Ministry of Health, Malaysia.
&
Ministry of Agriculture and
Agro-Based Industry, Malaysia.

MALAYSIAN ACTION PLAN ON ANTIMICROBIAL RESISTANCE (MyAP-AMR) 2017-2021

Malaysian Action Plan on Antimicrobial Resistance (MyAP-AMR) 2017-2021
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on
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FOREWORD BY THE HONOURABLE MINISTER OF HEALTH, MALAYSIA

Antimicrobial resistance (AMR) is a serious global public health threat in this century and like any other country, Malaysia is not spared from this hazard. The cases of antimicrobial resistance (AMR) continues to escalate, impacting on the health of both humans and animal. It also has major economic consequences for us all. Major drivers of AMR include inappropriate use of antimicrobials in healthcare practices as well as in animal production, especially those used for non-therapeutic purposes.

AMR cannot be eradicated; however, collaborative and comprehensive action needs to be taken to reduce the spread of antimicrobial resistance. Without effective antimicrobials, we are in danger of returning to the "pre-antibiotic era", with potentially devastating effect on the health and welfare of both humans and animals.

AMR is a One Health issue which requires interdisciplinary coordination amongst all sectors that of human health, food and animal health. As antimicrobials are vital in both the human and animal sectors, it is therefore a shared responsibility to preserve the efficacy of these invaluable drugs. The multi-sector harmonisation of strategies and measures to address the challenge of AMR are highly necessary.

Following the adoption of the Global Action Plan on Antimicrobial Resistance during the 68th World Health Assembly, Malaysia is cognisant of the impact of AMR and is highly committed to taking action by establishing a "One Health" working group, with nominated representatives across related sectors in the drafting of the Malaysian Action Plan on AMR or known as MyAP-AMR.

I would like to express my sincere thanks and heartily congratulate the committee for their commendable efforts in developing this action plan and I hope that we will work together in the spirit of cooperation as envisioned with One Health in carrying out the plan to minimise AMR and ensure the availability of effective antimicrobials for the present and future generation.

Datuk Seri Dr S. Subramaniam
Minister of Health, Malaysia

FOREWORD BY THE HONOURABLE MINISTER OF AGRICULTURE AND AGRO-BASED INDUSTRY, MALAYSIA

Antimicrobials are important in the treatment of both humans and animals. In order to minimise the development of antimicrobial resistance (AMR) and to maintain the effectiveness of these antimicrobials, an integrated approach using "One Health" concept is essential in addressing this issue. The Malaysian Action Plan on AMR (MyAP-AMR) has been developed involving multiple sectors and it addresses a wide range of activities required to tackle AMR problem effectively. The implementation of the activities in the MyAP-AMR requires commitment and complementary efforts from all related sectors including veterinarians, farmers, fishery officers, industry leaders and all related stakeholders.

In improving animal health, disease prevention strategies are crucial which includes improvement of biosecurity and husbandry, increase in the use of vaccines and strengthening of surveillance. Educational campaigns and awareness of AMR should also be addressed to all levels of society.

Last but not least, I would like to thank and applaud all parties involved either directly or indirectly in developing and appraising this action plan. I hope that this will provide guidance in the responsible use of antimicrobial agents in efforts to combat AMR and preserve the efficacy of this precious drugs for the present and the future generation.

Dato' Sri Ahmad Shabery Cheek
Minister of Agriculture and Agro-based Industry, Malaysia

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And all TWG Members that have contributed into making this book a success.

IMPLEMENTERS

In response to our shared responsibility in the containment of AMR, the key implementers of MyAP-AMR are:

1. Ministry of Health Malaysia,
2. Department of Veterinary Services, Ministry of Agriculture and Agro-based Industry
3. Department of Fisheries, Ministry of Agriculture and Agro-based Industry
4. Ministry of Higher Education
5. Ministry of Defence Hospitals
6. Private Healthcare facilities
7. Community Pharmacist
8. The Animal Food Industry
9. Professional Organisations pertaining to Human And Animal Health

In addition to the above list, we would like to acknowledge the important role of universities, the private sector, international partners, non-governmental organizations and civil society in implementing MyAP-AMR.

ABBREVIATIONS

APHM	Associations of Private Hospitals of Malaysia
AST	Antibiotic Sensitivity Testing
CPD	Continuing Professional Development
DCD	Disease Control Division
DOE	Department of Environment
DOF	Department of Fisheries Malaysia
DVS	Department of Veterinary Services Malaysia
FAO	Food and Agriculture Organization of the United Nation
FHDD	Family Health Development Division
FLFAM	Federation of Livestock Farmers' Association Malaysia
FOMCA	Federation of Malaysian Consumer Associations
FSQD	Food Safety and Quality Division
FSQL	Food Safety and Quality Laboratory
GVHP	Good Veterinary Hygiene Practice
HA-MDRO	Healthcare Associated Multidrug Resistant Organisms
HECC	Health Education Communication Centre
HPPNK	National Farmers, Livestock Breeders and Fisherman's Day
HPPNN	State Farmers, Livestock Breeders and Fisherman's Day
IMR	Institute for Medical Research
KETTHA	Ministry of Energy, Green Technology and Water
KKMM	Ministry of Communications and Multimedia
KPDNKK	Ministry of Domestic Trade, Co-Operative and Consumerism
MAHA	Malaysia Agriculture, Horticulture and Agrotourism
MDD	Medical Development Division
MINDEF	Ministry of Defence
MMA	Malaysian Medical Association
MOA	Ministry of Agriculture and Agro-based Industry
MOH	Ministry of Health
MOHE	Ministry of Higher Education
MPS	Malaysian Pharmaceutical Society
MRSA	Methicillin-resistant Staphylococcus Aureus
MYGAP	Malaysian Good Agricultural Practices
NPHL	National Public Health Laboratory
NPHVL	National Veterinary Public Health Laboratory
NRE	Natural Resources and Environment
OIE	World Organization for Animal Health
PERHILITAN	Department of Wildlife and National Parks
PHL	Public Health Laboratory
PSD	Pharmaceutical Services Department
TTT	Training the Trainers
VHM	Veterinary Health Mark
WAAW	World Antibiotic Awareness Week
WHO	World Health Organization

