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STATUS UPDATE ON ANTIMICROBIAL RESISTANCE ACTIVITIES IN ANIMAL RESOURCES SECTOR IN AFRICAN UNION MEMBER STATES



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Disclaimer: The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official Policy or position of the African Union – InterAfrican Bureau for Animal Resources.

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EXECUTIVE SUMMARY

An online questionnaire survey was conducted among Chief Veterinary Officers in 54 African Union Member States between May and June 2023. Its objective was to enable clear understanding of the status of implementation of antimicrobial resistance activities in African Union Member States.A response rate of 69% (37/54) was achieved.

Findings revealed that most countries (24) had validated and operational National Action Plans, but few (11) had National Action Plans that were still underdevelopment or non-existent (2). Thirty-seven (37) countries provided names and contacts of AMR Focal Points for Animal Production/Production and Public Health to allow initiating the Africa AMR Surveillance Network and its related activities. In addition,37 countries provided required names and locations for setting-up a database for national reference laboratories for AMR testing. Most countries (34) performed Antimicrobial Susceptibility Testing methods in their national laboratories, with the Disk Diffusion Test (24) predominantly performed.

Antimicrobial resistance was reported in farm animals in all the 37 countries, with Tetracycline resistance being predominantly reported (43%), followed by Penicillin resistance (16%), Quinolone resistance (8%), Acaricides resistance (5%), Trypanocide resistance (5%), Streptomycin resistance (3%) and Sulphonamide resistance (3%). Reported resistance against drug combinations was low (3%). The majority of the countries (17) reported a prevalence of 0-20%. Fewer countries (8) reported a prevalence of 21-40%. Other countries (10) reported a prevalence of 41-60%. Only one country reported a prevalence of 61-80% and another that reported unknown status of the prevalence of antimicrobial resistance.

Beef (59%), Poultry (53%) and Dairy (31%) were identified as priority livestock value-chains for AMR surveillance. Few (4) countries had well-functioning integrated AMR surveillance programmes. But the majority of the countries (15) had AMR surveillance programmes for the different sectors but that were not integrated. While some countries (6) had no AMR surveillance programmes, with others (12) having developed AMR, surveillance plans but were not operational

Many countries (26) had trained technicians and equipped veterinary laboratories for antimicrobial susceptibility testing. While, few (11) countries did not have. Most (21) countries had AMR data specialists specific for animal isolates. While, fewer (14) countries had AMR data specialists for human isolates. Two countries had AMR data specialists for both human and animal isolates.

Farm animals were the predominant animal sample source. In addition, current antimicrobial use was considered the most important risk factor for AMR. The most preferred AMR surveillance method at national level was active surveillance (43%), followed by passive surveillance (27%), sentinel surveillance (11%), combined active and passive surveillance (5%) and passive and sentinel surveillance (5%). Random sampling (65%) and systematic sampling (19%) were the preferred sampling strategies for AMR work.

Findings on the specific pathogens targeted for AMR surveillance at national level, revealed that the majority of the countries (9) target *E. coli*, followed by a combination of *Campylobacter spp*., *Salmonella spp*., *Escherichia coli*, *Enterococcus spp*., *Staphylococcus aureus, Pseudomonas aeruginosa* and *Mycobacterium tuberculosis* (13), and a combination of *Salmonella spp*., *Escherichia coli*, *Mycobacterium tuberculosis*, *Helminthes*, Ticks and *Trypanosoma spp*. (12). However, a few countries (3) had not determined target pathogens for AMR surveillance.

Responses on the feasible laboratory testing methodologies at national indicated that a range of laboratory methods, including, Bacterial culture and isolate identification, Characterization of isolates, Standardized antimicrobial susceptibility testing, Quality control, Recommended antimicrobials for surveillance, and Minimum inhibition Concentration test (MIC) were considered commonest (68%). A few countries (19%) were able to conduct only Bacterial cultures and isolate identification. While others (8%) were able to conduct only standardized antimicrobial susceptibility testing. Two countries did not have capacity to conduct any laboratory methods.

Findings revealed a total of 16 countries confirmed having software tools and experts for AMR data analysis and reporting on the antimicrobial susceptibility testing. While, 21 countries confirmed not having AMR data analysis and AST reporting experts and tools.

AMR surveillance (31%), development or implementation of the AMR National Action Plan (28%) and training on AMR surveillance and antimicrobial susceptibility testing (19%) were the priority AMR activities at national level recommended for AU-IBAR.

Implementation of programs, finance and training human resource to mitigate harm from AMR (47%), followed by supporting increase in the number of veterinary laboratories with quality AMR diagnostic tests (19%), and developing or revising, funding and monitoring implementation of National Action Plans for AMR (16%) were priority AMR activities at regional level recommended for AU-IBAR.

Improving surveillance of antimicrobial use and antimicrobial resistant microorganisms (94%) was the main AMR activity at continental level recommended for AU-IBAR.

In conclusion, survey responses provided a satisfactory basis to allow the establishment and operationalization of the Africa AMR Surveillance Network and for initiating development of capacities of Member States to undertake surveillance and monitoring of Antimicrobial Resistance in the animal health sector.

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ABBREVIATIONS AND ACRONYMS

AMR	Antimicrobial Resistance
AST	Antimicrobial Susceptibility Testing
AU	African Union
AUC	African Union Commission
AU-IBAR	African Union Interafrican Bureau for Animal Resources
CES AMR	Containing the Emergence and Spread of Antimicrobial Resistance in Africa
CPHRL	Central Public Health Reference Laboratory, Lakka, Freetown Sierra Leone
COHL	Central Public Health Laboratories, Kampala
CVL	Central Veterinary Laboratory
DARBE	Department of Agriculture, Rural Development, Blue Economy and Sustainable Environment
DRC	Democrat Republic of the Congo
INSP	Institut National de Sante Publique
IPCI	Institut Pasteur of Ivory Coast
GDP	Gross Domestic Product
LANAVET	Laboratoire Nationale Veterinaire, Yaoundée, Garoua and Douala
LVCD	Laboratoire Central Veterinaire de Diagnostic
MIC	Minimum Inhibitory Concentration
MS	Member States
NADDEC	National Animal Disease Diagnostics and Epidemiology Center, Entebbe, Uganda
NAP	National Action Plan (for AMR)
LANADA	The National Laboratory for Agricultural Development Support
REC	Regional Economic Community
HTH	University Teaching Hospital, Lusaka District, Zambia
USD	United States Dollar
WHO	World Health Organization

1.0 BACKGROUND

1.1 Introduction

Animal resources are a key contributor to Africa's Agricultural GDP, however, animal diseases still burden Africa with annual losses of over US$4 billion in Sub-Sahara, an equivalent to 25% of the total value of animal production (Anon. 2022). Management of most diseases largely relies on use of anti-microbials. In addition, antimicrobials remain a key tool for the management of infectious diseases in humans and animals. To adhere to appropriate administration of an antimicrobial, appropriate clinical diagnosis and prescription by an animal health professional is key. However, irrational use of drugs has led to the emergence and spread of antimicrobial resistance. Unfortunately, overuse and inappropriate use of antimicrobials (e.g., unregulated use in animal feed) have contributed to the emergence and spread of antimicrobial resistance. Inappropriate use of antibiotics in animal production leads to unnecessary resistance to antimicrobials in animal and human pathogens. Likewise, overuse and misuse of antimicrobials in animal production and crop agriculture are contributing to the emergence and spread of antimicrobial resistant microorganisms.

Antimicrobial resistance in animals has received comparatively less attention than in humans. However, reports indicate that from 2000 to 2018, the proportion of AMR above 50% increased from 0.15 to 0.41 in chickens and from 0.13 to 0.34 in pigs (Van Boeckel *et al*., 2019). Tetracyclines, sulfonamides, quinolones and penicillins which are commonly used in farm animals as antibiotic growth promoters to help them gain weight are also the ones with highest resistance rates (Van Boeckel, *et al*.2019). Furthermore, resistance has been observed for streptomycin, tetracycline and triazole fungicide in crop production (FAO, 2018).

Antimicrobial resistance has been detected in *Campylobacter spp*., *Salmonella spp*., *Escherichia coli*, and *Enterococcus spp* within animal the production sector in Africa. This trend raises public health concerns due to the potential transmission of resistant bacteria from food-producing animals to humans. Hence the need to prevent and mitigate the threat of AMR using a One Health approach. Adherence to responsible and prudent use of antimicrobial in production settings according to marketing authorizations and professional advice is necessary to minimize AMR.

1.2 Causes of antimicrobial resistance

Causes of antimicrobial resistance are illustrated in the diagram below according to WHO reports (WHO, 2016). These include, over-prescribing antimicrobials; not observing the course of treatment; overuse of antimicrobials in livestock and fish farming; poor infection control while applying biosecurity measures; poor hygiene and sanitation; and limited new antimicrobials being developed.

