16%) or environment (5%) sectors.

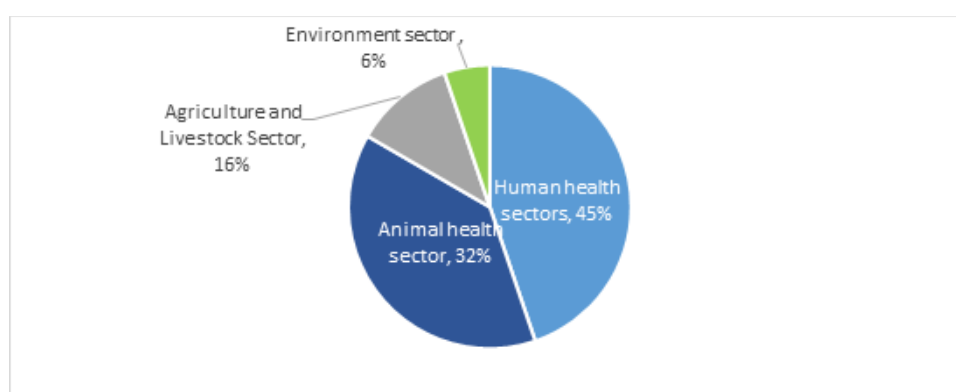


Figure 4.5 Sectors represented among post-module survey respondents

The surveys also collected some information about participants' roles. Of 26 responses received, participants were mainly lab scientists, technicians or technical officers and veterinary officers. Table 4.19 summarises top five of the reported roles. Table 4D in Annex 4 provides a full list of participants' roles.

Additionally, the survey checked participants' years of experience in their current organisation, and it was found that most participants (n=8) have been working in their organisations for between 9-14 years.

Table 4.19 Participants' roles

Role	Number
Laboratory scientist	5
Laboratory Technical Officer or Technician	4
Veterinary Officer or Technician	4
Federal epidemiology officer	2
Surveillance Specialist	1

4.2.6.3 Learning experiences and Fleming online modules

The first section of the post-module survey aimed to provide an understanding of modules' features that participants found most useful, the activities or content they enjoyed most, factors that facilitated or hindered their learning and finally the impact of online modules on their confidence in certain AMR related activities.

The most useful module features - As Table 4.20 illustrates, 'case studies and exemplar materials' are module features that participants found most useful to their learning, followed by 'course content about microbes, microbial resistance and tackling AMR', 'Reflective questions that required participants to consider their AMR knowledge' and 'video content'.

The responses also indicate that "links to websites that required participants to find information" and "discussion with colleagues at work or beyond the course" were found least useful by participants. In additions, "blogs" are the features with the highest percentage of not being used by the participants. This information is particularly valuable for future AMR course design and development in a professional context as they suggest activities and content type that can contribute more to learning about AMR.

Table 4.20 Most useful features of the Fleming online modules

	Very useful	Slightly useful	Not very useful	Not at all useful	I did not use it
videos	78%	9%	6%	-	6%
Course content about microbes, microbial resistance and tackling AMR	88%	9%	-	-	3%
Questions which asked you to reflect on your knowledge about AMR	81%	16%	-	-	3%
Questions which asked you to reflect on how the content related to your work problems	66%	31%	-	-	3%
Case studies/exemplar material	91%	9%	-	-	-

Blogs	25%	56%	6%	-	13%
Glossary	56%	31%	6%	-	6%
Links to websites which required you to find information	66%	16%	12%	-	6%
The learning journal	53%	31%	9%	-	6%
Discussions with colleagues at work/beyond the course	66%	19%	9%	3%	3%

Most enjoyable module features - Participants were asked to specify what they enjoyed most about the Fleming online modules. There were some features such as “simplicity and clarity of the content”, “relevance of modules to work” or “knowing further about AMR” that were reported more frequently by the participants. Table 4.21 summarises such features.

“The online modules on AMR that I like most were Antimicrobial susceptibility testing and Antimicrobial stewardship because it is related to my job and the explanation is very clear and it makes me understand how bacteria become resistant in animal or human”

Table 4.21 Most enjoyable module features

Most enjoyable features	Instances (n)	Examples
Knowing further about AMR	6	<i>“It enlarged my learning about AMR”; “Knowing further about AMR”. “The materials and the videos are very clearly and useful. It helps me to get well understanding about AMR and develop my self-awareness on how to processing AMR data and study about AMR surveillance”;</i>
Simplicity and clarity of content	6	<i>“simplicity of explaining things in modules and mostly definitions of some terms”. “It has helped me acquire knowledge and skill that is relevant to my job”;</i>
Relevance of modules to current role/work	4	<i>“I do like most about these modules because at the moment my work is relating to AMR especially in animals. As a veterinary technician at XX School of Health Research, this module very helpful for me to learn, improve my knowledge and implement in my work”.</i>
Quizzes	2	<i>“quiz that followed every activity”; “questions at the end”.</i>
Illustrations and visual aids	2	<i>“Illustrations and the way the text has been modified with simplicity so that everyone can understand it well”;</i>

		<i>"What I like most is the visual aids diagram explanation is very much helpful in understanding the course much more clearer."</i>
Self-paced nature of modules	2	<i>"You can do them at your own convenient time"; "Learning on my own pace".</i>

Enablers and barriers of learning - The survey also collected some information about the factors that supported or hindered participants' learning, and it was found that "learning more about AMR and related topic" encouraged most participants to engage with the online modules as the following responses show:

"The fact the I'll get to learn more encouraged me to study the modules"
"I took these modules and found that this is very helpful for us especially for me because this is a good opportunity to improve my knowledge and gained more experience about AMR in animal"

Other factors that supported participants' learning were mainly related to the modules and their content. Some examples of such features include simple-to-understand language, course outline and content, graphics and videos or ease access (anytime, anywhere) (see Table 4.22).

Table 4.22 Factors that supported online learning

Encouragers	Instances (n)	Examples
Learning more about AMR	7	<i>"The desire to learn more about AMR"</i>
Module(s) outline and content	3	<i>"The informative graphics and videos encouraged me to take online modules"</i>
Simple-to-understand language	1	<i>"What supported me was the language used was simple to understand so it encouraged me to do the online modules more"</i>
Ease of access to materials	1	<i>"Support - easy access to the learning material anytime"</i>

Considering the barriers to learning, the responses revealed that *internet connectivity* and *electric-related issues* were the main barriers to most participants' learning. Statements such as *"the internet connection was one of the problems that discouraged me from learning this module because sometimes I can't access to some videos and link and takes more time to access"* or *"the internet facility and electricity facility are very less in our country which made me hard to get online courses"* show some issues around accessing the online modules. Another difficulty seems to be *"time constraints"*, as some participants found it difficult to find enough time to engage with the module(s):

"Unfortunately, I didn't get enough time because of work and family issues"

Table 4.23 outlines other reported barriers. Of note that 6 participants did not specify any barrier or did not answer this question.

Table 4.23 Barriers to participants' learning

Barrier	Instances (n)	Examples
Internet connectivity	8	<i>"Nothing, but data and lack of institutional internet accessibility"</i>
Electricity-related issues	3	<i>"what nearly discourage me is the situation of power in my Country and specifically in my area, also the cost of data"</i>
Time constraints	3	<i>"Time constraint"</i>
Long study hours to complete a module	2	<i>"Discouragement will be from the long modules hours"</i>
Repeated log-ins required	1	<i>"The information was great but it's discouraging signing in after logging off and having to search for the course you are studying. Signing in again should take you straight to where you left off!"</i>
Not understanding some videos	1	<i>"some videos were not clear"</i>

Issues accessing the online modules – The survey also included a question whether students had any access issues. The main challenge reported was unreliable or slow internet which affected their access to modules negatively. Another most frequently stated issue was re-log ins or re-registrations required by the platform. For example, a participant stated that *"when I have completed a module, I just have to go back to the initial link and click to go to the course and register for a new module again"* or another participant mentions that *"I found it a bit difficult to get back to a course I am studying after I log off and sign in again"*. A few participants reported issues related to specific websites like YouTube being firewalled at one's institution:

"Sometimes some of the videos I can't access to because my device is locked by IT center in our workplace. Actually, I can't access the platform such a Youtube".

Nearly a third of the participants (n=11) reported no issues and five (n=5) did not provide any answer to this question (see Table 4.24).

Table 4.24 Issues accessing the online modules

Issue	Instances (n)
No issues	11
Slow and unreliable internet	8
Re-log ins and re-registrations	3
Exploring and navigating the course	1
Managing time	1
Others	2

Devices used – A survey question required participants to indicate if they had an appropriate device, broadband/data, time or ICT skills to access and engage with the modules. The answers to this

question show that 91% of participants had access to a device such as a tablet or laptop to engage with the course; however, this percentage reduces to 66% when participant comment on their access to the broadband or data as a quarter of participants' (25%) did not have good access to the internet. When "sufficient time for studying the modules" is considered, half of participants believed they had enough time (54%) while 24% stated they were struggling with time. It seems participants felt fairly confident about required ICT skills to engage with the modules since 72% reported sufficient level of digital skills (see Table 4.25).

Table 4.25 Access to devices and broadband

Statement	Strongly disagree	Disagree	Neither Agree /disagree	Agree	Strongly agree
I had access to a device (laptop, tablet, mobile phone) to access the online modules most of the times.	3%	0%	6%	19%	72%
My broadband/ data allowed me to easily access the modules and materials	9%	16%	9%	16%	50%
I had sufficient time to complete modules	9%	15%	22%	23%	31%
I was able to access the modules from different locations (e.g. home, workplace, a combination of both)	3%	12%	3%	22%	59%
I had enough digital (ICT) skills to go through online modules	3%	3%	22%	22%	50%

4.2.6.5 Impacts of Fleming online modules

Perceived level of confidence in AMR knowledge and related activities after completing one or more Fleming online module(s) - As Table 4.26 shows, there are four areas that participants felt mostly or very confident about regarding AMR, namely "understanding the significance of AMR as a global issue", "understanding the significance of AMR as a local issue", "their current knowledge and understanding of AMR" as well as "AMR surveillance" and finally "talking to a colleague about AMR". In comparison, the responses show participants felt least confident in "processing and analysing AMR data" and "Legal and ethical considerations in AMR data". These two areas are generally scored the lowest by participants and suggest that future professional development opportunities should aim to enhance skills related to dealing with AMR data.

Table 4.26 Participants' perceived level of confidence about AMR knowledge and related activities

Knowledge, skill, or activity	Not at all	Not very	Slightly	Mostly	Very
your current knowledge and understanding of antimicrobial resistance	3 %	6 %		47%	44%
Talking to a colleague about antimicrobial resistance	3 %	3 %	6 %	38%	50%
The ways your work role contributes to tackling AMR	3 %	16%		25%	56%
Your organisation's role in relation to AMR	6 %	10%		28%	56%
The significance of AMR as a global issue	3 %		19%		78%
The significance of AMR as an issue locally	3 %	6 %	19%		72%
Your current knowledge and understanding of AMR surveillance	6 %	6 %		38%	50%
Your current use of specialised terms and vocabulary relevant to AMR	3 %	16%		38%	44%
Using data in AMR surveillance	3 %	6 %	19%	38%	34%
Legal and ethical considerations in AMR data	13%	9 %	13%	31%	34%
Processing and analysing AMR data	9 %	16%	19%	28%	28%

Impact of Fleming online modules on improving identified gaps in Grant 1 - The post-module survey also checked the extent to which Fleming online modules contributed to areas of improvement identified by the OU Fleming Grant 1 (see Logic Model Section 2.1). Table 4.27 shows that the online modules have contributed to addressing all these areas; however, the extent of contribution varies from one area to another. The first two areas of improvement that 94% of participants agree or strongly agree on are the contribution of online modules to acquiring knowledge and skills that are relevant to participants' jobs and the opportunity to improve their work. The second area of improvement is the increased participants' awareness of AMR being a

multi-sectoral challenge and helping them learn more about AMR (91% agreement). This led participants to believe that the online modules provided them with an opportunity for their professional development. 87% of participants also strongly agree or agree that as a result of taking Fleming they are encouraged to incorporate new practices related to AMR surveillance into their work.

What is least encouraged by the modules (53%) is the use of social applications and technologies (e.g. WhatsApp) for learning and connecting with other professionals. Although this area is not largely addressed by the online modules, the AMR Toolkit that accompanies the online content has considered several opportunities for social learning, team building and connecting with other professionals.

Table 4.27 Participants' perceived impact of Fleming modules

Statement	Strongly disagree		Disagree	Neither Agree /disagree	Agree	Strongly agree
The online modules helped me learn more about AMR and develop my self-awareness that AMR is a multi-sectoral challenge	3%	6%	13%		78%	
The online modules offered me an opportunity for my professional development	3%	6%	22%		69%	
The online modules helped me acquire knowledge/skill that is relevant to my job	3%	3%	25%		69%	
The online modules have offered me an opportunity to improve in ways that are relevant to my role	3%	3%	25%		69%	
The online modules have offered me an opportunity to collaborate with other people and to know how my work relates to the work of others in the AMR	3%	6%	6%	31%		53%
The online modules have encouraged me to use social apps (e.g. WhatsApp) for learning and connecting with others	3%	9%		31%	28%	28%
The online modules have encouraged me to incorporate new practices related to AMR surveillance into my work		6%	6%	31%		56%
The online modules provide me with an opportunity to restructure my work	3%	3%	12%		38%	44%

Enablers and barriers in applying new knowledge or skills to work - The post-module survey also checked what would encourage or inhibit participants from using what they have learned at their work. Based on responses from participants it becomes clear that the “global fight against AMR” and “information and new knowledge acquired from the Fleming modules” are the two most frequently cited factors that encourage participants to use what they have learned in their workplace. The following factors were also mentioned by participants but only once: ‘Representing AMR data accurately’, ‘Management support’ and the module on surveillance system design. Eight participants (n=8) did not report any factors and responded to this question with “nothing” (see Table 4.28).

Table 4.28 Factors encouraging participants to apply their newly learned knowledge to work

Encouragers	Instances (n)	Examples
Fight against a global challenge	7	<i>The new practices adopted for AMR practice should be employed in every organization. The new types of microorganism with newly defined mode of resistance are being discovered and they need to be monitored for the safe of the society. What encourage me to applying new AMR knowledge or skill to my work practice is as we know that AMR is a global problem so many people will die if we are not taking care of this. Even in our country we have a low used of antibiotics in animal but sometimes people like farmers they don't know what is AMR? How antibiotics can become resistance in animals? How it can transmit to human? and so on.</i>
Knowledge and information acquired from the Fleming modules	6	<i>The knowledge that the online modules impart has encouraged me to apply it at my workplace for the benefit of patients. Information acquired has prompted me to talk more about the dangers of AMR to my residents.</i>

The main inhibitor is related to the work environment and linked to “unavailability of resources” and this includes:

- Lack of financial resources or limited funds
- Unavailability of antibiotic sensitivity test and lack of advanced diagnostic facilities
- Lack of materials, reagents, chemicals and some equipment for advance microbiology methods like EPI

4.2.7 Analysis of interview data with students enrolled in the online modules

We conducted semi-structured interviews with students enrolled in online modules (n=20). At the time of the interviews, most students had enrolled in one of the ten available pathways in the OU Fleming online collection. Most of the interviewees (n=14) had completed between 2 and 4 modules. One student, in particular, had completed three pathways and another one had completed

one pathway. The following section presents the main findings from the analysis of the interview data¹⁴.

4.2.7.1 Motivations and expectations from the online modules

Interview data point to several reasons that motivated students to enrol to the online modules. First, many students (n=16) reported that they were keen to extend their knowledge or gain new knowledge about AMR “to get a deep and detailed knowledge about this” (P14AH). Few others (n=4) appeared to be motivated by the global developments around AMR and opportunities to find out about what is happening in countries beyond theirs, as indicated in the following: *“I wanted to know what it's all about. And all those mechanisms, and what the world is looking at, how the world is looking at it”* (P15HH). Hoping to get some support in their day-to-day work (n=3), that may also lead to changes in their practices (n=4) were two more reasons identified in the interviews: *“That will also help me to know how to modify my way of doing work to be able to meet the global expectations [...]”* (P18HH). A number of students (n=4) got to find out and enrol on the modules following recommendation by their managers or senior staff: *“I got this information from Dr. xxx, and he told me to study these modules”* (P11AH); *“Because I was requested by my fellow mentor”* (P2HH). One student, reported that s/he hoped that his/her organisation will benefit from his/her learning (n=1). Finally, a few students (n=5) joined the course out of curiosity for the course itself: *“I just went online to learn, to have a feel of how the platform looked like”* (P6HH); *“Searching through Google, I found keeping the keywords like antimicrobial resistance, antimicrobial. And I found this [course], so then I tried to see how it would be”* (P8HH).