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INTRODUCTION

It is a known fact that Antimicrobial Resistance (AMR) is a natural occurring phenomenon whenever antimicrobials are used due to the process of bacterial adaptation. The overuse and misuse of antimicrobial drugs however does expedite this phenomenon. Frequent antibiotic usage over long periods of time puts selective pressure on bacteria by killing susceptible bacteria, allowing antibiotic-resistant bacteria to survive and multiply.

AMR is not a new issue. This global health problem has in fact soared since the 1970s and it is now named by the World Health Organization as one of the primary public threats of the 21st century due to its rapid and ongoing spread. If AMR spreads unchecked, many infectious diseases will become untreatable. This in turn leads to more severe illness and increase in mortality. A report from the Review on Antimicrobial Resistance by Jim O' Neill projected that if rising AMR is not addressed, the annual death toll could reach 10 million by the year 2050. The threat of AMR is real and proven as it is only the 4th time that a health issue has been discussed at the United Nations General Assembly. WHO, in collaboration with the Food and Agriculture Organization of the United Nations (FAO) and the World Organisation for Animal Health (OIE) have also developed a manual to assist countries in preparing their national action plan.

The indiscriminate use of antibiotics in human medicine and agriculture has driven the distribution of antibiotic resistant bacteria. In addition, antibiotic use also affects environmental microbiome. Water contaminated with these untreated effluents from human waste, livestock farms or aquaculture are recycled into agricultural land leading to the groundwater containing significant amounts of antibiotic remnants and antibiotic resistant bacteria. AMR is multifactorial problem that cuts across human health, animal health as well as the environment and requires a unified approach and cross sector intervention.

While AMR is known as a public health threat, it is also a major economic concern. The high cost of treating AMR affects the economy of the country. New antibiotic development is no longer considered to be an economically wise investment due to economic factors and uncertain returns on investment. With no major new class of antimicrobials discovered since the late 1980s and limited new drugs in the pipeline, this severely restricts future therapeutic options.

AMR Situation in Malaysia: Human Health

National surveillance programmes provide geographic and demographic data on disease etiologies and resistance trends of key pathogens; alerts us of new and emerging resistance threats; and gives guidance in the use of surveillance data for public health action. The World Health Organization (WHO) Global Strategy for Containment of Antimicrobial Resistance recommends the establishment of a national inter-sectoral task force with broad membership for coordinating surveillance activities and overseeing policy interventions and advocacy efforts.

Realizing the importance of the AMR in human health, the Government of Malaysia has embarked on several strategies to contain the spread and minimize the threat of AMR in human health in Malaysia.

Among the activities are the establishment of National Surveillance of Antibiotic Resistance (NSAR) programme in Malaysian hospitals. The NSAR was initiated in 1988 and the programme established in 2000 with its coordinating reference laboratory, the Institute for Medical Research. As of 2016, the number of participating hospitals has reached 41.

According to the NSAR, *Acinetobacter baumanii* resistant to meropenem has risen from 49% in 2008 to 61% in 2016. The emergence of beta-lactamase producers (ESBL) among *enterobacteriaceae* has become a major concern in our hospitals. *Klebsiella pneumoniae,* one of the commonest causes of nosocomial infections in our hospitals has shown an increase in resistance rate towards cefotaxime from 22% in 2008 to 27.7% in 2015. *Escherichia coli* resistance to cefotaxime has increased from 15% in 2010 to 23.4% in 2016. The New Delhi metallo-β-lactamase -1 (NMD-1) gene was first detected in carbapenem-resistant *Klebsiella pneumoniae* (CRKP) in 2010 in a Malaysia hospital. The spread of this resistant gene is rapid and has resulted in reports of CRKP in various hospitals in Malaysia. CRKP has shown a tremendous rise in the recent years, from 0.3% in 2011 to 2.8% in 2015.

The NSAR also reported an increase in vancomycin resistance among *Enterococcus faecium*, resistance rising from 8.7% in 2012 to 14.9% in 2016. An increase in antibiotic resistance is also seen in a common foodborne pathogen, Salmonella sp, with resistance rates against ciprofloxacin rising from 1.9% in 2013 to 3.4% in 2016, while resistance to ampicillin has reached 25% in 2016.

Streptococcus pneumoniae, the commonest cause of community-acquired pneumonia, is now 31% resistant to erythromycin, which is one of the commonest antibiotics used in primary care in treating respiratory tract infections.

The efficacy of the world's antibiotics is decaying and if this continue without any intervention, we may find infectious diseases which the country managed to curb in the past make a comeback.

A separate surveillance of CRE is also carried out to monitor the spread in Malaysian hospitals. The CRE Surveillance in 2016 reported an alarming increase in the number of cases from 28 cases in 2011 to more than 800 cases in 2016. Analysis of these cases showed that 95% of the patients have history of antibiotic exposure and out of these, 50.6% has history of antibiotic exposure of more than 7 days. Polymixin resistance has also been reported among the CRE cases and report shows a 21.7% Polymixin resistant enterobacteriaceae attributable death in year 2016.