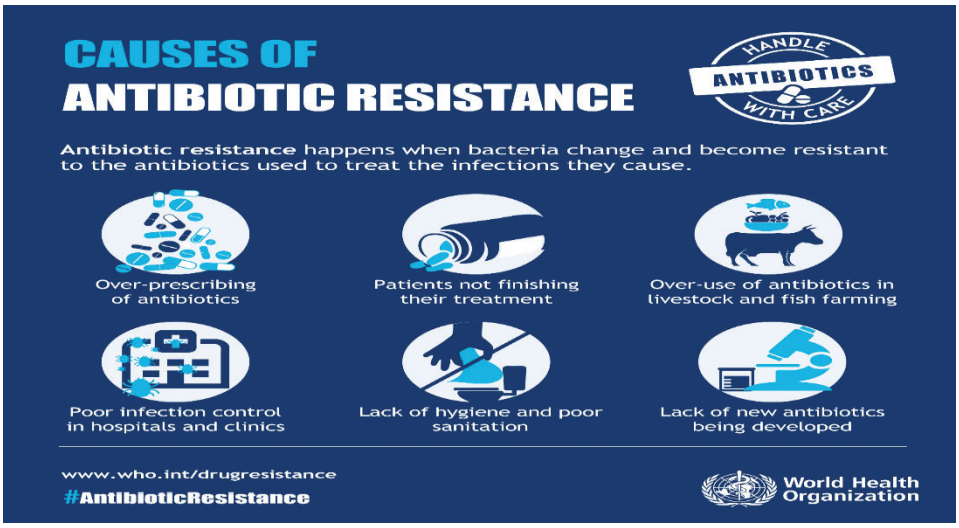


Illustration of causes of antimicrobial resistance (WHO, 2016)

1.3 Mechanism of antimicrobial resistance

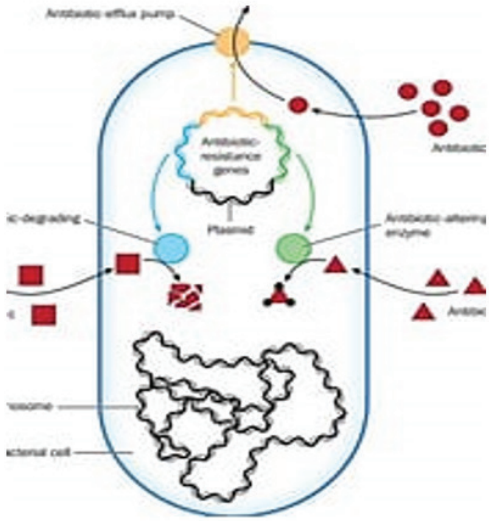
The multiple mechanisms through which microorganisms develop resistance to antimicrobials is illustrated in the schematic diagram below according to Britannica (2023).

Mechanisms of antimrobial resistance

Microorganisms such as bacteria can develop resistance to antimicrobials through multiple mechanisms (Britannica, 2023) .

These mechanisms include:

- Activation of drug efflux pumps that actively remove a drug from the cell,
- Inactivation of a drug by microorganism enzymes,
- Alteration of cell drug targets of the microorganism,
- Inhibition of drug uptake into cell,
- Degradation of antimicrobials by enzymes,
- Antimicrobial target modification,
- Complete replacement of antimicrobials targets,
- Changes in membrane permeability to antimicrobials
- Production of altered targets.



(Illustration for the mechanism for antimicrobials resistance, Britannicca,2023)

1.4 AU-IBAR interventions on antimicrobial resistance

AU-IBAR is a specialized technical office of the Department of Agriculture, Rural Development, Blue Economy and Sustainable Environment of the African Union Commission, mandated to support and coordinate the utilization of livestock, fisheries, aquaculture and wildlife as resources for both human wellbeing and economic development in the Member States of the African Union. The Vision of the AU-IBAR Strategic Plan 2018-2023 is an Africa in which animal resources contribute significantly to integration, prosperity and peace.

AU-IBAR intervention on tackling AMR is guided by the African Union Framework for Antimicrobial Resistance Control (2020-2025) and the African Position on Antimicrobial Resistance. AU Framework for AMR control seeks to strengthen AMR control activities by establishing a coordination mechanism for AMR control at the continental level, facilitating implementation of AMR actions in Member States (MS) and Regional Economic Communities (RECs) and coordinating AMR interventions with Partners. The strategic objectives of the Framework are:

1. Improving surveillance of antimicrobial use and AMR microorganisms;
2. Delaying emergence of AMR;
3. Limiting transmission of AMR;
4. Mitigating harm from AMR microorganisms

An African Union (AU) Task Force for AMR control, composed of AUC institutions and RECs working on AMR has been established to work with MS, RECs and Partners to prioritize continent-wide efforts to increase political commitment, mobilize resources,

and promote policies that improve AMR control.

In line with AU framework for AMR control and AU African Position on AMR, AU-IBAR is implementing a project on "Containing the Emergence and Spread of Antimicrobial Resistance in Africa (CES-AMR Africa) project." Its objective is to enhance AMR governance with focus on regional approaches that strengthen capacities to undertake surveillance of AMR microorganisms.

However, the major challenge to implementation of activities for the afore-mentioned project is paucity of status information on antimicrobial resistance work in AU Member States related to animal health and production. This justified undertaking of a survey among key experts in the animal resources sector in the African Union Member States.

2.0 OBJECTIVES

The overall objective of the survey was to enable clear understanding of the status of implementation of antimicrobial resistance activities in African Union Member States. The information was to inform policy development and targeted interventions in all Member States and Regional Economic Communities across the African continent.

The specific objectives included:

- To establish and operationalize the Africa AMR Surveillance Network
- To develop capacities of Member States to undertake surveillance and monitoring of Antimicrobial Resistance in the animal health sector

3.0 METHODOLOGY

An online questionnaire survey was conducted among Chief Veterinary Officers in 54 African Union Member States between May and June 2023. A detailed questionnaire on a Google form entitled "Update on AMR activities in Member States" was dispatched to all of them. It was submitted in three languages: English, French and Portuguese. The survey sought feedback on the following:

- The status of the National Action Plan on antimicrobial resistance
- Contacts of current Focal Points for antimicrobial resistance work representing Animal Health and/or Animal Production and Public health
- The status of ongoing surveillance and laboratory testing on antimicrobial resistance
- Names and locations of designate national reference laboratories for antimicrobial resistance

- Priority livestock value-chains for surveillance on antimicrobial resistance
- Recommended activities for AU-IBAR to implement on antimicrobial resistance at continental, regional and national levels

4.0 RESULTS

4.1 Country response to the survey

A total of 37 (69%) African Union Member States responded to the survey. They included, Algeria, Burkina Faso, Burundi, Cameroon, Cape Verde, Chad, Congo Brazzaville, Cote D'Ivoire, DRC, Egypt, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, Guinea-Bissau, Guinea Conakry, Kenya, Lesotho, Madagascar, Malawi, Mali, Morocco, Mozambique, Namibia, Nigeria, Rwanda, Sao Tome & Principle, Sierra Leone, Somalia, South Sudan, Tanzania, Tunisia, Togo, Uganda, Zambia and Zimbabwe.

However, a total of 17 (31%) Member States did not respond. These, included, Angola, Benin, Botswana, Central African Republic, Comoros, Djibouti, Equartoria Guinea, Liberia, Libya, Mauritius, Mauritania, Niger, Senegal, Seychelles, South Africa and Sudan.

4.2 Regional response to the survey

A summary of country response according to regions in Africa is presented in Table 1. The best response was achieved in Eastern Africa (9/10, 90%) and Northern Africa (4/5, 80%), followed by Central Africa (6/7, 86%). However, response in Southern Africa (8/14, 57%) and Western Africa (10/17, 59%) was below expectation.

Table 1: *Summary country response according to regions in Africa*

Region	No. of countries responded	No. of countries yet to respond
Central Africa	6	1
Eastern Africa	9	1
Northern Africa	4	1
Southern Africa	8	6
Western Africa	10	7

4.3 Status of the National Action Plans on antimicrobial resistance

Most countries had validated and operational National Action Plans (65%), but fewer (30%) had National Action Plans that were still underdevelopment and non-existent (5%) (see Table 2).

Table 2: *Summary of response on the status of national action plans on antimicrobial resistance*

Status of national Action Plan on AMR work	Number of countries	Countries
Non-existent	2/37 (5%)	Guinea-Bissau, Chad
Still underdevelopment	11/37 (30%)	Somalia, Cameroon, Cape Verde, Sao Tome & Principle, Lesotho, Burkina Faso, Algeria, Mali, Gabon, South Sudan and Togo
Validated and operational	24/37 (65%)	Madagascar, Congo Brazzaville, Uganda, Zambia, Egypt, DRC, Sierra Leone, Nigeria, Malawi, Zimbabwe, Tanzania, Tunisia, Guinea Conakry, Mozambique, Kenya, Eritrea, Cote D' Ivoire, Burundi, Morocco, Ethiopia, Rwanda, Namibia, Gambia and Eswatini

4.4 Details of current AMR Focal Points for Animal Health/Production and Public Health

Names and contacts of AMR Focal Points for Animal Production/Production and Public Health are presented in Table 3. This is a database for national AMR Focal Points for animal health/production and Public Health.

