TACKLING ANTIMICROBIAL RESISTANCE: THE AMR SURVEILLANCE TOOLKIT

A RESOURCE FOR MANAGERS, TEAM LEADS AND SENIOR STAFF IN HEALTHCARE SETTINGS IN AMR SURVEILLANCE NETWORKS

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The Fleming Fund

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CONTENTS

INTRODUCTION

One of the greatest global health challenges of our time is antimicrobial resistance (AMR).

The World Health Organisation (WHO) defines AMR as the ability of a microorganism (bacteria, viruses, parasites) to stop an antimicrobial (an antibiotic, antiviral or antimalarial) from working against it.[1] The subsequent transmission and spread of resistant pathogenic bacteria result in drug-resistant infections.

The increasing use of antimicrobials worldwide has been associated with a global increase in drug-resistant infections. Without effective antibiotics, routine medical procedures will be less safe in the future and even minor infections will no longer be treatable.

At present, drug-resistant infections are estimated to account for 50,000 deaths each year in Europe and the USA alone, but by 2050 it is estimated that they will account for 10 million deaths per year worldwide.[2]

The effects of AMR are predicted to be more acute in resource-limited settings such as in low- and middle-income countries (LMICs). 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.

WHY SHOULD I USE THE TOOLKIT IN MY WORK?

As a health professional, you have a key role to play in addressing this global threat and you must be supported to develop more effective ways of working around AMR practice. However, opportunities for professional development are limited. To this end, we – a research team at The Open University, UK – asked staff in healthcare facilities involved in AMR work about the difficulties that they face in implementing effective AMR surveillance.[3] This activity took place in three LMICs (Bhutan, Ghana and Tanzania), and we found that health professionals:

- lack specific knowledge around AMR that is critical for good AMR practice, while opportunities for professional development are limited
- are not always able to use newly learned knowledge or skills in their day-to-day work because of existing ways of working and organisational structure
- do not work in a connected way where roles and teams function together and do not fully understand their role in relation to the overall AMR system or network.
- welcome opportunities to learn more about dealing with AMR data.

1 WHO 2020. Antimicrobial Resistance. World Health Organisation. Accessed February 2 2020. https://www.who.int/antimicrobial-resistance/en/.

2 O'Neill, J. (2016) Tackling Drug-Resistant Infections Globally: Final Report and Recommendations, Review on Antimicrobial Resistance, London: Wellcome Trust/HM Government [online]. Available at https://amr-review.org/sites/default/files/160525_Final%20paper_with%20cover.pdf (accessed 18 August 2021).

3 Littlejohn, A., Charitonos, K. and Kaatrakoski, H. (2019) 'The role of professional learning in addressing global challenges: tensions and innovations associated with AMR', *Frontiers in Education*, 15 October [online]. Available at https://doi.org/10.3389/feduc.2019.00112 (accessed 18 August 2021).

In response to these difficulties we developed this AMR surveillance toolkit, which will support you and your colleagues to overcome one or more of these challenges.

Here is what one health professional told us upon completing the toolkit activities with his team:

This particular toolkit is unique. We've never had something like this. [...] This [toolkit] is designed in such a way that it's optimally interactive. It is not one person talking and the rest of the people listening. [...] It is a more effective way of actually learning on the job than what we've been doing previously.

(Laboratory Manager,
Teaching Hospital in Ghana)

Figure 1 Toolkit testing in a health setting in Ghana.

WHO IS THE TOOLKIT FOR?

This toolkit is suitable for you if you are working in an animal or human health healthcare setting or a related organisation (such as the environment, or a government organisation) and you are in a management or leadership role. This means that you are in a position to influence relevant staff in your organisation by bringing together a team of people involved in AMR activities. This could be an existing team that you are managing or a newly formed team with people in roles associated with AMR work.

Facilitators of the toolkit can be in roles such as (but not limited to):

- managers and senior managers
- supervisors
- technical leads and site leaders
- heads of sections
- administrators
- Fleming Fund fellows
- policy-makers.

If you are an individual in one of these roles then you can act as a facilitator in the activities included in the toolkit.

Despite the focus on leadership roles, each of the three tools included in the toolkit are best supported when used collaboratively with a group of colleagues. This will ensure that you and your colleagues are offered an opportunity to reflect on their AMR surveillance practices and are supported to take their practices forward.

Here are some examples of standalone use:

- If you are a senior manager/leader you could use the tools to reflect on how well your local AMR surveillance system works, and to identify next steps to strengthen the existing AMR system or introduce a new one.
- If you are the head of a unit or a supervisor you could use the tolls to reflect on and review your AMR practices, and seek opportunities to support your colleagues to apply what they already know (or any newly learned skills and knowledge) to their day-to-day-work.
- If you are a policy-maker, you could use the tools to evaluate existing AMR policies and programmes in terms of how they support good AMR surveillance practices and to consider whether any changes to policies and programmes are required.

WHO CAN BE PART OF THE TEAM USING THE TOOLKIT?

Anyone who is a member of staff in animal or human health healthcare settings or related organisations (such as environment or a government organisation) and is involved in work associated with AMR could be part of the team you are bringing together to use the toolkit.

The team could be formed by people in junior and senior positions in your organisation. They could be in roles such as (but not limited to):

- microbiologists
- laboratory scientists/technicians
- pharmacists
- physicians
- nurses
- administrators
- biostatisticians
- members of the IT team
- vets
- paravets
- field officers.

Teams could be based in a particular unit in a healthcare setting such as a microbiology lab in a veterinary clinic, clinical team in the ICU, administrators in the management team and so on. Teams could also be formed by bringing together a few representatives across units in a particular setting as long as they are involved in AMR work. If you cannot form a team within your own institution then a team could also be based across institutions, for example AMR surveillance teams across the various ministries, vets across animal health clinics in a particular district/region and so on.

WHAT DOES THE TOOLKIT INCLUDE?

The toolkit is a collection of three main tools. Each tool includes various tasks that you and your colleagues can do together and will help you develop new strategies around AMR practice to use in your day-to-day work. It gives you an opportunity to relate what you already know or learned from the Open University/Fleming Fund AMR online modules[4] to your specific work situation and needs.

We hope the toolkit facilitates team discussions around the above challenges and helps professionals like you turn them into opportunities for better and improved work practices.

The three tools are designed to be used in combination with the OU/Fleming Fund online modules. This is particularly advisable for Tool 2; specific suggestions of modules to study prior to starting Tool 2 are provided. The three tools can also be used independently from the modules.

TOOL 1: YOUR ROLE IN AN AMR SURVEILLANCE NETWORK

Problem identified in Tool 1

You and other health professionals in different job roles, settings and networks have responsibility for AMR surveillance. These could include staff in a microbiology laboratory in a regional hospital, clinicians and nurses in an intensive care unit in a teaching hospital, veterinary field officers in an animal health setting, pharmacists in community health settings, or public sector staff/policy-makers in the Ministry of Health and Ministry of Agriculture.

You all must work together to tackle the global threat of AMR; understanding each other's role in relation to the overall AMR system is key to achieve this goal. However, our research has shown that you are not always fully informed of this interworking, and how your work can impact the overall system.

What is the benefit of using Tool 1?

This tool helps you and your colleagues overcome this gap. It guides you and other professionals in a similar role (such as managers, heads of units or supervisors) to support your team members to form a better understanding of how their work connects with the work of others in the AMR system.

What does Tool 1 include?

Tool 1 includes four tasks that you and your colleagues can carry out as a team to help you reflect on your own roles and responsibilities and the roles of other people. As a team you can also identify gaps in existing roles within your own work setting (such as a local AMR network), understand the contribution of each role to the network and negotiate how you can work together more effectively. This tool will help you and your colleagues understand the importance of your work and how it relates to the overall AMR system.

TOOL 2: DEALING WITH AMR DATA

Problem identified in Tool 2

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.[5] You and other 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. These could be laboratory managers/supervisors in a veterinary hospital, heads of units in a clinical setting, a hospital director with their management team, the Chief Pharmaceutical Officer and the Chief Clinical Officer in the Ministry of Health, or a Minister's Health Advisor.

Communicating and reporting results to relevant people is equally important. The absence of any of these skills can limit effective AMR practices.[6]

What is the benefit of using Tool 2?

Tool 2 is designed to help you develop the epidemiological skills needed to participate in local and national AMR surveillance activities. It helps you understand your contribution to data collection and management within AMR surveillance systems and provides opportunities for your team to identify improvements in your workplace. By using this tool you will also have an opportunity to develop your understanding of bias and validity, and the interpretation of data from AMR studies.

What does Tool 2 include?

Tool 2 includes three tasks that you and your colleagues can carry out as a team to help you understand your role in collecting, recording, analysing and reporting AMR data, and also identify opportunities for improvements in your workplace.

4 See the collection of online modules: https://www.open.edu/openlearncreate/course/index.php?categoryid=415

5 Littlejohn, A., Charitonos, K. and Kaatrakoski, H. (2019) 'The role of professional learning in addressing global challenges: tensions and innovations associated with AMR', Frontiers in Education, 15 October [online]. Available at https://doi.org/10.3389/feduc.2019.00112 (accessed 18 August 2021).

6 Charitonos, K., Littlejohn, A., Kaatrakoski, H., Fox, A., Chaudhari, V., Seal, T. and Tegama, N. (2019) 'Technology-supported capacity building on amr surveillance: findings from the pilot phase', internal report, Milton Keynes: The Open University

TOOL 3: REFLECTING ON YOUR WORK AND CHANGING YOUR WORKPLACE

Problem identified in Tool 3

Effective AMR practice combines both the appropriate knowledge and the action taken as a result of this knowledge.

We know from our work in education and educational research that learning skills or knowledge (through Fleming Fund online modules, for example) in itself is not enough to tackle AMR.[7] There is 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.

What is the benefit of using Tool 3?

Tool 3 encourages you and your colleagues to think critically and develop strategies to apply your newly acquired learning or what you already know to day-to-day work. It also helps you and your team to find ways to overcome barriers that delay or stop you from doing this.

What does Tool 3 include?

Tool 3 includes three tasks that you and your colleagues can carry out as a team to reflect on existing practices, organisational structures or work cultures that may challenge you in applying what you know or learn through professional development programmes in your own day-to-day job.

HOW IS THE TOOLKIT STRUCTURED?

Each tool includes three or four tasks in total. Each task consists of four sections. All tasks are designed to support you as a facilitator in leading or facilitating discussions as a team that follow a logical progression.

First, you are informed of the task objective and the problem(s) it tries to address. Instructions are then provided to help you and the team go through the tasks. Finally, some suggestions are included after each task to offer opportunities for reflection and uptake of further actions, and to ensure the long-term impact of the task.

Problem to address

Objective

Group tasks

Follow-on actions

WHAT DOES YOUR ROLE AS A FACILITATOR INVOLVE?

As a facilitator, you are asked to identify a small group of co-workers (up to five to eight people) who are involved in AMR work in your organisation and bring them together as a team.

As a team you can work through the various toolkit tasks over a specific period of time. This could be over a couple of weeks, a month or a few months. It is up to you to decide the frequency of your meetings but having regular meetings over time will be more beneficial.

It is good to set some regular meetings as a team when you can go through the toolkit tasks together. You can go through all three tools or you can choose the one(s) that are more relevant to the roles in your team or any existing issues around AMR surveillance that affect the way your team is operating. The meetings could take place face-to-face but if this is not possible, you could use digital, mobile and online tools that will allow you to meet online.

7 Littlejohn, A., Charitonos, K. and Kaatrakoski, H. (2019) 'The role of professional learning in addressing global challenges: tensions and innovations associated with AMR', Frontiers in Education, 15 October [online]. Available at https://doi.org/10.3389/feduc.2019.00112 (accessed 18 August 2021).

Prior to your first meeting as a team, you should spend some time to go through the tool(s) you have chosen and familiarise yourself with the various tasks included. This will be important when using the toolkit with your team, as you will know what is asked from you and your colleagues to do. We have included some facilitators' notes to support you in this. We have also included examples from the two countries who have taken part in the initial study that provide concrete links with the context of AMR surveillance in LMICs.

Figure 2 Toolkit testing in a health setting in Ghana.

Your role as the facilitator is threefold:

- You must ensure that time has been allocated to members of your team to come together and go through the tasks.
- It is important to create a 'safe' space for your team; a space where your colleagues feel they can openly discuss and share their views about existing AMR practices, any challenges they face and ideas for future action. You may want to use the same physical space in your workplace for the duration of your toolkit engagement (such as a meeting room). You may also decide to set some rules for participation in advance. For example, it will be good to stress that no one will be affected negatively in the work environment by sharing ideas in this space – or that anything that is shared during your discussions will not be shared beyond the team.
- You should support your colleagues to discuss the points raised in the various group tasks, to provoke and challenge them but also listen to what they have to say.