Surveillance of antimicrobial use is crucial as it provides insights of antimicrobial misuse and to evaluate the impact of resistance containment interventions. Antibiotic utilisation surveillance in Malaysia has been established in selected hospitals since 2001, covering a selection of hospitals under the Ministry of Health (MOH), Ministry of Higher Education (MOHE), Ministry of Defence (MINDEF) as well as private hospitals. It is later known as National Surveillance on Antibiotic Utilisation (NSAU) and expanded to the primary care setting (MOH health clinics) since July 2015.

Data were reported using standardised usage density rates, based on the World Health Organization's Anatomical Therapeutic Chemical standards for 'defined daily doses' (DDDs) which allows comparison at state, national and regional level. For hospital, this data covers the use of 26 selected antibiotics in 84 hospitals and whereas for primary care, data covers the use of 2 antibiotics in 225 health clinics.

For Hospital, data collected include total amount of selected injectable antibiotics (in grams) dispensed from the in-patient pharmacy to adult patients, total number of hospital admission (adult patients) for the reporting year and the number of days adult patients were admitted in the hospital for the reporting year. Data are also divided into two main categories: All Wards and ICU usage data.

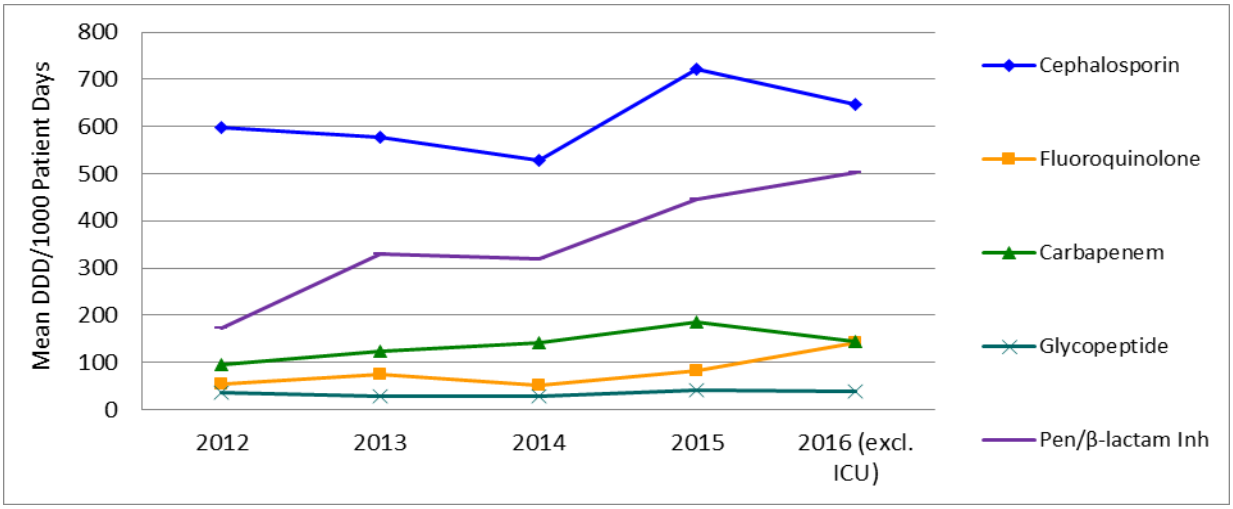

Figure 1. Utilisation trend from 2012 to 2016 for five highest-usage antibiotic groups (All Wards)

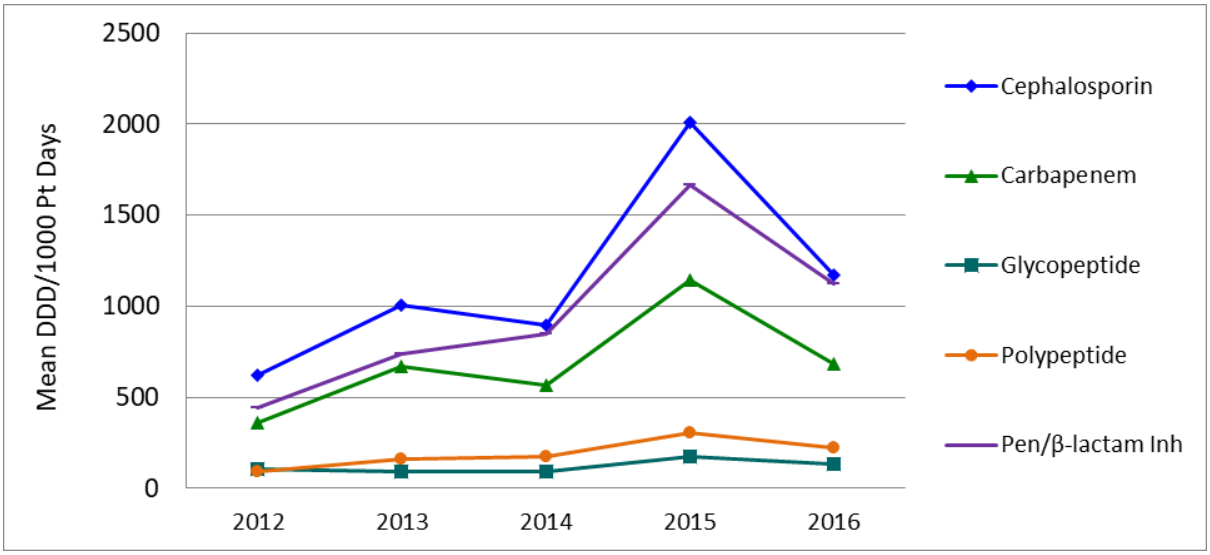

Figure 2. Utilisation trend from 2012 to 2016 for five highest-usage antibiotic groups (ICU)

