



THE PHILIPPINE ACTION PLAN TO COMBAT ANTIMICROBIAL RESISTANCE

2019-2023

ONE HEALTH APPROACH





Philippine National Action Plan on Antimicrobial Resistance 2019-2023

**Inter-Agency Committee on Antimicrobial Resistance (ICAMR)
Department of Agriculture
Department of Health
Food and Agriculture Organization
World Health Organization**

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MESSAGE



Antimicrobial resistance (AMR) is a threat to the production and distribution of safe food that is essential for the general well-being of our people and growth of our economy.

This past year, the agriculture sector has made some headway into integrating AMR strategies in making sure that our animals are safe to handle and eat. We have enhanced surveillance mechanisms and have increased awareness campaigns in farms and communities.

In this Philippine National Action Plan on AMR 2019-2023, we hope to collaborate with and learn from our colleagues in other sectors.

This plan envisions stronger governance, surveillance systems, agriculture laboratories, better animal and food production, research, education and advocacy among other strategies.

We call on the support of government officials, local governments, industries, the academe and private partners to achieve the vision and strategies of this Plan.

We can work together to ensure a sustainable and progressive agriculture sector that will fulfill the needs of our people.

To the men and women behind this Philippine National Action Plan on AMR, congratulations for a job well done!

Mabuhay!

WILLIAM D. DAR, Ph.D.
Secretary

*A food-secure and resilient Philippines
with prosperous farmers and fisherfolk*



Message from the Secretary of Health



In recent years, we have seen significant achievements on how the country works to reduce Antimicrobial Resistance. Initiatives such as the antimicrobial stewardship program in hospitals and prescription required for dispensing of antimicrobials have ensured better distribution of antimicrobials across the country.

Antimicrobials are a previous resource for treatment of diseases and save lives. We take the challenge to ensure rational use of antimicrobials, ensure access and boost innovation in health care and the discovery of new drugs. These are essential components to ensure Universal Health Coverage and protect our people from financial risk.

Together with the agriculture sector and many other stakeholders, I am honored to present this Philippine National Action Plan on AMR 2019-2023. Together, we can achieve more towards preventing the spread of AMR, and making sure that what we eat everyday are safe!

[Signed]

Francisco T Duque III, MD, MSc
Secretary
Department of Health

Index of Abbreviations

A.O.	Administrative Order
ADDL	Animal Disease Diagnostic Laboratories
AIHO	Alliance for Improving Health Outcomes
AIVSA	Animal Industry and Veterinary Services Act
AMC	Antimicrobial Medicines Consumption
AMR	Antimicrobial Resistance
AMS	Antimicrobial Stewardship
AMU	Antimicrobial Use
ANSORP	Asian Network for Surveillance of Resistant Pathogens
ARSP	Antimicrobial Resistance Surveillance Program
ASC	Antimicrobial Stewardship Steering committee
ASEAN	Association of Southeast Asian Nations
AST	Antimicrobial Sensitivity Testing
ATLASS	Assessment Tool for Laboratory and Surveillance Systems

BAHA	Barangay Animal Health Aides
BAI	Bureau of Animal Industry
BALA	Barangay Animal Livestock Aides
BFAR	Bureau of Fisheries and Aquatic Resources
BHFS	Bureau of Health Facilities and Services
CHED	Commission on Higher Education
CHD	Centers for Health Development
CLSI	Clinical and Laboratory Standards Institute
CPE	Continuing Professional Education
DA	Department of Agriculture
DENR	Department of Environment and Natural Resources
DepEd	Department of Education
DILG	Department of Interior and Local Government
DOLE	Department of Labor and Employment
DOST	Department of Science and Technology

DPCB	Disease Prevention and Control Bureau
DTI	Department of Trade & Industry
EB	Epidemiology Bureau
FAO	Food and Agriculture Organization of the United Nations
FDA	Food and Drug Administration
GAA	General Appropriations Act
GAHP	Good Animal Husbandry Practices
GAqP	Good Aquaculture Practices
GDP	Gross Domestic Product
GIA	Grants-In-Aid
HACCP	Hazard Analysis and Critical Control Points
HAI	Healthcare-Associated Infections
HERDIN	Health Research and Development Information Network
HFDB	Health Facilities Development Bureau
HFSRB	Health Facility and Services Regulatory Bureau

HOMIS	Hospital Operation and Management Information System
HPDPB	Health Policy Development and Planning Bureau
ICAMR	Inter-agency Committee on Antimicrobial Resistance
ICC	Infection and Control Committees
IEC	Information, Education, and Communication
IPC	Infection Prevention and Control
ISO	International Organization for Standardization
JBLMRH	Jose B. Lingad Memorial Regional Hospital
KAP	Knowledge, Attitude, and Practice
LGU	Local government unit
M&E	Monitoring and Evaluation
MOA	Memorandum of Agreement
MOP	Manual of Procedures
MRSA	Methicillin-Resistant Staphylococcus aureus
NAG	National Antibiotic Guidelines

NAGCom	National Antibiotic Guidelines Committee
NAP	National Action Plan
NASPCP	National AIDS/STI Prevention and Control Program
NCR	National Capital Region
NDA	National Dairy Authority
NDPCO	National Drug Policy Compliance Officer
NEC	National Epidemiology Center
NEQAS	National External Quality Surveillance System
NHLN	National Health Laboratory Referral Network
NMIS	National Meat Inspection Service
NTP	National TB Control Program
NUHL	National Unit for Health Laboratories
NUHRA	National Unified Health Research Agenda
OASR	Office of Assistant Secretary for Regulations
PCAARRD	Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development

PCC	Philippine Carabao Center
PCHRD	Philippine Council for Health Research and Development
PD	Pharmaceutical Division
PGH	Philippine General Hospital
PhilPSP	Philippine Practice Standards for Pharmacists
PHRR	Philippine Health Research Registry
PHSR	Pharmaceutical Health Research
PMAS	Post Marketing Alert System
PNAP	Philippine National Action Plan
PRC	Professional Regulatory Commission
PSP	Pharmacy Standards of Practice
PVMA	Philippine Veterinary Medical Association
R&D	Research and Development
RHLN	Regional Health Laboratory Network
RITM	Research Institute of Tropical Medicine

RLNC	Regional Laboratory Network Councils
RO	Regional Offices
SLH	San Lazaro Hospital
TWG	Technical Working Group
UNICEF	United Nations International Children's Emergency Fund
UP	University of the Philippines
USAID	United States Agency for International Development
VDR	Veterinary Drug Resistance
WAAW	World Antibiotics Awareness Week
WHO	World Health Organization

I. Background

Antimicrobial resistance (AMR) is a major public health concern; the misuse and overuse of antimicrobials in different sectors can gravely affect humans in ways that range from medical, social, and even economic. AMR develops when antimicrobials are misused and overused, and it can spread and can transfer to humans directly via direct contact to resistant organisms through ingestion of the products or through environmental runoff exposures. Moreover, runoff or wastes from manufacturing of antimicrobials and improper disposal by pharmaceutical companies can expose the environment to unnecessary drugs. Figure 1 depicts how this affects and leads to AMR in plants, animals, and humans. Aquatic animals and even the water sources can be affected, which again affect humans through aquatic products and water ingestion.

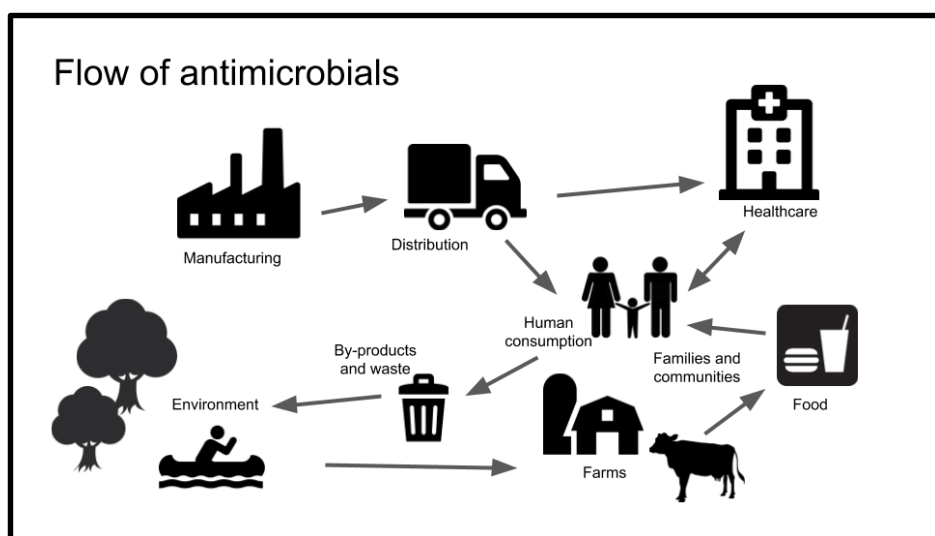


Figure 1. Flow of Antimicrobials from Manufacturing, to Consumption, to the Environment

Resistance can pass on from one person to another and spread beyond local borders, especially if proper infection control is not practiced. The spread of resistant organisms can strain and challenge the already dwindling antimicrobial options available. This can lead to what experts have termed as “post-antibiotic era” wherein even minor infections may lead to death. Medical management and surgeries will be difficult to perform because of possible infection during and after the procedures. The economic loss from the death of animals and humans due to AMR is huge. According

to World Bank (2014), if AMR is not properly addressed, by 2050, 28 million people will be pushed into poverty and healthcare costs can reach up to USD 1 trillion per year.

The Philippines has been a champion in initiatives to address AMR. The Inter-Agency Committee on Antimicrobial Resistance (ICAMR) was established in 2014. In the following year, the National Action Plan on AMR 2015-2017 was published. A game-changing policy in the Philippines was Republic Act 10918 “No Prescription No Dispensing” Policy as implemented by the Food and Drug Administration. Annex A lists other policies related to AMR in animal and human health sectors.

Table 1. Milestones on AMR Policy and Implementation in the Philippines

Year	Milestone
2013	Joint Administrative Order between DOH and DA for Registration of Veterinary Drugs and Products
2014	Formation of the Inter-Agency Committee on Antimicrobial Resistance (ICAMR) (DOH AO. No. 42)
2014	DA Special Order No. 695.2014 creating the DA TWG on AMR, amended in 2016
2014	FDA No Prescription No Dispensing Policy
2014	AO 2014-0006 Policy on the Establishment of Laboratory Networks
2014	Antimicrobial Resistance Surveillance Program (ARSP) started
2015 May	Launch of the Philippine Action Plan to Combat AMR 2015-2017

2015 November	First celebration of World Antimicrobial Awareness Week (WAAW)
2015	Antimicrobial Resistance Surveillance Program (ARSP) launched by RITM and ICAMR
2015	DOH AO 2015-0049 Rules and Regulations Governing the Antimicrobial Resistance Surveillance Program Accreditation of Bacteriology Laboratories in the Philippines for the PhilHealth Reimbursement of Select Antibiotics in the Philippine National Drug Formulary
2016	DOH AO 2016-0002 National Policy on Infection Prevention and Control in Health Care Facilities
2016	National Antibiotic Guidelines published
2016	Antimicrobial Stewardship (AMS) Trainings initiated
2016	DOH AO 2016-0002 Hospital Acquired Infections or ICP
2016	Food Safety Act of 2016
2017	ATLASS Mission conducted in the Philippines
2017	DOH-PD Point Prevalence Survey
2017	DA DO No. 4, s. 2017 Rationalization of all DA Laboratories
2017	Publication of the National Unified Health Research Agenda (NUHRA) 2017-2022 highlighting support for AMR and research on drug discovery, innovation and health technologies

2018	PhilHealth Circular No. 2018-0009 Use of Restricted Antimicrobials in PhilHealth-Accredited Health Care Institutions in Accordance with the ARSP
2018	Development of ARSP in Animals
2018	DA Initiates the IAMResponsible Campaign in the animal and agroculture sector

Status of Key Indicators

The 2014 National Action Plan on AMR identified five pathogens as potential targets to measure the impact of AMR interventions. The following targets are:

- **Target 1:** Reduce by 30% carbapenem-resistant Enterobacteriaceae (*E. coli* and *Klebsiella* spp.) infections acquired during hospitalization.
- **Target 2:** Maintain the 0% prevalence of ceftriaxone-resistant *Neisseria gonorrhoeae*.
- **Target 3:** Reduce by at least 30% the overall methicillin resistance in *Staphylococcus aureus* bloodstream infections compared to rates in 2014
- **Target 4:** Reduce by 30% multidrug-resistant *Pseudomonas* spp infections acquired during hospitalization compared to estimates in 2014.
- **Target 5:** Reduce by 25% ciprofloxacin-resistant non-typhoidal *Salmonella* infections compared to 2014

The table below shows the status of the above targets:

Table 2. Status of Accomplishment of Targets

	Baseline (2014) based on ARSP annual report	Target by 2020	Target by 2020 (%R)	2017	% change compared with baseline
Hospital Acquired Carbapenem-Resistant <i>Enterobacteriaceae</i> (<i>E</i>	4.5	30% reduction	3.1	8.4	118

coli.)					
Hospital Acquired Carbapenem-Resistant <i>Enterobacteriaceae</i> (<i>Klebsiella pneumoniae</i>)	7.9	30% reduction	5.5	11.2	30
Ceftriaxone-resistant <i>Neisseria gonorrhoeae</i>	0	Maintain at 0%	0	0	0
MRSA (blood)	60	30% reduction	42	55	-9
HA MDR pae (invasive)	21.6	30% reduction	15.1	20	-6
Ciprofloxacin-resistant non-typhoidal <i>Salmonella</i>	21.6	25% reduction	16.2	9	-58

Reference: Research Institute for Topical Medicine

Achievements from 2014 to 2018

The accomplishments and achievements based on Key Strategies (KS) of the Plan are summarized below.

KS1: Commit to a comprehensive, financed national plan with accountability and civil society engagement

In 2014, the Philippine government organized the Inter-Agency Committee on Antimicrobial Resistance (ICAMR). The committee was led by the Department of Health and co-led by the Department of Agriculture. The ICAMR facilitated the development of the National Action Plan to Combat AMR 2015-2017, which was launched in May 2015. Regular meetings were held to receive progress updates from all its members. The ICAMR ensured high-level support through the participation of the DOH Executive Committee members in key meetings and events. It also facilitated the organization of Antimicrobial Awareness Week Celebrations every November. As part of governance, DOH designated the National Drug Policy Compliance Officers (NDPCO) in DOH Regional Offices. The DOH Pharmaceutical Division is tasked to be the Secretariat of the ICAMR and prepares annual budgets covering AMR initiatives among others.

To strengthen its intra-agency efforts, the Department of Agriculture (DA) organized the AMR Technical Working Group which was composed of the Bureau of Animal Industry, the National Meat Inspection Service (NMIS), the National Dairy Authority

(NDA), the Philippine Carabao Center (PCC), and the Bureau of Fisheries and Aquatic Resources (BFAR). In 2015, the DA started a project with the Food and Agriculture Organization to support AMR efforts. The AMR budget is allocated under the Food Safety budget. Regional AMR Councils in the animal sector are being organized.

KS2: Strengthen surveillance and laboratory capacity

The Philippine AMR surveillance and laboratory capacity for microbial detection has been housed in Research Institute for Tropical Medicine (RITM), which serves as the national reference laboratory for communicable diseases and AMR. Microbiology surveillance has started since the 1980s. Currently, RITM facilitates the training of microbiology experts and laboratory personnel across the country.

The DOH and RITM developed the Antimicrobial Resistance Surveillance Program (ARSP) which aims to monitor the resistance rates of organisms in the country. More hospitals are being added to the existing 30 accredited laboratories that will submit specimen to ARSP. The DOH and RITM, with the support of experts in infectious diseases, also developed training modules on Antimicrobial Stewardship (AMS), which aims to improve and measure antimicrobial use and prescription in hospitals. Hospitals with accredited ARSP-laboratory and functioning AMS program are allowed to prescribe advanced antibiotics.

The DA made efforts to strengthen surveillance laboratory capacity. The DA Central Laboratories evaluated antimicrobial susceptibility testing (AST) and conducted detailed evaluation of the capacity of regional laboratories. Staff were sent abroad for advanced training through DA and FAO support. Moreover, the DA-BFAR initiated a National Residue Monitoring and Control Program. DA laboratories are being strengthened to adhere to standards of the Clinical Laboratory and Standards Institute (CLSI). LGUs are engaged in capacity building for local sample collection and processing. These samples are sent to regional laboratories for testing. The ARSP for Animal Health has been drafted and is being reviewed for approval.

KS3: Ensure uninterrupted access to essential medicines of assured quality

The Philippines already had policies to ensure access and quality of medicines prior to initiatives on AMR and the National Action Plan. Examples of these policies are the FDA circular 2013-008 (Adoption of the the ASEAN Post Marketing Alert System) and the FDA circular 2012-012 (guidelines for handling rapid alerts from quality defects).

A key policy tackles the mainstreaming of antibiotic treatment with financing/ payments based on ARSP laboratory results (PhilHealth Circular 2006-0015). Annex A summarizes policies related to AMR. DOH is building partnerships with private sector and other development agencies to strengthen access to medicines and ensure uninterrupted supply through an effective supply chain and procurement system.

Initiatives to strengthen access in animal sector is starting. Forging of partnerships with healthcare professionals, organizations, and consumer groups is ongoing and spearheaded by BAI and BFAR.

KS4: Regulate and promote rational use of medicines, including in animal husbandry and ensure proper patient care

In 2016, the Philippines issued RA 10918, otherwise known as the Pharmacy Law, requiring prescription for dispensing of antibiotics. Some LGUs have adopted policies on the Rational Use of Medicines at the local level to prevent sale of antibiotics outside of pharmacies. This policy is currently being implemented and monitored. DOH, RITM and experts have developed the Antimicrobial Stewardship Program for hospitals, which promotes building of teams of service providers, pharmacists and microbiologists by their specific tasks. This program has been rolled out in all Level 2 and Level 3 hospitals across the country. The Philippine AMS Program is being studied by other countries as a model to adopt. The Philippines has also developed National Antibiotic Guidelines as part of efforts to strengthen clinical practice guidelines. The Philippine Pharmacy Standards of Practice (PSP) has a training package being rolled out. Point Prevalence Surveys to assess the use of antimicrobials have been started. It is essential to monitor how these initiatives are being implemented and the impact they create in enhancing healthcare, improving rational antibiotic use and reducing AMR and hospital acquired infections.

In the animal health sector, there is an ongoing review of the existing regulatory framework. Results of this review are expected to guide DA, FDA and DOH in delineating roles in regulating antimicrobials and the medicine supply chain. DA monitors for the banned antimicrobials animal feeds stores. Coordination and dialogue with LGUs, clients, stakeholders, and industry are ongoing to assess challenges and promote prudent use of antimicrobials in agriculture and farms

KS5: Enhance infection prevention and control across all settings

Much of the efforts on infection prevention and control are in hospitals ensuring quality and safety of services. In 2016, DOH issued the National Policy on Infection Prevention and Control (IPC) that outlines priority strategies. This is a development from the National IPC Standards in 2009. IPC Teams, training and indicators are included as a requirement in hospital licensing.

The reduction of infection in animals is part of farming practices outlined in Good Animal Husbandry Practices (GAHP) and Good Aquaculture Practices (GAqP) that are being harmonized through the ASEAN cooperation. The Philippines promotes these standards to develop farms and ensure better products for domestic consumption and exportation. Agricultural farms who apply for roadshows usually have international trade relations, thereby ensuring good practices. The Philippine national standards for aquatic commodities (milkfish and tilapia; shrimp and crab) have been developed.

KS6: Foster innovations, research and development

Research on AMR in humans is led by microbiologists, infectious diseases specialists, universities and hospitals. AMR has been included in the National Unified Health Research Agenda 2017-2022 as part of research on responsiveness. In addition, the NUHRA is keen on innovation and R&D of medicines. AMR is also included in the Pharmaceutical Health Research agenda of the DOH Pharmaceutical Division. Research on AMR in animals is done by various agencies, such as PCC, UPLB and CLSU. The Department of Science and Technology has research councils for human health (PCHRD) and agriculture (PCARD), although AMR is largely housed in human health research.

AIHO has collected recent AMR-related research and has identified potential research gaps (Annexes E, F and G). Desk review and consultations have also raised many research questions and these are listed in Annex H.

KS7: Development of a Risk Communication Plan to Combat AMR

The Philippines participated in the annual celebration of the World Antimicrobial Awareness Week from 2015 to 2018. ICAMR has developed information and

education materials and infomercials and disseminated them in these events. DA also celebrated WAAW at the central level and in some regions. The focus of the 2018 event is on Food Safety. DA developed the IAMResponsible campaign targeting veterinarians, farmers, students and the general public. In 2018, DA conducts roadshows across the country.

Further details on the status and achievements are described in the Implementation Report on the National Action Plan to Combat AMR 2015-2017. Annexes in this document contain further information on policies related to AMR (Annex A), Members of ICAMR and DA-TWG (Annex C and Annex D) and Research in Animal and Human Health (Annex E and F).

Synthesis of Challenges and Opportunities

This section summarizes the foreseen challenges and opportunities in facing antimicrobial resistance. The Implementation Report on the National Action Plan to Combat AMR 2015-2017 contains more detailed information on accomplishments, achievements and gaps.