WHAT ARE THE BENEFITS FROM USING THE TOOLKIT?

The evaluation of the AMR surveillance toolkit in healthcare organisations across Ghana and Nepal has demonstrated a range of benefits for the facilitators and the teams that went through these activities. The toolkit:

- brought together a team of professionals in different job roles and ranks to discuss AMR-related work, which had never happened before in these organisations
- improved understanding of roles and responsibilities in the local AMR system
- improved understanding of the AMR system, both at the facility level but also beyond (such as communication barriers among professionals in different fields or sectors)
- enhanced staff self-worth and confidence in their work
- increased awareness of areas that require attention in their organisations, such as how laboratory test results are used in patient treatment, or inadequate communication between units
- initiated local actions within teams or at the facility level, such as the launch of new communication strategies across units
- increased awareness of the work environment itself, with the toolkit being viewed as supporting team bonding among colleagues.

Figure 3 Toolkit testing in a health setting in Nepal.

HOW WAS THE TOOLKIT DEVELOPED?

The AMR surveillance toolkit was developed as part of the Fleming Fund programme, a £265 million UK aid investment to tackle AMR in LMICs around the world. The programme is managed by the UK Department of Health and Social Care (DHSC) in partnership with Mott MacDonald, the Fleming Fund Grants Management Agent.

The toolkit is based on previous work led by Allison Littlejohn[8] (UCL Knowledge Lab, UK) to increase the impact of professional learning on work practices and processes. The AMR surveillance toolkit is written by Koula Charitonos, Fereshte Goshtasbpour, Saraswati Dawadi (The Open University, UK) and Skye Badger (Ausvet), with contributions from Allison Littlejohn (UCL Knowledge Lab, UK), Abhinav Vaidya and Santosi Giri (Nepal Public Health Research and Development Center), and Alex Owusu-Ofori (Kwame Nkrumah University of Science and Technology, Ghana).

The toolkit was developed and evaluated through participatory co-design methodology, including twelve healthcare organisations in Ghana and Nepal. The development was supported through review meetings with in-country partners in Nepal and Ghana, and two participatory co-design workshops with stakeholders 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. Participation in the activities in each of the organisations included teams of professionals from a variety of units and roles such as clinical microbiologists, pharmacists, laboratory scientists, administrators, veterinarians, physicians and laboratory managers.

We wish to thank all the team leads for their commitment and contribution to the study. Thanks to Ms Paola De Munari, Senior Project Manager at The Open University, for her work on project management. Thanks also to Mott Macdonald and the UK Government DHSC for the support they provided in the development and evaluation of the toolkit.

Team leads and participating organisations

Nepal:

- Dr Aashish Gyawali, Animal Clinic at Shree Sayuri Bhume School
- Dr Shiva Khanal, Nepal Pet Service Center
- Dr Karishma Malla Vaidya and Dr Aasiya Rajbhandari, Paropakar Maternity and Women's Hospital
- Dr Manisha Sharma, Kathmandu Medical College
- Dr Olita Shilpakar, Bir Hospital
- Dr Sanu Krishna Shrestha, Dhulikhel Hospital

Ghana:

- Dr Mildred Adusei-Poku, Noguchi Memorial Institute for Medical Research
- Dr Mawuli Leslie Aglanu, Kumasi Centre Collaborative Research
- Dr Sylvester Dassah, Navrongo Health Research Centre
- Dr Anthony Enimil, Komfo Anokye Teaching Hospital
- Mr Emmanuel Eshun, Veterinary Services Directorate
- Dr Kennedy Osei Mensah, Tamale Teaching Hospital

The AMR surveillance toolkit forms a part of **the Fleming Fund collection** available from the Open University at the OpenLearn Create platform.

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8 Margaryan, A., Littlejohn, A. and Lukic, D. (2018) 'The development and evaluation of a learning from incidents toolkit', *Policy and Practice in Health and Safety,* 16(1), pp. 57–70 [online]. Available at https://doi.org/10.1080/14773996.2018.1465263 (accessed 18 August 2021).

TOOL 1:

Your role in the AMR surveillance network

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TOOL 1: YOUR ROLE IN THE AMR SURVEILLANCE NETWORK

Antimicrobial resistance (AMR) is recognised as one of the most serious global threats to human health in the 21st century. It is defined as the ability of a microorganism (bacteria, viruses, parasites) to stop an antimicrobial (an antibiotic, antiviral or antimalarial) from working against it.[9]

AMR surveillance provides early warning in health systems about the spread of new resistant strains of bacteria. It is vital to slowing down bacterial resistance.[10] Surveillance systems have been set up around the world to examine this spread at local, regional, national and international levels. For example:

- At the local level, AMR surveillance data can help inform the best treatment and care for a patient in a hospital.
- At the regional level, it can be used to help sites – hospitals, clinics, veterinary surgeries and so on – to improve service delivery and identify gaps in provision.
- At a national level, the data highlights those populations most at risk, guiding national policy, planning and resource allocation.
- Each of these levels are brought together in an interconnected network so that data can be shared globally to co-ordinate effort around the world to slow the rate of AMR.

The responsibility for AMR surveillance is across these various levels of the network and across sites within each level: for example, clinics, hospitals, laboratories or pharmacies.

Surveillance work is carried out by a number of professionals, often with different specialisms, who work directly together (such as a team in a hospital laboratory) or indirectly (such as a clinician and a laboratory team).

For example, clinicians or nurses gather samples and send these to a laboratory, where technicians may perform an AMR susceptibility test. The results of the tests are reported back to the clinicians (and/or the patients), who then need to decide what the best treatment to offer to the patient is. Likewise, in animal healthcare settings, the veterinary field officer collects samples from animals and sends them to the veterinary microbiologist for testing, processing and reporting results. In both cases there may also be active surveillance, such as taking swabs from healthy humans or animals to look at carriage of resistant organisms.

Ideally, the roles or sites within a network should include all expertise and effective inter-working procedures necessary for successful AMR surveillance. However, in many countries, the concept of working across teams and in a network is not well-supported or practised. Many professionals are not clear about how their work fits with the network and what value that they contribute. In addition, sometimes it is not clear who has the ownership of specific tasks.[11] The following activities will help address these issues.

PROBLEM: Professionals in AMR surveillance systems do not work in a connected way where roles and teams function together, and do not fully understand their role in relation to the overall AMR system or network.

OBJECTIVE: Tool 1 helps professionals to understand their role in the AMR network, and identify where and how they contribute to the AMR surveillance process. In addition, it helps them to identify new roles to bridge the gaps in the current network and covers strategies for effective communication across roles.

9 World Health Organisation (WHO) (2020) *Global Antimicrobial Resistance and Use Surveillance System (GLASS) Report: Early Implementation 2020,* Geneva: WHO [online]. Available at https://www.who.int/publications/i/item/9789240005587 (accessed 18 August 2021).

10 O'Neill, J. (2016) T*ackling Drug-Resistant Infections Globally: Final Report and Recommendations,* Review on Antimicrobial Resistance, London: Wellcome Trust/HM Government [online]. Available at https://amr-review.org/sites/default/files/160525_Final%20paper_with%20cover.pdf (accessed 18 August 2021).

11 Charitonos, K., Littlejohn, A., Kaatrakoski, H., Fox, A., Chaudhari, V., Seal, T. and Tegama, N. (2019) 'Technology-supported capacity building on amr surveillance: findings from the pilot phase', internal report, Milton Keynes: The Open University

MATERIALS NEEDED IN TOOL 1

In-person meeting:

- Flipchart paper
- Marker pens
- Adhesive (to hang paper on walls)
- Laptop, projector and internet connection (for PowerPoint slides; alternatively, use an overhead projector and printed transparencies of slides)
- Printouts of figures and tables, depending on the task

Online meeting:

- Internet access and broadband speed
- PC, laptop, tablet or mobile phone
- Videoconferencing tools (such as Zoom, MS Teams, Skype, Cisco Webex, Whereby or Google Meet)
- Access to online whiteboards (such as Google Jamboard, Miro, MS Teams whiteboard or the Canvas Chrome app)

Task 1.1: Networking – how your work on AMR connects to the work of others

Time: around 90 minutes

Group size: five to eight participants and a facilitator

Seating arrangement: in a group, pairs or individually

In this task, participants work together to identify the local AMR network and understand their own and other people's roles and responsibilities within the network.

As the facilitator, you should do the following:

1. Ask participants to individually consider their own role or position, and write down their three main responsibilities, especially around contributions to AMR/AMR surveillance.
2. Create a list of all the roles and positions in the group that are associated with AMR.
3. Ask each participant to select one of other roles or positions listed that they feel more connected to in terms of AMR task. Encourage each participant to share in the group in what ways they are connected to the other role, such as through daily tasks or common responsibilities. Clarify any ambiguities about roles or responsibilities in your group.
4. Work with the whole group and place all the roles or positions identified in a diagram. This way you can start to visualise your group's network with the various connections. Use flipchart/butcher's paper in this task.
5. Facilitate a discussion in the group and highlight in the diagram the roles or positions that have more connections compared with other roles in this network. Make a note of the roles without any connections.
6. Ask participants to work in pairs and consider other roles or positions that exist in your organisation that contribute to AMR or AMR surveillance. Add these to the diagram.
7. Note the connections between the various roles or positions, and also make a note of the roles without any connections. The diagram you are creating reflects a draft diagram of your local AMR network: keep it, because you will revisit it in the Task 1.2.
8. As a group, consider the various levels of AMR surveillance task – local, regional, national and global – and discuss whether any of the existing roles or positions in the team, as drawn in the diagram, reach any of these levels. Participants can start with their role within their local network and then extend it to regional, national and global networks. Encourage participants to think about their position relative to all of these networks to help them understand their role or position overall.

AMR network	AMR network
Paediatrician	Veterinarian or veterinary field officer
Infectious disease physician	Microbiologist
Microbiologist and clinical microbiologists	Microbiology supervisor
Information technologist	
Clinical pharmacist	

Figure T1.1 Examples of local AMR networks (adapted from Cogen et al., 2020).

Local AMR network in field practice	Local AMR network in veterinary clinic
Farmers	Veterinary clinicians
Field veterinarians	Veterinary technicians
Veterinary technicians	Veterinary surgeon
Agro-vet shop	Human laboratory, technician
Vet laboratory technicians	Vet laboratory technicians

Figure T1.2 Examples of a local AMR network in the animal health sector in Nepal (courtesy of Dr Shiva Khanal and the team based at the Nepal Pet Service centre).

Depending on how familiar the participants are with the roles or positions in the organisation, you may want to provide them with an example of a local network, such as the examples in Figures T1.1 and T1.2. You can adapt them to your own local network in your organisation. Share the following examples with the group members and ask them to list roles that are associated with the AMR task at all levels.

FOLLOW-ON ACTIONS

Does your organisation have a document that clearly defines the roles and responsibilities of the teams or roles or positions involved in AMR?

- **YES**: Review the documents as a team and consider the various roles or positions and associated responsibilities in light of the discussion you had in Task 1.1. Consider any gaps in the existing roles and identify any changes in the local AMR network that may lead to positive changes in processes around AMR surveillance and necessary collaboration between roles.
- **NO**: Set aside some time as a team to create this reference document. In your institution there might be a specific committee that is responsible for developing such reference documents. Can you approach members of this committee with a suggestion to create such a document?

Note that roles and responsibilities continually evolve because of new developments in the field. Therefore, this document will require regular revisiting and reviewing.

Task 1.2: Networking – how does your role contribute to the AMR surveillance network?

Time: about 90 minutes

Group size: five to eight participants and a facilitator

Seating arrangement: in a group, pairs or individually

Effective cross-role or cross-team working within an organisation or across different sites is critical for successful AMR surveillance. This task builds on Task 1.1. and helps participants to understand and clarify how their work links to someone else's or how one team's work links to other teams in a network.

As the facilitator, you should do the following:

1. Show Figures T1.3–T1.7 to the participants and draw their attention to how different teams in a workplace or different roles in a network need to work collaboratively for effective AMR surveillance.
2. Ask the participants to work in pairs. Using the list of roles and the diagram of the local AMR network from Task 1.1, they should draw further links between roles or positions across different units in their workplace. Encourage them to draw on the examples provided and use any format that best presents the procedure of collaboration between roles and teams.
3. Display the new diagrams produced by each pair on a wall and ask participants to do the following:
   a. Note any similarities or differences between the various diagrams.
   b. Note whether any of the roles or positions have a higher number of connections to other roles. Discuss in the group why that is. What role do the people in these positions serve in the AMR network?
   c. Share observations about whether there is any disconnection between roles. Discuss as a group why this is the case and how people in such roles can work more collaboratively.[12]

12 If you are doing this task online, participants can draw their diagram, take a photo of it and share it in the chat section of the online tool.