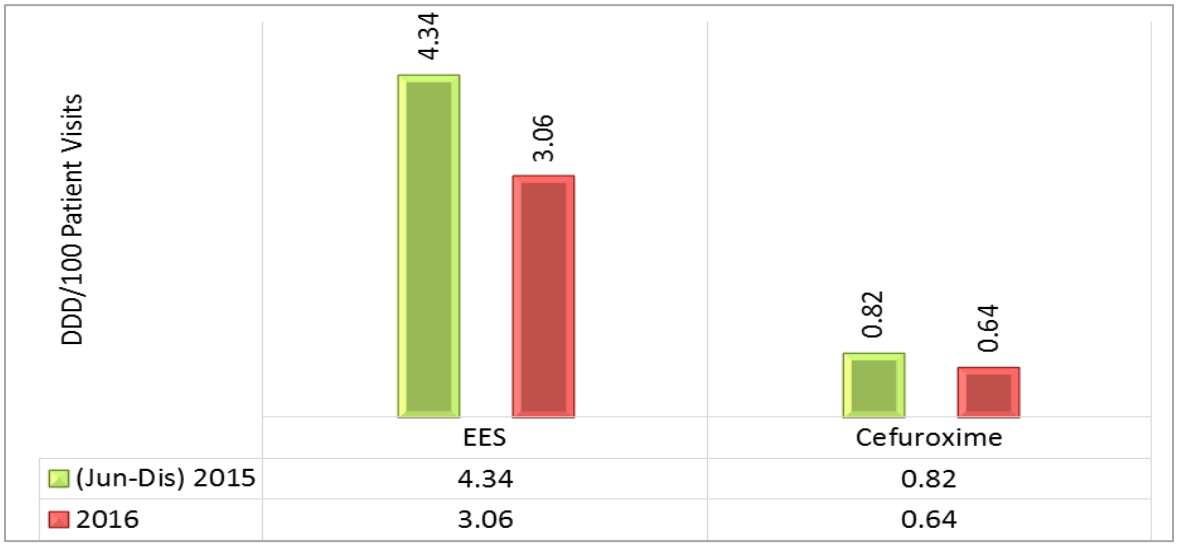

Figure 3. Antibiotic utilisation in MOH primary care from 2015 to 2016

The key findings from the surveillance shows that the top 5 antibiotics used in hospitals are cephalosporins, fluoroquinolones, carbapenems, glycopeptides and penicillin/beta-lactamase inhibitors. In primary care, the number of DDD per 100 patient visits for 2016 for Erythromycin Ethylsuccinate (EES) and cefuroxime were 3.06 and 0.64, respectively.

Protocol on Antimicrobial Stewardship (AMS) Programme in Healthcare Facilities was published by MOH in 2014 followed by implementation of AMS in MOH hospitals and primary care settings. Since then, various AMS measures have been carried out in many hospitals. Due to this, a downward trend seen with antibiotic utilisation in 2016, especially in ICU. This was particularly true with MOH hospitals where reduction in antibiotic utilisation is seen with almost all antibiotics. A few hospitals have also implemented "carbapenem 72-hour stop order" which requires physicians to review and justify continuation of treatment with carbapenem beyond 72 hours. This might have contributed to the decline in carbapenem utilisation in MOH.

In addition to NSAU, National Point Prevalence Survey on Antibiotic Utilisation has been conducted among inpatients and outpatients in MOH healthcare facilities. The survey among inpatients was initiated in 2015 and continued in 2016, involving 19 state and tertiary hospitals. The objective is to measure the prevalence of hospitalised patients prescribed with antibiotics. In 2016, this survey found that 32.7% to almost 60% of inpatients in individual hospitals were prescribed with antibiotics, whereby 78.2% of all the antibiotics prescribed were for empirical therapy, 13.6% for microbiologically confirmed treatment, 5.7% for surgical prophylaxis, and the remaining 2.6% for non-surgical prophylaxis. These findings were consistent with the data for 2015.

The point prevalence study among outpatients, which has been conducted for the first time in 2015, was participated by 371 health clinics. The objective is to measure the antibiotic usage pattern in primary healthcare facilities in Malaysia. In contrast to NSAU which only monitors two antibiotics, this survey included all antibiotics which were available in the clinics. Finding shows that 8.92% prescriptions received at the pharmacy counter in the health clinics contained antibiotics, mostly amoxicillin (42.3%), followed by erythromycin (22.4%) and cloxacillin (18.1%).

AMR Situation in Malaysia: Animal Health

Apart from human health, it is also known that antimicrobials are used in the agricultural sectors to increase animal production through improved animal growth and disease prevention. This includes usage of antimicrobials in veterinary and aquaculture.

In 2012, The Department of Veterinary Services (DVS) conducted a preliminary study of AMR in domestic chicken. From the studies, 38 isolates of Salmonella were obtained from the cloacal swab. The antimicrobial susceptibility testing on the Salmonella showed that 13.5% were resistant to tetracycline, 5.4% were resistant to Polymixin B and erythromycin respectively while 2.7% were resistant to chloramphenicol, Penicillin G and trimethoprim respectively.

In another study conducted by DVS, samples were collected from year 2013 and 2014 to investigate and determine the prevalence and antimicrobial patterns of Salmonella isolates from chicken meat from poultry processing plants in Central region of Peninsular Malaysia. The study demonstrated a high prevalence of Salmonella contamination in raw chicken meat obtained from the processing plants. There were also a variety of antimicrobial resistance spectrum including MDR phenotypes among the salmonella isolates. These data emphasized the public health importance to continuously educate consumers in proper food hygiene and highlight the need for continued surveillance of foodborne pathogens including antimicrobial resistant variants throughout the food production chain.

Currently veterinary biologics and vaccines are registered under the Department of Veterinary Services Malaysia, while veterinary drugs are under the jurisdiction if the National Pharmaceutical Regulatory Agency (NPRA), Ministry of Health.