In terms of their expectations, most students (n=14) seemed to have an expectation that they would be able to enhance or gain new knowledge about AMR: *“As it was related to antimicrobial resistance, I was expecting that I would get to learn about AMR and how it is prevalent in a global, as well as local and national, level”* (P11AH). One student had an expectation that the modules would help him understand his role in AMR surveillance, while for other five students (n=5) the expectation was that they would be able to learn practical skills that they can use in their workplace such as AMR data handling (testing, analysis, management): *“I wanted the module to be something that I could apply, something that would relate to me. I did not want it to be abstract. So, I was looking for a module that was specific to what I do, not a module that is quite abstract that I can't relate to it [...]”* (P12HH).

Following this, another question was looking at whether students' expectations have been met. Most students (n=14) reported that their expectations have been met and four of them (n=4) further reported that they learnt more than what they expected: *“In my view, it's [course] amazing. It's amazing [...] Well, I wasn't actually expecting it. But I think it's good stuff”* (P6HH). Only one student responded that his expectations had not been met (P13).

¹⁴ Each student is represented with the alphabet 'P' followed by a number 1 to 20. In order to indicate whether students were from human health sector or animal health sector, an abbreviation is included after their respective numbers (AH for animal health sector, HH for human health sector).

4.2.7.2 Organising learning

A set of interview questions focused on how students organised their learning. In terms of the devices used to access the modules, interview data indicate that most of the interviewees used a laptop, while a few of them used multiple devices, depending on the location they were while studying: *“I was doing both the phone and then with my laptop”* (P8HH); *“Whenever I'm at work, I use the PC, the office PCs, the desktop that we have, and then the laptop”* (P10HH).

Many students reported feeling comfortable with studying online: *“I prefer being on this site, which gives me a sense of being on a task”* (P6HH) but the data suggest that they also liked the feature of being able to download the module materials. This is verified by the OLC platform reports and the number of downloads in each module (see Table 4.1). As expected, the main reason reported was connectivity issues, which greatly affect LMICs:

“When you get the internet, you prefer to download them and read them later. Because maybe to read them online directly, sometimes, you might not get the internet working fully [...]” (Participant, 18HH).

Another reason reported was linked to what students could do with the materials. For example, one student reported that he could annotate the printed materials. It also seems that the location of study and whether they were using a private or a public machine (i.e. PC at workplace) had an effect on the decision to download or not. For the student in the first excerpt that follows, downloading allowed him to choose a space at his workplace without any distractions, whereas the second had no option of downloading as s/he was using an institutional computer:

[...] whenever I'm at work and I'm at work proper, that means I'm always behind a screen. And whenever people see you behind a screen, they feel you are doing anything other than work [...] it causes a lot of distraction [...] So as much as possible, I try to have my sheet so I can go hide somewhere and go through the modules that way (P10HH).

“I was using the organisation's computer, the institution's computer. I wasn't using my personal computer. So that's why I didn't download (P16HH).

Other students whose only access to internet is through work, they opted for downloads so they could study these at home.

“We don't have access to Internet every day 24/7. So, when we have access at work I normally downloaded and when I have time during weekend so in the in the night I just go back and start looking at it” (P19AH).

An implication for students who opted to study the modules offline was that they could not demonstrate that they completed all the activities hence could not complete the quiz and claim a badge.

In terms of the location where students were accessing the modules from, the findings are mixed. Some students seemed to access the modules from their organisation because of better access to technology and internet connectivity: *“I did it at work. We have a free Wi-Fi service, internet at work and I also have a PC at work. So basically, I did the online learning at work”* (P12HH). A few others seemed to access the modules both from home and organisation - *“What I have been doing, when I go to my place of work very early in the morning if I find there is space for me, I open my computer, I start working on these modules. But mainly, I've been doing it at night when I've come back from work at home”* (P15HH). Finally, three students reported that they had access to the modules only from home and this meant that they were engaged in learning in their own time. *“I completed the all the pathways at home. I did have to manage my time, so I work from roughly eight to five so it's. I did it after work after hours”* (P20AH).

Indeed, time management was reported by interviewees as an important factor during their studies because of their workload pressure. This might have affected the completion rates that have been collected in the OLC platform analytics. A way they have dealt with this was to study before they started work and/or during their break time:

OK, so what I do is, when I get to work, that is when I download most of the materials. And normally, I try to at least use 30 minutes before I start work, because when I start work, I might not be able to get time to go through the materials (P18HH).

I come to work at least three hours before we start work, so during that time from 5:00 AM to 8:00 AM. That's the time that I log onto the website to study the modules first [...]. In between work, if I have no samples waiting to be amplified, then during the time too I log on and I don't download module site. I do it like in real time because I'm using Wi-Fi (P7HH).

A few others seemed to study only at night: *“I would not take them during the day. I take them around 11-10, 11-12. And when I'm tired, I leave it there and work and fall asleep”* (P6).

For two students in particular, (P1HH, P14AH) developments around covid19 and the lockdowns in their country had in fact helped them with their studies: *“Regarding time, fortunately, in Nepal, when I knew about the module, we were in lockdown. And we still are in lockdown. So, it was not difficult for me to manage time* (P14AH).

One of the interviewees pointed to an unexpected way of organising their learning. This interviewee was nominated by the team lead who tested the AMR Toolkit in an organisation in Nepal. The student reported that they formed a team of six, across different organisations, and held online meetings every week to discuss their learning and how they can apply their learning into their work.

We used to have a meeting once weekly. Every week [INAUDIBLE] [...] we fixed a time that we will learn these modules. And we will discuss in meetings. And we used to discuss about that module in the meeting-- next meeting. And we perform this almost six, seven weeks we have done this. We have several meetings in Zoom [...]. And we discuss about the module, how can we apply this module, what can be further done (P13AH).

Of these six students only one have enrolled into the course. One of the team members (P14AH) would download the module materials and share these with the rest of the team. Then, they were all going through the PDF files and meet once a week to discuss their learning and as indicated in the excerpt above, this took place over a period of six to seven weeks. The platform analytics gathered in the OLC platform do not reflect such self-organised teams of professionals.

4.2.7.3 Students' views about the modules and their learning

Part of the interview questions were used to examine students' views about the quality of the modules. The evidence generated suggest that almost all students appreciated the quality and made positive remarks about the language used:

I think the language is very straightforward and clear. And if you are a lab person, you can easily understand whatever is being said in the tests [...] the content, I said it is very good, I wish every lab person would have the opportunity to go through these modules, because it's very good (P18HH).

The language is down to Earth. Frankly, it's very, very easy to comprehend (P10HH); Someone who is not an expert can just read and understand it [the course] so I think that's something good (P19AH).

Responses also highlighted the good quality of the audio-visual resources used and the quizzes:

The information contained in the module. They are so nice. Especially the perspective that it gave on One Health. I have not looked at it that way. But reading from the module, I had-- I really understood the concept of One Health [...] The contents were great. The contents were great (P12HH).

The videos were-- yeah, it just works very well [...] the videos actually makes things easier for me. And then, yeah, the quizzes also good. It actually tests the knowledge on what you have read so far. (P16HH)

Additionally, almost all the students (n=18) reported that the objectives of each module were made clear to them "right from the beginning of the courses through till the end" (P10HH), though for two it did require students to have some prior knowledge in the field of AMR.

All the students have indicated that the online modules were a good learning opportunity for them and they have supported their learning:

What I feel is I have learned a lot on AMR through this course, and also as a Fleming fellow I've learned a lot from AMR. That's why I can talk a lot on AMR and I can train a lot on AMR. And just knowing how AMR has become a global threat. All this knowledge is through these courses. That's what I have gained (P4HH).

As a result of their participation in the online modules they reported an improved understanding of AMR (n=13), including AMR data management, interpretation and reporting (n=5) and better understanding of their roles in AMR surveillance network (n=5). Furthermore, around a quarter of students have indicated that the course has helped them to establish better communication channels with their colleagues (n=5). More than half of the students (n=12) seemed to be interested in sharing their knowledge and modules links and/or recommending the course to their colleagues: *"I would recommend most of my unit members to also sign up to look at the module. In my view, it's amazing"* (S6HH). Three of them reported that they have already recommended the course to their colleagues and also shared PDF files of some modules with other colleagues: *"I also downloaded some of the course, which I share with my friends"* (P14AH).

One interviewee (P13AH) mentioned that he organised a training with 40 technicians where he shared his newly acquired knowledge from the modules.

In terms of the challenges that students faced in their learning, interview data point to 4 main challenges:

The first one is related to time - *"It's just a battle of just restructuring my time to be able to get enough time for this online course"* (P12HH); *The timing was a bit of challenge for me because my work kept me on my toes every hour, and then I had to be working* (P9HH).

The second one is related to navigating the site online (n=6) - *"One thing I would like to say about this is that the website was very complex, and I was having challenges navigating through the website [...] personally, I had to manoeuvre my way [...] it was very challenging"* (P16HH).

Access to the internet and electricity seemed to be another major challenge for a quarter of students (n=5): *"We have problems with the internet. We have problem with the power going off. You are deep in a module, power goes off for two hours. So, it disorients you [...]"* (S15HH).

Finally, one student (P5HH) reported that she faced some challenges in understanding the videos, but she appreciated the transcription included in the module: *"Since English is my second language, sometimes I may not understand the pronunciation. At that time, I used to download the description and I see that description, and then I hear it. So that will help me to understand everything clearly"* (P5HH).

Students were also asked to comment on what the OU can do to improve the course. Their recommendations included: more videos need to be added (n=3); a credit or certificate needs to be provided to students as badges may not be valued much in their contexts (n=2); website needs to be made less complex for students (n=2); the course needs to be updated time and again (n=1); more examples need to be included (n=1); emphasis should be on the Fleming countries (n=1); more diagrams and pictures need to be included to complement the contents (n=2) and a question should be added in each section after the quiz to help students reflect on their learning (n=1). Furthermore, one of the students reported that contexts of the modules are too European; we need to widen up the contents and *"examples to include a little bit in Africa, a little bit in Asia"* (P12HH).

4.2.7.4 Relevance to work roles and application of knowledge

All the students indicated that the modules are relevant to their job roles and many recognised that they now “*have to apply this [knowledge] and share this information with more people*” (P13AH). A few interview questions focused on finding out whether the participation in the online modules helped them to apply their knowledge and bring changes in their work practices. The interview data indicated that a few students had already started transferring their knowledge into their work practices and almost a quarter of students (n=6) reported that they had already made some changes in their work:

Actually in our lab, they were not using properly for diagnosis [...] by seeing the symptoms, they were treating. And after going through this module, I told them [colleagues] that we had to try to take this specimen for a culture, and to know which kind of microorganisms they are suffering from and which kind of bacterial virus they are suffering from. And we had to take samples. And we have started somehow taking samples and going through the diagnosis (P11AH).

Before these modules, I was not conscious. But after one module [...] I was completely changes. And my practise is completely changed after reading these modules (P13HH).

Of these students, three studied the online modules alongside taking part in the AMR Toolkit activities. During their interview, they reflected on the benefits that having gone through both resources have brought. Their responses suggest that the main benefit is related to recognising areas that require change, but also taking some actions that make a difference in their day-to-day practice:

“After going through the online modules and then the training [AMR Toolkit] - now, we double-check everything, every result that goes out of the lab. I double-check every result that goes out of the lab [...] So it has brought an improvement in our work” (P16HH);

I deal with data a lot. My work is mostly around data. And I'm always looking out for gaps. I'm always looking out for missing values. It's in my best view data should be complete. So if I notice gaps, what I do is I report to the PCR team. We deal directly with the PCR Lab team. And sometimes I follow it up for the entire day. And it seems I'm the only person doing that. My other colleagues don't do that. So I feel that's what AMR [toolkit] has offered me. And that's the change I've made ever since I took the toolkit just to ensure that my data is complete. I try as much as possible to follow up on the results and also on the entries (P10HH).

A few students (n=4) further reported that they have brought changes in their communication practices:

a colleague was supposed to pass information to a unit, but then it was communicated to the wrong unit. So, we realised it was a gap that is a difference in professional routines, and so

from the modules and the toolkit, we were able to tell them they're supposed to pass through this unit to this before it gets to here, and then the issue will be resolved. So we applied it, and then it was resolved (P7HH).

Furthermore, there are indications that students have used their knowledge acquired from the course in developing SOPs on media preparation (n=1) and establishing an AMR surveillance network (n=15) and in carrying out their field work (n=1).

One of the students (P18HH) further reported that he has been proactively taking initiative to transfer his knowledge into his work practice but support by the senior management in his organisation was crucial. Examples that indicate that students were doing things differently as a result of their participation in the modules is the following:

I started working with taking a specimen for the culture. Like, we also have a team. We also started to take blood samples, faecal samples for the treatment. Before that, they were just giving the medicine, seeing the symptoms (P13AH).

But after the online modules and then the training [toolkit], now when there is a problem like that [samples with repeated ID] [...] First, I used not to know how to solve that problem [...] I just know where to channel my queries to (P16HH).

Despite these positive examples, almost a third of the students (n=7) indicated that they have not applied their knowledge into their work practice yet but appeared confident this will happen in the future (n=5). *"I got to realise that I can do more or learn more. Even if I wouldn't use it right now, I might use it later"* (P8HH). At the same time, one student (n=1) recognised that existing work structures may not make it possible for him to apply the newly acquired knowledge:

we have our own procedure and SOPs - SOPs were written for us and we perform the procedures and do tests and reporting. We have to follow SOPs and we cannot change our SOPs and I cannot change that" (P1HH).

Indeed, further data from the interviews pointed to several barriers that may discourage professionals from applying new skills into their work, including: workload pressure (n=4), staff resistant to change (n=2), insufficient management support (n=3), lack of resources (n=5), lack of confidence to transfer knowledge (n=2), hierarchical power structure in their organisation (n=4), gender discrimination at their work place (n=1) and younger generation losing interest in reading and learning new things (n=1).

During the interviews, the students were also asked to reflect on what may support them to apply their knowledge into their work. Data gathered indicated that they need the following types of support: logistical support (n=7), face-to-face or practical skills training (n=4), co-operation from their colleagues or teamwork (n=4), support from the management (n=4), reduced workload pressure (n=1), collaboration between those (both organisation and individuals) involved (n=1), their colleagues recognising their roles in AMR (n=1), and other colleagues' enrolment in the course (n=1).

Finally, the interview data revealed that students have been facing several challenges in their work such as: lack of resources or physical facilities (n=5), lack of skilled human resources (n=5), workload pressure (n=2), poor communication among staff (n=3), poor connectivity and power cut (n=5), no proper guidelines for junior staff (n=2), no use of local level data or the data collected in the organisation (n=1) and staff carelessness (n=1).

4.3 Summary and recommendations

This section provided a detailed analysis of the data that were gathered as part of the monitoring and evaluation of the Global AMR curriculum. A variety of methods were used to monitor the success of the Fleming Learning grant managed by the OU such as platform analytics linked to the enrolled learners on the modules, platform logs, pre- and post-surveys and interviews with learners.

The analysis showed that the Global AMR Curriculum offered a free, relevant and accessible form of professional development for professionals whose work is associated with AMR. 25 modules with 10 pathways were released from January to August 2021. 360 students enrolled on 'AMR Surveillance and You' (Target = 250). Participation in all modules generated good levels of activity, completion and student satisfaction. Visitors to the site spent an average of 46 minutes per visit. Of those who enrolled on modules, 45% completed module activities (Target = 25%). Of those who completed, 98.7% attempted the quiz. On average 43% of the total number of enrolled students were awarded a Digital Badge (Target =10%). The average satisfaction rate was 78% across all modules (Target = 75%) (see Table 4.1).

Platform logs showed that a total of 2,376¹⁵ visitors have accessed the OU Fleming online modules between January and October 2021. Across the modules, a total of 8,452 visits took place and the average time a visitor spent on the platform was approximately 32 minutes, while they accessed the online modules through a variety of devices (see Table 4.3). Evidence points that most visits took place after the release of promotional materials by Mott MacDonald and DHSC, which shows the importance of distributing information about the modules through the right channels. Platform logs importantly illustrate good representation from Fleming Fund participating countries among the visitors to the modules while evidently the reach of the modules was well beyond this group (e.g UK, USA, Australia).

Further to this, participation in the Global AMR Curriculum supported professionals in learning conceptual and relational knowledge about AMR. Evidence generated suggests that the main motivations to consider taking the Fleming online modules were knowing more about AMR, satisfying personal interest, being involved in AMR-related activities and looking for professional development opportunities. Evidence also suggests that learners in the online modules and pathways perceived that they had learned about AMR. They gained confidence about understanding AMR and AMR surveillance and improved their ability to talk with a colleague about AMR. There was some evidence that the AMR Curriculum supported them in learning about relational knowledge (i.e. how each job relates to other roles and tasks). In particular students understood how their role

¹⁵ Visitors to the module are counted once per device/browser in the specified timeframe. This figure includes the enrolled users. Total visits to the module refers to the total number of times the module is accessed.

relates to others within the AMR surveillance network. However, there was limited evidence of students learning practical knowledge (e.g. how to analyse AMR data). Of note, the Terms of Reference for Grant 2 placed a focus on conceptual knowledge rather than practical or relational knowledge. Practical and relational forms of knowledge should be further supported through other complementary types of professional development. In terms of the design of the modules, according to respondents to the post-survey the most useful features were “case-studies and exemplar materials”, “reflective questions” and “video content”, while “links to external websites” and “discussion with colleagues at work or beyond the course” were reported as least useful for learning.