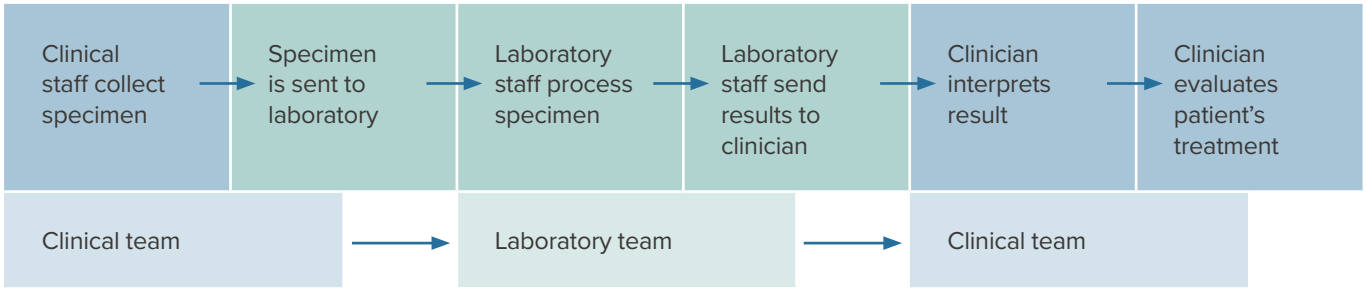


Figure T1.3 An example of collaborative work in a hospital.

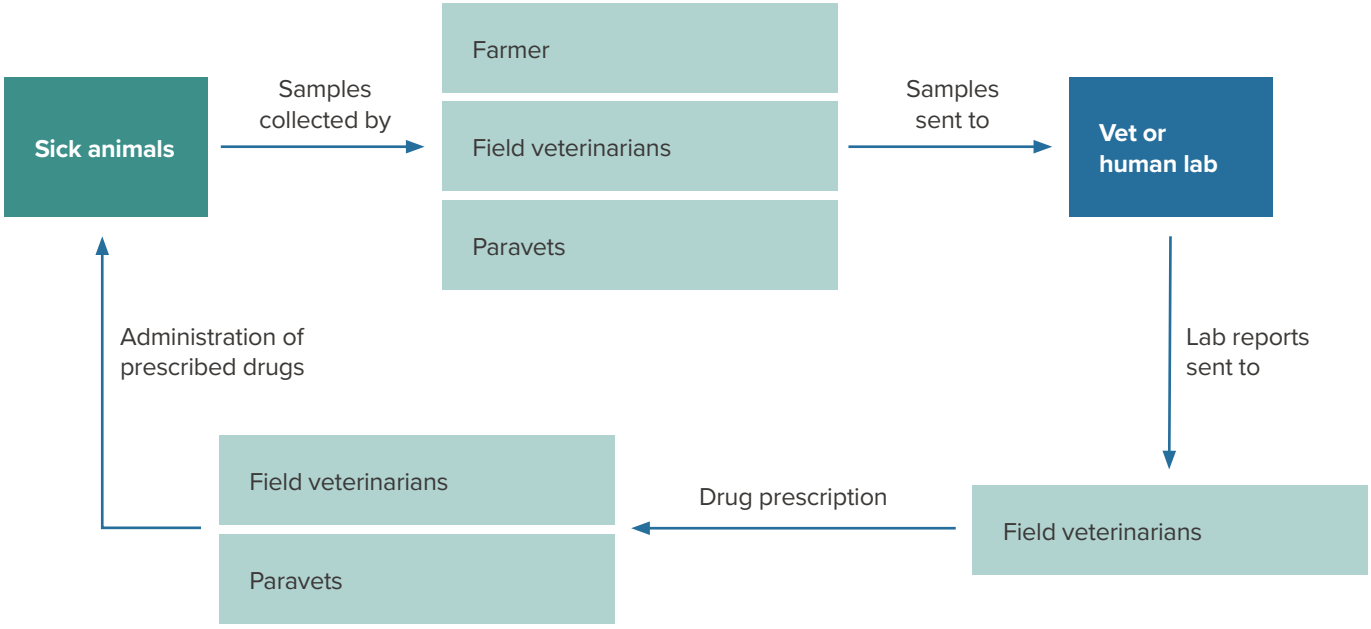


Figure T1.4 An example of a collaboration between farmers, vets, paravets and laboratory technicians in field practice for ruminants such as cattle, buffalo, sheep and goat (Dr Shiva Khanal and the team based at the Nepal Pet Service centre).

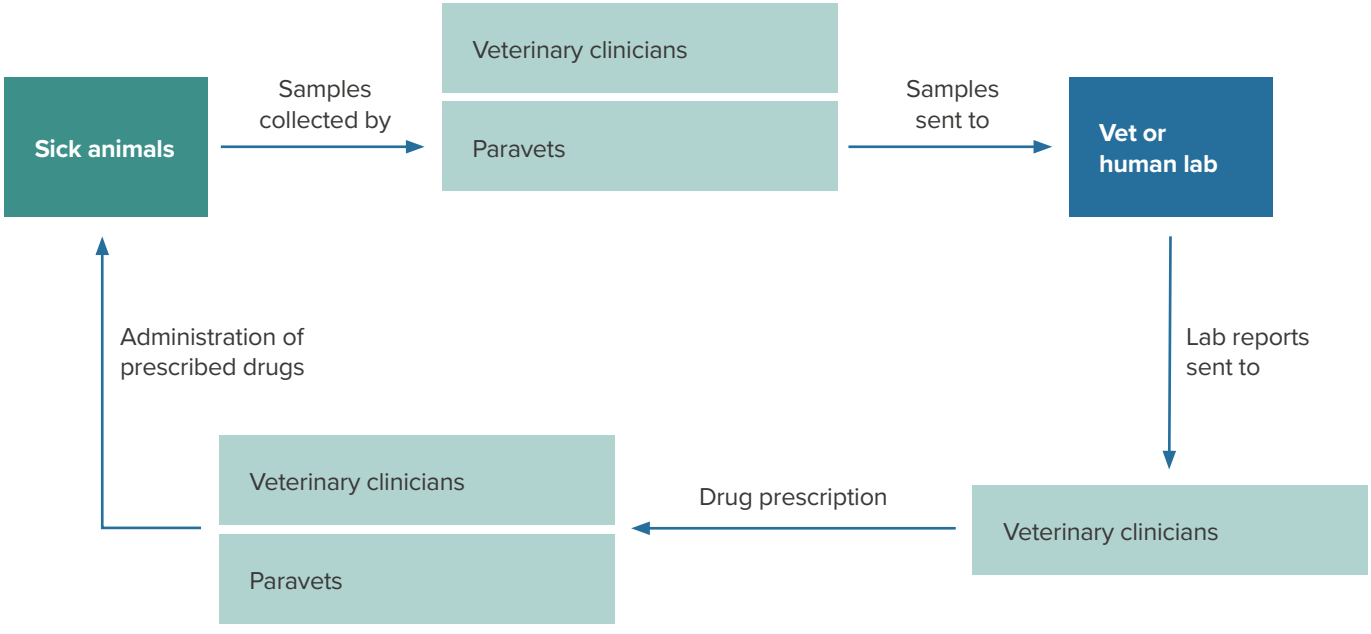


Figure T1.5 An example of a collaboration in a vet clinic (Dr Shiva Khanal and the team based at the Nepal Pet Service centre).

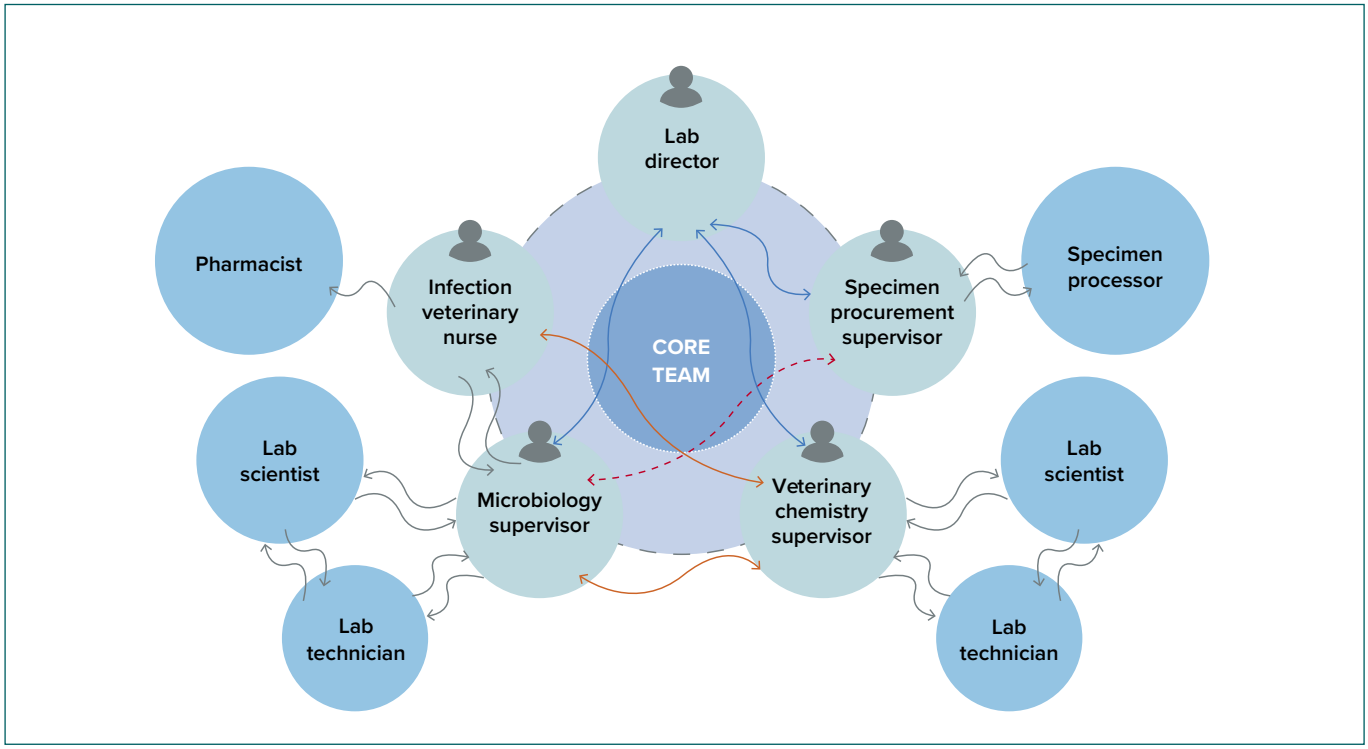


Figure T1.6 An example of collaborative work in a veterinary hospital.

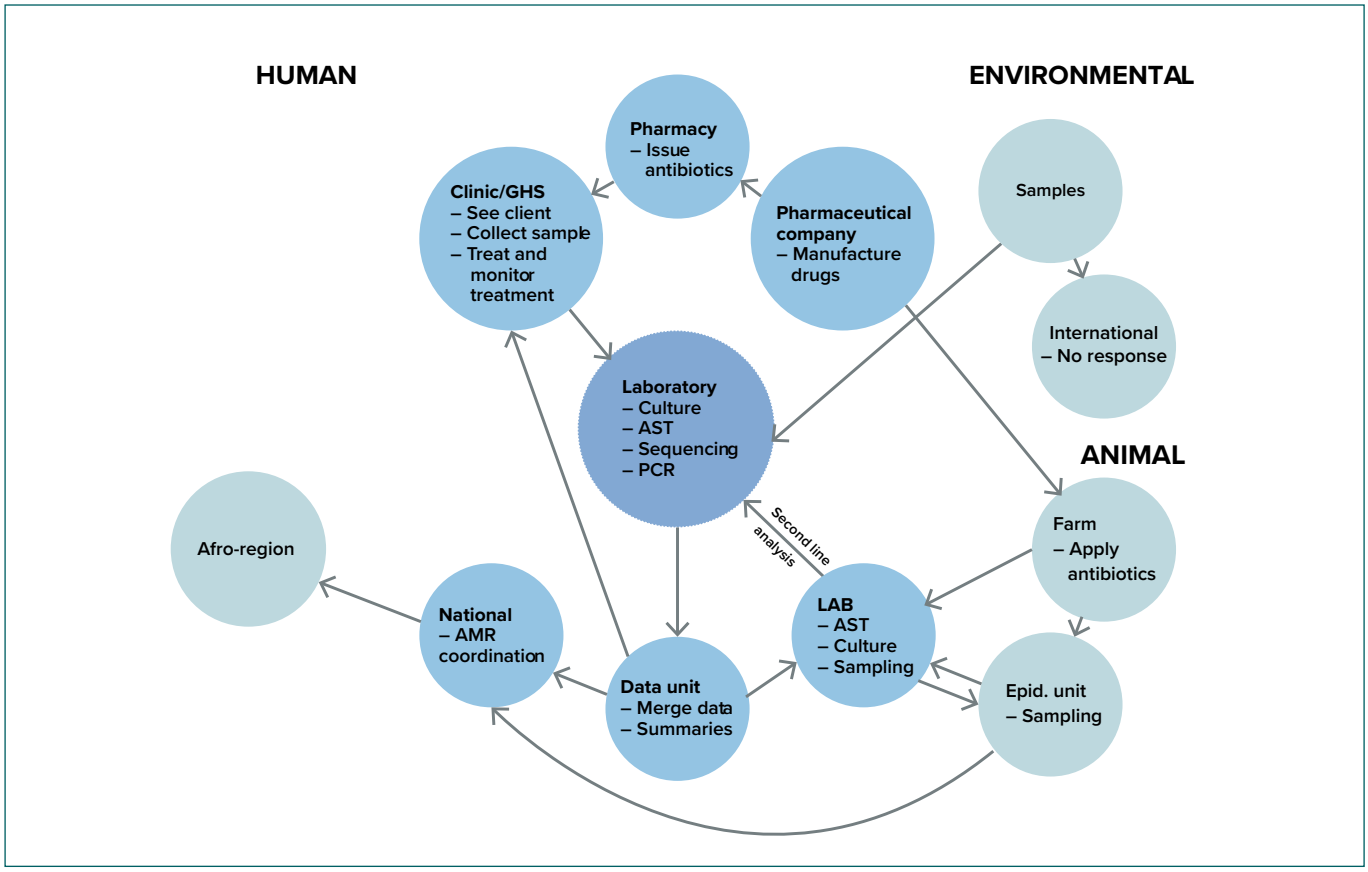


Figure T1.7 AMR surveillance systems in Ghana (drawn by Dr Sylvester Dassah, Dr Milred Adusei Poku and Mr Emmanuel Eshun in a participatory co-design workshop in Ghana, 16 July 2021).