DVS of Malaysia plans to harmonize and strengthen AMR surveillance and monitoring in the country, to conduct more research as well as to educate and give awareness to the farmers, public and user of antimicrobials in the animal health sector. Other than that, facilities and laboratory capacity as well as diagnosis methods needs to be improved.

AMR issues involving fish production health also needs to be addressed however due to the different dimension of aquatic biology, the approach in combatting antimicrobial resistance needs to be constructed with its own identity.

In Malaysia, AMR monitoring in fisheries is relatively in its infancy. Although there is a comprehensive on-going monitoring programme for veterinary drug residues from the aquaculture farms, there has been limited research and monitoring programme for AMR aspect.

AMR in fish and fisheries environment has been frequently reported in Malaysia. However most of the studies focused on the prevalence of AMR pathogens, resistance pattern and detection of resistant genes. The method used in characterising and quantifying resistance varies among the researchers. Besides, there was no validation of the clinical significance of the AMR reported and no linkages between antimicrobial use and the resistance frequencies observed. Thus, conclusion on the extent of AMR in fish in Malaysia could not be assessed justifiably at present.

Data on antimicrobials usage in aquaculture is also limited. At present, there is no register or list of the permitted antibiotics to be used by the aquaculturist in Malaysia. Off-label use of antimicrobials may be significant and may also result in the use of a wider range of agents. From the literature, oxytetracycline, tetracycline, quinolone, sulphonamides, oxolinic acid and trimethoprim are among the antibiotics that are allowed and commonly used in Asian countries. Since the antibiotics used in aquaculture belong to the same group of those used for humans, the issue of AMR in fish should be equally attended to as per One Health agenda.

EXECUTIVE SUMMARY

The threat of antimicrobial resistance (AMR) is growing at an alarming rate with the misuse of antimicrobial agent as the main driver of resistance that threatens the treatment of diseases. The world needs to change the way it prescribes and uses antibiotics as there is a possibility that we are heading into a post-antibiotic era. There has not been a new class of antibiotics since the 1980s and even if new medicines are developed, without any intervention and control over the usage of these drugs, antimicrobial resistance will remain a major threat. Malaysia, like the rest of the world is not spared and has been encountering the repercussions of AMR which includes increased in numbers of untreatable infectious diseases, higher mortality and increased in economic cost.

In 2015, the sixty-eight World Health Assembly urges all member states to adopt the global action plan on AMR and develop the country's national action plan on AMR aligned with the global action plan and with standards and guidelines established by relevant intersectoral agencies. In response to this, the Ministry of Health Malaysia initiated a working committee which calls for an urgent collaboration among different related sectors under a One Health approach to address on the development of the Malaysian Action Plan framework. This initial framework outlines the views of stakeholders from across the sectors of human and animal health including aquaculture as well as the food sectors on gaps and solutions to address AMR situation in Malaysia.

Based on thorough discussions and feasibility, the planning committee has opted for four priority areas to be included as part of our commitment in the national action plan on AMR. This includes:

I. Public Awareness and Education
II. Surveillance and Research
III. Infection Prevention and Control
IV. Appropriate Use of Antimicrobials

The Malaysian action plan on AMR (MyAP-AMR) includes a comprehensive educational and awareness plans to educate the public, students, media and professionals to increase knowledge on AMR. This MyAP-AMR will also incorporate a teaching module on AMR into tertiary education and healthcare professionals for a comprehensive and updated AMR teaching. Under the surveillance and research, an integrated surveillance manual on AMR and antimicrobial consumption involving human and animal health will be developed to help in assessing the health burden imposed by the resistant pathogen thus assisting the policymakers on managing the budget allocations and programme priorities accordingly. Priority area on infection prevention and control focuses on improvement of infection control related activities and surveillance as well as biosecurity measures through development and updates of surveillance and policies. Stewardship programmes will also be reinforced at the healthcare facilities with the establishment of AMS as one of the criteria for hospital accreditation. To ensure prudent use of antimicrobials in veterinary sectors, several measures taken including the development of National Veterinary antibiotics guideline.

Implementation of the activities under each priority areas requires commitment and leadership from all agencies. This is a common effort which enables different stakeholders to use it as a platform towards a common goal to prevent and curb the spread of AMR. The progress of the activities will be monitored by the National Coordinating Centre on AMR and will be reported to the National Antimicrobial Resistance Committee co-chaired by the Director General of Health and Department of Veterinary Services.

GOVERNANCE

Antimicrobial resistance is a grave concern globally and in view of the implications of this issue, the Ministry of Health Malaysia has initiated a concerted effort with stakeholders from other related agencies in setting up a committee on AMR to lead and advise as well as to implement actions in tackling the rapidly increasing rate of AMR. The National Antimicrobial Resistance Committee (NARC) was formed in March 2017. Under the "One Health" framework, this committee is co-chaired by the Director General of Health and Director General of Department of Veterinary Services. The members of NARC composed of stakeholders from relevant ministries, universities and organization are responsible in providing technical input and to review NARC outputs. The NARC is supported by four technical working groups responsible in providing technical input, drafting of the MyAP-AMR and strategizing actions in the plan. As AMR has become the health agenda at all level and due to the complexity of AMR coordination from various sectors, a National Coordinating Centre for Antimicrobial Resistance (NCCAR) has been established to facilitate and coordinate activities. (See figure below)