Finally, there was evidence that work structures, existing infrastructure (i.e. internet connectivity), and time constraints limit opportunities for professionals to engage in, or apply, what they learn. Existing work culture and processes, access to limited resources and busy workloads exacerbated in situations of emergency (i.e. Covid19) hindered participation in the AMR Global curriculum and uptake of new AMR surveillance practice. Evidence highlighted that support from senior management and colleagues is crucial to apply their knowledge into their work.

5. Promoting Contextualised learning and sustainability

5.1 Introduction

Objective 3 aimed to provide contextually relevant approaches to learning to increase the impact of learning through change in work practices and processes. More specifically the objectives were to:

- i. Support professionals to apply the knowledge they learned through global modules and pathways to their practice.
- ii. Identify impediments to professionals' application of learned knowledge in the workplace.

To achieve these objectives, but also in response to the covid19 pandemic that required to identify solutions that could be implemented remotely and led by in-country partners, we co-created the AMR Surveillance toolkit for professionals working in human and animal health settings or related organisations (government organisations, environmental organisations) to support the adoption of knowledge learned through the global AMR curriculum¹⁶.

5.2 The AMR Surveillance toolkit

The concept of a toolkit to contextualise learning within the workplace is based on previous work led by Littlejohn et al (2017) and Margaryan et al (2018) to increase the impact of professional learning on work practices and processes.

The purpose of the Toolkit is to guide professionals in healthcare organisations to apply existing knowledge or knowledge they learn through the Fleming Fund/OU online modules and pathways within their work and contextualise this knowledge to their specific work situations.

The toolkit was designed to be used by team facilitators or team leaders: these are professionals in a management or leadership role (such as managers, senior managers, heads of units, supervisors). People in these roles are viewed as best placed to bring together a team of professionals involved in AMR activities and can influence relevant staff in their organisation. Members of this team could be professionals involved in work associated with AMR, in junior and senior positions (such as Microbiologists, Laboratory scientists/technicians, Pharmacists, Physicians, Nurses, Biostatisticians, Vets, Paravets, Field officers and so on).

Despite the focus of the toolkit on the team facilitator / lead the toolkit was designed to be used collaboratively as this would ensure that the team would go through specific activities and reflect on their existing work structures and AMR surveillance practices, develop an understanding of the local AMR system and their roles in relation to the overall system. In this way the toolkit will help address three areas identified in Grant 1 as critical for effective AMR surveillance that are outlined in the Logic Model (see Section 2.1, Figure 2.2).

The Toolkit is a collection of three main tools. Each tool includes various tasks that teams led by a team facilitator/lead could carry out, including information, guidelines, visual information (diagrams,

¹⁶ The toolkit is available at <https://www.open.edu/openlearncreate/course/view.php?id=7828>

flowcharts) as to how to support teams within organisations in addressing these three areas. The three tools were designed to be used in combination with the OU/Fleming Fund online modules. Specifically, the toolkit included:

Tool 1: Your role in the AMR Surveillance Network

Understanding each other's role in relation to the overall AMR system is key to achieve an effective surveillance system. Yet, our research has shown that professionals in healthcare settings are not always fully informed of this interworking and how their work can impact the overall system. Tool 1 was designed to address this gap. It supports the team facilitator / lead and a team to form a better understanding of how their work connects with the work of others in the AMR system. It encourages professionals to think about their role within the local, national and global network and how their work relates to other professionals, as well as engage in a set of activities to identify ways they can improve their work. Tool 1 includes four tasks in total (approx. 1.5h per task).

Tool 2: Dealing with AMR Data

Our work with health professionals in LMICs has shown that generating good quality AMR data is key to good AMR surveillance practice and helps informed decision-making in the AMR response (see Littlejohn et al., 2019; Charitonos et al., 2019). Health professionals in various roles need to know how to collect, receive, analyse, monitor, or document AMR data, as well as how to interpret them as test results. Communicating and reporting results to relevant people is equally important. The absence of any of these skills can limit effective AMR practices. Tool 2 was designed to help professionals develop the epidemiological skills needed to participate in local and national AMR surveillance activities. It helps them understand their contribution to data collection and management within AMR surveillance systems and develop understanding of bias and validity and the interpretation of data from AMR studies. It also provides opportunities for the team facilitator/lead and the team to identify improvements in their workplace. Tool 2 includes three tasks in total (approx. 1.5h per task).

Tool 3: Reflecting on your work and changing your workplace

Effective AMR practice combines both the appropriate knowledge and action taken as a result of this knowledge. Past research in education shows that learning skills or knowledge (e.g. through Fleming Fund online modules) in itself is not enough to tackle AMR (Littlejohn et al., 2019). There are a range of factors that can make it difficult for professionals to use what they have learned in their day-to-day work. For example, there might be some deep-rooted practices in a workplace that challenge the use of new knowledge, skill or what professionals already know or there might be some barriers such as lack of equipment or resources. Lack of monitoring or feedback might be another reason for not improving the work practices. Tool 3 encourages the team facilitator/lead and the team to think critically and develop strategies to apply their newly acquired learning or what they already know to day-to-day work. It also helps them to find ways to overcome barriers that delay or stop you from doing this. Tool 3 includes three tasks in total (approx. 1-1.5h per task).

5.3 The methodology to co-create the AMR surveillance toolkit

The AMR Surveillance toolkit was co-created in collaboration with in-country partners (technical leads with expertise in the field) and a sample of end users (i.e. human and animal health professionals), through five main phases:

1. **Scoping and drafting:** developing a draft toolkit based on findings from Grant 1 and subject-specific developments.
2. **Discussing and reviewing the draft with in-country partners:** discussions with technical leads in weekly review meetings to collect their feedback and input on the draft toolkit. The draft Toolkit was revised and refined accordingly.
3. **Evaluating the toolkit:** A sample of local team facilitators/leads in twelve healthcare organisations were recruited to test the toolkit. The toolkit was tested through online or onsite events in Nepal and Ghana. An initial orientation meeting was held for providing information to the team leads/facilitators before the launch of the activities, while a participatory workshop was organised upon completion of the toolkit activities where all team leads / facilitators took part.
4. **Collating input and sharing analysis with in-country partners and team facilitators/leads:** The information gathered from the events organised as part of the toolkit testing (interviews, proformas, participatory workshops) was analysed and the key findings were shared with in-country partners and team facilitators/leads for further input.
5. **Reviewing and finalising the toolkit:** Based on the analysis of the information gathered from the events organised as part of the toolkit testing (interviews, proformas, participatory workshops) and any additional input from the in-country teams the Toolkit was refined further.

The following diagram summaries the described phases:

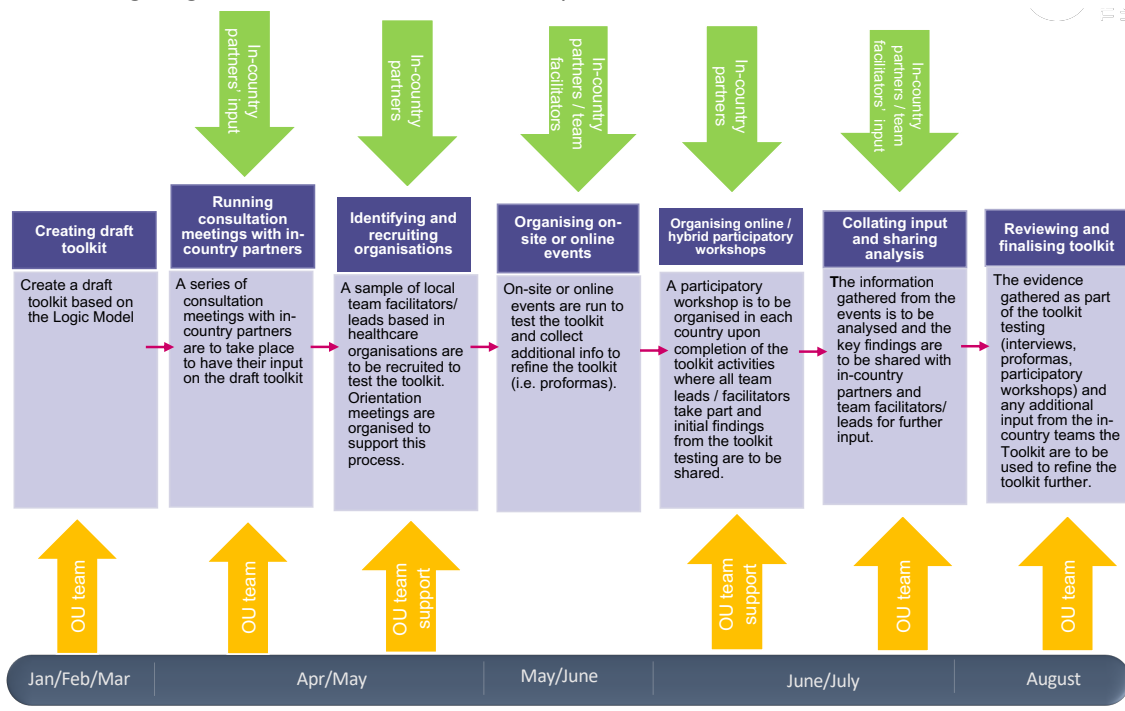


Figure 5.1 The methodology to co-create a toolkit

5.4 The evaluation of the AMR toolkit in Nepal and Ghana

In order to create a resource that is contextually relevant, including identifying impediments to professionals' application of learned knowledge in the workplace (as per Obj 3), two countries were selected for closer engagement in the development and evaluation of the AMR Toolkit: Nepal and Ghana. The evaluation of the toolkit took place between March and August 2021.

In both countries specific technical-leads with expertise in the field were identified and worked closely with the OU team throughout the five main phases that are outlined in the previous section. In the evaluation process, the technical leads had a leading role in identifying and recruiting organizations to be part of the study, co-designing and developing a version of the AMR Surveillance Toolkit, coordinating the toolkit testing in several organisations and organizing the orientation meetings and the final participatory workshop. The two technical leads recruited in each country were selected through a call for expression of interest based on terms of reference agreed with Mott Macdonald.

Specifically, in Nepal, the OU team worked with Dr Abhinav Vaidya, Professor of Community Medicine (technical lead) and Santosi Giri (AMR expert), both based in the Nepal Public Health Research and Development Center (PHRD Nepal). The PHRD Nepal is a not-for-profit making, non-political NGO with a vision to ensure evidence based public health practices guided by evidence informed policies and guidelines for sustainable development in health.

In Ghana, the OU team worked with Dr Alex Owusu-Ofori, Senior Lecturer (Technical lead) and Ofebea Asare (Career Development and Research Manager), both based in the Kwame Nkrumah University of Science and Technology (KNUST). Dr Owusu-Ofori is also an Honourary Consultant Clinical Microbiologist at the Komfo Anokye Teaching Hospital in Kumasi and a member of the AMR Platform that is co-ordinating the AMR activities in Ghana.

Six organisations took part in the evaluation in each country across human health and animal health sectors, as shown in Table 5.1 and Table 5.2. Seven team leads/facilitators in Nepal (n=7; n=3 male, n=4 females) and six in Ghana (n=6; n=5 male, n=1 female) led the activities in each organisation. The two tables below also show the diversity of roles of the team members. In total, thirty-six professionals (n=36; n=20 male, n=16 female - incl. the team leads) took part in the toolkit activities in Nepal and thirty-four (n=34; n=22 male, n=12 female – incl. team leads) in Ghana.

The evaluation data were drawn from individual interviews (Nepal n=5, average duration 43'; Ghana n=6, average duration 45') and proformas (n=12) that each of the team leads / facilitators provided upon completion of the activities. Data from the two final participatory workshops, including presentation slides given by the team leads / facilitators, were also collected.

Table 5.1 Team Leads and participating organisations in Nepal

Team Lead / Facilitator	Organisation	Sector	Tools tested	Format of delivery	Team members (incl. team lead)	Roles (incl. team lead)
Dr Manisha Sharma	Kathmandu Medical College	Human Health	1, 3	Online	5 (1 male, 4 female)	2 Microbiologists (incl. team lead); Pharmacology; dentist; student of microbiology.
Dr Aashish Gyawali	Animal Clinic at Shree Sayuri Bhume School	Animal Health	1	Online	6 (5 male, 1 female)	Veterinary Instructor/Clinical Co-ordinator & Farm Manager (team lead); 3 vets; vet technician; paravet.
Dr Olita Shilpakar	Bir Hospital	Human Health	2, 3	Online	5 (3 male, 2 female)	Senior Consultant Emergency Physician (team lead); geriatric; microbiologist; pharmacist; medical officer.
Dr Shiva Khanal	Nepal Pet Service Center	Animal Health	1, 3	Online	7 (6 male, 1 female)	Veterinary Clinician and Surgeon (team lead); 2 veterinarians; 2 veterinarian officers; veterinary lab head; veterinary Technician.
Dr Karishma Malla Vaidya; Dr Aasiya Rajbhandari	Paropakar Maternity and Women's Hospital	Human Health	1	Face-to-face	6 (1 male, 5 female)	Head of Department of Pathology - Pathologist (team lead); microbiologist; nursing supervisor; pharmacy officer; paediatrician; medical technologist; Obstetrician and Gynaecologist.
Dr Sanu Krishna Shrestha	Dhulikhel Hospital	Human Health	2	Online	7 (5 male, 2 female)	Head of Department of Emergency and General Practice (team lead); General Surgeon; Nursing Manager; Emergency Physician; Pharmacovigilance Officer; Microbiologist; General Physician.

Table 5.2 Team Leads and participating organisations in Ghana

Name	Organisation	Sector	Tools tested	Format of delivery	Team members (incl. Team lead)	Roles (incl. Team lead)
Dr Anthony Enimil	Komfo Anokye Teaching Hospital	Human Health	1, 3	Face-to-face	5 (4 male, 1 female)	Clinician (head of unit, team lead); nurse; environmental unit; biostatistician; pharmacist/ chest clinic.
Dr Kennedy Osei Mensah	Tamale Teaching Hospital	Human Health	2	Face-to-face	5 (5 male)	Laboratory Manager (team lead); Pharmacist; clinician; laboratory Scientist; microbiologist.
Mr Emmanuel Eshun	Veterinary Services Directorate	Animal Health	1	Face-to-face	7 (4 male, 3 female)	Veterinary technologist (team lead); microbiologist; administrator; data analysis fish biologist.
Dr Sylvester Dassah	Navrongo Health Research Centre	Human Health	1	Face-to-face	5 (3 male, 2 female)	Laboratory Manager/ Medical Laboratory Scientist (team lead); Research Officer – Microbiology; Medical Laboratory Scientist; 2 Research Assistants – Microbiology.
Dr Mildred Adusei-Poku	Noguchi Memorial Institute for Medical Research	Human Health	1, 2	Face-to-face	6 (1 male, 4 female)	Research fellow/lecturer (team lead) Research assistant; lab professional; research associate; data scientist.
Dr Mawuli Leslie Aglanu	Kumasi Centre Collaborative Research	Human Health	2, 3	Face-to-face	6 (4 male, 2 female)	Research fellow (team lead); Biomedical Scientist; Laboratory technicians; Field and Laboratory assistant; 2 research assistants.

5.4.1 The role of the team facilitator / lead in the toolkit testing

The role of the facilitator was seen as threefold:

1. to ensure any approvals were in place prior to the testing of the toolkit and that time has been allocated to members of their team to come together and go through the tasks.
2. to create a 'safe' space for the team; a space where team members would feel they can openly discuss and share their views about existing AMR practices, any challenges they face and ideas for future action.
3. to support the team members to discuss the points raised in the various group tasks, to provoke and challenge them but also listen to what they had to say.

Prior to launching the activities in each organisation, the team leads / facilitators took part in an orientation workshop organised by the technical leads and the OU team. The team leads / facilitators were asked to identify a small group of co-workers (up to 5-8 people) who were involved in AMR activities in his/her organisation to form a team that would take part in the toolkit testing. Given time constraints in the evaluation process but also due to Covid19 developments in the countries the time of the testing, the facilitators were asked to complete at least one of the three tools, by choosing the one(s) that are more relevant to the roles in their teams or any existing issues around AMR surveillance that affect the way the team/organisation is operating. The teams had to complete the tasks over a short period of time (i.e. two to three weeks). Specific online modules that were linked to the toolkit activities were also recommended to the teams however as it will be discussed below time restrictions did not allow the various teams to engage substantially with the modules. The format of testing (online, face-to-face), tools to be tested and the frequency of the teams' meetings was left to the team lead / facilitator and the team to decide upon.