4. Ask each participant individually to revisit their role in the team as discussed in Task 1.1, or the role of their team in the overall AMR network, and make notes on the following questions:
   a. What is your role within the team and which other members or teams do you have to work with?
   a. How does your role contribute to the overall AMR system?
   b. What might happen for the overall AMR system if you were not able to do your work well?

5. Ask the participants to work in pairs or groups of three to discuss how their roles contribute to the overall performance of the team, or how their team contributes to the overall work of the wider (regional, national) AMR network.
6. Move between the pairs or groups[13] and take note of key discussion points. Then share a summary and open the group discussion about how work between roles or teams can be strengthened – that is, what barriers must be minimised.

FOLLOW-ON ACTIONS

Create the diagram from Task 1.2 with other colleagues at work and ensure that it represents your organisation's AMR team or network of teams, and the collaboration between roles. Display this diagram in relevant offices and use it periodically to evaluate whether the inter-working is still efficient or requires any changes.

Discuss whether new roles or positions (or a re-allocation or different set of responsibilities within existing roles) are needed in your team to work more effectively with AMR surveillance across teams, units or sectors.

Task 1.3: Networking – your communications within the network

Time: about 90 minutes

Group size: five to eight participants and a facilitator

Seating arrangement: in a group, pairs or individually

The success of a surveillance system relies on many people working together. Communication between these people and effectively sharing AMR data is crucial for the progression of the AMR surveillance process. Not only is it important for professionals to engage in effective communication, but they must also be able to trust that the information provided is accurate.

As the facilitator, you should do the following:

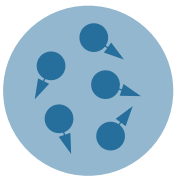
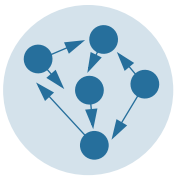
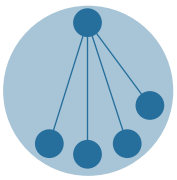
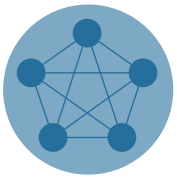
1. Ask participants to get into pairs and look at the AMR network diagram they created in Tasks 1.1 and 1.2. Ask them to highlight one or two key roles or positions that they regularly communicate with about AMR surveillance.
2. Encourage the participants to share in their small group any communication approaches that they currently follow in their day-to-day work with the roles or positions identified above.
   a. Do they follow the same approach with everyone?
   b. Do they know the communication preferences (such as preferred time or mode of communication) of people in the other roles or positions that they identified above?

13 If you are facilitating this task online, attend different break-out rooms.

3. Ask each pair to report the following back to the wider group (but encourage them to share their story without naming individuals):
   a. An example of good practice around communication that they have established.
   b. An example of a situation where there were gaps in communication, miscommunication or breakdowns in communication.
4. Note down on a flipchart paper the communication strategies that participants currently use. Also, capture in detail the various stories of any challenges they found in communication approaches. You will revisit these in later stages of this task.
5. Encourage the participants in the same pairs to discuss possible reasons that may have contributed to the reported breakdowns in their communication with the identified roles/positions. Examples of possible reasons include:
   - differences in schedules and professional routines
   - differences in norms of professional education
   - emphasis on rapid response
   - confusion and unclear expectations
   - differences in language and jargon.

   Ask each pair to report back to the wider group while you are listing the various reasons reported on another piece of flipchart/butcher's paper. Attach both papers from Steps 4 and 5 to the wall.
6. Distribute copies of Table T1.1 below, which summarises the stages of communication among team members. Give the group members enough time to familiarise themselves with each stage.

Table T1.1 Communication stages (adapted from *Nursing Times*, 2015).

	Forming	Professionals in a team try to gather information about each other's role. They do not know each role very well, so they are usually polite and avoid conflicts and disagreements. They may work independently on their tasks and not focus on the relationships between their own role and other members or roles.
	Storming	This involves communicating to gain clarity about activities and responsibilities, and how and when to work independently or collectively. Since it involves discussing responsibilities and may lead to conflicting perspectives, reactions, expressions of motions, poor listening or defending, it is called storming.
	Norming	Professionals establish 'norms of working together'. They agree on norms such as what mode of communication to use (such as emails, written reports, uploading files in shared folders, telephone); what to be communicated and by when (communication expectation); how often to have team meetings to review the AMR workflow; and what to do when conflict between roles arises. Establishing these norms facilitates connected work and collaboration.
	Performing	Once norms are established and there is a shared understanding of how the local AMR system works, the team can work together more easily and its members are able to communicate and coordinate effectively. There is also more openness and trust, and fewer time-consuming distractions based on interpersonal and group dynamics.

7. Encourage the participants to gather around the piece of paper showing the existing communication strategies from Step 4. Ask them to get into groups of three or four to discuss the question: 'What is your current stage of communication as a team at work?' Participants might find it difficult to choose a specific stage because of different experiences they have in their communication with different roles or teams. If so, suggest that they look across stages and identify specific communication practices they follow at work.
8. Revisit the list of reasons that may affect communication with other roles or positions (from Step 5). Ask the participants in small groups to propose ways that would help to minimise these barriers. Participants could refer back to the example they provided in Step 3 when making suggestions. You should make a note of the various responses you may receive from each group.

FOLLOW-ON ACTIONS

As individuals, reflect on the following periodically, and – if it is needed – discuss the outcomes of your reflection with your team members or colleagues in your local AMR network (if applicable, tie this into a regular process such as appraisal at your work):

- Who do you have to communicate with for AMR surveillance?
- What is the best approach to communicate with each person or role within your network? Do you share the same communication goals? Do you know their communication preferences?
- Do you have challenging communication with other members of the team? How can you make them less challenging?

As the facilitator, examine the stories shared by team members in Step 3 and review the list of the barriers reported in the discussion that affect communication with other roles or teams. Add any other barriers that are revealed through the stories. In your team, set-up some short-term and long-term goals to minimise these barriers and review these regularly in team meetings.

Task 1.4: Networking – your communication breakdowns

Time: about 90 minutes

Group size: five to eight participants and a facilitator

Seating arrangement: in a group, pairs or individually

Task 1.4 helps teams to reflect on communication breakdowns and the way they can be addressed for working together more effectively.

As the facilitator, you should do the following:

1. Share the Examples A–D with the participants. Give the group members enough time to familiarise themselves with the examples.

Example A

I know sometimes in very sick children, clinicians give a para-treatment. And then they write on their sample requests to the lab, 'We have begun treating with this drug.' And the good clinicians write them on the form for us [laboratory technicians] that we began treating with this drug, so test it. But at other times there's the request form issue – you can get a request with no age, no sex, no diagnosis.

(Lab technician based in a teaching hospital in a LMIC)

Example B

One time, I got a HVS [high vaginal swab] and I was supposed to let it go as normal flora, but I didn't feel good. There was no diagnosis. So I called the patient. We have phone numbers on the receipts. I called the person, but they didn't pick up, so I withheld their report – which shouldn't be so. And then, patients come to the front, and the report was not ready. So they sensed. They came. I said, 'OK. I want to see the person.' I asked, 'What is wrong with your relative?' They said, 'She has cancer.' And when you have cancer you're immunosuppressed. We should have followed with [specific drug]. But in a normal case, if we don't have any diagnosis or I didn't have a one-on-one, it would just go. And so sometimes it's difficult and we have requests forms which are not properly filled.

(Lab technician based in a teaching hospital in a LMIC)

Example C

I just called the patient, spoke with the doctor – and it's a typical example. Ideally, I shouldn't call the patient – I should call the doctor straight. There's no means of communication. You have to walk all the way to – and this one has no ward. There's no ward on this sample request form. So fortunately, I had a telephone number of the mother of the child, an 11-month-old child. And I was able to call. This child has sepsis. And so I wanted them to start treating or giving [specific drug], because a child last week – I followed up a child who passed on. It had candida in the blood, and before we could follow up with them to start treatment, the child was gone.

(Medical laboratory scientist in a central lab in a LMIC)

Example D

It is easy to buy veterinary antibiotics without a veterinarian's prescription in agro-vet shops. Veterinary has become business rather than service. Paravets administer antibiotics in a higher dose than required. They do not follow a dose, duration and withdrawal period. Only a few of them consult veterinarians regarding treatment and choice of drugs. They use highly potent broad-spectrum antibiotics for minor infections.

(Vet in an animal health clinic in a LMIC)

2. Ask participants to work in pairs and discuss the examples above in terms of the communication practices they facilitate or hinder.
    - What do the request forms serve in each of the first three examples?
    - What would the consultation with vets offer in Example D?
    - What could go wrong in each of these examples?
    - In what ways would you try to resolve the issues described in the four examples?

3. In pairs, ask the participants to share a situation where there was a miscommunication that caused confusion, misunderstanding, delay or interruption in their work, and discuss the followings:
    a. What were you trying to achieve through your communication?
    b. Why did it not go based on your plan?
    c. How did you resolve the communication breakdown?
    d. How can similar situations be prevented in the future?

4. As a group, share the factors that caused a communication breakdown and if applicable, the way they were resolved.

FOLLOW-ON ACTIONS

Review the diagram you created in Task 1.2 with your group and evaluate whether the current communication between the links you created work effectively, or require some adjustment.

As the facilitator, examine the stories shared by team members in Step 3 and review the factors reported in the discussion that caused communication breakdowns. Review the strategies or mechanisms used by members of your team to resolve these breakdowns, if applicable. Set up some short- and long-term team goals to minimise these barriers, and review these regularly in team meetings.

Note that communication strategies and mechanisms continually evolve as new people take up new roles or new situations arise, which may cause misunderstandings, delays or interruptions in your team's work. This task will require regular revisiting and reviewing.

TOOL 2:

Dealing with AMR Data

The Fleming Fund

UKaid from the British people

The Open University

TOOL 2: DEALING WITH AMR DATA

Central to all AMR surveillance activities is collecting, analysing and reporting data. High-quality data is needed to design effective, evidence-based policies and interventions to control and reduce AMR. However, it can be challenging to understand how common AMR is and where it occurs in a country, because AMR data is often collected, analysed and reported in different ways at local levels.[14]

Many countries also lack laboratory and data management capacities to support effective surveillance.[15] Epidemiological skills are important for analysing and interpreting AMR surveillance data, yet few professionals receive formal training in epidemiology. AMR and surveillance activities are often affected by validity and bias; however, these limitations are not commonly understood or reported.[16]

To obtain high-quality AMR data, professionals involved in surveillance activities must understand their role in collecting, recording, analysing and reporting data. Therefore, this tool is designed to help professionals develop the epidemiological skills needed to participate in national AMR surveillance activities.

PROBLEM: Many professionals involved in AMR surveillance do not have the necessary epidemiological skills to record, analyse and communicate findings accurately.

OBJECTIVE: This tool aims to help professionals understand their contribution to data collection and management within AMR surveillance systems and provides opportunities for teams to identify improvements in their workplace. Professionals using this toolkit will also have an opportunity to build on their understanding of bias and validity and the interpretation of data from AMR studies.

