

Draft

One Health

**STRATEGY for the PREVENTION and CONTAINMENT of
ANTIMICROBIAL RESISTANCE for ETHIOPIA**

*to address livestock production, aquaculture & fisheries, food, agriculture and the
environment*

***Third* Edition, 2015 to 2020**

Updated and Revised on November 2017

Addis Ababa, Ethiopia

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ACKNOWLEDGMENTS

FOREWORD

ABBREVIATIONS AND ACRONYMS

AMR	antimicrobial resistance
<i>AMs</i>	<i>Antimicrobials</i>
<i>AMU</i>	<i>Antimicrobials use</i>
<i>ASF</i>	<i>animal source food</i>
<i>AU-IBAR</i>	<i>Africa Union-Inter Africa Bureau for Animal Resources</i>
BCC	behavior change communication
C&S	culture and sensitivity
FMHACA	Food, Medicines, Healthcare Administration and Control Authority
<i>GAP</i>	<i>Global Action Plan</i>
HIV	human immunodeficiency virus
IPC	infection prevention and control
KABP	<i>Knowledge Attitude Behaviour and Practices</i>
<i>MRL</i>	<i>Minimum requirement level</i>
MDGs	Millennium Development Goals
<i>MDR</i>	<i>Multi drug resistant</i>
MSH	Management Sciences for Health
NACARC	National Advisory Committee on Antimicrobial Resistance Prevention and Containment
<i>OIE</i>	<i>World Organization for Animal Health</i>
<i>PNEC</i>	<i>Predicted no effect environmental concentrations</i>
<i>PPP</i>	<i>Public-Private Partnership</i>
<i>SBCC</i>	<i>Social Behavioral Change Communication</i>
<i>SDGs</i>	<i>Sustainable Development Goals</i>
SIAPS	Systems for Improved Access to Pharmaceuticals and Services
<i>SOPs</i>	<i>Standard Operating Procedures</i>
STG	standard treatment guideline
TB	Tuberculosis
<i>UNGA</i>	<i>United National General Assembly</i>
USAID	United States Agency for International Development
<i>VMF</i>	<i>Veterinary medicines formulary</i>
<i>VSTGs</i>	<i>Veterinary standard treatment guideline</i>
WHA	World Health Assembly
WHO	World Health Organization

VISION AND SCOPE

Vision

The vision is a society where antimicrobials are recognized and managed as a valuable and shared resource, maintaining their efficacy so that infections in humans, animals *and plants* remain treatable, **the environment safe from antimicrobials residues** and communities continue to benefit from the advances that antimicrobials enable.

Scope

This strategy includes effective antimicrobial resistance (AMR) prevention and containment of the ever-increasing range of infectious threats caused by bacteria, parasites, viruses, and fungi in humans, animals, *food*, agriculture, and the environment. The multiple stakeholders across sectors and the whole of society will be coordinated for the prevention and containment of AMR.

INTRODUCTION

Background

During the past seven decades, antimicrobial medicines have saved millions of lives, substantially reduced the burden of diseases that were previously widespread, improved the quality of life, and helped increase life expectancy. However, the emergence and reemergence of antimicrobials resistance (AMR) *has made it difficult if not impossible this to happen. And AMR has been globally recognized as an emerging threat to public health and economic threat as well as an issue of food safety, nutrition security, livelihood and achievement of SDGs. AMR is a truly One Health issue that interconnects the health of humans, animals, plants and the environment that needs be addressed through cross-sector collaboration (CSE, <http://cseindia.org>).* The emergence and spread of AMR in several microorganisms has rendered the management of many infectious diseases *in humans, animals and plants* difficult. The development of resistance to antimicrobials commonly used to treat malaria, TB, HIV, and others common pathogens *in public health and in terrestrial and aquatic animals and plants* is of particular *concern* and is an impediment in achieving Sustainable Development Goals (SDGs) and may even *reverse the hard Millennium Development Goals (MDGs).*

AMR has been one of the top priority global agenda. These can be seen from the speeches, initiatives, and guidance to harmonize the efforts and coordination of the global repose in the fight against AMR. The following are some of them:

Director General of WHO, Dr. Margaret Chan, May 18, 2015, 68th World Health Assembly (WHA) opening speech) "... Drugs that were once lifesavers are now worthless. Hospitals have become hotbeds for the transmission of highly resistant superbugs, increasing the risk that hospitals kill rather than heal. AMR is not a future threat looming on the horizon. It is here, right now, and the consequences are devastating." (Dr. Margaret Chan, Director General of WHO, June 25, 2014, at the Ministerial Conference on AMR). "... more and more first- and second-line antimicrobials failed ... post-antibiotic era in which common infections will once again kill..."¹

The world bank group study on the impacts of AMR "...Without AMR containment, the SDGs for 2030, such as ending poverty, ending hunger, ensuring healthy lives, reducing inequality, and revitalizing global partnerships are unlikely to be achieved ... Progress in containing AMR will be facilitated and can be sustained only when veterinary and human public health systems perform to acceptable standards. Investing in AMR containment will increase the probability that an economic and public health catastrophe will be avoided... AMR Containment benefits 4-13 times more than the global investment cost..." (World Bank Group March 2017).

Secretary General, United Nations, H.E., Ban Ki-moon speech during the United Nations General Assembly (UNGA) Sep 2016 "... a fundamental, long-term threat to human health, sustainable food production and developmentThese trends are undermining hard-won achievements under the MDGs, including against HIV/AIDS, TB, malaria and the survival of mothers and children. If we fail to address this problem

¹ <http://www.who.int/dg/speeches/2015/68th-wha/en/>

quickly and comprehensively, AMR will make providing high quality universal health coverage more difficult, if not impossible.”²

Director General of Food and Agricultural Organization of the United Nations (FAO-UN), José Graziano da Silva speech during the UNGA 22 Sep 2016) “... FAO welcomes the Political Declaration on Antimicrobial Resistance ... It calls for the involvement of public health and veterinary authorities, the food and agriculture sector, financial planners, environmental specialists, and consumers... the development of evidence-based ways to prevent and mitigate antimicrobial resistance, as well as to promote the prudent use of antibiotics...”³

AMR is a natural biological phenomenon that can be amplified or accelerated by actions and inactions of human practices and a variety of other factors. The use of an antimicrobial for any infection, real or feared, in any dose and over any time period, *and their use for both therapeutic and non-therapeutic purposes* forces microbes to either adapt or die in a phenomenon known as “selective pressure.” The microbes that adapt and survive carry genes for resistance, which can be passed on. When antimicrobials are used incorrectly, such as for too-short a time, at too-low a dose, or for the wrong disease; the likelihood that bacteria and other microbes will adapt and replicate rather than be killed is greatly enhanced. Much evidence supports the view that the total consumption of antimicrobials *both in humans and animals, and the residues from their use in food and pharmaceutical manufacturing waste and other effluents to the environment and ecology are* the critical factors in selecting resistance. Paradoxically, underuse through lack of access, inadequate dosing, poor adherence, and substandard antimicrobials may play as important a role as overuse. The emergence of resistance is a result of use, overuse, and misuse in humans, animals, and plants *and release to* the environment.

The global encouraging actions and commitments and momentum in the fight against AMR has increased since the adoption of the global action plan (GAP), tripartite agreement among WHO-FAO-OIE⁴ and political declaration⁵ of the United Nations General Assembly (UNGA) in September 2016. But these have to be supported with the development of national strategies and action plans and translated into actions by countries.