Prior to first meeting as a team, the team facilitator was asked to spend some time to go through the tool(s) he/she has chosen and familiarise themselves with the various tasks included.

5.5 Key findings of the toolkit testing in Nepal

The data generated through the evaluation of the toolkit in Nepal provided evidence that point to at least five important areas of impact associated with the use of the three tools.

The first benefit is related to the toolkit leading to **the formation of a local team** of professionals in roles associated with AMR. This was seen as a positive initiative in the participating organisations and a starting point that *"could lead in the future"* (TL5). The reported positive effects of having a team in place suggest two key areas that merit further examination: the role of deliberate practice among the team leads in selecting the people who could be part of the team as well as the role that a 'local' team can play as a response to AMR. To explain, the participants in the teams were from across units / departments (in human health settings) or across several organisations in the same district (in animal health settings). The latter was due to the small size of the animal health clinics with team leads / facilitators not being able to draw on enough number of people to form the team. The facilitators emphasised their rationale of bringing a team together:

When deciding to use the tool, we were looking forward to creating a team of hospital staff of different departments who were interested in AMR and had a significant role to play in AMR and its surveillance during their everyday activities. The group thus formed should be able to realize what role they play in AMR and what the rest of the staffs expect of them (Proforma, TL6)

The facilitator TL1 also highlighted that *“the team... was represented in the overall veterinary system of Nepal, where I was working as a facilitator, as well as a clinician... and a veterinary instructor [...] We had one complete team [...] There was one field veterinarian who would do the treatment in the field and send samples to the labs. And there was one microbiologist who is currently working in the field of poultry microbiology (G2C1_AH1TL1M).*

These were newly formed teams with stakeholders of AMR from different units but all based in the same institution (or district in the case of animal health settings). This characteristic was emphasised by facilitator TL4 as particularly important especially compared to a previous training experience she had when people from different institutions took part in an WHO meeting:

“I think this one was more interactive because it was on the local level and it was from the same institute. In the WHO one which I went, it was quite broad. There were different people from different backgrounds and from different institutes [...] It was just putting forth our ideas. But this toolkit, I think, is more effective because all the people who are stakeholders of AMR, they are brought together in the same place. And we're talking about the problems. Over there, we talked about the problem, but we did not know how to raise them. Because [...] we were from different institutes. And different institutes had different problems [...] That was the major plus point for this testing. Because we are from the same institute. And we're from different backgrounds [...] Previously, it was national wide. It should be effective for policy making. But for us, individually, it was not that effective” (G2C1_HH2TL4F)

The teams were formed based on **existing knowledge of the organisations and personal networks the team leads/facilitators had**. On a few occasions it was reported that formal approvals by the senior management were sought (e.g. TL4, TL3) but this was not a widespread practice among the facilitators. Even in the case when the team leads had formal authorisation for the toolkit testing to take place in their organisations, the activity was not embedded within staff's workloads time as for example the case with facilitator TL3 whose team met after work hours.

The second main benefit associated with the testing of the toolkit was that it **provided a framework** for the participants across professional roles to have **supported conversations around AMR**. This is further related to a third benefit, that the toolkit **promoted relational thinking in professional work and led to re-considerations of inter-professional work**. The facilitators reported that the use of the toolkit brought a greater realisation of one's role as well as the inter-connection of roles and responsibilities in the AMR system. For example, facilitator TL1 reported that one of the participants was a *“field veterinarian, [...] a paraveterinarian. And he came to know the importance of veterinarian” (G2C1_AH1TL1M)*. Similarly, facilitator TL6 said that the *“Pharmacist being in the team made realize the important of his role in AMR surveillance” (proforma)*, while TL2 emphasised that through Tool 1 he got to understand his own role and responsibilities associated with AMR better:

I was able to defend myself what my role and responsibilities are because of being a veterinarian, I have to do many things like collecting samples. So I to collect samples. I have to do surgeries. Sometimes, I have to perform UAC ultrasound, also. I have many role and

responsibilities. And that toolkit made me understand what my role is in terms of AMR” (G2C1_AH2TL2M)

The toolkit also helped breaking down misconceptions around whose role is responsible for AMR in their organisations, hence increased their understanding that AMR is not a single person or profession’s responsibility. In this way the toolkit made some assumptions that professionals have about one another visible and **increased understanding of inter-dependency of practices, namely how one’s work relates to another**. This is highlighted in the following by TL3 who reported that when she was first approached to take part in the toolkit testing she was sceptical how relevant AMR is with her work role. In the interview it became clear that through the toolkit testing this view had shifted:

“When we just talked about AMR [...] maybe it's not that relevant to my job. But then when we went through the tools [...], so we also realised that we have a role, right from the history taking to the clinical examination and to the signs and symptoms. And the forms that we fill, that also holds such great importance [...] So that is a very, very practical example because I have been dealing with that problem. The clinician has been dealing with that. And the lab technician had the same thing to offer [...]” (G2C1_HH1TL3F).

The facilitators (TL4, TL5) also highlighted that the toolkit provided **an opportunity for having new or different type of interactions with their colleagues** and realising that AMR has not had a major role in their work before: *“this actually made us all come together. Before, we never used to talk with the dental people. Now, we are like, that is a parallel” (TL4)*. Getting to understand each other’s knowledge and expertise in the field of AMR, listening to the contributions their colleagues were making and learning from one another was seen as enhancing inter-professional team cohesion and bonding:

“my participants were more knowledgeable than me. I found that, you know? And I also learned from them. Microbiology was there, pharmacology was there, and other clinicians, including me, learned from them [...] They started talking enthusiastically, and they shared their experiences, and it was quite impressive” (G2C1_HH3TL5M)

Overall, the facilitators reported that the toolkit was relevant to their work role and included practical examples that they could draw on (TL1, TL3). By using it, the toolkit led to increased knowledge on AMR - *“the toolkit as one of the opportunities that I got to learn something not very, very familiar to me [...] I'm quite comfortable with the tool kit and AMR than I was before doing this toolkit” (TL3)*

A fourth benefit is that there was evidence that the toolkit **enabled identification of areas of work that require change** by enhancing awareness of specific work practices that are critical in the AMR surveillance process. Issues individuals or organisations are currently facing related to AMR work practices such as communication among stakeholders and AMR Data management emerged strongly in the data among the facilitators who tested Tools 1 and 2 and led to discussions around how these could be resolved. TL5 referred to the need to improve the whole cycle of AMR data in his organisation after they *“realised that we ha[ve] to contribute in this field and we have to improve*

data collection system, data analysis system [...] and data dissemination system” (TL5). Facilitator TL3 referred to lack of awareness that AMR data were being collected in their organisation and that due to lack of human resources this had stopped after three years. In her team they discussed this issue by considering how her own unit could be contributing to this:

“we can overcome these kinds of problems if we can get a good record, a proper report in the emergency or in the inpatient department or in the lab if we have, actually, this kind of manpower. So what we lack in terms of manpower or resources-- so we had a quite good discussion regarding in Tool 2” (TL3)

Facilitators TL1 and TL2 identified communication gaps between vets, paravets and farmers:

“paraveterinarians don't communicate with the veterinarian doctors who are more into the knowledge of this animal health. And most importantly, we don't communicate with our farmers, who are the ones who will be using the medicine [...] We have many communication gap between all these stakeholders who are totally responsible for this AMR” (TL1)

Facilitator TL2 suggested that farmers and paravets *“play a crucial role in AMR [...] So we as a team member can [organise] our next programme in the field level to the farmers. So I think this is the good outcome from this toolkit” (TL2)*

What this evidence suggests is that the toolkit led the facilitators and the teams to **initiate local actions or express intentions to act**. Evidence for this was not strong at the time of the data collection, but this might be because proformas and interviews took place soon after the completion of the toolkit activities. Facilitator TL5 referred to a few initiatives his team discussed such as *“to gather and discuss about AMR every month, and also [...] to publish AMR data in the hospital [in the hospital bulletins about emerging problem of AMR], because this knowledge and this information should be delivered to all the physicians and all the clinicians [...] many of our (...) doctors prefer very expensive antibiotics” (TL5)*. He also referred to taking advantage of an existing structure in their organisation, the ‘daily morning conference’ where issues around AMR could be raised.

Similarly, TL4 referred to the possibility of organising a monthly ‘resistance’ meeting like other meetings that are taking place in her organisation (e.g. a mortality meeting) where stakeholders will be able to discuss AMR related topics (e.g. organisms that are being isolated, drugs facing resistance), also acknowledging issues around data in her organisation and also the possibility of forming a student body which talks about AMR. In her proforma, facilitator TL6 referred to several actions being underway as a result of the toolkit testing. For example, the microbiology laboratory planned to tighten its sample acceptance and rejection criteria, while doctors and nurses were encouraged to fill in as much detail as possible in the request forms (minimal of patient demographics, date of admission, ward of admission, relevant clinical history and planned antibiotic they are starting after collecting the sample). The clinicians also planned to make local hospital guidelines regarding antibiotic use and they also addressed the need to upgrade the quality of antibiotics available in the hospital pharmacy. This is related to the procurement processes followed in her organisation which often dictates the quality of antibiotics available as *“priority is given to cheaper products that people with very low income can also afford [...] A feedback from the clinicians*

if they notice any such incident where the microbiology report indicates a drug as sensitive but the drug in use doesn't appear effective is to be communicated to the pharmacist. The pharmacist then follows up on the drug and probes into its quality, and avoids the purchase of such medication in the future". Finally, TL1 expressed an intention to re-run the toolkit activities in his organisation.

The identification of areas of work that require change and the reported intentions to act point to evidence that the use of the Toolkit may lead to a fifth benefit of **supporting sustainability through continued engagement from team members**. A few facilitators (e.g. TL4, TL5) stated they had or were planning as a team to meet the director of their organisation "to have some concrete plan for the future" (TL5). TL4 referred to a positive change as a result of using the toolkit that "*has made us understand so much about our role [...] We can make a difference. We should make a difference*". At the same time both TL4 and TL5 were pragmatic that this requires them to do "*small steps first*" (TL4). The evidence from the interviews as well as discussion during the final workshop suggested that the facilitators now had more clarity about 'the bigger picture on AMR' and were motivated to carry on engagement with their teams in the long term –

"Before, we used to talk only about our role in laboratory, our role in clinics with the patient. Now we understood that, as a teacher also, we're very, very responsible to teach our students about AMR. So what this toolkit made us realise is communication is a key, first of all. And the second thing is this is - we all have a stake in AMR. And moreover, we are very willing to go forward with that. So this is the positive sense that we got from this toolkit testing. And hopefully, we can build upon that" (TL4).

As facilitator TL5 put it "*at the end of the programme, all of us agreed that this is not the end. This is beginning*". (G2C1_HH3TL5M)

5.5.1 Key challenges associated with the toolkit testing in Nepal

The main challenges associated with using the testing of the toolkit in Nepal were related to seven factors:

Time - In Nepal a few team leads / facilitators (n=2) reported to have got approval from senior management to carry out the testing of the toolkit in their organisations. This might have meant that participants had limited time available to engage in Toolkit activities because this activity was not directly linked to their workload. Getting colleagues to agree to take part in the toolkit testing and issues around time were reported by all the facilitators as challenges they faced in organising the toolkit testing. Forming a cross-departmental team also meant that the facilitators had to accommodate different work patterns, schedules and work shifts while organising the toolkit activities and "*it was so difficult for everybody to come to a point where everybody was free for at least three hours*" (TL3). In several occasions this meant that the team had to meet outside of work hours. Time issues also affected enrolment of participants to the online modules hence the toolkit was not used as originally intended i.e. a complementary resource to the online modules.

Buy-in from participants - Identifying and inviting colleagues to be part of the team was a key activity taking place prior to the testing. One facilitator (tbc) reported that her colleagues were reluctant to get on-board as they were not aware of how their role is linked to AMR work.

when I first started asking them whether they were interested to take part in this testing or not, they were, like myself [...] They were also actually a bit reluctant. Even the microbiologist-- forget the clinician. Even the microbiologist, she was telling me that "OK, I've forgotten quite a few things about AMR. I have to study a bit". And she was a little reluctant, actually. And same was the case with the others also (G2C1_HH1TL3F)

Covid19 and mode of delivery – Health professionals have a demanding work schedule. This situation was exacerbated with the surge of Covid19 cases in the country and a national lockdown that Nepal had the time the testing took place. Due to restrictions in meeting face-to-face, all the facilitators but one (TL6), took a decision to run the toolkit activities online via videoconferencing tools (e.g. ZOOM). The facilitators reported that their preferred mode of delivery would have been in-person meeting as they felt that some of the activities (e.g. Tool 3 around trust and challenging relationships) would have been *"more interactive and more effective"* (TL1) had they done them with everyone in the same room. They also reported issues with the network that often affected their meetings. That said, all five facilitators were able to carry out the activities online despite the lockdown in the country and it also allowed them to have some flexibility in terms of when to organise the team meetings (as in TL3 case that was late in the night).

Relevance of the toolkit to the animal health professionals – Both facilitators from the animal health sector (TL1, TL2) expressed reservations with some activities in the toolkit as not being appropriate for their colleagues. This was because many examples were drawn from the human health sector. TL2, despite being positive about the benefits they had from the toolkit, he suggested that there should be a separate toolkit for the animal health sector. Another challenge reported by the two facilitators was that in a small organisation like theirs they had not many specialised staff related to AMR to be able to form a team from within their organisation.

Lack of technical knowledge on AMR – Facilitators TL5 and TL3 reported that facilitating Tool 2 required a certain level of familiarity and knowledge about AMR that they felt they were to an extent lacking. This was partly resolved by enrolling on online modules and ensuring that they went through the toolkit activities themselves so they were well prepared. TL1 and TL3 also reported that participants in their teams faced some difficulties with technical terms: *"The technical terms that related to AMR he [paravet] was not aware [...]"* (TL1) and *"In the third activity about the bias and the validity, we did have a bit of technical difficulty... we actually have studied [...] in our medical school. But then most of them, we have forgotten those to some extent [...]"* (G2C1_HH1TL3F). A few facilitators reported going through the online modules themselves and have recommended specific modules to their colleagues.

Not a well-established AMR surveillance system in the country – Facilitator TL4 raised an important point that an underlying assumption in many of the toolkit activities was that there is an AMR system in the country which is well-established and that professionals are aware of this. However this is not the case and due to this, she felt that participants in her team were challenged when asked to make links to the expanded roles and responsibilities associated with AMR, as envisioned in the toolkit: *"Most of the time, they were like, I know my role, but I'm not doing my role"* (G2C1_HH2TL4F). This also points to existing work structures that may be a barrier in adapting or

changing practice. Associated with this are also feelings of disempowerment that professionals may feel when being faced with such challenges in their everyday practice.

“I don't know whether it is adaptable or not. Like for example, pharmacist is completely not involved. We included him, but he said, see, this is my role. I know that. But I can't contribute because we're not doing anything of that sort. Whenever the doctor writes the antibiotics, we give it. That's it. We are not involved in antibiogram. We are not involved in the policy-making” (TL4)

Dynamics of inter-professional working – The role of the facilitator was critical in organising and facilitating the activities and orchestrating discussions, especially around challenging topics such as ‘trust issues’ (in Tool 3). For most of the facilitators this was a new role they had to perform. Time also seemed to be a crucial element as team members needed time to ‘open-up’ or ‘warm-up’ to the types of discussions the toolkit was encouraging, especially considering that team members had not worked together before:

“They were not that willing to tell us about our drawbacks [...] we could not say you clinicians are doing this, this, this. And they could not say you laboratory centre are doing this, this, this. But still, we tried to explore it. We came to a nice discussion about it. But initially, there was the hesitation [...]” (G2C1_HH2TL4F)

The toolkit included activities that sought to help the team raise issues around trust, challenging relationships and poor practices. One facilitator reported that the challenge for her was that power dynamics were present, which had an effect on how discussions unfolded during the meetings:

there's some kind of subtle power game, also, that is going on. Because clinicians are like, we're doing our best. Maybe the lab is not up to the par. And laboratory is like, yes, we are doing our best. But maybe clinicians do not listen to us [...] But we talked about it in detail. And we explored about the possibility of what we can do to make it better from both sides [...] But there was a subtle power play kind of thing going on” (TL4)

This also had an effect on how she could share learning from the toolkit in the days/weeks that followed, which as reported it was limited to the existing networks they have in the organisation. This could be overcome if they get support by senior management at their organisation – *“until and unless we get backup from the management or somewhere else, we are very intimidated by it [to talk to all the senior doctors about antimicrobial resistance and to tell them, no, you should do this]. So maybe that's the problem. (G2C1_HH2TL4F)*

5.6 Key findings from the toolkit testing in Ghana

The Toolkit evaluation provided evidence that the tools complement the modules and pathways in a number of ways. There are at least five important benefits generated through using the tools:

First, **the Toolkit engendered team formation**. All the facilitators described how they used the tools to support conversations around how to improve AMR processes (Facilitators G1, G2, G3, G4, G5, G6). Facilitator G5 said: “So the key element here is... the interactive nature of [the Toolkit] which was good to allow people to communicate and bring out their views and make it more interactive, not more or less just giving information without interactions.” Facilitator G6 also emphasised the

importance of building a local intra-professional network: “it led us to develop kind of an AMR network for our institution, so that alone, I think that toolkit was very, very relevant to us. So, if we are able to implement the network that we designed or developed for our institution, I think it will be good.”