Table 3: *Names and contacts of AMR Focal Points for Animal Health/Production and Public Health for respective countries*

No.	Country	Animal Health Focal point	Public Health Focal Point
1	Burkina Faso	Ouermi Zerbo Lamouni Habibata, Laboratoire National d'Elevage, e-mail: habiouermi@gmail.com	Prof. PODA Armel
2	Cameroon	Dr Donbou Bertrand, Ministère de l'Elevage, des Pêches et des Industries Animales - MINEPIA Yaoundé, CAMEROUN Tél.: + (237) 675032096	Dr TSEUKO Dorine, Ministère de la Santa Publique, Yaoundé, CAMEROUN Tel: +(237) 699078363
3	Cape Verde	Achada de Sao Filipe, caixa postal n° 278, contacto (00238)2604180.	None
4	Republic of Congo (Brazzaville)	Dr N'Kaya-Tobi Directeur Général de l'Elevage Ministère de l'agriculture, de l'élevage et de la pêche Délégué national auprès de l'Organisation Mondiale de la Santé Animale (OMSA) Tél.: +(242)055672767/ +(242)066585570 BP: 2453 Brazzaville République du Congo. Email: nkayatobi2012@gmail.com	Dr Makaya Dakaya Dangui Nieko Nicole Prisca, Laboratoire National de SantÃ© Publique, E-mail: nicolemakaya@gmail.com
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No.	Country	Animal Health Focal point	Public Health Focal Point
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No.	Country	Animal Health Focal point	Public Health Focal Point
14	Sao Tome & Principe	Dr Alfredo da Mata Délégué de l'OMSA Ministère de L'Agriculture Pèches et Développement Rural Avenida marginal 12 de Julho Caixa Postal 718 SAO TOME ET PRINCIPE Tel: +239 9904403 E-mail: alfredodamata66@gmail.com	Jeryson Ramos da Costa E-mail: jerysonramos23@gmail.com Tel: +2399983773
15	Sierra Leone	Dr. Sahr Ramond Gborie (Animal Health) E-mail: srgborie@gmail.com Mr.Salamu Saidu (Animal Production) E-mail: salamsaidu76@gmail.com)	None
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31	Mali	Pr. Ibrehim Guindo +223-76078639; Dr Satigui Sidibe, Laboratoire central veterinaire	Pr. Niani Mounkoro, Chu Gabriel Toure

No.	Country	Animal Health Focal point	Public Health Focal Point
32	Namibia	Dr. Lee-Monique Anderson, Ministry of Agriculture, Water & Land Reform, Directorate of Veterinary Services, Central Veterinary Laboratory; email: Lee-monique.Anderson@mawlr.gov.na	Ms. Tuyakula Johannes; Ministry of Health and Social Services Directorate of Pharmaceutical Services E-email: Tuyakula.Johannes@mhss.gov.na
33	Gabon	Dr RERAMBYATH Guy Anicet, Directeur Général Adjoint 1 B.P 136 Libreville, GABON Tel. +24166634071/ +24177598824 E-mail : g.rerambyath@gmail.com g.anicet_rerambyath@yahoo.fr	Dr Armel MINTSA,
34	The Gambia	Saidal Ali Bah Department of Livestock, E-mail: bahsaidalali@gmail.com	Dr. Babanding Sabally Director of Gambia Pharmaceutical Services, E-mail: saballo45@hotmail.com
35	Eswatini	Dr Courage Mudyanavana Veterinary Public Health Unit, Department of Veterinary and Livestock Services; E-mail: bertcou@yahoo.co.uk Dr Zizwe Cindzi Department of Veterianary and Livestock Services; E-mail: zizwecindzidr@gmail.com	Ms Thuli Magagula Deaprtment of Pharmaceutical Services, Ministry of Health; E-mail: tpmag91@gmail.com
36	Togo	Mr TCHEDRE Kissao,Docteur vétérinaire, chef section cliniques et pharmacies à la Direction de l'Elevage, Tél: (+228) 90055007, email: kissaotchedre@live.fr	Professeur Salou Mounerou enseignant à l'Université de Lomé, +228 93 47 59 89 · mounerous@gmail.com
37	South Sudan	Alor Kwaja, Ministry of Livestock and Fisheries RSS, Juba, South Sudan e-mail: alorkwaja@gmail.com	Abe Abias, National Public Health Laboratory RSS, Juba, South Sudan, E-mail: lojuanabe@gmail.com

4.5 Designated national reference laboratories for AMR testing

Names and locations of national reference laboratories for AMR testing are shown in Table 4. Most countries (26/37,70%) had designated reference laboratories for AMR testing. However, fewer (11/37,30%) did not have designated AMR reference laboratories. These included, Somalia, Cape Verde, Sao Tome & Principle, Lesotho, Eritrea, Morocco, Guinea-Bissau, Mali, Namibia, Gambia and Togo.

Table 4: *Names and locations of national reference laboratories for AMR testing in respective countries*

No.	Country	National AMR Testing Reference Laboratories
1	Burkina Faso	Laboratoire National de reference RAM Ã Bobo Dioulasso
2	Cameroon	LANAVET: Yaoundée, Garoua and Douala
3	Cape Verde	Laboratario Veterinario Achada de Sao Filipe
4	Republic of Congo (Brazzaville)	Laboratoire National de Santé Publique, Brazzaville, Centre ville
5	DRC	Central Veterinary Laboratory, (Animal Health) General Reference Hospital of Kinshasa (Public Health)
6	Guinea Conakry	Institut National de Sante Publique (INSP) ET Laboratoire Central Veterinaire de Diagnostic (LCVD)
7	Madagascar	Laboratoire National de Diagnostic Veterinaires
8	Rwanda	Rwanda National Reference Laboratory, Rwanda, Kigali City, Street: KN 4 AV P.O. Box 7162 Kigali, Rwanda. Rubirizi National Veterinary Laboratory (RNVL). City of Kigali Kicukiro district, Kanombe sector, in Rubilizi cell.
9	Somalia	None
10	Uganda	National Animal Disease Diagnostics and Epidemiology Center (NADDEC), Entebbe. Central Public Health Laboratories (CPHL), Kampala.
11	Zambia	University Teaching Hospital (HTH)- Lusaka District. Central Veterinary Research Institute- Chilanga District
12	Mozambique	Direccao de Ciencias Animais/IIAM; Av. de Mocambique Km 1.5, Maputo
13	Egypt	Animal Health Research Institute, Egypt
14	Sao Tome & Principe	None
15	Sierra Leone	Central Veterinary Laboratory Teko in Makeni, Bombali District Central Public Health Reference Laboratory (CPHRL) Lakka, Freetown Sierra Leone
16	Tanzania	Central Veterinary Laboratory, Dar es Salaam (Veterinary) National Public Health Laboratory, Dar es Salaam (Public Health)
17	Tunisia	Lilia MESSADI, professor of microbiology in The National School of Veterinary Medicine
18	Nigeria	Bacteria Research Laboratory, National Veterinary Research Institute Jos, Plateau State (Animal Health) NCDC Reference Laboratory, Gaduwa, Abuja, FCT (Human Health); University College Hospital, Ibadan, Oyo State (Human Health).
19	Malawi	Central Veterinary Lab in Lilongwe (Animal Health) National Reference Microbiology Lab, Lilongwe (Public Health)
20	Lesotho	None
21	Zimbabwe	Central Veterinary Laboratory (CVL), Bacteriology Laboratory (Animal health), 18A Borrowdale Road, Harare. National Microbiology Reference Laboratory (Human Health), 14 Lobengula Road, Harare, Zimbabwe.
22	Kenya	Central Veterinary Laboratory in Kabete, Nairobi

No.	Country	National AMR Testing Reference Laboratories
23	Eritrea	National Health Laboratory
24	Cote d'Ivoire	IPCI Institut Pasteur of Ivory Coast (IPCI) The National Laboratory for Agricultural Development Support (LANADA)
25	Burundi	Animal Health: Laboratoire National Veterinaire Public health: INSP + 8 other laboratories.
26	Morocco	None
27	Guinea-Bissau	None
28	Ethiopia	Animal Health Institute Veterinary Laboratory, Sebeta, Ethiopia
29	Chad	Institut de recharge en Elevage pour le developpement duTchad, Ndjamena
30	Algeria	Laboratoire Regional Veterinaire de Draa Ben Khedda. Dans la Wilya de Tizi-Ouzou.
31	Mali	None
32	Namibia	None
33	Gabon	Laboratoire d'analyse du Ministère de la Santé
34	The Gambia	None
35	Eswatini	Central Veterinary Laboratory, Department of Veterinary and Livestock Services, Manzini
36	Togo	None
37	South Sudan	Central Veterinary Laboratory Juba.

4.6 Antimicrobial Susceptibility Testing (AST) methods performed in national laboratories

In Table 5, is shown a summary of Antimicrobial Susceptibility Testing methods performed in national laboratories in respective countries. The majority of the countries (34/37, 92%) indicated AST methods performed in their national laboratories. While, few (3/37, 8%) countries, including, Cape Verde, Sao Tome & Principe and Guinea-Bissau indicated that they were not performing antimicrobial Susceptibility Testing.

The Disk Diffusion Test was performed in the majority of countries (24/37, 65%). While, few countries (5/37,13.5%) performed the Minimum Inhibition Concentration test and others (5/37,13.5%) performed both the Disk Diffusion Test and the Minimum Inhibition Concentration test. Some countries (3/37, 8%) did perform any antimicrobial susceptibility testing at all.

Table 5: *Summary of antimicrobial susceptibility methods performed in national laboratories*

Country	Antimicrobial Susceptibility Testing methods performed in national laboratories
Madagascar	Disk Diffusion Test
Somalia	Disk Diffusion Test
Cameroon	Minimum inhibitory concentration
Republic of the Congo	Disk Diffusion Test
Uganda	Disk Diffusion Test
Zambia	Disk Diffusion Test
Egypt	Disk Diffusion Test and Minimum Inhibitory Concentration
Cabo Verde	None
Sao Tome and Principe	None
DRC	Disk Diffusion Test
Sierra Leone	Disk Diffusion Test
Nigeria	Disk Diffusion Test
Malawi	Disk Diffusion Test
Lesotho	Disk Diffusion Test
Zimbabwe	Disk Diffusion Test
Tanzania	Disk Diffusion Test
Burkina Faso	Minimum inhibitory concentration
Tunisia	Minimum inhibitory concentration
Guinea	Disk Diffusion Test
Mozambique	Disk Diffusion Test
Kenya	Minimum inhibitory concentration
Eritrea	Disk Diffusion Test
Cote d'Ivoire	Disk Diffusion Test
Burundi	Disk Diffusion Test
Morocco	Disk Diffusion Test and Minimum Inhibitory Concentration
Guinea-Bissau	None
Ethiopia	Disk Diffusion Test
Chad	Disk Diffusion Test
Rwanda	Disk Diffusion Test and Minimum Inhibitory Concentration
Algeria	Disk Diffusion Test
Mali	Disk Diffusion Test
Namibia	Disk Diffusion Test and Minimum Inhibitory Concentration
Gabon	Minimum inhibitory concentration
Gambia	Disk Diffusion Test
South Sudan	Disk Diffusion Test and Minimum Inhibitory Concentration
Togo	Disk Diffusion Test
Eswatini	Disk Diffusion Test

4.7 Antimicrobial agents showing resistance in farm animals

A summary of antimicrobial agents showing resistance in farm animals in respective countries is shown in Table 6. Antimicrobial resistance was reported in farm animals in all the 37 countries that responded to the questionnaire survey. Tetracycline resistance was reported in the majority of the countries (43%), followed by Penicillin resistance (16%), Quinolone resistance (8%), Acaricides resistance (5%), Trypanocide resistance (5%), Streptomycin resistance (3%), and Sulphonamide resistance (3%). Reported resistance against drug combinations was low (3%).