Maximizing One Health Approach

One Health approach integrates the health aspects of the human, animal, and plant sectors. With this, there is recognition that the sectors are cognate and influence one another. Coordination between different sectors is always challenging. Although the ICAMR, under DOH and DA, have already defined composition of its members, participation has been varied. Engagement of key sectors should be strengthened including trade and industry, plant, aquaculture, education and local governments. There is an opportunity to strengthen the One Health Approach by increasing the involvement of the environment sector. Although civic society involvement was mentioned, there has been very limited engagement at present. There is also a great opportunity for the private sector, especially private institutions and industry, to be more involved. The new Action Plan is framed to identify the potential areas of collaboration across these sectors.

Review of Mandates, Roles and Responsibilities of Partner Agencies

Even after three years, some roles are still unclear and need to be properly mapped. The roles of DTI and DILG, for example, are not sufficiently elaborated. Specific offices within DOH and DA which are supposed to be involved in the AMR program are not yet fully onboard, in part due to different priorities, roles and mandates that need to be defined.

Skills mapping and adequate human resources are crucial requisites for AMR. In order to sufficiently address the current challenges, it is essential to have a strategy to ensure the ideal number of people who are skilled and knowledgeable in handling AMR needed to be deployed. This applies to all sectors involved, whether from human, animal, or environment sides.

The DOH and DA have a temporary joint policy assigning offices responsible for certification of veterinary products with antimicrobials. This joint policy expired in September 2018 and should be renewed. The FDA plans to create a Veterinary Unit. This calls for urgent action from the FDA to establish the unit and secure adequate and competent workforce to oversee its activities.

In terms of ensuring supply of medicines, there is still confusion about the extent of the roles of DOH, DA, and LGU.

Currently, there is no veterinary formulary executive council to decide on the list of essential medicines for animals. This was already mentioned last PNAP 2015-2018.

Annex I maps the regulation and control for the antimicrobial market in animals and humans. This information is developed to provide guidance to policy makers on the stakeholders, their roles, and the current policy gaps.

Need to Strengthen Surveillance Mechanisms, Monitoring and AMR Data to Guide Policy and Implementation

Surveillance and monitoring of AMR in human health are mainly done through RITM's ARSP. On the other hand, hospitals and laboratories nationwide have an essential role to support this surveillance system. There is a need to determine target number of sentinel sites. In addition, the available data is not yet case-based which is important in determining actual cases and how these are managed.

There is no system yet in monitoring, regulating and evaluating antibiotics in hospitals that are subsidized by PhilHealth. The gap in data and knowledge in this area further compounds the challenges in determining the appropriateness of the number and type of antimicrobial prescribed versus the disease and/or pathogen.

The data system for AMR is a key area for improvement. An online database of different AMR indicators is not yet available and not integrated. Indicators that point to progress of the program are also undefined, such that monitoring and evaluation are still limited to process inputs and program outputs. Although a database of antimicrobials for human use is available online, this has yet to be done in the veterinary sector.

Surveillance within the entire agricultural sector is not yet unified, as some private companies conduct their own surveillance activities. A platform for stakeholders to communicate data is also not yet available that can inform both animal and human health sectors.

Despite the numerous training and development programs offered by the various offices involved, the fast turnover of manpower limits the implementation of what they have learned. Monitoring of how these trainings have improved AMR strategies is also not in place.

Regional laboratory capacity for AMR detection needs to be built and fully assessed for both animal and human sectors. An integrated surveillance system for AMC, AMU, and HAI is yet to be developed, as well as the protocols to analyze, synthesize, and use these data.

Furthermore, the data collected in the animal sector can be expanded to include information such as clinical breakpoints of pathogens, masterlist of farms including backyard farms, farm supplies, animal feed stores, and private laboratories in all LGUs, etc.

The vast data, information, indicators, targets and inter-related systems required to monitor AMR shows a need for an overall M&E framework for humans, animals and their points of interaction. Different types of data and information, sources, stakeholders and processes should be described in this framework.

Need for Harmonized Policies, Protocols and Technical Guidance for Different Areas of AMR work

There are a number of policies that are essential in addressing AMR, especially coming from the animal sector. One major policy is the banning of antimicrobials as growth promoters in animal industry. Its use has a grave impact on the food consumed by humans. A Philippine Practice Standards for Veterinarians in relation to Rational Dispensing of Antimicrobials, as well as a National Antibiotic Guidelines for animal health are also needed. Part of the guidelines for its rational use should also include the use of antimicrobials only with a prescription from a veterinarian, similar to human health where antimicrobials cannot be readily bought if a physician's prescription is not available. The ASEAN Guidelines for Prudent Use of Antimicrobials in Livestock has yet to be adapted locally. Implementation and monitoring of good animal husbandry and aquaculture practices should be strengthened.

In terms of infection prevention and control, much is yet to be done in the animal sector. A national IPC program in backyard and industry farms needs to be developed, as well as clinical guidelines for livestock infection prevention and control.

For human health, policies related to food safety and AMR need to be further elucidated and specified. Disease-specific treatment guidelines should also be in place. Additionally, an issuance by the DOH requiring different levels of health facilities to adhere to the AMS program needs to be released.

The rigorous monitoring of the implementation of the different policies related to AMR is a crucial point of focus. Meanwhile, policies that are in the pipeline also need to have a strong monitoring and evaluation component incorporated.

Finally, crafting an integrated protocol for AMR response is crucial, particularly in cases of outbreaks.

Need to Strengthen Resource Mobilization in Order to Meet Demands

Since 2014, the GAA has not mentioned any line items to address AMR specifically. The financing for AMR-related activities is fragmented; budgets may reflect allocations for antibiotics, infection control in hospitals, IEC, etc, but do not include

specific allocations for AMR . Hence, there is difficulty ascertaining the exact expenditure for AMR the past years.

Meanwhile, financing for AMR cases through the Philhealth has not yet been finalized. Hence, the burden to patients remains immense, especially for indigents. To mitigate this, the Philhealth Outpatient Benefit package must be scaled up. Furthermore, the monitoring and evaluation of Philhealth Circular No. 15, s. 2006 and DOH AO 2015-0049 are necessary steps.

Opportunity to Boost Research on AMR

Philippine research on AMR is currently limited. Most research focus on tuberculosis (TB), as it is commonly granted funding from donors. Available data and research are limited for other pathogens like *Streptococcus sp.*, *E. coli*, *Klebsiella sp.*, MRSA, *A. baumannii*, etc.

AMR detection, prevention, and control specific to animal health have not been specifically mentioned in the National Unified Health Research Agenda (NUHRA); only a general statement on AMR was mentioned. Other concerns that need more research and funding for both sectors are supply chain, policy, community, and behavior. Currently, most research activities are related to microbiology, surveillance and clinical studies. There is also scarcity in the development of new antibiotics, especially in the country. In relation to this, the private sector buy in needs to be strengthened to increase their investments on antimicrobials, especially at the R&D level.

In cases where researches are available, accessing these can be difficult. Research database/repository for Philippine studies on AMR in animal health has not been developed, leaving many studies unpublished. Hence, there should also be a push to improve the publication rate of researches and build the local database.

Antimicrobial residues in the environment can affect both animal and human health through the food chain, however, no research is available in the country on environmental impact of manufacturing and agricultural runoffs. There is a general lack of data on the level of antimicrobials in rivers, seas, as well as the soil.

There are still a lot of research that needs to be done in order for the country to have

better scientific evidence and data to manage AMR. Annex E and Annex F lists all recent research done in Animal Health and Human Health Respectively. Annex G identifies potential research gaps. A list of possible research questions can be found in Annex H.

Continue capacity building, education, awareness and advocacy

Although there is increasing awareness of AMR, there is still much to be done in this area. No survey has been conducted to assess how much the campaigns of the DOH has reached the general public and how this has changed their behavior. The ongoing campaign of DA, IAMResponsible, also needs to be assessed.

Specific key messages for consumers, livestock stakeholders, health professionals need to be developed. Risk communication strategies should also be prepared. Consumer groups need to be involved so that they are empowered in making better choices for their families. Primary healthcare facilities should also have IEC materials on AMR.

In both the animal and human sectors, the training and development of health workers need to include AMR awareness and response. To this end, DepEd, CHED, and PRC should be onboard. There is also a need to train LGU staff and volunteers for the proper handling and collection of respiratory samples for surveillance of diseased animals at the grassroots level.

II. Methodology

From July to August 2018, the ICAMR, through the support of WHO Philippines, conducted a review of the implementation of the previous National Action Plan from 2015-2017. Consultants from the Alliance for Improving Health Outcomes (AIHO) facilitated data gathering, including desk reviews, interviews and consultations with different stakeholders from government agencies, non-government organizations, professional societies, and partners.

On September 26, 2018, an initial consultation with the Department of Agriculture (DA), its involved subunits, and a representative from the agriculture private sector

was organized in order to review the key result areas and objectives and subsequently deliberate on potential activities for inclusion in the next action plan. The DA had representatives from the following agencies: Bureau of Animal Industry (BAI), National Dairy Authority (NDA), Bureau of Fisheries and Aquatic Resources (BFAR), National Meat Inspection Services (NMIS), and the Philippine Carabao Center (PCC). Meanwhile, the private sector was represented by the Philippine Veterinary Medical Association.

For the DOH and its involved institutions, the consultation was held on October 3, 2018. Attendees from the Department of Health were from the Pharmaceutical Division (PD), Epidemiology Bureau (EB), Health Facility Development Bureau (HFDB), Health Facilities & Services Regulatory Bureau (HFSRB) and Disease Prevention & Control Bureau (DPCB). The hospitals were represented as well, with participants coming from Research Institute for Tropical Medicine (RITM), Jose B. Lingad Memorial Regional Hospital (JBLMRH), San Lazaro Hospital (SLH) and Philippine General Hospital (PGH). Moreover, experts from the National Antibiotic Guidelines Committee (NAGCom) and the Antibiotic Stewardship Steering Committee (ASC) were also present to guide the discussions especially on the technical aspect of antimicrobial stewardship. Lastly, the World Health Organization Philippine Country Office provided technical guidance as well especially on linking animal health initiatives to human health AMR developments.

On 16 October 2018, participants from Animal Health and Human Health sectors gathered for a national consultation and strategic planning on AMR. The Department of Agriculture and Department of Health, through the support of the Alliance for Improving Health Outcomes (AIHO), presented accomplishments, challenges and gaps on AMR based on the review of the implementation of the 2015-2017 Philippine Action Plan. The participants reviewed and finalized the seven key strategies and objectives for 2019-2023. Part III of this document outlines these strategies, objectives and activities. Timelines, responsible agencies, measurement and budget are enumerated in Annex B.

Table 3. Strategic Areas and Key Strategies

Strategic Areas	Key Strategies
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Implementation of the PNAP	Commit to the Philippine National Action Plan through multisectoral engagement and accountability.
Surveillance and laboratory	Strengthen surveillance and laboratory capacity
Access to antimicrobials	Ensure uninterrupted access to safe and quality-assured antimicrobials
Optimal use of antimicrobials	Regulate and promote the optimal use of antimicrobials
Reduction of infection	Implement appropriate measures to reduce infection across all settings
Innovation and research	Promote innovation and research on AMR
Awareness, communication and education	Improve awareness and understanding of antimicrobial resistance through effective communication and education.

Comparison between Original NAP (2014) and PNAP (2018)

The current plan maintains the key strategies from the original NAP. However, some words are refined to better reflect that this plan is about AMR. For example, instead of using the term “essential medicines”, the new plan uses the term “antimicrobials”. More sectors and agencies need to be involved in this program, hence the inclusion of “multisectoral engagement” in lieu of “civic society engagement.” Finally, there is recognition that communication does not only involve “risks”, hence the KS is revised to “effective communication”. The table below shows the previous strategies and the revised strategies for 2019-2023.

Table 4. Comparison between the NAP and PNAP

Philippine Action Plan to Combat AMR 2015-2017	Philippine National Action Plan on AMR 2019-2023
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Commit to a comprehensive, financed national plan with accountability and civic society engagement	Commit to the Philippine National Action Plan through multisectoral engagement and accountability.
Strengthen surveillance and laboratory capacity	Strengthen surveillance and laboratory capacity
Ensure uninterrupted access to essential medicines of assured quality	Ensure uninterrupted access to safe and quality-assured antimicrobials
Regulate and promote rational use of medicines, including in animal husbandry and ensure proper patient care	Regulate and promote the optimal use of antimicrobials
Enhance infection prevention and control across all settings	Implement appropriate measures to reduce infection across all settings
Foster innovations, research and development	Promote innovation and research on AMR
Development of a Risk Communication Plan to Combat AMR	Improve awareness and understanding of antimicrobial resistance through effective communication and education.

Aside from the words used, indicators are also enhanced to reflect conditions in animal sector, as well as the environmental indicators. All of these are made in relation to food safety indicators. In terms of stakeholders, more agencies are included to reflect the multisectoral nature in addressing AMR.

III. Philippine National Action Plan 2019-2022

A. Vision, Mission, Targets and Indicators for 2019-2023

Vision

A nation protected against the threats of antimicrobial resistance

Mission

To implement an integrated, comprehensive, and sustainable national program to address antimicrobial resistance geared towards safeguarding human and animal health, and preventing interference in agricultural, food, trade, communication and environmental sector activities.

General indicators

These are the recommended new set of indicators for 2023 based on 2017 baseline.

- **Target 1:** Reduce by 10% carbapenem-resistant Enterobacteriaceae (*E. coli* and *Klebsiella* spp.) infections acquired during hospitalization.
- **Target 2:** Maintain the 0% prevalence of ceftriaxone-resistant *Neisseria gonorrhoeae*.
- **Target 3:** Reduce by at least 10% the overall methicillin resistance in *Staphylococcus aureus* bloodstream infections compared to rates in 2017.
- **Target 4:** Reduce by 10% multidrug-resistant *Pseudomonas* spp infections acquired during hospitalization compared to estimates in 2017.
- **Target 5:** Reduce by 25% ciprofloxacin-resistant non-typhoidal *Salmonella* infections compared to 2017.
- **Target 6:** 10% reduction in use of antibiotics in humans and animals.
- **Target 7:** Identify baseline AMR and use in animal sector.

The new indicators were set during the Technical Consultation with DA, DOH and AMR experts on 7 November 2018.

B. Outcome Indicators

Human Health Sector

The following table summarizes resistance rates of antimicrobials in 2014 and 2017. The ICAMR has set targets by 2023 based on track record observation and expert opinion. This list is adopted from WHO Recommendations on Critical, High Priority and Medium Priority microbes and resistance for Monitoring. The ICAMR with infectious disease experts conducted a consultation on these indicators on 7 November 2018.

Table 5. Resistance Rates in 2014 and 2017, with 2023 Targets, based on the WHO Priority Pathogen List

Priority	Microbe	Resistance	2014	2017	2023 (target)
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Critical	<i>Acinetobacter baumannii</i>	carbapenem-resistant			
		imipenem	n.a.	**57%	51.3%
		meropenem	n.a.	**56%	52.2%
	<i>Pseudomonas aeruginosa</i>	carbapenem-resistant			
		imipenem	n.a.	17%	15.3%
		meropenem	45.30%	14%	12.6%
High	<i>Staphylococcus aureus</i>	methicillin-resistant, vancomycin-intermediate and resistant			
		MRSA RATE	60.30%	57%	39.9%
		vancomycin	n.a.	2%	1.4%
	<i>Salmonellae</i>	fluoroquinolone-resistant			
	Nontyphoidal Salmonella	ciprofloxacin	21%	9%	6.75%
	<i>Neisseria gonorrhoeae</i>	cephalosporin-resistant, fluoroquinolone-resistant			
		penicillin	*89.1%	85%	76.5%
ciprofloxacin		*84.8%	67%	60.3%	
Medium	<i>Streptococcus pneumoniae</i> (using meningitis breakpoints)	penicillin-non-susceptible			
		penicillin	7%	10%	8.9%
	<i>Haemophilus influenzae</i>	ampicillin-resistant			
		ampicillin	12%	14%	12.6%
	<i>Shigella spp.</i>	fluoroquinolone-resistant			

		ciprofloxacin	*13.8%	11%	9.9%
*2011-2014 because of the number of isolates submitted**In 50% of all reported isolates **Currently not collected for the ARSP					

Notes:

1. Table is based on WHO Recommendations. The following were removed: *Enterobacteriaceae*, *Enterococcus faecium*, *Helicobacter pylori* and *Campylobacter* spp.
2. The targets are based on the 10% reductions set.
3. For ciprofloxacin resistance for non-typhoidal *Salmonella*, the target is 25% reduction.

Animal Health Sector

The Animal Health Sector is developing the system for AMR surveillance. Three Components have been identified with target population, target bacterial species and target antibiotics. The Animal Health Sector aims to improve the system and establish a baseline by 2020. These targets are from the Antimicrobial Resistance Surveillance Plan for Animal Health.

Component 1: Healthy Food Animals

Target Population: Pigs and Poultry

Table 6. Target Bacterial Species for Healthy Food Animals

Zoonotic bacteria	Commensal bacteria
1. <i>Salmonella</i> spp.	1. <i>Escherichia coli</i>
2. <i>Campylobacter</i> spp.*	2. <i>Enterococcus faecium</i> *
	3. <i>Enterococcus faecalis</i> *

*AST for these bacteria will be as per recovered isolates (no set sample size), while improved capacity for isolation of these organisms will be pursued

Target Antibiotics: Minimum Inhibitory Concentration data will be generated for the following antimicrobials by the NMIS and the BAI

Table 7. Target Antibiotics

Azithromycin	Ciprofloxacin	Streptomycin
Ampicillin	Colistin	Sulfamethoxazole
Cefotaxime	Gentamicin	Tetracycline
Ceftazidime	Meropenem	Trimethoprim
Chloramphenicol	Nalidixic acid	

Component 2: Diseased Livestock

Target Population

- a. Pigs and poultry with respiratory illnesses
- b. Dairy animals (cattle, water buffalo) with clinical and subclinical mastitis

Target Bacterial Species

Table 8. Target Bacterial Species for Diseased Livestock

<u>Swine*</u>	<u>Poultry**</u>	<u>Dairy Cattle & Water Buffaloes</u>
1. <i>Actinobacillus pleuropneumoniae</i>	1. <i>Mycoplasma</i>	1. <i>Staphylococcus aureus</i>
2. <i>Pasteurella multocida</i>	2. <i>Pasteurella multocida</i>	2. <i>Streptococcus agalactiae</i>
3. <i>Bordetella bronchiseptica</i>	3. <i>Haemophilus paragallinarum</i>	3. <i>Escherichia coli</i>
4. <i>Streptococcus suis</i>		

**Haemophilus suis* and other economically significant respiratory pathogens in swine will be considered, however their critical breakpoints have not yet been defined.

**Clinical breakpoints have not been set for these pathogens

Component 3: Diseased Aquatic Animals

Table 9. Target Population and Bacterial Species for Diseases Aquatic Animals

Target Population	Target Bacterial Species
Tilapia	<i>Streptococcus agalactiae</i> <i>Streptococcus iniae</i> *
Milkfish and Shrimp	<i>Vibrio parahaemolyticus</i>

**S. iniae* is also an emerging human pathogen, aside from being a major pathogen in fish.

C. Stakeholders

The Department of Health and Agriculture play critical roles in this new plan since human and animal health are the ones that ultimately suffer from effects of AMR. In addition, DENR, DTI, DILG, DepEd and CHED are all given bigger roles. DENR is essential in completing the environmental arm of the One Health approach. The antimicrobial residues found in the environment, as well as the microbes that can be changed because of these residues, can only be fully addressed if DENR is fully onboard. Its monitoring and policing powers, especially with industry-related pollutants, are instrumental to creating a better environment.

DTI, on the other hand, can ensure that the products that get into the country are safe and of good quality. This has implications most especially on food safety.

Meanwhile, DILG, has a crucial role in local policy development, implementation, and monitoring. This plan aims to strengthen the capacity of local governments to support efforts to control AMR.

PRC, CHED, and DepEd are included in this plan to emphasize their fundamental roles in educating and increasing the awareness of the health workers and the general public about AMR. The methods of preventing AMR like hand washing, vaccination, etc. can also be disseminated at different levels.

The human health and animal health private sectors have huge roles in AMR implementation. They are essential partners for surveillance and monitoring, trainings, delivery of services, professional and public education, effective supply chain, advocacy and research. Private partners, professional societies and the civil

society are also key partners in the training and production of professional workforce that are better equipped to implement safe and secure services, as well as in managing AMR. More specifically, the Pediatric Infectious Disease Society of The Philippines (PIDSP), Philippine Pharmacists Association (PPhA), Philippine Hospital Infection Control Nurses Association (PHICNA), and Philippine Hospital Infection Control Society (PHICS) as members of the Antimicrobial Stewardship Steering committee (ASC) are active in the Philippine AMR initiatives. But as the PNAP 2019-2023 rolls out, greater involvement of other professional organizations such as the Philippine Society of Public Health Physicians (PSPHP) and patient organizations such as the Philippine Alliance of Patient Organizations (PAPO) is needed.

