ERITREAN NATIONAL ACTION PLAN ON ANTIMICROBIAL RESISTANCE

2021 - 2025

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TABLE OF CONTENTS

List of Figures iii

List of Tables iii

Abbreviations iv

Foreword vi

Statements of Commitment by the Ministers vii

Acknowledgment ix

List of Multi-Sectoral Committee x

1. Introduction to Antimicrobial Resistance 1

2. Overview of the Relevant Sectors 2

2.1 Geographic and Demographic Context 2

2.2 Overview of the Health Sector 2

2.3 Overview of the Agriculture Sector 3

2.4 Overview of the Marine Sector 3

2.5 Overview of the Environment Sector 3

3. Governance 4

4. Situational Analysis 6

4.1 Education and Awareness 6

4.2 Research and Surveillance of AMR 7

4.3 Laboratory Capacity and Quality 8

4.4 Infection Prevention and Control 9

4.5 Antimicrobial Use in Humans, Animals and Plants 12

4.5.1 Drug Regulatory Authority 12

4.5.2 Procurement, Distribution and Storage 12

4.5.3 Prescribing of Antimicrobials in Humans, Animals and Plants 13

4.5.4 Departmental Report of AMU in a National Referral Hospital 14

5. Conclusion 15

6. Strategic Objectives 16
7. Operational Plan 20
8. Monitoring and Evaluation 47
9. Risk Analysis 59
10. Annexes 68
Annex 1. Situational Analysis of AMR in Eritrea: Strengths, Weaknesses, Opportunities and Threats (SWOT) 68
Annex 2. Attendees of the Consensus Workshop 74

LIST OF FIGURES

Figure 1. Governance Structure of Eritrean AMR Committee 5

LIST OF TABLES

Table 1. Monitoring Framework for Tracking Progress of Implementation 47

Table 2. The Results Chain 54

Table 3. Risks and Measures 59

ABBREVIATIONS

AMR	Antimicrobial Resistance
AMU	Antimicrobial Use
ARV	Anti-retroviral
BCC	Behavior Change Communication
CLTS	Community Led Total Sanitation
ENLM	Eritrean National List of Medicine
EQAS	External Quality Assessment Scheme
ERN	Eritrean Nakfa
ESTG	Eritrean Standard Treatment Guidelines
FAO	Food and Agriculture Organization
GAP	Global Action Plan
GLASS	Global Antimicrobial Surveillance System
GMP	Good Manufacturing Practice
HAI	Healthcare Associated Infection
IDSR	Integrated Disease Surveillance and Response
IPC	Infection Prevention and Control
IQA	Internal Quality Assessment
KAP	Knowledge, Attitudes and Practices
MOA	Ministry of Agriculture
MOE	Ministry of Education
MOH	Ministry of Health
MOI	Ministry of Information
MOLG	Ministry of Local Government

MOLWE	Ministry of Land, Water and Environment
MOMR	Ministry of Marine Resources
NAPHL	National Animal and Plant Health Laboratory
NHL	National Health Laboratory
NMFA	National Medicines and Food Administration
OCMHS	Orotta College of Medicine and Health Sciences
ODF	Open Defecation Free
OIE	World Organization for Animal Health
OTC	Over The Counter
POPs	Pollutants and Obsolete Pesticides
PPE	Personal Protective Equipment
PSM	Procurement and Supply Management
SANA	Situational Analysis and Needs Assessment
SOP	Standard Operating Procedure
TOR	Terms of Reference
TWG	Technical Working Group
UN	United Nations
UNICEF	United Nations Children's Fund
VEN	Vital, Essential and Necessary
WAHIS	World Animal Health Information System
WHA	World Health Assembly
WHO	World Health Organization

FOREWORD

Antimicrobials play a critical role in the treatment of humans, farm animals (aquatic and terrestrial) and plants diseases. Their use is essential to crop production, food security, the welfare and wellbeing of humans and animals.

Since the discovery of penicillin in 1928, antimicrobials have caused a dramatic change not only in the treatment of infectious diseases but also in the fate of mankind. As a result, tremendous achievements have been made in the status of global health, which is reflected by drastic reduction of communicable diseases and increased average life expectancy in general.

However, these achievements are threatened by the emergence of drug resistant organisms where the ability to treat infectious diseases is observed to be compromised. Antimicrobial resistance (AMR) has become a global concern by undermining the advances made in health and medicine. It is also observed to put the gains of the Millennium Development Goals at risk and endangers achievements of the Sustainable Development Goals.

Antimicrobial resistance was declared a world health threat at the 67th World Health Assembly (WHA) in 2014. If left unattended, AMR is estimated to cause 10 million deaths annually worldwide and this may cost the world 100 trillion dollars by 2050. The Global Action Plan (GAP) which urged member states 'to have in place national action plans on AMR with standards and guidelines established by relevant intergovernmental bodies' was adopted in 2015.

As a follow up to the GAP, Eritrea has developed and put in place this National Action Plan (NAP) on AMR under the 'One Health' approach with the collaborative work of various ministries and partners mainly, the Ministry of Health (MOH), the Ministry of Agriculture (MOA), the Ministry of Land, Water and Environment (MOLWE), the Ministry of Marine Resources (MOMR), the World Health Organization (WHO), the Food and Agriculture Organization (FAO) and the academia. As a result, sound strategies and interventions have been designed in order to preserve the effectiveness of antimicrobial agents and to slow down the emergence and spread of AMR in Eritrea.

Amina Nurhussien,
Minister of Health

STATEMENTS OF COMMITMENT BY THE MINISTERS

MINISTRY OF HEALTH

I Ms. Amina Nurhussien, together with my staff are committed to the implementation of the Eritrean National Action Plan for combating Antimicrobial Resistance through 'One Health' approach. We shall collaborate and invest resources with other relevant Ministries to ensure preservation of the available antimicrobials and prevent further resistance. This will be implemented by improving awareness and understanding of AMR through effective communication and training, strengthening knowledge, research and surveillance, reducing the incidence of infection and optimizing the use of antimicrobial medicines in human health.

Dec. 28, 2020

Amina Nurhussien,
Minister of Health

MINISTRY OF AGRICULTURE

I Mr. Arefaine Berhe, together with my staff are committed in the implementation of the Eritrean National Action Plan for combating Antimicrobial Resistance through 'One Health' approach. We shall collaborate with other relevant Ministries and stakeholders and invest resources in ensuring that we preserve the available antimicrobials and prevent resistance. This will be implemented by improving awareness and understanding of AMR through effective communication and training, strengthening knowledge, research and surveillance, reducing the incidence of infection and optimizing the use of antimicrobial medicines in plant and animal health.

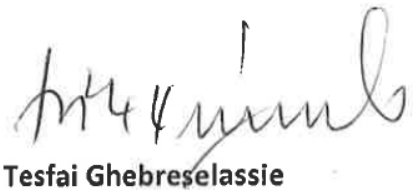
Dec. 28, 2020

Arefaine Berhe
Minister of Agriculture

MINISTRY OF LAND, WATER AND ENVIRONMENT

I Mr. Tesfai Ghebreselassie, together with my staff are committed in the implementation of the Eritrean National Action Plan for combating Antimicrobial Resistance 'One Health' approach. We shall collaborate with other relevant Ministries and stakeholders and invest resources in ensuring that we preserve the available antimicrobials and prevent resistance. This will be implemented by improving awareness and understanding of AMR through effective communication and training, strengthening knowledge, research and surveillance, reducing the incidence of infection, optimizing the use of antimicrobial medicines and protecting the environment from contamination with antimicrobials.

Dec. 28, 2020



Tesfai Ghebreselassie
Minister of Land, Water and Environment

MINISTRY OF MARINE RESOURCES

I Mr. Tewolde Kelati, together with my staff are committed in the implementation of the Eritrean National Action Plan for combating Antimicrobial Resistance through 'One Health' approach. We shall collaborate with other relevant Ministries and stakeholders and invest resources in ensuring that we preserve the available antimicrobials and prevent resistance. This will be implemented by improving awareness and understanding of AMR through effective communication and training, strengthening knowledge, research and surveillance, reducing the incidence of infection and optimizing the use of antimicrobial medicines in aquatic health.

Dec. 28, 2020

Tewolde Kelati
Minister of Marine Resources

ACKNOWLEDGMENT

The Ministry of Health (MOH), the Ministry of Agriculture (MOA), the Ministry of Land, Water and Environment (MOLWE), and the Ministry of Marine Resources (MOMR) would like to thank the World Health Organization (WHO), the Food and Agriculture Organization (FAO) and the academia for their financial and/or technical support in the development of the Eritrean National Action Plan (NAP) on antimicrobial resistance.

The multi-sectoral committee together with the technical working groups from all the stakeholders have worked tirelessly in the development of this document. The production of this document has gone through a process whereby there was an initial inception workshop which involved all the relevant stakeholders. The process involved formation of thematic working groups for the four strategic objectives of the NAP, conducting situational analysis, development of strategic interventions, operational plans, monitoring and evaluation frameworks, costing of the NAP using the one health costing tool and risk mitigation plan. Throughout the whole process, the collaboration from all sectors coupled with political commitment was commendable.

My special thanks are expressed to all members of the multi-sectoral committee, technical working groups, and core team for their commitment and hardworking, including WHO country office and consultants in the process of producing the Eritrean AMR National Action Plan.

Berhane Ghebretinsae

Director General, Department of Medical Services
Ministry of Health, Eritrea

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1. Berhane Ghebretinsae, Chair of Committee, Ministry of Health
2. Amanuel Negassi, Co-chair of Committee, Ministry of Agriculture
3. Kahsay Negash, Ministry of Agriculture
4. Afewerki Mehretab, Ministry of Agriculture
5. Mulugeta Alemu, Ministry of Health
6. Tewelde Yohannes, Ministry of Health
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1. INTRODUCTION TO ANTIMICROBIAL RESISTANCE

Antimicrobial resistance (AMR) has been a known phenomenon that occurs naturally as a result of natural selection. Indiscriminate use and misuse of antimicrobials in humans, food and feed animals, agriculture and aquaculture has resulted in selection pressure for the development and maintenance of AMR in the human, animal and environmental sectors. As a result, AMR is becoming a growing threat to the efficacious treatment of diseases caused by bacteria, viruses, parasites and fungi resulting in increased mortality and morbidity, prolonged hospital stays, greater direct and indirect costs, and spread of infections to others. AMR in the food production continuum from farm to fork presents the risk of transmission of resistant micro-organisms and contamination with antibiotic residues within and between humans and food of animal or plant sources. Similarly, AMR in the environment, i.e. soil, water and air serves as a reservoir and a transmission route for AMR. It is hence of great public health concern globally.

The World Health Organization (WHO) in its 2014 "AMR: Global Report on Surveillance", highlighted the catastrophic consequence of AMR. The Assistant Director General for Health Security for the WHO, Dr. Keiji Fukuda stated, "*A post-antibiotic era – in which common infection and minor injuries can kill – is far from being an apocalyptic fantasy, but instead a very real possibility for the 21st century*" (WHO, 2014).

The 2015 "Antibiotic Resistance: Multi-Country Public Awareness Survey" confirmed that the use of antibiotics is widespread with 65% of the respondents from 12 countries having used antibiotics in the last 6 months. Use was higher in low-income countries (42%) compared to that of higher income countries (29%), intimating higher levels of AMR may be present in low-income countries. The data also showed that young people, aged between 16 and 24, were more likely to have used antibiotics (37%) compared to individuals above the age of 65 (24%). Levels of AMR awareness and understanding on how to address the issue were mixed, with 87% of respondents agreeing that individuals should only take antibiotics when prescribed, whereas 25% agreeing that they may use antibiotics prescribed to a friend or family. Moreover, 57% of the respondents stated that there is not much they can do to help (WHO, 2015).

In the framework of the GAP on AMR, developed by the WHO with the active contributions of FAO and OIE in the spirit of 'One Health', the OIE is tasked with the construction and maintenance of a global database on the use of antimicrobial agents in animals. In this endeavor, the FAO and the WHO, through their tripartite collaboration, supported the OIE towards this goal. In the last trimester of 2015, the OIE launched its first annual data collection on the use of antimicrobial agents in animals from OIE member countries. Data were reported back to the OIE by 130 OIE member countries (out of 180 member countries), with 68% (89 out of 130 member countries) providing concrete data on the use of antimicrobial agents in animals. Most member countries (47 out of 89; 53%) were unable to differentiate how

antimicrobial agents are being used in different groups of animals. Poultry, cattle and sheep/goats (small ruminants) are the most frequently reported food-producing species. Tetracycline and macrolides are the most commonly reported antimicrobial agents used among member countries. The Americas, followed by Asia, have the highest proportions of member countries that authorize the use of growth promoters.

The global trend of increased Antimicrobial Use (AMU) poses a great threat. The AMR Review commissioned by the United Kingdom estimated that AMR could cause 10 million deaths a year by 2050 (O'Neill J, 2014) while the World Bank Report in 2016 projected a decrease in Gross Domestic Product from 1.1 to 3.8% in a low and high AMR scenario respectively, ultimately exacerbating the financial and health burden of AMR, if we fail to tackle the issue.

In developing countries, the high proportion of life-threatening bacterial infections, exacerbated by inadequate awareness, laboratory facilities and human resources for health is expected to worsen the impact of AMR, as low-income countries were slow in joining the global initiative against AMR. The situation in Eritrea is not different from that of other developing countries as evident from the situational analysis.

2. OVERVIEW OF THE RELEVANT SECTORS

2.1 GEOGRAPHIC AND DEMOGRAPHIC CONTEXT

Eritrea, located in the North Eastern part of Africa, is bounded by the Republic of Sudan in the North and West, by the Federal Democratic Republic of Ethiopia in the South, by Djibouti in the Southeast and the Red Sea in the East. Although no population census has been conducted in the country, as of 1st January 2018, the Ministry of National Development estimates the country's population to be 3.3 million with an estimated 2.8% annual growth rate of the population.

2.2 OVERVIEW OF THE HEALTH SECTOR

The Government of Eritrea accords health a prominent place in its priorities and is committed to the attainment of its health goals. The principal health sector policy goal is to create a healthy nation and a safe environment. To achieve these, the Government of Eritrea has adopted Primary Health Care (PHC) as the principal strategy towards the attainment of the goal. Among the key guiding principles of the health policy are equity, comprehensiveness of services, community involvement, partnership, and political commitment.

Since 1991, the number of governmental hospitals increased from 16 to 28; health centers (including maternal and child healthcare centers) from 4 to 63; and health stations (including clinics) from 106 to 249 (MOH 2012). Overall, the total number of health facilities increased from 126 in 1991 to 340 in 2010, an increase of 170 percent. There are also 30 pharmacies, 34

drug shops, and 226 rural drug vendors throughout the country. As a result, access to health care within 10 km increased from about 40% in 1991 to about 75% in 2017, and about 60% of the population lives within five km of a health facility (EPHS 2010).