Second, **the Toolkit supported conversations across professional roles, leading to inter-professional team cohesion** (Facilitators G2, G3, G5). Each tool provided a framework to scaffold discussion, encouraging professionals with diverse roles to talk about issues associated with AMR surveillance. Facilitator G4 explained: “I really appreciated using this toolkit compared to the other ones where you just sit and listen. You really don't have the opportunity to have a real discussion with the [modules]. But in this case, with the team, we could actually sit and have a discussion about what the test tool was talking about and what was required of us.” (Facilitator G4). Through these conversations, professionals identified linkages across practice which gave rise to new realisations of the inter-dependency of different job roles. Facilitator G5 explained: “honestly I wasn't building much relationship at workplace. I was always focusing. I come in, I do my work, and I do what is relevant, then go. I wasn't really actively thinking on building a good working relationship with my team. I was mostly focus on just do the work that's supposed to be done and then make sure everything is submitted and that is it. Now I actually think about establishing a very good relationship and building a working relationship more effectively with the team.’ These discussions triggered a realisation that AMR surveillance requires good inter-professional work, leading to a third benefit.

A third benefit was that **use of the Toolkit led to reconsideration of inter-professional work**, making visible some of the unseen assumptions that professions have about one other (mentioned by Facilitators G1, G2, G3, G4, G5, G6). For example, in the proforma G1 stated that “One of the clear understanding and take away from testing the toolkit was the issue of who an AMR professional is. The realization that the policy maker or in our case the administrator is part of the network was quite revealing”. Similarly, facilitator G2 reflected that “the interconnectivity of our roles was not obvious at the onset of Tool 1 evaluation” (Facilitator G2, proforma). The conversations that professionals engage in as they use the tools helps them develop an overall view of how AMR surveillance operates and makes visible the assumptions professionals have around different activities (mentioned by Facilitators G3 and G4). Facilitator G4 explained “my team members did not believe that they were playing any role at all in AMR surveillance. But then after going through the tool and trying to work around the activities that were required of us, we were actually doing a lot of work in the AMR so that you get to identify your role. You describe your responsibilities. And then it gave, as I said, people a sense of belonging and a sense of pride that's actually involved in this kind of work”. Similarly, facilitator G5 described that the use of the toolkit “increase participants’ self-worth and confidence. By pointing out their role in the AMR surveillance network and how their contributions influence policy decisions both locally and internationally, they felt more appreciated knowing how their indispensable there are in the AMR surveillance network” (Facilitator G5, proforma). This, in turn, promotes relational thinking in how professions work together, emphasising the need for a network enabling inter-professional work. Facilitator G6 described this as follows: “The Toolkit also brought some light to it that it is not just only one profession or one group. When it comes to AMR, it has to do with a whole lot of interconnected network. So while we're in the discussion, everybody was very excited how the connections are. And one of the things we were

seeing is that also, if all these groups will be up and work well then, we would have been in a good position to do much more intensive research. So, we thought that the tool was of very good relevance to us.” (Facilitator G6).

When asked what outcome she would prioritise when using the tools Facilitator G4 emphasised consideration of intra-professional working: “I believe that we should be a bit focused in creating the network.” Facilitator G5 explained why this was important: “I think they [the team] became very aware that if they make a mistake at one point then it's going to affect the entire system, not only what they do. And then they are not working as an individual. You work, then you finish yours and pass it to the next person. Then the next person works and finish and pass it to the next person. So, we all work in a team, so each individual contributes to the other.” “And then they realised that they actually play a very significant role and that aspect of making them aware that they are part of a larger surveillance network that is doing very good in saving lives ... They are now very happy to see that they are actually playing a role and their work is being recognised.”

There was evidence that **the Toolkit enabled identification of areas of work that require change**, and this led the facilitators and the teams to initiate local actions or express intentions to act. Use of the tools encouraged professionals to consider their work setting and reflect on existing work practices. For example, Facilitator G2 recognised “inadequate communication between all the units represented [in the team] (facilitator G2, proforma). Recognising areas of work that require change may lead to identifying ways in which their practice could be improved: “Comparing these two kits [the Toolkit and the modules/ pathways]... this Toolkit, it actually allows for discussion and allows for people to brainstorm to identify which is the best practise or the best pathways to go along with and also identify from the staff's point of view of their challenges that they actually go through in the process of ... their duties So this allows for an in-depth knowledge or in-depth process of gathering information that will actually help the entire process at the go.” (Facilitator G4). Facilitator G3 suggested that the Toolkit created space to identify and agree small changes that could have a big impact in terms of improving AMR surveillance: “they look little things, but they make a big impact in the patient care going forward.” He referred to the team deciding to publish antibiogram data on selected pathogens within the hospital on a regular interval as a form of improving flow of data on AMR, and also improving easy accessibility to laboratory services at all hours (facilitator G3, proforma).

More examples of change were described during the interviews by Facilitators G3, G4 and G5. For instance, Facilitator G4 described how communication processes were changed by the team “Another major thing that we [changed was] communication. Like I was trying to describe, an issue comes up today, and I am probably off duty tomorrow. People were just given verbal information-- so verbal form of communication, so that if whoever was told what it was does not show up the next day, the test that needed to be repeated ends up not being repeated. So, after going through the tool, we decided to implement a system of handing over, where we installed books at the various sessions, where people had to write their handover notes should be handed over to the next team so that there will be continuity. And there will not be a breach in the work that is supposed to be done. And it has been working beautifully since then.” Facilitators G2, G3 and G5 further suggested continuing engagement with the toolkit in the future to “enhance the skills of the staff involved in generating AMR data” (facilitator G3 proforma) and “train and refresh staff knowledge on good data

management practices starting right from study conceptualisation and design stage to publication and development of policy briefs for dissemination” (facilitator G5, proforma).

There was (limited) evidence that use of the Toolkit may lead to a fifth benefit of **supporting sustainability through continued engagement from team members**. Facilitators G5 and G6 emphasised the ‘excitement’ within the teams. As Facilitator G6 explained: “the team that went through the toolkit, they are very excited and will want us to fully implemented and let the others also address to understand. It will lessen our work. Once everybody in the network knows there are rules and we are working within data queries, laboratory queries, queries from the clinical will all reduce.” “They [the team] are very excited. The change I can see here is that, even though we have been doing antimicrobial work, we didn't consider it so much of something that could feed directly into the AMR network. So now the thinking is that, yes, we need to get these local activities that we are doing properly streamlined so that we can feed into any existing network, or if there is any network that is already established, we can easily feed into it. So that is the current excitement within my team who tested the tool.”

5.6.1 Key challenges associated with the toolkit testing in Ghana

The main challenges associated with using the ToolKit were related to six factors:

First, if time is not set aside to consider AMR surveillance practice and processes, **participants may have limited time available to engage in ToolKit activities**. All the Facilitators in Ghana circumvented this problem by securing high level approval to use the ToolKit from a senior member of staff. This strategy allowed Ghanaian participants to take the time to engage with the Toolkit. Despite this, setting “meeting times was initially difficult to fix because of the different units” (facilitator G2 proforma). Team meetings or events also provide an opportunity to reflect on and plan how to improve AMR surveillance.

Second, **participants may need an incentive to encourage them to participate in Toolkit activities**. Facilitator G3 provided an incentive by offering local CPD credits to encourage and reward participation in the workshop.

Third, **the Toolkit activities need to be organised practically and the discussion ideally is recorded and reported**. However, it can be difficult for the Facilitator to organise, record and facilitate. To overcome this problem, a few facilitators appointed a co-facilitator to work with them.

In general, the ability of the Facilitator to engage participants was critical for effective use of the Toolkit. However, most **Facilitators have limited experience of running reflective, planning sessions and need to be guided in understanding how to realise these events**. The facilitator notes provided information and recommendations on how to run each session. When asked how he learned how to run these types of sessions, Facilitator G6 said: “To me, as a facilitator, it was fine, because it gives you guides. And at some point, it even gives you some pointers how to start or initiate a discussion. If you asked a question, and they are not saying anything, then there are some guided.”

The wording of the Toolkit activities was not appropriate for every context. Facilitators G3 and G5 found it useful to rephrase the ToolKit activities to make the tools more relevant to their specific

work contexts. Team Lead 5 explained it was useful to change “some of the structures or the languages... that were not that simple and straightforward for them to pick up.” Some resources, such as videos, were also not appropriate as they could not be played at the workplace (firewall and connectivity issues), while specific activities were more oriented to specific sectors (i.e. human health) (Facilitator G3, proforma).

Finally, an important point raised by facilitator G2 was related to an underlying assumption in many of the toolkit activities was that there is an AMR system in the country, which is well-established, hence professionals are familiar with this. However, **an AMR system does not yet exist in many institutions** and due to this, he felt that participants in his team were challenged when asked to make links to the expanded roles and responsibilities associated with AMR and as a result “some responses were totally left out or we needed to use our working experience to presume and discuss” (facilitator G2, proforma).

Although the teams were encouraged to use the Tools alongside the modules and pathways, time constraints did not allow this: “the timing for testing the toolkit made it very difficult to schedule for the workshops and to get participant enrol for the online modules” (facilitator G5, proforma). The Facilitators considered the Toolkit to be able to be used as standalone instruments. Professionals who engaged in ToolKit activities were not always able to learn from the modules or pathways because of the time constraints. There was a view that the Toolkit discussions take less time than participating in modules which could lead to more immediate positive outcomes (Team Lead G2, G3, G4, G5). Facilitator G4 suggested that more clarity is required of the links between the activities and the modules (facilitator G4, proforma).

5.7 Summary and recommendations

The AMR Surveillance toolkit was developed and evaluated through participatory co-design methodology, including twelve healthcare organisations in Nepal and Ghana. The development was supported through review meetings with an in-country partner in both countries and two participatory co-design workshops with professionals who led the activities in their organisations (i.e. team leads/ facilitators). The evaluation drew on data gathered through individual interviews and proformas that each of the team leads provided upon completion of the activities. The key findings and recommendations from the evaluation are summarised in the Table 5.3 below. These respond to requests made by the country teams during the participatory workshops to share the key findings and recommendations with them. As of September 2021, these have now been shared with the two technical leads in Ghana and Nepal as well as the twelve team leads.

Table 5.3 Findings and recommendations from Toolkit testing

Key Findings	Recommendations
1.The toolkit led to the formation of a local team.	<ul style="list-style-type: none"> • Support facilitators to focus on local settings and use the Toolkit to plan how to expand/ embed AMR surveillance teams within existing organisational structures. • As AMR increases, facilitators should be mindful of whether and how job roles related

	<p>to AMR surveillance need to be expanded; who else should be part of the local team and who might be excluded.</p>
<p>2.The toolkit provided a framework to support a wide range of professionals to talk about AMR.</p>	<ul style="list-style-type: none"> • Plan the toolkit activities to take place over several workshops. Not as a one-off activity. • Support professionals to explore conceptual and social aspects of learning that are linked to the work environment by raising awareness or providing access to such resources.
<p>3.The toolkit encouraged people to think about how their work relates to the work of other people, allowing them to re-consider inter-professional work.</p>	<ul style="list-style-type: none"> • Create opportunities for people from different departmental units and with different specialisations to get together. • Be mindful of dynamics of inter-professional work and the assumptions that different professionals have about one another.
<p>4. The toolkit supported professionals in identification of areas of work that require change.</p>	<ul style="list-style-type: none"> • Generate discussion within the team in ways that encourage professionals to initiate small-scale local actions that can make a big difference in improving AMR surveillance. • Share what is learned through these discussions across all the organisations involved. • Use the toolkit and/or online modules as and when you see it responds to the needs in the organisation.
<p>5. The Toolkit should support sustainability through continued, ongoing interactions of team members.</p>	<ul style="list-style-type: none"> • Maintain channels of communication among members of the team. • Encourage team members to set specific goals for the team and revisit these at regular intervals. • Use the local team as a platform from which to generate wider discussions about the problems each organisation is facing around AMR surveillance.
<p>6.Existing work structures and work environment limit how people could be applying / transferring knowledge.</p>	<ul style="list-style-type: none"> • Having a facilitator as a ‘champion’ is crucial. • Encourage key influencers in countries/ organisations to become facilitators who lead toolkit activities to change AMR surveillance practice and organisational policy. • Allow time for people from all ranks / units to learn on the job. • Offer recognition / rewards from within the organisation for staff engaging in professional development opportunities.

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ANNEX 1 Terms of Reference for OU Grant 2

1. Introduction

The Fleming Fund is the UK Government's investment to help low- and middle- income countries (LMICs) fight antimicrobial resistance (AMR) by improving surveillance. The Fleming Fund Grants Programme is the largest workstream within the Fleming Fund. Mott MacDonald is the appointed Management Agent for the Fleming Fund Grants Programme. The aim of the Grants Programme is to improve the ability of recipient countries to diagnose drug-resistant infections, and improve data and surveillance to inform AMR policy and practice at national and international levels. The geographic focus of the Fleming Fund Grants Programme is 24 LMICs from Sub-Saharan Africa, and South and South-East Asia. Support to participating countries is provided through three funding channels: Country Grants; Fleming Fellowship Scheme Grants; and Regional Grants.

The Fleming Fund's emphasis on AMR surveillance requires a particular focus on the professional practice of a wide range of individuals with a variety of skills, backgrounds and interests, including laboratory staff, public health professionals, policy makers, clinicians and nursing staff, veterinary professionals and agricultural workers, and pharmacists. There is an urgent need for these professionals to learn about good practices associated with AMR on a mass scale, with accessible learning materials for knowledge and skills development.

2. Rationale for this Global Learning Grant

The Open University (OU) is Mott MacDonald's Global Learning Partner for the Fleming Fund. In the first phase of the programme (April 2018 to September 2019), OU was awarded a grant (Grant 1) to develop and pilot an approach to address the large-scale learning needs of the programme. The OU's November 2018 scoping report highlights a number of priority themes, target groups and 'knowledge gaps' that need to be addressed to effectively tackle AMR at country level. The OU's report also identified a widespread demand for information on AMR across in the 'One Health' disciplines – a finding that reinforced the management Agent's experience from designing the Country and Regional Grants.

Some of these large-scale learning needs can be met by activities under the Grants portfolio. However, the Global Learning Grant is also an important vehicle for the Fleming Fund to reach many more people within the target Fleming Fund countries, and beyond.

Grant 1 to the OU also involved an assessment of AMR learning materials currently available online. Although there is a lot of material available, it is of variable quality and the scope is patchy. The material also tends to be generic or fragmented and, in most cases, is not well-designed for learners to retain or apply knowledge, and extend their professional skills. By improving the quality, learner focus and practical relevance of the materials available, there is potential to gain much more from AMR online learning products.

The second Global Learning Grant will therefore focus, firstly, on the synthesis, enhancement and supplementation of high-quality online AMR learning materials. To reinforce Fleming Fund objectives, there will be a focus on themes that are aligned to Fund priorities, approaches and existing investments. The second grant will also aim to address key gaps, such as understanding and application of the LSHTM roadmap and the poultry protocol (two blue-print surveillance approaches being funded through country grants). This material will complement other high-quality core modules covering AMR governance, One Health, and sector specific issues in human and animal health. It is anticipated that these customised learning materials will also help build a commonality

and consistency of approach across the Fleming Fund. The learning materials will be freely and openly available within and beyond the life of the Fleming Fund Grants Programme.

To increase the uptake and coverage of these online learning opportunities, the Management Agent will leverage the Grants Programme to advocate for key target groups to enrol in the online courses. Ultimately, the focus will be on building capacity to report into GLASS and use of data at country level to change policy and practice.

We anticipate that this initiative will also pave the way for the expansion of national surveillance systems, for example by helping to bring staff at new surveillance sites up to speed to enable them to integrate quickly into the system. In addition, the initiative could go some way to addressing the perennial problem of staff turnover in LMICs and the ongoing need for retraining and information updates. This approach also offers the potential to reach beyond the immediate beneficiaries of the Fleming Fund to carry the Fleming Fund 'message' to a wider audience.

3. Grant purpose

The purpose of the second Fleming Fund Global Learning Grant is to produce sets of high quality learning material that will address key knowledge and information gaps at-scale. These learning materials should be aligned to Fleming Fund priorities and complement and enhance other Fleming Fund investments. The learning products should be freely and openly available online and should observe the Fleming Fund's core principles – in particular, those of alignment and sustainability, promotion of One Health themes and value for money working.