Table 6: *Antimicrobial agents showing resistance in farm animals in respective countries*

Antimicrobial agent showing resistance in farm animals	No. of countries reporting resistance	Names of Countries
Acaricides	2/37 (5%)	Cape Verde, Sao Tome & Principe
Penicillin	6/37 (16%)	Madagascar, Cameroon, Lesotho, Tunisia, Guinea Conakry and Cote D'Ivoire
Quinolones	3/37 (8%)	Congo Brazzaville, Egypt and Algeria
Streptomycin	1/37 (3%)	Eritrea
Sulphonamides	1/37 (3%)	Somalia
Tetracyclines	16/37 (43%)	Uganda, Zambia, DRC, Sierra Leone, Nigeria, Malawi, Zimbabwe, Tanzania, Burkina Faso, Mozambique, Kenya, Burundi, Morocco, Guinea-Bissau, Rwanda and Mali
Tetracycline and Penicillin	1/37 (3%)	Togo
Tetracycline, Penicillin, Streptomycin, & Acaricides	2/37 (5%)	Gabon and South Sudan
Tetracycline, Sulfonamides, Quinolone, Penicillin & Streptomycin	1/37 (3%)	Eswatini
Tetracycline, Sulfonamides, Quinolones, Penicillin and Streptomycin	1/37 (3%)	Namibia
Tetracyclines and Sulphonamides	1/32 (3%)	Namibia
Tetracycline, Sulfonamides, Quinolones, Penicillin and Streptomycin	1/37 (3%)	The Gambia
Trypanocides	2/37 (5%)	Ethiopia and Chad

4.8 Priority livestock value chains for AMR surveillance

Beef, Poultry and Dairy were the priority livestock value-chains identified for AMR Surveillance (Figure 2). Piggery, Fish & aquaculture, Dromedary camels and Goats were other minor livestock value-chains identified.

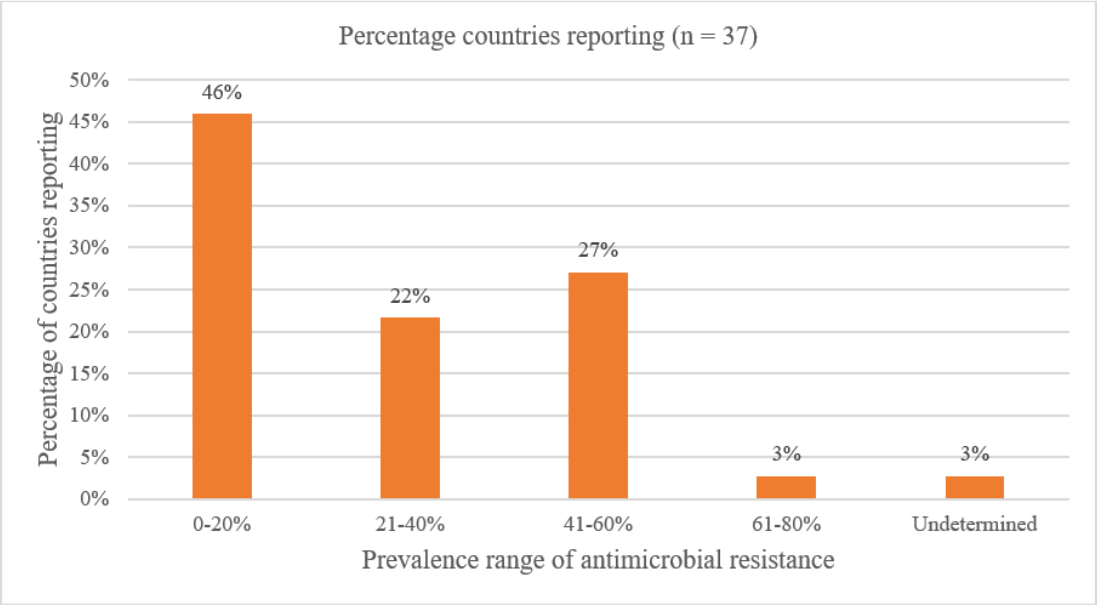


Figure 1: *A summary of responses on priority livestock value-chains for AMR surveillance*

4.9 Prevalence of antimicrobial resistance in farm animals

The prevalence of antimicrobial resistance in farm animals is shown in Figure 2. The majority of the countries (17/37), including, Madagascar, Cameroon, Egypt, Cape Verde, Sao Tome & Principe, Malawi, Lesotho, Burkina Faso, Guinea Conakry, Eritrea, Ethiopia, Namibia, Cote D'Ivoire and Guinea Bissau, Eswatini, South Sudan and Togo reported a prevalence of 0-20%. Fewer countries (8/37), namely, Somalia, Zimbabwe, Tanzania, Mozambique, Kenya, Burundi, Rwanda and Algeria reported a prevalence of 21-40%. In addition, other countries (10/37), namely, Congo Brazzaville, Uganda, DRC, Sierra Leone, Nigeria, Tunisia, Morocco, Chad, Mali and Gabon reported a prevalence of 41-60%. Zambia was the only country (1/37) that reported a prevalence of 61-80%. While the Gambia was the only country that reported an unknown status of the prevalence of antimicrobial resistance.

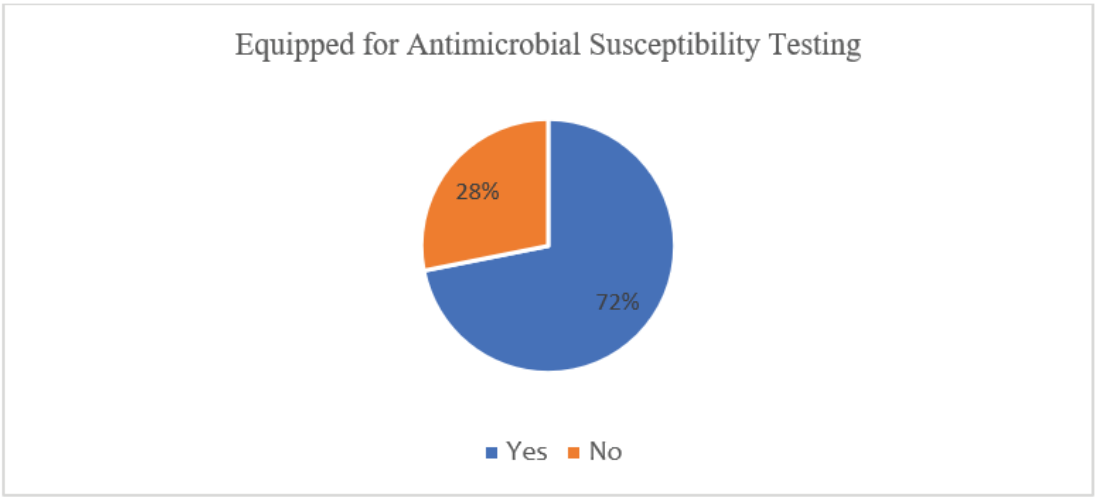


Figure 2: *Prevalence of antimicrobial resistance in farm animals as per responses from 37 African Union member states*

4.10 Status of AMR surveillance programme

The majority of the countries (41%) had AMR surveillance programmes for the different sectors but that were not integrated (see Table 7). Some countries (16%) had no surveillance programmes for AMR. While others (32%) had developed AMR surveillance plans but were not operational. Only few (11%) countries had well-functioning integrated AMR surveillance programmes.

Table 7: *Summary of the status of the AMR surveillance programme*

Status	No. of countries	Names of countries
AMR surveillance for the different sectors exist but are not integrated	15/37 (41%)	Madagascar, Uganda, Zambia, Egypt, Malawi, Lesotho, Zimbabwe, Tanzania, Tunisia, Mozambique, Morocco, Guinea-Bissau, Ethiopia, Eswatini and Algeria
No surveillance programme has been established	6/37 (16%)	Somalia, Cape Verde, Burundi, Chad, Namibia and The Gambia
Surveillance plan has been developed but yet to be operationalized	12/37 (32%)	Congo Brazzaville, Sao Tome, Sierra Leone, Nigeria, Burkina Faso, Eritrea, Cote D'Ivoire, Rwanda, Mali, Gabon, South Sudan and Togo
A well-functioning integrated AMR surveillance programme exists	4/37 (11%)	Cameroon, DRC, Guinea Conakry and Kenya

4.11 Status of trained technicians and equipped veterinary laboratories for Antimicrobial Susceptibility Testing

A total of 26 (70%) countries confirmed having trained technicians and equipped veterinary laboratories for antimicrobial susceptibility testing (Figure 3). These included Cameroon, Uganda, Zambia, Egypt, Cape Verde, DRC, Nigeria, Malawi, Lesotho, Zimbabwe, Tanzania, Burkina Faso, Tunisia, Guinea Conakry, Kenya, Cote D'Ívoire, Morocco, Ethiopia, Chad, Rwanda, Algeria, Mali, Namibia, The Gambia, Togo and Eswatini. While, 11 (30%) countries, including, Madagascar, Somalia, Congo Brazzaville, Sao Tome, Sierra Leone, Mozambique, Eritrea, Burundi, Guinea-Bissau, Gabon and South Sudan did not have trained technicians and equipped laboratories for AST.