2.3 OVERVIEW OF THE AGRICULTURE SECTOR

Eritrea has three major agro-ecological zones, which are conducive for the growth of diverse horticultural, field crops and rearing of different species of livestock. Its geographical location also makes it favorable for the multiplication of various plant and animal diseases and pests that pose problems to the human health and environment.

Eritrea is endowed with diverse livestock population, of which the majority being small ruminants accounting for about 67% followed by cattle, indigenous chickens and camels that account 19%, 11% and 3%, respectively. The major source of live animals, accounting over 75%, for mutton and beef is the Western Lowlands of the country where livestock production is mainly agro-pastoral and pastoral. In addition to the above indigenous livestock species, the country has also above 20,000 heads of Eritrean Grade Holstein Friesian and crossbreed dairy cattle, above 5,000 pigs and over 200,000 exotic layer chickens managed under intensive production system. These intensively managed livestock are mainly kept in the mid and highland zones of the country that have ideal climate for rearing temperate breeds. Furthermore, about 27,126 hectares of land (MOA-Agricultural Extension Department 2017 Annual Report) covered by irrigated horticultural crops (vegetables and fruits) is in frequent use of pesticides for the prevention and control of plant pests and diseases as well as weeds.

2.4 OVERVIEW OF THE MARINE SECTOR

Another potential source of economic income for the country is the marine resources. The semi-annual estimated total allowance catch was 23,750 tons/year and number of required fishing vessels was 74 (40 foreign bottom trawling, 14 long lines and 20 purse-seiners) on soft demersal, reef based demersal, crustaceans, large and small pelagic fishes.

2.5 OVERVIEW OF THE ENVIRONMENT SECTOR

The overall mandate of the Department of Environment in the Ministry of Land, Water and Environment (MOLWE) is focused on environment protection and conservation norms. It develops environmental regulations, guidelines and undertakes the enforcement, monitoring and evaluation of conduct. Some environmental awareness programs for communities, policy/decision makers have also been conducted by the Department of Environment. These environmental awareness programs focused on solid and liquid waste, hazardous chemical waste, biodiversity conservation, climate change, land degradation and desertification, environmental policy, regulations, guidelines and enforcements. The critical mandate of the department of environment is hampered by the fact that it does not possess the necessary

laboratory infrastructure to accomplish its mission in an exhaustive manner. However, there are some instruments that are used to assess air pollution caused by vehicles, refrigerators and other plants. The Department of Water Resources of the MOLWE has a laboratory that is equipped with some facilities such as a refrigerator, freezer, incubator, autoclave, etc. This laboratory is engaged in assessing water quality to ensure access to clean and safe water and to protect the environment and human health. However, the laboratory needs updated guidelines and procedures, new equipment, financial and technical support in order to conduct effective laboratory activities including antimicrobial susceptibility testing, rapid diagnostic testing including other sophisticated equipment to ensure availability of water resources for end users in terms of quantity and quality and protection from all types of pollution.

3. GOVERNANCE

The development of the AMR National Action Plan (NAP) in the 'One Health' approach was initiated with the inclusion of all relevant stakeholders. A multi-sectoral committee and a secretariat were established to steer the process of the NAP development. The committee is co-chaired by the Director Generals from the Ministry of Health (MOH) and the Ministry of Agriculture (MOA) with membership from the MOH, MOA, and Ministry of Land, Water and Environment (MOLWE), Ministry of Marine Resources (MOMR), Academia and UN agencies (WHO and FAO). From the multi-sectoral committee, four technical working groups in line with the strategic objectives of the Global Action Plan (GAP) on AMR were established and assigned specific tasks related to the strategic objectives of the GAP on AMR. The AMR secretariat composed of focal persons from the MOH, MOA, MOLWE and WHO collates and synthesizes the reports of the technical working groups and submits them to the multi-sectoral committee for its consideration.

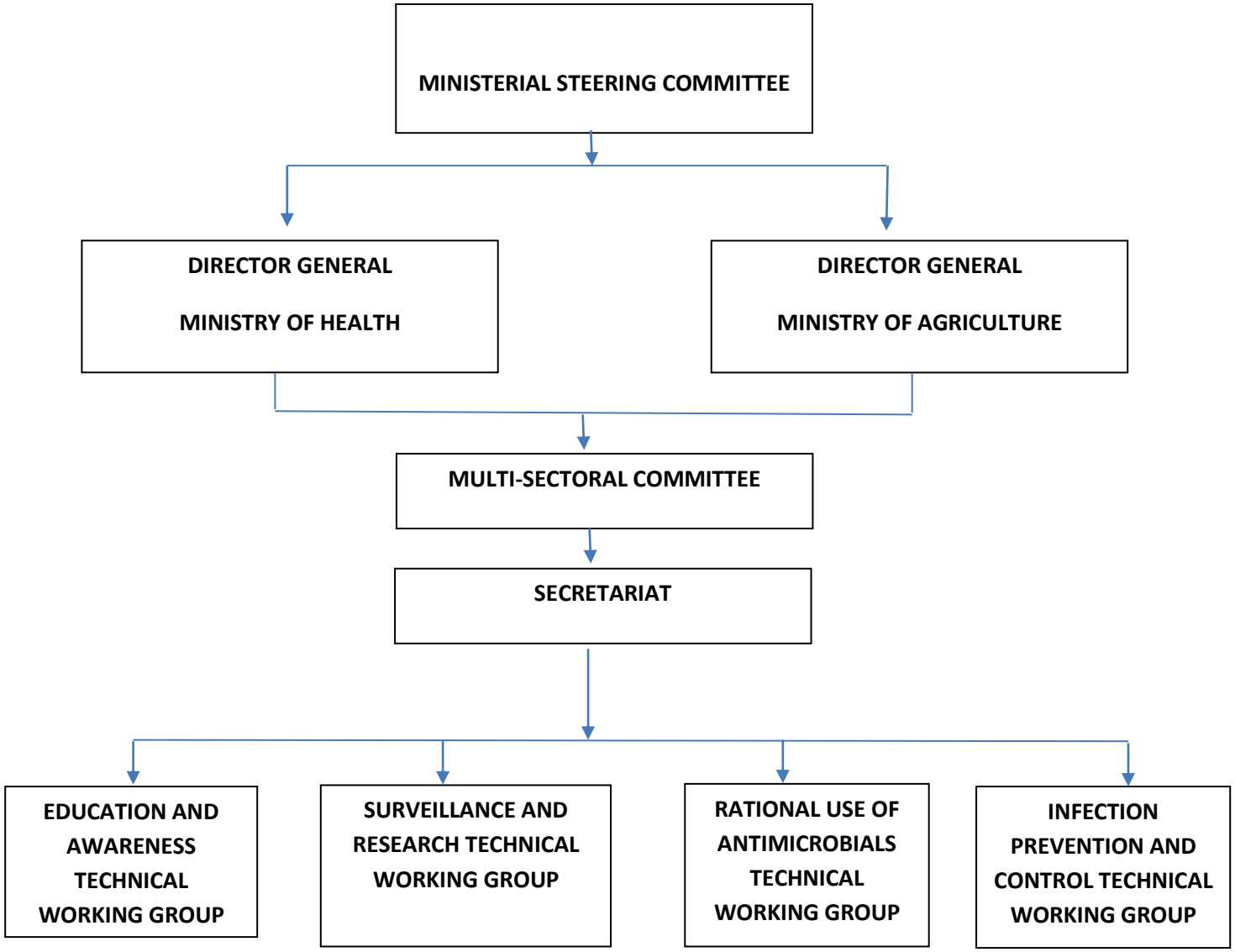

Figure 1. Governance Structure of Eritrean AMR Committee

Oversight of implementation of the NAP will be conducted by the ministerial steering committee composed of the Ministers of Health, Agriculture, Marine Resources and Land, Water and Environment. The steering committee should be co-chaired by the Minister of Health and Minister of Agriculture, working closely with the multi-sectoral committee in following-up and coordinating activities.

Under the steering committee, the multi-sectoral committee will have the overall responsibility in coordinating and monitoring the implementation process. It will assess the implementation progress of the NAP by conducting review meetings twice a year. The Committee will monitor progress on the implementation of specific actions in all relevant sectors; human health,

agriculture, environment and marine resources. Besides, it will provide advice and guidance in relation to any issues that arise during implementation. Investment, research and development shall be undertaken by all the four technical working groups.

4. SITUATIONAL ANALYSIS

4.1 EDUCATION AND AWARENESS

Public education and awareness creation is one of the main strategies adopted by the WHA in 2015 to tackle the challenges of AMR. As part of its resolution, the WHO decided to commemorate Antibiotic Awareness Week in member states annually at all levels including policy makers, health and veterinary personnel, as well as communities in order to promote best practices, and avoid further emergence and spread of AMR. As a response to the resolution, the MOH and MOA have been conducting limited AMR awareness raising activities since 2015 in line with the 'One Health' approach by organizing and conducting Antibiotics Awareness campaigns.

Some member states also took additional steps such as the 'Antibiotic Guardian', developed by Public Health England, encouraging all members of civil society to pledge how they will make better use of antimicrobials in order to save these medicines from becoming obsolete (Antibiotic Guardian, 2017).

In Eritrea, AMR was not a priority in the past decades. Hence, activities conducted on awareness and educational programs on AMR that target students, health, veterinary and environmental professionals and the general public were limited. In the education system AMR is not addressed adequately at all levels. It is only addressed partially and inadequately in the colleges as part of the pharmacology course. This implies that graduates are deployed to their workplaces without having adequate knowledge on AMR. In addition, there are limited in-service training programs on AMR to bridge the gap. An unpublished study by Issac et al. (2009), revealed that antibiotic seeking behavior among college students was common in the country. Besides, sharing of antibiotics, using leftover medicines, flushing medicines into toilets, disposing leftover or unused medicines also appear to be common practices in communities. One of the probable causes that contribute to the above-mentioned behaviors is the absence of medicines take-back program in the community. Thus establishment of such programs in community pharmacies would help to facilitate safe disposal of antimicrobials at community level.

Antimicrobial resistance awareness amongst farmers is also perceived to be very limited. This is reflected in the existing practice of farmers who use drugs and pesticides from open market (irrespective of their quality), pharmacy retail outlets and veterinary pharmacies without valid

prescriptions. In addition, farmers tend to use lower than recommended doses and duration, thereby exposing the animals and plants for the emergence of AMR.

The MOLWE has been also actively working in disseminating information that promotes sustainable use and conservation of the environment since 1997. Issues addressed by the Ministry include inter alia ozone depleting substances, management of used oil, biodiversity conservation and pesticide management. However, none of these awareness raising activities address AMR directly, and as such, it is still a gap that needs to be addressed.

4.2 RESEARCH AND SURVEILLANCE OF AMR

Research and surveillance are important strategies for developing an evidence-based plan of action and to monitor the trends of AMR. However, in the Eritrean context both strategies are not well developed and established in all sectors. Besides there is no coordination among the sectors even in the limited activities they implement.

The capacity and preparedness of the Ministries in conducting surveillance on AMR varies. In the MOH there is an Integrated Disease Surveillance and Response (IDSR) unit, that conducts effective surveillance and response activities of communicable and non-communicable diseases. Whenever the unit suspects the presence of resistant pathogens, it sends specimens to the National Health Laboratory (NHL) for culture and sensitivity testing. But the process has problems of coordination and there is low awareness of priority human pathogens amongst health professionals and the public.

Under MOA, there is a national laboratory that has capacity to detect antimicrobial resistant pathogens. However, awareness on preventing and controlling AMR in the food and animal production sectors is poor. There is no system for conducting surveillance and sharing information on AMR. Hence, there is an urgent need of establishing an integrated surveillance system that monitors the occurrence of AMR in the animal and plant sectors.

The food and feed production industry is also not well developed and regulated in Eritrea. There is no legislation that indicates the amount of antimicrobials that can be used in raw materials of food and feed production and there is no quality assurance program related with AMR and antimicrobial use in the process of production. This is mainly due to limited capacity and absence of a well-staffed and equipped quality control laboratory.

The MOMR has legislation that deals with the procurement, distribution/circulation and use of antimicrobials and the control of maximum residual limits. There is also a legal notice that obliges all stakeholders to keep records with respect to AMR. However, this is not seriously executed as there is no mechanism that facilitates its implementation.

From the above statements, it is obvious that there is no mechanism that coordinates the surveillance of AMR in the various sectors in Eritrea. Besides, there is no national reference laboratory designated for AMR surveillance to accurately confirm diagnoses, develop, maintain and share relevant reference material, or to serve as a resource or coordination point.

The situation is also similar with regards to research. There is no data repository on AMR-related research on humans, animals, food, plants and environment isolates and, as such, it is difficult to estimate the national health and economic impact of AMR. A comprehensive national research agenda that takes into consideration social science and behavioral studies and the development of new vaccines, treatments, and diagnostic tools that are relevant for human, animal, and plant health is also absent.

Research conducted on AMR in the country is limited. In the MOH, a number of small AMR-related research projects were conducted. For example, a study conducted by Seyoum et al. (2017) that aimed to identify the prevalence of AMR for specific drugs was conducted at the NHL. The findings of the study indicated that there was high rate of bacterial resistance. *E. coli* isolates were found to be the most prevalent at 32.2% (n=48) and were sensitive to chloramphenicol, gentamycin and ceftriaxone with sensitivity rates of 72.9%, 70%, and 56.3% respectively; but were resistant to ampicillin and cephalexin at 87.5% and 72.9% respectively.

In the MOA, there is no AMR research program to date mainly due to absence of research priority areas, absence of multidisciplinary research activities and lack of integrated biological, epidemiological, and economic data that are important for research and monitoring the emergence and spread of AMR.

The MOMR has been collaborating with the College of Marine Science and Technology in detecting new antimicrobials from the Red Sea, which is mainly based on extraction of marine bioactive products from marine sponges, sea cucumber, shrimp shell (chitosan), sea weeds and mangroves and testing their efficacy against some bacterial strains in collaboration with national health laboratories of the MOH and MOA.

4.3 LABORATORY CAPACITY AND QUALITY

The laboratory system is an important component that brings the various sectors (health, agriculture, marine, and environment) together under the 'One Health' approach. The importance of having accurate and reliable laboratory services underpinned by a strong quality assurance system is pivotal to the 'One Health' response. However, in Eritrea the laboratories in various sectors are organized independently and they do not communicate or share information with each other. Besides, they overlap with each other in the functions and tests they perform. For example, the laboratories in the Eritrean Standard Institute, MOH, MOA, and MOMR are involved in conducting food testing functions, of course with different magnitude

and perspective. As a result, they are not in a position to monitor and regulate AMR in the country and produce a national image in the context of 'One Health' response.

In the health sector, there are five levels of laboratories ranging from level 1 to level 5 in line with the levels of the health delivery system. These are: one (1) level 5 - the NHL that is capable of conducting culture and sensitivity tests, two (2) level 4 - National Reference Hospital Laboratories, six (6) level 3 - Zonal Referral Hospital Laboratories, twenty (20) level 2 - Hospital Laboratories and forty-three (43) level 1 - Community Hospital Laboratories.