In Ethiopia, there are indications of misuse and *over use* of antimicrobials by health care providers, unskilled practitioners, and animal husbandry and *medicines drug* users. These, coupled with the rapid spread of resistant microbes and inadequate surveillance *in their monitoring*, have exacerbated the problem.

The prevention and containment of AMR has a common approach and requires integrated and well-coordinated efforts at the global, national, institutional, and individual levels. AMR is a

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<http://webtv.un.org/watch/ban-ki-moon-un-secretary-general-opening-remarks-at-high-level-meeting-on-antimicrobial-resistance/5135412517001>

³ <http://www.fao.org/about/who-we-are/director-gen/faodg-statements/detail/en/c/435414/>

⁴ http://www.who.int/foodsafety/zoonoses/final_concept_note_Hanoi.pdf?ua=1

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http://www.un.org/pga/71/wp-content/uploads/sites/40/2016/09/DGACM_GAEAD_ESCAB-AMR-Draft-Political-Declaration-1616108E.pdf

biological, behavioral, technical, economic, regulatory, and educational problem and requires a comprehensive response strategy developed on the basis of evidence.

As AMR is a global and cross-border issue, the World Health Organization (WHO) published its first Global Strategy for Containment of Antimicrobial Resistance in 2001. This key document provided an operational framework and a comprehensive set of AMR containment-related interventions that reflect AMR's multi-factorial and *multisector* nature. The 68th World Health Assembly (WHA) passed a resolution in May 2015⁶ on the global action plan to contain AMR with five strategic objectives that member states can adapt and use. *In addition, The Food and Agricultural Organization (FAO) of the United Nations (UN) during its 39th conference in June 2015⁷ passed a similar resolution in support of WHO's global action plan and developed FAO action plan on AMR in support of food and agriculture sectors and minimize the impacts of AMR (FAO 2016). A similar effort has been done by World Organization for Animal Health (OIE 2016).*

Some countries have also developed and revised their AMR containment strategies. Accordingly, relevant documents have been reviewed and used in *this third* revision of the STRATEGY for the PREVENTION and CONTAINMENT of ANTIMICROBIAL RESISTANCE for ETHIOPI.

The five strategic objectives *of the strategy* are:

- Raise awareness and understanding and improve education on antimicrobial use, resistance prevention, and containment through effective communication and training.
- Strengthen the knowledge and evidence on antimicrobial use and resistance through one-health surveillance and research.
- Improve infection prevention and contain the spread of resistant microorganisms across human and animal communities and health care settings through individual and environmental sanitation, hygiene, and infection prevention measures.
- Optimize the use of antimicrobials in human and animal health through effective stewardship practices.
- Strengthen and establish national alliances and partnerships, management and governance arrangements, and resource mobilizations for the prevention and containment of AMR at all levels.

Situational Analysis of Antimicrobials Use and Resistance in Ethiopia

The 2009 national AMR baseline situation assessment (DACA 2009) documented the review of 10,000 culture and sensitivity (C&S) tests from across the country over a five-year period; about one-third of the tests contained one or more microorganisms. The assessment also documented

⁶ http://apps.who.int/gb/ebwha/pdf_files/WHA68/A68_19-en.pdf

⁷ <http://www.fao.org/3/a-mr246e.pdf>

that most microorganisms (bacteria) that are commonly involved in causing infections in human beings and animals showed a considerable degree of resistance to commonly used first-line antimicrobials (antibacterials) over the five-year period. Multiple AMR organisms were commonly identified.

The AMR baseline survey (DACA 2009) used 10 different tools to look into the curriculum of health professionals; reviewed research; assessed the knowledge, attitudes, and practices of health care providers and clients; and looked into service records. Following identification of gaps and targets, the national strategy for AMR prevention and containment was developed (EFMHACA 2011), followed by a national plan of action that has cascaded to stakeholder institutions and interventions targeted at the identified gaps. This has helped streamline subsequent interventions.

There are diseases that are transmitted from animals to humans and vice versa. Humans acquire infection from animals during husbandry, health service delivery, leather manufacturing, food processing, and vaccine production; laboratories, from zoo keeping; and from consumption of foods of animal origin (milk and meat from cattle, sheep, goats, poultry, pigs, and fish) and eggs. In zoonosis, susceptible and resistant microorganisms are transmitted from animals to man and sometimes from man to animals. Antimicrobials used in both humans and animals are similar and can be overprescribed for therapeutic, prophylactic purposes and as feed additives. The emergence and prevalence of *Salmonella*, *S. aureus*, and *E. coli* with multiple resistances in food animals can seriously compromise in public health.

Review of the course content at health training institutes (for both humans and animals) has shown that some improvement in education has occurred, including much more emphasis on the local context of antimicrobial use, resistance, and containment; *the need for counselling of patients and animal owners* on and adherence to treatment with antimicrobials; adherence to treatment guidelines to prevent and contain AMR; and prophylaxis use of *antimicrobials*. However, areas still lacking include rational prescribing and dispensing, standard treatment guidelines (STGs), principles and concepts of choosing antimicrobials and essential medicines (these are covered adequately in medicine and pharmacy classes); theory and practice in microbiology courses (less time is allowed); and key microbial resistance, nosocomial infections, and AMR mechanisms and containment. *Moreover, the findings of a recent curriculum mapping and competence evaluation report of veterinary training conducted by the Ohio State University and University of Gondar revealed that AMR and Drug Residue are not well covered in the current harmonised curriculum of Veterinary Education though briefly mentioned in both Veterinary Pharmacology & Toxicology and Veterinary Public Health Courses (UOG and OSU 2017. Curriculum Mapping and Competency Evaluation Report).*

Average availability of key antimicrobials in health facilities was 73%. Availability of treatment guidelines in health facilities was 61%. Medicines use education was given in only 27% of health facilities, but no education on the proper use of antimicrobials was given to clients in the health facilities.

Although the level and training type differs in aggregate, prescribers' knowledge of antimicrobials was, in certain categories, seriously compounded with the often empirical practices used during treatment. They had also reported that certain microorganisms did not respond to first-line antimicrobials.

Even if there was some awareness of nosocomial infections, little is done by facilities to prevent and contain it. In addition, the availability and utilization of C&S tests and awareness of the factors contributing to AMR and containment strategies was low, and key infection prevention supplies and materials were not readily available.

Clients' knowledge of prescribed antimicrobials, including routes, dosages, frequency of administration, duration of use, and the importance of continuing treatment even if they feel better, were less than the standard. Clients also believe that antimicrobials are used for illnesses like during watery diarrhoea and the common cold. Moreover, it was revealed that self-medication with antimicrobials was common. The sources of information for their self-medication were the pharmacy, leftover antimicrobials at home, and friends and relatives.

Antimicrobial prophylaxis was used in the majority of surgical procedures, including clean surgical procedures and in more doses and duration than is recommended. A number of wide spectrum and combination antimicrobials and those with a potential resistance and toxicity problems were also used.

Prescribing antimicrobials to inpatients was widespread. More than two-thirds had 1 or more antimicrobials prescribed with a maximum of 6 (with an average of 1.5). Average duration of stay in a hospital for medical inpatients with antimicrobials prescribed was 7.4 days. Rational prescribing as measured by the extent of adherence to the Ethiopian STG 2004 was strikingly low. For example, the antimicrobials chosen and the duration of therapy for pneumonia conformed with the STG was only 20%, meningitis 33%, typhoid 25%, urinary tract infection about 20%, and relapsing fever 14.8% only.

Reviews of the outpatient prescription paper records showed that 23.0% of health facilities had not used standard prescription paper, often with incomplete information as regards to the date of prescription, diagnosis, and prescriber's details. The outpatient prescriptions contained one or more antimicrobials in 62% of patient encounters.