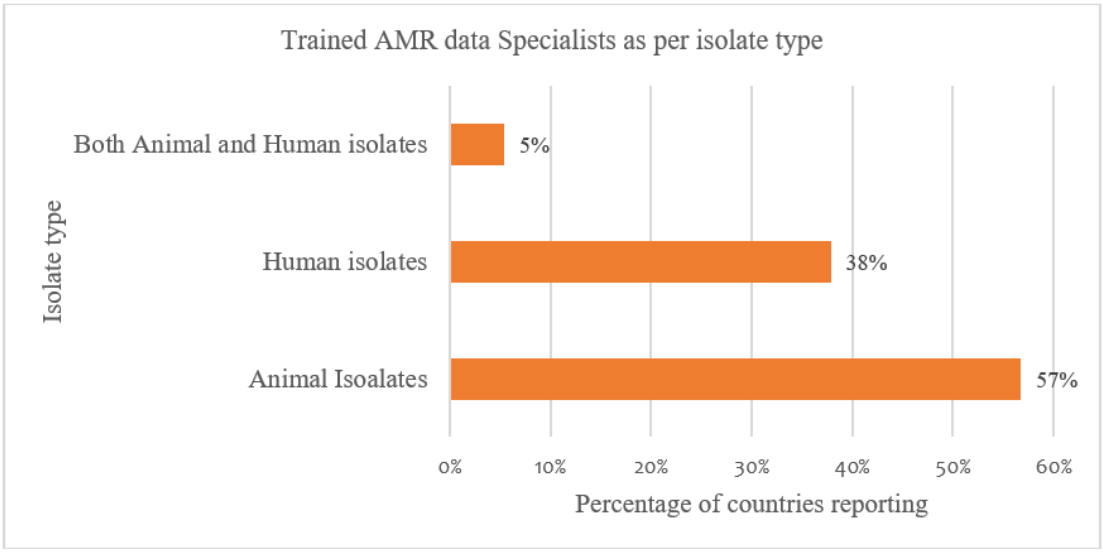


Figure 3: *Pie chart showing percentage of countries with (Yes) and without (No) trained technicians and equipped veterinary laboratories for antimicrobial susceptibility test*

4.12 Status of trained personnel for AMR data collection, analysis and reporting as per isolate type

A total of 21 (57%) countries including, Madagascar, Somalia, Cameroon, Uganda, Zambia, Sierra Leone, Malawi, Lesotho, Zimbabwe, Tanzania, Burkina Faso, Tunisia, Kenya, Burundi, Morocco, Guinea-Bissau, Ethiopia, Chad, Rwanda, Mali and South Sudan, had AMR data specialists specific for animal isolates (Figure 4).

While, 14 (38%) countries, including, Congo Brazzaville, Egypt, Cape Verde, Sao Tome and Principe, DRC, Nigeria, Guinea Conakry, Mozambique, Eritrea, Cote D'Ivoire, Algeria, Gabon, The Gambia and Eswatini had AMR data specialists for human isolates. Only 2 (5%) countries, including, Namibia and Togo had AMR data specialists for both human and animal isolates.

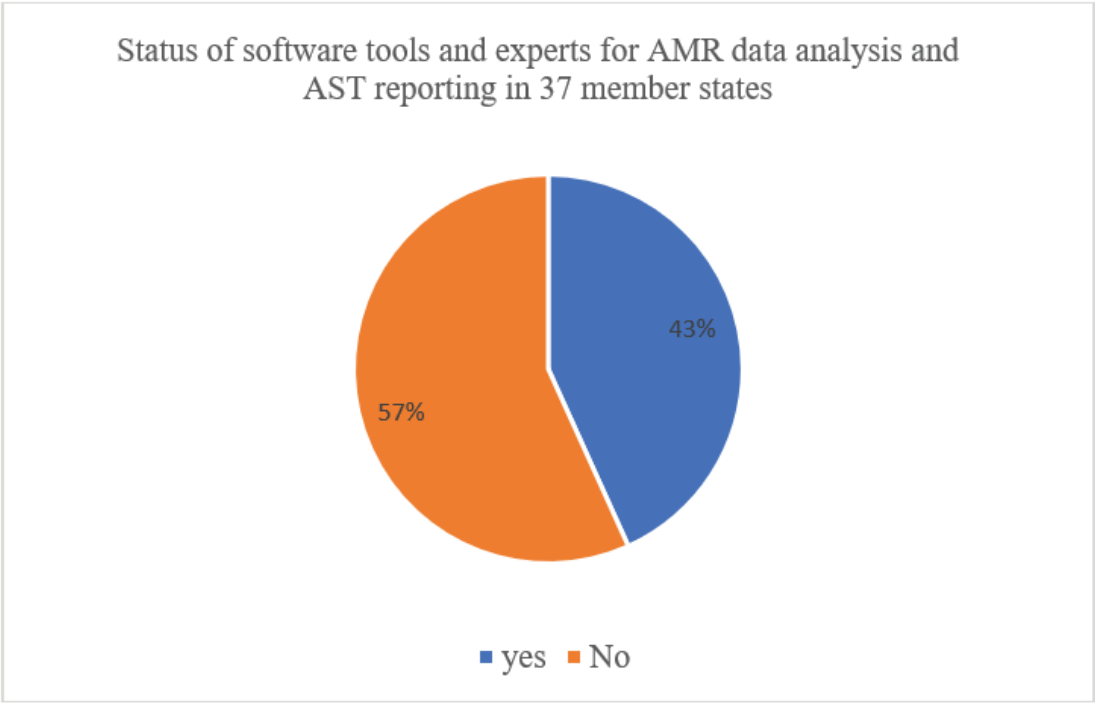


Figure 4: *The proportion of trained AMR data specialists per isolate type*

4.13 Animal sample sources for AMR surveillance at national level

Animals on the farm constituted the major animal sample sources, followed by post slaughter samples or a combination of the two (Table 8).

Table 8: *Summary of responses regarding the animal sample sources for AMR surveillance*

Animal sample source	No. of countries	Names of countries
Animals on the farm	22/37 (59%)	Madagascar, Somalia, Cameroon, Congo Brazzaville, Uganda, Zambia, Sao Tome & Principle, DRC, Sierra Leone, Lesotho, Tanzania, Tunisia, Guinea Conakry, Kenya, Eritrea, Cote D'Ivoire, Burundi, Guinea Bissau, Rwanda, Algeria, Mali and Chad
Post slaughter samples	4/37 (11%)	Nigeria, Burkina Faso, Mozambique and Algeria
Animals on the farm and post slaughter samples	4/37 (11%)	Egypt, Zimbabwe, Namibia and Gambia
Animals on a farm, Post slaughter animal specimen, Meat specimen in retail stores/butcheries	5/37 (14%)	Malawi, Morocco, Ethiopia, Togo and Eswatini
Not applicable	2/37(5%)	Cape Verde, Gabon

4.14 Animal Risk factors for AMR at national level

Current antimicrobial use was considered the most important risk factor for AMR (Table 9). Other factors included Age of an individual, Specimen type and Geographical location of an individual.

Table 9: *Summary responses on risk factors for antimicrobial resistance*

Risk factors	No. of countries responded	Name of countries responded
Current antimicrobial use	19/37 (51%)	Madagascar, Congo Brazzaville; Zambia; Egypt; Sao Tome & Principe; Sierra Leone, Nigeria, Lesotho; Tanzania; Guinea Conakry; Mozambique; Kenya; Eritrea; Cote D'Ivoire; Algeria, Mali, Gabon, Gambia and South Sudan
Age	3/37 (8%)	Somalia, Uganda & DRC
Age, specimen type, geographical location, current antimicrobial use	12/37 (32%)	Cameroon, Malawi, Zimbabwe, Burkina Faso, Tunisia, Morocco, Guinea-Bissau, Ethiopia, Rwanda, Namibia, Togo and Eswatini
Age, Geographical location	2/37 (6%)	Burundi and Chad
Not applicable	1/37 (3%)	Cape Verde

4.15 Animal AMR surveillance methods at national level

The most preferred AMR surveillance method was active surveillance (43%), followed by passive surveillance (27%), combined active and passive surveillance (14%), sentinel surveillance (11%), and passive and sentinel surveillance (5%) (Table 10).

Table 10: *Animal AMR surveillance methods*

AMR surveillance methods	No. of countries responded	Names of countries responded
Active surveillance	16/37 (43%)	Uganda, Zambia, Egypt, DRC, Nigeria, Tanzania, Burkina Faso, Kenya, Eritrea, Cote D'Ivoire, Burundi, Morocco, Guinea Bissau, Chad, Rwanda and Gambia
Passive surveillance	10/37 (27%)	Madagascar, Somalia, Congo (Brazzaville), Cape Verde, Sao Tome & Principe, Lesotho, Tunisia, Mozambique, Algeria and Namibia
Sentinel surveillance	4/37 (11%)	Sierra Leone, Guinea Conakry, Ethiopia and Mali
Active & passive surveillance	5/37 (14%)	Malawi, Zimbabwe, South Sudan, Togo and Eswatini
Passive & Sentinel surveillance	2/37 (5%)	Cameroon and Gabon

4.16 Animal sampling strategies for AMR work at national level

Preferred sampling strategies for AMR are shown in Table 11. The most preferred sampling strategy was random sampling (65%). Followed by systematic sampling (19%), then a combination of systematic and random sampling (11%) and purposive (5%).