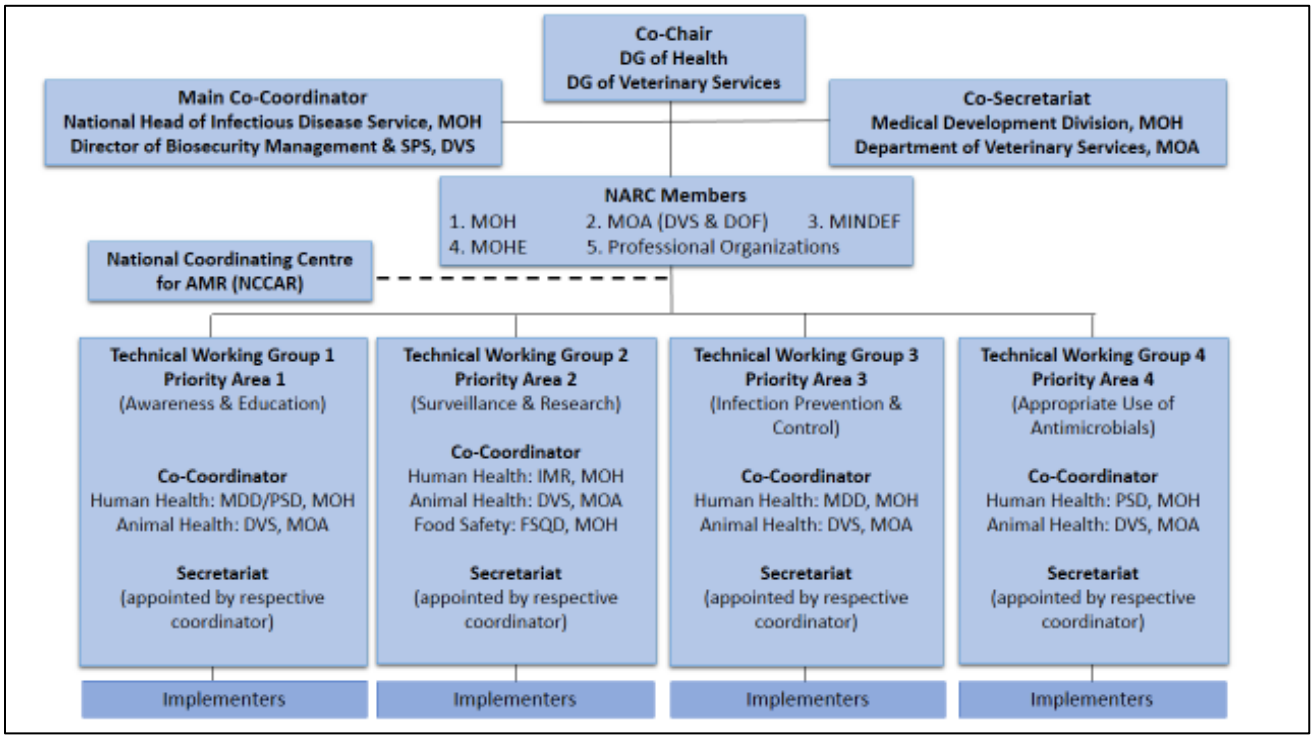

Figure 4. National Antimicrobial Resistance Committee (NARC) Framework

GENERAL OBJECTIVE

To slow the emergence of AMR and prevent its spread, it is important to: (1) increase public knowledge and understanding of AMR and use of antimicrobials, particularly in those involved in healthcare, nursing care, food, and livestock production and aquaculture, (2) understand the state of AMR emergence and prevalence, and use of antimicrobials (including surveillance, monitoring and research), and to assess the risk based on the understanding of AMR and the issue (3) enhance proper infection prevention and

control, (4) ensure appropriate use of antimicrobial in order to reduce antimicrobial- resistant organisms. The following priority measures over the next five years (2017 - 2021) were developed in this perspective. Relevant ministries, agencies, and organizations should engage in a common effort to undertake these measures under One Health approach.

FRAMEWORK

The MyAP-AMR is structured based on the following four priority areas: (1) Public awareness and education, (2) Surveillance and research, (3) Infection prevention and control and (4) Appropriate use of antimicrobials. These priority areas were defined in line with the strategic objectives set by the Global Action Plan on AMR endorsed in May 2015 in the 68th World Health Assembly.

Table 1. Four Priority Areas and Objectives for Containment of AMR

Key Priority Areas	**Objectives**
1. Public Awareness and Education	Improve awareness and understanding of AMR through effective communication, education and training
2. Surveillance and Research	Strengthen the knowledge and evidence base through surveillance and research
3. Infection Prevention and Control	Reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures
4. Appropriate Use of Antimicrobials	Optimize the use of antimicrobial medicines in human and animal health

The strategies to achieve the above objectives are described with their purposes, specific actions, target groups, responsible ministries, agencies, and institutions for the actions, and indices to evaluate the actions.

EXPECTED OUTCOME

The outcome expected from this action plan includes reduction in national human consumption of antibiotics and reduction in the volume of antibiotic use in food production; reduction in the prevalence of AMR based on data collected through integrated programmes for surveillance of AMR throughout the country; and reduction in the prevalence of preventable infections in particular the incidence of drug-resistant infections in health care settings. Monitoring and evaluation will be conducted periodically to evaluate the effectiveness and impact of this plan.

1 OBJECTIVE

Improve Awareness and Understanding of Antimicrobial Resistance through Effective Communication, Education and Training

Strategies

1.1 **Increase national awareness of AMR through public communication programmes in human and animal health.**

1.2 **Establish AMR as a core component of professional education, training and development for the human and animal health sectors.**

1.3 **Include AMR in school extra-curricular activities in order to promote better understanding and awareness.**

1.4 **Provide the public media with accurate and relevant information on AMR.**

Strategy 1.1: Increase national awareness of AMR through public communication programme in human and animal health.