The MOA has one (1) National Laboratory and six (6) Regional Laboratories, located in each Zoba. The National Laboratory is the only laboratory that is capable of carrying out culture and sensitivity tests.

In the MOMR, the Fish Quality Control Laboratory was established in 2001 in collaboration with partners. The laboratory is organized in two sections namely, microbiology and chemistry, and is staffed with qualified professionals and equipped with modern machines (including atomic absorption spectrometer and high performance liquid chromatography) to conduct quality control tests, food testing and analysis that is crucial for issuing certificates for different purposes, including exports of marine resources. Thus it is the sole laboratory that carries out tests and analyses of marine products under the regulatory framework of the Ministry. At present the laboratory is working to start the validation of analyses methods, and is participating in proficiency tests for Total Volatile Base Nitrogen, isolation of *Vibrio parahaemolyticus* and enumeration of *E. coli* and Coliforms (Milk powder) and Food Analysis Performance Scheme.

With the exception of the laboratory in the MOLWE, which focuses mainly in water quality testing and analysis, the laboratories in the MOH, MOA, and MOMR have more or less similar human resources and laboratory infrastructure capacity and face similar challenges. They have no policy guidelines, Standard Operating Procedures (SOPs) and documentation, and there is a shortage of qualified professionals in various specialties. None of the laboratories are accredited and are thus mainly involved in routine diagnostic laboratory tests. Thus, there is an urgent need for strengthening their institutional capacity (both in human resources and infrastructure) and coordinating their performance in order to broaden their scope of work to include surveillance and research.

4.4 INFECTION PREVENTION AND CONTROL

Infection prevention and control (IPC), hygiene, sanitation, good animal husbandry and bio-security practices are amongst the main strategies that have to be followed in a coordinated manner by healthcare facilities, communities, food and animal production systems in the 'One Health' context in order to effectively address AMR. In line with this, relevant ministries like the

MOH, MOA, and MOLWE have been working in a relatively coordinated manner to prevent the spread of AMR.

The MOH has been actively working on IPC activities in all hospitals by establishing infection prevention and control committees, equipping hospitals with Clorox* producing machines and other materials, and empowering health workers to minimize Healthcare Associated Infection (HAI) to make hospitals safe. In addition, the MOH has developed a rural sanitation policy which deals with wider issues of environmental health including waste, water, housing, food, in addition to personal and public habits of cleanliness. To execute the policy, the Ministry has been working in the rural communities by implementing the Community Led Total Sanitation (CLTS) strategy to encourage community members to strictly practice hand washing, and waste management programs. The CLTS strategy has been going for a number of years and has succeeded in expanding Open Defecation Free (ODF) villages in the country. A national latrine coverage survey conducted in 2012 revealed that about 52.3% and 50% of households have proper waste management and proper hand washing practices. Even though recent study was not conducted on latrine coverage nationally, the 2015 ODF sustainability assessment revealed 77% availability of functional toilets and 73% usage in the already ODF communities. In addition, as of 2018, reports of the MOH show that 33% of the rural communities owned private household latrine. However, there is a concern for the urban areas as the strategy focuses primarily on the rural areas. Hence there is an urgent need for developing a strategy for the urban areas. A comprehensive IPC policy and guideline is also required in the Ministry.

Immunization is another strategy implemented by the MOH to prevent infection and spread of infectious diseases in communities. At present the Ministry provides 12 vaccines in its routine program of vaccinations. But there is a concern as the vaccines are given only to children and there is a need to introduce vaccines to adults mainly to health workers and vulnerable groups.

The MOH in collaboration with the MOLWE has conducted the Situational Analysis and Needs Assessment (SANA) for the preparation of national plans of joint action on Health and Environment, and for the implementation of the Libreville Declaration. They are further conducting various studies with the objective of assessing the sources of environmental contamination in the country.

The MOLWE has been working actively to prevent the spread of infections by conducting laboratory based studies on well waters, sewerage, soil and vegetables. Attempt has been made to assess the health impacts on farmers and consumers that arise from using untreated domestic waste water for cultivating vegetables. In 2004, the Ministry conducted a study on marine microbial pollution with an objective to ascertain baseline information on the nature, type, quantity, and disposal practices of industrial wastes in the country. A country-wide survey conducted by the Ministry on solid waste management from 2004 to 2007 revealed that only

55% of the solid wastes generated were properly collected and disposed of by the municipalities.

In 2016, the National Chemicals Profile was revised aiming at providing the needed information on the strength and weaknesses of existing national infrastructure (nature, type and quantity of existing chemicals, laboratories, storage facilities, human resources, etc.) and capabilities necessary for sound management of chemicals; thereby enabling the establishment of mechanisms for regulating and monitoring of chemicals in the country.

The MOLWE has also conducted assessments on waste generated from agriculture, industries and health facilities. The result of the assessments revealed that management of waste material is sub-optimal requiring serious attention. A national chemical profile that aimed to identify the chemicals in use and regulate them properly was prepared in 2012. The profile showed that most of the chemicals are not properly managed, and could be a cause of environmental contamination. However, in 2017 the Ministry has developed the National Hazardous Wastes and other Wastes Inventory Methodological Guide.

Pesticides have been in use in an increasing trend in Eritrea since 1950 due to the expansion of agricultural activities, the presence of migratory pests (mainly locusts, army worms and *Quela quela*), and to control pest infestation in livestock production which may have a direct or indirect negative impact on the health of humans and animals. To mitigate the situation, the MOA has been taking a number of measures including conducting inventory, safe-guarding pesticides in all stores and conducting country-wide social, environmental assessment. A national inventory of persistent organic pollutants and obsolete pesticides (POPs) has been ongoing in 294 stores since 2007. The country environmental social assessment was conducted in 2008 with the objective to identify the most critical POP stores and options for their secure safeguarding and disposal. As a result of the assessment, 8 stores based on their environmental and social risks were identified and 364 tons of POPs were sent to the United Kingdom in 4 shipments for appropriate disposal. The situation in 2018 reveals that almost all POPs are disposed, but there are about 50 tons of different POPs waiting for disposal abroad at high temperature incineration. In addition, about 70 tons of Actollic 20% will be disposed in a well-protected and designed landfill within the country. Moreover, the Ministry has established a field school for farmers in Mendefera, and conducted pest surveys on citrus fruits (specifically on wooly white fly pesticide), developed legislation for pesticides, and promotional materials that targeted milk producers and processing plants, slaughter houses and poultry production sites, and conducted various awareness raising activities.

The main challenges that the MOA is facing at present with respect to pesticides include lack of integrated pest management, illegal importation of pesticides, the use of alternatives which do not have a similar function and lack of personal protective equipment. There still is a high risk of

infectious diseases spread like anthrax where there is high livestock migration and livestock markets. Dead animals infected with anthrax are not burned and buried properly. The MOA is addressing these challenges by making available veterinary services, restricting livestock movement and providing three types of vaccination services, i.e., compulsory, blanket and ring. However, identifying the vaccinated from those unvaccinated livestock still remains a challenge.

4.5 ANTIMICROBIAL USE IN HUMANS, ANIMALS AND PLANTS

4.5.1 DRUG REGULATORY AUTHORITY

Ideally each Ministry is expected to execute its regulatory function by having an effective regulatory body that monitors the procurement, distribution, use and disposal of medicines in general and antimicrobials in particular. But the situation on the ground is different.

The MOH has a dedicated regulatory body, the National Medicines and Food Administration (NMFA), responsible for regulating the quality, safety and efficacy of medicines and medical devices, cosmetics, and food, spanning in the continuum from manufacturing, importation, exportation, marketing, use and post-marketing surveillance. To maximize its regulatory function, the NMFA is working to upgrade and accredit the existing National Drug Quality Control Laboratory to the level of ISO/IEC 17025. It has also updated its medicines registration guideline into the format of a Common Technical Document (CTD) aiming at harmonizing with the current medicines registration system. However, the NMFA has several challenges including: unavailability of well-designed food and beverage laboratory setup for regulating the food component, limited capacity in conducting inspection of Good Manufacturing Practice (GMP) for foreign manufacturers, lack of skills for conducting microbiology test parameters of antimicrobial preservative test and antibiotic assay, and regulating accessibility of antibiotics to health facilities and consumers.

Likewise, the MOA has a regulatory body responsible for regulating and controlling the imports and exports of agricultural products, plant and animal genetic materials, medicines, vaccines, pesticides, safety and quality of animal and plant processed foods and feeds, and the standards of agricultural by-products such as hides and skins. The Ministry has a legislation that guides its regulatory function. However, the legislation has limitations in specifying the maximum residual limit of antibacterial substances such as sulphonamides and quinolones.

4.5.2 PROCUREMENT, DISTRIBUTION AND STORAGE

The Ministries of Health and Agriculture perform procurement of medicines for use in humans, animals and plants. In the MOH, the Pharmacy Services Division and the NMFA are engaged in the Procurement and Supply Management (PSM) and regulation activities. Both divisions strive to ensure continuous availability of all medicines and medical/surgical devices in all health facilities; and are carefully stored, distributed properly and used rationally. The Eritrean

National List of Medicines (ENLM), which was first developed in 1993 and updated periodically, serves as a reference for procurement, manufacturing, prescribing and dispensing medicines. All medicines in the list are categorized according to their vital, essential, and necessary (VEN) classification, and level of use. According to the National Health Policy (2010), procurement of medicines outside the list is not allowed. However, in practice, due to inadequacy of staff and supportive guidelines, most of these objectives are not practiced, which ultimately leads to irrational use. At present the Pharmacy Services Division is drafting guidelines for the distribution, good storage and warehouse management, and disposing of expired medicines.

The MOA conducts procurement of veterinary medicines and pesticides mainly based on the prevalence of disease patterns and pest outbreaks. The Ministry developed a national list of pesticides and a list of medicines for use in animals and plants in 2006 and 2007 respectively. But the documents have not been reviewed since their development. The MOA also has a legal notice issued in 2006 (article No. 114/2006) that aims to regulate the importing, handling, use, storage and disposal of pesticides.

With respect to all sectors, there is still an urgent need for strengthening the PSM of pharmaceuticals and medical supplies in general and antimicrobials in particular in order to ensure the availability of safe, efficient, and effective medicines and medical supplies in the country.

4.5.3 PRESCRIBING OF ANTIMICROBIALS IN HUMANS, ANIMALS AND PLANTS

The Eritrean Standard Treatment Guideline (ESTG), first developed in 1998 and reviewed in 2017, is the standard reference document used for treatment in the health sectors. But there is no treatment guideline developed specifically for antimicrobials. As a result, prescription of antimicrobials depends mainly on the observation and diagnostic skills of the healthcare providers. It is also important to note that due to the existing limited number of physicians in the country, other categories of health workers (mainly nurses) are also mandated to prescribe and dispense medicines in lower health facilities. This is of great concern as antibiotics are not properly managed and prescribed in these settings. In addition, legal classification of drugs as “over the counter”, “pharmacy only” and “prescription only” has not been operational leading to the inappropriate use of antimicrobials in humans, animals and plants. To alleviate the situation, the NMFA in collaboration with the Pharmacy Services Division has taken initiative of scheduling all medicines, in order to preserve some critically important medicines. At present, the manual of medicines schedule has been finalized and is ready for use. All antimicrobials are scheduled as Prescription Only Medicines (POM), and such classification is expected to play a key role in optimizing the use of antimicrobials.

Information available on the prescribing patterns of antimicrobials in humans, animals, and plants is scanty. Studies conducted by the Pharmacy Services Division on rational use of medicines in 2017 revealed that there is an increased use of antibiotics in public health facilities

as patients receiving antibiotics was 44% in 1995, 59.9% in 2005, and 62.5% in 2017. The median value/percent of patients prescribed one or more antibiotics in public health facilities was 63.3%; and to more than half of the patients were prescribed one or more antibiotics in 77% of the facilities. The survey also found left over antibiotics in households and the need for raising consumer awareness to minimize irrational drug use. A study conducted by the NMFA in selected hospitals of Zoba Maekel revealed that antibiotics are the most prescribed medicines accounting for around 57% of all medicines used and are commonly prescribed for viral infections like the common cold and upper respiratory infections.

In the agriculture sector, absence of an updated list of medicines is the main barrier in prescribing appropriate medicines for animal and plant use. As a result, there is no formal way of prescribing veterinary drugs and pesticides. In the veterinary clinics prescription is based on the history and clinical investigation conducted by the mid-level veterinary professionals. Private veterinary professionals and rarely non-professionals are also involved in distributing and dispensing drugs (such as acaroids and antibiotics) and pesticides, in order to increase access of drugs and pesticides for livestock owners and horticultural farmers residing in remote areas. This is observed to become a challenge in monitoring the performance of the providers, and they have been found to sell illegally introduced drugs and pesticides wherever there is shortage or stock out of supplies. Hence, the regulatory authority of the MOA needs to consider establishing the required mechanism and tools relevant for monitoring and regulating medicines and pesticides in the sector. There is also an urgent need to enforce the existing laws to curtail the dispensing of drugs by non-professionals, peddling of medicines and pesticides and the illegal purchase of antimicrobials by farmers.

4.5.4 DEPARTMENTAL REPORT OF AMU IN A NATIONAL REFERRAL HOSPITAL

In order to understand the overall use of antimicrobials in hospitals, rapid assessment was conducted in Halibet National Referral Hospital, with emphasis on specific departments. The findings revealed that in the orthopedic department, the absence of antibiotics for pediatrics use was the main challenge. In the medical department, frequent shortage and stock out of diagnostics like X-ray and sputum examinations, forced the prescribing of broad-spectrum antimicrobials depending on the findings of clinical investigations. It is common to witness that almost all patients who visit the referral hospital have already taken one or two antibiotics previously, leaving no room to prescribe the appropriate one but only move to the higher level or next-line antimicrobials. Similarly, in the dental department, patients do not adhere to post extraction health education given. As a result, infection occurs most of the time requiring for the prescription of antibiotics. Thus, patients are continuously exposed to antimicrobials and this may result in resistance. Prescribing in the in-patient department depends on the physician's personal experience as there is no specific treatment guideline for antimicrobials. Besides, there is poly-pharmacy as patients are given new antibiotics without discontinuing the

previously prescribed one. Generally, patients frequently take certain antibiotics beyond the maximum limit, which could exacerbate AMR.

Although the use of anti-retroviral (ARV) in the country is rated fair, due to shortage of experts and supply, patients are forced to switch between different regimens which might affect the adherence and thereby cause resistance.