Table 11: *Animal sampling strategies for AMR*

Sampling strategy for AMR surveillance	No. of countries responded	Names of countries responded
Random sampling	24/37 (65%)	Somalia, Cameroon, Congo Brazzaville, Egypt, Sao Tome and Principe, DRC, Sierra Leone, Lesotho, Tanzania, Burkina Faso, Tunisia, Guinea Conakry, Kenya, Eritrea, Cote D'Ivoire, Burundi, Morocco, Ethiopia, Chad, Rwanda, Algeria, Mali, Namibia, The Gambia and Togo
Systematic sampling	7/37 (19%)	Madagascar, Uganda, Zambia, Nigeria, Zimbabwe, Guinea Bissau and Gabon
Random and Systemic sampling	4/37 (11%)	Malawi, Lesotho, South Sudan and Eswatini
Purposive sampling	2/37 (5%)	Cape Verde and Mozambique

4.17 Animal Pathogens targeted for AMR surveillance at national level

Specific pathogens targeted for AMR surveillance in countries are presented in Table 12. The majority of the countries (24%) targeted *E. coli*, followed by a combination of *Campylobacter spp*., *Salmonella spp*., *Escherichia coli*, *Enterococcus spp*., *Staphylococcus aureus, Pseudomonas aeruginosa* and *Mycobacterium tuberculosis* (35%), and a combination of *Salmonella spp*., *Escherichia coli*, *Mycobacterium tuberculosis*, *Helminthes*, Ticks and *Trypanosoma spp*. (32%). However, a few countries (6%) had not determined target pathogens for AMR surveillance.

Table 12: *Animal pathogens targeted for AMR surveillance in different countries*

Animal Pathogens targeted for AMR surveillance	No. of countries responded	Name of countries
E. coli	9/37 (24%)	Madagascar, Zambia, Sierra Leone, Nigeria, Tanzania, Burkina Faso, Guinea Conakry, Kenya, Eritrea
Campylobacter spp., Salmonella spp., Escherichia coli, Enterococcus spp., Staphylococcus aureus, Pseudomonas aeruginosa, Mycobacterium tuberculosis	13/37 (35%)	DRC, Uganda, Egypt, Lesotho, Mozambique, Morocco, Ethiopia, Rwanda, Gabon, South Sudan, Eswatini, Cameroon and Malawi
Salmonella spp., Escherichia coli, Mycobacterium tuberculosis, Helminthes, Ticks, *Trypanosoma spp.*	12/37 (32%)	Somalia, Sao Tome & Principe, DRC, Zimbabwe, Tunisia, Cote D'Ivoire, Burundi, Chad, Algeria, Mali, Namibia and Togo
Undetermined	3/37 (6%)	Cape Verde, Guinea Bissau and The Gambia

4.18 Feasible laboratory testing methodologies at national level

Responses on the laboratory testing methodologies available at national are presented in Table 13. A range of laboratory methods, including, Bacterial culture and isolate identification, Characterization of isolates, Standardized antimicrobial susceptibility testing, Quality control, Recommended antimicrobials for surveillance, and Minimum inhibition Concentration test (MIC) were considered commonest (68%). A few countries (19%) were able to conduct only Bacterial cultures and isolate identification. While others (8%) were able to conduct only standardized antimicrobial susceptibility testing. Cape Verde and Guinea Bissau did not have capacity to conduct any laboratory methods.

Table 13: *Summary responses on laboratory testing methodologies*

Feasible laboratory testing methodologies at national level	No. of countries responded	Names of countries
Bacterial culture and isolate identification; Characterization of isolates; Standardized antimicrobial susceptibility testing; Quality control; Recommended antimicrobials for surveillance; and Minimum inhibition Concentration (MIC)	25/37 (68%)	Madagascar, Somalia, Cameroon, Congo (Brazzaville), Zambia, Egypt, Sao Tome & Principe, Sierra Leone, Nigeria, Malawi, Zimbabwe, Tanzania, Burkina Faso, Kenya, Cote D'Ivoire, Morocco, Ethiopia, Rwanda, Algeria, Mali, Namibia, The Gambia, South Sudan, Eswatini and Uganda,
Bacterial culture and isolate identification	7/37 (19%)	DRC, Lesotho, Mozambique, Burundi, Chad, Gabon and Togo
Standardized antimicrobial susceptibility testing	3/37 (8%)	Tunisia, Guinea Conakry and Eritrea
Not applicable	2/37 (5%)	Cape Verde and Guinea Bissau

4.19 Status of software tools and experts for AMR data analysis and reporting for antimicrobial susceptibility testing

The status of software tools and experts for AMR data analysis and reporting for the antimicrobial susceptibility testing is presented in the pie chart below (Figure 5). A total of 16 (47%) countries confirmed having tools and experts. These included, Cameroon, Uganda, Zambia, Egypt, DRC, Zimbabwe, Tanzania, Burkina Faso, Tunisia, Kenya, Cote D'Ivoire, Morocco, Chad, Algeria, Mali and Togo.

While, 21 (57%) countries, including, Madagascar, Somalia, Congo Brazzaville, Cape Verde, Sao Tome & Principe, Sierra Leone, Nigeria, Malawi, Lesotho, Guinea Conakry, Mozambique, Eritrea, Burundi, Guinea-Bissau, Ethiopia, Rwanda, Namibia, Gabon, The Gambia, South Sudan and Eswatini confirmed not having AMR data analysis and AST reporting experts and tools.

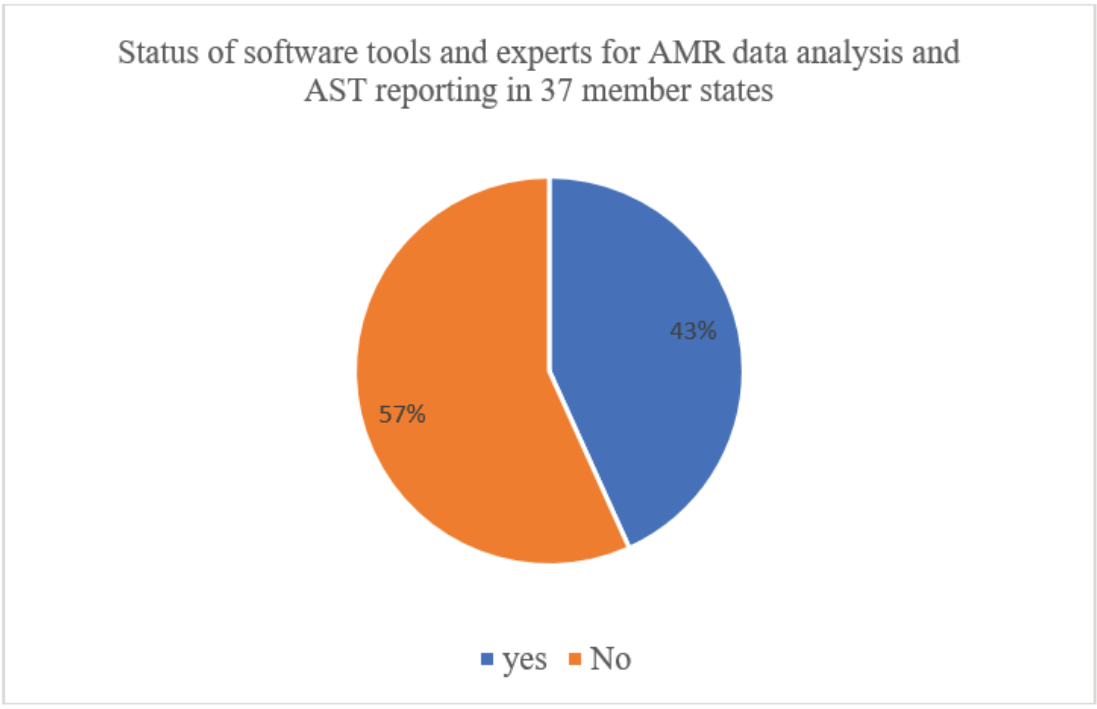


Figure 5: *Summary of status of software tools and experts for AMR data analysis and AST reporting*

4.20 Recommended priority AMR activities at national level

Priority AMR activities recommended for AU-IBAR and partners for implementation at national level, included AMR surveillance (31%), followed by development or implementation of the AMR National Action Plan (28%) and training on AMR surveillance and antimicrobial susceptibility testing (19%).

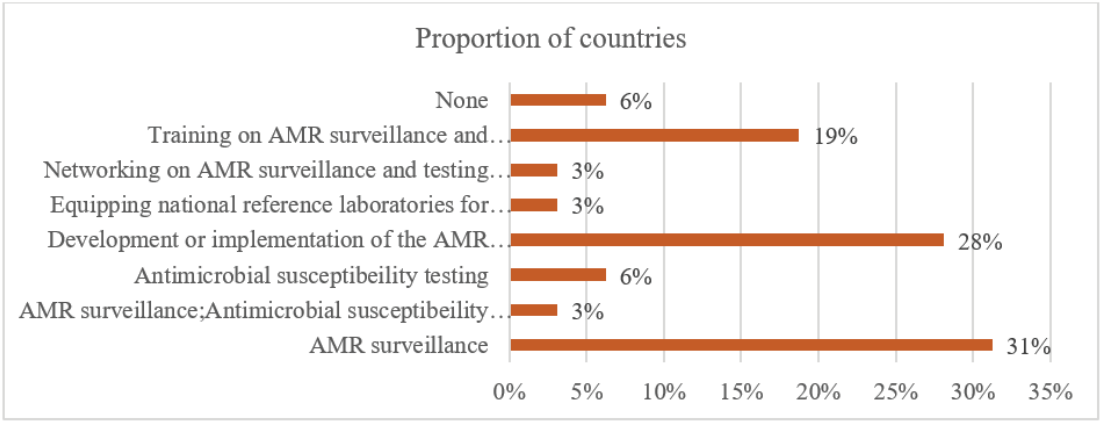


Figure 6: *summary of recommended priority AMR activities for implementation by AU-IBAR and partners at national level*

4.21 Recommended priority AMR activities for implementation by AU-IBAR and partners at regional level

The majority of the countries (47%) recommended implementation of programs, finance and training human resource to mitigate harm from AMR. A few (19%) recommended supporting increase in the number of veterinary laboratories with quality AMR diagnostic tests. In addition, others (16%) recommended development or revision, funding and monitoring implementation of national action plans for AMR.