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
1. Implement AMR and Antibiotic Awareness Campaign 1.1 Annual World Antibiotic Awareness Week (WAAW) a. National Level b. State Level c. District Level d. Institutional Level (eg : private & public hospitals, clinic, University hospitals 1.2 AMR and Antibiotic Awareness Campaigns for public and healthcare practitioners	Annually 2018	• Healthcare practitioners • Veterinarian & other professional related to food animal production • Food animal producers • Public • Aqua culturist • Livestock association & Aquaculture association • Students	MOH MOA • DVS • DOF MOHE
1.3 Targeted AMR and Antibiotic Awareness Campaign in food animals production and aquaculture • To promote AMR and antibiotic awareness in relevant conferences/ tradeshows e.g. HPPNN, HPPNK, MAHA • To promote consumers' awareness and demand for quality and safe-to-eat animal based product in relevant promotional activities. e.g. Promotional activities related to MyGAP/ VHM/ GVHP/ MyOrganic certification etc.	Annually	• Public • Food Animal Producers • Livestock association	MOH MOA • DVS • DOF

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
2. Promotional Activities for AMR Awareness			
2.1 Contents development • Content development workshop for social/printed media • Content repository development • Translation of AMR educational materials from WHO, FAO and OIE into various languages e.g.; Bahasa Melayu, Bahasa Tamil and Bahasa Mandarin	2017	• Healthcare professional • Veterinarians • University Students • Professional bodies • Fish Health Professionals • Aqua culturists	MOH: • PSD • HECC • Corporate Communication Unit • MDD MOHE: • Universities MOA: • DVS • DOF

2.2 Printed media
• Distribution of posters, pamphlets, pop-up message to:
  • All government and private health facilities
  • Public places
  • Schools, universities, colleges and community pharmacies
	2017	• All government and private health facilities
		• Public places
		• Schools
		• Universities & colleges
		• Aqua culturists
			MOH:
			• PSD
			• MDD
			• HECC
			• Corporate Communication Unit
			MOHE:
			• Universities
			MOA:
			• DVS
			• DOF

2.3 Mass media • AMR related articles in major languages newspapers, professional journals, newsletters, and magazines	2017	• Public	

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
2.4 Electronic media • Interviews, advertisements, crawler, public service announcement, "Medik TV", agro journal, video contents shared through the media and Malaysian One Health AMR Website. 2.5 Social media • Facebook • Instagram • Twitter	2017 2017	• Healthcare practitioners • Livestock industries • Aquaculture industries • Students • Public • Public	
3. Community empowerment programme on AMR with the introduction of AMR component into the Training the Trainers (TTT) Programme: • Duta Kenali Ubat Anda • Programme Ikon Gigi • KOSPEN	2017	• Community	MOH: • PSD • Dental Services MOA: • DVS
4. Knowledge, Attitude and Practice (KAP) Survey 4.1 A survey on knowledge on AMR and appropriate antibiotics use among public and healthcare practitioners 4.2 A survey on knowledge on AMR and appropriate antibiotics use among public, livestock and aquaculture industries	2018: baseline survey 2021: repeated survey	• Public • Healthcare practitioners • Public • livestock industries • Feed Industry • Fish health professional	MOH: • MDD • PSD • HECC • Corporate Communication Unit MOHE: • Universities MOA: • DVS • DOF

Evaluation Indices for Strategy 1.1

- Number of WAAW campaign conducted at various level (national/state/district/institutional)
- Number of AMR awareness activities/campaign conducted
- Number of promotional activities conducted through mass media
- Number of community empowerment programme conducted
- Report of KAP Survey

Strategy 1.2: Establish AMR as a core component of professional education, training and development for the human and animal health sector

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
1. Professional Training and Education 1.1 To include AMR and related topics in professional education module for healthcare providers, animal health professionals and food technologist • AMR topic included in patient safety awareness course for junior healthcare professional • AMR topic included in Malaysian Fisheries Certificate (Sijil Perikanan Malaysia)	2017 2019	• House officers/ provisionally registered pharmacist (PRPs) in MOH institutions and university hospitals • Undergraduates and Postgraduates in Colleges and universities (inclusive of allied health sciences/ veterinary/food science and technology) • Paramedics schools • Biomedical schools • Fisheries College/ Academy students	MOH: • MDD • PSD • FSQD MOA: • DVS • DOF MOHE

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
2. Development of AMR educational tool kits and training the trainers			

2.1 Development of AMR educational tool kits for human health (to be made available online)	2017	• Healthcare practitioners
		• Undergraduate Students:
		  • Medicine
		  • Dentistry
		  • Pharmacy
		• Allied Health Sciences
			MOH
			MOHE

2.2 Training the trainer of AMR educational tool kits for human health.	2018	MOH (For each state) • 1 specialist/ medical officer • 1 pharmacist MOHE and MINDEF • 1 specialist/ medical officer • 1 pharmacist	
2.3 Development of AMR educational tool kits for animal health (to be made available online)	2018	• Veterinary practitioners • Fish Health Professionals • Veterinary undergraduate Students	MOA • DOA • DOF MOHE
2.4 Training the trainer of AMR educational tool kits for animal health.	2019	Animal Health Sector: • Veterinary Officer (VO) • Assistant Veterinary Officer (AVO) • Para-veterinarians • Fisheries officer	

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
3. To establish AMR (point for CPD) E module	2019	• Healthcare professional • Pharmacists • Veterinarian	MOH: • MDD • PSD MOHE MOA: • DVS
4. Joint Conferences/ Symposium/Scientific meetings/seminars/ workshops	2019 and every two years	• Healthcare professionals • Veterinarian • Food technologist • Fisheries officers • Researchers	MOH: • MDD • PSD MOHE MOA: • DVS • DOF

Evaluation Indices for Strategy 1.2

- AMR topic introduced in the modules of medical school undergraduates
- AMR topic introduced in the modules of postgraduate training
- AMR topic introduced in the modules of houseman training
- AMR topic introduced in the modules of veterinary school undergraduates
- AMR topic introduced in the modules of Fisheries academy/ college students
- Educational tool kit on AMR developed
- Number of joint conferences/symposium/scientific meetings/seminars/ workshops