There has been evidences that food animals production, the food chain, and potentially from the environment to be significant contributors of AMR. There has been continued interested and focus on ensuring the health of animals and concern and implications to public health. At the same time there are best practices and lessons in the minimization of these too. Some countries have avoided or voluntarily phase-out antimicrobials growth promoters (AGPs) in food animals' production supported with research and evidence. Even some countries are also banning prophylactic use of antimicrobials; all antimicrobials to be used through veterinarians' prescriptions only; and antimicrobials to be used to individual sick animals and not to groups for non-therapeutic purposes. There are also experiences in monitoring of consumption of antimicrobials in animals.

Antimicrobials residues in food and the environment are also sources of selection pressure for AMR. It is also essential to see the environmental linkages of AMR such as with healthcare settings, animal farms waste, slaughter houses, pharmaceutical manufacturing and research waste, and disposal of unfit for use antimicrobials which may lead to high concentration of the antimicrobials in the environment leading to selection pressure.

Attention should be paid to strengthen veterinary services; increase awareness and attitudes of veterinarians and farms on the prudent use and stewardship of antimicrobials, on biosecurity, good farming practices, and rearing healthy animals, use of vaccinations, use of alternatives to antimicrobials; raising awareness of animal food consumers to demand antimicrobials-free and proper label of animal source food; and setting maximum residue limits (MRLs). In general responsible use of antimicrobials in food animals, surveillance on antimicrobials use, residues and resistance in the food and environment to prevent and contain AMR (Jim O'Neil et al 2015, <http://cseindia.org>).

Rationale for Revision of the Strategy

The 2009 AMR baseline survey helped identify gaps and target interventions which were used as input to develop the first National Strategic Framework for the Prevention and Containment of Antimicrobials Resistance (EFMHACA 2011), which has been used for five years. These documents have helped to implement multifaceted interventions to prevent and contain AMR. Some of the results are described in boxes in this strategy.

The revised health policy and the 2015-2020 Health Sector Transformation Plan has drawn attention to the prevention and containment of AMR. However, the growing public health and economic threats and the global nature of AMR have necessitated the updating and revision of the 2011 strategic framework. The review process has involved the National Advisory Committee on Antimicrobial Resistance Prevention and Containment (NACARC) members and other multiple stakeholders' institutions. This strategy contained here is formulated to have five inter-related and inter-dependent objectives which will harness efforts in the fight against AMR.

Despite the Ethiopian Government's commitment and efforts to prevent and contain AMR, the challenge continues to escalate at the national and global levels, leaving limited choices to prevent and control not only infectious diseases, but also manage some non-communicable and chronic diseases and procedures, such as organ transplants, cancer treatment, rheumatoid arthritis, dialysis, and surgery. AMR also may threaten hard-won health development goals and risk the economy. Success in the prevention and containment of AMR necessitates the involvement of public and private bodies to coordinate their efforts in an integrated manner in human and animal health and the environment.

GUIDING PRINCIPLES

These guiding principles describe the role of all stakeholders to follow a common approach that requires integrated and well-coordinated efforts at the national, institutional, and individual levels and that links with regional and global efforts. The principles, based on the approach of the 68th WHA, are as follows:

- Whole-of-society engagement, including a one-health approach. AMR affects everybody, regardless of where they live, their health, economic circumstances, lifestyle, or behavior. It will affect sectors beyond human health, such as animal health, agriculture, food security, environment, and economic development. Therefore, everybody—in all sectors and disciplines—should strive to preserve the effectiveness of antimicrobial medicines.
- Prevention first. Every infection prevented is one that needs no treatment. Prevention of infection can be cost-effective and implemented in all settings and sectors. This can slow the development and contain the spread of AMR infections.
- Ensure access and improve rational use of antimicrobials and infection prevention supplies.
- Understand the emergence and spread of AMR.
- Invest resources that will provide a return over time. Resources are required for the prevention of infection, surveillance, stewardship, operations and interventions research, and capacity building in the laboratory, human resources and systems, regulatory areas, and education and training.
- Institutionalize ownership. The core principle of stakeholders' and health institutions' ownership is that it empowers them to manage the AMR issue and problems that are specific to their institutions and enable them to take actions to combat AMR.
- Information sharing and networking to establish and strengthen global, national, and regional platforms to facilitate information sharing and networking against AMR.

The one-health approach and one-health response are coordinated, collaborative, multidisciplinary, and cross-sectoral actions to develop strategies for human, animal and plant health and the environment, which are inextricably linked. Synergistic efforts of all the sectors involved are required.

GOAL AND STRATEGIC OBJECTIVES

Goal

The goal is to prevent, slow down, and contain the spread of AMR through the continuous availability of safe, effective, and quality-assured antimicrobials and their effective use thereof. This can only be achieved through the collaborative actions among partners in human health, *animal health, the environment*, agriculture, the food industry, teaching and research institutes, civil societies and associations, the pharmaceutical industry, and global stakeholders to synergize efforts and resources.

Strategic Objectives

Strategic Objective One

Raise awareness and understanding and improve education on antimicrobial use, resistance prevention, and containment through effective communication and training.

Strategic Objective Two

Strengthen the knowledge and evidence on antimicrobial use and resistance through one-health surveillance and research.

Strategic Objective Three

Improve infection prevention and contain the spread of resistant microorganisms across human and animal communities and health care settings through individual and environmental sanitation, hygiene, and infection prevention measures.

Strategic Objective Four

Optimize the use of antimicrobials in human and animal health through effective stewardship practices.

Strategic Objective Five

Strengthen and establish national alliances and partnerships, management and governance arrangements, and resource mobilizations for the prevention and containment of AMR at all levels.

STRATEGIC OBJECTIVE ONE

Raise awareness and understanding and improve education on antimicrobial use, resistance prevention, and containment through effective communication, education, and training.

Education and empowerment of the whole society on antimicrobial use and resistance containment are needed to alleviate the standard practices (boxes below) observed in the use of antimicrobials. Pre- and in-service education of health (*human, animal, plant and environment*) professionals and continuing professional development are also focus areas. Mass media education and empowerment of the public and the whole society on antimicrobial use and resistance has been provided. However, there are still gaps in addressing the threats AMR has posed and continued scale-up of interventions needed to prevent and contain it. Education and empowerment still remains a key strategy to prevent and contain AMR.

Clients frequently believe that antibiotics will help them recover from all respiratory tract infections faster, although the most common pathogens are viral. And a significant percentage of clients did not finish their prescribed antibiotics or kept them for later use, all practices that encourage AMR. Clients also expect antibiotics for self-limiting infections (DACA 2009). Evidence on the benefits of educating clients about unnecessary antibiotic use is available. There have been efforts to increase awareness of the society on AMR prevention and containment through mass media (Tenaw A.2015) and education of clients at health-facility waiting areas.