5. CONCLUSION

Antimicrobial resistance is relatively a new concept for all sectors. As a result, it has not been prioritized in the sectors. Recently, attempts were made to increase awareness of AMR by incorporating it into the curriculum of colleges and conducting awareness raising activities. However, there is still limited awareness of AMR, and poor understanding of its magnitude and the factors that contribute to its emergence. Most importantly, there is lack of policies and legal tools to enforce the record of information, and implementation that support combating AMR in most of the sectors. In cases where such policies, laws and regulations are available, the enforcement is missing. Consequently, the antimicrobial seeking behavior of the Eritrean people combined with shortage and frequent stock out of antimicrobials in the system has triggered the usage of smuggled and uncontrolled antimicrobials in the country. Thus, the presence and use of illegal antimicrobials in the human, animal and plant health sectors is exposing the country to the increased risk of AMR.

The aim of the situational analysis is, therefore, to serve as basis for the development of the Eritrean NAP on AMR, aimed at combating AMR, increasing awareness, promoting appropriate use of antimicrobials, enhancing research and surveillance, as well as infection prevention and control.

6. STRATEGIC OBJECTIVES

The Eritrean National Action Plan is built on the situational analysis of AMR in the country. It aims to contain the increasing trend of AMR in the country and contribute to the ongoing global initiative on AMR. It will have the following five strategic objectives in line with Global Action Plan.

1. Improve awareness and understanding of AMR through effective communication and training.
2. Strengthen the knowledge and evidence base through surveillance and research.
3. Reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures.
4. Optimize the use of antimicrobial medicines in human, animal, and plant health.
5. Develop the economic case for sustainable investment that takes account of the needs of Eritrea, and increase investment in new medicines.

Each of these strategic objectives will have strategic interventions and key activities as outlined below. A detailed operational plan with time frame, performance indicator, and means of verification is also following the section.

Strategic Objective 1: Improve awareness and understanding of AMR through effective communication and training.	
Strategic Interventions	***Activities***
1.1: Improve awareness and understanding of AMR in the various groups of the general population.	**1.1.1** Assess knowledge, attitude and practices (KAP) of AMR and antimicrobial use in the general population. **1.1.2** Develop communication strategy and promotional materials on AMR and the rational use of antimicrobials. **1.1.3** Conduct sensitization campaigns on AMR and appropriate use of antimicrobials in target audiences.
1.2: Improve awareness and understanding of AMR in professionals of all relevant sectors.	**1.2.1** Revise and incorporate AMR and IPC into the curricula of Health Sciences and Agriculture colleges.
1.3: Incorporate AMR and IPC as core components of continuing education and professional development in all relevant sectors.	**1.3.1** Develop training manual on AMR and IPC to be used in continuing education of health and veterinary workers.

	1.3.2 Develop training manual on AMR and IPC to be used in the continuing education of various related professionals (plant, fishery, and environment).
1.4: Monitor the impact of sensitization campaigns and trainings on AMR in all target audiences.	**1.4.1** Assess the impact of AMR campaigns in the various target audiences of the general population.
Strategic Objective 2: Strengthen the knowledge and evidence base through surveillance and research.	
Strategic Interventions	***Activities***
2.1: Establish an integrated national surveillance system on AMR for all sectors.	**2.1.1** Develop guidelines and SOPs for an integrated and effective national surveillance system on AMR. **2.1.2** Establish a harmonized database and information sharing system on AMR in human, animal, plant, and environmental health.
2.2: Build capacity in designated national laboratories to produce high quality microbiological data for patient management, food, feed, environmental safety, and surveillance support activities in health, agriculture and environment sectors.	**2.2.1** Assess the capacity of existing laboratories with respect to AMR. **2.2.2** Designate and strengthen laboratories to work as focal point/s for AMR. **2.2.3** Establish an internal and external quality assurance system for AMR surveillance. **2.2.4** Implement a surveillance system in each sector to collect antimicrobial use (AMU) data. **2.2.5** Carry out antimicrobial residue testing for food and feed products.
2.3: Strengthen research capacity to prevent and contain AMR in human, animal and environmental health.	**2.3.1** Develop an integrated and priority-ranked research agenda for AMR. **2.3.2** Encourage professionals to conduct research on AMR.
Strategic Objective 3: Reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures.	
Strategic Interventions	***Activities***
3.1: Strengthen infection prevention and Control (IPC) program in health care settings.	**3.1.1** Develop an IPC guideline for the health sector. **3.1.2** Ensure adherence of the IPC guideline in health facilities. **3.1.3** Develop and implement protocols to combat hospital acquired infections.

3.2: Strengthen good husbandry practices and bio-security interventions in animal husbandry, plant, and fishery sectors.	**3.2.1** Develop guidelines on good bio-security measures in animal husbandry, plant, and fishery sectors. **3.2.2** Design an SOP to prevent and minimize transmission of infection from animals, plants fish and the environment to humans and vice versa.
3.3: Strengthen vaccination programs in human and animal health to reduce antimicrobial resistance.	**3.3.1** Protect human and animal health care providers and other vulnerable groups from infections through vaccination and PPE.
3.4: Strengthen waste management systems in the health, agriculture, and environment sectors and communities.	**3.4.1** Develop a comprehensive guideline of waste management for the urban and rural settings **3.4.2** Conduct regular health promotion activities to advocate personal hygiene and environmental sanitation.
Strategic Objective 4: Optimize the use of antimicrobial medicines in human, animal, and plant health.	
Strategic interventions	***Activities***
4.1: Develop guidelines on the use of antimicrobial agents in human, agriculture, fisheries and food/feed.	**4.1.1** Develop antimicrobial therapeutic guideline for human use. **4.1.2** Develop antimicrobial therapeutic guideline for animal use. **4.1.3** Integrate AMR into the periodic review of national essential list of medicines and standard treatment guidelines. **4.1.4** Develop standard treatment guidelines for veterinary practice, livestock and crop production, and fisheries.
4.2: Strengthen antimicrobial governance for appropriate use of antimicrobials in health care settings and communities.	**4.2.1** Develop hospital standard list of medicines, treatment guidelines, and formulary. **4.2.2** Monitor implementation of standard treatment in health settings, veterinary practice, livestock production, agriculture, and fishery.
4.3: Ensure access to safe and effective antimicrobials.	**4.3.1** Develop and utilize guideline on national procurement for antimicrobials. **4.3.2** Assess status and develop guidelines for medical storage facilities.

	4.3.3 Enhance quality regulation of antimicrobial use in all sectors.
Strategic Objective 5: Develop the economic case for sustainable investment that takes account of the needs of Eritrea, and increase investment in new medicines.	
Strategic interventions	***Activities***
5.1: Quantify and mobilize resources required for implementing the NAP on AMR.	**5.1.1**: Estimate the budget required for implementing the NAP on AMR. **5.1.2**: Mobilize the required budget for implementing the NAP.

7. OPERATIONAL PLAN

The operational plan matrix is a further detail of the strategic objectives. It consists of sub activities, unit measure, quantity, timeframe, level of implementation, cost of implementation, source of fund and indicators.

Strategic Objective 1: Improve awareness and understanding of AMR through effective communication and training.

Strategic Intervention 1.1: Improve awareness and understanding of AMR in the various groups of the general population.

Activity 1.1.1: Assess the knowledge, attitude and practices (KAP) of AMR and antimicrobial use in the general population.							
Sub-activity	***Unit***	***Quantity***	***Timeline***	***Implementation level (Location)***	***Responsible entity***	***Cost (ERN)***	***Indicator***
Sub-activity 1.1.1.1 Conduct AMR and antimicrobial use KAP survey among the general public.	Survey	1	2022	Nationwide	MOH and MOA	247,100.00	Compiled baseline KAP
Sub-activity 1.1.1.2 Disseminate findings of the KAP survey.	Workshop	1	2022	Asmara	MOH and MOA	38,000.00	Workshop conducted, report available
Activity 1.1.2: Develop a communication strategy and promotional materials on AMR and the rational use of antimicrobials.							
Sub-activity 1.1.2.1 Draft a communication strategy for AMR and AMU.	Strategy document	1	2023	Asmara	MOH and MOA	21,000.00	Availability of draft communication strategy document
Sub-activity 1.1.2.2 Conduct consensus-building workshop on the communication strategy for AMR and AMU.	Workshop	1	2023	Asmara	MOH and MOA	18,300.00	Finalized communication strategy

Sub-activity 1.1.2.3 **Print and disseminate the AMR and AMU communication strategy.**	Booklet	1500	2023	Asmara	MOH and MOA	15,000.00	Printed booklets
Sub-activity 1.1.2.4 **Draft a behavior change communication (BCC) discussion guide on AMR and AMU.**	BCC discussion guide	3000	2023	Asmara	MOH and MOA	30,000.00	Availability of draft BCC discussion guide document
Sub-activity 1.1.2.5 **Conduct consensus building workshop on the BCC discussion guide.**	Workshop	1	2023	Asmara	MOH and MOA	18,300.00	Finalized BCC discussion guide
Sub-activity 1.1.2.6 **Develop different types of promotional materials on AMR and AMU.**	Flyers Posters Brochures Billboards	100,000 30,000 15,000 12	2022 2022 2023 2024	Asmara	MOH and MOA	935,000.00	Number of promotional materials developed by type
Activity 1.1.3: Conduct sensitization campaigns on AMR and appropriate AMU in target audiences.							
Sub-activity 1.1.3.1 **Establish an integrated national awareness raising committee composed from various relevant sectors.**	Committee	1	2022	National	AMR chair and co-chair persons	1,000	Functional committee in place
Sub-activity 1.1.3.2 **Incorporate rational use of antimicrobials on health education sessions in health facilities.**	Health education sessions/year	52	2022-2025	Nationwide (all levels)	MOH	No cost incurred	Number of sessions per year

Sub-activity 1.1.3.3 **Conduct continuous awareness raising campaigns in the general public on AMR and AMU.**	Seminar	1/year/ zoba	2022-2025	Zoba level	MOA/MOH	47,900.00	Number of zoba seminars conducted per year
Sub-activity 1.1.3.4 **Commemorate the global antimicrobial awareness week annually.**	Commemoration event	1/year/ zoba/ nation	2022-2025	National and zoba level	MOA/MOH/ MOLWE	72,000.00	Annual commemoration conducted per annum in different geographical areas

Strategic intervention 1.2: Improve awareness and understanding of AMR in professionals of all relevant sectors.

Activity 1.2.1: Revise and incorporate AMR and IPC into the curricula of Health Sciences and Agriculture colleges.							
Sub-activity 1.2.1.1 **Conduct advocacy and sensitization meetings with all the training institutions.**	Workshop	1	2022	National	MOH/MOA	9,600.00	Advocacy meeting report
Sub-activity 1.2.1.2 **Incorporate AMR and IPC into the curricula of all relevant training institutions.**	Curriculum document	1	2024	National	MOA/MOH	64,000.00	Revised curriculum developed

Strategic Intervention 1.3: Incorporate AMR and IPC as core components of continuing education and professional development in all relevant sectors.

Activity 1.3.1: Develop training manual on AMR and IPC to be used in continuing education of health and veterinary workers.							
Sub-activity 1.3.1.1 Establish technical working group that will develop the manual.	Technical working group (TWG)	1	2022	National	MOH/MOA	1,000.00	TWG established
Sub-activity 1.3.1.2 Develop and print the training manual on AMR and IPC.	Training Manual	1 manual 1,500 copies	2023	National	MOH/MOA	127,500.00	Training manual in place
Sub-activity 1.3.1.3 Conduct training of trainers (TOT) sessions on how to use the training manual.	TOT Sessions	1	2023	National	MOH/MOA	28,600.00	Number of TOT sessions conducted
Sub-activity 1.3.1.4 Conduct cascade training of health and veterinary workers. (At least once a year in all zones and at national level).	Training Sessions	6	2023-2024	National and zoba levels	MOH/MOA	219,600.00	Number of training sessions conducted
Activity 1.3.2: Develop training manual on AMR and IPC to be used in the continuing education of various related professionals (plant, fishery, and environment).							
Sub-activity 1.3.2.1 Establish technical working group that will develop the manual.	Technical working group	1	2023	National	MOA/MOLWE /MOMR	1,000.00	Technical working group established
Sub-activity 1.3.2.2 Develop and print the training manual.	Training Manual	1,500 copies	2023	National	MOA	15,000.00	Training manual in place

Sub-activity 1.3.2.3 **Conduct training of trainers on how to use the training manual.**	TOT Sessions	1	2023	National	MOA	23,600.00	Number of training sessions conducted
Sub-activity 1.3.2.4 **Conduct cascade training of various professionals (plant, fishery, and environment).**	Training Sessions	6	2023-2025	National and zoba levels	MOA	255,600.00	Number of training sessions conducted

Strategic Intervention 1.4: Monitor the impact of sensitization campaigns and trainings of AMR in all target audiences.

Activity 1.4.1: Assess the impact of AMR campaigns in the various target audiences of the general population.							
Sub-activity 1.4.1.1 **Develop relevant tools required for monitoring and evaluating the implementation of all sensitization and training activities.**	M and E framework	1	2022	National level	MOH/MOA/ MOLWE	127,500.00	M and E framework in place
Sub-activity 1.4.1.2 **Monitor the improvement of awareness and understanding of AMR in the various groups of the general population.**	M and E annual report document	1	2022-2025	National level	MOH/MOA/ MOLWE	No cost incurred	Annual M and E report produced
Sub-activity 1.4.1.3 **Conduct mid-term evaluation of the national action plan of AMR.**	Mid-term review document	1	2024	National Level	MOH/MOA	127,500.00	Review report produced

Sub-activity 1.4.1.4 **Conduct national survey to assess the impact of AMR campaigns and trainings in the various groups of the general population.**	Survey	1	2025	National level	MOH/MOA/ MOLWE	247,100.00	Final national survey report
Sub-activity 1.4.1.5 **Document, publish and disseminate findings of the survey as required (professionals and general public).**	Publication	1	2025	National level	MOH/MOA/ MOLWE	12,800.00	Survey report publicized

Strategic Objective 2: Strengthen the knowledge and evidence base through surveillance and research.

Strategic Intervention 2.1 Establish an integrated national surveillance system on AMR for all sectors.