Table 10. Stakeholders per Key Strategy

Key Strategies	Stakeholders
1. Commit to the Philippine National Action Plan through multisectoral engagement and accountability.	<ul style="list-style-type: none"> ● Animal Health: DA, academe, private sector, PRC ● Human Health: DOH, FDA, PhilHealth, academe, private sector, PRC ● Relevant sectors: DILG, DENR, DTI, DepEd, CHED
2. Strengthen surveillance capacity	<ul style="list-style-type: none"> ● Animal Health: DA ● Human Health: DOH, hospitals ● Environment: DENR
3. Ensure uninterrupted access to safe and quality-assured antimicrobials	<ul style="list-style-type: none"> ● Animal Health: DA, FDA, DTI, LGUs, farmers, animal producers, professionals, private sector ● Human Health: DOH, FDA, PhilHealth, DTI, hospitals, LGUs, professional societies, private sector (suppliers)

<p>4. Regulate and promote the rational use of antimicrobials</p>	<ul style="list-style-type: none"> ● Animal Health: DA, FDA, LGUs, farmers, animal producers, professionals, private sector, academe ● Human Health: DOH, FDA, hospitals, LGUs, professional societies, private sector (retail stores)
<p>5. Reduce incidence of infection through sanitation, hygiene and infection prevention and control across all settings</p>	<ul style="list-style-type: none"> ● Animal Health: DA, LGUs, farmers, animal producers, professionals, private sector ● Human Health: DOH, hospitals, LGUs, professional societies, private sector
<p>6. Promote innovation and research on AMR</p>	<ul style="list-style-type: none"> ● Animal Health: DA, DOST, academe, private sector, professional societies ● Human Health: DOH, hospitals, DOST-PCHRD, academe, professional societies, private sector
<p>7. Improve awareness and understanding of antimicrobial resistance through effective communication and education.</p>	<ul style="list-style-type: none"> ● Animal Health: DA, LGUs ● Human Health: DOH, hospitals ● Education: DepEd, CHED

D. Key Strategies, Objectives and Activities

Key Strategy 1. Commit to the Philippine Action Plan through multisectoral engagement and accountability

Key Strategy 1 establishes enabling mechanisms to formulate and mobilize resources for the Philippine National Action Plan on AMR. These enabling mechanisms are articulated into the following objectives and activities, namely:

Objectives:

- 1.1 To forge a joint action plan to combat AMR for 2019-2023, including an agreement involving national agencies.
- 1.2 To elevate AMR as a national priority
- 1.3 To uphold accountability among various sectors in fulfilling their roles in the prevention and reduction of AMR
- 1.4 To allocate adequate resources for AMR initiatives in all relevant sectors
- 1.5 To continue collaboration for the achievement of key performance indicators

Partners:

- Animal Health: DA, academe, private sector, PRC
- Human Health: DOH, FDA, PhilHealth, academe, private sector, PRC
- Relevant sectors: DILG, DENR, DTI, DepEd, CHED

All Sectors: Animal Health, Human Health, Education, Trade, Professional Regulation, Other Relevant Sectors

Table 11. Objectives and Activities for Key Strategy 1

Objectives	Activities
1.1 To forge a joint action plan to combat AMR for 2019-2023, including an agreement involving national agencies.	<ol style="list-style-type: none"> 1. Conduct ICAMR strategic planning, as well as development of the 2019-2023 action plan to combat AMR 2. Conduct regular meetings to monitor implementation of the plan 3. Publish an ICAMR annual report
1.2 To elevate AMR as a national priority	<ol style="list-style-type: none"> 1. Draft and subsequently approve updated/ revised of joint policy; Issuance of an administrative order to include other government stakeholders (i.e. DepED, DENR and PRC) in ICAMR 2. Advocate AMR as a food safety issue of prime

	importance
1.3 To uphold accountability among various sectors in fulfilling their roles in the prevention and reduction of AMR	<ol style="list-style-type: none"> 1. Establish subcommittees within ICAMR (e.g. surveillance, research, financing) 2. Provide authority to the ICAMR Secretariat to ensure goals are met by the different stakeholders
1.4 To allocate adequate resources and expertise for AMR initiatives in all relevant sectors	<ol style="list-style-type: none"> 1. Include AMR in annual budget planning of the different agencies involved 2. Identify priority areas for international cooperation 3. Enhance international partnerships for AMR initiatives in human and animal health
1.5 To continue collaboration for the achievement of key performance indicators	<ol style="list-style-type: none"> 1. Regularly submit reports/required information of ICAMR member agencies identified in this action plan to the ICAMR secretariat

Key Strategy 2. Strengthen surveillance and laboratory capacity

Surveillance is the continuous, systematic collection, analysis and interpretation of health-related data for the purposes of planning, implementation, and evaluation of public health practice (WHO, 2018). Surveillance can serve (a) as the early warning system for emerging public health problems; (b) as data necessary for monitoring and evaluation (M&E) of public health interventions; and (c) to monitor and clarify the epidemiology of recognized health problems (WHO, 2018).

Recognizing the crucial role surveillance plays in the development of evidence-based policies for AMR and informing stakeholders, Key Strategy 2 aims to bolster the important elements of AMR surveillance as expressed in the following objectives and activities:

Objectives:

2.1 To improve the surveillance and diagnostic capabilities of hospitals, and laboratories

2.2 To capacitate health workers based on required competencies for different areas of AMR work

2.3 To institutionalize well-developed reporting, monitoring and surveillance systems/networks at all levels in health, agriculture and environment sectors

Partners:

- Animal Health: DA
- Human Health: DOH, hospitals, PhilHealth
- Environment: DENR

Table 12. Objectives and Activities for Key Strategy 2 (Animal Health)

Objectives	Activities
2.1 To improve the surveillance and diagnostic capabilities of hospitals, and laboratories	<ol style="list-style-type: none"> 1. Finalize, institutionalize and implement of ARSP in animals 2. Regularly perform assessments and inventory of resources for monitoring, surveillance and testing (including price reference of laboratory supplies and equipment) 3. Conduct leveling of capacities of DA to perform laboratory analysis for AMR 4. Organize regional laboratory capacity-building activities for AMR detection
2.2 To capacitate health workers based on required competencies for different areas of AMR work	<ol style="list-style-type: none"> 1. Assess skill mix and quantity of human resources for animal health surveillance and laboratories 2. Hire and subsequently train technical/laboratory personnel on monitoring, surveillance and testing methods and the operation of laboratories, including compliance to

	<p>accreditation standards (PNS ISO¹/IEC 17025², PNS ISO 15189³, PNS ISO/IEC 17020⁴, Codex⁵, CLSI⁶)</p> <p>3. Develop skills of LGU veterinary service staff for sampling and surveillance</p>
<p>2.3 To institutionalize well-developed reporting, monitoring and surveillance systems/ networks at all levels in health, agriculture and environment sectors</p>	<ol style="list-style-type: none"> 1. Finalize and approve surveillance and monitoring plan for animal health 2. Establish a national coordinating center for AMR within the animal health sector 3. Create master list of all veterinary feeds, farms, and drug establishments 4. Implement surveillance and monitoring systems for AMR and AMU in food-producing animals and their products: meats, fish & fishery products, milk, eggs, and honey 5. Develop formal document for monitoring and quantification of AMR and AMU trends in food-producing animals 6. Perform sampling and testing analysis for antibiotic susceptibility testing based on internationally accepted standards (i.e. CLSI) 7. Conduct data collection, sampling, testing, and analysis for veterinary drug residues in meat products, and connect findings with AMR.⁷

¹ The International Organization for Standardization (ISO) is an independent non-governmental organization composed of 162 national standard bodies developing over 22,000 international standards covering nearly all aspects of technology and manufacturing.

² ISO/IEC 17025 indicates requirements for the competence of testing and calibration laboratories

³ IEC 15189 outlines standards for quality and competence in medical laboratories.

⁴ IEC 17020 specifies standards for operation of different types of institutions performing inspection.

⁵ Codex Alimentarius is a group of internationally recognized standards, guidelines, policies, recommended practices on food, food production, and food safety.

⁶ The Clinical Laboratory Standards Institute (CLSI) is a non-profit international organization composed more than 1,400 organizations from over 60 countries setting and upholding the standards towards improvement of the quality test results, patient care delivery, and public health.

⁷ Residues are not part of AMR data.

Table 13. Objectives and Activities for Key Strategy 2 (Human Health)

Objectives	Activities
<p>2.1 To improve the surveillance and diagnostic capabilities of hospitals, and laboratories</p>	<ol style="list-style-type: none"> 1. Ensure sufficient laboratory human capacity and other resources through planning and resource allocation 2. Explore potential areas to strengthen financing of laboratory tests in public and private sectors 3. Expand ARSP training and accreditation to non-tertiary hospitals 4. Strengthen Luzon, Visayas and Mindanao reference laboratories to detect and monitor AMR surveillance
<p>2.2 To capacitate health workers based on required competencies for different areas of AMR work</p>	<ol style="list-style-type: none"> 1. Assess skill mix and quantity of human resources for human health surveillance and laboratories, e.g. infectious disease specialists, clinical pharmacists, medical technologists, etc. 2. Send technical personnel to relevant local and foreign trainings on monitoring, surveillance and testing methods and the operation of laboratories, including compliance to accreditation standards (PNS ISO/IEC 17025, PNS ISO 15189, PNS ISO/IEC 17020, Codex)
<p>2.3 To institutionalize well-developed reporting, monitoring and surveillance systems at all levels in health, agriculture and environment sectors</p>	<ol style="list-style-type: none"> 1. Integrate AMR in the strategies of the National and Regional Health Laboratory Network 2. Designate EB as the national coordinating center for AMR surveillance within the human health sector 3. Develop protocol to monitor, manage, analyze, and utilize HAI data from local, regional to national levels 4. Expand annual point prevalence surveys (PPS)

	<ul style="list-style-type: none"> utilizing prescription data <ul style="list-style-type: none"> a. Develop WHO methodology on antimicrobial use b. Develop e-prescription system that will include the collection of data on antimicrobial use c. Training on e-prescription system (integrated with pharmacovigilance) d. Adopt e-prescription system in DOH hospitals 5. Establish a case-based AMR surveillance to enable quantifiable burden of disease 6. Develop an integrated system for AMR, AMU, and HAI⁸ 7. Develop an IT platform to communicate data on AMR to stakeholders
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Table 14. Objectives and Activities for Key Strategy 2 (Environment Sector)

Objectives	Activities
2.1 To improve the surveillance and diagnostic capabilities of hospitals, and laboratories	<ol style="list-style-type: none"> 1. Engage with environment laboratories and relevant offices 2. Assess capacities of environment laboratories 3. Conduct environmental monitoring for AMR in residue 4. Ensure proper disposal of waste and hazardous materials 5. Enhance technologies and capabilities of environmental laboratories for monitoring 6. Monitor implementation of protocols on waste disposal from hospitals, health facilities, clinics, animal clinics

⁸ A similar system is employed in the USA. This is the National Antimicrobial Resistance Monitoring System for Enteric Bacteria (NARMS), which tracks antimicrobial susceptibility of certain enteric (intestinal) bacteria found in ill people, retail meats, and food animals. Established in 1996, NARMS is a partnership between US state and local public health departments, Centers for Disease Control and Prevention (CDC), the U.S. Food and Drug Administration (FDA), and the U.S. Department of Agriculture (USDA).

2.2 To capacitate health workers based on required competencies for different areas of AMR work	1. Train staff for environmental monitoring of residue
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Key Strategy 3. Ensure uninterrupted access to safe and quality-assured antimicrobials

Access to quality antimicrobials plays a role in the emergence of antimicrobial resistance because inadequate access can entail patients missing or taking improper doses. Therefore, ensuring access to quality antimicrobials policies that encourage adequate supply of quality antimicrobials, an efficient antimicrobial supply chain system and a public financing mechanism to ensure availability. Access to quality antimicrobials is embodied by the following objectives and activities:

Objectives:

- 3.1 To improve the registration, marketing authorization and post-marketing surveillance of antimicrobials
- 3.2 To monitor availability and affordability of quality antimicrobials at all levels of care
- 3.3 To develop a sustainable and effective supply chain management for antimicrobials

Partners:

- Animal Health: DA, FDA, DTI, LGUs, farmers, animal producers, professionals, private sector
- Human Health: DOH, FDA, PhilHealth, DTI, hospitals, LGUs, professional societies, private sector (suppliers)

Table 15. Objectives and Activities for Key Strategy 3 (Animal Health)

Objectives	Activities
3.1 To improve the registration, marketing	1. Review and assess current policies related to the use and other regulations of

<p>authorization and post-marketing surveillance of antimicrobials</p>	<p>antimicrobials, as well as issuances related to access to antimicrobials (especially in the distribution and sale in outlets)</p> <ol style="list-style-type: none"> 2. Issue Sanitary Phytosanitary Import Clearance 3. Issue Administrative Order on the Prudent Use of Veterinary Drugs 4. Create a joint regulatory framework with the FDA 5. Establish a unit within FDA to regulate veterinary drugs 6. Develop a database of registered antimicrobials, including quantitative production and importation 7. Perform quality monitoring of veterinary drugs 8. Monitor and penalize of use of unregistered antimicrobials in animal husbandry and aquaculture 9. Strictly enforcement and incentivize adherence to regulations on antibiotic prescription, dispensing, and use in animal husbandry 10. Require all antimicrobials to adhere to Good Manufacturing Practices⁹
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Table 16. Objectives and Activities for Key Strategy 3 (Human Health)

Objectives	Activities
<p>3.1 To improve the registration, marketing authorization and post-marketing surveillance of</p>	<ol style="list-style-type: none"> 1. Monitor the quality of registered antimicrobials in the market 2. Process streamlining of review and release of

⁹ Good Manufacturing Practice (GMP) minimizes risks in pharmaceutical production by ensuring products are produced consistently and in accordance to quality standards.

antimicrobials	<p>marketing authorization of new antibiotics that address priority infectious diseases in the country¹⁰</p> <ol style="list-style-type: none"> 3. Forge an agreement on regulatory control over drugs used in aquaculture (FDA and DA) 4. Harmonize regulatory framework in the production and use of antimicrobials in humans and animals (FDA and DA) 5. The use of technologies to increase surveillance and detect falsified and substandard drugs in the market
3.2 To monitor availability and affordability of quality antimicrobials at all levels of care	<ol style="list-style-type: none"> 1. Conduct representative drug availability surveys 2. Conduct representative survey of pricing of essential antimicrobials 3. Conduct representative supply chain studies¹¹ (from forecasting to distribution) 4. Update the National Antibiotic Guidelines
3.3 To develop a sustainable and effective supply chain management for antimicrobials	<ol style="list-style-type: none"> 1. Improve public medicine logistics and procurement system to prevent stock out of drugs, particularly antimicrobials in government health facilities 2. Ensure quality of antimicrobials at every step of the supply chain 3. Expand of Philhealth reimbursement to non-restricted antimicrobials 4. Develop PhilHealth benefit packages for antimicrobial resistance

¹⁰ During the 2018 DOH-DA strategic planning, stakeholders articulated the need for FDA to facilitate easier registration and approval processes for antibiotics. For instance, out of 10 new antimicrobials in the global market, only one (1) is approved in the Philippines.

¹¹ A study assessing the impact of current reforms of supply chain management should be conducted if supply chain has improved.

	<p>5. Implement PhilHealth benefit packages for antimicrobial resistance</p>
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Key Strategy 4: Regulate and promote the rational use of antimicrobials

AMR can occur because of the ability of the organism to neutralize the effect of antimicrobials. However, emergence of AMR is exacerbated by irrational use of antibiotics (WHO, 2018). In fact, during his 1945 Nobel Prize acceptance speech, Alexander Fleming warned that AMR will be brought about by the cavalier use of antimicrobials once they are made available freely in the market (Government of Japan, 2016).

Irrational use of antimicrobials is made possible when antimicrobials are obtained without prescription or prescribed in conditions where antimicrobials are not indicated. The use of antimicrobials to promote growth in livestock is also an area of concern. The Philippines' initiatives toward the prudent use of antimicrobials are articulated by the following objectives and activities:

Objectives:

- 4.1 To fully implement guidelines for rational use of antimicrobials
- 4.2 To create an enabling environment for the rational use of antimicrobials
- 4.3 To track policy enforcement on rational use of antimicrobials in markets, farms and communities

Partners

- Animal Health: DA, FDA, LGUs, farmers, animal producers, professionals, private sector, academe
- Human Health: DOH, FDA, hospitals, LGUs, professional societies, private sector (retail stores)
- Education, Trade and other sectors: DTI, DOLE, CHED, DepEd

Table 17. Objectives and Activities for Key Strategy 4 (Animal Health)

Objectives	Activities
4.1 To fully implement guidelines for prudent use of antimicrobials	<ol style="list-style-type: none"> 1. Review existing regulations and regulatory controls for registration, advertising, importation and end use¹² 2. Revive the Veterinary Formulary Executive Council 3. Develop National Antibiotic Guidelines for Animal Health 4. Development of national guidelines based on international or regional guidelines for an Antimicrobial Stewardship Program in animal health 5. Translate GAHP and GAqP into technical regulations 6. Documentation of good practices of GAHP and GAqP 7. Institutionalize Philippine Practice Standards for Veterinarians in relation to Prudent Prescribing of Antimicrobials 8. Ensure DTI labelling on meat products are pursuant to newly developed national guidelines 9. Conduct monitoring and surveillance of animal feeds and veterinary drug establishments
4.2 To create an enabling environment for the prudent use of antimicrobials	<ol style="list-style-type: none"> 1. Assign regional coordinators on AMR activities 2. Develop and subsequently implement a strategy for regulation of the use of antibiotics common to both human and animal health as growth promoters and the continuous

¹² Ensuring ethical marketing of medicines, medical representatives need to secure license from Professional Regulation Commission (PRC) to practice their profession. However, no similar regulatory instrument for animal health exist.

	<p>monitoring of banned antimicrobials¹³</p> <ol style="list-style-type: none"> 3. Register existing aquafarms' sources of raw materials, as well as swine and poultry feeds, in processing plants 4. Registration of VDAP establishments and products 5. Strict enforcement of existing regulations regarding medicated feeds 6. Development of guidelines for the regulation of antimicrobials in drinking water 7. Incentivize practitioners on the prudent use of antibiotics 8. Incentivize farms and operations by rewarding approvals for labelling their meat products with an official marketing tagline¹⁴
4.3 To track policy enforcement on rational use of antimicrobials in markets, farms and communities	<ol style="list-style-type: none"> 1. Conduct dialogue with clients, stakeholders, industry and LGUs 2. Develop a system for monitoring implementation of issued regulations 3. Engage LGUs in the implementation of regulations, especially in use of antimicrobials in backyard farms

Table 18. Objectives and Activities for Key Strategy 4 (Human Health)

Objectives	Activities
4.1 To fully implement guidelines for rational use of antimicrobials	<ol style="list-style-type: none"> 1. Develop a prescription audit system for antimicrobials <ul style="list-style-type: none"> ○ Assessment workshop ○ Identify existing information systems

¹³ The OIE's terrestrial code includes a list of allowed antibiotics with evidence that they are not a threat to AMR

¹⁴ Subject to labelling guidelines; e.g. "approved by DA / BAI & NMIS"

	<ul style="list-style-type: none"> ○ Pilot prescription audit system ○ Implementation (including training) ○ Integrate system in HOMIS or other hospital IT systems <ol style="list-style-type: none"> 2. Integrate antimicrobials, AMR and AMS principles and concepts in higher education curricula and in the continuing professional education (CPE) for health professionals 3. Actively coordinate with LGUs on the dissemination and implementation of policies through the National Drug Policy Compliance Officers (NDPCO) per region
4.2 To create an enabling environment for the rational use of antimicrobials	<ol style="list-style-type: none"> 1. Strictly enforce regulations on antibiotic prescription and use 2. Continue rolling out AMS program in Level 1 hospitals & RHUs 3. Document and disseminate best practices in AMS 4. Develop, improve, adopt and roll-out E-AMS in hospitals that have been piloted 5. Monitor AMS program including the PhilPSP and the dissemination of NAG in all health facilities 6. Policy to create/ require plantilla positions for clinical pharmacists in both public and private facilities 7. Roll out AMS Fellowship Program for Hospital Pharmacists

Table 18. Objectives and Activities for Key Strategy 4 (Education, Trade and other sectors)

Objectives	Activities
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4.1 To fully implement guidelines for rational use of antimicrobials	1. Integrate antimicrobials, AMR and AMS principles and concepts in higher education curricula and in the continuing professional education (CPE) for health professionals
4.2 To create an enabling environment for the rational use of antimicrobials	1. Training/ CPD on antimicrobial resistance and the National Antibiotic Guidelines for company/school physicians and nurses.

Key strategy 5: Implement appropriate measures to reduce infection across all settings

Reducing infection will also reduce the need for utilization for antimicrobials since treatment of infections often include the use of antimicrobials. Therefore, it is imperative to decrease antimicrobial consumption because it can limit the improper use of antimicrobials (WHO, 2018). Infection prevention and control also plays a role in the prudent use of antimicrobials in the agriculture sector since it removes the need to use antimicrobials as growth promoters. Food production should follow international standards in good animal husbandry and aquaculture practices and biosecurity. This is important to boost production for local consumption and exportation of animal food. Infection prevention and control including initiatives promoting biosecurity, sanitation, hygiene are expressed in the objectives and activities below.