MATERIALS NEEDED IN TOOL 2

In-person meeting:

- Flipchart paper
- Marker pens
- Adhesive (to hang paper on walls)
- Laptop, projector and internet connection (for PowerPoint slides; alternatively, use an overhead projector and printed transparencies of slides)
- Printouts of figures and tables, depending on the task

Online meeting:

- Internet access and broadband speed
- PC, laptop, tablet or mobile phone
- Videoconferencing tools (such as Zoom, MS Teams, Skype, Cisco Webex, Whereby or Google Meet)
- Access to online whiteboards (such as Google Jamboard, Miro, MS Teams whiteboard or the Canvas Chrome app)

14 Ashley, E.A., Shetty, N., Patel, J., van Doorn, R., Limmathurotsakul, D., Feasey, N.A., Okeke, I.N. and Peacock, S.J. (2019) 'Harnessing alternative sources of antimicrobial resistance data to support surveillance in low-resource settings', *Journal of Antimicrobial Chemotherapy,* 74(3), pp. 541–6 [online]. Available at https://doi.org/10.1093/jac/dky487 (accessed 18 August 2021).

15 Hay, S.I., Rao, P.C., Dolecek, C., Day, N.P.J., Stergachis, A., Lopez, A.D. and Murray, C.J.L. (2018) 'Measuring and mapping the global burden of antimicrobial resistance', *BMC Medicine,* 16(1), 78 [online]. Available at https://doi.org/10.1186/s12916-018-1073-z (accessed 18 August 2021).

16 Rempel, O., Pitout, J.D.D. and Laupland, K.B. (2011) 'Antimicrobial resistance surveillance systems: are potential biases taken into account?', *Canadian Journal of Infectious Diseases and Medical Microbiology,* 22(4), pp. e24–8 [online]. Available at https://doi.org/10.1155/2011/276017 (accessed 18 August 2021).

Task 2.1: The information cycle and the flow of data for AMR surveillance

Time: about 90 minutes

Group size: five to eight participants and a facilitator

Seating arrangement: in a group, pairs or individually

In this first task, participants will have an opportunity to build on their understanding of how information on AMR is obtained through collecting, managing, analysing and reporting data, and how this information becomes the basis for designing interventions and formulating policies. Participants will identify their own and their team's role in the flow of data for AMR surveillance. This task will require approximately one hour.

1. Ask participants to work in groups of two or three people to create a list of all the possible sources of AMR data in their workplace. When describing the sources of data, they should also identify the types of data they deal with, such as clinical patient or animal data, specimen data, laboratory data, pharmacy data, etc. Ask them to consider the following questions:
   - What data do you collect (or generate) yourself?
   - Is any data is being collected as part of an ongoing surveillance task?
   - Do you collect data from alternative sources, such as scientific papers, other research activities, etc.?
   - Are there any data sources that are not currently available to you to access? Or are there teams/units etc. in your workplace that you did not previously think of as potential sources of AMR data?

If you are meeting in person, participants can use paper or a whiteboard to write down their responses. If you are meeting remotely, online whiteboards may be a helpful tool to write down everyone's ideas.

Facilitator notes:

AMR surveillance data can be obtained in two ways: (1) directly from primary sources, such as clinical examination or laboratory testing, or (2) from secondary sources, by gathering data from national surveillance data programmes or research.

Some of the categories and types of data collected for AMR surveillance are as follows:

- Clinical (patient or animal) data (demographic data or metadata): unique identifier; age; gender; healthcare/veterinary facility; date of admission; presenting symptoms.
- Sampling data (for surveillance): unique identifier; species; breed; gender; sampling site (e.g. slaughterhouse, market); specimen site; specimen type; previous history, etc.
- Antimicrobial data: antimicrobial used; dosage; dosage interval; start/end date; history of antimicrobial treatments, etc.
- Laboratory data: data of receival; culture and ID methods; isolate identifier; antimicrobial susceptibility test (AST) method; species and serotype; quantitative AST result (e.g. minimum inhibitory concentration (MIC), zone diameter (ZD)); qualitative test result (S, I, R); genotypic test, etc.

If participants are working in laboratories or clinical settings, did they consider data sources other than primary sources? What about policy-makers? These participants are likely to access data from several different sources to help inform their decision-making.

2. Now that participants have identified the data they collect, get them to think about the other stages of the information life cycle. To get the discussion started, show the group Figure T2.1. Then, as a group, discuss turning data into information and the steps go through along the way. Prompt the group with the following questions:

   a. What do we do with data? (How do we manage/process and analyse data? At this point, data is converted to information.)

   b. How do we present information – for example, visually (tables, graphs), in reports, etc.?

   c. How do we use information? (Interpretation, decision-making, etc.)

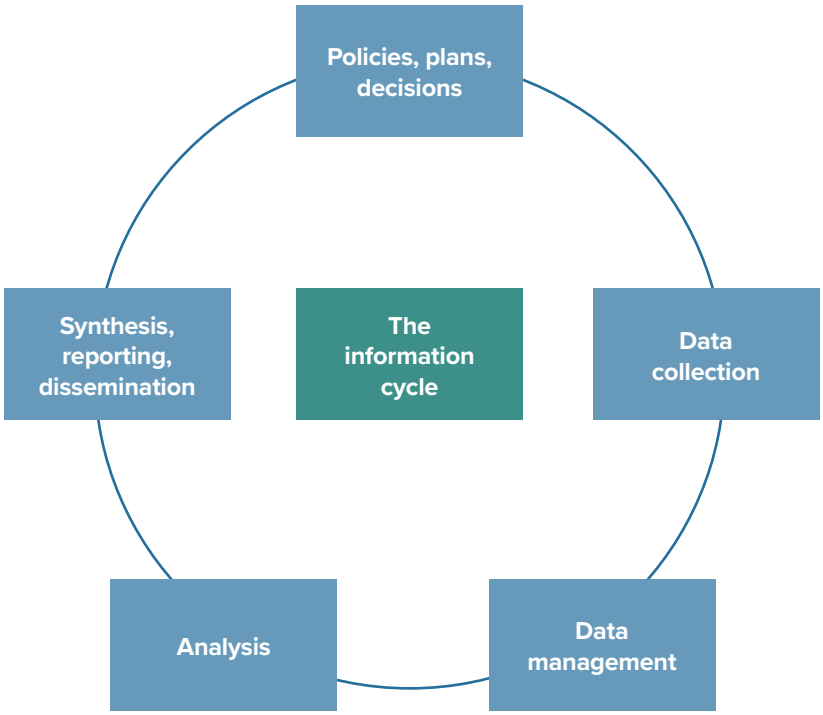


Figure T2.1 The information cycle (Ausvet).

3. Ask participants in pairs to sketch out the flow of AMR data in their workplace: specifically, where or how the data comes into the workplace, what happens with data in the workplace, and where data goes out of the workplace.

- Display the participants' diagrams on the wall (or share them online). Also, share the data flow diagrams provided: Figure T2.1 is for human health professionals, and Figure T2.2 is for animal health professionals.
- Ask the participants to compare their diagrams with each other, and with Figure T2.1 or Figure T2.2. Can the group identify how data moves through their workplace?

Facilitator notes:

For human health, the ideal data flow situation is local-level data (such as patient data from a hospital and microbiological data generated in a laboratory) moving from the patient care setting to national and global reporting systems.

At the local level, AST results are used to inform treatment decisions about an individual patient, and AST data from all patients in a hospital or local area are used to develop empirical prescribing guidelines. National government agencies may collect data from the local level to develop national prescribing guidelines for surveillance (for example, to report rates of resistance and track changes over time) and to develop intervention programmes. Finally, local-level data may be used to report to global surveillance initiatives such as GLASS.

In contrast to human health, much of the AMR data used for surveillance of animals comes from healthy animals. This data flows directly into national databases, often from national reference laboratories or well-supported provincial laboratories. However, some AMR surveillance data in animal health may come from sick animals. If this data is collected, then the flow of data is like that in human health settings. However, accessing AST data from sick animals can be challenging, because the data may come from privately run laboratories.

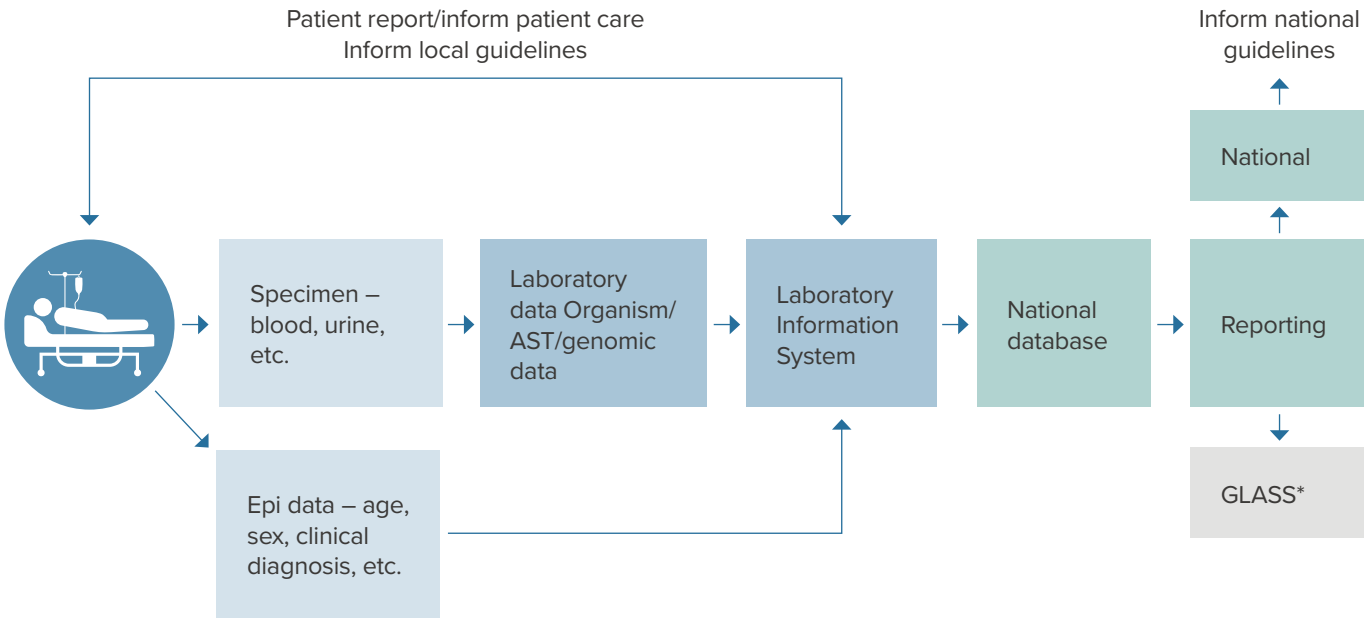


Figure T2.1 The flow of AMR data from clinical surveillance of hospitalised patients in a human health setting (Ausvet). (Note that 'GLASS' is the Global Antimicrobial Resistance Surveillance System.)