4. Grant objectives

This initiative has three objectives that will be aligned to three phases of delivery.

Objective 1: Curriculum development

Objective 1 focuses on development of a curriculum for online and distance learning relevant to One Health AMR surveillance in Fleming Fund countries. The curriculum will be based on six core modules:

- AMR governance
- AMR in the human health sector
- AMR in the animal health sector
- A One Health approach to AMR
- LSHTM roadmap¹⁷
- Poultry protocol¹⁸

The curriculum will be packaged as a series of Badged Open Courses (BOCs) and will build on signpost existing open-source learning materials. In addition, the Supplier will work with recommended subject matter experts, and consult with Fleming Fund Grantees and partners to develop relevant, quality-assured curriculum content and conduct formative user testing. The branded curriculum will be online, open access and accessible to learners in all 24 Fleming Fund countries.

Objective 2: Implementation and delivery

Objective 2 focuses on delivery of the curriculum through course recruitment, implementation, moderator support, monitoring and adaptation stages. The Supplier will work with Country and Regional Grantees and Host Institutions to promote high-volume participation. The Supplier will

¹⁷ The London School of Hygiene and Tropical Medicine Roadmap for participation in the Global Antimicrobial Surveillance System.

¹⁸ The new Plan for AMR surveillance in healthy broiler and layer poultry populations produced by the School of Veterinary Science, Massey University, New Zealand

provide targeted moderator support to facilitate the application of learning e.g. through formation of thematic discussion groups etc. The moderator will also monitor course uptake and performance to inform iterative modifications.

Objective 3: Promoting contextualised learning and sustainability

Objective 3 focuses on contextualising module content to promote a sustainable approach. This is likely to involve translation and local presentation of core modules, use of local data and further adaptations to specific target audiences and workplace environments in Fleming Fund constituent countries. This phase will require close collaborative working with Country and Regional Grantees and Host Institutions. It may include trainer-of-trainer approaches and sub-contracted learning initiatives with local partners.

Target audiences

The six modules will primarily be designed for targeted professionals in Fleming Fund countries to support and enhance other Fleming Fund investments – although the modules will also be openly available to other users beyond Fleming Fund countries.

Table 1: Primary target audience for each thematic module

Category	Description	AMR governance	AMR in the human health sector	AMR in the animal health sector	A One Health approach to AMR	LSHTM roadmap	Poultry protocol
Lab Professionals	Lab technician, assistant, technologists, lab scientist (across sectors)		x	x	x	x	
Senior Lab Professionals	Head/Manager of Lab, Head of Unit (across sectors)		x	x	x	x	
Clinical Services Professionals	Clinicians, nurses, pharmacists, epidemiologists, superintended, clinical officers		x		x	x	
Vet Services Professionals	Veterinarians, para-vets, Livestock professionals, field/vet officers, vet pharmacist			x	x		x
(Senior) Management staff in Clinical services	Head of Hospital, Chair of IPC committees / Drugs & Therapeutics / Resources	x	x		x	x	
(Senior) Management in Vet Services	Director / Deputy of Vet Services	x		x	x		x
Policy makers	AMR Secretariat, Ministry Health, Ministry of Agriculture, Livestock, Fisheries, WHO, FAO, OIE	x	x	x	x	x	

Scope of work

Scope of work for Objective 1

Objective 1 on curriculum development will focus on a tasks and deliverables for delivery of three key outputs (Table 2).

Table 2: Overview of scope of work for Objective 1

Task areas	Key elements	Indicative deliverables	Intended outputs
1. Development of module outlines	<p>Each module outline will be:</p> <ul style="list-style-type: none"> • Structured around a standardised, branded design based on a clear statement of learning outcomes • Based on existing available/open access materials • Developed in consultation with: <ul style="list-style-type: none"> a) recommended subject matter experts & b) Fleming Fund Grantees & partners 	<ul style="list-style-type: none"> • Course specifications & outlines for 6 required modules 	<ul style="list-style-type: none"> • 6 module-based BOCs developed covering required topic areas • 6 BOCs quality assured by subject matter experts • 6 BOCs successfully user tested and finalised within agreed timeframes using appropriate online delivery platform
2. Collation of module content	<ul style="list-style-type: none"> • As above - content for 6 modules will be compiled from existing online material & inputs from subject matter experts and selected Grantees & partners • Each module will be structured around a standard branded design based on a clear statement of learning outcomes • Content will focus on high-quality, user-relevant material 	<ul style="list-style-type: none"> • Inventory of content developed and aligned to module outlines • Full, structured content compiled for each of the 6 modules based on adapted & original content 	
3. Module design	<p>Modules will:</p> <ul style="list-style-type: none"> • Progress from basic to more advanced concepts, with signposting to additional resources • Be complementary to form a balanced overarching curriculum • Include interactive content to check learner progress • May include subject matter experts in delivery • Be Fleming Fund branded and quality assured • Be free to the user, open source and badged (with an online learner attendance certificate) 	<ul style="list-style-type: none"> • 6 core modules meeting all design criteria • Appropriate platform identified for curriculum delivery 	
4. User testing	<ul style="list-style-type: none"> • All modules will be subject to user testing by a stratified, 	<ul style="list-style-type: none"> • 6 modules revised to 	

	representative sample of users from each Fleming Fund region	address user feedback	
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Other Objective 1 considerations are:

- While the Supplier is expected to use available online materials, intellectual property rights must be respected. The Supplier must be explicit in explaining how these principles will be observed, and remain open and transparent in acknowledging content sources. Task set 2 above will include gaining formal agreement from relevant content providers to allow hosting &/or links to content.
- The Management Agent will lead on identifying subject matter experts. The Management Agent will reach prior agreement with the Supplier on how these experts will be sub-contracted.
- The Management Agent will assist in facilitating consultations with Country and Regional Grantee, Host Institutions and other partners. The aim of these consultation will be to complement, enhance and extend the capacity development activities of these key role-players, and to avoid duplication of effort.
- Selection of presenters for delivery of modules must, as far as possible, observe the principles of diversity, gender-balance and social inclusion.
- The delivery platform must be accessible to a range of users in diverse settings, sometimes with limited internet connectivity. The modules should, therefore, be easy to download and have some offline functionality. Data security and sustainability of the platform beyond the timeframes of the grant should be factored into platform selection, development and the deployment strategy. The platform and module design must allow for content to be securely modified or updated by a course administrator.
- The modules will initially be developed in English, but Objective 2 activities should include provision for translation into at least 2 additional languages (see below).

Scope of work for Objective 2

Objective 2 on implementation and delivery will focus on a tasks and deliverables for delivery of five key outputs (Table 3).

Table 3: Overview of scope of work for Objective 2

Task areas	Key elements	Indicative deliverables	Intended outputs
1. Course recruitment	<ul style="list-style-type: none"> • Fleming Fund Grantees and partners will be requested to promote the BOCs as an introduction or supplement to their own capacity building work. 	<ul style="list-style-type: none"> • Course recruitment strategy developed & implemented collaboratively 	<ul style="list-style-type: none"> • Agreed milestone targets reached for course recruitment
2. Moderator support	<ul style="list-style-type: none"> • Moderator support will be offered to groups of priority participants to assist them in forming applying learning and forming learner networks • The Supplier will manage course enrolment to ensure moderator 	<ul style="list-style-type: none"> • Moderator support strategy /protocol developed • Qualified course moderators in place for each 	<ul style="list-style-type: none"> • Successful course completion rates meet agreed milestone targets

	support is directed to priority target groups in Fleming Fund countries	module/ region/ priority learner group	<ul style="list-style-type: none"> More than 70% course participants satisfied with moderator support
3. Course monitoring & system maintenance	<ul style="list-style-type: none"> The Supplier will make provision for monitoring course uptake and completion, and will collate and respond to user feedback The Supplier will make provision for appropriate ICT support to ensure the curriculum can be easily and safely accessed by course participants at scale, and that there is timely troubleshooting support 	<ul style="list-style-type: none"> Functioning course monitoring system in place Timely monitoring data on KPIs, including course uptake, user feedback, system maintenance 	<ul style="list-style-type: none"> Course + system monitoring data indicate satisfactory provider delivery
4. Additional adaptations and user testing	<ul style="list-style-type: none"> Over time, the Supplier will add additional wrap-around content to address specific target groups. The Supplier must demonstrate that new material has been quality assured and subjected to user testing 	<ul style="list-style-type: none"> Quality assured wrap around content developed for each module target group 	<ul style="list-style-type: none"> Module content adapted to engage all agreed target groups

Other Objective 2 considerations are:

- The curriculum will be promoted among global, regional and national stakeholders in AMR e.g. AMR committees, ministries, UN agencies, universities, and technical organisations, Host Institutions, Country Grantees and Fleming Fellows. The Management Agent will help the Supplier access its networks.
- The Management Agent will continue to recommend subject matter experts for ongoing quality assurance and adaption work – sub-contracting arrangements will be subject to prior agreement.
- It is recommended that the Supplier’s work on adaptations to target groups is informed by work on learner profiles and learning pathways. These profiles/pathways should be updated through ongoing course monitoring, user feedback and guidance from subject matter experts/programme partners.

Scope of work for Objective 3

Objective 3 on promoting contextualised learning and sustainability will focus on a tasks and deliverables for delivery of four key outputs (Table 4).

Table 4: Overview of scope of work for Objective 3

Indicative tasks	Features	Indicative deliverables	Intended outputs
1. Development of a	<ul style="list-style-type: none"> Strategy for delivering a more contextualised curriculum 	<ul style="list-style-type: none"> Strategy for contextualised 	<ul style="list-style-type: none"> Contextualised approach

contextualised approach to increase sustainability	developed in consultation with key partners, Grantees and programme coordinators/adviser <ul style="list-style-type: none"> The approach will be piloted in 1-2 countries before going to scale in 5 priority countries 	approach developed	developed & piloted in at least 1 country
2. Monitoring, quality assurance & supportive supervision	<ul style="list-style-type: none"> For piloting and scale-up, the Supplier will provide ongoing supportive supervision & quality assurance support to local moderators/subcontractors The Supplier will also monitor progress to identify any need for corrective action and to capture lessons for scale-up 	<ul style="list-style-type: none"> Evidence of support & monitoring activities provided in selected countries 	<ul style="list-style-type: none"> Local moderators/sub-contractors have access to required support for successfully delivering local curriculum
3. Development of exit strategy	<ul style="list-style-type: none"> By the last 6 months of the program, the Supplier will develop an exit strategy for the online BOCs and sustained delivery of local courses in consultation with key stakeholders The exit strategy must be fully implemented within the last six months of the Fleming Fund program in 2021 	<ul style="list-style-type: none"> Exit strategy for BOCs/local curriculums developed within final 6 months 	<ul style="list-style-type: none"> Agreed exit strategy fully implemented within final 6 months Lessons learned from Global Learning initiative documented & disseminated

Other Objective 3 considerations are:

- This tasks for this objective will be addressed in the final phase of the assignment and will be informed by experience of at least 6 months experience of delivering the online BOCs.
- Activities are likely to include translation and local presentation of core modules, incorporation of local data, training of local moderators and additional face-to-face learning events
- Local courses may require sub-contracting of local partners. Sub-contracting arrangements must be agreed with the Management Agent in advance.
- Tasks for Objective 3 will be calibrated to the time and resources available in the final phase of the assignment in consultation with the Management Agent. Priority should be given to successful delivery of Objectives 1 and 2 and documentation of lessons learnt.

5. Supplier Roles and Responsibilities

Assignment delivery

The main role of the Supplier for this assignment will be to plan and implement the outputs and deliver the three objectives described above. The Supplier will be responsible for funding and employing the expert technical assistance and high-quality support needed to achieve agreed results. However, the Management Agent, Mott MacDonald, will assist in the identification of subject matter experts.

The Supplier will be responsible for financial management and controls for the grant as a whole (including the contributions of sub-grantees e.g. national/regional partners if applicable), and for monitoring and reporting to the Management Agent.

Aligned working

The Supplier is expected to work effectively and synergistically with other grants under the Fleming Fund Grants Programme, including the Country and Regional Grants and the Fleming Fellowship Scheme. The Supplier will maintain close links with the London team delivering the Fleming Fellowship scheme and will work with Regional Offices to ensure alignment of this grant with Country Grants, appropriate timing of delivery and engagement with government. Regional Offices will facilitate the Supplier's initial access to countries.

Measuring success

The Supplier should review the Fleming Fund standard set of indicators to establish whether any are appropriate for this grant and, if they are, include them in the Section 9 monitoring schedule. Otherwise, alternative indicators that are appropriately aligned to the objectives and outputs described above will be acceptable.

ANNEX 2 Global AMR Curriculum

Table 1A Modules released as part of the Global AMR Curriculum

Modules	Links to the Open Learn Create platform	Release date
A - AMR surveillance and you	https://www.open.edu/openlearncreate/course/view.php?id=5356	20 Jan
B - The problem of AMR	https://www.open.edu/openlearncreate/course/view.php?id=6447	20 Jan
C- Introducing AMR	https://www.open.edu/openlearncreate/course/view.php?id=5554	20 Jan
D - AMR in animals	https://www.open.edu/openlearncreate/course/view.php?id=6542	27 May
E1 - Isolating and identifying bacteria (human health)	https://www.open.edu/openlearncreate/course/view.php?id=6543	29 Mar
E2 - Isolating and identifying bacteria (animal health)	https://www.open.edu/openlearncreate/enrol/index.php?id=6849	24 Jun
F - Antimicrobial susceptibility testing (human health)	https://www.open.edu/openlearncreate/course/view.php?id=5594	29 Mar
G - Testing for mechanisms of resistance	https://www.open.edu/openlearncreate/course/view.php?id=6544	27 May
H - Quality Assurance and AMR surveillance	https://www.open.edu/openlearncreate/course/view.php?id=6545	25 Feb
I - Introducing a One Health approach to AMR	https://www.open.edu/openlearncreate/course/view.php?id=6546	25 Feb
J - An introduction to <u>AMR</u> surveillance	https://www.open.edu/openlearncreate/course/view.php?id=6547	27 May
K - Introducing AMR surveillance systems	https://www.open.edu/openlearncreate/course/view.php?id=6548	25 Feb
L - AMR surveillance in animals	https://www.open.edu/openlearncreate/course/view.php?id=6549	27 May
M1 - Sampling (<u>Human Health</u>)	https://www.open.edu/openlearncreate/course/view.php?id=6550	29 Mar
M2 - Sampling (<u>Animal Health</u>)	https://www.open.edu/openlearncreate/course/view.php?id=5624	29 Mar
N - An overview of national AMR surveillance	https://www.open.edu/openlearncreate/course/view.php?id=6551	29 Mar
O - Communicating AMR data	https://www.open.edu/openlearncreate/course/view.php?id=6552	24 Jun
P - Legal and ethical considerations in AMR data	https://www.open.edu/openlearncreate/course/view.php?id=6553	24 Jun

Q - Fundamentals of data for AMR	https://www.open.edu/openlearncreate/course/view.php?id=6554	25 Feb
R - Using AMR data for policy making	https://www.open.edu/openlearncreate/course/view.php?id=6555	17 August
S - Processing and analysing AMR data	https://www.open.edu/openlearncreate/course/view.php?id=6556	29 Mar
T - Summarising and presenting AMR data	https://www.open.edu/openlearncreate/course/view.php?id=6557	27 May
U - Antimicrobial stewardship in clinical practice	https://www.open.edu/openlearncreate/course/view.php?id=6558	17 August
V - <u>Diagnostic stewardship in clinical practice</u>	https://www.open.edu/openlearncreate/course/view.php?id=6559	27 May
W - <u>Antimicrobial stewardship in animal health</u>	https://www.open.edu/openlearncreate/course/view.php?id=6560	24 Jun

ANNEX 3 Monitoring and Evaluation of the Global AMR Curriculum

A. Pre-Survey

Understanding Antimicrobial Resistance

Thank you for taking part in the study by completing this survey which examines the role of relevant online modules in supporting and enabling learning for work. We particularly focus on healthcare professionals in order to understand more about the role that an online module plays in learning about antimicrobial resistance and your work in related facilities. The study is carried out by a research team funded by the Fleming Fund at the Open University [\[link\]](#).

You have been invited to complete this survey because you are taking a pathway related to Understanding Antimicrobial Resistance. Towards the end of this survey, you will be requested to indicate whether you will be willing to keep some digital diaries (5-minute guided audio recording of your learning experience fortnightly and for three months) and be invited to take part in an online interview that will last for 30 minutes. As with all aspects of the study, your participation is voluntary, and you will be free to withdraw submitted data from any aspect of the research.