Number of Antimicrobials and Medicine Use Broadcasts by Year

Priority Actions

Improve Awareness and Understanding, Education, and Empowerment of Clients and the Community

- Promote strong and sustainable whole-of-society engagement, awareness raising, education, and empowerment about antimicrobial use and resistance *prevention and containment in human, animal and plant health, and environmental practices* through effective use of the media
- Advocate AMR as a national and global priority across pertinent government ministries *and institutions to mainstream AMR prevention and containment*
- Promote and support the establishment of a one-health coalition to combat AMR
- Incorporate *personal, public and food* hygiene *and* sanitation, *good farming and environment control practices*, infection prevention, *and* antimicrobial use and resistance *for both human, animal and plant health* into school curricula to promote better understanding and awareness
- Educate clients and the public to not *use non-prescribed antimicrobials to animals and* self-medicate, share, discontinue, or hoard antimicrobials and to not demand them from health care providers for self-limiting illnesses
- *Encourage* the media to accurately report relevant information and reinforce key messages about antimicrobial use and resistance *for both human and animal health practice*
- *Conduct community survey to assess KABP (Knowledge, attitude and behavioral practice) in targeted audiences*
- *Develop an evidence based national and regional communication strategy*
- Support the development *and dissemination* of core *Information Education Communication (IEC) and social, behavioral communication (SBCC) materials on AMU, AMR, and AMR prevention and containment to different audience groups, appropriate channels, materials and key messages*
- Increase public engagement to promote key messages about antimicrobial use *in both human and animal health practices through one health approach.*
- Promote open public discussion and raise awareness about antimicrobials and the ways to limit their use for low-risk and self-limiting infections to behavior change *in the society*
- Ensure proper disposal of unfit-for-use antimicrobials *and other hazardous wastes* to protect the environment
- *Improve the awareness of the society to use legal source and not to use illegal source antimicrobials*

- *Targeted education of farmers on AMR and agro-ecological alternative farming practices*
- *Inform the public about and regulate the occurrence of antimicrobial residues above the minimum requirement level (MRL) in animal source food (ASF) and the consequence health hazards imposed through their use.*

Support Education and Training of Human, Animal, *Plant and environmental* Health Care Professionals *AMs, AMU, AMR, and AMR prevention and containment*

- Support the incorporation and revision of *curricula or course content* for undergraduate and postgraduate professionals (human and animal *health, agriculture and environmental*) *focused on AMs, AMU, AMR, and AMR prevention and containment*
- Encourage AMR awareness and education on responsible prescribing, dispensing, use, and administration *for human, animal and plant health* practices
- Strengthen effective prevention, management, and control of infection in undergraduate and postgraduate curricula for human *medicine, nursing, pharmacy, dentistry, veterinary, feed/food, nutrition, plant, and environment health* professionals courses
- Facilitate the development of sector-specific prescribing guidelines and promote responsible- use practices, including effective dissemination of guidance
- Support *human and animal* health professionals in reinforcing adherence counseling and key messages and in providing resources for informed decision-making during patient counseling on AMR prevention and containment
- *Ensure the implementation of continuous* professional education and development programs for human and animal health care, *feed and nutrition* professionals on antimicrobials and AMR
- Ensure that antimicrobial stewardship competencies are included in professional curricula and continuing professional development.

The AMR baseline survey has shown that there are gaps in training and research of public health importance. Instructors of microbiology, pharmacology, and pharmacotherapy participated during the baseline survey, strategy, and plan of action preparation. They were also involved in the training of trainers programs and encouraged to review the course content and time allocation for AMR containment in their respective courses. Some of the faculties have made significant strides to include content and allocate time to AMR prevention and containment.

STRATEGIC OBJECTIVE TWO

Strengthen the knowledge and evidence on antimicrobial use and resistance through one-health surveillance and research.

Surveillance (*AMU, AMR, AMs residues and PMS*) and research are essential in guiding management of infectious diseases and updating infection control policies and practices, antimicrobial use, medicines lists, and STGs. It is also critical to provide early warning of emerging and reemerging infectious diseases, monitoring changing patterns of resistance, and targeting and evaluating AMR prevention and containment measures. Inadequate surveillance and research means that resistance prevalence and trends are not known and that baseline data for evaluating potential interventions are unavailable.

The antimicrobial use, resistance, and containment baseline survey (DACA 2009) showed that empiric treatment with antimicrobials is widely practiced. Therefore, establishing and strengthening microbiology laboratories, encouraging microorganism culture and susceptibility testing, analyzing and periodic reporting, and sharing with health care providers and others are important. Standardizing methods and procedures for surveillance of antimicrobial use and AMR and ensuring data quality should also be given emphasis. Therefore, an effective network that generates and collates data on use, resistance, and use/ consumption of antimicrobial medicines needs to be established or strengthened. There are experiences in the collection, analysis, interpretation, and use of such data in Ethiopia.

Priority Actions

Support Surveillance of AMR Microorganisms

- Establish/strengthen national, regional, and health facilities' surveillance systems to detect and report AMR and disseminate information to facilitate decision making on diagnoses and treatments in public health, veterinary practice, and food laboratories
- *Establish surveillance systems of AMR microorganism in humans, animals, plants, feed and environment (including aquatic, manure and waste)*
- Ensure the establishment of networks to develop surveillance linkages, testing methods, and data sharing between human and veterinary sectors at national and regional levels
- *Collate/channel research outputs, reports and case studies on AMR from universities and other research institutes to support the surveillance system (establish multi-institutional collaboration) and informed policy and decision making*
- Support Culture and Sensitivity tests on targeted microorganisms

- Support the quality assurance and standardization of routine antimicrobial testing and interpretation of results to improve diagnoses and treatment of infections
- Support and conduct population-based, real-time surveillance to monitor AMR patterns to demonstrate the extent of the problem in both human and animal health
- *Maintain a national data base on AMR micro-organisms and genes*
- Disseminate data to users, national and regional focal points, and stakeholders
- Encourage health care providers to utilize antimicrobial sensitivity test *results* and data in humans and animals health
- Extend alerts about new and emerging antibiotic resistance issues to a wide range of professionals
- Use the generated information to monitor trends, as an early warning system, and to determine risk factors and drivers of resistance
- Assess the magnitude of AMR microorganisms and infectious disease burden through networks of laboratories equipped with the capacity to perform quality assured antimicrobial susceptibility testing and estimate the impacts on public health and the economy
- Use the data generated to compare outcomes of interventions
- *Encourage and support surveillance, monitoring and regulation of the abuse and indiscriminate use of AMs in livestock and poultry farms as growth promoter and prophylaxis.*

Support Surveillance of Antimicrobial Use

- Support accessibility *and affordability* of the right antimicrobials *for the target species*
- *Regularly conduct AMU, AMs residues, and Post Marketing Surveillance of antimicrobials*
- *Encourage to develop improved legislation governing the manufacturer, market authorization, importation, distribution and use of antimicrobials*
- *Develop guidelines and promote good practices in the use of antibiotic (limit prophylactic antibiotic use)*
- Monitor *the* prescribing, dispensing, client/community use *practices and behaviors*, and consumption patterns, *why antimicrobials are being used and misused across sectors*

- Support the assessment of non-therapeutic use of antimicrobials in veterinary and agriculture settings
- Support the identification of factors that influence prescribing, dispensing, and use by clients
- Strengthen the collection, consolidation, and publication of antimicrobials use to disseminate data and information to users, national and regional focal points, and stakeholders to facilitate decision making
- Support a series of population-based, real-time surveillance systems to monitor antimicrobial use to demonstrate the extent of the problem in both human and animal health
- Support studies on behavioral aspects about self-medication and adherence, and develop interventions to bring about behavior change
- Strengthen *clinical trial*, the premarket testing and post-marketing quality surveillance of antimicrobials and infection prevention supplies
- *Establish institutional ethical review committee which can support the surveillance on AMU*
- Monitor and evaluate the impact of pharmaceutical promotion on antimicrobial use
- Support generation of evidence in the promotion of antimicrobial use and containment of resistance

Establish or Strengthen Capacity of National, Regional, and Health Facility Public and Animal Health Laboratories