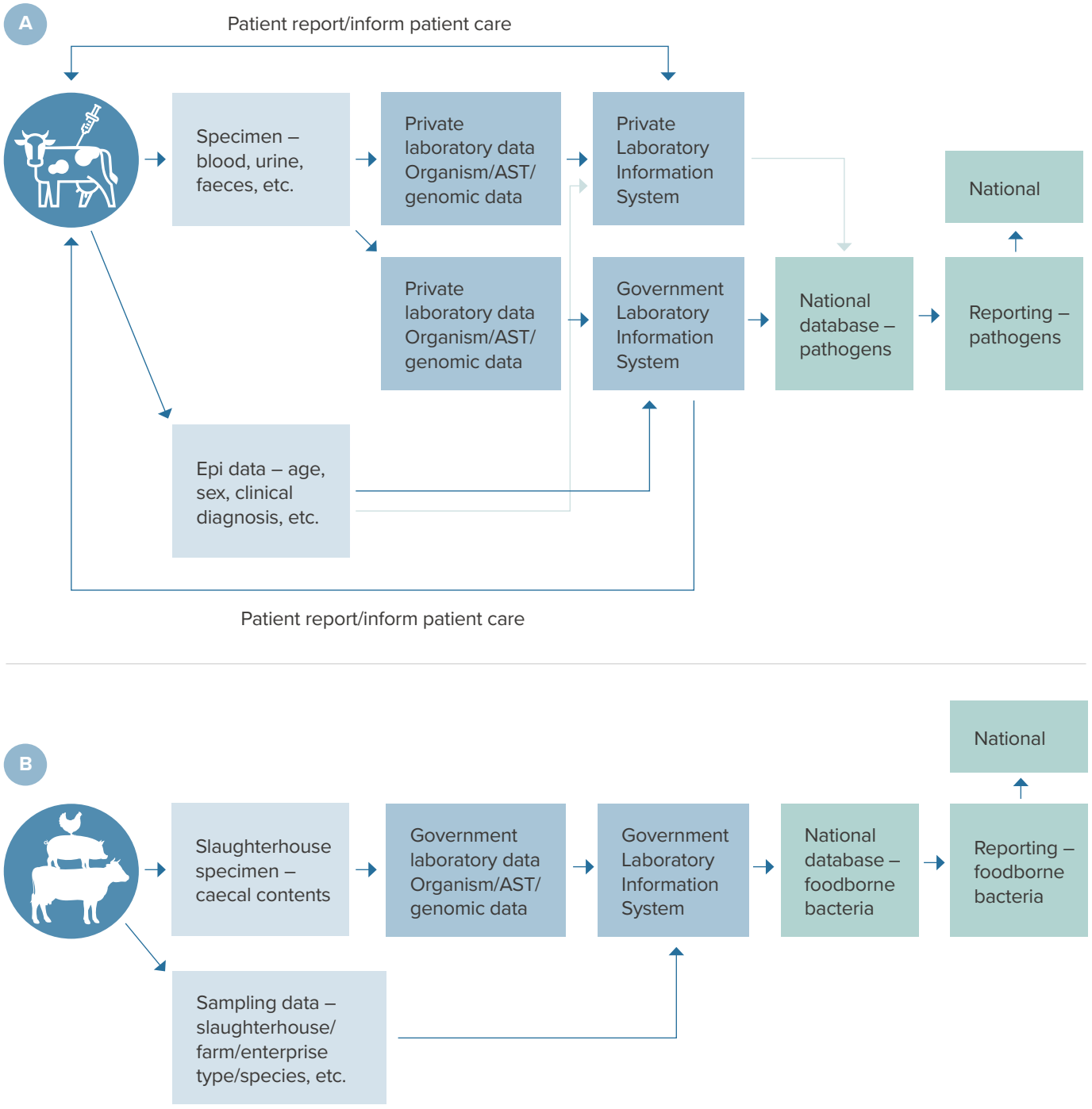


Figure T2.2 Clinical surveillance of sick animals in an animal health setting and active surveillance of food animals in animal health setting (Ausvet).

4. Ask the participants to form pairs or groups of three, and identify on their diagram what their roles and responsibilities are in terms of the flow of AMR data. (They could use Figure T2.1 or Figure T2.2 if they did not produce their own diagram.) Ask them to describe to each other how they contribute to the flow of AMR data in their workplace.

5. When data management and data quality procedures are not clear, there is a risk that poor-quality data will be submitted, or that data will not be generated regularly or on time. This affects the flow of data through the AMR surveillance system. Still in their pairs or groups of three, ask the participants to identify any challenges they experience with AMR data flow in their workplace. They should write down these challenges on paper or on a whiteboard.

Facilitator notes:

Challenges may include inadequate laboratory capacity, a lack of electronic databases, poor linkages between clinical and laboratory data, etc. For example, a participant may be a microbiologist who is responsible for generating and recording AST data, but they work under significant resourcing pressures (such as no time, broken equipment, etc) that affects their ability to perform laboratory tests to as high a quality as they would like.

Alternatively, a participant may be a policy-maker who is reliant on data from the national database and other sources, but there is not enough good-quality information available. The policy-makers rely on this data to develop and implement interventions to control AMR. Some of these interventions may significantly impact members of the community: for example, banning certain antimicrobials in food animals can affect farmers. Without good evidence to demonstrate otherwise, a ban on an antimicrobial agent may negatively impact the health and welfare of animals. Therefore, accurate information is needed to ensure that interventions are necessary and effective.

Ask the participants to report back to the group on their challenges with the flow of AMR data in their workplace. Discuss these challenges as a group and identify practical solutions to some of the problems.

FOLLOW-ON ACTIONS

As a team leader or manager, you may be able to fix some problems with the way that AMR data flows through your workplace. Reflect on the practical solutions your team may have come up with during this session and think about whether some of these can be implemented. Review these activities regularly.

Task 2.2: Data management for AMR surveillance

Time: about 90 minutes

Group size: five to eight participants and a facilitator

Seating arrangement: in a group, pairs or individually

Data management is the next step on the information cycle after data collection. It refers to a set of processes to prepare data for analysis. Without good data management, errors can occur when data is entered, analysed and interpreted; this in turn affects the truthfulness of the information communicated about AMR in a population. Therefore, good-quality data management is an essential component of any surveillance system.

In this task, participants will reflect on their understanding of database management principles in their workplace. This task will require approximately one hour.

1. As a whole group, ask the participants to identify data management processes required for an AMR surveillance programme. Write these down on paper or a whiteboard.

Facilitator notes:

If needed, you could help to start the discussion by mentioning some of these processes, such as:

- data entry, checking for errors, other quality assurance measures
- determining the essential data set
- creating indicator variables
- integrating two or more data sources
- structuring data within the database structures
- data storage and archiving
- data governance – policies and procedures for access, sharing, confidentiality
- data security and protection systems.

2. Next, ask the whole group to identify and write down what they think are the best practice characteristics of a good data management system for an AMR surveillance programme.

Facilitator notes:

If needed, you could help to start the discussion by mentioning some of these characteristics, such as:

- a single validated source of information
- privacy and confidentiality (such as ‘de-identifying’ patient data)
- adaptive and responsive database systems
- a well-structured and compatible IT system
- user-friendliness
- electronic databases where possible (avoid paper-based forms)
- recording raw (quantitative) results, such as MIC, zone diameter measurements

3. Now work through a scenario of what poor data management practices could look like and what can be done to improve them. In this scenario, Ani, an employee of the Ministry of Health, is responsible for putting together all the information required to report to GLASS.

Share Figure T2.4 with participants and work through the steps Ani that has to go through to submit data to GLASS, the global AMR surveillance system managed by the World Health Organization (WHO).

Facilitator notes:

While this scenario is related to participants who work in human health settings, it is also relevant to those who work in animal health settings.

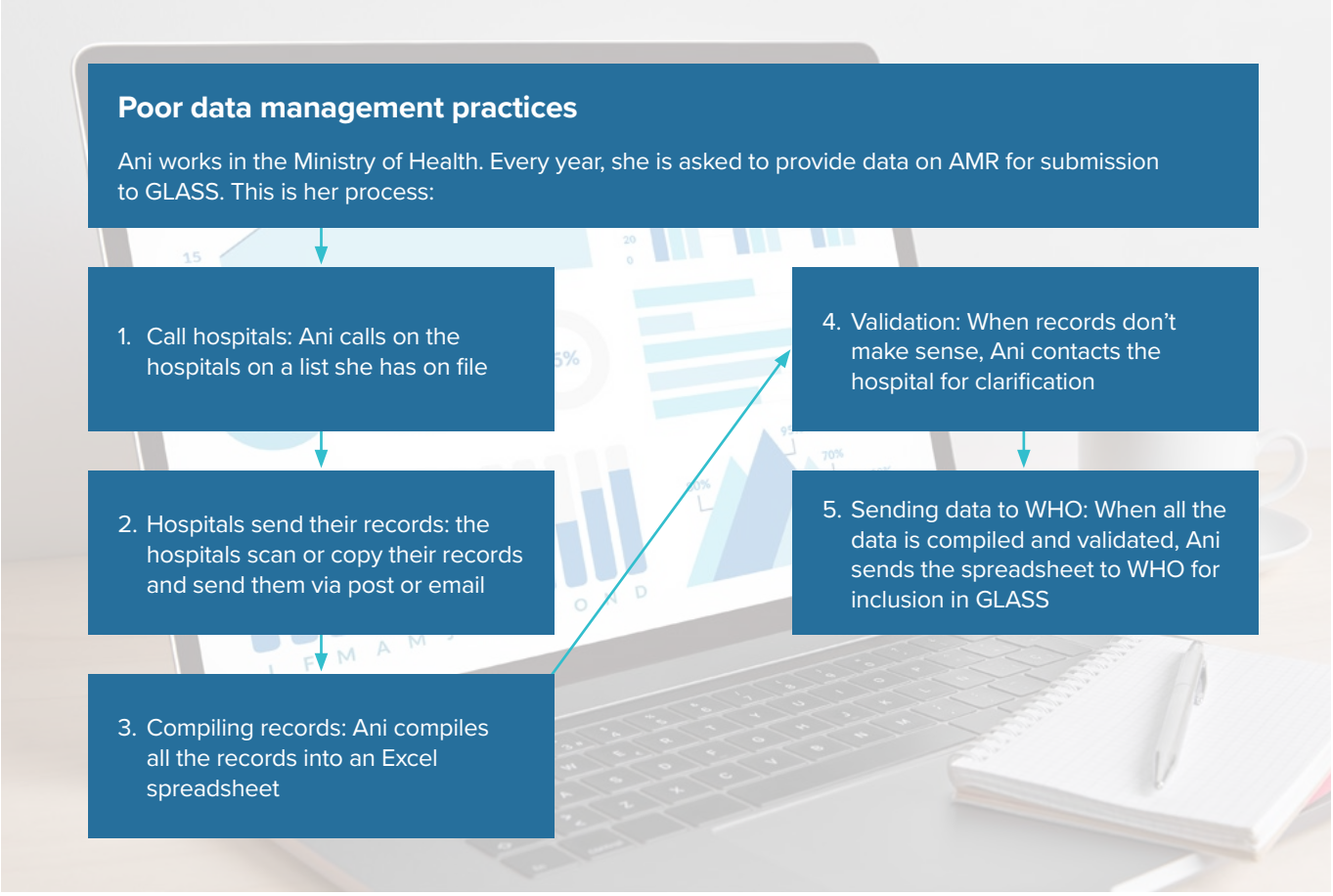


Figure T2.3 Examples of poor data management practices for reporting to GLASS (Ausvet).

4. Now work through what best practice data management looks like for Ani. Ask the group to identify best practice options at each step, and briefly discuss before revealing the answer. Be sure to discuss what best practice is if the group has been unable to determine this before sharing Figure T2.5.

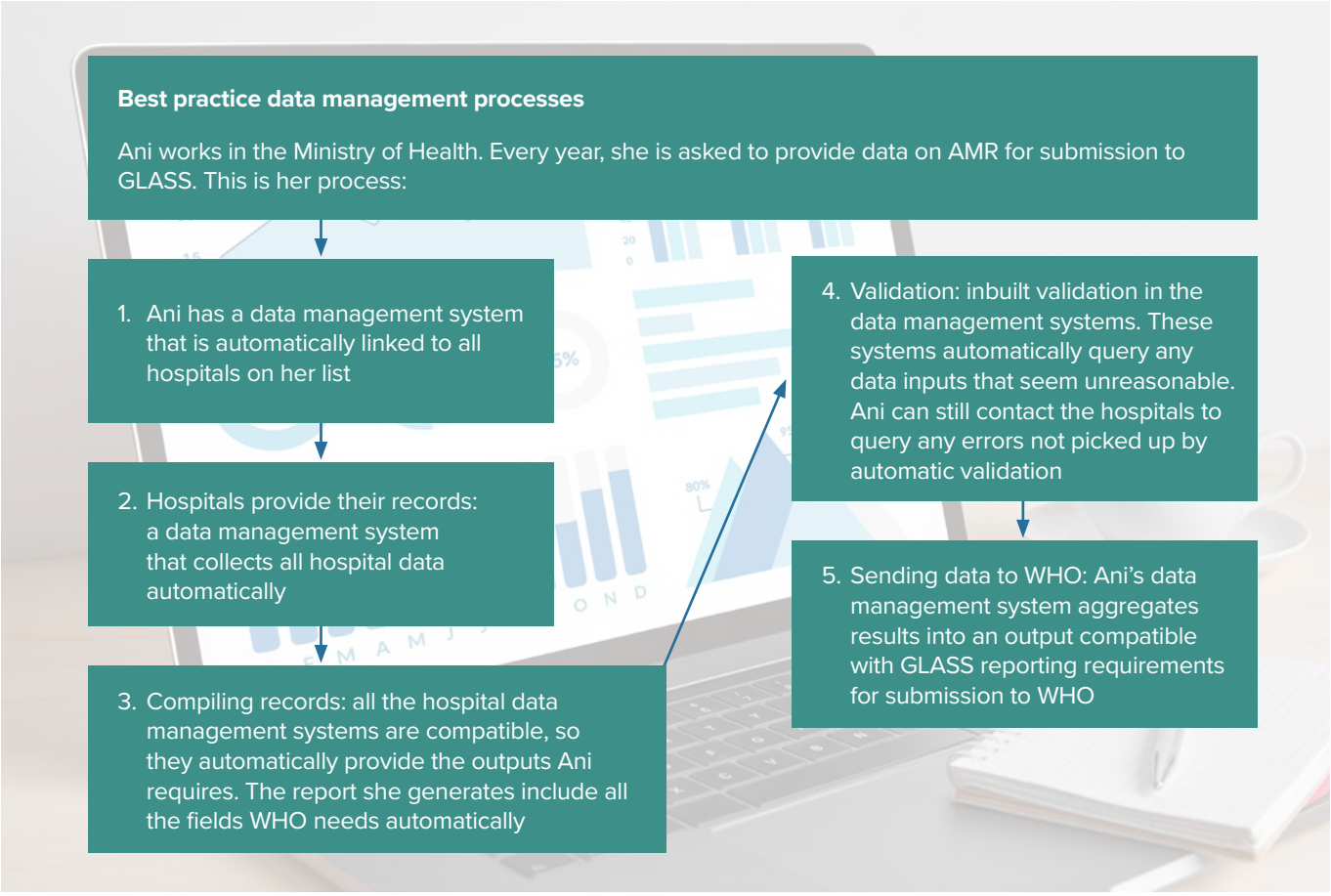


Figure T2.4 Examples of best practice data management for reporting to GLASS (Ausvet).