Activity 2.1.1: Develop guidelines and SOPs for an integrated and effective national surveillance system on AMR.							
Sub-activity	***Unit***	***Quantity***	***Timeline***	***Implementation level (Location)***	***Responsible entity***	***Cost (ERN)***	***Indicator***
Sub-activity 2.1.1.1 Establish a technical working group constituted by the various sectors.	TWG	1	2022	National	MOH/MOA/MOMR/ MOLWE	6,000.00	Functional TWG with defined TOR
Sub-activity 2.1.1.2 Assess and evaluate existing guidelines and SOPs in various sectors.	Assessment	1	2022	National	MOH/MOA/MOMR/ MOLWE	28,700.00	Assessment report available
Sub-activity 2.1.1.3 Develop integrated/ harmonized national guidelines and SOPs for AMR surveillance.	Guidelines and SOPs documents	2	2022	National	MOH/MOA/MOMR/ MOLWE	127,500.00	Technical assistant recruited and documents developed
Sub-activity 2.1.1.4 Conduct consensus-building workshop.	Workshop	1	2022	National	MOH/MOA/MOMR/ MOLWE and other relevant stakeholders	58,000.00	Validated guidelines and SOPs

Sub-activity 2.1.1.5 Print and disseminate the guidelines and SOPs.	Publication	1	2022	National	MOH/MOA	120,000.00	Printed guidelines and SOPs
Activity 2.1.2: Establish a harmonized database and information sharing system on AMR for human, animal, plant, and environmental health.							
Sub-activity 2.1.2.1 Assess existing databases of AMR in the various sectors.	Assessment	1	2022	National	TWG (MOH/MOA/MOMR/ MOLWE)	28,700.00	Assessment report
Sub-activity 2.1.2.2 Identify and designate a sector as a national focal point for data collection and repository on AMR.	Focal point designation	1	2022	National	MOH	No cost incurred	Focal point sector designated
Sub-activity 2.1.2.3 Define a mechanism and modalities for data collection, collation, analysis, and information management.	AMR data management guideline	1	2022	National	TWG (MOH/MOA/MOMR/ MOLWE)	32,000.00	Harmonized AMR data management guideline in place

Strategic Intervention 2.2: Build capacity in designated national laboratories to produce high quality microbiological data for patient management, food, feed, and environmental safety, and surveillance support activities in health, agriculture and environment sectors.

Activity 2.2.1: Assess the capacity of existing laboratories with respect to AMR.							
Sub-activity 2.2.1.1 Establish a technical working group constituted by the various sectors.	TWG	1	2022	National	MOH/MOA/MOMR/ MOLWE	6,000.00	Functional TWG with defined TOR
Sub-activity 2.2.1.2 Conduct preliminary assessment of existing laboratories.	Assessment	1	2022	National	TWG	56,950.00	Preliminary assessment report
Sub-activity 2.2.1.3 Conduct comprehensive assessment of the existing various laboratories with a technical advisor.	Assessment	1	2022	National	TWG	225,000.00	Assessment report with recommendation
Sub-activity 2.2.1.4 Communicate assessment findings with all relevant sectors.	Workshop	1	2022	National	TWG	58,000.00	Assessment findings communicated

Activity 2.2.2: Designate and strengthen laboratories to work as focal point/s for AMR.							
Sub-activity 2.2.2.1 **Designate laboratory/laboratories to work as focal point/s, based on the findings of the assessment.**	Focal point laboratorial	2	2022	National	MOH/MOA/MOMR/ MOLWE	No cost incurred	Number of designated focal point laboratories
Sub-activity 2.2.2.2 **Strengthen the human and infrastructural capacity of the designated laboratory/laboratories as focal point/s.**	Infrastructure Human Resources	2	2023 2024	National	MOH/MOA	18,641,180.00	Infrastructural improvements Number and cadre of human resources appointed
Activity 2.2.3: Establish an internal and external quality assurance system for AMR surveillance.							
Sub-activity 2.2.3.1 **Establish routine internal quality assessment (IQA) for AMR surveillance.**	Routine	N/A	Daily	All levels	MOH/MOA/MOMR/ MOLWE	845,000.00	IQAS established
Sub-activity 2.2.3.2 **Introduce a routine external quality assessment scheme (EQAS) for all surveillance laboratories.**	EQAS	2	2022	National	MOH/MOA	No cost incurred	EQAS established

Sub-activity 2.2.3.3 **Organize joint training workshops for microbial identification, anti-microbial sensitivity testing, and data harmonization in human, animal, food, plants and the environment.**	Workshop	01/year	2022-2025	National	MOH/MOA/MOMR/MOLWE	298,400.00	Joint training workshops conducted annually
Sub-activity 2.2.3.4 **Identify selected laboratories for AMR surveillance.**	AMR surveillance labs	6 (2 National level and 4 Zonal Level)	2022-2025	National/Zonal	MOH/MOA/MOMR/MOLWE	No cost incurred	Number of laboratories selected for AMR surveillance
Sub-activity 2.2.3.5 **Identify priority pathogens and antimicrobials for human, animal, plant and environment surveillance.**	WHO Priority pathogens and others	4	2022-2025	National	MOH/MOA /MMR/MOLWE	No cost incurred	Priority pathogens identified
Activity 2.2.4: Implement a surveillance system in each sector to collect antimicrobial use (AMU) data.							
Sub-activity 2.2.4.1 **Train 20 data collectors for collection of AMU data for humans using the WHO tool.**	Training	1	2022 and 2025	National	MOH	192,000.00	Trained data collectors

Sub-activity 2.2.4.2 **Collect human consumption data.**	Document	1	2022 and 2025	National	MOH	No cost incurred	Humans AMU data available
Sub-activity 2.2.4.3 **Train 15 data collectors for collection of AMU data for animals using the OIE tool.**	Training	1	2022 and 2025	National	MOA	149,000.00	Trained data collectors
Sub-activity 2.2.4.4 **Collect animal consumption data.**	Document	1	2022 and 2025	National	MOA	No cost incurred	AMU data available for animals
Activity 2.2.5: Carryout antimicrobial residue testing for food and feed products.							
Sub-activity 2.2.5.1 **Capacitate laboratory with equipment for antimicrobial residue testing.**	Procurement	1	2022–2025	National	MOA	450,000.00	Residue testing equipment available
Sub-activity 2.2.5.2 **Capacitate laboratory with reagents for antimicrobial residue testing.**	Procurement	1	2022 - 2025	National	MOA	450,000.00	Antimicrobial residue test results available

Strategic Intervention 2.3: Strengthen research capacity to prevent and contain AMR in human, animal and environmental health.

Activity 2.3.1: Develop an integrated and priority-ranked research agenda for AMR.							
Sub-activity 2.3.1.1 Establish an inclusive technical working group.	TWG	1	2022	National	MOH/MOA /MOMR/MOLWE and other relevant stakeholders	6,000.00	Functional TWG with defined TOR
Sub activity 2.3.1.2 Undertake an AMR research priority setting exercise.	Research priorities	1	2022	National	MOH/MOA /MOMR/MOLWE	127,500.00	AMR research priorities determined
Sub-activity 2.3.1.3 Organize a consensus-building workshop to validate the priority research agenda for AMR.	Workshop	1	2022	National	TWG	58,000.00	Validated AMR research priorities
Sub-activity 2.3.1.4 Publish and disseminate the AMR research guideline and the research agenda.	Document	1	2023	National	TWG	20,000.00	Published AMR research guideline document

Activity 2.3.2: Encourage professionals to conduct research on AMR.							
Sub-activity 2.3.2.1 Organize research methodology training on AMR for professionals in human, animal, and environmental sectors.	Training	01/year	2022-2025	National	MOH/MOA /MOMR/MOLWE and other relevant stakeholders	572,400.00	Number of trainees on AMR research methodology annually
Sub-activity 2.3.2.2 Mobilize resources to support and finance priority research topics from the national research agenda.	Resource mobilization proposal	01/year	2022-2025	National	MOH/MOA /MOMR/MOLWE and other relevant stakeholders	No cost incurred	Resource mobilized

Strategic Objective 3: Reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures.

Strategic Intervention 3.1: Strengthen infection prevention and control (IPC) program in health care settings.

Activity 3.1.1: Develop an IPC guideline for the health sector.							
Sub-activity	***Unit***	***Quantity***	***Timeline***	***Implementation level (Location)***	***Responsible entity***	***Cost (ERN)***	***Indicator***
Sub-activity 3.1.1.1 **Establish a cross-cutting working group to develop the IPC guideline.**	Committee	1	2022	Asmara	MOH	No cost incurred	Functional committee in place
Sub-activity 3.1.1.2 **Draft IPC guideline.**	Document	1	2022	Asmara	MOH	45,000.00	IPC guideline drafted
Sub-activity 3.1.1.3 **Conduct consensus-building workshop.**	Workshop	1	2022	Asmara	MOH	36,550.00	Workshop report
Sub-activity 3.1.1.4 **Print and distribute IPC guideline to all health facilities.**	IPC guideline	500	2022	Nationwide (All Health facilities)	MOH	45,000.00	Availability of IPC guideline in all health facilities
Activity 3.1.2: Ensure adherence of the IPC guideline in health facilities.							
Sub-activity 3.1.2.1 **Establish cross-cutting IPC committees at national, zonal, and facility (hospital) levels.**	Committee	31	2022	Nationwide	MOH	No cost incurred	Number of Hospitals with functional IPC committees
Sub-activity 3.1.2.2 **Assign IPC focal persons at lower level health facilities.**	Focal person	226	2022	Nationwide	MOH	No cost incurred	Number of health facilities with IPC focal person

Sub-activity 3.1.2.3 Conduct training of trainers (TOT) on IPC measures.	Training session	2	2023	Asmara	MOH	112,900.00	Number of health professionals trained
Sub-activity 3.1.2.4 Conduct cascade training on IPC measures to health workers.	Training session	1	2023	Nationwide	MOH	217,200.00	Number of health professionals trained
Sub-activity 3.1.2.5 Equip all health facilities with necessary IPC materials and tools.	IPC materials	List of IPC materials and tools	2023	Asmara	MOH	12,135,000.00	Number of health facilities equipped with IPC materials
Sub-activity 3.1.2.6 Conduct regular supportive supervision of IPC in health facilities.	Supervision	2 times a year	2024-2025	National/zonal	MOH	413,100.00	Number of hospitals supervised
Activity 3.1.3: Develop and implement protocols to combat hospital acquired infections.							
Sub activity 3.1.3.1 Develop protocol for aseptic techniques.	Protocol	1	2023	Asmara	MOH	45,000.00	Aseptic technique protocols available
Sub activity 3.1.3.2 Conduct intensive training of health workers on minimizing HAI.	Training	1	2023	Hospitals nationwide	MOH	62,450.00	Number of health workers who received training
Sub activity 3.1.3.3 Conduct regular monitoring to ensure the protocol is being followed.	Monitoring and Supervision	2 times per year	2024-2025	National/zonal	MOH	243,600.00	Number of hospitals monitored on regular basis

Strategic Intervention 3.2: Strengthen good husbandry practices and bio-security interventions in the animal husbandry, plant, and fishery sectors.

Activity 3.2.1: Develop guideline on good bio-security measures in animal husbandry, plant and fishery services.							
Sub-activity 3.2.1.1 **Establish a cross-cutting technical working group.**	Committee	1	2022	National	MOA/ MOMR	No cost incurred	Functional TWG in place
Sub-activity 3.2.1.2 **Develop guideline on good animal husbandry and biosecurity measures, fishery and plants.**	Document	1	2022	National	MOA/ MOMR	78,750.00	Good animal husbandry and biosecurity guideline in place
Sub-activity 3.2.1.3 **Conduct consensus and validation workshop of the guidelines.**	Workshop	1	2022	National	MOA/ MOMR	78,750.00	Workshop reports
Sub-activity 3.2.1.4 **Conduct TOT of plant, fishery and animal professionals on the guidelines.**	Training	1	2022	National	MOA/ MOMR	78,750.00	Number of trainees who received TOT
Sub-activity 3.2.1.5 **Conduct cascade training of plant, fishery and animal professionals on the guidelines.**	Training	6	2022	Zonal	MOA/ MOMR	78,750.00	Number of trainees who received training
Sub-activity 3.2.1.6 **Conduct regular monitoring of good animal husbandry and biosecurity activities in animal husbandry, plant, and fishery.**	Monitoring and supervision	2 times a year	2024-2025	Zonal	MOA/ MOMR	40,600.00	Number of zonal clinics supervised

Activity 3.2.2: Design an SOP to prevent and minimize transmission of infection from animals, plants, fish and the environment to humans and vice versa.							
Sub-activity 3.2.2.1 **Strengthen the routine vaccination program in food animals by ensuring access to vaccines, reagents and instruments.**	Vaccines and reagents	Yearly	2022-2025	Nationwide	MOA	4,275,000.00	Number of vaccines and reagents required and supplied
Sub-activity 3.2.2.2 **Conduct vaccination campaigns.**	Campaign	Annually	2022-2025	Nationwide	MOA	252,500.00	Number of vaccination campaigns conducted
Sub-activity 3.2.2.3 **Establish a rapid surveillance system for early detection and warning of priority (risk) zoonotic diseases.**	Surveillance System	1	2023	Nationwide	MOA	No cost incurred	Functional surveillance system in place
Sub-activity 3.2.2.4 **Develop a guideline for the implementation of appropriate response measures to limit transmission in the event of emergence of zoonotic diseases with the potential of transmission to human beings.**	Ring vaccination Culling	1	2022-2025	National	MOA	1,500,000.00	Effective response measures in place
Sub-activity 3.2.2.5 **Strengthen the inter-sectoral collaboration mechanism for preventing and managing zoonotic diseases.**	Data sharing and response	2 times a year	2023	Asmara	MOA/ MOH	No cost incurred	Effective inter-sectoral mechanism in place

Strategic Intervention 3.3: Strengthen vaccination programs in human and animal health to reduce antimicrobial resistance.

Activity 3.3.1: Protect human and animal health care providers and other vulnerable groups from infections through vaccination and PPE.							
Sub-activity 3.3.1.1 Establish a cross-cutting-working group of experts to identify relevant vaccines and develop SOPs.	Committee	1	2023	National	MOH/ MOA	No cost incurred	Cross- cutting working group in place
Sub-activity 3.3.1.2 Ensure availability of the required vaccines.	Vaccine antigens	List the vaccine antigens	2023	National	MOH/ MOA	300,000.00	Required vaccines available

Strategic Intervention 3.4: Strengthen waste management systems in the health, agriculture, and environment sectors and communities.