- Support standardization of laboratory methodologies and quality assurance techniques and improve availability and reliability of microbiology laboratory facilities and tests
- *Support Laboratory facilities maintenance*
- *Ensure availability of laboratory supplies*
- Support and conduct C&S tests on targeted microorganisms and antimicrobials that will help assess the impact of interventions in humans and animals
- *Introduce AMR rapid diagnostic tests and research methods*
- *Assess, improve and build the capacity of national and regional, health facility public health and animal health laboratory for AMR surveillance and diagnostic testing (sample collection and shipment, biosafety, biosecurity, skill and knowledge, testing)*

- *Strengthen laboratory quality management system; equipment maintenance and calibration system*
- *Prepare a laboratory development plan based on identified gaps (sample collection, transport, submission, processing and confirmatory testing, training, consumables, and equipment)*
- *Review laboratory sample referral standard operating procedures (SOPs) (biosafety, biosecurity, handling, transport, processing and testing)*
- *Establish a national AMR germ bank to preserve circulating isolates of AMR pathogens.*
- *Establish an inter-laboratory resource sharing, networking, and joint planning mechanism*

Support Basic and Operational/Intervention/*Applied* Research

- Identify and prioritize antimicrobial use and resistance research needs
- Encourage research to understand the factors that facilitate development of resistance and transmission pathways between the environment, humans, animals, and the food supply
- Encourage the development of alternative treatments for infections that do not rely on antimicrobials; this has to be complemented with combination therapy and optimal dosing
- Promote research to identify high-risk strains, their resistance mechanisms, and their spread
- Promote the biopharmaceutical incubator consortium to promote innovation for new antimicrobials, vaccines, *diagnostic tool* and therapies development
- *Promote adoption of new diagnostic tools/point of care devices and techniques (Field applicable, rapid test)*
- Support genomic technologies and sequencing that have the potential to improve appropriate, prompt, early, tailored treatment, benefitting patients and conserving antimicrobials
- Explore the possibility of developing an “AMR index” to communicate gaps in antimicrobial effectiveness and help aggregate data on resistance to assess trends over time and across locations
- Support research on the economic impact of AMR and its interventions
- *Support/strengthen work to correlate AMs use and residues monitoring with AMR*
- *Strengthen periodic monitoring of AMR, AMs use and residues*

- *Develop AMR early warning system*
- *Encourage AMR gene preservation for future research/bio-banking (For future vaccine, therapeutic and diagnostic production)*

Support Surveillance of Antimicrobial Residues in food

- *Strengthen the national surveillance systems to detect antimicrobial residues in animals food and feed in locally produces and imports*
- *Strengthen the national surveillance systems to detect antimicrobial residues in human food in locally produces and imports*
- *Support, identify and prioritize research on Antimicrobial residue in food, its impacts and interventions*

Support Surveillance of Antimicrobial Residue in the Environment

- *Monitor antimicrobials effluent and wastes from manufacturing plants, health facilities, individual households, waste from animals, slaughter houses*
- *Establish standards for waste discharge from manufacturing and food processing plants, human and animal health care settings*
- *Initiate or support establishment of advanced antimicrobials treatments plants with chlorination, ultraviolet radiation, and other advanced technologies*
- *Support establishment of antimicrobials in effluent and waste treatment plants*
- *Initiate/Establish predicted no effect environmental concentrations (PNEC) for resistance selection*

STRATEGIC OBJECTIVE THREE

Improve infection prevention and contain the spread of resistant microorganisms across human and animal communities and health care settings through individual and environmental sanitation, hygiene, and infection prevention measures.

Infection prevention and control (IPC) measures in health facilities and the community reduces the risk of transmission of infections and minimizes the need for and use of antimicrobials. This prevents subsequent emergence of resistant strains. Furthermore, IPC measures contain the spread of resistant microbes once resistance has emerged. These measures include individual and environmental hygiene; promoting vaccination; use of personal protective equipment; maintaining a clean environment; appropriate use of antiseptics and disinfectants; decontamination, cleansing, and sterilization (or high-level disinfection) of instruments; improving safety in risky areas of the health facilities for humans and animals; safe use and disposal of sharps; appropriate waste and *manure and waste disposal management (e.g. poultry droppings) and disposal*; and isolation of patients infected by highly contagious microorganisms, when required; *Disease prevention and control, Good husbandry practices, biosecurity measures*. Partners in many sectors of society and the general public will need to be involved in these efforts.

Infection prevention and patient safety (IPPS) measures have been emphasized in Ethiopia; training manuals for health care providers and managers have been prepared, training on IPPS given, quantities of infection prevention commodities and supplies required per level of care have been listed, and infection prevention IEC/BCC materials developed and put to use. IPPS has also been given high priority by high-level government authorities in the follow-up of referral hospitals in Addis Ababa. However, there remains a lot to be done on IPPS.

Priority Actions

Strengthen Infection Prevention and Control Programs

- Expand IPC systems at national, regional, health facility, and community levels both for humans and animals
- Strengthen vaccination programs in human and animal health to prevent infections
- *Strengthening the quarantine systems not to import AMR micro-organism with exotic animals*
- *Encouraging to develop new vaccines for animals (e.g. clostridial vaccine)*
- Establish/enhance infection prevention standards
- Develop/revise, disseminate/implement, monitor, and evaluate infection prevention guidelines and codes of professional *conduct/practice*; set minimum accreditation standards (e.g., infrastructure of health facilities) and other relevant resources to promote IPC

- *Support the establishment and functionality of the professional councils for proper regulation of the health professionals and profession*
- *Promoting use of rapid diagnostic tools (right drug at the right time)*
- *Establish/ensure use of herd health packages such as disease prevention and control, good husbandry practices, biosecurity measures, and manure and waste disposal management (poultry dropping)*
- Launch IPC need-based education and training programs to target audiences in human and animal health
- Limit the emergence, *re-emergence* and spread of multidrug resistant organisms in humans and animals and *environment* through multi-sectoral and international collaboration
- Encourage dissemination, implementation, and monitoring of best practices
- *Support better use of AMR, AMU, PMS and AMs residue data*
- Ensure the availability and adopt the use of evidence-based IPC practices and tools in human and animal health care settings
- Support initiatives and mobilize adequate human and material resources and supplies for IPC

Strengthen Infection Prevention and Control Practices *in Public Health and Veterinary Health Facilities*

- Establish IPC practices and create an enabling environment
- Develop and avail IPC guidelines to develop relevant standard operating procedures and monitor their implementation
- Standardize and promote the proper use of antiseptics and disinfectants
- Ensure availability and proper use of infection prevention materials and supplies
- Establish/strengthen a functional Infection Prevention and Control Committee in each health facility
- Conduct regular pre-service and in-service trainings on IPC
- Monitor and evaluate all IPC practices in health facilities

- Expand availability and use of diagnostics to improve treatment of AMR infections, enhance infection control, and facilitate outbreak detection and response in health care and community settings
- Encourage timely diagnosis and treatment of drug-resistant microorganisms

Promote Infection Prevention and Control Practices in Communities

- Develop tools for information, education, and communication/behavior change communication (IEC/BCC) on IPC in communities, including schools and public gathering areas
- Conduct need-based *animal and public* health education on IPC and AMR
- Implement, monitor, and evaluate sustainable infection prevention, *animal and public* health/antimicrobial use education
- Promote hygiene, sanitation, and infection prevention
- *Promote prevention of zoonotic diseases*

Strengthen Good Animal Health/Livestock Management Practices

- *Promote biosafety, biosecurity measures and good husbandry practices*
- *Improve awareness and good nutrition as a substitute for the use of antimicrobials*
- *Improve awareness and understanding on keeping cleanliness of the yard minimize stress to minimize use of antimicrobials*
- *Improve vaccination accesses and practices*
- *When antimicrobials are indicated to the animal consider to minimize the impact of use in other animals and in the environment e.g. use of alternative routes of administration than adding in food or drink of animals*
- *Prohibit or discourage use of antimicrobials for growth promotion*
- *Minimize use of antimicrobials for prophylaxis and metaphylaxis*

Strengthen public and animal health Information system

- *Develop diseases outbreak and AMR micro-organism notification systems and practices*
- *Strengthen/Implement prevention and outbreak management*
- *Develop national guideline and SOPs for outbreak investigation and response (case management, infection prevention, environmental issues, field investigation forms)*

- *Develop SOP information management system of effluent and waste management from pharmaceutical and food/feed manufacturing or processing plants, public and animal health facilities, slaughter houses*

STRATEGIC OBJECTIVE FOUR

Optimize the use of antimicrobials in human and animal health through effective stewardship practices.