5. Now that participants know what best practice looks like, ask them (either individually or in small groups) to identify how the data management system used in their current job compares with best practice. Ask them to refer to the lists of data management processes and best practice characteristics that they created in Steps 1 and 2, and to make a note of the strengths and weaknesses of the data management system in the workplace.

Facilitator notes:

Be sure to share the lists from Steps 1 and 2 so that they can refer to them during this exercise.

6. Following on from Step 5, ask the participants to work in groups to identify where data management practices can be improved in their workplace to:
   a. improve the quality of the data contained in the database (such as minimising data entry errors, using electronic records, etc.)
   b. improve data flow through the workplace (for example by using a central database)
   c. meet reporting requirements set by their workplace, government agencies, and international programmes such as GLASS or OIE (whether the data is standardised, or if there minimum essential data sets).

Facilitator notes:

If required, resources on the reporting requirements for GLASS and OIE can be found at the end of the toolkit to inform the discussion.

Ask each group to present these ideas back to the main group for a general discussion. As a group, help to identify how data management systems can be improved within the workplace.

FOLLOW-ON ACTIONS

Think critically about the challenges that participants have reported during the discussion about data management. Can you implement improvements in data management processes? Support staff to adopt new data management processes.

Task 2.3: Understanding error, bias, and validity in AMR data for interpretation

Time: about 90 minutes

Group size: five to eight participants and a facilitator

Seating arrangement: in a group, pairs or individually

Facilitator notes:

Here's a quick recap (if you need one) on error, bias, and validity. When conducting surveillance to determine the frequency of AMR in a population, we are always aiming to find the 'truth'. Deviation from the truth may be due to random or systematic errors. Systematic error (also known as bias) is the most important error associated with AMR data. **Bias** occurs when the samples collected are from patients or animals that are not representative of the population (selection bias). Bias also occurs because of problems with diagnostic or laboratory equipment, for example a mis-calibrated instrument causing repeated measurement errors.

Validity

Describes the extent to which a study measures what it intends to measure without systematic bias. It is divided into two parts: (1) **internal validity**, which describes how representative study results are of true study population values, and (2) **external validity**, which describes to what extent study results can be extrapolated to the target population.

The participants have now worked their way around the information cycle to data analysis and interpretation. For this task, participants will have an opportunity to understand common sources of error and bias, and limits to validity of AMR data – and how these affect data interpretations. After this task, participants should critically appraise sources of error and bias in AMR data and determine if the results are valid for the population.

1. **Selection bias task**: Start this task by watching **a two-minute YouTube video on selection bias**.[17] (This video was part of a task in the module Fundamentals of AMR data, from the Tacking antimicrobial resistance online course.) After watching it, ask the group to identify examples of selection bias that may occur in their workplace or in AMR surveillance in general. The participants should write down these limitations or challenges.

Facilitator notes:

Participants may identify forms of error or bias that are not selection bias. If this occurs during the discussion, note these biases and inform participants what type of bias they have identified.

In human health settings, selection bias can occur when only specimens from hospitalised patients who do not respond to first-line treatment are collected and submitted ASTs. If there is no AST data from patients who are successfully treated with the first antimicrobial prescribed – that is, patients who are less likely to have resistant infections – then the results from surveillance may overestimate the prevalence of AMR in the human population.

In animal healthcare settings, selection bias can occur when only healthy animals are sampled. For example, broilers (meat chickens) are sampled at slaughterhouses for national surveillance of AMR in foodborne bacteria. However, only healthy chickens are sent to the slaughterhouse – sick chickens may die or are euthanised before reaching the end of the production cycle. Sick birds may be more likely to have a resistant infection that did not respond to antimicrobials. This means that the results of a study of AMR in foodborne bacteria from healthy broilers at slaughter may underestimate the prevalence of AMR in broilers overall. However, if the objective of surveillance in food animals is to estimate the prevalence of AMR in animals that enter the human food chain, then this bias is not really a problem, because sick birds do not generally enter the food chain. Instead, separate surveillance activities can be conducted on sick animals. In this case, the objective of surveillance in sick animals would be to detect changing or emerging resistance mechanisms.

2. As a whole group, look at an example of selection bias as shown in Figure T2.6. In the example, a researcher investigates the prevalence of methicillin-resistant Staphylococcus aureus (MRSA) in people in Indonesia. Work through the steps that the researcher takes to determine the prevalence of MRSA in Indonesian hospitals.

Facilitator notes:

While this scenario is related to participants who work in human health settings, the concepts are also relevant to those who work in animal health settings.

17 If you cannot access YouTube in your organisation, share the link of the video with the participants and ask them to watch this prior to the team meeting.

Selection bias: Example

A researcher designs a study that aims to report the prevalence of methicillin-resistant *Staphylococcus aureus* (MRSA) in Indonesia. The research steps include:

1. The researcher has a friend working in a surgical ward of a hospital in Jakarta

2. The friend downloads all the AST results for post-operative patients on the ward in the past 12 months

3. Over 1000 AST results were available, so the researcher is very pleased with the sample size, which minimises random error

4. The researcher analyses the data

5. The results show that 72% of S. aureus samples are resistant to methicillin

6. The researcher concludes that MRSA is very common in Indonesia

Figure T2.5 An example of selection bias in an AMR study in human healthcare (Ausvet).

Now ask the participants the following questions:

a. What is wrong with this study?

Facilitator notes:

The researcher's target population was the whole of Indonesia, but the population sampled was just selected from post-operative patients in one surgical ward of a hospital in Jakarta. Post-operative patients are more likely to be exposed to MRSA than the general population. Also, the patients selected were only those where doctors have requested AST. It is likely these patients had AST performed because they had failed antimicrobial therapy.

b. Should the researcher abandon the study and start again?

Facilitator notes:

The study can still provide some useful information – on the prevalence of MRSA in post-operative patients in a hospital in Jakarta, for example. However, it cannot answer the original research question: 'What is the prevalence of MRSA in Indonesia?'

c. Could the data be used for AMR surveillance in Indonesia?

Facilitator notes:

The data should not be used alone to measure the prevalence of MRSA in the Indonesian population, because it only describes the prevalence of MRSA in post-operative patients at a hospital in Jakarta. However, in combination with data from other hospitals and outpatient settings, this data can contribute to understanding AMR in Indonesia overall.

3. Validity task: Start this task by watching a two-minute YouTube video on external validity. After watching it, ask the participants to think about their work and the populations they sample. Prompt the discussion with the following questions:
   a. What samples does your workplace collect or process? Are the samples from healthy animals, sick people, etc.?
   b. What are the implications for external and internal validity in interpreting and reporting on AMR from these samples?
   c. What can be done in your workplace to address the validity problems?
4. Next, ask the group to examine the validity problem in AMR surveillance which is this:

   In most cases we want to answer the question 'What is the prevalence of resistance to antimicrobials in a population in Country X?' but the activities that generate data used in surveillance can usually only answer the question 'What is the prevalence of resistance to antimicrobials in the bacterial isolates tested?' When the sample is not representative, as is the case in most AMR surveillance, the information from AST cannot be easily extrapolated to the wider population.

Prompt the discussion by asking the group the following:

a. What are the limitations of AMR data and how do they affect what we know about AMR overall?
b. How can we make samples more representative in human health and animal health?
c. If the challenges are too great to achieve representativeness in AMR studies, what else can be done to manage validity and the appropriate reporting of AMR data?

Facilitator notes:

some suggestions for improving validity include:

- making sure you are sampling representative data points – for example, don't just sample broiler chickens reared in a large commercial farm if you want to learn about AMR in chickens in a country where smallholders raise most chickens
- evaluating the validity of a study when interpreting its results
- not making conclusions at the population level if the study is based on a biased, non-representative sample
- educating yourself and colleagues on the importance of validity in surveillance.

FOLLOW-ON ACTIONS

As individuals, reflect on the following when participating or reviewing data arising from AMR studies or surveillance activities:

- Is the design of the task appropriate for the research or surveillance objective?
- Do the sampling units (people or animals sampled) differ systematically from the general population that is being examined?
- Is the way that AMR is measured susceptible to measurement or misclassification errors?
- Is the interpretation of results appropriate? For example, are the report authors wrongly implying that the results can be extrapolated to the general population?

Additional resources on the collection of AMR and AMU data for international reporting requirements (GLASS and OIE)

WHO/GLASS

- Global Antimicrobial Resistance Surveillance System: Manual For Early Implementation (WHO, 2015)
- Global Antimicrobial Resistance and Use Surveillance System (GLASS) Report: Early Implementation 2020 (WHO, 2020)
- WHONET: microbiology laboratory database software

OIE

- 'Monitoring of the quantities and usage patterns of antimicrobial agents used in food-producing animals', Chapter 6.9 of the Terrestrial Animal Health Code (OIE, 2019)
- 'Guidance for completing the OIE template for the collection of data on antimicrobial agents intended for use in animals' (OIE, 2020)
- Template for an AMU survey
- OIE Annual Report on Antimicrobial Agents Intended for Use in Animals: Better Understanding of the Global Situation, fifth report (OIE, 2021)

Tackling antimicrobial resistance online modules

- Fundamentals of data for AMR https://www.open.edu/openlearncreate/course/view.php?id=6554
- Processing and analysing AMR data https://www.open.edu/openlearncreate/course/view.php?id=6556
- Sampling (human health) https://www.open.edu/openlearncreate/course/view.php?id=6550
- Sampling (animal health) https://www.open.edu/openlearncreate/course/view.php?id=5624
- Introducing AMR surveillance systems https://www.open.edu/openlearncreate/course/view.php?id=6548

TOOL 3:

APPLY YOUR LEARNING AND CHANGE YOUR WORKPLACE

The Fleming Fund
UKaid from the British people
The Open University

TOOL 3: APPLY YOUR LEARNING AND CHANGE YOUR WORKPLACE

The aim of this tool is to help you to identify, develop and apply skills and knowledge relevant to your role to change and improve your working practice and the practice of people that you work with.

To tackle AMR, we need both the knowledge and action taken because of this knowledge. In other words, it is important for human and animal health professionals not only to learn new AMR-related knowledge or skills, but also to apply them to their day-to-day work for a more effective AMR practice. However, there is a range of factors that can make it difficult for professionals to use what they have learned in their day-to-day work.[18]

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 workplace practices.

PROBLEM: Professionals are not always able to use newly learned knowledge or skills in their day-to-day work, because they have few opportunities to reflect on their learning and make sense of it in ways that are relevant to their roles. They may also have a limited understanding of how they can apply their learning to their work while existing forms and structures of work (as well as limited resources) may not support staff to use what they know, or any newly learned skills and knowledge, in their day day-to-day practice. Trust and openness among staff are not always evident. Strong hierarchical structures in a workplace may create mistrust among staff while management may not be aware that hierarchal structures can lead to a lack of trust among staff.

OBJECTIVE: This tool is designed to facilitate a group session around identifying barriers that prevent staff from applying their knowledge of AMR to their work and discussing opportunities to support staff in this process and minimise or remove barriers or challenges they face.

MATERIALS NEEDED IN TOOL 3

In-person meeting:

- Flipchart paper
- Marker pens
- Adhesive (to hang paper on walls)
- Laptop, projector and internet connection (for PowerPoint slides; alternatively, use an overhead projector and printed transparencies of slides)
- Printouts of figures and tables, depending on the task

Online meeting:

- Internet access and broadband speed
- PC, laptop, tablet or mobile phone
- Videoconferencing tools (such as Zoom, MS Teams, Skype, Cisco Webex, Whereby or Google Meet)
- Access to online whiteboards (such as Google Jamboard, Miro, MS Teams whiteboard or the Canvas Chrome app)

18 Littlejohn et al., 2019; Charitonos and Littlejohn, 2021; Kaatrakoski et al., 2021.

Task 3.1: Applying what you know – dealing with the challenges that might obstruct knowledge transfer

Time: about 90 minutes

Group size: five to eight participants and a facilitator

Seating arrangement: in a group, pairs or individually

Task 3.1 encourages the team to reflect on factors that can make it difficult for professionals to use what they have learned in their day-to-day work.