Activity 3.4.1: Develop a comprehensive guideline of waste management for the urban and rural settings.							
Sub-activity 3.4.1.1 Establish a cross-cutting-working group.	Committee	1	2022	National	MOH/MOA/ MOLWE	No cost incurred	TWG established
Sub-activity 3.4.1.2 Draft a comprehensive waste management guideline.	Document	1	2022	National	TWG	98,250.00	Draft comprehensive waste management guideline in place
Sub-activity 3.4.1.3 Conduct consensus-building workshop.	Workshop	1	2022	National	MOH/MOA/ MOLWE	36,500.00	Workshop reports

Sub-activity 3.4.1.4 **Print and distribute waste management guideline.**	Guideline	1000	2023	Nationwide	MOH/MOA/ MOLWE	27,000.00	Number of waste management guidelines distributed
Sub-activity 3.4.1.5 **Monitor closely implementation of the waste management guideline.**	Monitoring	Twice a year	2023-2025	Nationwide	MOH/MOA/ MOLWE	162,400.00	Number of functional waste management processes place
Activity 3.4.2: Conduct regular health promotion activities to advocate personal hygiene and environmental sanitation.							
Sub-activity 3.4.2.1 **Assess knowledge attitude and practice of IPC (with emphasis on hand hygiene) in different social groups of the community as well as in animal, plant and fishery and workers.**	KAP assessment	1	2023	Nationwide	MOH/MOA/ MOLWE/ MOMR	411,040.00	Number of assessments done
Sub-activity 3.4.2.2 **Develop promotional materials based on the KAP findings.**	Material developed	Flyers Brochures Booklets	2023	National	MOH/MOA/ MOLWE/ MOMR	350,000.00	Number and type of promotional materials developed
Sub-activity 3.4.2.3 **Conduct continuous campaigns on personal hygiene, sanitation, and proper disposal of waste materials for all sectors.**	Campaigns	Annually	2023-2025	Nationwide	MOH/MOA/ MOLWE/ MOMR/MOI	7,800.00	Number of sessions conducted on personal hygiene, sanitation and proper disposal of waste materials.
Sub-activity 3.4.2.4 **Promote hand washing in school children and communities.**	Awareness raising sessions	Annually	2023-2025	Nationwide	MOH/MOE/ MOI	940,320.00	Number of sessions conducted on hand washing practices

Sub-activity 3.4.2.5 **Encourage communities to conduct regular community sanitation campaigns or focus group discussions on hygiene and sanitation and IPC for all sectors.**	Meetings	58 (at each sub Zoba)	2024	Nationwide	MOLG/MOH /MOLWE	No cost incurred	Number of sanitation campaigns conducted
Sub-activity 3.4.2.6 **Promote hygienic practices in animal, plant and fishery sectors.**	Health education	Twice a year	2023-2025	Nationwide	MOA/ MOLWE/ MOH/MOMR	156,720.00	Proper hygienic practice in animal, plant and fishery sectors

Strategic Objective 4: Optimize the use of antimicrobial medicines in human, animal, and plant health.

Strategic Intervention 4.1: Develop guidelines on the use of antimicrobial agents in human, agriculture, fisheries and food/feed.

Activity 4.1.1: Develop antimicrobial therapeutic guideline for human use.							
Sub-activity	***Unit***	***Quantity***	***Timeline***	***Implementation level (Location)***	***Responsible entity***	***Cost (ERN)***	***Indicator***
Sub-activity 4.1.1.1 Establish a technical working group.	Working group	1	2022	National	MOH	No cost incurred	Technical working group established
Sub-activity 4.1.1.2 Draft a guideline on the use of antimicrobial agents.	Document	1	2022	National	MOH	139,400.00	Guideline drafted
Sub-activity 4.1.1.3 Conduct consensus-building workshop.	Workshop	1	2022	National	MOH	86,300.00	Workshop conducted
Sub-activity 4.1.1.4 Print and distribute the guideline.	Guideline	600	2022	National	MOH	120,000.00	Guideline printed and distributed
Sub-activity 4.1.1.5 Conduct training on the new developed guideline.	Training	1	2022	National	MOH	46,200.00	Number of training sessions
Sub-activity 4.1.1.6 Monitor closely implementation of the antimicrobial guideline.	Supervision	2	2023-2025	Nationwide	MOH	2,304,000.00	Guideline implementation monitored
Activity 4.1.2: Develop antimicrobial therapeutic guideline for animal use.							
Sub-activity 4.1.2.1 Establish a technical working group.	Working group	1	2022	National	MOA/ MOMR	No cost incurred	Working group established

Sub-activity 4.1.2.2 **Draft a guideline on the use of antimicrobial agents.**	Document	1	2022	National	MOA/ MOMR	139,400.00	Guideline on AM drafted
Sub-activity 4.1.2.3 **Conduct consensus-building workshop.**	Workshop	1	2022	National	MOA/ MOMR	86,300.00	Workshop conducted
Sub-activity 4.1.2.4 **Print and distribute the guideline.**	Guideline	1	2022	National	MOA/ MOMR	120,000.00	Guideline printed and distributed
Sub-activity 4.1.2.5 **Monitor closely implementation of the antimicrobial guideline.**	Supervision	2	2023-2025	Nationwide	MOA/ MOMR	1,152,000.00	Guideline implementation monitored
Activity 4.1.3: Integrate AMR into the periodic review of national essential list of medicines and standard treatment guidelines.							
Sub-activity 4.1.3.1 **Review the national standard treatment guidelines with respect to AMR.**	Guideline	1	2022	National	MOH	127,500.00	Guideline reviewed
Sub-activity 4.1.3.2 **Conduct consensus building workshop.**	Workshop	1	2022	National	MOH	86,300.00	Workshop report
Sub-activity 4.1.3.3 **Print and distribute the revised, treatment protocol.**	Guideline	600	2022	National	MOH	120,000.00	Guideline printed and distributed
Activity 4.1.4: Develop standard treatment guidelines for veterinary practice, livestock and crop production, and fisheries.							
Sub-activity 4.1.4.1 **Establish a cross-cutting working group to develop standard treatment guidelines for veterinary**	Working group	1	2022	National	MOH/MOA/ MOMR	No cost incurred	Functional working group established

practice, livestock production, agriculture, and fishery.							
Sub-activity 4.1.4.2 **Draft standard treatment guideline for veterinary practice, livestock and crop production, and fishery.**	Treatment guideline	1	2022	National	MOH/MOA/ MOMR	127,500.00	Treatment guideline drafted
Sub-activity 4.1.4.3 **Conduct consensus-building workshop.**	Workshop	1	2022	National	TWG	228,600.00	Workshop conducted
Sub-activity 4.1.4.4 **Print and distribute the document.**	Guideline	600	2022	National	MOH/ MOA	120,000.00	Guideline printed and distributed

Strategic intervention 4.2: Strengthen antimicrobial governance for appropriate use of antimicrobials in health care settings and communities.

Activity 4.2.1: Develop hospital standard list of medicines, treatment guidelines, and formulary.							
Sub-activity 4.2.1.1 **Establish/re-activate medicine and therapeutic committees in hospitals.**	Therapeutic committee	12	2022	Six NR[a] Hospitals and six ZR[b] Hospitals	MOH	No cost incurred	Therapeutic committee established
Sub-activity 4.2.1.2 **Develop/revise standard list of medicines, treatment guidelines, and formulary in hospitals.**	Guidelines	12	2022	Six NR[a] Hospitals and six ZR[b] Hospitals	MOH	60,080.00	Guidelines developed

Sub-activity 4.2.1.3 **Print and disseminate the standard list medicines, treatment guidelines, and formulary in hospitals.**	Guideline	1800	2022	Six NR[a] Hospitals and six ZR[b] Hospitals	MOH	360,000.00	Guideline printed and distributed
Sub-activity 4.2.1.4 **Conduct training on the developed guidelines.**	Training	1	2022	National	MOH	601,200.00	Number of people trained
Activity 4.2.2: Monitor implementation of standard treatment in health settings, veterinary practice, livestock production, agriculture and fishery.							
Sub-activity 4.2.2.1 **Establish a mechanism and tools to monitor appropriate use of antimicrobials in health settings, veterinary practice, livestock production, agriculture, and fisheries.**	Monitoring Tools	2	2022	National	MOH/MOA/ MOMR	64,240.00	Monitoring tools developed
Sub-activity 4.2.2.2 **Conduct regular supervision/audit of antimicrobial use/prescription habits by human and animal health professionals.**	Supervision	2 MOH 2 MOA 2 MOMR	2022-2025	Nationwide	MOH/MOA/ MOMR	2,764,800.00	Supervision conducted

[a] NR- National Referral

[b] ZR- Zonal Referral

Strategic intervention 4.3: Ensure access to safe and effective antimicrobials.

Activity 4.3.1: Develop and utilize guideline on national procurement for antimicrobials.							
Sub-activity 4.3.1.1 **Develop a method to quantify national consumption of antimicrobials to use as baseline for procurement.**	Guideline	1	2022	National	MOH/ MOA	303,700.00	Guideline developed
Sub-activity 4.3.1.2 **Strengthen or establish the database for assessment of antimicrobial use.**	Database	1	2022	National	MOH/ MOA	288,100.00	Database established
Sub-activity 4.3.1.3 **Conduct consensus building workshop.**	Workshop	1	2022	National	MOH/ MOA	86,300.00	Workshop report
Sub-activity 4.3.1.4 **Designate a national procurement agency or committee for antimicrobials.**	National agency or committee	1	2022	National	MOH/ MOA	No cost incurred	Functional national procurement agency designated
Sub-activity 4.3.1.5 **Develop guidelines for the national procurement system.**	Guideline	1	2022	National	MOH/ MOA	200,000.00	Guidelines developed
Sub-activity 4.3.1.6 **Print and distribute the guideline.**	Guideline	1	2021	National	MOH/ MOA	300,600.00	Guideline distributed

Activity 4.3.2: Assess status and develop guidelines for medical storage facilities.							
Sub-activity 4.3.2.1 **Assess existing storage of medicines, specifically antimicrobials, in the various sectors.**	Assessment	1	2022	Nationwide	MOH/ MOA	311,280.00	Assessment report
Sub-activity 4.3.2.2 **Develop guidelines and SOPs for the storage and management of antimicrobials.**	Guidelines and SOPs	1	2023	National	MOH/ MOA	628,100.00	Guidelines developed
Activity 4.3.3: Enhance quality regulation of antimicrobial use in all sectors.							
Sub activity 4.3.3.1 **Enhance post marketing surveillance with regard to antimicrobials in animal and human health.**	Post marketing surveillance	2	2022-2025	Nationwide	MOH/ MOA	3,529,080.00	Post marketing surveillance conducted
Sub activity 4.3.3.2 **Strengthen regulatory enforcement to prohibit sale of antimicrobials as OTC for both animal and human use.**	Supervision	Twice/year	2022-2025	Nationwide	MOH/ MOA	1,176,360.00	Number of supervisions conducted

8. MONITORING AND EVALUATION

Currently Eritrea does not have any baseline data as AMR activities will only commence after the actual implementation of this NAP. Therefore, the baseline is zero for all activities.

Table 1. Monitoring Framework for Tracking Progress of Implementation

Key Interventions	*Activity*	*Performance Indicator*	*Means of Verification*	*Year of Implementation*			
				2022	*2023*	*2024*	*2025*
Strategic objective 1: Improve awareness and understanding of AMR through effective communication and training.							
Strategic intervention 1.1 Improve awareness and understanding of AMR in the various groups of the general population.							
Activity 1.1.1	Assess the knowledge, attitude, and practices (KAP) of AMR and AMU in the general population.	KAP survey conducted	KAP survey report	x			
Activity 1.1.2	Develop a communication strategy and promotional materials on AMR and the rational use of antimicrobials.	Communication strategy, BCC guide and promotional materials developed	Availability of communication strategy, BCC guide, promotional materials	x	x		
		BCC discussion guide on AMR and AMU developed	Availability of BCC discussion guide in place		x		
		Different promotional materials developed	Availability of promotional materials	x	x	x	x
Activity 1.1.3	Conduct sensitization campaigns on AMR and appropriate AMU in	Sensitization campaigns conducted on regular basis	Sensitization campaign reports	x	x	x	x

	target audiences.						
Strategic intervention 1.2 Improve awareness and understanding of AMR in professionals of all relevant sectors.							
Activity 1.2.1	Revise and incorporate AMR and IPC into the curricula of Health Sciences and Agriculture colleges.	AMR and IPC concepts incorporated into the curricula of all relevant sector training institutions	Revised curriculum documents of training institutions of all relevant sectors			x	
Strategic intervention 1.3 Incorporate AMR and IPC to be used in continuing education of health and veterinary workers.							
Activity 1.3.1	Develop training manual on AMR and IPC to be used in continuing education of health and veterinary workers.	Training manual for health workers on AMR and IPC developed	Training manual available		x		
Activity 1.3.2	Develop training manual on AMR and IPC to be used in the continuing education of various related professionals (plant, fishery, and environment).	Training manual on AMR and IPC for non-health sectors developed	Training manual available		x		
		Cascade training conducted on AMR and IPC	Training logbook		x	x	x
Strategic intervention 1.4 Monitor the impact of sensitization campaigns and trainings on AMR in all target audiences.							
Activity 1.4.1	Assess the impact of AMR campaigns in the various target audiences of the general population.	Midterm assessment to determine implementation status of the AMR plan	Assessment reports			x	
		National survey to assess the impact of AMR campaigns and trainings conducted	Survey report				x
		Number of publications	Publications				x
Strategic objective 2: Strengthen the knowledge and evidence base through surveillance and research.							
Strategic intervention 2.1 Establish an integrated national surveillance system on AMR for all sectors.							

Activity 2.1.1	Develop guidelines and SOPs for an integrated and effective national surveillance system on AMR.	Guidelines and SOPs for national surveillance system on AMR developed	Guidelines and SOPs	x			
Activity 2.1.2	Establish a harmonized database and information sharing system on AMR for human, animal, plant, and environment health.	A harmonized (integrated) database developed	Functional and harmonized database	x			
Strategic intervention 2.2 Build capacity in designated national laboratories to produce high quality microbiological data for patient management, food, feed, and environmental safety and surveillance support activities in human, animal and environmental sectors.							
Activity 2.2.1	Assess the capacity of existing laboratories with respect to AMR.	Capacity of existing laboratories with respect to AMR assessed	Assessment report	x			
Activity 2.2.2	Designate and strengthen laboratories to work as focal point/s for AMR.	Focal point laboratories designated	Names of designated laboratories	x	x		
		Designated laboratories strengthened in terms of their human and institutional capacity	Number of adequately strengthened laboratories		x		
Activity 2.2.3	Establish an internal and external quality assurance system for AMR surveillance.	Functional quality assurance system for AMR in place	Annual reports		x	x	
Activity 2.2.4	Implement a surveillance system in each sector to collect antimicrobial use (AMU) data.	AMU consumption data available for humans, animals and plants	Bi-annual reports	x	x	x	x

Activity 2.2.5	Carryout antimicrobial residue testing for food and feed products.	Statistics of number of residue tests done	Annual reports	x	x	x	x
Strategic intervention 2.3 Strengthen research capacity to prevent and contain AMR in human, animal and environmental health.							
Activity 2.3.1	Develop an integrated and priority-ranked research agenda for AMR.	Integrated and priority-ranked research agenda for AMR developed and in use	Research agenda	x			
Activity 2.3.2	Encourage professionals to conduct research on AMR.	Number of professionals trained on research methodology	Training reports		x	x	x
		Number of research projects conducted	Research documents		x	x	x
Strategic Objective 3: Reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures.							
Strategic intervention 3.1 Strengthen infection prevention and control (IPC) program in health care settings.							
Activity 3.1.1	Develop an IPC guideline for the health sector.	IPC guideline developed for the health sector	Guideline	x			
Activity 3.1.2	Ensure adherence of the IPC guideline in health facilities.	Number of supervision sessions conducted to monitor adherence to IPC measures	Supervisory reports		x	x	x
Activity 3.1.3	Develop and implement protocols to combat hospital acquired infections.	Number of people trained on combating HAI	Training reports		x	x	x
Strategic intervention 3.2 Strengthen good husbandry practices and bio-security interventions in the animal husbandry, plant and fishery sectors.							