When microbes are exposed to antimicrobials, susceptible organisms are eradicated while resistant ones persist, passing on their resistant genes to off-spring by replication or to other species through horizontal gene transfer. There is sufficient evidence that the higher the use of antimicrobials, the greater is the resistance to them and vice versa. Countries, regions, or health care facilities with higher antimicrobial use are associated with higher incidence of resistance. Poor infection prevention and control practices; inadequate training and capacity to diagnose and manage infectious diseases; overuse and misuse of antimicrobials; poor prescribing and dispensing practices; demand by uninformed patients and lack of adherence to treatments; substandard medicines and not up-to-date and biased medicine information; poor access to antimicrobials, leading to inadequate dosage regimens; and insufficient duration of therapy are important contributors to AMR. Therefore, judicious use of antimicrobials in human and veterinary settings is an important strategy to reduce the emergence of resistance. Achieving this strategy involves strengthening technical and regulatory requirements and bringing about a change in the behavior of prescribers, dispensers, and clients. Policies and regulations that encourage more appropriate and rational use of antimicrobials are key long-term interventions for the containment of AMR.

There are indications for the existence of high-level antimicrobial use (Andualem 1995, MOH 2003, FMHACA 2006, DACA 2009, and FMHACA 2010). To overcome these practices, there have been many initiatives, such as the establishment of functioning infection prevention, drug and therapeutic, and antimicrobials stewardship committees in health facilities. These multidisciplinary teams are involved in the review of infection prevention practices, medicines use reviews and evaluations, and providing feedback to their respective staffs for improved health outcomes. Exemplary health facilities are engaged in such practices, but they must be scaled up at other facilities. To facilitate these practices, STGs, formularies, and medicine prescribing and dispensing manuals have been put into use.

Medicine Prescribing Indicators in Health Facilities in Ethiopia

Source: Tenaw Andualem 1995, MOH 2003, FMHACA 2006, DACA 2009, FMHACA 2010

Priority Actions

Promote Optimal Prescribing and Dispensing *practices* of Antimicrobials

- Ensure accessibility of essential antimicrobials *to all human and animal* health
- *Ensure the availability and monitor the use of and adherence to evidence-based guidelines and job aids, such as STGs/VSTGs, antimicrobial use policies, lists of essential or formulary medicines, good prescribing and dispensing manuals, and standard prescription forms*
- Ensure and support the availability of evidence-based best approaches for responsible prescribing, dispensing, and administering principles for antimicrobials
- Strengthen or establish **microbiological** diagnostic facilities and conduct regular antimicrobial sensitivity tests *in both human and animal health practices*
- Promote proper prescribing and dispensing practices and minimize empiric treatment of infectious diseases
- Develop and disseminate guidelines for *proper therapeutic, prophylactic use of antimicrobials and avoidance of any use of antimicrobials in feed*
- Design and utilize locally feasible labeling, dispensing, and adherence aids
- Promote sustainable communication among prescribers, dispensers, and other *human and animal* health care providers
- *Establish or strengthen proper functioning of drug and therapeutics and/or antimicrobial stewardship committees*
- Support the development of antimicrobial stewardship working manuals and *standard operating* procedures
- Provide up-to-date and *unbiased scientific medicine information services based on veterinary and human drug promotional guideline* to health providers, clients, and the community
- Assure that information provided by pharmaceutical companies is based on evidence and is in line with the policies and guidelines of the country
- Organize and conduct regular, need-based, pre-service and in-service continuing education and training to prescribers, dispensers, **and** other *animal and human* health care providers *and feed and nutrition professionals*
- Work collaboratively to strengthen the available evidence base to benchmark current levels of resistance and antimicrobial consumption and develop or improve early warning systems

- *Strengthen the capacity of human and veterinary clinic to properly diagnose and treat diseases to minimize antimicrobial resistance.*

Promote Adherence to Treatment and Proper Use by Clients and the Public

- Support empowerment of the public and organizations on appropriate use of antimicrobials, *as they are shared resources*
- *Support and provide simple, targeted information to clients and the public*
- Support the design and the implementation of antimicrobial use and resistance containment education programs to clients and the public
- Empower clients to provide information to and get information from animal and human health care providers *and feed and nutritional professionals about their health, diseases they have had, and their antimicrobial use (prescribed and self-medicated) history*
- Encourage and support antimicrobial use adherence by clients and the public
- Regulate over-the-counter availability of and self-medication *and medication of own animals* with antimicrobial medicines

Clients and the public's empowerment and knowledge about health and disease in general and of the medicines they are using in particular are of vital importance, not only in the prevention of medicine-related problems and AMR, but are also major factors that influence treatment adherence and good health outcomes. Patients who were provided the right information and counseling knew more about their medicines and how to use them. Evaluation of patients' knowledge may be used to educate the clients themselves and providers about problem areas to influence behavior change.

Rational Antimicrobial Use in Animal Health and Food Production

- Ensure access to essential antimicrobials for therapeutic use and vaccines to prevent diseases and minimize the use of antimicrobials
- Work closely with industries involved in *feed manufacturing* and animal husbandry and restrict non-therapeutic use of antimicrobials
- Eliminate the use of human *and animal* health care antimicrobials as growth promoters *in feed and medicated* feed additives in animal *production*.
- Strengthen regulations for the food *and feed* industry, including reviewing standards for animal products *and feed* and setting clear specifications

- *Ensure the availability and monitor the use of and adherence to evidence-based guidelines and job aids, such as STGs/VSTGs, antimicrobial use policies, lists of essential or formulary medicines (E/VMF), good prescribing and dispensing manuals/, and standard prescription forms*
- Ensure and support the availability of evidence-based approaches to adherence for responsible prescribing, dispensing, and administration principles
- Conduct regular pre-service and in-service trainings for practitioners in animal health and production on the proper use of antimicrobials, resistance prevention, and containment
- Prevent over-the-counter availability of and discourage self-medication with antimicrobials
- Conduct regular antimicrobial C&S tests for prescribing and dispensing decisions
- Encourage and Empower those involved in animal husbandry to get information about antimicrobials from veterinary professionals
- Foster antimicrobial stewardship programs in animal health care settings
- Support collaborative work to strengthen the available evidence base, benchmark current levels of resistance and antimicrobial consumption, and improve early warning systems
- Encourage exploration of options for the collection and analysis of veterinary medicine prescription and use data, including local audit information
- Explore the possibility of developing an “AMR index” to communicate gaps in antibiotic effectiveness and help aggregate data on resistance to assess trends over time and across locations.
- Initiate the inclusion of AMR prevention and containment *activities* in the respective plans of stakeholders
- *Establish dedicated AMR regulatory institutionalize entity ??? Can/should we?*
- *Design rapid alert system with risk assessment, risk management, and risk communication system in the regulatory frame work*
- *Develop list of AMs to be restricted to humans and animal use only, phase-out growth promotion, limit use for prophylaxis, have recommended labelling requirements*
- *Support/encourage research, development and promotion of alternative and complementary interventions for MDR infections*
- *Support/encourage auditing of farms, health facilities and health care providers on their use of antimicrobials and incentivize and disincentive for the respective actions.*
- *Ensure AMs, AMU, AMR and AMR prevention and containment focused curriculum or course content on the relevant professionals trainings*
- *Initiate formulation of antimicrobial and feed and nutritional use policy*