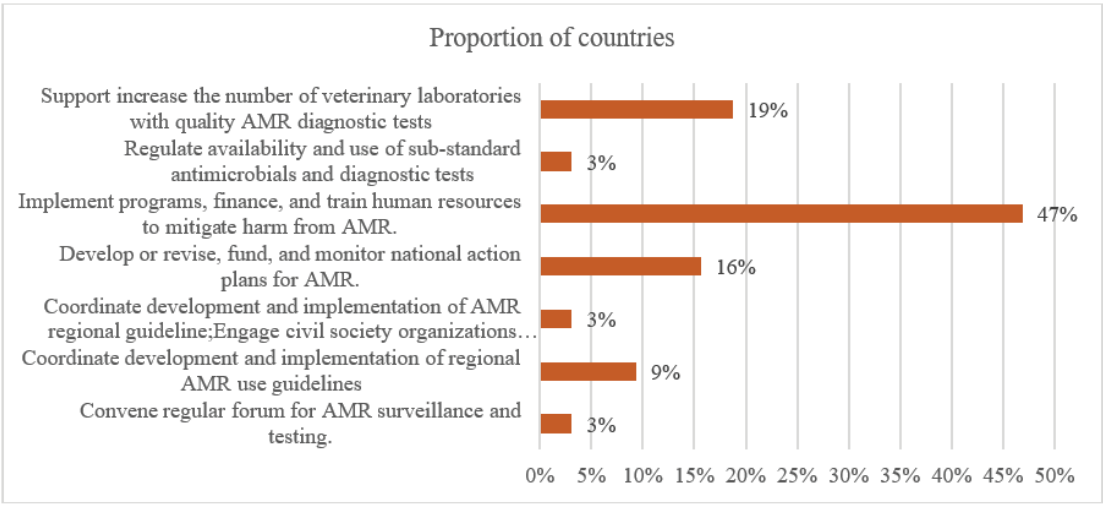


Figure 7: *Recommended priority AMR activities for implementation by AU-IBAR and partners at regional level*

4.22 Recommended priority AMR activities for AU-IBAR and partners for implementation at continental level

The majority of the countries (94%) recommended AU-IBAR to improve surveillance of antimicrobial use and antimicrobial resistant microorganisms at continental level (Figure 8). Few countries (3%) recommended mitigating harm from antimicrobial resistant microorganisms. Equally, few countries (3%) recommended improving surveillance of antimicrobial use and antimicrobial resistant microorganisms; delaying AMR emergence; and limiting AMR transmission.

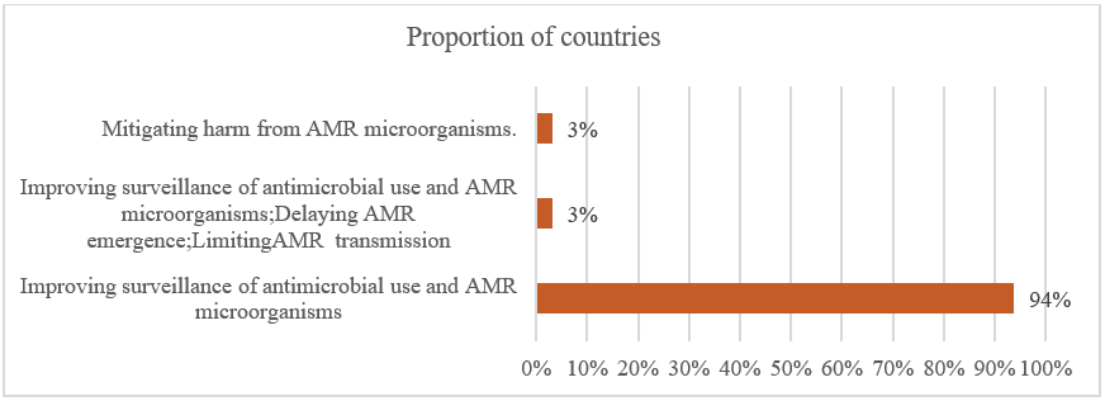


Figure 8: *Recommended priority AMR activities for implementation by AU-IBAR and partners at continental level*

5.0 DISCUSSION

The survey achieved a response rate of 69% among African Union Member States. This constitutes a sizeable proportion of countries (37) to allow initiation of targeted AMR interventions, namely, (1) establishment and operationalization of the Africa AMR Surveillance Network; and (2) development of capacities of Member States to undertake surveillance and monitoring of Antimicrobial Resistance in the animal health sector.

At regional level, the best response was achieved in Eastern Africa, Northern Africa and Central Africa, suggesting these are regions currently embracing AMR work. Further support for AMR work in these regions is necessary. However, there is need to promote AMR work in the Southern Africa and Western Africa, given their low response rate.

Most countries (24) had validated and operational National Action Plans, but few (11) had National Action Plans that were still underdevelopment or non-existent (2). Immediate support for AMR work is required in countries that already have validated and operational National Action Plans. While support for development of the National Action Plans is necessary in countries with underdeveloped or non-existent National Action Plans.

The database of names and contacts of AMR Focal Points for Animal Production/ Production and Public Health has 37 countries. This constitutes a nucleus for initiating the Africa AMR Surveillance Network and its related activities.

The database of national reference laboratories for AMR testing has names and locations of national reference laboratories for 37 countries. Amongst them 26 countries have fully-fledged designated reference laboratories for AMR testing. These could benefit from immediate capacity building support. However, few (11) countries, including, Somalia, Cape Verde, Sao Tome & Principle, Lesotho, Eritrea, Morocco, Guinea-Bissau, Mali, Namibia, Gambia and Togo did not have designated AMR reference laboratories may require development support towards AMR reference laboratories.

The majority of the countries (34) indicated Antimicrobial Susceptibility Testing methods were performed in their national laboratories. While, few (3) countries, including, Cape Verde, Sao Tome & Principe and Guinea-Bissau indicated that Antimicrobial Susceptibility Testing methods had not been initiated. Suggesting the majority of the countries required refresher training on AST methods to improve testing proficiency, while few countries need foundational training to initiate AMR testing laboratories and performance of AST methods.

Regarding the AST methods, the Disk Diffusion Test was performed in the majority of countries (24), while, few countries (5) performed the Minimum Inhibition Concentration test and others (5) performed both the Disk Diffusion Test and the Minimum Inhibition Concentration test. Suggesting that capacity building could aim at increasing the number of experts that can proficiently perform these methods across the AU member States. The goal would be to have a critical mass of such experts.

Regarding, antimicrobial agents showing resistance in farm animals, antimicrobial resistance was reported in farm animals in all the 37 countries. Tetracycline resistance was reported in the majority of the countries (43%), followed by Penicillin resistance (16%), Quinolone resistance (8%), Acaricides resistance (5%), Trypanocide resistance (5%), Streptomycin resistance (3%), and Sulphonamide resistance (3%). Reported resistance against drug combinations was low (3%). Suggesting that the focus of the AMR Surveillance Network should largely be on these antimicrobial agents.

Beef, Poultry and Dairy were the priority livestock value-chains identified for AMR Surveillance. Piggery, Fish & aquaculture, Dromedary camels and Goats were other minor livestock value-chains identified. AMR surveillance could accordingly focus on Beef, Poultry and Dairy value-chains.

The survey confirmed prevalence of antimicrobial resistance in farm animals in all 37 countries that responded. The majority of the countries (17) reported a prevalence of 0-20%. Fewer countries (8) reported a prevalence of 21-40%. Other countries (10) reported a prevalence of 41-60%. Only one country reported a prevalence of 61-80% and another that reported unknown status of the prevalence of antimicrobial resistance. These findings justified the need to support further implementation of AMR surveillance and AMR testing in the animal resources sector, especially in the 37 countries.

The findings indicated few (4) countries had well-functioning integrated AMR surveillance programmes. But the majority of the countries (15) had AMR surveillance programmes for the different sectors but that were not integrated. While some countries (6) had no AMR surveillance programmes, with others (12) having developed AMR, surveillance plans but were not operational. Suggesting, efforts and support should be aimed at boosting AMR surveillance programme in the 37 countries to be well-functional and integrated among sectors.

The majority of countries (26) confirmed having trained technicians and equipped veterinary laboratories for antimicrobial susceptibility testing. While, 11 countries did not have trained technicians and equipped veterinary laboratories. The findings suggest existence of experts already to allow initiating immediate capacity building activities regarding AMR laboratory testing. In limited cases, fresh training of technicians and equipping of veterinary laboratories for antimicrobial susceptibility testing may be required.

Regarding the status of trained personnel for AMR data collection, analysis and reporting, 21 countries confirmed they had AMR data specialists specific for animal isolates. While, 14 countries had AMR data specialists for human isolates. Two countries had AMR data specialists for both human and animal isolates. Suggesting training should focus on creating a critical mass of AMR data specialists for both animal and human isolates.

Findings on animal sample sources for AMR surveillance, revealed that animals on the farm constituted the major animal sample sources, followed by post slaughter samples or a combination of the two. Indicating that AMR surveillance should largely focus on farm animals.