Objectives:

- 5.1 To enhance capacities of health personnel, facility, and community for infection prevention, sanitation and hygiene
- 5.2 To implement coordinated programs on sanitation, hygiene and infection prevention and control in hospitals, health facilities, animal clinics and farms
- 5.3 To improve good animal husbandry practices and biosecurity in animal farms

Partners:

- Animal Health: DA, LGUs, farmers, animal producers, professionals, private sector
- Human Health: DOH, hospitals, LGUs, professional societies, private sector

Table 19. Objectives and Activities for Key Strategy 5 (Animal Health)

Objectives	Activities
5.1 To enhance capacities of health personnel, facility, and community for infection prevention, sanitation and hygiene	<ol style="list-style-type: none"> 1. Implement Good Animal Husbandry Practices and Good Aquaculture Practices as Philippine National Standards 2. Strengthen animal health system capacity
5.2 To improve good animal husbandry practices and biosecurity in animal farms	<ol style="list-style-type: none"> 1. Ensure strict implementation of biosecurity measures in agriculture and aquaculture farms, with adherence to GAHP 2. Implement HACCP System in processing plants 3. Implementation of GMP for feed mills, importers, manufacturers, and suppliers

Table 20. Objectives and Activities for Key Strategy 5 (Human Health)¹⁵

Objectives	Activities
5.1 To enhance capacities of health personnel, facility, and community for infection prevention, sanitation and hygiene	<ol style="list-style-type: none"> 1. Conduct basic and continuous training of ICC personnel (IPC, and surveillance of HAI and other diseases) 2. Integrate infection prevention and control in other existing public health programs 3. Conduct effective IPC education and promotion at the community level
5.2 To implement coordinated programs on sanitation, hygiene and infection prevention and control in hospitals, health facilities, and other settings	<ol style="list-style-type: none"> 1. Enforcement of licensing standards on IPC 2. Monitor compliance of health facilities with the National Infection Prevention and Control Policy 3. Conduct mentoring activities of health facilities on

¹⁵ It should be noted that DOH-HFDB has a plan for IPC in hospitals including budget provisions.

	<p>IPC by professional societies and model hospitals</p> <p>4. Improve biosecurity measures</p> <p>5. Develop a protocol for AMR outbreaks (for hospitals)</p> <p>6. To develop a national system to monitor selected hospital acquired-infections and assess the effectiveness of interventions.</p>
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Key Strategy 6: Promote innovation and research on AMR

The problem of antimicrobial resistance is twofold: (1) the improper use of antimicrobials exacerbates the development of microbes’ resistance to existing antibiotics; and (2) the drying up of the antibiotics pipeline means that in the long run, the biological arms race against the microbes will be lost. Therefore, in order to address AMR, there is a need to develop evidence-based policies and initiatives to alter improper use of antimicrobials as well as develop incentives for the development of new antimicrobials. Annexes E and F contain AMR-related researches completed or ongoing in the Philippines in the last five years. Annexes G and H list research gaps and potential research questions and areas as guidance for researchers.

Objectives:

- 6.1 To create a supportive and sustainable environment for AMR research
- 6.2 To disseminate information on AMR
- 6.3 To promote development of innovative technologies and knowledge translation of AMR research

Partners:

- Animal Health: DA, DOST, academe, private sector, professional societies
- Human Health: DOH, hospitals, DOST-PCHRD, academe, professional societies, private sector

Table 21. Objectives and Activities for Key Strategy 6 (Animal Health)

Objectives	Activities
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<p>6.1 To create a supportive and sustainable environment for AMR research</p>	<ol style="list-style-type: none"> 1. Develop an integrated, targeted AMR Research Agenda for animal health and animal products (meats, milk, eggs, and honey) and other related areas 2. Establish comprehensive database for AMR research; Upgrade existing IT system on AMR research 3. Coordinate with public and private research agencies, think tanks, academe and professional societies to strengthen research collaboration 4. Conduct AMR research in different fields - microbiology, genetics & molecular studies, agriculture, animal production and husbandry, behavioural, market, innovation, supply chain, etc.
<p>6.2 To disseminate information on AMR</p>	<ol style="list-style-type: none"> 1. Include new discoveries and data in the iAMResponsible campaign, ensuring understanding by general public 2. Present research results and conclusions to stakeholders and industry to augment policy formation 3. Publish research results in peer-reviewed, scientific journals (considering CLSI Standards) 4. Develop inventory of AMR-related research on animals and their products (meats, milk, eggs, honey, etc.)
<p>6.3 To promote development of innovative technologies and knowledge translation of AMR research</p>	<ol style="list-style-type: none"> 1. Prioritize research that benefit small hold farmers (i.e. concepts and technology they could use in their farms) 2. Conduct research on good animal husbandry practices and alternatives to antimicrobial agents 3. Strengthen inter-agency collaboration for the conduct of research with DOST-PCARD, DOH and industry

Table 22. Objectives and Activities for Key Strategy 6 (Human Health)

Objectives	Activities
6.1 To create a supportive and sustainable environment for AMR research	<ol style="list-style-type: none"> 1. Mobilize budget and other resources for AMR research and development from various sources 2. Develop an integrated AMR research agenda prioritizing the development of new types of antimicrobials, novel therapies, genetic and molecular basis & trends of AMR, system, supply chain, economic studies, policy, community, patient level, provider level and behavior researches
6.2 To disseminate information on AMR	<ol style="list-style-type: none"> 1. Update database of local researches related to AMR available to all 2. Translate and disseminate AMR research into information for professionals and general public
6.3 To promote development of innovative technologies and knowledge translation of AMR research	<ol style="list-style-type: none"> 1. Identify fields related to AMR and antibiotic research that have potential for translation and commercialization 2. Establish an AMR innovation fund 3. Support universities, think tanks, experts and researchers who conduct innovation technologies for AMR and antibiotics 4. Encourage private sector collaboration to increase investments in R&D for antimicrobials

Key Strategy 7: Improve awareness and understanding of antimicrobial resistance through effective communication and education

Effective communication is an integral part of every public health initiative. Along with altering the behavior of the target population, effective communication fosters

participation and cooperation of stakeholders. The Philippines' initiative to improve awareness and understanding of antimicrobial resistance through effective communication and education is articulated in the objectives and activities below.

Objectives:

7.1 To increase public awareness on the rational use of antibiotics

7.2 To integrate AMR prevention and reduction in pre-service training of health and agriculture professionals

Partners:

- Animal Health: DA, LGUs
- Human Health: DOH, hospitals
- Education: DepEd, CHED

Table 23. Objectives and Activities for Key Strategy 7 (Animal Health)

Objectives	Activities
7.1 To increase public awareness on the rational use of antibiotics	<ol style="list-style-type: none"> 1. Conduct KAP studies for farmers, nutritionists, feed millers, and other stakeholders on prudent antimicrobial use and/or the impact of uncontrolled use of antimicrobials 2. Develop and subsequently implement the IAMResponsible campaign for different sectors (consumers, farmers, veterinarians, etc.) 3. Conduct nationwide advocacy campaign on prudent use of antimicrobials and food safety 4. Improve communication means (e.g. social media) for AMR awareness campaigns and/or public notifications 5. Conduct advocacy meetings with stakeholders

	<ol style="list-style-type: none"> 6. Produce IEC materials for distribution to stakeholders 7. Produce and disseminate (social media) documentary films on food production and safety with information on AMR
7.2 To integrate AMR prevention and reduction in pre-service training of health and agriculture professionals	<ol style="list-style-type: none"> 1. Implement risk communication plan specifically anchored to good veterinary practices targeting veterinarians, nutritionists, feed millers, suppliers, and farm owners 2. Integrate AMR awareness, prevention and reduction in school curriculum for pre-service training of health and agriculture professionals

Table 24. Objectives and Activities for Key Strategy 7 (Human Health)

Objectives	Activities
7.1 To increase public awareness on the rational use of antibiotics	<ol style="list-style-type: none"> 1. Update localized IEC materials on AMR 2. Continuously implement general IEC and advocacy activities in different settings especially in communities to affect behavior change 3. Conduct effective, targeted health promotion and communication initiatives about AMR, AMU, and AMS in various settings (e.g. health facilities, schools, work place) through various channels (social media, television, print media, theaters, etc.) directed towards consumers. 4. Develop an evaluation mechanism for promotion and communication initiatives on

	<p>AMR, AMU, AMS</p> <ol style="list-style-type: none"> 5. Engage with LGUs on AMR advocacy 6. Develop a risk communication plan for AMR
7.2 To integrate AMR prevention and reduction in pre-service training of health and agriculture professionals	<ol style="list-style-type: none"> 1. Integrate AMR awareness, prevention and reduction in school curriculum for pre-service training of health and agriculture professionals

Table 25. Objectives and Activities for Key Strategy 7 (Education)

Objectives	Activities
7.2 To integrate AMR prevention and reduction in pre-service training of health and agriculture professionals	<ol style="list-style-type: none"> 1. Conduct dialogue with DepEd and CHED officials/ focal points 2. Integrate AMR awareness, prevention and reduction in school curriculum for pre-service training of health and agriculture professionals

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Annexes

- A. List of Policies Related to AMR
- B. Key Strategies, Objectives, Activities, Stakeholders, Timelines and Budget
- C. Members of the Inter-Agency Committee on Antimicrobial Resistance (ICAMR)
- D. Members of Department of Agriculture Technical Working Group
- E. AMR-Related Research in Animal Health
- F. AMR-Related Research in Human Health
- G. Research Gaps
- H. Provisional Research Agenda: Topics, Areas and Questions
- I. Mapping of Regulation and Controls for the Antimicrobial Market in Animals and Humans

Annex A. List of Policies Related to AMR

Animal Health

Policy Number	Title	Agency
Republic Act No. 9711	Food and Drug Administration (FDA) Act of 2009	Food and Drug Administration
Republic Act No. 10611	Food Safety Act of 2013	Food and Drug Administration
Republic Act No. 6675	Generics Act of 1988	Food and Drug Administration
Joint A.O. 2013-0026	Rules on the Regulation of Veterinary Drugs and Products, Veterinary Biological Products, and Veterinary Drugs Establishments	Department of Agriculture & Food and Drug Administration
FDA Advisory No. 2013-006	The Risk of Indiscriminate Use of Antimicrobials in Animals	Food and Drug Administration
DA A.O. #40 and DOH A.O. #111-C, s. 1990	Rules and Regulations on Dispensing of Veterinary Drugs and Products	Department of Agriculture
DA A.O. #33 and DOH A.O. #111-A, s. 1991	Rules and Regulations on Registration of Veterinary Drugs and Products	Department of Agriculture
DA A.O. #39 and DOH A.O. #111-B, s. 1991	Rules and Regulations to Implement Prescribing Requirements for the Veterinary Drugs and Products	Department of Agriculture
A.O. No. 14 s.2006	Implementation of the national veterinary drug residues control program and creation of the interagency committee	Department of Agriculture
A.O. No. 24 s. 2009	Implementation of the veterinary drug residues control	Department of Agriculture

	program in foods	
A.O. No. 14 s.2006	Implementation of the national veterinary drug residues control program and creation of the interagency committee	Department of Agriculture

Human Health

Policy Number	Title	Agency
Republic Act No. 9502	Universally Accessible Cheaper and Quality Medicines Act of 2008	Department of Health
Republic Act No. 6675	Generics Act of 1988	Department of Health
Republic Act No. 9711	Food and Drug Administration (FDA) Act of 2009	Food and Drug Administration
Republic Act No. 10918	No Prescription No Dispensing Policy	Food and Drug Administration
AO No. 2015-0049	Rules and Regulations Governing the Antimicrobial Resistance Surveillance Program Accreditation of Bacteriology Laboratories in the Philippines for the PhilHealth Reimbursement of Select Antibiotics in the Philippine National Drug Formulary	Department of Health
AO No. 2016-0002	National Policy on Infection Prevention and Control in Healthcare Facilities	Department of Health

AO No. 42	Creating and Inter-agency Committee for the Formulation and Implementation of a National Action Plan To Combat Antimicrobial Resistance in the Philippines	Office of the President
Philhealth Circular No. 2018-0009	Use of Restricted Antimicrobials in Philhealth-accredited Health Care Institutions in Accordance with the Antimicrobial Resistance Surveillance Program (ARSP)	Philippine Health Insurance Corporation
Philhealth Circular No. 15, s-2006	Reimbursement of Claims for PNDF Drugs Used only in Hospitals Accredited Under the DOH Antimicrobial Resistance Surveillance Program	Philippine Health Insurance Corporation
AO No. 2014-4245	Creation of the National Antibiotic Guidelines Committee (NAGCom)	Department of Health
FDA Memorandum Circular No. 2014-015	Display of Antimicrobial Resistance (AMR) Infomercial	Food and Drug Administration
FDA Advisory No. 2014-057	Patient Counselling by Physicians and Pharmacists	Food and Drug Administration
FDA Advisory No. 2013-069	Consumer Tips on Buying Medicines from Drug Outlets	Food and Drug Administration
FDA Advisory No. 2013-057	Consumer Warning in self-medication	Food and Drug Administration
FDA Advisory No. 2013-054	Guidelines for Donors of Medicines Public Tips on Using Meds	Food and Drug Administration
FDA Advisory No. 2013-006	The Risk of Indiscriminate Use of Antimicrobials in Animals	Food and Drug Administration
DOH-FDA Advisory NO. 2012-017	Antimicrobial Resistance	Department of Health - Food and Drug Administration

<p>FDA circular 2013-008</p>	<p>Adoption of the Association of the Southeast Asian Nations (ASEAN) Post-Marketing Alert System (PMAS) for Defective or Unsafe Processed Food Products, Pharmaceutical Products, Traditional Medicines and Health Supplements, and Cosmetic and Household Hazardous Products and Devices</p>	<p>Food and Drug Administration</p>
<p>FDA circular 2012-012</p>	<p>Guidelines for Handling Rapid Alerts Arising from Quality Defects</p>	<p>Food and Drug Administration</p>
<p>AO 2014-0006</p>	<p>Guidelines on the establishment of laboratory networks</p>	<p>Department of Health</p>

Annex B. Key Strategies, Objectives, Activities, Responsible Agencies, Timelines and Budget

Note: The timelines, measurements, responsible agencies and estimate budget in this annex are still proposed. These will be reviewed by ICAMR for approval in Q1 2019.

Key Strategy 1. Commit to the Philippine Action Plan through multisectoral engagement and accountability

Animal Health, Human Health, Environment, Trade and Commerce, Education, Professional Regulation and Relevant Sectors

Objectives	Activities	Timeline	Measurement/ output	Responsible Agency	Budget
1.1 To forge a joint action plan to combat AMR for 2019-2023, including an agreement involving national agencies.	<ol style="list-style-type: none"> 1. Conduct ICAMR strategic planning, as well as development of the 2019-2023 action plan to combat AMR 2. Conduct regular 	Q4 2018 Quarterly	<ol style="list-style-type: none"> 1. 2019-2023 action plan to combat AMR. 2. Minutes of meeting 3. Yearly publication of 	ICAMR, DA, DOH, FAO, WHO DILG, DENR, DTI, DepEd, CHED, FDA, PhilHealth	P250,000.00 P200,000.00 (four meetings every year for five years) ICAMR report online

	meetings to monitor implementation of the plan 3. Publish an ICAMR annual report	Yearly	ICAMR report.	Academe, private sector	publication
1.2 To elevate AMR as a national priority	<ol style="list-style-type: none"> Draft and subsequently approve updated/ revised joint policy; Issuance of an administrative order to include other government stakeholders (e.g., DepEd, DENR and PRC) in ICAMR Mainstream AMR in the food safety action plan 	<p>2019</p> <p>2018</p>	<ol style="list-style-type: none"> Issuance of joint policy including other government stakeholders (e.g., DepEd, DENR and PRC) in ICAMR Inclusion of AMR in the food safety action plan. 	<p>ICAMR, DA, DOH</p> <p>FDA, DA</p>	<p>P200,000.00 for launch</p> <p>Part of No. 1</p>
1.3 To uphold accountability among various sectors in	<ol style="list-style-type: none"> Establish technical working groups within ICAMR (e.g. 	2019	<ol style="list-style-type: none"> Activity report and minutes of meeting of 	ICAMR, DA, DOH	P 5,000 per TWG per quarterly meeting

fulfilling their roles in the prevention and reduction of AMR	surveillance, research, financing) 2. Provide authority to the ICAMR Secretariat to ensure goals are met by the different stakeholders	2019	established technical working groups.		Additional HR at P300,000.00 per year
1.4 To allocate adequate resources and expertise for AMR initiatives in all relevant sectors	1. Include AMR in annual budget planning of the different agencies involved 2. Identify priority areas for international cooperation 3. Enhance international partnerships for AMR initiatives in human and animal health	Every year 2019 2019	1. Inclusion of AMR in the annual approved budget of ICAMR member agencies. 2. Reports, technical advisories 3. Minutes of meetings 4. Collaboration projects with other countries on	ICAMR, DA, DOH	Part of annual budgeting cycle Budget included in research

				AMR	
1.5 To continue collaboration for the achievement of key performance indicators	1. Regularly submit reports/required information of ICAMR member agencies identified in this action plan to the ICAMR secretariat	TBD	1. Regular submission of reports/required information of ICAMR member agencies.	ICAMR, DA, DOH	Collaboration meetings P500,000.00

Key Strategy 2. Strengthen surveillance and laboratory capacity

Animal Health

Objectives	Activities	Timeline	Measurement/ Output	Responsible Agency	Budget
2.1 To improve the surveillance and diagnostic capabilities of hospitals, and	1. Finalize, institutionalize and implement of ARSP in animals	2019 onwards	1. Quarterly ARSP results	DA-BAI DA-NMIS DA-BFAR	P5,000,000 per year <i>This item requires</i>

laboratories	<p>2. Regularly perform assessments and inventory of resources for monitoring, surveillance and testing (including price reference of laboratory supplies and equipment)</p> <p>3. Conduct leveling of capacities of DA to perform laboratory analysis for AMR</p> <p>4. Organize regional laboratory capacity-building activities for AMR detection</p>	2020	<p>2. Price survey</p> <p>3. Assessment and/or survey of laboratories' capacities</p> <p>4. Training on AMR detection</p>	DA-PCC	<p>planning and budget review from DA offices with laboratories.</p>
2.2 To capacitate health workers based on required competencies for different areas of AMR work	<p>1. Assess skill mix and quantity of human resources for animal health surveillance and laboratories e.g. infectious disease</p>	2019 2020	<p>1. Assessment of current skill mix of people working in laboratories</p>	DA-BAI	<p>P1,600 x 30 x 3 days x 3 batches = P432,000.00 Training program</p>

	<p>specialists, clinical pharmacists, etc.</p> <p>2. Hire and subsequently train technical/laboratory personnel on monitoring, surveillance and testing methods and the operation of laboratories, including compliance to accreditation standards (PNS ISO¹/IEC 17025², PNS ISO 15189³, PNS ISO/IEC 17020⁴, Codex⁵, CLSI⁶)</p> <p>3. Develop skills of LGU veterinary service staff</p>	2021	<p>2. A document discussing the skill mix and number of these staff needed for better surveillance</p> <p>3. Laboratory personnel hired</p> <p>4. Laboratory personnel trained on different topics</p>	<p>P18,000.00 x 12 x 10 persons = Recruitment</p> <p>P1,600 x 30 x 3 days x 3 batches = P432,000.00</p> <p>Training program</p>
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¹ The International Organization for Standardization (ISO) is an independent non-governmental organization composed of 162 national standard bodies developing over 22,000 international standards covering nearly all aspects of technology and manufacturing.

² ISO/IEC 17025 indicates requirements for the competence of testing and calibration laboratories

³ IEC 15189 outlines standards for quality and competence in medical laboratories.

⁴ IEC 17020 specifies standards for operation of different types of institutions performing inspection.

⁵ Codex Alimentarius is a group of internationally recognized standards, guidelines, policies, recommended practices on food, food production, and food safety.

⁶ The Clinical Laboratory Standards Institute (CLSI) is a non-profit international organization composed more than 1,400 organizations from over 60 countries setting and upholding the standards towards improvement of the quality test results, patient care delivery, and public health.

<p>2.3 To institutionalize well-developed reporting, monitoring and surveillance systems at all levels in health, agriculture and environment sectors</p>	<p>for sampling and surveillance</p>		<p>including accreditation standards</p> <p>5. Training of LGU staff on sampling and surveillance</p>		
<p>1. Finalize and approve surveillance and monitoring plan for animal health</p> <p>2. Establish a national coordinating center (NCC) for AMR within the animal health sector</p> <p>3. Create master list of all veterinary feeds, farms, and drug establishments</p> <p>4. Implement surveillance and monitoring systems for AMR and AMU in</p>	<p>2019</p> <p>2020</p> <p>2019</p> <p>2020</p>	<p>1. Signed and published surveillance and monitoring plan</p> <p>2. NCC established</p> <p>3. Master list created</p> <p>4. Surveillance and monitoring document in food-producing</p>	<p>DA-BAI</p> <p>DA-NMIS</p> <p>DA-BFAR</p> <p>DA-PCC</p>	<p>Ongoing</p> <p>P3,000,000 to cover for coordinating center, master list and surveillance and monitoring systems - planning, design and basic equipment</p>	

	<p>food-producing animals and their products: meats, fish & fishery products, milk, eggs, and honey</p> <p>5. Develop formal document for monitoring and quantification of AMR and AMU trends in food-producing animals⁷</p> <p>6. Perform sampling and testing analysis for antibiotic susceptibility testing based on internationally accepted standards (i.e. CLSI)</p> <p>7. Conduct data collection, sampling, testing, and analysis for veterinary drug residues in meat</p>	<p>2020</p> <p>2020</p> <p>2019</p>	<p>animals</p> <p>5. Report on AMU and AMR in animals</p> <p>6. Sampling and analysis for antibiotic susceptibility done</p> <p>7. Report on Drug residue testing</p>	<p>Budget for sampling and testing analysis: P500,000.00 per year (BAI to confirm budget)</p> <p>Routine activity</p>
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⁷ The process of developing a formal, public document must first undergo discussion with the animal health TWG, as well as undergo a risk analysis to ensure proper communication

	products, and connect findings with AMR. ⁸				
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Human Health

Objectives	Activities	Timeline	Measurement/ Output	Responsible Agency	Budget
2.1 To improve the surveillance and diagnostic capabilities of hospitals, and laboratories	<ol style="list-style-type: none"> 1. Ensure sufficient laboratory human capacity and other resources through planning and resource allocation 2. Prepare Investment Plan for AMR monitoring and surveillance 3. Explore potential areas to strengthen financing of laboratory tests in public and private sectors 	<p>2020-2023</p> <p>2019</p> <p>2019</p> <p>2020-2023</p>	<ol style="list-style-type: none"> 1. Human resources plan outlining what skills are needed and how many are needed for each 2. Investment Plan drafted 	DOH-PD RITM	<p>Investment Planning P400,000.00</p> <p><i>Detailed costing study is required for investment in laboratories at national and regional levels. For consultation with RITM and EB.</i></p> <p><i>Indicative budget to set up regional laboratories P50,000,000.00 for three years</i></p>

⁸ Residues are not part of AMR data.