As the facilitator,

1. Distribute copies of the following list of challenges to the group. You may also show this in a PowerPoint presentation. These challenges have been reported by healthcare professionals and refer to difficulties they experience to apply their learning about AMR in their day-to-day work.

- Professionals' limited knowledge of AMR.
- The lack of public awareness of the AMR threat. This could result in pressure from patients or clients (such as farmers) to get antibiotics prescribed.
- Lack of trust among health professionals in various roles and ranks.
- The limited flow of information concerning AMR across local and national surveillance networks.
- Limited professional development opportunities for professionals to reskill or upskill.
- Limited opportunities for interdisciplinary and multi-sectoral collaboration.

2. Ask the participants to get into pairs or groups of three to discuss each of the challenges in the list above. Use the following questions to facilitate discussion:

- What do you think of these challenges? Are you surprised by any of them?
- How are these challenges related to your day-to-day experiences at work?
- What other difficulties do you face when applying knowledge on AMR in your day-to-day work?
- What other difficulties would you add to the list?

3. List the main challenges that have been reported by the groups. You may use a flipchart paper and place it on the wall. Invite each group to share their key notes of discussion.
4. Use the list to select the challenges that the group feels are most relevant to them. Remember that these are the challenges and recommendations affecting the operation of the team, and not an individual. For each challenge, ask the participants to form pairs or groups of three to develop some specific actions and recommendations that they think should be implemented in their organisation.
    - Write down the recommended actions. Make a distinction between actions that are 'required' and 'optional/desired'.
    - Discuss how you would implement these recommendations in your unit, across units or your organisation.
    - Discuss how you could share the information in ways that would encourage your colleagues to relate the recommended actions to their own roles and work context.

Note that if not all of the challenges can be discussed in the same meeting, keep a record and discuss in a future session.

FOLLOW-ON ACTIONS

Think critically about the challenges that your team has reported and make an action plan to support your colleagues to integrate knowledge into day-to-day work. Identify people and resources that you may need to put your plan into action. Set up some short- and long-term goals in your team to minimise these challenges, and review these regularly in team meetings.

Task 3.2: Applying what you know – reflecting on good practice around AMR

Time: about 90 minutes

Group size: five to eight participants and a facilitator

Seating arrangement: in a group, pairs or individually

Task 3.2 encourages members of the team to recognise and reflect on existing good practice around AMR.

As the facilitator,

1. Encourage the group to share some examples of good practice on AMR that they are practising themselves or have observed in their workplace.
2. Note down the examples that were shared (from Step 1) so you can share these further with other colleagues, if possible.
3. Ask the participants to form small groups to discuss Examples A–G and reflect on the practices that are described. You could discuss all of the examples or you may select a few that are more relevant to your team.

Example A

I know sometimes in very sick children, clinicians give a para-treatment. And then they write on their sample requests to the lab, 'We have begun treating with this drug.' And the good clinicians write them on the form for us [laboratory technicians] that we began treating with this drug, so test it. But at other times there's the request form issue – you can get a request with no age, no sex, no diagnosis.

(Lab technician based in a teaching hospital in a LMIC)

Example B

One of the challenges is that we still have request forms that are handwritten. And we don't want ones you don't have all the information you need on it, so when you're going to our register or our books, you see some missing data. So that is one of the main challenges we have now. We can have request forms without names, – and we know with the local names, you can have a name that can go for both male and female, so when they don't state their sex, it's difficult to know whether it's for a male or a female. And it's sometimes the clinical data or the diagnosis – clinicians don't really write that. It's just about 10% completed. Most of the forms come without a diagnosis.

(Microbiologist in a lab in a teaching hospital in a LMIC)

Example C

A blood sample was sent to me for an examination. The sample was collected in an EDTA vial with the proper amount, i.e. 3 ml. The sample was well labelled, with age, sex, species, breed and ongoing medicines. The sample was received within half an hour, so that a good blood smear could be prepared. I sent back the report to the clinician in a timely manner.

Example D

Once I received a blood sample of a dog in an EDTA vial requested for haematological examination. On examination of the blood smear under a microscope, echinocytes were seen, which was a strange phenomenon. Usually, echinocytes are seen in chronic renal failure in dogs. Also, an excess of EDTA (underfilled tube) is responsible for echinocytes: actually, only 1 ml of blood was drawn by clinician, and at least 3 ml of blood was required to dilute the EDTA. In this particular case, an excess of EDTA caused a faulty result to occur.

(Vet lab technician in a clinic in a LMIC)

Example E

Food safety is the major issue in my country, where veterinarians, human doctors and public health workers, all three disciplines, meet. Poultry farmers use antibiotics at the last hour of marketing of poultry, regardless of their health status. Many growth promoters have been incorporated into animal diets. Some farmers do so owing to a lack of knowledge, while many others because of business motives. Sadly, they do not follow the withdrawal period: a specific period of time after the last dose of the veterinary medicine has been administered that must elapse before an animal or foodstuffs from an animal can enter the food chain. For example, the withdrawal period of enrofloxacin for meat is three weeks and for milk is four days. The public are not supposed to consume animal products in this period because such products have the residual effect of drugs. This residual effect of antibiotics may lead to AMR.

(Vet in an animal clinic in a LMIC)

Example F

While working in the intensive care unit (ICU), the lab technician showed up with the sputum culture report of a critically ill patient undergoing treatment. The organism isolated was resistant to all the antibiotics available for antibiotic sensitivity test in the lab. We had upgraded the antibiotic to a broad-spectrum group, piperacillin and tazobactam, as per his deteriorating condition. There were no diskettes of this antibiotic in the lab for the sensitivity test. The lab staff informed the authorities of the hospital and made the diskettes of piperacillin–tazobactam available for the sensitivity test. The report was in our hands within a few days. The antibiotic was sensitive and the patient improved.

(Consultant in a central hospital in a LMIC)

Example G

A patient who was suffering from fever and burning sensation of urine had been taking ofloxacin tablets from a nearby drugstore for three days. His condition was not improving, so he visited the hospital. Urine R/E and cultures were sent. Forms were filled, which included the details of the patient. It was also mentioned in the form that the patient was under antibiotics. Urine culture reports were positive and he was resistant to ofloxacin. However, the patient did not come to collect the report. The lab staff was kind enough to inform us. The patient was notified via telephone and his antibiotics were changed. He recovered well in a few days.

(Consultant in a central hospital in a LMIC)

- Distinguish between examples of good and poor practice around AMR.
- How do the practices described in the examples affect the AMR surveillance process?
- Ask the participants to suggest possible reasons that affect the practices described in the examples, whether positively or negatively. Make a note of all the reasons suggested.
- As a group discuss how could people involved in the examples be rewarded for good practice performed or be supported to change their work practice?

4. In small groups, encourage the participants to share one example of an existing practice around AMR that they have observed or are practising themselves, and that they think in hindsight needs to be improved. Invite each group to share key points of their discussion.
5. As a group, list the practices identified in Step 4 and ask the participants to suggest possible reasons that affect such practices. Make a note of all the reasons suggested and add these to the list you started creating in Step 2.

FOLLOW-ON ACTIONS

Think critically about the examples of good and poor practice that the participants discussed. Can you reward any existing good practice of your team? Can you share such examples of good practice beyond the team, and establish ways for the team to find out about good practice on AMR that is happening in your own organisation or elsewhere? You may also consider:

- facilitating a discussion around the type of support that the team needs to change some of the practices identified in their own examples (from Step 3)
- developing some regular meetings to discuss existing practices on AMR as a team
- identifying specific actions and recommendations that could be implemented in your team
- which of these actions should be prioritised in the short and long term.

Review these actions regularly to ensure that they align with the organisations' priorities, as well as with recent developments in AMR.

Task 3.3: Applying what you know – developing trust and openness

Time: about 90 minutes

Group size: six to eight participants and a facilitator

Seating arrangement: in a group or pairs

Task 3.3 aims to support a discussion around issues of trust and encourage members of your team to promote trust and openness among their colleagues.

Facilitator note

Good AMR surveillance requires trust and openness among professionals. Here is an example of how a lack of trust among professionals creates a tension and affects the quality of their work:

In many, many places in developing countries, [sampling and testing] does not happen because first, the clinician does not do the sampling. Very often, they do not do the sampling, because [...] they don't trust the result of the lab. And if they don't trust the results of the lab, they don't do the test because they know that they will not use the result. [...] They don't send test, so the lab has very little tests to perform, and so they are not very good at performing tests and they are not very good at giving good results. And so it doesn't work.

In many countries this tension may be the result of strong hierarchical structures within health systems. It has also been reported that in several settings, senior staff usually do not talk or share their experiences with their junior staff. This might create a communication gap between the staff, which may affect the quality of their work.[17]

Drawing on this, this task is designed to encourage your staff to promote trust and openness among their colleagues.

As the facilitator,

1. Present the following examples of types of relationships existing among professionals in AMR related activities. You could use a power point presentation or provide a printed copy of the examples to each person in the group. You may present all the examples or select a few that are more relevant to your team.

Example A

just called the patient, spoke with the doctor – and it's a typical example. Ideally, I shouldn't call the patient – I should call the doctor straight. There's no means of communication. You have to walk all the way to – and this one has no ward. There's no ward on this sample request form. So fortunately, I had a telephone number of the mother of the child, an 11-month-old child. And I was able to call. This child has sepsis. And so I wanted them to start treating or giving [specific drug], because a child last week – I followed up a child who passed on. It had candida in the blood, and before we could follow up with them to start treatment, the child was gone. So this child was being given some drugs which would not work at all for them. So I told the doctor that, obviously, you know you have to change your drugs. And he said, yes. So the child was on another medication, and mentioned something else, which does not work for this drug – for this bacteria that we have found. So then AMR is in, because she's taking drugs that she shouldn't have been taking that she doesn't need.

(Medical laboratory scientist in a central lab in a LMIC)

Example B

In many, many places in developing countries, [sampling and testing] does not happen because first, the clinician does not do the sampling. Very often, they do not do the sampling, because [...] they don't trust the result of the lab. And if they don't trust the results of the lab, they don't do the test because they know that they will not use the result. [...] They don't send test, so the lab has very little tests to perform, and so they are not very good at performing tests and they are not very good at giving good results.[19]

Example C

A lab report of a patient from the emergency room was doubtful and did not correlate with his clinical condition. The doctor from the emergency called the lab technician and discussed it with him. The lab staff agreed to repeat the test once more in the same lab to confirm and clear doubts.

There was a similar case of a doubtful report of another patient, where the treating doctor suspected the lab team as inefficient and sent the samples to be repeated in a comparatively expensive private lab that supposedly provided him incentives.

(Consultant in a central hospital in a LMIC)

Example D

We found that we don't have many problems communicating in the local AMR network. It is because most of us hold the same degree of education. There are some technical difficulties between clinicians and veterinary technicians that could be solved with regular meetings and bonding. However, there are some barriers to the local network and regional/national network. This may be due to hierarchical differences, confusion and unclear expectations. There are some barriers in communication between human lab technicians and clinicians that might have arisen from different educational backgrounds, difference in reference level of parameters, differences in species of bacteria isolated, etc.

(Consultant in a hospital in a LMIC)

Example E

In field conditions I can hardly find any lab to perform antimicrobial susceptibility tests [ASTs]. On the other hand, farmers want prompt treatment from my side because their animals are dying or the production [milk] is decreasing day by day. In this situation I am left with no options other than prescribing broad and highly potent antibiotics without performing ASTs.

(Vet in an animal health clinic in an LMIC)

19 Charitonos et al., 2018, pp. 24–5

2. Invite participants in small groups to discuss the examples. You may use the following questions to help your discussion:
   - What type of relationships are described in these examples and how do they unfold considering situations emerging in their setting?
   - How does trust enable or hinder relationships in the examples provided?
   - Do any of the examples remind you of situations in your own workplace? If yes, in what ways? If not, what do you think might be different in your team or organisation compared to the example provided?

   Invite each of the groups to share key points of their discussion.
3. As a group, discuss how 'trust' unfolds in day-to-day situations, especially when working with others. Is trust important in the way you perform your work?
4. Discuss and list possible reasons why some relationships are more challenging than others. In what ways can trust be further developed in your relationships with others and/or as a team? Share some ideas in the group.

FOLLOW-ON ACTIONS

Think critically about the examples of challenging relationships that the participants have reported during the discussion – especially cases where trust seems to be affecting working relationships. You may like to consider:

- facilitating a discussion around the type of support the team needs to develop more trust in their working relationships
- developing some regular meetings to discuss existing challenging situations that the team faces
- identifying specific actions and recommendations that could be implemented in your team
- which of these actions should be prioritised in the short and long term.

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