Current antimicrobial use was considered the most important risk factor for AMR. Other factors included, Age of an individual, Specimen type and Geographical location of an individual.

The most preferred AMR surveillance method was active surveillance (43%), followed by passive surveillance (27%), combined active and passive surveillance (14%), sentinel surveillance (11%), and passive and sentinel surveillance (5%). Suggesting active surveillance would be the most important method of choice.

The most preferred sampling strategy was random sampling (65%). Followed by systematic sampling (19%), then a combination of systematic and random sampling (11%) and purposive (5%). Indicating random sampling was the sampling strategy of choice.

Findings on the specific pathogens targeted for AMR surveillance at national level, revealed that the majority of the countries (9) target *E. coli*, followed by a combination of *Campylobacter spp*., *Salmonella spp*., *Escherichia coli*, *Enterococcus spp*., *Staphylococcus aureus, Pseudomonas aeruginosa* and *Mycobacterium tuberculosis* (13), and a combination of *Salmonella spp*., *Escherichia coli*, *Mycobacterium tuberculosis*, *Helminthes*, Ticks and *Trypanosoma spp*. (12). However, a few countries (3) had not determined target pathogens for AMR surveillance. Thus, these pathogens constitute the main ones to be targeted in AMR surveillance and AMR testing across AU member states.

Responses on the feasible laboratory testing methodologies at national indicated that a range of laboratory methods, including, Bacterial culture and isolate identification, Characterization of isolates, Standardized antimicrobial susceptibility testing, Quality control, Recommended antimicrobials for surveillance, and Minimum inhibition Concentration test (MIC) were considered commonest (68%). A few countries (19%) were able to conduct only Bacterial cultures and isolate identification. While others (8%) were able to conduct only standardized antimicrobial susceptibility testing. Cape Verde and Guinea Bissau did not have capacity to conduct any laboratory methods.

Findings revealed a total of 16 countries confirmed having software tools and experts for AMR data analysis and reporting on the antimicrobial susceptibility testing. While, 21 countries confirmed not having AMR data analysis and AST reporting experts and tools. Suggesting the need for capacity building on software tools and experts on AMR data analysis and reporting for antimicrobial susceptibility testing.
AMR surveillance (31%), followed by development or implementation of the AMR

National Action Plan (28%) and training on AMR surveillance and antimicrobial susceptibility testing (19%) were the priority AMR activities at national level recommended for implementation by AU-IBAR and partners.

Implementation of programs, finance and training human resource to mitigate harm from AMR (47%), followed by supporting increase in the number of veterinary laboratories with quality AMR diagnostic tests (19%), and developing or revising, funding and monitoring implementation of National Action Plans for AMR (16%) were priority AMR activities at regional level recommended for implementation by AU-IBAR and Partners.

Improving surveillance of antimicrobial use and antimicrobial resistant microorganisms (94%), followed by mitigating harm from antimicrobial resistant microorganisms (3%), and a combination of improving surveillance of antimicrobial use and antimicrobial resistant microorganisms; delaying AMR emergence; and limiting AMR transmission (3%) were AMR activities at continental level recommended for implementation by AU-IBAR and partners.

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Recommendations

- Support development of the National Action Plans in countries with underdeveloped or non-existent National Action Plans.
- AMR surveillance should consider focussing on Tetracycline, Penicillin, Quinolone, Acaricides, Trypanocide, Streptomycin and Sulphonamide.
- AMR surveillance should consider focussing on beef, poultry and dairy value-chains.
- AMR surveillance should consider focussing on *E. coli*, *Salmonella spp*, Campylobacter, *Enterococcus spp*. and Staphyloccoccus aureas.
- AU-IBAR and Regional Economic Communities should consider focussing on AMR surveillance, development or implementation of the AMR National Action Plan and training on AMR surveillance and antimicrobial susceptibility testing as priority AMR activities at national level.
- AU-IBAR and Regional Economic Communities should consider implementation of programs, finance and training human resource to mitigate harm from AMR, supporting increase in the number of veterinary laboratories with quality AMR diagnostic tests, and developing or revising, funding and monitoring implementation of National Action Plans for AMR as priority AMR activities at regional level.
- AU-IBAR and Regional Economic Communities should consider focussing on improving surveillance of antimicrobial use and antimicrobial resistant as priority AMR activities at continental level.

6.2 Conclusion

The survey responses were a satisfactory basis to allow the establishment and operationalization of the Africa AMR Surveillance Network and for initiating development of capacities of Member States to undertake surveillance and monitoring of Antimicrobial Resistance in the animal health sector.

7.0 ACKNOWLEDGEMENT

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ANNEXES

Annex 1: Questionnaire on Status of AMR activities in African Union Member States

Update on Status of AMR activities in African Union Member States

The African Union Interafrican Bureau for Animal Resources (AU-IBAR) is undertaking this survey to understand the status of implementation of Antimicrobial resistance activities. The information received will inform policy development and targeted interventions. We appreciate your making time to complete this survey.
magona.joseph@gmail.com Switch account

Not shared

*** Indicates required question**

Country*
Choose

Region
*
Choose

What is the status of the National Action Plan on AMR?*
Validated and operational
Still under development
None existent

Provide contacts of current Focal Points for AMR representing Public Health and Animal Health and /or Animal production.
*
Your answer

Provide contacts (Name, Institution and email address) of current Focal Point for AMR representing Animal Health and /or Animal production.
*
Your answer

Provide contacts (Name, Institution and email address) of current Focal Point for AMR representing public health

*

Your answer

Does you country have designated national reference laboratory(ies) for AMR testing? *

Yes

No

Provide names and location of designated national reference laboratories

Provide a list of Antimicrobial Susceptibility testing (AST) methods commonly performed in national laboratories in your country.*

Disk Diffusion Test

Minimum Inhibitory Concentration

Gene sequencing for AMR confirmation

Other:

Provide a list of antimicrobials against which resistance has been reported in farm animals in your country. *

Tetracyclines

Sulfonamides

Quinolones

Penicillins

Streptomycin

Cotrimazole

Benzimadozoles

Acaricides

Trypanocides

What are the priority livestock value chains for AMR surveillance in your country?

*

Beef
Poultry
Fish and aquaculture
Piggery
Dairy
Other:

What is the prevalence of antimicrobial resistance in farm animals in your country?*

0-20%
21-40%
41-60%
61-80%
81-100%

Does your country have a well-functioning programme of integrated surveillance of antimicrobial resistance?

*

Yes a well-functioning integrated AMR surveillance programme exists

AMR surveillance for the different sectors exist but are not integrated

Surveillance plan has been developed by yet to be operationalized
No surveillance programme has been established

Does your country have trained technicians and equipped veterinary laboratories to conduct Antimicrobial Susceptibility Testing?

*

Yes
No

Does your country have trained personnel for AMR data collection, analysis and reporting regarding the following:

*

Human isolates
Animal isolates
Retail food isolates

What sample sources are considered when designing an integrated surveillance in farm animals regarding antimicrobial resistance in your country?*
Animals on a farm
Holding ground animal specimen
Post slaughter animal specimen
Meat specimen in retail stores/butcheries
Other:

What risk factors are considered while conducting an integrated surveillance in farm animals on antimicrobial resistance in your country.
*
Age
Sex
date of specimen collection
Specimen type
Geographical location
Current antimicrobial use
Other:

What surveillance methods are most likely to be considered while designing an integrated surveillance in farm animals on antimicrobial resistance in your country.
*
Active surveillance
Passive surveillance
Sentinel surveillance
Other:

What sampling strategies are most likely to be considered while designing an integrated surveillance in farm animals on antimicrobial resistance in your country.

*

Random sampling
Systematic sampling
Other:

Please provide a list of commonly included microorganisms or pathogens or vectors targeted during an integrated surveillance in farm animals on antimicrobial resistance in your country.

*

Campylobacter spp.
Salmonella spp.
Escherichia coli
Enterococcus spp.
Staphylococcus aureus
Pseudomonas aeruginosa
Mycobacterium tuberculosis
Helminthes
Ticks
Trypanosoma spp.
Other:

Of these laboratory testing methodologies, what would be feasible to be performed in your country?

*

Bacterial culture and isolate identification
Characterization of isolates
Standardized antimicrobial susceptibility testing
Quality control
Recommended antimicrobials for surveillance
Treatment and testing (MIC)
None
Other:

Does your country have software tools and experts for AMR data analysis and reporting regarding interpretation of antimicrobial susceptibility results?
*

Yes
No

List three priority AMR activities you would recommend for implementation at national level?*

Development or implementation of the AMR National Action Plan
AMR surveillance
Antimicrobial susceptibeility testing
Training on AMR surveillance and Antimicrobial Susceptibility testing
Equipping national reference laboratories for AMR testing
Networking on AMR surveillance and testing via the AMRSNET and African AMR forum.
Not stated

List three priority AMR activities you would recommend for implementation at the regional level.
*

Implement programs, finance, and train human resources to mitigate harm from AMR.
Support increase the number of veterinary laboratories with quality AMR diagnostic tests
Regulate availability and use of sub-standard antimicrobials and diagnostic tests
Coordinate development and implementation of regional guidelines for prudent use of AMR
Convene regular forum for AMR surveillance and testing.
Develop or revise, fund, and monitor national action plans for AMR.
Engage civil society organizations, media, and the general public to promote AMR awareness and
Support research to allow understanding of the status of AMR and AMU at regional level

List three priority AMR activities you would recommend for implementation at the continental level.

*

Improving surveillance of antimicrobial use and AMR microorganisms
Delaying emergence of AMR
Limiting transmission of AMR
Mitigating harm from AMR microorganisms.

Submit

Clear form



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