2.2 To capacitate health workers based on required competencies for different areas of AMR work	<p>4. Expand ARSP training and accreditation to non-tertiary hospitals</p> <p>5. Strengthen Luzon, Visayas and Mindanao reference laboratories to detect and monitor AMR surveillance</p>	2023	<p>3. ARSP training of Level II and I hospitals</p> <p>4. ARSP Accreditation of Level II and I hospitals</p> <p>5. Visayas and Mindanao reference laboratories identified</p>	DOH-PD RITM Hospitals	P1,500,000.00 Consultancy/ Feasibility study
	<p>1. Assess skill mix and quantity of human resources for human health surveillance and laboratories, e.g. infectious disease specialists, clinical pharmacists,</p>	2019	Needs assessment	Number and title of	P5,000 per day x 20

	<p>2. Send technical personnel to relevant local and foreign trainings on monitoring, surveillance and testing methods and the operation of laboratories, including compliance to accreditation standards (PNS ISO/IEC 17025, PNS ISO 15189, PNS ISO/IEC 17020, Codex,</p>		<p>trainings attended, and by whom</p>		<p>days x 5 personnel = P500,000 per year</p>
<p>2.3 To institutionalize well-developed reporting, monitoring and surveillance systems/ networks at all levels in health, agriculture and environment sectors</p>	<p>1. Integrate AMR in the strategies of the National and Regional Health Laboratory Network</p> <p>2. Designate EB as the national coordinating center for AMR surveillance within the human health sector</p> <p>3. Develop protocol to monitor, manage, analyze, and utilize HAI data from</p>	<p>2019</p> <p>2019</p> <p>2019</p> <p>2020-2021</p>	<p>Inclusion of AMR in the EB and PIDSR framework</p> <p>AO designating EB as NCC</p> <p>Protocol on monitoring, managing, analyzing, and utilizing HAI data</p>	<p>DOH-PD HFDB RITM Hospitals EB</p> <p>EB, HFDB, DPCB</p>	<p>P500,000.00</p> <p>P500,000.00</p> <p>P500,000.00</p>

	<p>local, regional to national levels</p> <p>4. Expand annual point prevalence surveys (PPS) utilizing prescription data</p> <ol style="list-style-type: none"> a. Develop WHO methodology on antimicrobial use b. Develop e-prescription system that will include the collection of data on antimicrobial use c. Training on e-prescription system (integrated with pharmacovigilance) d. Adopt e-prescription system in DOH hospitals <p>5. Establish a case-based AMR surveillance to enable quantifiable burden of</p>	<p>2019-2023</p> <p>2020</p> <p>2020</p> <p>2019</p> <p>2019</p> <p>2020-2021</p>	<p>AMU Surveillance system institutionalized</p> <p>Case-based AMR surveillance protocol developed</p> <p>System for integrated</p>	<p>PD, Philhealth, FDA</p> <p>RITM, EB, PD, DPCB</p> <p>RITM, EB, PD,</p>	<p>P 5,000,000.00 annually</p> <p>P 500,000.00</p> <p>P 500,000.00 (with pilot)</p> <p>P 2,000,000.00</p> <p>P 500,000.00 Consultancy and meetings</p>
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	disease			surveillance institutionalized with regular reports disseminated	DPCB, HFDB ICAMR ICAMR ICAMR	P 500,000.00 P 1,000,000.00 For consultation with EB, need to integrate/ harmonize with PIDSR P1,000,000.00 annually
6.	Develop an integrated system for AMR, AMU, and HAI ⁹	2020				
7.	Develop an IT platform to communicate data on AMR to stakeholders	2019				
8.	Workshop/ trainings on IT for hospitals and healthcare practitioners in private and public sectors	2021		No. of trainings conducted, people trained, hospitals participated		

Environmental Sector

⁹ A similar system is employed in the USA. This is the National Antimicrobial Resistance Monitoring System for Enteric Bacteria (NARMS), which tracks antimicrobial susceptibility of certain enteric (intestinal) bacteria found in ill people, retail meats, and food animals. Established in 1996, NARMS is a partnership between US state and local public health departments, Centers for Disease Control and Prevention (CDC), the U.S. Food and Drug Administration (FDA), and the U.S. Department of Agriculture (USDA).

Objectives	Activities	Timeline	Measurement/ Output	Responsible Agency	Budget
2.1 To improve the surveillance and diagnostic capabilities of hospitals, and laboratories	<ol style="list-style-type: none"> 1. Engage with environment laboratories 2. Assess capacities 3. Conduct environmental monitoring for AMR in residue 4. Ensure proper disposal of waste and hazardous materials 5. Enhance technologies and capabilities of environmental laboratories for monitoring 6. Monitor implementation of protocols on waste disposal from hospitals, HF, clinics, animal clinics 	<p>2019</p> <p>2020</p> <p>Ongoing</p> <p>Ongoing</p> <p>2020</p> <p>2020-2023</p>	<ol style="list-style-type: none"> 1. MOA/MOU 2. Technical reports 3. Monitoring reports on AMR in residue 4. Monitoring reports on compliance to proper disposal of waste and hazardous materials 5. TBD 6. Monitoring reports on waste disposal from 	DENR	<p>Meetings</p> <p>P500,000.00 consultancy</p> <p>Ongoing Routine</p> <p>P3,000,000.00 indicative budget</p> <p><i>Budget to be identified</i></p>

				hospitals, HF, clinics, animal clinics		
2.2 To capacitate health workers based on required competencies for different areas of AMR work	1. Train staff for environmental monitoring of residue	2020	1. Number of staff trained by facility	DENR	P2,000 x 20 participants x 5 days x 3 batches = P600,000.00 Training	

Key Strategy 3. Ensure uninterrupted access to safe, effective and quality-assured antimicrobials

Animal Health

Objectives	Activities	Timeline	Measurement/ Output	Responsible Agency	Budget
3.1 To improve the registration, marketing authorization and	1. Review and assess current policies related to the use and	2019	Policy review conducted	DA-TWG FDA	P500,000.00

<p>post-marketing surveillance of antimicrobials</p>	<p>other regulations of antimicrobials, as well as issuances related to access to antimicrobials (especially in the distribution and sale in outlets)</p> <p>2. Issue Sanitary Phytosanitary Import Clearance</p> <p>3. Issue Administrative Order on the Prudent Use of Veterinary Drugs</p> <p>4. Create a joint regulatory framework with the FDA</p> <p>5. Establish a unit within FDA to regulate veterinary drugs</p> <p>6. Develop a database of registered antimicrobials, including quantitative production and importation</p>	<p>2019</p> <p>2019</p> <p>2019</p> <p>2020</p> <p>2020</p> <p>2020</p>	<p>Key policies developed, approved and disseminated</p> <p>AO establishing Veterinary Unit in FDA</p> <p>Online Database of registered antimicrobials</p> <p>Quality assessment studies of different veterinary antimicrobials</p>	<p>Routine¹¹</p> <p>Include in meetings</p> <p>Include in meetings</p> <p>P2,000,000.00 per year (confirm with FDA)</p> <p>P500,000.00 IT system/consultant</p> <p>P1,000,000.00 per year</p> <p>P500,000.00 per year</p>
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¹¹ The issuance of SPS import clearance is a regular activity of quarantine.

	<p>7. Perform quality monitoring of veterinary drugs</p>	2021			Routine P500,000.00 per year
	<p>8. Monitor and penalize of use of unregistered antimicrobials in animal husbandry and aquaculture</p>	2019-2023	Prescription studies		Routine
	<p>9. Strictly enforce and incentivize adherence to regulations on antibiotic prescription, dispensing, and use in animal husbandry</p>	2019-2023	GMP seal in antimicrobials sold in the market		Routine
	<p>10. Require all antimicrobials to adhere to Good Manufacturing Practices¹⁰</p>				

Human Health

¹⁰ Good Manufacturing Practice (GMP) minimizes risks in pharmaceutical production by ensuring products are produced consistently and in accordance to quality standards.

Objectives	Activities	Timeline	Measurement/ Output	Responsible Agency	Budget
3.1 To improve the registration, marketing authorization and post-marketing surveillance of antimicrobials	<ol style="list-style-type: none"> 1. Monitor the quality of registered antimicrobials in the market 2. Process streamlining of review and release of marketing authorization of new antibiotics that address priority infectious diseases in the country¹² 3. Forge an agreement on regulatory control over drugs used in aquaculture (FDA and DA) 4. Harmonize regulatory framework in the production and use of antimicrobials in 	<p>2019-2023</p> <p>2019</p> <p>2019-2020</p> <p>2019-2020</p>	<ol style="list-style-type: none"> 1. PMS report on the quality of registered antimicrobials and the presence of unregistered antimicrobials. 2. Protocols for facilitated processes of review and marketing authorization of new antibiotics available in websites; issuance of 	<p>FDA</p> <p>FDA</p> <p>FDA, DA</p>	<p>P 1,000,000.00 Confirm budget with FDA</p> <p>P200,000.00</p> <p>P200,000.00 legal consultant and meetings</p> <p>Include in No. 3</p>

¹² During the 2018 DOH-DA strategic planning, stakeholders articulated the need for FDA to facilitate easier registration and approval processes for antibiotics. For instance, out of 10 new antimicrobials in the global market, only one (1) is approved in the Philippines.

	humans and animals (FDA and DA)		certificate of product registration, license to operate for antimicrobials and importation clearance.			
3.2 To monitor availability and affordability of quality antimicrobials at all levels of care	<ol style="list-style-type: none"> 1. Conduct representative drug availability surveys 2. Conduct representative survey of pricing of essential antimicrobials 3. Conduct representative supply chain studies¹³ (from forecasting to distribution) 4. Update the National Antibiotic Guidelines 	<p>2019-2022</p> <p>2019-2020</p> <p>2019-2020</p> <p>2020-2023</p>	Reduction of AMU by 10% (Target NO. 6)	<p>PD</p> <p>PD</p> <p>PD</p> <p>National Antibiotics Guideline Committee</p>	<p>P5,000,000.00 for levels I, II, III, (2019-2022)</p> <p>Part of No. 1</p> <p>P 1,500,000.00 Consultancy</p> <p>P2,000,000.00</p>	
3.3 To develop a	1. Improve public medicine	2019-2021	5% stockout rate	DOH-PD	P2,000,000.00	

¹³ A study assessing the impact of current reforms of supply chain management will be conducted if supply chain improved.

<p>sustainable and effective supply chain management for antimicrobials</p>	<p>logistics and procurement system to prevent stockout of drugs, particularly antimicrobials in government health facilities</p> <p>2. Ensure quality of antimicrobials at every step of the supply chain</p> <p>3. Expansion of Philhealth reimbursement to non-restricted antimicrobials</p> <p>4. Develop PhilHealth benefit packages for antimicrobial resistance</p> <p>5. Implement PhilHealth benefit packages for antimicrobial resistance</p>	<p>2019-2021</p> <p>2019</p> <p>2020</p> <p>2021</p>	<p>Documents on quality assessment and monitoring</p> <p>Philhealth circular on reimbursement of use of antimicrobials</p> <p>Philhealth benefit package for AMR developed</p> <p>PhilHealth Benefit package for AMR developed and implemented in 10 hospitals</p>	<p>DOH-BAC PhilHealth Procurement and Supply Chain Management Team Private sector Hospitals FDA PhilHealth PhilHealth PhilHealth</p>	<p>Consultancy</p> <p>Part of No. 1</p> <p>P2,000,000.00 for TA</p> <p>Part of No. 3</p> <p>P5,000,000.00 as initial support</p>
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Key Strategy 4: Regulate and promote the rational use of antimicrobials

Animal Health

Objectives	Activities	Timeline	Measurement/ Output	Responsible Agency	Budget
4.1 To fully implement guidelines for prudent use of antimicrobials	1. Review existing regulations and regulatory controls for registration, advertising, importation and end use ¹⁴	2019	Developed NAG for animal health	DA-TWG BAI BFAR PCC	P1,000,000.00
	2. Revive the Veterinary Formulary Executive Council	2020	Contextualization of GAHP and GAqP into Philippine context		P500,000.00
	3. Develop National Antibiotic Guidelines for Animal Health	2020			P3,000,000.00
	4. Development of national guidelines based on international or regional guidelines for an	2020	Updated Philippine Practice Guidelines for Veterinarians		P2,000,000.00

¹⁴ Ensuring ethical marketing of medicines, medical representatives need to secure license from Professional Regulation Commission (PRC) to practice their profession. However, no similar regulatory instrument for animal health exist.

4.2 To create an enabling environment	<p>Antimicrobial Stewardship Program in animal health</p> <p>5. Translate GAHP and GAqP into technical regulations</p> <p>6. Documentation of good practices of GAHP and GAqP</p> <p>7. Institutionalize Philippine Practice Standards for Veterinarians in relation to Prudent Prescribing of Antimicrobials</p> <p>8. Ensure DTI labelling on meat products are pursuant to newly developed national guidelines</p> <p>9. Conduct monitoring and surveillance of animal feeds and veterinary drug establishments</p> <p>1. Assign regional coordinators on AMR activities</p>	<p>2019</p> <p>2020</p> <p>2020</p> <p>2021</p> <p>2020</p> <p>conduct pilot</p> <p>2020</p>	<p>Adopted guidelines</p> <p>Studies conducted</p> <p>Policy or protocol</p> <p>Monitoring of policy</p> <p>Monitoring report of pilot shared</p> <p>Baseline rate of AMU in farms by</p>	<p>DA-TWG</p> <p>BAI</p>	<p>P1,000,000.00</p> <p>P500,000.00</p> <p>P1,000,000.00</p> <p>Routine</p> <p>P200,000.00</p> <p>Annual budgeting of new staff</p>
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for the prudent use of antimicrobials	<p>2. Develop and subsequently implement a strategy for regulation of the use of antibiotics common to both human and animal health as growth promoters and the continuous monitoring of banned antimicrobials¹⁵</p> <p>3. Register existing aquafarms' sources of raw materials, as well as swine and poultry feeds, in processing plants</p> <p>4. Registration of VDAP establishments and products</p> <p>5. Strict enforcement of existing regulations regarding medicated feeds</p> <p>6. Development of guidelines for the regulation of antimicrobials in drinking</p>	2020	2020 Reduction of use by 10% in 2023	BFAR PCC	P3,000,000.00 Consultancy/ TA P2,000,000.00 TA Routine Routine P1,000,000.00 TA P1,000,000.00
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¹⁵ The OIE's terrestrial code includes a list of allowed antibiotics with evidence that they are not a threat to AMR

	water	2020			P1,000,000.00 Promotion and orientation
	<p>7. Incentivize practitioners on the prudent use of antibiotics</p> <p>8. Incentivize farms and operations by rewarding approvals for labelling their meat products with an official marketing tagline¹⁶</p>				
4.3 To track policy enforcement on rational use of antimicrobials in markets, farms and communities	<p>1. Conduct dialogue with clients, stakeholders, industry and LGUs</p> <p>2. Develop a system for monitoring implementation of issued regulations</p> <p>3. Engage LGUs in the implementation of regulations, especially in use of antimicrobials in backyard farms</p>	2019 2020 2019-2023	Baseline date on antimicrobial use in markets and farms	DA-TWG BAI	P500,000.00 Consultancy P1,000,000.00 P2,000,000.00

¹⁶ Subject to labelling guidelines; e.g. "approved by DA / BAI & NMIS"

Human Health

Objectives	Activities	Timeline	Measurement/ Output	Responsible Agency	Budget
4.1 To fully implement guidelines for rational use of antimicrobials	<ol style="list-style-type: none"> 1. Develop a prescription audit system for antimicrobials <ul style="list-style-type: none"> ○ Assessment workshop ○ Identify existing information systems ○ Pilot prescription audit system ○ Implementation (including training) ○ Integrate system in HOMIS or other hospital IT systems 2. Integrate antimicrobials, AMR 	<p>2019-2023</p> <p>2019</p> <p>2019</p> <p>2020</p> <p>2021</p> <p>2020</p>	<p>Prescription Audit system developed, piloted, and implemented</p> <p>AMR and AMS discussed in colleges, especially in health-related</p>	<p>PD HFDB HFSRB Hospitals KMITS</p> <p>CHED</p>	<p>P1,000,000.00 per year</p> <p>P500,000.00</p>

	and AMS principles and concepts in higher education curricula and in the continuing professional education (CPE) for health professionals 3. Actively coordinate with LGUs on the dissemination and implementation of policies through the National Drug Policy Compliance Officers (NDPCO) per region	2021	fields AMR as one of the topics in different societies' CPE LGUs having local rules and/or activities that support anti-AMR campaign	CHDs, DILG	P500,000.00 Orientation meetings
4.2 To create an enabling environment for the rational use of antimicrobials	<ol style="list-style-type: none"> 1. Strictly enforce regulations on antibiotic prescription and use 2. Continue rolling out AMS program in Level 1 hospitals & RHUs 3. Document and disseminate best practices in AMS 4. Develop, improve, adopt and roll-out E-AMS in hospitals 	2020 2019-2020 2020	AMS program in 200 Level 1 hospitals E-AMS implemented in 10 hospitals 90% of L3 hospitals	FDA PD, HFDB, HFSRB, Hospitals PD PD HFSRB, CHDs	P2,000,000.00 P10,000,000.00 per year P5,000,000.00 P5,000,000.00

	that have been piloted	2021	with clinical pharmacists 60% of L2 hospitals with clinical pharmacists	HHRDB, HFDB, PD, DILG, DBM	Coordination with HFDB
5.	Monitor AMS program including the PhilPSP and the dissemination of NAG in all health facilities	2020			
6.	Policy to create/ require plantilla positions for clinical pharmacists in both public and private facilities	2020		PD	P1,000,000.00 per year
7.	Roll out AMS Fellowship Program for Hospital Pharmacists				

Education, Trade and other sectors

Objectives	Timeline	Measurement/	Responsible Agency	Budget
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	Activities		Output	
4.1 To fully implement guidelines for rational use of antimicrobials	<ol style="list-style-type: none"> 1. Integrate antimicrobials, AMR and AMS principles and concepts in higher education curricula and in the continuing professional education (CPE) for health professionals 	2021-2023	Inclusion in curricula	DTI, PD, FDA, DepEd, CHED, DOLE Meetings only
4.2 To create an enabling environment for the rational use of antimicrobials	<ol style="list-style-type: none"> 1. Training/ CPD on antimicrobial resistance and the National Antibiotic Guidelines for company/school physicians and nurses. 	2019-2023	5 CPD trainings conducted every year	DTI, PD, FDA, DepEd, CHED, DOLE, Professional societies Ongoing with professional societies

Key strategy 5: Implement appropriate measures to reduce infection across all settings

Animal Health

Objectives	Activities	Timeline	Measurement/ Output	Responsible Agency	Budget
5.1 To enhance capacities of health personnel, facility, and community for infection prevention, sanitation and hygiene	<ol style="list-style-type: none"> 1. Implement Good Animal Husbandry Practices and Good Aquaculture Practices as Philippine National Standards 2. Strengthen animal health system capacity 	2019-2023	GAHP and GAqP adopted into Philippine context and disseminated	BAI BFAR PCC LGU	P1,600.00 x 30 participants x 3 days x 6 batches = P864,000.00 per year Part of No. 1 budget
5.2 To improve good animal husbandry practices and biosecurity in animal farms	<ol style="list-style-type: none"> 1. Ensure strict implementation of biosecurity measures in agriculture and aquaculture farms, with adherence to GAHP 	2020-2023	80% of commercial farms with biosecurity measures	BAI BFAR PCC LGU	P500,000.00 per year for monitoring

	2. Implement HACCP System in processing plants		GMP observed in 60% of feed mills, importers, manufacturers and suppliers		Part of budget
	3. Implementation of GMP for feed mills, importers, manufacturers, and suppliers				P500,000.00 per year for orientation meetings

Human Health¹⁷

Objectives	Activities	Timeline	Measurement/ Output	Responsible Agency	Budget
5.1 To enhance capacities of health personnel, facility, and community for infection prevention, sanitation and hygiene	1. Conduct basic and continuous training of ICC personnel (IPC, and surveillance of HAI and other diseases)	2019-2023 2020	IPC prevention and control programs in	HFDB DPCB Hospitals	P1,600.00 x 30 participants x 5 days x 10 batches = P2,400,000.00 per year P2,500,000.00 per year TA and trainings

¹⁷ It should be noted that DOH-HFDB has a plan for IPC in hospitals including budget provisions.