Participation in the study is separate from participating in the online module. This means that if you do not want any of your responses on the module to be considered for the research project, you can withdraw consent for us to use this without affecting your potential to complete the module and gain your participation certificate. To withdraw your data, please contact us as indicated below. You may find some more information about the study helpful in making your decision for the project to use the data you provide and engage with the optional surveys, digital diaries and interview (please see participant information sheet here).

In this survey you are asked questions about you as a participant, how you came to know about this module, what your expectations of the module are and what you hope this module will allow you to learn, especially in relation to your professional practice. It also includes some questions about your previous experiences of learning. It has six sections (A-F) and will take you approximately 15-20 minutes to fill in.

By taking part in this survey we assume you have given us your consent to use your responses as part of the Fleming Fund study. Data collected will be accessible only by the research team at the Open University and will not be shared with anyone without your approval. All data will be anonymised prior to any presentations or publications and you will not be identified.

If you have any questions about this study or would like to withdraw your data at any point, please contact Dr Saraswati Dawadi, Institute of Educational Technology, The Open University (Saraswati.Dawadi@open.ac.uk).

Thank you very much for your time and input!

SECTION A: About you

A1. Please tell us your gender:

1. Male
2. Female
3. Other
4. Prefer not to say

A2: Which country do you currently live in?

A3. Are you a Fleming fellow?

1. Yes
2. No

A4. Please tell us your age:

1. under 25
2. 25-34
3. 35-44
4. 45-54
5. 55-64,
6. 65 and over

A5. Please tell us the highest level of qualification you have.

1. Secondary school certificate
2. Certificate
3. Diploma
4. BA/BSc
5. MA/MSc
6. PhD
7. No qualifications
8. Other*

If you selected Other, please specify:

A6. Please tell us how many years of work experience in total do you have in the health sector (i.e. human health, animal health, agriculture and livestock, environment)?

- a) No experience
- b) Less than 2 years
- c) 3-8 years
- d) 9-14 years
- e) 15-20 years
- f) More than 20 years

A7. On a scale between 1 and 5 (1=not at all, 5=highly) how confident are you in your level of English in:

	Not at all	Not very	Slightly	Mostly	Highly
Understanding spoken English					
Speaking English					
Reading English					

Writing English					
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A8. On a scale between 1 and 5 (1=not at all, 5=highly), how confident are you in using computers and the Internet?

Not at all	Not very	Slightly	Mostly	Highly

SECTION B: About your workplace

B1. Do you currently work for an organisation in the public health sector (i.e. human health, animal health, agriculture and livestock, environment)?

1. Yes
2. No
3. Prefer not to say

If yes: Carry on in this section B2 If no: Go to section D

B2. If yes, please tell us if the organisation you work for is in the:

1. Human health sector
2. Animal health sector
3. Agriculture and Livestock Sector
4. Environment sector
5. Other*

If you selected Other, please specify

B3. Where is your organisation located?

1. Capital
2. Urban area (other than the capital)
3. Rural area

B4. Please tell us how many years of work experience you have in your current organisation?

1. Less than 2 years
2. 3-8 years
3. 9-14 years
4. 15-20 years
5. More than 20 years

B6. Is your organisation part of the AMR surveillance network in your country?

1. Yes
2. No*
3. I don't know
4. Prefer not to say

B6.1 If no: Will your organisation join the AMR surveillance network in your country in the future?

1. Yes
2. No
3. I don't know

SECTION C: About your role and technology use

C1. What's your role in the current organisation?

Please specify here (e.g., lab scientist, lab technician): _____

C2. Please describe your role in one sentence: *What it is that you do?*

free text

C3. Which unit in your organisation are you based on? (e.g. in bacteriology, microbiology, serology, etc.)?

free text

C4. How often do you use digital devices (e.g. your mobile phone, a computer or a laptop) at work for work-related matters?

- 1 Multiple times in a day
- 2 Once per day 2-3 times a week
- 3 Once per week
- 4 Rarely (e.g. once per month)
- 5 Never
- 6 I prefer not to say

D. About the Online Module

D1. How did you know about the online module (The AMR Professional) you are currently taking?

- 1. from the Fleming fund email/newsletter/website
- 2. from a colleague
- 3. from the Open University website
- 4. from a WhatsApp group
- 5. from my professional group distribution lists
- 6. the notice board in my organisation
- 7. from AMR networks in my country
- 8. Others

If you selected others, please specify....

D2. Please tell us if this is your first experience of taking part in an online module.

- a. Yes
- b. No
- c. I don't remember
- d. I prefer not to say

D3. Please tell us if this is your first experience of taking part in a (professional) programme on AMR.

- e. Yes
- f. No
- g. I don't remember
- h. I prefer not to say

D4. What made you sign up for the online module?

Free text...

D5. Did you talk to someone at work about taking part in this online module?

- a Yes
- b No
- c I prefer not to say

D5.1 If yes: What made you talk to him/her?
D5.2 If not: Who else should know about this?

Free text (please do not refer to specific names, instead refer to roles)

D6. What will inhibit/help you complete this module ‘The AMR Professional’?

Free text ...

D7. What will make this online module (The AMR Professional) useful for you? (you may tick more than one)

1. Access to resources on AMR (e.g. videos, articles)
2. Access to professionals in my country
3. Access to professionals in other countries
4. Practical examples related to my role at work
5. Knowledge about antimicrobial resistance
6. Knowledge about antimicrobial resistance surveillance system
7. Specialised terms/vocabulary relevant to AMR I could be using in my job
8. Knowledge of good laboratory practice and quality management systems
9. Knowledge about the One Health approach
10. Knowledge about data processing for AMR
11. Knowledge about stewardship in AMR
12. Other*

If you selected other, please specify...

E. About your understanding of antimicrobial resistance

E1. On a scale between 1 and 5 (1=not at all, 5=highly), how confident do you feel about:

Not at all	Not very	Slightly	Mostly	Highly

1. your current knowledge and understanding of antimicrobial resistance
2. talking to a colleague about antimicrobial resistance
3. talking to a member of your family about antimicrobial resistance
4. the ways your work role contributes to tackling AMR
5. your organisation’s role in relation to AMR
6. the significance of AMR as a global issue
7. the significance of AMR as an issue locally
8. your current knowledge and understanding of AMR surveillance
9. your current use of specialised terms and vocabulary relevant to AMR
10. using data in AMR surveillance

F. Module Expectation and Knowledge Transfer

F1. What do you expect from this online Module ‘The AMR Professionals’?

Free text _____

F2. What do you expect will change in your day-to-day job when you take part in this online module?

Free text _____

F3. What will encourage or inhibit you from applying new AMR knowledge or skills to your workplace in the future?

Free text _____

If you are willing to participate in recording diaries and a follow-up interview, please provide your name and email, and we will get in touch with you soon.

Thank you very much!

Fleming Fund: Tackling Antimicrobial Resistance Project, funded by UK Aid, Dept of Health and Social Care through Mott MacDonald

The Institute of Educational Technology and the International Development Office at the Open University are leading this research, aiming to examine how online learning supports and enables learning for work.

We'd like to thank you for your time in taking part in this survey!

Your opinion is highly valued by the Open University and the Fleming Fund. If you have any other questions, we would be happy to answer them. Please contact: Dr Saraswati Dawadi (Saraswati.Dawadi@open.ac.uk ; Mobile: 0044 (0)7424711775).
Institute of Educational Technology, The Open University, Jennie Lee Building, Walton Hall, Milton Keynes, MK7 6AA, Tel: +44 (0) 1908368753

B. Post-Survey

Post-Module Survey for the Open University Course 'Understanding Antimicrobial Resistance' as part of the Fleming Fund

Thank you for considering taking part in the study by completing this survey. This study examines the role of the online Fleming Fund Open University Course about Antimicrobial Resistance (AMR) in supporting and enabling learning for work. We particularly focus on professionals in facilities (both human and animal health) to gain an understanding about the role that an online course plays in relation to learning about antimicrobial resistance and your work in the facility. The study is carried out by a research team funded by the Fleming Fund at the Open University [link].

All participants registered for the Course have been invited to take part in a study through an information sheet. One of the data collection methods is by online survey and this is the post-course survey for the Course. Included in this survey at the end is an invitation to have an interview with a member of the project team. There will be an additional consent form for the interview which you should complete if you wish to take part in these. As with all aspects of the research element of this course, your participation is voluntary, and you will be free to withdraw data submitted from any aspect of the research until 30 June 2021.

Participation in the study is separate from your participation in the online course and does not affect your course completion. This means that if you do not want any of your responses on the course to be considered for the research project, you can withdraw consent for us to use this without affecting your potential to complete the course and gain your certificate of participation. To withdraw your data, please contact us as indicated below.

In this survey, you will be asked questions mainly about your experience of learning from the online course (e.g., how you found the course and what you learnt from the course) and the extent to what you applied your knowledge and skills to your workplace. It also includes some questions about previous experiences of your learning. It is organised into four sections A-D and will take you approximately 20-25 minutes to fill in this survey.

By taking part in this survey we assume you have given us your consent to use your responses as part of the Fleming Fund study. Data collected will be accessible only by the research team at the Open University and will not be shared with anyone without your approval. All data will be anonymised prior to publication and participants will not be identified.

If you have any questions about this study or would like to withdraw your data, we would be happy to answer your questions and respect your wishes. Please contact: Dr Saraswati Dawadi, Research Associate, Institute of Educational Technology, The Open University, Saraswati.Dawadi@open.ac.uk

Thank you very much for your time and input which will benefit future professionals who will take part in this online course.

SECTION A: About your experience as a participant in the online modules

A1. Please tell us how useful you found the following features to your learning. If you haven't engaged with these please tick 'I did not use this'.

	Very useful	Slightly useful	Not very useful	Not useful at all	I did not use this
Videos					
Course content about microbes, microbial resistance and tackling AMR					
Questions which asked you to reflect on your knowledge about AMR					
Questions which asked you to reflect on how the content related to your work-based problems					
Case studies/exemplar material					
Glossary					
Links to relevant websites which required you to find information					
Your learning journal					
Discussions with colleagues at work/beyond the course					

A2. On a scale between 1 and 5 (1=not at all, 5=highly), how confident do you feel about the followings now that you completed the module

Not at all	Not very	Slightly	Mostly	Highly

1. your current knowledge and understanding of Antimicrobial resistance
2. talking to a colleague about antimicrobial resistance -
3. talking to a member of your family about antimicrobial resistance
4. the ways your work role contributes to tackling AMR
5. your organisation's role in relation to AMR
6. the significance of AMR as a global issue
7. the significance of AMR as an issue locally
8. your current knowledge and understanding of AMR surveillance
9. your current use of specialised terms and vocabulary relevant to AMR
10. using data in AMR surveillance

SECTION B: Learning from the Online Modules

B1. What did you like most about the online modules on AMR?

Free text: _____

B2. What supported or discouraged you from learning about AMR in the online modules?

Free text: _____

B3. To what extent do you agree with the following statements?

Scale next to statements (1) strongly agree (2) agree (3) neither agree nor disagree (4) disagree (5) strongly disagree

- a. The online modules helped me learn more about AMR and develop my self-awareness that AMR is a multi-sectoral challenge
- b. The online modules offered me an opportunity for my professional development
- c. The online modules helped me acquire knowledge/skill that is relevant to my job
- d. The online modules have offered me an opportunity to improve in ways that are relevant to my role
- e. The online modules have offered me an opportunity to collaborate with other people and to know how my work relates to the work of others in the AMR
- f. The online modules have encouraged me to use social apps (e.g. WhatsApp) for learning and connecting with others
- g. The online modules have encouraged me to incorporate new practices related to AMR surveillance into my work
- h. The online modules provide me with an opportunity to restructure my work

Section C: Reflections on the impact of the online modules on your work practice

C1. What, if any, has changed as a result of you taking part in this online course?

Free text: _____

C1i. How do you know that things have changed? Please give us an example which shows that you have used / applied your learning from the online course to think or do things differently at work.

Free text: _____

C2: What has encouraged or inhibited you from applying new AMR knowledge or skills to your work practice?

Free Text: _____

D. Module Access

Scale next to statements (1) strongly agree (2) agree (3) neither agree nor disagree (4) disagree (5) strongly disagree

- a. I had access to a device (laptop, tablet, mobile phone) to access the online modules most of the times
- b. My broadband/ data allowed me to easily access the modules and materials
- c. I had sufficient time to complete modules
- d. I was able to access the module from a variety of locations (e.g. home, workplace, a combination of both)
- e. I had enough digital (ICT) skills to go through online modules

Please tell us if you had any problems in accessing the online modules

Free text

SECTION D: About you and your workplace

D1. Do you currently work for an organisation in the public health sector (i.e. human health, animal health, agriculture and livestock, environment)?

1. Yes
2. No
3. Prefer not to say

If yes: Carry on in this section. If no: Go to D8.

D2. If yes, please tell us if the organisation you work for is in the:

1. Human health sector
2. Animal health sector
3. Agriculture and Livestock
4. Environment
5. Other*

If you selected Other, please specify (free text)

D3. Where is your organisation located?

1. Capital
2. Urban area (other than the capital)
3. Rural area

D4. What's your role in your organisation? Please specify (e.g., lab technician) and describe it in one sentence

Free text....

D5. Please tell us how many years of work experience you have in your current organisation?

1. Less than 2 years
2. 3-8 years
3. 9-14 years
4. 15-20 years
5. More than 20 years

D6. Please tell us your gender:

1. Male
2. Female
3. Other
4. Prefer not to say

D7: Which country do you currently live in?

D8. Are you a Fleming fellow or associated with a Fleming fund project/scheme?

1. Yes
2. No

D9. Please tell us your age:

1. under 25
2. 25-34
3. 35-44
4. 45-54

5. 55-64,
6. 65 and over

D10. Please tell us the highest level of qualification you have.

1. Secondary school certificate
2. Certificate
3. Diploma
4. BA/BSc
5. MA/MSc
6. PhD
7. No qualifications
8. Other*

If you selected Other, please specify: (free text)

D11. On a scale between 1 and 5 (1=not at all, 5=highly) how confident are you in your level of English in:

	Not at all	Not very	Slightly	Mostly	Highly
Understanding spoken English		Not very			
Speaking English		Not very			
Reading English		Not very			
Writing English		Not very			

Follow-on interviews

We would like to follow-up on this survey with a short interview that will give us an opportunity to discuss with you in details aspects of the online module. If you agree, a member of our research team will get in touch with you shortly to agree the most convenient time and method (likely to be by phone or online) at a time that is convenient for you. We will ask you a few questions about your experience in the online module, any benefits you may have and any issues you may have experienced, as well as how this module is linked to your everyday job.

Even if you tick 'Yes' below, you can change your mind and we will give you the option to withdraw from the interviews after we make any contact with you.

Would you like to be contacted for an interview?

- a. Yes
- b. No

If yes - Please state your email address here, if we may contact you regarding a follow-up interview:

[comment box]

If no – go to final page

Final page

Thank you!

Fleming Fund: Tackling Antimicrobial Resistance Project

Funded by UK Aid, Dept of Health and Social Care through Mott MacDonald

The Institute of Educational Technology and the International Development Office at the Open University are leading this research, aiming to examine how online learning supports and enables learning for work.

We'd like to thank you for your time in taking part in this survey!

Your opinion is highly valued by the Open University and the Fleming Fund.

If you have any other questions, we would be happy to answer them. Please contact:

Dr Saraswati Dawadi (Research Associate, the Open University, UK) at Saraswati.Dawadi@open.ac.uk, mobile: +44 (0)7424711775.

C. End-of-module Survey

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Overall, I am satisfied with the quality of the module					
The amount of time required to take the module was appropriate for my personal circumstances					
It was easy to navigate the module website to access learning materials					
The language and instructions were clear and easy to follow					
Sufficient opportunities were provided to check my understanding on the module					
The module was relevant to my job role and workplace					
The module showed me how I can do certain activities at work (e.g. doing a test, entering data, or making critical decisions)					
The module helped me identify areas of improvement at workplace or solve workplace problems					
I was able to link the module to my previous experience and/or knowledge					
My level of understanding about the AMR has improved as compared to my understanding prior to taking this module					
During the module, I had opportunities to reflect on what is taught and/or talked to my colleagues about it					
It is very likely that I'll use what I learned in this module in my daily work					
I have a clear idea about my next module choice					

2. What, if any, has changed as a result of you taking part in this online module?

Free text

Follow-up

3. How do you know that things have changed? Please give us an example which shows that you have used / applied your learning from the online module to think or do things differently at work.

Free text-----.