Activity 3.2.1	Develop guideline on good bio-security measures in animal husbandry, plant and fishery services.	Good animal husbandry and biosecurity guideline for animals plant and fishery sectors	Good animal husbandry and biosecurity guideline	x	x		
		Cascade training on IPC, hygiene and sanitation and biosecurity measures conducted	Training reports	x	x		
Activity 3.2.2	Design an SOP to prevent and minimize transmission of infection from animals, plants, fish, and the environment to humans and vice versa.	A surveillance system for early warning and detecting for priority zoonotic diseases established	Surveillance reports	x			
		Vaccination campaigns conducted on regular basis	Vaccination campaign reports	x	x	x	x
Strategic intervention 3.3 Strengthen vaccination programs in human and animal health to reduce AMR.							
Activity 3.3.1	Protect human and animal health care providers and other vulnerable groups from infections through vaccination and PPE.	Number and types of vaccines made available	Inventory document of all vaccines available	x	x	x	x
		Vaccination campaigns conducted on regular basis	Vaccination campaign reports	x	x	x	x
Strategic intervention 3.4 Strengthen waste management systems in the health, agriculture and environment sectors and communities.							
Activity 3.4.1	Develop a comprehensive guideline for waste management for urban and rural settings.	Comprehensive waste management guideline developed	Waste management guideline	x			
Activity 3.4.2	Conduct regular health promotion activities to advocate personal hygiene and	KAP assessment on hygiene and sanitation measures conducted	Assessment document	x			

	environmental sanitation.	Promotional materials developed based on KAP assessment results	Types and number of IPC materials in use		x	x	x
		Number of media outlets on personal and environmental hygiene	Number of media outlets	x	x	x	x
Strategic Objective 4: Optimize the use of antimicrobial medicines in human, animal, and plant health.							
Strategic intervention 4.1 Develop guidelines on the use of antimicrobial agents in human, agriculture, fisheries and food/feed.							
Activity 4.1.1	Develop antimicrobial therapeutic guideline for human use.	Availability of antimicrobial therapeutic guideline for human use	Guideline	x			
Activity 4.1.2	Develop antimicrobial therapeutic guideline for animal use.	Availability of antimicrobial therapeutic guideline for animal use	Guideline	x			
Activity 4.1.3	Integrate AMR into the periodic review of national essential list of medicines and standard treatment guidelines.	AMR integrated into the review of national list of medicines and standard treatment guidelines	National list of medicines and treatment guidelines integrating AMR	x			
Activity 4.1.4	Develop standard treatment guidelines for veterinary practice, livestock and crop production, and fisheries.	Standard treatment guidelines for veterinary practice, livestock and crop production and fishery developed	Standard treatment guidelines	x			
Strategic intervention 4.2 Strengthen antimicrobial governance for appropriate use of antimicrobials in health care settings and communities.							
Activity	Develop hospital standard list of	Hospital standard list of	Hospital standard	x			

4.2.1	medicines, treatment guidelines, and formulary.	medicines, treatment guidelines, and formulary developed	list of medicines, treatment guidelines, and formulary document				
Activity 4.2.2	Monitor implementation of standard treatment in health settings, veterinary practice, livestock production, agriculture and fishery.	Monitoring done on regular basis	Monitoring reports	x	x	x	x
Strategic intervention 4.3 Ensure access to safe and effective antimicrobials.							
Activity 4.3.1	Develop and utilize guideline on national procurement for antimicrobials.	Availability of national procurement system for AMR	Procurement guideline	x			
		Procurement done using the national procurement guideline	Annual procurement documents	x	x	x	x
Activity 4.3.2	Assess status and develop guidelines for medical storage facilities.	Assessment of existing storage facility conducted	Storage facility assessment report	x			
		SOPs and guidelines for effective use of storage facilities developed	SOPs and guideline		x		
Activity 4.3.3	Enhance quality regulation of antimicrobial use in all sectors.	Post marketing surveillance and supervision conducted on regular basis	Surveillance and supervision reports	x	x	x	x

Table 2. The Results Chain

Strategic Objectives and Interventions	Process Indicators	Output Indicators	Outcome/Impact Indicators

	(Activities)	(Short Term Results)	(Long Term Results)
Strategic objective 1: Improve awareness and understanding of AMR through effective communication and training.			
Strategic intervention 1.1: **Improve awareness and understanding of AMR in the various groups of the general population.**	KAP survey on AMR and antimicrobial use conducted Communication strategy, BCC guide and promotional materials developed	Level of use of different promotional materials, and BCC discussion guide	Percent AMR awareness increased from baseline in target population (general public, health workers and non-health workers) as determined by surveys conducted
Strategic intervention 1.2: **Improve awareness and understanding of AMR in professionals of all relevant sectors.**	AMR and IPC concepts incorporated into the curriculum of all relevant sector training institutions	Number of training institutions who have incorporated AMR and IPC concepts into their respective curricula	Percent of graduates from the training institutions with adequate knowledge of AMR and IPC concepts
Strategic intervention 1.3: **Incorporate AMR and IPC as core components of continuing education and professional development in all relevant sectors.**	Training manuals for health and non-health sectors developed Cascade training on AMR and IPC conducted	Proportion of medical and veterinary workforce in public and private sectors who have received training on AMR and IPC measures	Percent of professionals with adequate knowledge of AMR and IPC concepts
Strategic intervention 1.4: **Monitor the impact of sensitization campaigns and trainings on AMR in all target audiences.**	Midterm assessment done to determine implementation status of the AMR plan National survey to assess the impact of AMR campaigns	Assessment results published	Percent reduction of AMU in humans, animals, plants and the environment

		and trainings conducted Number of publications			
Strategic objective 2: Strengthen the knowledge and evidence base through surveillance and research.					
Strategic intervention 2.1: **Establish an integrated national surveillance system on AMR for all sectors.**	➡	Guidelines and SOPs for national surveillance system on AMR developed A harmonized (integrated) database developed		National report on surveillance of AMR published	Degree (level) of AMR detection
Strategic intervention 2.2: **Build capacity in designated national laboratories to produce high quality microbiological data for patient management, food, feed, environmental safety, and surveillance support activities in health, agriculture and environment sectors.**	➡	Capacity of existing laboratories with respect to AMR assessed Focal point laboratories designated Functional quality assurance system for AMR in place	➡	Number of laboratory facilities working in compliance with accepted standards and norms with regards to AMR	
Strategic intervention 2.3: **Strengthen research capacity to prevent and contain AMR in human, animal and environment health.**	➡	Number of professionals trained on research methodology Integrated research agenda for AMR developed		Number of researches conducted	Research findings applied
Strategic Objective 3: Reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures.					

Strategic intervention 3.1: **Strengthen infection prevention and control (IPC) program in health care settings.**	➡	IPC guideline for the health sector developed Number of supervision conducted to monitor adherence to IPC measures Number of people trained on combating HAI	➡	Proportion of health hospitals implementing infection and control programs	Percent of hospitals with hand hygiene compliance rate > 75%
Strategic intervention 3.2: **Strengthen good husbandry practices and bio-security interventions in animal husbandry, plant, and fishery sectors.**	➡	IPC guideline for animal husbandry, plant and fishery services in place Cascade training conducted A surveillance system for early warning and detecting for priority zoonotic diseases established		Proportion of health animal health facilities implementing infection prevention and control programs	Prevalence of hospital acquired infections Percent reduction of incidence of health care associated infections i.e. surgical sites, catheter associated urinary tract infections, etc.
Strategic intervention 3.3: **Strengthen vaccination programs in human and animal health to reduce antimicrobial resistance.**	➡	Number and types of vaccine agents made available Vaccination campaigns conducted on regular basis		Vaccine coverage rate	
Strategic intervention 3.4: **Strengthen waste management systems in the health, agriculture, and environment sectors and communities.**	➡	Comprehensive waste management guideline developed KAP assessment on IPC measures conducted Number of media outlets conducted		Improvement in knowledge, attitudes and behaviors on IPC as determined by the KAP study	

Strategic Objective 4: Optimize the use of antimicrobial medicines in human, animal, and plant health.					
Strategic intervention 4.1: **Develop guidelines on the use of antimicrobial agents in human, agriculture, fisheries and food/feed.**	➡	Availability of antimicrobial therapeutic guideline for human and animal use AMR integrated into the review of national list of medicines and standard treatment guidelines Standard treatment guidelines for veterinary practice, livestock and crop production and fishery developed		Level of compliance with antimicrobial therapeutic guideline for human and animal use ADR reporting tools in place	Percentage of hospitals prescribing antimicrobials with > 80% compliance with guidelines Percentage of animal health facilities prescribing antimicrobials with > 80% compliance with guidelines
Strategic intervention 4.2: **Strengthen antimicrobial governance for appropriate use of antimicrobials in health care settings and communities.**	➡	Hospital standard list of medicines, treatment guidelines, and formulary developed Monitoring done on regular basis	➡	Number of health care facilities working in accordance with the standard list of medicines, treatment guidelines and national formulary	Percent of illegal access points of antimicrobials
Strategic intervention 4.3: **Ensure access to safe and effective antimicrobials.**		Availability of national procurement system for AMR Procurement done using the national procurement guideline Assessment of existing storage facility conducted		Percent of procurement done in compliance to the national procurement system Number of storage facilities	

	➡	SOPs and guidelines for effective use of storage facilities developed Post marketing surveillance and supervision conducted on regular basis		fulfilling criteria for safe storage of vaccines and drugs	

9. RISK ANALYSIS

Table 3. Risks and Measures

Risks and Mitigation Measures			
Description of Risk	**Probability (High, Medium, Low)**	**Impact (High, Medium, Low)**	**Mitigation Measures**
Strategic objective 1: Improve awareness and understanding of AMR through effective communication and training			
Institutional Risks: • Unavailability of risk communication strategy	• High	• Medium	• Accelerate the development of risk communication on AMR • Communicate effectively the communication strategy for use
• Delays in revision of curriculum in academic institution	• High	• Medium	• Review existing curriculum in academic institutions with respect to AMR and take actions as required • Empower professional associations to actively participate in the awareness raising activities of AMR
• Unavailability of training manuals on combating AMR and IPC	• Medium	• Medium	• Empower professional associations to actively participate in the awareness raising activities of AMR
• Weak monitoring and evaluation mechanisms	• High	• Medium	• Conduct survey to establish baseline data on AMR and • Conduct periodic follow-up surveys to measure progress

Fiduciary Risks: • Absence of earmarked Budget for promotional activities of combating AMR	• High	• High	• Allocate adequate budget for AMR promotional activities • Advocate at relevant institutions/partners for funding of AMR promotional activities • Incorporate AMR in various proposals and concept notes for funding
• Low funding utilization rate			• Advocate for effective and efficient transaction of budget/fund • Monitor proper utilization of funds continuously • Integrated supervision and sensitization activities at all levels
Operational Risks: • Difficulty in ensuring inter-sectoral coordination	• Medium	• High	• Advocate for presence of structured coordinating mechanism at higher level/Ministerial level • Designated AMR office/focal point in the relevant Ministries • Organize regular meetings among stakeholders
• Inability to create tailored messages on AMR for the various groups of the general public according their access to media outlets	• Medium	• High	• Develop tailored promotional materials on AMR for the various target groups • Develop training packages tailored to specific groups of the institution • Capacity building for developing promotional materials in all relevant sectors

• Absence of tailored training packages relevant to different categories • Limited logistical support for dissemination of promotion materials	• Medium • Medium	• High • High	• Equip relevant sectors with logistics (Vehicles and Films) • Explore resources from partners • Liaise with Ministry of Information for provision of a slot in the media
Programmatic and Performance Risks: • Low motivation and non-attractive incentives for staff	• Medium	• Medium	• Devise creative in-service motivation packages for health workers • Equip relevant sectors with promotional materials and logistics (Vehicles and Films)
Other Risks:	-	-	
Overall Risk Rating for Strategic Objective 1	Relatively Medium	Relatively High	

Risks and Mitigation Measures			
Description of Risk	**Probability (High, Medium, Low)**	**Impact (High, Medium, Low)**	**Mitigation Measures**
Strategic objective 2: Strengthen the knowledge and evidence base through surveillance and research			
Institutional Risks: • Inadequacy of infrastructure for detection and reporting of resistant pathogens	• High	• High	• Invest to build some standardized laboratories at all levels • Set standards for laboratories at different levels • Mobile resources from different sources
• Presence of vertical surveillance system or reporting in different sectors	• High	• High	• Strengthen capacity of Microbiologists • Establish sentinel sites to identify resistant pathogens • Introduce proficiency testing scheme at all levels (internal and external)
• Absence of the designated national reference laboratory (ies) (Animal or Human health?)	• Low	• High	• High level advocacy for integrated surveillance/ information sharing system
Fiduciary Risks: • Inadequate funding	• High	• High	• Submit concept notes to relevant institutions/organizations for funding • Incorporate some activities in the existing HSS activities and other related programs

Operational Risks: • Networking challenges	• High	• High	• Institute non-web based reporting system (SMS)
• Delay in construction and/or refurbishment of the laboratories	• High	• High	• Advocacy for the smooth construction process
• Sample transportation	• High	• High	• Establish Microbiology laboratories that perform Drug Sensitivity Testing (DST) at the sentinel sites
• Delay in procurement	• High	• High	• Establish national procurement committee with defined TORs and guidelines
Programmatic and Performance Risks: • Unreliable power supply	• Medium	• Medium	• Equip laboratories with alternative power supply system
• Absence of clear and accountable program for AMR in all relevant Ministries	• High	• High	• Advocate for AMR to have defined positions in relevant sectors
Other Risks:	-	-	
Overall Risk Rating for Strategic Objective 2	High	High	

Risks and Mitigation Measures			
Description of Risk	**Probability (High, Medium, Low)**	**Impact (High, Medium, Low)**	**Mitigation Measures**
Strategic Objective 3: Reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures			
Institutional Risks: • Inadequate infrastructure and equipment for IPC implementation	• High	• High	• Equip health facilities with essential IPC materials including incinerators, PPE • Refurbishment of health facilities
• Unavailability of standardized national waste management and disposal system with accountable body	• High	• High	• High level communication with relevant stakeholders to establish a national disposal system and identify accountable entity
• Unavailability of Medicines take back programs at community level	• High	• High	• Introduce a mechanism to take back left-over medicines from communities. Community pharmacies and health facilities can act as potential sites.
• Unavailability of sustainable power supply of cold chains for vaccine storage in the zones (for animal and human vaccines)	• Medium	• High	• Equip Health facilities with alternative power supply system • Advocate for introduction of innovative technologies for vaccine transportation