			2021	all Level 1 facilities		P2,500,000.00 per year
	2. Integrate infection prevention and control in other existing public health programs					
	3. Conduct effective IPC education and promotion at the community level					
5.2 To implement coordinated programs on sanitation, hygiene and infection prevention and control in hospitals, health facilities, and other settings and ensure their sustainability	1. Enforcement of licensing standards on IPC	2019-2023	2019-2023	Baseline data and annual monitoring of IPC compliance	HFDB DPCB HFSRB Hospitals	P2,000,000.00 per year P1,000,000.00 per year
	2. Monitor compliance of health facilities with the National Infection Prevention and Control Policy		2019-2023			P1,000,000.00 per year
	3. Conduct mentoring activities of health facilities on IPC by professional societies and model hospitals		2019-2023	Protocol for AMR outbreaks developed and	RITM CAMR, EB, RITM	Part of training P2,000,000.00 for consultancy/ TA
	4. Improve biosecurity measures					

	<p>5. Develop a protocol for AMR outbreaks (for hospitals)</p> <p>6. To develop a national system to monitor selected hospital acquired-infections and assess the effectiveness of interventions</p>		disseminated		Included in No. 5
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Note: DOH-HFDB has a plan for IPC in hospitals including budget provisions.

Key Strategy 6: Promote innovation and research on AMR

Animal Health

Objectives	Activities	Timeline	Measurement/ Output	Responsible Agency	Budget
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<p>6.1 To create a supportive and sustainable environment for AMR research</p>	<p>1. Develop an integrated, targeted AMR Research Agenda for animal health and animal products (meats, milk, eggs, and honey) and other related areas</p> <p>2. Establish comprehensive database for AMR research; Upgrade existing IT system on AMR research</p> <p>3. Coordinate with public and private research agencies, think tanks, academe and professional societies to strengthen research collaboration</p> <p>4. Conduct AMR research in different fields -</p>	<p>2019</p> <p>2020</p> <p>2019-2020</p> <p>2019-2023</p>	<p>1. AMR Research agenda developed</p> <p>2. AMR research database readily accessible from ICAMR and BAI</p> <p>3. At least 20 research projects completed based on AMR Research Agenda</p>	<p>DA-TWG DA-Research PCARD Academe</p>	<p>P500,000.00 for research agenda setting</p> <p>P500,000.00</p> <p>P5,000,000.00 per year budget as part of 2% MOOE</p>
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	microbiology, genetics & molecular studies, agriculture, animal production and husbandry, behavioural, market, innovation, supply chain, etc.						
6.2 To disseminate information on AMR	<p>1. Include new discoveries and data in the iAMResponsible campaign, ensuring understanding by general public</p> <p>2. Present research results and conclusions to stakeholders and industry to augment policy formation</p> <p>3. Publish research results in peer-reviewed, scientific</p>	2019			DA-TWG BAI Private sector Academe	P500,000.00	
		2019-2023				P500,000.00 per year	
		2019-2023				P500,000.00 per year	

	journals (considering CLSI Standards)	2020	Updated inventory by 2023		P500,000.00
4.	Develop inventory of AMR-related research on animals and their products (meats, milk, eggs, honey, etc.)				
6.3 To promote development of innovative technologies and knowledge translation of AMR research	<p>1. Prioritize research that benefit small hold farmers (i.e. concepts and technology they could use in their farms)</p> <p>2. Conduct research on good animal husbandry practices and alternatives to antimicrobial agents</p> <p>3. Strengthen inter-agency collaboration for the conduct of research with DOST-</p>	<p>2020</p> <p>2020-2023</p> <p>2019</p>	<p>1. At least 1 research that can be applied in farms</p> <p>2. At least 1 research in alternative antimicrobials</p>	<p>DA-TWG</p> <p>DA-Research</p> <p>PCARD</p>	<p>P500,000.00</p> <p>P500,000.00 per year</p> <p>P500,000.00 per year</p>

	PCARD, DOH and industry					
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Human Health

Objectives	Activities	Timeline	Measurement/ Output	Responsible Agency	Budget
6.1 To create a supportive and sustainable environment for AMR research	<ol style="list-style-type: none"> 1. Mobilize budget and other resources for AMR research and development from various sources 2. Develop an integrated AMR research agenda prioritizing the development of new diagnostic tests to detect AMR, types of antimicrobials, novel therapies, genetic and molecular basis & 	<p>2019-2023</p> <p>2019</p>	Number of research projects funded according to research agenda	<p>PD</p> <p>PCHRD</p> <p>Private sector</p> <p>Academe</p>	<p>P 10,000,000.00</p> <p>P500,000.00 for research agenda setting</p>

	trends of AMR, system, supply chain, economic studies, policy, community, patient level, provider level and behavior researches						
6.2 To disseminate information on AMR	<ol style="list-style-type: none"> 1. Update database of local researches related to AMR available to all 2. Translate and disseminate AMR research into information for professionals and general public 	<p>2020</p> <p>2019-2023</p>	<p>Infographics and/ or laymanized abstract distributed</p>	<p>PD</p> <p>PCHRD</p> <p>Academe</p> <p>HPCS</p>	<p>P2,000,000.00</p> <p>P5,000,000.00 annually</p>		
6.3 To promote development of innovative technologies and knowledge translation of AMR research	<ol style="list-style-type: none"> 1. Identify fields related to AMR and antibiotic research that have potential for translation and commercialization 2. Establish an AMR 	<p>2019</p> <p>2020-2023</p>	<p>Document identifying these opportunities</p> <p>Number of researches and</p>	<p>PD</p> <p>PCHRD</p> <p>Academe</p> <p>Private sector</p> <p>ICAMR</p>	<p>Part of 6.1.2</p> <p>P15,000,000.00 per year for human health</p>		

	<p>innovation fund</p> <p>3. Support universities, think tanks, experts and researchers who conduct innovation technologies for AMR and antibiotics</p> <p>4. Encourage private sector collaboration to increase investments in R&D for antimicrobials</p>	2019-2023	institutions supported by the fund	PCHRD-PD PD, FDA, PHAP	P2,000,000.00 per year
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Key Strategy 7: Improve awareness and understanding of antimicrobial resistance through effective communication and education

Animal Health

Objectives	Activities	Timeline	Measurement/ Output	Responsible Agency	Budget
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7.1 To increase public awareness on the rational use of antibiotics	<p>1. Conduct KAP studies for farmers, nutritionists, feed millers, and other stakeholders on prudent antimicrobial use and/or the impact of uncontrolled use of antimicrobials</p> <p>2. Develop and subsequently implement the iAMResponsible campaign for different sectors (consumers, farmers, veterinarians, etc.)</p> <p>3. Conduct nationwide advocacy campaign on prudent use of</p>	2019	<p>1. KAP study completed</p> <p>2. iAMResponsible campaign report containing activities for different sectors</p> <p>3. Campaign materials</p> <p>4. AMR Health promotion Plan developed and implemented</p> <p>5. Advocacy</p>	DA-TWG, FAO	<p>P2,000,000.00</p> <p>P2,000,000.00 per year</p> <p>P1,000,000.00 per year</p>
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	<p>antimicrobials and food safety</p> <p>4. Improve communication means (e.g. social media) for AMR awareness campaigns and/or public notifications</p> <p>5. Conduct advocacy meetings with stakeholders</p> <p>6. Produce IEC materials for distribution to stakeholders</p> <p>7. Produce and disseminate (social media) documentary films on food production and safety</p>	<p>2020</p> <p>2019-2023</p> <p>2020</p> <p>2020</p>	<p>meetings conducted</p> <p>6. IEC materials distributed</p> <p>7. Documentary films disseminated in social media</p>	<p>P1,000,000.00 per year</p> <p>P500,000.00 per year</p> <p>P1,000,000.00 per year</p> <p>P2,000,000.00</p>
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7.2 To integrate AMR prevention and reduction in pre-service training of health and agriculture professionals	with information on AMR	<p>2020</p> <ol style="list-style-type: none"> 1. Implement risk communication plan specifically anchored to good veterinary practices targeting veterinarians, nutritionists, feed millers, suppliers, and farm owners <p>2021</p> <ol style="list-style-type: none"> 2. Integrate AMR awareness, prevention and reduction in school curriculum for pre-service training of health and agriculture professionals 	<ol style="list-style-type: none"> 1. Risk communication plan for animal sector developed and disseminated 2. AMR integrated in school curriculum of pre-service training 	DA-TWG	<p>Include in meetings</p> <p>Include in meetings</p>
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Human Health

Objectives	Activities	Timeline	Measurement/ Output	Responsible Agency	Budget
7.1 To increase public awareness on the rational use of antibiotics	<ol style="list-style-type: none"> 1. Update localized IEC materials on AMR 2. Develop Advocacy Plan and Health Promotion Plan for AMR 3. Continuously implement general IEC and advocacy activities in different settings especially in communities 4. Conduct effective, targeted health promotion and communication initiatives about AMR, 	<p>2019</p> <p>2019-2020</p> <p>2019-2023</p> <p>2019-2023</p> <p>2020-2023</p>	<ol style="list-style-type: none"> 1. IEC materials disseminated 2. Health Promotion and Advocacy Plan 3. Annual celebration of WAAW in Regions 4. Conduct of awareness 	<p>PD, HPCS DOH, DOH-CHDs</p>	<p>P2,000,000.00</p> <p>P1,500,000.00 for consultant and meetings</p> <p>P5,000,000.00 annually</p> <p>P2,000,000.00 per year</p> <p>P2,000,000.00 per</p>

	<p>AMU, AMS in various settings (e.g. health facilities, schools, workplace) through various channels (social media, television, print media, theaters, etc.) directed towards consumers.</p> <p>5. Develop an evaluation mechanism for promotion and communication initiatives on AMR, AMU, AMS</p> <p>6. Engage with LGUs on AMR advocacy</p> <p>7. Develop a risk communication plan for AMR</p>	<p>2020</p> <p>2021</p> <p>2020</p>	<p>activities in schools, health facilities and workplace</p> <p>5. M&E plan for AMR promotion</p> <p>6. LGU level activities</p> <p>7. Risk communication plan developed</p>	<p>year</p> <p>P500,000.00</p> <p>P1,000,000.00</p> <p>P1,000,000.00 TA/ consultancy</p>
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7.2 To integrate AMR prevention and reduction in pre-service training of health and agriculture professionals	1. Integrate AMR awareness, prevention and reduction in school curriculum for pre-service training of health and agriculture professionals	2020	1. AMR integrated in pre-training curriculum content	CHED	P1,000,000.00
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Education and other sectors

Objectives	Activities	Timeline	Measurement/ Output	Responsible Agency	Budget
7.2 To integrate AMR prevention and reduction in pre-service training of health and	<p>1. Conduct dialogue with DepEd and CHED officials/ focal points</p> <p>2. Integrate AMR awareness, prevention and reduction in school</p>	<p>2019</p> <p>2020</p>	1. Updated information and IEC materials published on ICAMR website, social	<p>1. PD, FDA, DepEd, CHED, and HPCS</p> <p>2. DOH, DA, CHED (& PRC?)</p>	<p>Meetings</p> <p>P500,000.00 Meetings</p>

<p>agriculture professionals</p>	<p>curriculum for pre-service training of health and agriculture professionals</p>		<p>media platforms, print media, posters in pharmacies , and aired in theaters and TV stations 2. Training modules and monitoring reports</p>		
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Annex C. Members of the Inter-Agency Committee on Antimicrobial Resistance (ICAMR)

- **Department of Health**
 - Disease Prevention and Control Bureau
 - Epidemiology Bureau
 - Food and Drug Administration
 - Health Facilities Development Bureau
 - Health Facility and Services Regulatory Bureau
 - Health Promotion and Communication Service
 - Pharmaceutical Division
 - Research Institute for Tropical Medicine / National Reference Laboratory
- **Department of Agriculture**
 - ASEC Livestock
 - Bureau of Animal Industry
 - Bureau of Fisheries and Aquatic Resources
 - National Meat Inspection Service
 - OPP

- OSEC
- Philippine Carabao Center
- **Department of Science and Technology**
- Philippine Council for Health Research and Development
- Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development
- **Department of Interior and Local Government**
- **Department of Trade and Industry**

Annex D. Members of DA TWG

1. Bureau of Animal Industry (BAI)
2. National Meat Inspection Service (NMIS)
3. National Dairy Authority (NDA)
4. Philippine Carabao Center (PCC)
5. Bureau of Fisheries and Aquatic Resources (BFAR)

Annex E. AMR-Related Research in Animal Health

This Annex is included in the Plan to provide guidance to decision makers and planners on what researchers and information are already available in the Philippines. It also gives idea of institutions involved and experts.

TITLE	AUTHOR/S	INSTITUTION/S	JOURNAL /	YEAR
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UNPUBLISHED/ONGOING			PUBLICATION	
Engaging the food and agriculture sectors in sub-Saharan Africa and south and southeast Asia in the global efforts to combat Antimicrobial resistance using One-Health Approach (GCP/GLO/710/UK)		FAO HQ, FAO-RAP, FAOPH, DA-BAI		2017-March 2021
Surveillance of antimicrobial resistant E. Coli and Salmonella in livestock farms and markets		WHO-AGISAR, Philippine Carabao Center, Research Center for Zoonoses Control - Japan		
The Philippines' pilot surveillance on the extent of antimicrobial resistance in commensal and enteric zoonotic bacteria isolates from livestock and the farm environment		DA - Biotech; NMIS; Philippine Carabao Center		
Prevalence, molecular epidemiology, and antibiotic resistance profiles of methicillin resistant <i>Staphylococcus aureus</i> (MRSA) from milk and rural samples of dairy buffaloes	Badua, A. T., & Mingala, C.N.	Philippine Carabao Center, Chang Mai University - Thailand		
Identification, molecular characterization, and risk factor analysis of antimicrobial resistance, virulence factors and genetic characteristics of <i>Klebsiella pneumoniae</i> from dairy cattle farms in Batangas,	Flor Marie Immanuelle, Rafallo Pilapil-Amante			

Philippines				
Strengthening capacities, policies and national action plans on prudent and responsible use of antimicrobials in fisheries	Melba G. Bondad-Reantaso	FAO Aquatic AMR Project (FMM/RAS/298)		
Quantification of antibiotic residues and identification of antibiotic-resistance genes of microorganisms in raw chicken from wet markets in Quezon City, Philippines	Professor Levi Letlet H. Larcia II, Professor Joanna V. Toralba, Ms. Melanie V. Salinas	University of the Philippines Manila - College of Public Health		

<p>Surveillance of antimicrobial resistance in the Philippines</p> <p>Surveillance and characterization of antimicrobial resistant <i>Escherichia coli</i> and <i>Salmonella</i> from livestock farms, egg, milk and meat in the Philippines</p>	<p>Department of Health</p> <ul style="list-style-type: none"> - National Center for Disease Prevention and Control (NCDPC) - National Epidemiology Center (NEC) - National Center for Health Facility Development - National Center for Health Promotion - Bureau of Quarantine - Health Emergency Management Staff - San Lazaro Hospital - Research Institute for Tropical Medicine (RITM) - Centers for Health Development (CHDs) - National Center for Pharmaceutical Access & Management (NCPAM) <p>Department of Agriculture</p> <ul style="list-style-type: none"> - Bureau of Animal Industry (BAI) - National Meat Inspection Service (NMIS) <p>Department of Environment and Natural Resources</p> <ul style="list-style-type: none"> - Philippine Animal Welfare Bureau <p>Philippine Inter-agency Committee on Zoonoses</p> <p>University of the Philippines - College of Public Health</p> <p>Philippine Hospital Infection Control Society</p> <p>Philippine Council for Quality Assurance in Clinical Laboratories</p>	
<p>-</p>	<p>PCC; Hokkaido University</p>	

Phenotypic and genotypic antimicrobial resistance of <i>Escherichia coli</i> isolated from healthy buffaloes, cattle, pigs, and chickens and environmental sources in major livestock-producing regions in the Philippines (old title)	Padilla, M.A., et al.			
PUBLISHED				
Isolation and molecular Characterization of streptococcal species recovered from clinical infections in farmed Nile tilapia species (<i>Oreochromis niloticus</i>) in the Philippines	Legario, F.S., Choresca, C.H., Turnbull, J.F., and Crumlish, M.	Institute of Aquaculture, Faculty of Natural Sciences, University of Stirling (UK)/Natural Sciences Department, Ilo Science and Technology University/ National Fisheries Research and Development Institute-Fisheries Biotechnology Center (DA)	Journal of Fish Disease, Sept. 14, 2020 DOI:10.1111/jfd.13247	
Antimicrobial used in backyard and commercial poultry and swine farms in the Philippines: A qualitative pilot study	Barroga, T.R.M, Morales, R.G., Benigno, C.C., Castro, S.J.M., Caniban, M.M., Cabullo, M.F.B., Agunos, A., de Barlogh, K., and Dorado-Garcia, A.	Food and Agriculture Organization of the United Nations (GCP/GLO/710/UK), Bureau of Animal Industry Department of Agriculture, National Meat Inspection Service Department of Agriculture, Food and Agriculture Organization of the United Nations Regional Office of Asia and the Pacific, Food and Agriculture Organization of the United Nations	Frontiers of Veterinary Science Doi:10.3389/fvets.2020.00329	2020

	Rome, Italy			
Multidrug resistant Salmonella serotype anatum in travelers and seafood from Asia, United States	Karp, B.E., Leeper, M.M., Chen, J.C., Tagg, K.A., Frncois Watkins, L.K., and Friedman, C.R.	Centers for Disease Control and Prevention, Atlanta, Georgia, USA	Emerging Infectious Diseases, 26(5):1030-1033	2020
Prevalence, antibiogram, and resistance profile of extended-spectrum beta lactamase producing E. coli isolates from pigs farms in Luzon, Philippines	Gundran, R.S., Cardenio, P.A., Salvador, R.T., Sison, F.B., Benigno, C.C., Kreausukon, K., Pichpol D., Punyapornwithaya, V.	College of Veterinary Science and Medicine Central Luzon State University, Philippine College of Veterinary Epidemiologist and PHIL VET Health Services, Faculty of Veterinary Medicine Chiang Mai University	Microbial Drug Resistance DOI:10.1089/mdr.2019.0019	2019
Draft genome sequence of multidrug-resistant Vibrio parahemolyticus strain PH698, infecting penaeid shrimp in the Philippines	Saloma, C.P., Penir, S.M.U., Azanza, J.M.r., dela Pena, L.D., Usero, R.C. et al	National Institute of Molecular Biology and Biotechnology University of the Philippines Diliman, Philippine genome Center University of the Philippines Diliman, Southeast Asia Fisheries Development Center Aquaculture Development Center, Negros Prawn Producers Cooperative	Microbiol resource Announc 8:e01040-19 https://doi.org/10.1128/MRA.01040-19 .	2019
Prevalence and distribution of blaCTX-M, blaSHV, blaTEM genes in extended-spectrum beta-lactamase producing E coli isolated from broiler farms in the	Gundran, R.S., Cardenio, P.A., Villanueva, M.A., Sison, F.B., Benigno, C.C., Kreausukon, K.,	College of Veterinary Science and Medicine Central Luzon State University, Livestock Biotechnology Center Department of Agriculture,	BMC Veterinary Research 15(227) https://doi.org/10/1186/s12917-019-1975-9	2019

Philippines	Picjpol, D., and Punyapornwithaya, V.	Food and Agriculture Organization of the United Nations Regional Office for Asia and the Pacific, Faculty of Veterinary Medicine Chiang Mai University		
Occurrence and antibiotic sensitivity of <i>E. coli</i> and <i>Salmonella</i> spp. In retail chicken meat at selected markets in Velencia City, Bukidnon, Philippines	Elumba, Z.S., Allera, M.L.M, Taganas, R.R.R.	Department of Biology Central Mindanao University	Asian Journal of Biological and Life Sciences, 7(2):53-58	2018
Antibiotic susceptibility patterns of bacteria isolated from crustaceans stranded in the Philippines	Obusan, M.C.M., Aragonas, L.V., Rivera, W.L., and Siringan. M.A.T.	Institute of Biology University of the Philippines Diliman, Institute of Environmental Sciences and Meteorology University of the Philippines Diliman, Natural Sciences Research Institute University of the Philippines Diliman	Aquatic Mammals, 44(5):568-579	2018
Detection of Quinolone resistance through amplification of the <i>gyrA</i> gene of the <i>Mycobacterium</i> species form Human and Animal Sources	Garcia, G.G., Espinosa, R.K.M., Miguel, M., Bernardino, M.L., Aquino, M.A.D., and Mingala, C.N.	College of Veterinary Science and Medicine Central Luzon State University, Biosafety and Environmental Section Philippine Carabao Center, Tropical Disease Foundation Philippine Institute of Tuberculosis	International Journal of Veterinary Science, 7(4):190-194.	2018
SMolecular detection of tetracycline and sulfonamide resistance genes in	Garcia, G.G., Francia, A.J.e., Costales, K.B.,	College of Veterinary Science and Medicine Central Luzon State	International Journal of Veterinary Medicine,	2018

respiratory and gastrointestinal bacterial isolates of ruminants	Balbin, M.M. and Mingala, C.N.	University, Biosafety and Environmental Section Philippine Carabao Center	8(1):1-9
Multiple resistance to medically important antimicrobials of commensal <i>E. coli</i> isolated from dresses broiler chickens in CALABARZON, Philippines	Torio, H.E., and Padilla, M.A.	College of Veterinary Medicine Nueva Vizcaya State University, College of Veterinary Medicine University of the Philippines Los Banos	Philippine Journal of Veterinary Medicine, 55(2):95-106 2018
Antibiotic resistance and extended-spectrum beta-lactamase production of <i>E. coli</i> isolated from irrigation waters in selected urban farms in Metro Manila, Philippines	Vital, P.G., Zara, E.S., Paraoan, C.E.M., Dimasupil, M.A.Z., Abello, J.J.M., Santos, I.T.G., and Rivera, W.L.	Institute of Biology University of the Philippines Diliman, Natural Sciences Research Institute University of the Philippines Diliman	Water, 10(548) Doi:10.3390/w10050548 2018
High level resistance and multi-resistance to medically important antimicrobials in <i>E. coli</i> isolated from healthy pigs at slaughter in Laguna, Philippines	Padilla, M.A., and Amatorio, M.Q.	College of Veterinary Medicine University of the Philippines Los Banos, College of Veterinary Medicine Benguet State University	Philippine Journal of Veterinary Medicine, 54(1):36-45 2017
Multiple antimicrobial resistance of the <i>E. coli</i> isolated from Nile tilapia sold in wet markets in Metro Manila and their conjugative transferability if drug resistance	Jose, M.A.I., and Cabrera, E.C.	Department of Biology De La Salle University, Department of Biological Sciences MSU Iligan Institute of Technology	DLSU Research Congress 2017
Antimicrobial resistance in <i>Escherichia coli</i> and <i>Salmonella</i> spp. isolates from fresh produce and the impact to food safety	Vital, P. G., Caballes, M. B. D., & Rivera, W. L.	Institute of Biology, College of Science, University of the Philippines Diliman, Quezon City, Philippines	J Environ Sci Health B. 52(9):683-689. doi:10.1080/03601234.2017.1331676