Evidence from the field and published reports indicates the irrational use of antimicrobials in livestock production, either for treatment or prevention of animal diseases. Also, published and unpublished reports indicate that microorganisms isolated from animals are resistant to common antimicrobials in use. The Ethiopian Veterinary Drugs and Feed Additives Control Authority has tried to provide information, guidelines, and training on rational use of antimicrobials in agricultural practices and livestock production including product quality and proper use, hoping to strengthen partnerships in

STRATEGIC OBJECTIVE FIVE

Strengthen and establish national alliances and partnerships, management and governance arrangements, and resource mobilizations for the prevention and containment of AMR at all levels.

AMR is a global threat, with limited tools to deal with it. The increasing movements of people, animals, food and other products, and medical tourism have facilitated transmission of resistant microorganisms. Local action alone will not be sufficient to bring about desired change. Concerted and coordinated national and international efforts are needed to bring together various stakeholders to influence opinion, obtain support, mobilize action, harness expertise and resources available in different sectors, and improve governance. These efforts have to be complemented with international partnerships and collaborations. Resistant strains in one part of the globe have to be rapidly detected, diagnosed, and contained. All sectors must collaborate on innovations; enhance stewardship practices; address the threats of AMR, and move the issue of AMR to the political level.

Priority Actions

Strengthen or Establish a National Alliance for the Prevention and Containment of AMR

- Establish a team or focal points at different levels of the health care system for coordinating national activities and sharing information with all stakeholders
- Establish or strengthen a multi-institution and multidisciplinary advisory committee at different levels to advise, advocate, and educate on national efforts and to take assignments in their own institutions
- *Promote public and private partnerships (PPP) in the delivery of health services*
- Develop networks and platforms for regular and formal interactions to facilitate experience and information exchange
- *Encourage and support the active participation of civic societies and professional associations in the AMR prevention and containment activities*

A multidisciplinary and multi-institution NACARC was established to advise, guide, and harness the fight against the challenges of AMR in Ethiopia. The advisory committee has also participated in reviewing the baseline survey and the AMR containment strategy, co-organized symposiums and workshops, and advocated and catalyzed AMR containment in their respective institutions.

Resource Mobilization

- Mobilize or secure adequate resources to implement the strategy for the prevention and containment of AMR in all respective sectors and institutions
- *Support/encourage to generate evidences contributions and returns on investment of AMR containment*
- *Encourage, facilitate, and collaborate in the development of new antimicrobials, vaccines, diagnostics, and novel therapies*

Strengthen National and International Networks and Collaborations

- Support and coordinate national and international activities related to AMR
- Strengthen the capacity to implement effective AMR containment and prevention strategies
- Develop linkages with all stakeholders
- Promote regular and formal interactions
- Encourage development partners in capacity building
- Collaborate with mass media to create awareness and empower the public
- Collaborate with professional associations to enhance information sharing and incorporate AMR as an important element of continuing education

Governance and Partnerships

- Develop a mechanism for international communication of critical events that may signify new resistance trends with global public and animal health implications
- Collaborate in the development and consistent use of international standards for determining resistance, identify evidence-based interventions, adapt these strategies to new settings, and evaluate their effectiveness in the prevention and containment of AMR
- Partner with other nations to promote quality, safety, and efficacy of antimicrobials and strengthen country pharmaceutical supply chains
- Form sustainable coalitions, management, and governance arrangements at all levels to bring together different sectors and stakeholders and own the implementation of this strategy
- Strengthen international collaborations to improve knowledge and understanding and gather information on drivers of AMR

- Strengthen conservation and stewardship of existing antimicrobials
- Demonstrate leadership in building political support for action
- Coordinate regulatory approaches by collaborating with regional and international organizations, such as Africa Union, *AU-IBAR*, *FAO*, WHO and *OIE*, to harmonize international data submission and risk assessment and guidelines related to the licensure and/or approval of antimicrobial products, including vaccines and diagnostics.
- *Adopt/develop evidences and scientific basis for national and international standards relevant to AMR, AMU, and AMs residues*
- *Provide data, information, and evidences for use of alternatives to antimicrobials use and show the health and economic implications of it.*
- *Conduct research on regulatory approaches in AMU in the relevant sectors including food and agriculture*
- *Prohibit or phase-out use of antimicrobials for growth promotion.*
- *Develop a publicly accessible scientific and technical information on AMR, AMU and other data relevant to public health, animal health, food, and agriculture and environment sectors.*
- *Review, revise, and implement relevant legislations and regulations from manufacture up to end use in relation to AMs, AMU, and AMR and AMR Containment*

IMPLEMENTATION, MONITORING, AND EVALUATION

This *third revised and updated One Health* Strategy for the Prevention and Containment of Antimicrobials Resistance in Ethiopia provides direction to guide actions and coordinate efforts across stakeholders *and sectors*. It will be implemented in accordance with the revised detailed *national and institutional* plan of actions and milestones for achieving the strategy's goals and objectives, along with metrics *and methods* for measuring progress. *The detailed implementation* plan provides details of *inputs*, activities *and outputs*, *outcomes and impacts and goals*, *indicators*, responsibilities of stakeholders, time frames, and budgets will follow and will be printed as a separate document. This strategy recognizes the need for a wide range of activities and a wide variety of players to support the prevention and containment of AMR. The strategy also recognizes the need for action by many organizations and individuals. The implementation may address the following issues:

- Obtaining national commitments to prevent and contain AMR
- Establishing a focal point in Ethiopia with the responsibility for coordinating the national alliance for implementation of evidence-based decisions of AMR and IPC programs and activities
- Strengthening the NACARC
- *Strengthening infection prevention and client safety*
- Strengthening antimicrobial stewardship programs
- Developing public IEC/BCC empowerment campaigns or activities and programs
- Establishing a national surveillance with mandatory reporting through efficient and quality laboratory networks and existing surveillance systems
- *Using the surveillance system to feed into the monitoring and evaluation system and determining what resources are required to support it*
- Developing and making available various national standards and guidelines for surveillance and strengthening regulatory support for their implementation
- Organizing continuing education that includes AMR containment and IPC courses for professionals and all health care workers through health-related institutions and professional bodies
- Collating research findings to develop actions
- Collaborating with international agencies for coordinated technical support and sharing current information and resources
- Identifying or consolidating AMR containment indicators
- Pool required data and information in one place to support policy making

- Establishing a strong monitoring and evaluation mechanism
- *Review, assess, and update action plans with stakeholders on a regular basis*
- Reviewing data generated on a regular basis to assess the performance and effects of interventions
- Assessing performance at different levels and organizing review meetings for this purpose as one monitoring mechanism

MEASURES OF SUCCESS

Given the complexity of the AMR threats and the responses, it is essential that every stakeholder is clear about its contribution in combating AMR, both within its own mandate as well as others that have a bearing on activities of other sectors. Ownership of the strategy by all stakeholders is critical to move forward and yield the desired results. This strategic document is important in presenting what needs to be done in Ethiopia to prevent the emergence, re-emergence, and contain the spread of AMR and how Ethiopia fits into regional and global efforts to combat resistance.