4. What would you like to see added, changed or emphasised in future modules that assisted in your learning

Free text

D. Student Interview protocol

- **Explain the purpose of interview**
 - Gain an understanding of students’ learning about AMR, particularly from the online modules developed by the OU, their job roles/responsibilities, and the implementation of their knowledge and skills to their workplaces
 - Gain an understanding of the barriers and enablers to learning and knowledge implementation
- Obtain participant’s consent
 - Obtain their consent to involve them in this study and record the discussion
- Conduct a discussion

Discussion prompts	
1.	Can you please explain to me what is your role in your organization and your main responsibilities? (What it is that you do?)
2.	What tools do you use? Who do you work with?
3.	Can you describe a typical task that you do and what are the challenges in this task for you?
Participants’ expectations from the global curriculum	
4.	What made you sign up to the module(s)?
5.	What other experiences of online learning did you have in the past?
Follow up questions:	
-	What did your participation in the online modules involve/require?
-	What were you expecting?
-	Were the objectives of each module made clear to you? Have your expectations been met?
-	What did you find the most relevant to you and your role (if any)?
-	How did you organise your learning online? (hours, were you accessing the materials at home/at work, what devices did you use, were you downloading materials and work through them offline?)
-	How did studying online in the modules work for you? What were the main issues / challenges?
-	What do you think works well in the online modules in the current provision, if any? (give an example)
-	What doesn’t work well in the OU online modules, if any? How do you know? (example)
-	What, if anything, can the OU do in the future to improve the online modules?
6.	To what extent are the FF modules on AMR relevant to your job role?
7.	Can you please share with me an experience you had in the online modules that you felt was an effective learning experience? What made it effective?
8.	What has your participation in the online modules enabled you to do as an X [their role] that you couldn’t do before?
Follow up questions:	
-	can you give me an example?
-	Is this an important change for you? Why?
If nothing changed, any reasons why you were not able to benefit from the OU modules?	
Knowledge implementation	

9. Can you help me understand if there are any areas / tasks / activities in your day-to-day work that you have already identified that your learning from the modules is particularly relevant and could be used?

10. What might support you to use the learning from the online modules in your work practice?

11. I am wondering if you can share with me any (recent) experience at work, where you felt you were doing things differently because of participating in this module/course?

12. What encourages you to learn and apply new AMR knowledge or skills to your work practice?

13. What discourages you from learning and applying new AMR knowledge or skills to your work practice?

Follow up questions:

14. What, if anything, might improve the way you go about dealing with AMR in your organization?

15. Is there anything else that you feel it is useful for us to know about your learning on the online modules?

Introduction

- **Explain the purpose of interview**
 - Gain an understanding of how the toolkit (or a particular tool) was tested in a local context.
 - Gain an understanding of the strengths and weakness of the toolkit
 - Gain an understanding of the suitability of the toolkit in the local context where it has been tested
 - Gain an understanding of the barriers and enablers to the toolkit implementation
- **Obtain participant’s consent**
 - Obtain their consent to involve them in this study and record the discussion
- **Conduct a discussion**

Discussion prompts
1.Can you please explain to us what your role is in your organization? (What it is that you do?)
2. What made you want to take part in the testing of the toolkit?
3. How does your role link to the roles of the people who took part in the testing of the toolkit?
4. Please summarise any training or other activities you have participated in about antimicrobial resistance prior to this toolkit (incl. online). If so, how different has been for you, if any difference?
5. How did you organize the testing of the toolkit? (e.g. did s/he need any approvals? Buy-in from participants?) Please explain how did you facilitate / lead the testing of the toolkit. What did being the facilitator of this toolkit require?
6.How did you find the (structure of the activities? How did that work for you?)
7. Could you share with us an example from while you were testing the toolkit of what you felt to be particularly relevant to you and your team ? - What made it relevant?
8. Did you find any aspects of i. the process and ii. content of the toolkit testing challenging? - What were the key challenges that you as the facilitator faced when testing the tool(s)? If so, please can you explain how did [this aspect] helped your role as a facilitator? If not, can you help us understand what made you not use (or not complete) e.g. post-activity actions?
9. What has your team’s participation in the toolkit testing enabled you to do as a team that you couldn’t do before? (give example) - Is this an important change for you? Why? -Please can you identify any particular parts of the toolkit which helped this change. - If nothing changed, why you were not able to benefit from this toolkit yet ?

10. Did you discuss the toolkit testing and your learning through this with anyone else in your organization (incl. members of your team)?

If so, did this lead to any changes in either the views of others or changes in practice?

If not, what would it be required for any change to take place?

11. What benefits(s) if any, the toolkit can bring to professionals like you, especially around tackling of AMR?

12. Do you have any thoughts following your participation in the toolkit about how learning on the job should look like?

For example, would you now like to participate in further work-related learning or would like to engage in other activities ?

13. As a result of completing the toolkit, can you point us to an area of work related to AMR in your organization that requires change?

What, if any, might improve the way you doing things about AMR in your organization? Can you link this to any particular part of the toolkit?

14. What, if any, The Open University could do in the future to improve the provision of learning for work?

15. Is there anything else that you think might be useful to us and the Fleming Fund team?

F. Toolkit testing Proforma

This proforma is for reporting feedback on the meetings/workshops organised to test the AMR toolkit.

We would like to thank you for your feedback in this proforma. Your feedback is important to us as we aim to adapt the AMR toolkit and make it available to other professionals in all the Fleming Fund countries.

Organisation Name	
Your name (optional)	
Your job title and brief description of your role	
How did you take part in the meeting/workshop? (remotely or in person)	
Number of professionals in the meeting/workshop where you tested the AMR Toolkit	
Number of meetings/workshops you took part	
Which tool(s) were tested in the meeting/workshop(s)? If more than one tools were tested, please mention all the tools here.	

1. Have you gone through the online modules on AMR designed by the Open University before you took part in the meeting/workshop where you tested the toolkit? If you had done so, please list the modules here:

2. Please write a brief description of how the meeting/workshop was organised (i.e., tools or resources used, processes followed, the role of the facilitator and so on)

3. What were you expecting? Have your expectations been met?

4. What did your participation in the meeting/workshop involve or require? What worked well? What didn't work well?

5. Please give us one example of an activity you did during the meeting/workshop (s) that you thought it was particularly relevant to your role. Leave blank if you cannot think of any activity.

6. What did the toolkit enable you to do as a team that you couldn't do before? Is this an important change?

If nothing changed, please tell us why you were not able to benefit from the toolkit.

7. What were the key challenges that you or the team faced when testing the tool(s)?

8. Please give us one example of an activity you did during the meeting/workshop or of something you read or heard that you intend to use in the future.

9. What benefits(s) if any, the toolkit can bring to professionals like you, especially regarding tackling of AMR?

10. What, if any, the Open University could do to improve the activities in the AMR toolkit?

We would like to thank you for your time in producing this proforma. We would like to follow-up on this proforma with a short interview that will give us an opportunity to discuss with you in more detail your experience of taking part in the testing of the toolkit. Your feedback is important to us as we aim to adapt the AMR toolkit and make it available to other professionals in all the Fleming Fund countries.

If you agree, a member of our research team will get in touch with you in the next few weeks to agree the most convenient time and method for you (likely to be online).

Would you like to be contacted for an interview? If yes- Please state your email address here that we can use to invite you to an interview.

Email:

Please have no worry if you are not interested in. This will not affect you negatively in any way.

If you would like more information about this study, please contact Dr Saraswati Dawadi at Saraswati.Dawadi@open.ac.uk .

THANK YOU!

Annex 4 Data from surveys

Pre-Survey results

Table 4A. List of countries represented in the responses of the pre-survey

Country	Number of participants
Nigeria	148
Ghana	51
Nepal	28
Cambodia	26
Bangladesh	19
Malaysia	18
Pakistan	14
UK	12
Kenya	10
Papua New Guinea	10
Thailand	10
Cameroon	7
Tanzania	7
Timor-Leste	6
Vietnam	6
Philippines	5
Ethiopia	4
India	4
Indonesia	4
Lao PDR	4
Netherlands	4
Sierra Leone	4
Hungary	3
Malawi	3
UGANDA	3
Zambia	3
Zimbabwe	3
Australia	2
Benin	2

Botswana	2
Canada	2
France	2
Germany	2
Laos	2
Myanmar	2
République Démocratique du Congo	2
Senegal	2
Bhutan	1
Brazil	1
Burkina Faso	1
Ecuador	1
Eswatini	1
Guatemala	1
Ireland	1
Jordan	1
Mexico	1
oman	1
South Africa	1
Sri Lanka	1
Sudan	1
Switzerland	1
Togo	1
United Arab Emirates	1

Table 4B Professional roles of the respondents in the pre-survey

Role	Number
Lecturer, senior lecturer or professor	31
Research officer, assistant and fellows	27
Laboratory scientist	18
Veterinary Officer	17
AMR-related roles	16
Consultant	13
Pharmacist and pharmacy assistant	13
Lab technicians	12
Vet technicians	12

Veterinarian	12
Epidemiologist	11
Microbiologist	11
Manager or director	10
Head of lab or lab manager	7
Medical doctor	7
Student (PhD, postdoc, Masters)	7
Fellow	5
Physician	5
Project officer or project assistant	5
Scientific Officer	5
Laboratory Technologist	4
Project manager, project leader	4
(Senior) Technical advisor	3
Technical Officer	3
Animal Health Field Officer	2
Paediatric	2

Table 4C Units where respondents in the pre-survey are based (pre-survey, n=451)

Unit	Number
Microbiology	118
Bacteriology	60
Other	36
Public health	25
Epidemiology	21
Clinical services	20
Veterinary clinic	13
Serology	11
Research unit or centre	10
Diagnostic, prevention and treatment	9
Animal health	9
Pathology	9
Pharmacy	9
Medicine	8
AMR Surveillance	8
Virology	7
immunology	7
Infectious Diseases	7
Paediatric unit	6
Field services	6
Pharmacology	6
Molecular biology	6
Environment	5

Parasitology	5
Food safety or food technology	4
Biochemistry	4
Regulatory (biosecurity, drug) unit	3
Policy and policy support	2
Molecular Diagnostics	2
Biotechnology	2
Haematology	2

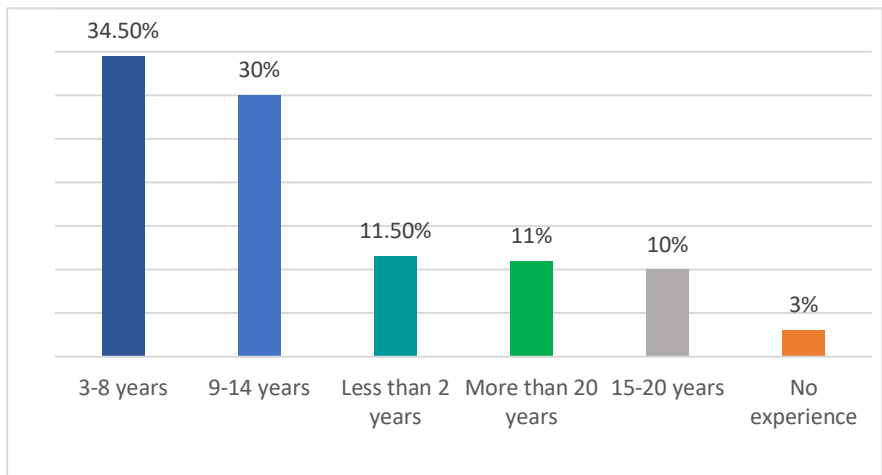


Figure 4A Years of work experience (pre-survey, n=451)

Post-survey results (n=32)

Table 4D Participants' roles

Role	Number
Laboratory scientist	5
Laboratory Technical Officer or Technician	4
Veterinary Officer or Technician	4
Federal epidemiology officer	2
Surveillance Specialist	1
Veterinary student	1
Consultant, Microbiology lab	1
Safety assessor	1
Clinical Pharmacist	1
Veterinarian	1
Veterinary Technologist	1
Antimicrobial Resistance Desk Officer	1
Director	1
Clinician	1
Research Assistant	1

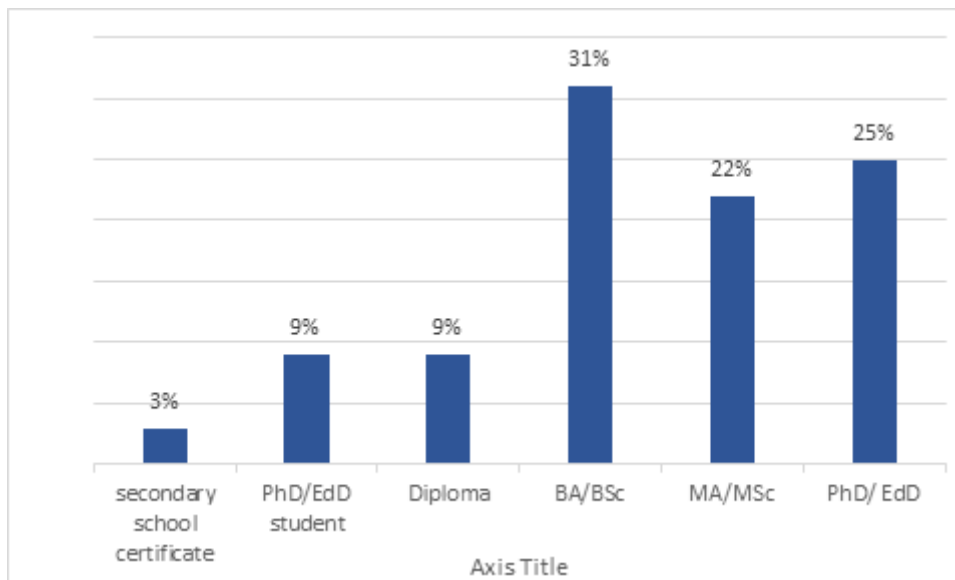


Figure 4B Participants' highest level of qualification

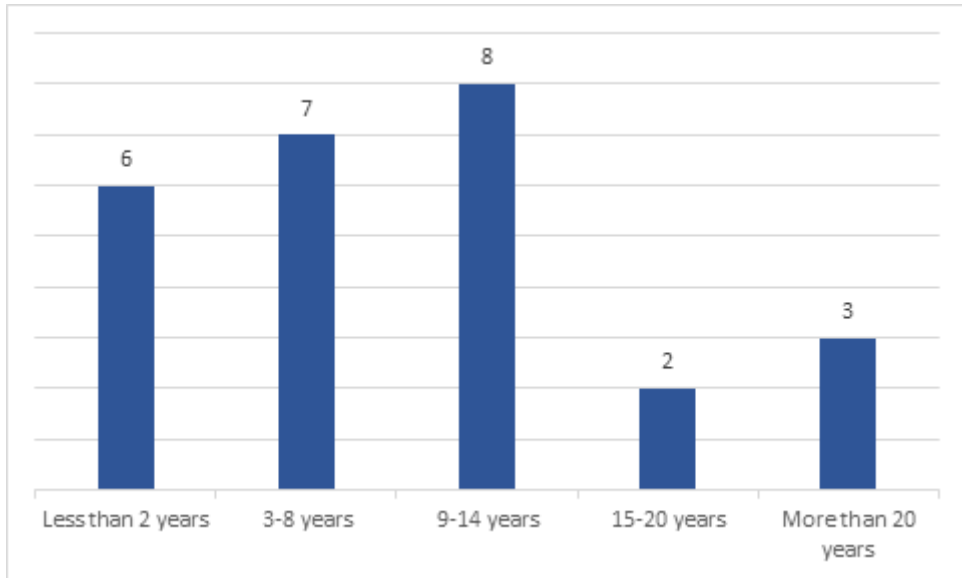


Figure 4C Years of work experience

End of Module survey

Table 4D Number of responses to the end-of-module survey per module

Code	Modules	Release dates	Number of responses to end-of-module survey
5356	AMR surveillance and You	20 Jan	20
6549	AMR surveillance in animals	27 May	1
6547	An introduction to AMR surveillance	27 May	7
6551	An overview of national AMR surveillance	29 Mar	3
6542	Antimicrobial resistance in animals	27 May	12
6560	Antimicrobial stewardship in animal health	24 Jun	No data
6558	Antimicrobial stewardship in clinical practice	17 Aug	No data
5594	Antimicrobial susceptibility testing	29 Mar	5
6552	Communicating AMR data to stakeholders	24 Jun	3
6559	Diagnostic stewardship in clinical practice	27 May	No data
6554	Fundamentals of data for AMR	25 Feb	5
6546	Introducing a One Health approach to AMR	25 Feb	7
6548	Introducing AMR surveillance systems	25 Feb	8
5554	Introducing antimicrobial resistance	20 Jan	24
6849	Isolating and identifying bacteria (animal health)	24 Jun	3
6543	Isolating and identifying bacteria (human health)	29 Mar	4
6553	Legal and ethical considerations in AMR data	24 Jun	2
6556	Processing and analysing AMR data	29 Mar	5
6545	Quality assurance and AMR surveillance	25 Feb	3
5624	Sampling (animal health)	29 Mar	4
6550	Sampling (human health)	29 Mar	2
6557	Summarising and presenting AMR data	27 May	3
6544	Testing for mechanisms of resistance	27 May	No data
6447	The problem of antimicrobial resistance	20 Jan	21
6555	Using AMR data for policy-making	17 Aug	1

**Data accurate as of 1 September 2021*