<p>Molecular characterization and antimicrobial resistance of <i>Salmonella enterica</i> from swine slaughtered in two different types of Philippine abattoir</p> <p>Detection of Class I and II integrons for the assessment of antibiotic and multidrug resistance among <i>Escherichia coli</i> isolates from agricultural irrigation waters in Bulacan, Philippines</p>	<p>Calayag, A.M.B., Pacilbare, P.A.P., Santos, P.D.M., Bautista, C.A.C., Rivera, W.L.</p> <p>Paraoan, C.E.M., Rivera, W.L., Vital, P.G.</p>	<p>Institute of Biology, College of Science, University of the Philippines Diliman, Quezon City, Philippines</p> <p>Institute of Biology, College of Science, University of the Philippines Diliman, Quezon City, Philippines</p>	<p>Food Microbiol. 65: 51-56. doi: 10.1016/j.fm.2017.01.016</p> <p>J Environ Sci Health B. 52(5):306-313. DOI: 10.1080/03601234.2017.1281647</p> <p>International research Journal of Interdisciplinary and Multidisciplinary Studies, 2(2):65-72 ISSN:2394-7969 (online); 2394-7950 (print)</p>	<p>August 2017</p> <p>May 2017</p>
<p>Microbial Plate count and detection of <i>E. coli</i> in in pork meat samples form stalls in a public wet market in Cebu, Philippines</p>	<p>Yandug, B.S., Ventura, D.C., Ybanes, R.H.D., and Ybanez, A.P.</p> <p>Lim, P.W., Tiam-Lee, D.C., Pacilbare, P.A., Subejano, M.S., Cabero-Palma, J.A., Penuliar G.M.</p>	<p>Southwestern University, Biology and Environmental Studies Program University of the Philippines Cebu, Gallas College of Medicine University of the Visayas, University of Southern Philippines Foundation</p> <p>Institute of Biology, College of Science, University of the Philippines Diliman, Quezon City, Philippines</p>	<p>Jpn J Infect Dis. 70(3):311-313. doi: 10.7883/yoken.JJID.2016.309</p>	<p>2016</p> <p>October 2016</p>
<p>High rates of contamination of poultry meat products with drug-resistant <i>Campylobacter</i> in Metro Manila, Philippines</p>	<p>Lim, P.W., Tiam-Lee, D.C., Pacilbare, P.A., Subejano, M.S., Cabero-Palma, J.A., Penuliar G.M.</p>	<p>Institute of Biology, College of Science, University of the Philippines Diliman, Quezon City, Philippines</p>	<p>Jpn J Infect Dis. 70(3):311-313. doi: 10.7883/yoken.JJID.2016.309</p>	<p>October 2016</p>

Perspective on Antimicrobial Resistance in Livestock and Livestock products in ASEAN countries	Archawakulathep, A., Kim, C.T.T., Meunsene, D., Handijatno, D., Hassim, H.A., Rovira, H.R.G., et al.	Various Veterinary Institution and Universities in Southeast Asia	Thai Journal of Veterinary Medicine, 44(1):5-13	2014
Loads and antimicrobial resistance of <i>Campylobacter</i> spp. on fresh chicken meat in Nueva Ecija, Philippines	Sison, F.B., Chaisowwong, W., Alter, T., Tiwananthagorn, S., Pichpol, D., Lampang, K.N., Baumann, M.P., Götz, G.	Freie Universität Berlin, Germany; Chiang Mai University, Thailand; Department of Pathobiology, College of Veterinary Science and Medicine, Central Luzon State University	Poult Sci. 93(5):1270-3. https://doi.org/10.3382/ps.2013-03791	May 2014
Antimicrobial resistance of <i>Salmonella enterica</i> isolates from tonsil and jejunum with lymph node tissues of slaughtered swine in Metro Manila, Philippines	Ng, K.C., Rivera, W.L.	Institute of Biology, College of Science, University of the Philippines, Diliman, Quezon City	ISRN Microbiol. 2014:364265. DOI: 10.1155/2014/364265	March 2014
Microbiological quality of fresh produce from open air markets and supermarkets in the Philippines	Vital, P.G., Dimausay, K.G.B., Widmer, K.W., and Rivera, W.L.	Institute of Biology University of the Philippines Diliman, Natural Sciences Research Institute University of the Philippines Diliman, International Environmental Analysis and Education Center Gwangju Institute of Science and Technology	The Scientific World Journal http://dx.doi.org/10/1155/2014/219534	2014
Microbiological quality of chicken- and pork-based street-vended foods from Taichung, Taiwan, and Laguna, Philippines	Manguiat, L.S., Fang, T.J.	Department of Food Science and Biotechnology, National Chung Hsing University, Taiwan;	Food Microbiol. 36(1):57-62. doi: 10.1016/j.fm.2013.04.00	October 2013

			Department of Nutrition, China Medical University, Taiwan	5	
Relationship between multi-resistance of Philippine isolates <i>Campylobacter jejuni</i> and antimicrobial usage	Baldrias, L.R.		College of Veterinary Medicine University of the Philippines Los Banos	Philipp J. Vet Med, 50(2):104-111	2013
Estimated maximum daily intake of Streptomycin residue in port consumed by age and gender groups in the Philippines	Vutey, V., Baldrias, L.R., Divina, B.P., and Ducusin, R.J.T.		Royal University of Agriculture Phom Phen Cambodia, College of Veterinary Medicine University of the Philippines Los Banos	International Journal of Environmental and Rural Development 3(1):62-67	2012
In vitro sensitivity and resistance of 46 <i>Leptospira</i> strains isolated from rats in the Philippines to 14 antimicrobial agents	Chakraborty, A., Miyahara, S., Villanueva, S.Y., Gloriani, N.G., Yoshida, S.		Department of Bacteriology, Graduate School of Medical Sciences, Kyushu University; Department of Medical Microbiology, College of Public Health, University of the Philippines—Manila, Manila, Philippines	Antimicrob Agents Chemother. 54(12):5403-5. DOI: 10.1128/AAC.00973-10	December 2010

<p>Identification and characterization of Class 1 integron resistance gene cassettes among <i>Salmonella</i> strains isolated from imported seafood</p>	<p>Khan, A.A., Ponce, E., Nawaz, M.S., Cheng, C.M., Khan, J.A., West, C.S.</p>	<p>Division of Microbiology, National Center for Toxicological Research, U.S. Food and Drug Administration; Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE), Departamento de Biotecnología Marina, Mexico; Pacific Regional Laboratory-Southwest, U.S. Food and Drug Administration; Department of Cardiology, University of Arkansas for Medical Sciences</p>	<p>Appl Environ Microbiol. 75(4):1192-6. DOI: 10.1128/AEM.02054-08</p> <p>February 2009</p>
<p>Level and percentage recovery of resistance to oxytetracycline and oxolinic acid of bacteria from shrimp ponds</p>	<p>Tendencia, E.A., & dela Peña, L.D.</p>	<p>Aquaculture Department, Southeast Asian Fisheries Development Center</p>	<p>Aquaculture. 213(1-4):1-13. doi: 10.1016/S0044-8486(02)00017-0</p> <p>2002</p>

Annex F. AMR-Related Research in Human Health

This Annex is included in the Plan to provide guidance to decision makers and planners on what researchers and information are already available in the Philippines. It also gives idea of institutions involved and experts.

This list of AMR related studies excludes studies on TB drug resistance

Title	Author/s	Institution/s	Journal/ Publication	Year	Funding agency	Found using
A case of multi-drug resistant typhoid fever: proliferation vs. eradication	Menadro M. Sandoval		The Filipino Family Physician	1995		HERDIN

<p>A cross-sectional study on the antimicrobial sensitivity profile of multi-drug resistant gram-negative bacteria from inpatients and outpatients at a tertiary hospital in Cagayan de Oro City, January-November 2006</p>	<p>Darel Gresan C. Quisil, Candy T. Cahilog, Jeanette A. Venancio, Cleva Teresita M. Alaba, Marco Po D. Dela Cruz, Paul Carlo P. Araneta, Celeste A. Corinales, Melissa T. Sy, Henissa B. Edrozo, Arnold C. Perez</p>		<p>2007</p>		<p>HERDIN</p>
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<p>A Multicenter, Randomized, Double-blind, Parallel-group Clinical Study of S-649266 Compared with Meropenem for the Treatment of Hospital-acquired Bacterial Pneumonia, Ventilator-associated Bacterial Pneumonia, or Healthcare-associated Bacterial Pneumonia Caused by Gram negative Pathogens</p>	<ol style="list-style-type: none"> 1. Ronald Allan R. Payumo, MD 2. Lalaine Liamido Mortera, MD 3. Malbar G. Ferrer, MD 4. Joel M. Santiago, MD 5. Marie Grace Dawn T. Isidro, MD 6. Ronnie Z. Samoro, MD 7. Joven Roque V. Gonong, MD 8. Albert Albay, Jr. MD 9. Myla M. Castillo, MD 	<ol style="list-style-type: none"> 1. Mary Johnston Hospital 2. Manila Central University - Filemon D. Tanchoco Medical Foundation 3. St. Paul's Hospital Iloilo 4. Quirino Memorial Medical Center 5. West Visayas State University Medical Center 6. West Visayas State University Medical Center 7. Lung Center of the Philippines 8. Philippine General Hospital 9. Dr. Jose N. Rodriguez Memorial Hospital 	<p>N/A</p>	<p>On-going</p>	<p>Shionogi & Co., Ltd</p>	<p>Philippine Health Research Registry</p>
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<p>A Phase 3 Prospective, Randomized, Multicenter, Open-Label, Central Assessor-Blinded, Parallel Group, Comparative Study to Determine the Efficacy, Safety and Tolerability of Aztreonam-Avibactam (ATM-AVI) ±Metronidazole (MTZ) versus Meropenem±Colistin (MER±COL) for the Treatment of Serious Infections due to Gram-Negative Bacteria, Including Metallo-B-Lactamase (MBL) – Producing Multidrug Resistant Pathogens, for Which There Are Limited or No Treatment Options</p>	<ol style="list-style-type: none"> 1. Camilo C. Roa Jr., MD 2. Albert Albay, Jr. MD 3. Lalaine Liamido Mortera, MD 4. Marie Grace Dawn T. Isidro, MD 	<ol style="list-style-type: none"> 1. Philippine General Hospital 2. Philippine General Hospital 3. Manila Central University - Filemon D. Tanchoco Medical Foundation Hospital 4. West Visayas State University Medical Center 	<p>N/A</p>	<p>Pending</p>	<p>Pfizer Inc.</p>	<p>Philippine Health Research Registry</p>
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<p>A randomized trial of ciprofloxacin versus cefixime for treatment of gonorrhea after rapid emergence of gonococcal ciprofloxacin resistance in the Philippines</p>	<p>Aplasca, M.R., Pato-Mesola, V., Klausner, J.D., Manalastas, R., Wi, T., Tuazon, C.U., Dallabetta, G., Whittington, W.L., Holmes, K.K.</p>	<p>Clin Infect Dis. 32(9):1313-8</p>	<p>2001</p>	<p>AstraZeneca AB</p>	<p>DA-PCC</p>
<p>An Open-Label, Randomized, Multicenter, Phase III Study of Ceftazidime Avibactam (CAZ-AVI, Formerly CAZ104) and Best Available Therapy for the Treatment of Infections Due to Ceftazidime Resistant Gram Negative Pathogens</p>	<p>Armando Crisostomo, MD</p>	<p>Philippine General Hospital</p>	<p>On-going</p>	<p>Philippine Health Research Registry</p>	

Antibacterial activities of ethanolic extracts of Philippine medicinal plants against multidrug-resistant bacteria	Demetrio L. Valle Jr., Jeannie I. Andrade, Juliana Janet M. Puzon, Esperanza C. Cabrera, Windell L. Rivera		Asian Pacific Journal of Tropical Biomedicine	2015		HERDIN
Antibiotic policy in PGH			Drug Bull PGH	1990		HERDIN
Antibiotic resistant bacteria in raw chicken meat sold in a public market in Quezon City, Philippines	Margaret L. de Guzman, Rizza Mae E. Manzano, Jessamae France B. Monjardin	Department of Biology, College of Arts and Sciences - University of the Philippines-Manila, Department of Science and Biology, College of Arts and Sciences - Miriam College, Quezon City	Philippine Journal of Health Research and Development	2016		HERDIN

Antimicrobial and Antiparasitic Constituent(s) of <i>Moringa oleifera</i> Lam	<ol style="list-style-type: none"> 1. Florecita S. De Guzman, PhD 2. Windell L. Rivera, PhD 3. Jose Manuel L. Gutierrez 	<ol style="list-style-type: none"> 1. University of the Philippines - Diliman, Institute of Biology 2. University of the Philippines - Diliman, Institute of Biology 3. University of the Philippines - Diliman, Institute of Chemistry 	Acta Medica Philippina	On-going	Philippine Council for Health Research and Development, Department of Science and Technology	Philippine Health Research Registry
Bacteremia caused by multi-resistant salmonella- A therapeutic problem	Ofelia Castro-Tablan			1980		HERDIN

<p>Bactericidal Property of Zingiber officinale (Ginger) Against Staphylococcus aureus, Methicillin Resistant Staphylococcus aureus, Escherichia coli and Extended Spectrum Beta Lactamase Escherichia coli.</p>	<p>Alfredo V. Corpuz</p>	<p>University of Northern Philippines - Main</p>	<p>N/A</p>	<p>On-going</p>	<p>Philippine Council for Health Research and Development, Department of Science and Technology</p>	<p>Philippine Health Research Registry</p>
<p>Bioactive Metabolite Screening of Nephrolepis cordifolia Plant and its Associated Fungal Endophytes Against Methicillin-Resistant Staphylococcus aureus</p>	<p>Judee Nogodula</p>	<p>University of the Immaculate Conception</p>	<p>N/A</p>	<p>On-going</p>	<p>Philippine Council for Health Research and Development, Department of Science</p>	<p>Philippine Health Research Registry</p>

Ceftazidime-Avibactam for the Treatment of Infections Due to Ceftazidime Resistant Pathogens	Armando Crisostomo, MD	Philippine General Hospital (PGH)	N/A	On-going	AstraZeneca AB	Philippine Health Research Registry
Community-acquired methicillin-resistant Staphylococcus aureus pyomyositis: A case report	Vincent Paul C. Godinez, Cherry Taguiang-Abu	De La Salle University Medical Center	The Philippine Journal of Microbiology and Infectious Diseases	2008		HERDIN

Comparative study of co-trimoxazole and tetracyclines in the treatment of penicillin-resistant gonorrhoea	Lao LM, Bautista A, Francisco M,		Journal of the Philippine Medical Association	1979		HERDIN
Correlates of gonococcal infection and of antimicrobial-resistant <i>Neisseria gonorrhoeae</i> among female sex workers, Republic of the Philippines, 1996-1997	Klausner, J.D., Aplasca, M.R., Mesola, V.P., Bolan, G., Whittington, W.L., Holmes, K.K.		J Infect Dis. 179(3):729-33	1999		DA-PCC
Development of an antibacterial IHM-PG01	Cecilia Nelia C. Maramba-Lazarte, MD	National Institutes of Health - University of the Philippines - Manila, Institute of Herbal Medicine	N/A	On-going	Philippine Council for Health Research and Development, Department of Science	Philippine Health Research Registry

Development of New Antimicrobial Anoplin Lipopeptides	<ol style="list-style-type: none"> 1. Portia Mahal G. Sabido, PhD 2. Windell L. Rivera, PhD 3. Maria M. Abe 	<ol style="list-style-type: none"> 1. University of the Philippines - Diliman, Institute of Chemistry 2. University of the Philippines - Diliman, Institute of Biology University of the Philippines - Diliman, Institute of Chemistry 		On-going	Philippine Council for Health Research and Development, Department of Science and Technology	Philippine Health Research Registry
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Distribution within a tertiary hospital of ofloxacin-resistant <i>Pseudomonas aeruginosa</i> serotypes	Garvez MD Jr, Francisco RC, Tupasi TE		The Philippine Journal of Microbiology and Infectious Diseases	can't access	HERDIN
Drug resistant <i>Salmonella typhi</i>	Thelma E. Tupasi , Rodrigo Luis C. Romulo , Vilma M. Co , Ellamae D. Sorongon		Makati Medical Center Proceedings	1994	HERDIN
Extraction, Purification and Preliminary Toxicity and Antioxidant Potential Assessment of the Phytochemicals from Selected Medicinal Plants of Mindanao	1. Mylene M. Uy, PhD 2. Anita P. Rivera	Mindanao State University - Iligan Institute of Technology, College of Science and Mathematics		On-going	Philippine Health Research Registry Philippine Council for Health Research and Development, Department of Science and Technology

In vitro activity of piperacillin-tazobactam on piperacillin-resistant organisms	Co VM, Tolentino LE, Lazo JM, Baes LC		MMC Proc	1995		HERDIN
In vitro evaluation of broad-spectrum beta-lactams in the Philippines medical centers: role of fourth-generation cephalosporins	Johnson, D.M., Biedenbach, D.J., Jones, R.N.	The Philippines Antimicrobial Resistance Study Group	Diagn Microbiol Infect Dis. 35(4):291-7	1999		DA-PCC
In vitro evaluation of <i>Tinospora rumphii</i> Boerlage (Makabuhay) stem extract as an Antimicrobial Agent against <i>Staphylococcus aureus</i> , <i>Streptococcus pyogenes</i> and <i>Pseudomonas aeruginosa</i>	1. Diane V. Lagda, MD 2. Johannes F. Dayrit, MD, FPDS 3. Ma. Teresita G. Gabriel, MD, FPDS 4. Catherina Jessica Sutantoyo, MD	Research Institute for Tropical Medicine		Completed	Philippine Council for Health Research and Development, Department of Science and Technology	Philippine Health Research Registry

	5. Grace Monica P. Ibaviosa, MD	San Pedro College		Completed	Philippine Council for Health Research and Development, Department of Science and Technology	Philippine Health Research Registry
In Vitro study of the Potential Anti-microbial properties of "Moti-Moti"	Jasmen Pasia	San Pedro College		Completed	Philippine Council for Health Research and Development, Department of Science and Technology	Philippine Health Research Registry

<p>Key informant interview on antimicrobial resistance (AMR) in some countries in the western pacific region</p>	<p>Yuri Lee and Mami Wakabayashi</p>	<p>1. Health Services Development Unit, World Health Organization, Western Pacific Regional Office, United Nations Avenue, P.O. Box 2932, Manila, 1000, Philippines</p> <p>2. Institute of Health Services Research, Yonsei University, Seoul, South Korea</p>	<p>Globalization and Health</p>	<p>2013</p>	<p>Google Scholar</p>
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Multidrug resistant <i>Mycobacterium leprae</i> from patients with leprosy.	Maeda, S., Matsuoka, M., Nakata, N., Kai, M., Maeda, Y., Hashimoto, K., Kimura, H., Kobayashi, K. Kashiwabara, Y.		Antimicrob Agents Chemother. 45(12):3635-9	2001		DA-PCC
Multidrug resistant <i>Staphylococcus aureus</i> from waste pickers of Iligan City	Lucilyn D. Lahoylahoy, Leonell Albert L. Quitos, Ernee Gild S. Calumba	Mindanao State University-Iligan Institute of Technology	2nd InterZonal Res Congress for Visayas & Mindanao	can't access		HERDIN
Origin and dissemination of chloroquine-resistant <i>Plasmodium falciparum</i> with mutant pfcrt alleles in the Philippines	Chen, Nanhua, Kyle, Dennis, Bell, David, Wilson, Danny W, Cheng, Qin, Martin, Laura B, Pasay, Cielo	Department of Drug Resistance and Diagnostics, Australian Army Malaria Institute, Queensland, Australia	Antimicrobial Agents and Chemotherapy	2005		HERDIN