• Absence of legislation on compensation of condemned infected animals	• High	• High	• Advocate for development and enactment of legislation
Fiduciary Risks: • Inadequate funding	• High	• High	• Submit concept notes to relevant institutions/organizations for funding • Incorporate IPC measures in the existing HSS activities
• Delay of procurement	• Medium	• Medium	• Have meetings with relevant authorities to speed up procurement
Operational Risks: • Inadequate personal protective equipment (PPE) and hygienic materials	• Low	• Low	• Secure PPE and hygienic materials at all levels
• Weak inter-sectoral coordination	• Low	• High	• High level advocacy
Programmatic and Performance Risks: • Lack of IPC trained personnel	• Low	• Medium	• Capacity Building
• Weak IPC monitoring mechanism	• Low	• Low	• Institute strict and regular monitoring mechanisms at all levels
Other Risks:	-	-	
Overall Risk Rating for Strategic Objective 3	Medium	Medium	

Risks and Mitigation Measures			
Description of Risk	**Probability (High, Medium, Low)**	**Impact (High, Medium, Low)**	**Mitigation Measures**
Strategic Objective 4: Optimize the use of antimicrobial medicines in human, animal, and plant health.			
Institutional Risks: • Stock out of essential medicines • Risk of getting substandard medicines during procurement	• High • Medium	• High • Medium	• Ensure continuous availability of essential medicines • Ensure presence of reliable procurement system • Establish procurement committee at Ministry level with clear TOR and guidelines • Enhance quality assurance and post-market surveillance system at all levels
Fiduciary Risks: • Budget insufficiency	• High	• High	• Submit concept notes to relevant institutions/organizations for funding • Incorporate some activities in the existing HSS activities
Operational Risks: • Overprescribing of antimicrobials	• High	• High	• Ensure prescribers and dispensers are adherent to Medicines schedule • Introduce periodic review of antibiotics utilization at health facilities

• Infiltration of illegal antimicrobials (Porous border)	• Medium	• High	• Strengthen laboratory and diagnostic setups in health facilities to discourage empiric treatment • Ensure uninterrupted availability of essential medicines • Strengthen inspection capacity at all levels • Establish multi-sectoral coordination mechanism to combat SF products
Programmatic and Performance Risks: • Poor compliance with existing guidelines/ protocols	• High	• High	• Ensure continuous education in collaboration with stakeholders • Ensure regular monitoring and supportive supervision
Other Risks:	-	-	
Overall Risk Rating for Strategic Objective 4	High	High	

10. ANNEXES

Annex 1. Situational Analysis of AMR in Eritrea: Strengths, Weaknesses, Opportunities and Threats (SWOT)

STRENGTHS	WEAKNESSES
• A multi-sectoral committee, a sub-committee of the National Health Security Committee, co-chaired by the MOH and MOA is responsible for the development, implementation, monitoring and evaluation of the NAP. • Progress on the NAP implementation in health, agriculture, marine and the environment is assessed at the bi-annual meetings of the National Health Security Committee. • AMR is partially (albeit not adequately) addressed in Colleges as part of the Pharmacology course. • The MOH published two booklets that aim to improve the rational use of medicines in healthcare providers and the general public with a dedicated chapter on AMR focusing on how to address misuse/overuse of antibiotics. • The MOA celebrates "World Antibiotic Awareness Week" with the aim of increasing awareness on AMR with respect to animal health, plants and the environment. • The National Health Laboratory (NHL) has the capacity to undertake culture and sensitivity testing. • The MOA has a central laboratory that has the capacity to detect AMR pathogens.	• AMR was not a priority in the last decade. • Awareness and educational programs on AMR that target students, health care professionals and the general public are limited. • Health professional graduates are deployed to work without having adequate knowledge of AMR. • There are no in-service training programs on AMR. • Antibiotic seeking behavior among college students and army is common. • Sharing of antibiotics, using leftover medicines, flushing medicines into toilets, disposing leftover or unused medicines with routine garbage appear to be common practice in communities. • AMR awareness amongst farmers is perceived to be very limited. • Farmers use smuggled drugs and pesticides irrespective of their quality at higher than recommended dosages and treatment regimens, thereby exposing the animals and plants to greater amounts of antimicrobials. • There are minimal tools that assist health providers to conduct health education to engender behavioral change in communities.

• MOMR has legislation that deals with procurement, distribution/circulation and use of antimicrobials and the control of maximum residual limits together with a legal notice that obliges all actors to keep records with respect to AMR. • The MOH has conducted a number of small research projects with respect to AMR. • MOLWE undertakes water quality testing and analysis. • The MOH has been actively working on IPC activities in all hospitals by establishing infection prevention committees, equipping hospitals with chlorine producing machines and other materials and empowering health workers to minimize healthcare associated infection (HAI) to make hospitals safe. • The MOH has developed a rural sanitation policy executed by way of the CLTS strategy which deals with wider issues of environmental health including waste, water, housing, food, and, personal and public habits of cleanliness. • Open Defecation Free villages in the country have increased, latrine coverage is about 52.3% and 50% of households have proper waste management and practice hand washing properly. • The MOH provides 12 vaccines in its routine program of vaccinations. • The MOH in collaboration with the MOLWE is conducting various studies with the objective of assessing the sources of environmental contamination in the country. • The MOLWE has been working actively to prevent the spread of infections by conducting laboratory based tests and studies on water wells, sewerages, soils, and vegetables.	• Surveillance and research are not well-established in all three sectors and there is no coordination, integration nor does sharing of data from of what little exist. • There is no national reference laboratory designated for AMR surveillance to accurately confirm diagnoses, develop, maintain and share relevant reference material, or to serve as a resource or coordination point. • The laboratories in the MOH, MOA and MOMR are not accredited and there are minimal/no guidelines, SOPs or other documents. • Laboratory services are fragmented with minimal if any collaboration, communication and data sharing, precluding the 'One Health' approach to surveillance on a national level. • Laboratory services are constrained by minimum/lack of human, infrastructural and operational resources. • There is low awareness of priority human pathogens amongst professionals and the public. • The food and feed production industry is not well developed and regulated in the country. • There is no legislation that indicates the amount of antimicrobials that can be added as raw materials in food and feed producing plants. • There is no quality assurance program related with AMR and antimicrobial use in the process of production. • There is limited capacity, and absence of a well-staffed and equipped quality control laboratory for food and feed. • There is no mechanism to monitor the implementation of MOMR legislation and legal notices.

• Attempt has been made to assess the health impacts on farmers and consumers that arise from using untreated domestic waste water for cultivating vegetables. • MOLWE conducted a study on marine microbial pollution with an objective to ascertain baseline information on the nature, type, quantity, and disposal practices of industrial wastes in the country. • The MOA has addressed the escalating use of pesticides by inter alia conducting inventory, safe-guarding pesticides in all stores and conducting country wide environmental social assessment. • A field school for farmers established in Mendefera, conducted pest survey on citrus fruits, developed legislation for pesticides, developed promotional materials that targeted milk producers and processing plants, slaughter houses and poultry production sites, and conducted various awareness raising activities. • The MOA is addressing anthrax and other infectious diseases in animals by making available veterinary services, restricting livestock movement and providing three types of vaccination services (compulsory, blanket and ring). • The MOH has an organized, dedicated regulatory body that develop necessary guidelines and other tools crucial for regulation and control of drugs (including antimicrobials). • In the MOH, the NMFA has oversight of the quality and efficacy of medicines, medical devices, cosmetics and food, spanning the continuum from their manufacturing, importation, exportation, marketing and use, as well as carrying out post-marketing surveillance. • The Quality Control Laboratory (QCL) is introducing minilab test kits to be used at port entries.	• Research conducted on AMR in the country is very limited. • There is no data repository on AMR-related research on humans, animals, food, plants and environment isolates and as such it is difficult to estimate the national health and economic impact of AMR. • A comprehensive national research agenda that takes into consideration social science and behavioral studies; development of new vaccines, treatments, and diagnostic tools that are relevant for human, animal, and plant health is absent. • There is no AMR research program in the MOA due to absence of research priority areas, lack of multidisciplinary research activities and lack of integrated biological, epidemiological, and economic data that are critical for research related to monitoring the spread of AMR. • A country-wide survey conducted by the Ministry on solid waste management from 2004 to 2007 revealed that only 55% of the solid wastes generated were properly collected and disposed of by the municipalities. • The management of waste generated from agriculture, industries and health facilities is sub-optimal and demands serious attention. • A national chemical profile that aimed to identify the chemicals in use and regulate them properly was prepared in 2012 showed that most of the chemicals are not properly managed, and may be a cause of environmental contaminations. • The pesticide-related challenges faced by the MOA include lack of integrated pest management, illegal importation of pesticides, the use of alternatives which do not have similar function and lack of personal protective equipment.

• In the MOH, the Pharmacy Services Division, and the NMFA are engaged in PSM and regulation to ensure continuous availability of all medicines and medical/surgical devices in all health facilities and that they are stored, distributed properly and used rationally. • The ENLM, serves as a reference for procurement, manufacturing, prescribing and dispensing medicines which are VEN classified. • The MOA has developed a national list of pesticides and a list of medicines for use in animals and plants and has a legal notice issued in 2006 (article No. 114/2006) that aims to regulate the importing, handling, use, storage and disposal of pesticides. • Private veterinary professionals are used in distributing and dispensing of drugs (such as acaroids and antibiotics), in order to increase access to drugs for livestock owners who reside in remote areas.	• The MOA and MOMR do not have regulatory bodies for medicines and pesticides used in veterinary clinics, plant protection and aquatic farming. • There is an absence of legislation that specifically tries to control the maximum residual limit of antibacterial substances, such as sulphonamides and quinolones. • The NMFA does not routinely conduct GMP assessments. • There is no mechanism that facilitates the detection and combating of SF medicines. • The QCL is constrained by the lack of human, infrastructural and operational resources. • The QCL lacks capacity to check the quality of certain medicines, such as fixed-dose combination. • The national list of pesticides and medicines for use in animals and plants has not been reviewed since 2007. • The ESTG does not contain STGs for antimicrobials. • Antibiotics are not properly managed and prescribed in lower level health facilities where other categories of health workers are authorized to prescribe. • Inappropriate use, misuse and overuse has been evidenced in several studies. • Studies on the rational use of medicines indicate increasing antibiotic prescription rates of 44%, 59.9% and 62.5% in 1995, 2015 and 2017 respectively and medicines are commonly prescribed for viral infections like common cold and upper respiratory infections.

OPPORTUNITIES	THREATS
• The MOLWE's activities related to the dissemination of information that promotes sustainable use and conservation of environment since 1997 may be expanded to address AMR. • The MOH's Integrated Disease Surveillance and Response (IDSR) unit, that conducts effective surveillance and response activities of communicable may be leveraged to undertake robust, representative surveillance of AMR. • MOMR collaborates with the College of Marine Science and Technology in detecting new antimicrobials extracted from marine bioactive products from marine sponges, sea cucumber, shrimp shell (chitosan), sea weeds and mangroves in the Red Sea and their efficiency against some bacterial strains. • The CLTS strategy could be expanded to the urban areas. • The MOH in collaboration with the MOLWE is developing the situational analysis and needs assessment (SANA) for the preparation of national plans of joint action, and for the implementation of the Libreville Declaration on Health and Environment. They are further conducting various studies with the objective of assessing the sources of environmental contamination in the country. • The Pharmacy Services Division is drafting guidelines for disposing expired medicines, good storage and warehouse management, good distribution practice and a management manual for hospital pharmacies. • The NMFA in collaboration with the Pharmacy Services Division has taken the initiative of drafting the medicines schedule manual. All antimicrobials are scheduled as POM and such	• The MOA faces the challenges of dispensing of drugs by nonprofessionals, peddling of medicines and pesticides and the illegal purchase of antimicrobials by farmers. • Farmers use smuggled drugs and pesticides irrespective of their quality at higher than recommended dosages, thereby exposing the animals and plants to greater amounts of antimicrobials and greater selection pressure for the development and maintenance of resistance.

classification is expected to play a key role in optimizing the use of antimicrobials. • Medicines take back home messages could be instituted at community pharmacy level. • The increase in the number of young graduates in the fields of veterinary sciences and plant protection.	

Annex 2. Attendees of the Consensus Workshop.

NAME	ORGANIZATION
Abrahalei Kessete	NMFA/ MOH
Abraham Milash	Environmental Health/ MOH
Afeworki Mehreteab	MOA
Alganesh G/Kristos	FAO
Amanuel Negassi	Office of the Minister/ MOA
Andemichael Fessehaye	Sembel Hospital
Andom Gebretnsae	MOMR
Bereket Habte	OCMHS
Berhane Ghebretinsae	Medical Services Department/ MOH
Bereket Mosazeghi	MOLWE
Dawit Tesfageregish	NHL/ MOH
Dr. Alemu Gebreselasie	Berhan Ayni National Referral Hospital
Dr. Amanuel Mehereteb	Mendefera Regional Referral Hospital
Dr. Bereket Gebremicheal	Orotta National Referral Hospital
Dr. Dawit Estifanous	Orotta National Referral Hospital
Dr. Eden Tareke	OCMHS
Dr. Goitom Mebrahtu	MOH
Dr. Henok Tsehaye	Assab Hospital
Dr. Luul BanteYerga	Halibet National Referral Hospital
Dr. Mohamud El fetah	OCMHS
Dr. Solomun Tsegay	Halibet National Referral Hospital
Dr. Yemane Seyum	OCMHS
Dr. Yishak Gebrekidan	Eritrean Institute of technology
Dr. Yohannes Geberat	WHO
Dr. Yonatan Hagos	Orotta National Referral Hospital
Dr. Yonatan Tesfay	MOH
Efrem Gebremeskel	NAPHL/ MOA
Efrem Keflemariam	MOLWE

Elias Teages	OCMHS
Estifanous Tsehaye	Pharmacy Service/ MOH
Gilay Kahsai	IPC/ MOH
Habteab Goitom	Hamelemalo Agricultural College
Iyassu Bahta	NMFA/ MOH
Kahsay Negash	MOA
Michael Ghirmay	NMFA/ MOH
Micheal Tadele	NMFA/MOH
Mikias Tekue	Pharmacy Service/ MOH
Mulugeta Alemu	Pharmacy Service/ MOH
Mulugeta Russom	NMFA/ MOH
Natnael Araya	NMFA/ MOH
Nexerab Gebreluul	NHL/ MOH
Regbe Samuel	MOH
Saleh MoHamed	NHL
Sami Mahmoud	MOMR
Seble Haile	Eritrean Institute of Technology
Semere Gebregiorgis	UNICEF
Seyum Teame	United Nations Population Fund
Simon Rezene	NMFA/ MOH
Sirak Abraham	Pharmacy Service/ MOH
Solyana Ngusbrhan	WHO
Tekelhaymanot Weldeselasie	OCMHS
Tesfaldet Weldeab	MOH
Tewolde Yohannes	Policy Planning/ MOH
Yemane Halie	MOH
Yergealem Mahari	MOH
Yohanna Negassi	MOMR
Yohannes Abraham	Pharmecor
Zekarias Negru	NMFA/ MOH