The strategy considers the following are some of the measures as potential indicators of success:

- Political *and professional* commitment and strong leadership, governance, and stewardship to support implementation of this strategy
- Strengthened and full commitment of the multi-institutional and multidisciplinary NACARC
- Establishment of a functional taskforce on the one-health approach
- Stakeholders that have developed, revised, and implemented their action plans and contributed to the overall implementation of the strategy
- Functional surveillance that collects, reports, interprets, and monitors changes in antimicrobial use and resistance trends in humans, animals, the food industry, and the environment and that is shared with those involved in these areas; this information should be used to compare the outcomes of interventions with the baseline
- Achievement of desired changes in infection prevention and antimicrobial use practices and behaviors
- Collection of antimicrobial use data by specific categories, such as human health, animal health, and the food industry, and the data is used for decision making
- Collection of data on resistant and re-emerging microorganisms data are generated and disseminated and appropriate actions are taken
- Generation of target indicators of progress and data sources for measuring success
- Regular follow-up and report by high-level government bodies
- Evaluation of the outcomes *and impacts* of the interventions for each strategic objective and generation of evidence for success (or lack of success)
- Use successful *and evidenced based* interventions as a basis for scaling up other interventions

BIBLIOGRAPHY

Andualem T, Kafel Z. Retrospective Drug Use Study Using Prescribing Indicators in 32 Health Facilities, *Eth Pharm J.* 1995. vol. 13

Andualem T. Containing AMR in Ethiopia: What Role do the Media Play? 2015;
<http://siapsprogram.org/2015/06/11/containing-amr-in-ethiopia-what-part-do-the-media-play/>

Andualem T. Outcomes of Mass Media Intervention on Containment of Antimicrobials Resistance in Ethiopia. 2015;
<http://siapsprogram.org/publication/outcomes-of-the-journalists-capacity-building-intervention-in-the-prevention-and-containment-of-antimicrobial-resistance-in-ethiopia-2012-to-2014/>

Australian Government, Department of Health, Department of Agriculture. Responding to the Threat of Antimicrobial Resistance: Australia's First National Antimicrobial Resistance Strategy 2015-2019;
[http://www.health.gov.au/internet/main/publishing.nsf/content/1803C433C71415CACA257C8400121B1F/\\$File/amr-strategy-2015-2019.pdf](http://www.health.gov.au/internet/main/publishing.nsf/content/1803C433C71415CACA257C8400121B1F/$File/amr-strategy-2015-2019.pdf)

Centre for Science and Environment (CSE). Study on antibiotic use in poultry: Global regulatory initiatives and impact, <http://cseindia.org>.

Centers for Disease Control. Antibiotic Resistance Threats in the United States, 2013;
www.cdc.gov/drugresistance/pdf/ar-threats-2013-508.pdf

Dowell SF, Levitt AM. Protecting the Nation's Health in an Era of Globalization: CDC's Global Infectious Disease Strategy. 2002; <http://stacks.cdc.gov/view/cdc/13371>

Drug Administration and Control Authority (DACA), Strengthening Pharmaceutical Systems. Antimicrobial Use, Resistance, and Containment Baseline Survey Syntheses of Findings. August 2009, Addis Ababa, Ethiopia

Food and Agriculture Organization of the United Nations (FAO) 2016. THE FAO ACTION PLAN ON ANTIMICROBIAL RESISTANCE 2016-2020: Supporting the food and agriculture sectors in implementing the Global Action Plan on Antimicrobial Resistance to minimize the impact of antimicrobial resistance

Food, Medicines, Healthcare Administration and Control Authority (FMHACA). Assessment of the Pharmaceutical Sector in Ethiopia. October, 2006, Addis Ababa, Ethiopia

FMHACA. Assessment of the Pharmaceutical Sector in Ethiopia. September 2010, Addis Ababa, Ethiopia

FMHACA. National Strategic Framework for the Prevention and Containment of Antimicrobials Resistance. August 2011

Government of Canada. Antimicrobial Resistance and Use in Canada: A Federal Framework for Action. October 2014;
<http://healthycanadians.gc.ca/alt/pdf/drugs-products-medicaments-produits/buying-using-achat-utilisation/antibiotic-resistance-antibiotique/antimicrobial-framework-cadre-antimicrobiens-eng.pdf>

Jim O'Neil 2015 Antimicrobials in Agriculture and the Environment: Reducing Unnecessary Use and Waste the Review on AMR;

Ministry of Health (MOH). Assessment of the Pharmaceutical Sector in Ethiopia. October 2003, Addis Ababa, Ethiopia

World Organization for Animal Health (OIE) 2016. The OIE Strategy on Antimicrobial Resistance and the Prudent Use of Antimicrobials November 2016

Review on Antimicrobial Resistance (United Kingdom). Antimicrobial Resistance: Tackling a Crisis for the Health and Wealth of Nations, 2014;
http://amr-review.org/sites/default/files/AMR%20Review%20Paper%20-%20Tackling%20a%20crisis%20for%20the%20health%20and%20wealth%20of%20nations_1.pdf

United Kingdom. UK Five-Year Antimicrobial Resistance Strategy: 2013-2018.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/244058/20130902_UK_5_year_AMR_strategy.pdf

University of Gondar and Ohio State University 2017. Curriculum Mapping and Competency Evaluation Report.

The White House. National Strategy for Combating Antibiotic Resistant Bacteria. September 2014; https://www.whitehouse.gov/sites/default/files/docs/carb_national_strategy.pdf

World Economic Forum. Global Risks 2013, Eight Edition;
www3.weforum.org/docs/WEF_GlobalRisks_Report_2013.pdf

World Health Organization (WHO). Antimicrobial Resistance: Global Report on Surveillance. 2014; www.who.int/drugresistance/documents/AMR_report_Web_slide_set.pdf

WHO. Global Action Plan on Antimicrobial Resistance. 2015;
www.who.int/drugresistance/AMR_DRAFT_GAP_1_Oct_2014_for_MS

WHO. Global Strategy for Containment of Antimicrobial Resistance; 2001;
www.who.int/drugresistance/WHO_Global_Strategy_English.pdf

WHO. Regional Strategy on Prevention and Containment of Antimicrobial Resistance, 2010-2015. WHO Regional Office for South-East Asia, 2010;
www.searo.who.int/entity/antimicrobial_resistance/BCT_hlm-407.pdf

WHO. Worldwide Country Situation Analysis: Response to Antimicrobial Resistance. April 2015; www.who.int/drugresistance/documents/situationanalysis/en/

World Bank Group 2017. Final Report DRUG-RESISTANT INFECTIONS: A Threat to Our Economic Future March 2017

ANNEX 1: Consultative Workshop to Update and Revise the One Health Antimicrobials Resistance Prevention and Containment Strategy for Ethiopia *to address livestock production, aquaculture & fisheries, food, agriculture and the environment*

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ANNEX 2: NATIONAL ADVISORY COMMITTEE FOR ANTIMICROBIAL RESISTANCE PREVENTION AND CONTAINMENT

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ANNEX 3: PARTICIPANTS OF THE WORKSHOP TO REVISE THE STRATEGY FOR THE PREVENTION AND CONTAINMENT OF AMR IN ETHIOPIA

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