Preformulation and Formulation Studies of the Alcoholic Extract of Punica granatum L., Exocarp as Antimicrobial Ointment	Anna Muriel T. Jacinto	University of Perpetual Help System DALTA - Las Piñas	N/A	On-going	Philippine Council for Health Research and Development, Department of Science and Technology	Philippine Health Research Registry
Prevalence and correlates of antibiotic sharing in the Philippines: antibiotic misconceptions and community-level access to non-medical sources of antibiotics	Barber DA, Casquejo E, Ybañez PL, Pinote MT, Casquejo L, Pinote LS, Estorgio M, Young AM	1. Department of Epidemiology, University of Kentucky, Lexington, KY, USA. 2. Island Ventures, Inc., Lapu-Lapu City, Cebu, Philippines.	Tropical Medicine & International Health	2017		Google Scholar

<p>Prevalence of Mercury-Resistant and Antibiotic-Resistant Bacteria found in Dental Amalgam</p>	<p>Sittie Rohana D. Pundogar, Jing . Bautista, Franco G. Teves</p>	<p>Department of Biological Sciences, College of Science and Mathematics - Mindanao State University-Iligan Institute of Technology, Department of Biological Sciences, College of Science and Mathematics - Mindanao State University-Iligan Institute of Technology, Department of Biological Sciences, College of Science and Mathematics - Mindanao State University-Iligan Institute of Technology</p>	<p>International Research Journal of Biological Sciences</p>	<p>2014</p>	<p>HERDIN</p>
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Prevalence of methicillin-resistant Staphylococcus aureus and methicillin-resistant coagulase negative staphylococcus in a tertiary hospital	Chua, Jennifer A, Atilano, Maria Arlee, Coronel, Remedios F, Pena, Adrian C	Section of Infectious Diseases, Department of Medicine, St. Luke's Medical Center, SLMC	The Philippine Journal of Microbiology and Infectious Diseases	2001	HERDIN
Purchase of antibiotics without prescription in Manila, the Philippines. Inappropriate choices and doses	Lansang MA, Lucas-Aquino R, Tupasi TE, Mina VS, Salazar LS, Juban N, Limjoco TT, Nisperos LE, Kunin CM	Department of Medicine, University of the Philippines College of Medicine, Philippine General Hospital, Manila	Journal of Clinical Epidemiology	1990	Google Scholar
Rational use of antimicrobials	Jose G. Villalobos	De La Salle University - Emilio Aguinaldo College	The Medical Journal of DLSU-EACM	1988	HERDIN
Rational use of antimicrobials in pregnancy	Manalastas R Jr		POGS 1992 Annual Convention and 46th	1992	HERDIN

	<p>See and Sequence'-Genomic surveillance of antimicrobial resistant and high-risk pathogenic clones within the Philippines</p>	<ol style="list-style-type: none"> 1. Celia C. Carlos, MD 2. Ma. Charmian M. Hufano, MD 3. Marietta L. Lagrada, RMT 4. Agnetta M. Olorosa, RMT 5. June M. Gayeta 6. Karis Lee M. Del Castillo 7. Laila T. Flores 8. David Aanensen, PhD 9. Silvia Argimon, PhD 	<p>Research Institute for Tropical Medicine (RITM)</p>	<p>N/A</p>	<p>On-going</p>	<p>Philippine Council for Health Research and Development, Department of Science and Technology</p>	<p>Philippine Health Research Registry</p>
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10. John Stelling, MD

Studies of resistance to chloroquine, quinine, amodiaquine and mefloquine among the Philippine strains of <i>Plasmodium falciparum</i>	Smrkovski LI, Uylangco CV, Rodriguez CS, Alcantara AK, Buck RL	Trans Royal So Trop Med Hyg	can't access	HERDIN
Synthesis of Imidazole-based Antifungal Agents	1. Susan D. Arco, Ph.D 2. Eduardo C. Atayde Jr. 3. Rachelle Anne Geline P. Ureta	University of the Philippines - Diliman, Institute of Chemistry	On-going	Philippine Health Research Registry Philippine Council for Health Research and Development, Department of Science and Technology
Warning on misuse of antibiotics		The Filipino Family Physician	1988	HERDIN

Annex G. Research Gaps

This is an overview of research gaps in the Philippines based on current published research available.

Research Area	Human Health	Animal Health
Microbiology studies	Studies available, needs to be continued	Ongoing study, needs to be continued
Genetic, molecular, physiologic studies	Limited	Ongoing study, needs to be continued
Community/ farm knowledge, perceptions and practices/ behaviour	None	Ongoing study, needs to be continued
Distribution of antimicrobials, prescription practices, marketing	None	Ongoing study, needs to be continued
Supply chain and procurement studies	Very limited	Limited study, needs to be continued
Pricing, drug availability surveys	limited	None
Studies on use of antimicrobials	Limited PPS surveys	Ongoing study, needs to be continued

Economic studies, costs of AMR resistance, economic projections	Ongoing study on cost of AMR resistance in hospitals; need to have more	None
Studies from environmental samples/ isolates	None	Ongoing study, needs to be continued
R&D and innovation on antimicrobials	Mostly bioequivalence	Limited
Alternatives to antimicrobials	None	Limited; Probiotics, traditional medicine (medicinal plants and acupuncture)
Diagnostic/ detection technologies	None	Limited

Annex H. Provisional Research Agenda: Topics, Areas and Questions

This is a rapid listing of AMR Related Research Needs based on consultations held from July to October 2018 during the AMR 2015-2017 Implementation Review and planning for the 2019-2023 Philippine National Action Plan. This list can guide planners, advocates and researchers on what topics are important for research and useful for policy and program development. These are raw ideas and references for AMR research agenda.

Animal Health

Research Area	Possible Topics	Research questions raised
Microbiology studies Genetic, molecular, physiologic studies	Temporal and spatial analysis of bacterial indicators and its AMR profile in agriculture/aquaculture AMR determinants and virulence factors mining in bacterial indicators in agriculture/aquaculture and fisheries through use of whole genome sequencing Use of genomic technologies and databases to track Antimicrobial resistance in the	What are the resistance rates of pathogens of importance in healthy animals and diseased animals? What is the monthly/quarterly trend of bacterial indicator and its AMR profile throughout the production cycle? In different production setting? Farm to slaughterhouse to market? In a year?

	<p>Philippines (and globally)</p> <p>Characterizing AMR in livestock/poultry/aquaculture pathogens towards improved Antimicrobial Stewardship in agriculture/aquaculture production in the country</p> <p>Metagenomic based approach (use of 16s rRNA) for survey of Antimicrobial resistance in livestock/aquaculture and its environment</p> <p>Influence of bacterial population in the development and dissemination of AMR (use of shogun metagenomics)</p>	<p>Which bacterial species is influencing the development and dissemination of AMR?</p> <p>Aside from beta-lactamase genes, what other equally important AMR determinants (plasmids, colistin resistance etc., metal resistance, SPIs, etc.) are present in bacterial indicators in the Philippines? At what rate? Which sample? Its correlation and presence in both human, animal, and their environment?</p>
<p>Food safety</p>	<p>Surveillance of bacterial indicators (component 1), AMR profile, and virulence factors towards food safety</p> <p>Tracking of bacterial indicators and its AMR profile/characteristics throughout production/food chain (farm to market to table)</p> <p>Establishment of baseline data on AMU and AM residue in agriculture farms and food products in the market</p>	<p>What bacterial species is commonly isolated in the food chain? What are their AMR profiles and virulence factors?</p> <p>At what stage/step of the production chain has the highest rate of bacterial indicators? Has the AMR profiles changed throughout the production?</p> <p>How are we going to strengthen the food safety program in the Philippines?</p> <p>Are the stakeholders (producers and</p>

<p>Community/ farm knowledge, perceptions and practices/ behaviour</p>	<p>Review of legislations/regulations related to Food safety in the Philippines: strength and possible loopholes</p> <p>KAP on Food safety among producers and consumers</p> <p>Comparison of AMU and AMR profiles of bacteria isolated from different production systems/management</p> <p>Comparison of AMU and veterinary drug residues in food products from different production systems/management</p>	<p>consumers) aware of “Food safety”? Or the right question would be, do we care about food safety?</p> <p>To push the agenda on food safety and AMR, we need evidenced/data to come up with evidence-based guidelines</p>
<p>Community/ farm knowledge, perceptions and practices/ behaviour</p>	<p>Baseline studies on use of antimicrobials and feeds in animal food production</p> <p>Association between Antimicrobial use and Antimicrobial resistance in agriculture/aquaculture production</p> <p>Antimicrobial resistance pathways in animals; review practices and development of interventions to reduce AMR in the country</p> <p>KAP on AMU/AMR in agriculture/aquaculture production (whether backyard/semi-commercial/large/large scale farms)</p>	<p>What is the extent of regulation of medicated feeds at the local level? How much do farms use medicated feeds?</p> <p>What are the knowledge, attitudes, and practices of farmers, veterinarians, and consumer groups in the Philippines regarding antimicrobial resistance in animal health?</p> <p>What are the KAP regarding antimicrobial resistance in animal health of farmers in backyard farms?</p>

	Assessment of competency and literacy levels of veterinarians regarding AMR in animal health before and after exposure to the iAMResponsible campaign/ GAHP/ GAqP roadshows	What are the competency and literacy levels of veterinarians regarding AMR in animal health before and after exposure to the iAMResponsible campaign/ GAHP/ GAqP roadshows?
Distribution of antimicrobials, prescription practices, marketing	KAP on AMU/AMR for vet drug manufacturers, sellers, etc. (including Pharmacies) Review of regulatory framework for human-animal antimicrobials	What are the bottlenecks to registration of pharmaceutical products and active pharmaceutical ingredients in animal health?
Supply chain and procurement studies	KAP on AMU/AMR for vet drug manufacturers, sellers, etc. (including Pharmacies) Review of regulatory framework for human-animal antimicrobials	Where are antibiotics actually used in the animal/ agriculture supply chain for feeds and medicines?
Pricing, drug availability surveys	KAP on AMU/AMR for vet drug manufacturers, sellers, etc. Review of regulatory framework for human-animal antimicrobials Pharmacies	
Studies on use of antimicrobials	National Antibiotic Guidelines for Animal Health	What are the most commonly used antimicrobials in the agriculture and aquaculture industries?

	<p>Development of guidelines for the regulation of antimicrobials in drinking water</p> <p>To track policy enforcement on rational use of antimicrobials in markets, farms and communities</p>	
<p>Economic studies, costs of AMR resistance, economic projections</p>	<p>Assessment of Antimicrobial use (volume, availability, etc.) during disease outbreaks</p> <p>Temporal analysis in the antimicrobial use and attitude of farmers</p>	<p>How farmers react during disease outbreaks? How if the AMU trend affected by disease outbreaks? Or during normal situations (no disease outbreaks)?</p>
<p>Studies from environmental samples/ isolates</p>	<p>Correlation and presence of AMR determinants in bacterial isolated from human, animal, and their environment?</p> <p>Environmental dissemination of pathogenic bacteria (E. coli, Salmonella, Campylobacter) and their AMR profiles after manure application from farms (swine, poultry, ruminants)</p> <p>Assessing the impact of manure application in agricultural lands on the transmission of AMR in the environment</p> <p>AMR profile and virulence factors of bacteria</p>	<p>How bad is environmental contamination? Where? What is the mechanism of transfer from humans to animals to environment?</p> <p>How are the practices in agriculture affects the development and dissemination of AMR? Example, manure application in farms?</p> <p>What are the big roles of GAHP, GaqP, and DENR in the reduction of AMR development and dissemination in the agriculture system?</p>

	<p>(X) isolated from different environments exposed to different anthropogenic activities</p> <p>Role of stray/wild animals in the dissemination of bacterial indicators and AMR determinants in different environment settings</p> <p>Review and compliance of environmental related regulations, programs, and practices in the farm: towards AMR reduction and control</p>	
<p>R&D and innovation on antimicrobials Diagnostic/ detection technologies</p>	<p>Development and application of smart, low-cost pathogen detection platforms (whether DNA or serological-based assays)</p> <p>Capability assessment of DA-National Reference Laboratories (BAI, NMIS, BFAR, NDA, PCC), Regional Animal Disease Diagnostic Laboratories, and partner institution in the conduct of AMR related programs/surveillance/research</p>	<p>Before we further move to conduct of ant R&D and innovation activities/studies, have we assessed the capability of our labs? Not only their infra or presence of equipment necessary to conduct R&D, but especially their technical knowledge on AMR (and related topics).</p>
<p>Alternatives to antimicrobials</p>	<p>Probiotics as alternative to AM in agriculture-livestock production</p>	<p>What are alternatives to antimicrobials as growth promoters?</p>

Human Health

Research Area	Topics	Research questions
<p>Laboratory studies Microbiology studies Genetic, molecular, physiologic studies</p>	<p>Feasibility study and costing for strengthening of reference laboratories in Luzon, Visayas and Mindanao AMR investment plan for the health sector (including surveillance, HR, laboratories, environmental monitoring, M&E system) Skill mix assessment for laboratory and surveillance for AMR Genomic studies for surveillance Applications of whole genome sequencing studies in clinical management of AMR</p>	
<p>Monitoring and surveillance of AMR</p>	<p>Review of monitoring and surveillance systems in order to know what information is available and how to integrate or combine different types of information for monitoring of processes, outputs and outcomes Review of M&E and surveillance systems in other countries and how these can be applied to the Philippines Protocol for response to AMR outbreaks in</p>	

	hospitals	
Community/ farm knowledge, perceptions and practices/ behaviour		What are the gaps in understanding of Filipinos on the use antimicrobials?
Distribution of antimicrobials, prescription practices, marketing	Conduct representative drug availability surveys	
Supply chain and procurement studies	Conduct representative supply chain studies (from forecasting to distribution)	What are the institutional processes that serve as bottlenecks to registration of pharmaceutical products?
Pricing, drug availability surveys	Conduct representative survey of pricing of essential antimicrobials	
Studies on use of antimicrobials	Update the National Antibiotic Guidelines Development of IPC in public health and primary care programs, framework and training manual Compliance of health facilities on HAI reduction and IPC interventions	What are the effects of the implementation of “no prescription no dispensing” policy on access to antimicrobials? What are the effects of the implementation of “no prescription no dispensing” policy on the health seeking behavior of Filipinos? How do Filipinos circumvent the “no prescription no dispensing” policy? What is relationship between antimicrobial use and demographic characteristics?

<p>Implementation studies and reviews</p>	<p>AMS and IPC best practices and implementation review Develop system to monitor hospital acquired infection and effectiveness of interventions, their link with AMR</p>	<p>What are the outcomes and impacts? Are these cost-effective?</p>
<p>Economic studies, costs of AMR resistance, economic projections</p>	<p>PhilHealth benefit packages for AMR and HAI Expansion of economic studies Cost-effectiveness analysis of surveillance, IPC and AMR interventions especially in healthcare Cost-effectiveness studies of innovative programs in AMR and AMS (Is it worth the investment?)</p>	
<p>Studies from environmental samples/ isolates</p>	<p>Assessment of Environment labs</p>	
<p>R&D and innovation on antimicrobials</p>		<p>What incentives from the government are needed to entice the private sector to increase investments in antimicrobial research and development (R&D)? What are the institutional processes that serve as bottlenecks to registration of pharmaceutical products?</p>

Alternatives to antimicrobials	Potential of herbal medicines as alternative to antimicrobials	
Diagnostic/ detection technologies	Innovative and new technologies	

Environment and Other Studies

1. Assessment of environment laboratories to detect AMR
2. AMR detection in water, waste and environment

Annex I. Mapping of Regulation and Controls for the Antimicrobial Market in Animals and Humans

This Annex is prepared to provide an overall perspective of existing policies and potential policy gaps on AMR and related areas.

GENERAL AREAS

Area	Agencies in Charge	Policies
Food Safety Laws	DOH, FDA and DA	RA 9711 or FDA Act of 2009 RA 10611 or Food Safety Act of 2013 "An Act to Strengthen the Food Safety Regulatory System in the

			Country to Protect Consumer Health and Facilitate Market Access of Local Foods and Food Products, and for other Purposes.
Animal Health Laws	DA		
Farming and Animal Production Legislation	DA		
Pesticide Legislation and Soil Quality	DENR		
Waste Management and Disposal Law	DOH, DENR, DA		PD 856 or the Code on Sanitation of the Philippines (Chapter XVIII, section 81-83)
Water Law	DENR		
Aquaculture Law	DA		

ANIMALS

Entry and Manufacturing of Antimicrobials

	Agencies in Charge of Regulating Medicines/ Antimicrobials	Policies	Agencies in Charge of Regulating Feeds	Policies
Licensing of Importer	License to Operate (LTO) or authorization of drug product from FDA necessary	DOH AO 2014-0034 BFAD (FDA) Bureau	FDA DA?	

		Circular 07 s. 2004		
Business permit	LGU DTI		LGU DTI	
Pre-Registration of Importation			FDA	
Importation of Active Pharmaceutical Ingredients/ Importation of Pre-made antibiotics	Customs DTI		Customs DTI	
Manufacturing	LTO or authorization of drug product from FDA necessary	DOH AO 2014-0034	DTI FDA DA?	
Registration of product?	DA? FDA?		DA? FDA?	

Distribution and Marketing of Antimicrobials

	Agencies in Charge of Regulating Medicines/ Antimicrobials	Policies	Agencies in Charge of Regulating Feeds	Policies
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Business permit for distribution	DTI FDA	DOH AO 2014-0034	DTI FDA
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Post-Marketing of Antimicrobials

	Agencies in Charge of Regulating Medicines/ Antimicrobials	Policies	Agencies in Charge of Regulating Feeds	Policies
Business permit for retail stores (agrivet stores)	LGU		LGU	
Prescription	PRC		PRC	
Utilization	DA, PVMA FDA should be involved here?		DA, PVMA	

HUMANS

Entry and Manufacturing of Antimicrobials

	Agencies in Charge of Regulating Medicines/ Antimicrobials	Policies
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Licensing of Importer	LTO or authorization of drug product from FDA necessary	DOH AO 2014-0034 or "Rules and Regulations on the Licensing of Establishments Engaged in the Manufacture, Conduct of Clinical Trial, Distribution, Importation, Exportation, and Retailing of Drug Products, and Issuance of Other Related Authorizations"
Business permit	LGU DTI FDA (LTO)	DOH AO 2014-0034 or "Rules and Regulations on the Licensing of Establishments Engaged in the Manufacture, Conduct of Clinical Trial, Distribution, Importation, Exportation, and Retailing of Drug Products, and Issuance of Other Related Authorizations"
Pre-Registration of Importation	FDA	DOH AO 2014-0034 or "Rules and Regulations on the Licensing of Establishments Engaged in the Manufacture, Conduct of Clinical Trial, Distribution, Importation, Exportation, and Retailing of Drug Products, and Issuance of Other Related Authorizations"
Importation of Active Pharmaceutical Ingredients/ Importation of Pre-made antibiotics	FDA (Customs & DTI)	DOH AO 2014-0034 or "Rules and Regulations on the Licensing of Establishments Engaged in the Manufacture, Conduct of Clinical Trial, Distribution, Importation, Exportation, and Retailing of Drug Products, and Issuance of Other Related Authorizations"
Manufacturing	DTI FDA	DOH AO 2014-0034 or "Rules and Regulations on the Licensing of Establishments Engaged in the Manufacture, Conduct of Clinical Trial, Distribution, Importation, Exportation, and Retailing of Drug Products, and Issuance of Other Related Authorizations"
Registration of Product	FDA	DOH AO 2014-0034 or "Rules and Regulations on the Licensing of Establishments Engaged in the Manufacture, Conduct of Clinical Trial, Distribution, Importation, Exportation, and Retailing of Drug Products, and Issuance of Other Related Authorizations"

Inclusion in PNDF (for government procurement and PhilHealth purchasing)	DOH Health Regulations Team/PD (NCPAM) ¹⁸	DOH AO 2012-0023 or the “Revised Implementing Guidelines for the Philippine National Formulary System (PNFS)”
Reference pricing (for government procurement and PhilHealth purchasing)	DOH	

Distribution and Marketing of Antimicrobials

	Agencies in Charge of Regulating Medicines/ Antimicrobials	Policies
Business permit for distribution	DTI FDA	DOH AO 2014-0034 or “Rules and Regulations on the Licensing of Establishments Engaged in the Manufacture, Conduct of Clinical Trial, Distribution, Importation, Exportation, and Retailing of Drug Products, and Issuance of Other Related Authorizations”

Post-Marketing of Antimicrobials

	Agencies in Charge of Regulating Medicines/ Antimicrobials	Policies
Business permit for retail	LGU	DOH AO 2014-0034 or “Rules and Regulations on the Licensing of

¹⁸ The Formulary Executive Council (FEC) recommends list of drugs to be included in PNDF to Usec/Asec in-charge of NCPAM(PD).

stores (hospital pharmacy and retail stores)	FDA DOH	Establishments Engaged in the Manufacture, Conduct of Clinical Trial, Distribution, Importation, Exportation, and Retailing of Drug Products, and Issuance of Other Related Authorizations”
Prescription ¹⁹	PRC (?) Professional organizations Hospitals through clinical pharmacologists	
Utilization	DOH-PD FDA ²⁰	RA 10918 or Pharmacy Act (Article IV, section 30)

¹⁹ Professional practice of physicians are beyond the jurisdiction of FDA while PRC does not and may not have the capacity to monitor how physicians prescribe. Interestingly, the Antimicrobial Stewardship (AMS) Program in Hospitals is designed in such a way that hospitals can “self-regulate” in-patient use of restricted antimicrobials.

²⁰ FDA implements the “no prescription no dispensing policy” of prescription drugs and pharmacist-only OTC medicines through its field monitoring office.