Strategy 1.3: Include AMR in school extracurricular activities in order to promote better understanding and awareness

Actions	Target Implementation date	Target Group	Responsible Unit(s)
1. Basic AMR education incorporated into "Doktor Muda" Programme • Hand washing & infection and vaccination • Antibiotic use and resistance	2020	Primary & Secondary School	MOH: • HECC • MDD • PSD
2. Basic AMR education introduced into extra-curriculum activities: • St John Ambulance • Persatuan Bulan Sabit Merah	2020	Primary & Secondary School	MOH: • HECC • MDD • PSD MOHE • Universities

Evaluation Indices for Strategy 1.3

- Basic AMR education introduced into school extra-curriculum activities

Strategy 1.4: Provide the public media with accurate and relevant information on AMR

Actions	Target Implementation date	Target Group	Responsible Unit(s)
1. Media workshop • AMR-related education provided to the media practitioners involved in broadcasting AMR article.	2018	Media practitioners	MOH: • Corporate Communication Unit • MDD • PSD MOA • DVS • DOF

Evaluation Indices for Strategy 1.4

- Number of media workshop conducted

2 OBJECTIVE

Strengthen the Knowledge and Evidence Base through Surveillance and Research

Strategies

2.1 Strengthen the national surveillance system that consist of a core set of organisms and antimicrobial medicines from both health care facilities and the community

2.2 Strengthen the national surveillance system for AMR by harmonising surveillance system in both human and animal health using standardized tests for identification of resistant microorganisms.

2.3 Develop antimicrobial surveillance system in animal health.

2.4 Establish a comprehensive One Health Surveillance System for AMR that promotes participation in regional and global networks and sharing of information.

2.5 Develop an alert mechanism for AMR detection and reporting of newly emerged resistance that may constitute a public health emergency of international concern (PHEIC).

Strategy 2.1: Strengthen the national surveillance system that consist of a core set of organisms and antimicrobial medicines from both health care facilities and the community

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
1. Strengthen National Surveillance of Antimicrobial Resistance in Malaysia (NSAR) 1.1 Increase number of participating hospitals in reporting of Antibiotic Sensitivity Test (AST) through WHONET 1.2 Involvement of private hospital	2018	All hospitals with microbiology laboratory with AST capacity	MOH: • IMR • MDD Microbiology Lab in Hospitals Private laboratory
2. Strengthen National Surveillance on Healthcare Associated Multidrug Resistant Organism (HA-MDRO) 2.1 Improve collection of data and reporting system in MOH and university hospitals 2.2 To include Carbapenem resistant enterobacteriaceae and Acinetobacter baumannii in Malaysian Patient Safety Goals no. 4 2.3 To incorporate MRSA Bacteremia into the HA-MDRO surveillance	2018	Hospitals • MOH • MOHE • MINDEF • Private hospitals	MOH: • MDD

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
3. Establishment of community surveillance of AMR • Yearly point prevalence survey on urinary tract infection (UTI) in the community	2018	All primary healthcare facilities (Type 1 & 2)	MOH: • NPHL&PHL • IMR • DCD • FHDD
4. WHONET training for participating laboratories (human & animal health, food safety, fisheries and private hospitals)	On going	• MOH • MOHE • MINDEF • MOA: DVS, DOF • private hospitals microbiology laboratories	MOH • IMR • FSQD MOA • DVS • DOF
5. To identify gap in surveillance of specific organisms. • To include *Neisseria gonorrhoea*e into list of core pathogens for reporting (case-based surveillance)	2018	MOH	MOH • PHL • DCD • FHDD
6. Reporting of antibiotic consumption sales data through International Medical Statistics (IMS)	2019	• Hospitals and Primary Healthcare	MOH • PSD

Evaluation Indices for Strategy 2.1

- Number of medical institutions participating in AMR surveillance (NSAR)
- Number of medical institutions participating in HA-MDRO surveillance
- Number of primary healthcare facilities involved in community AMR surveillance
- Number of laboratories with personnel trained on using WHONET
- Number of primary healthcare facilities participating in gonorrhoea surveillance
- Report of antibiotic consumption sales data

Strategy 2.2: Strengthen the national surveillance system for AMR by harmonising surveillance system in both human and animal health using standardized tests for identification of resistant microorganisms.

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
1. Standardization of test methods for AMR across microbiological laboratories 1.1 Establish a standard method for AMR analysis covering various antibiotics 1.2 Conduct training to laboratory personnel	2017	MOH • NPHL • IMR • FSQL MOA • DVS (NPHVL) • DOF	MOH • NPHL • IMR • FSQL MOA • DVS • DOF
2. Enrolment in Quality Assurance (QA) programme for laboratories that are involved in testing for AMR in animal, food and fishery provided by central reference laboratory (IMR)	2019	MOH • FSQL MOA • DVS • DOF	MOH • IMR • FSQL MOA • DVS • DOF
3. WHO Integrated Global Survey on ESBL-producing E.coli using "One Health" approach, "The Tricycle Project".	2018	MOH • MDD • NPHL • IMR • DCD MOA • DVS NRE • DOE • NAHRIM	MOH • MDD • NPHL • IMR • DCD MOA • DVS NRE • DOE • NAHRIM

Evaluation Indices for Strategy 2.2

- Protocol for standardization of test methods for AMR analysis developed
- Number of training on standardization of AMR analysis carried out
- Number of laboratory participating in QA programme on AMR lab testing
- Completion of Tricycle pilot project involving isolates from human, animal and environment

Strategy 2.3: Develop antimicrobial surveillance system in animal health.

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
1. Establish AMR surveillance in livestock production • Poultry • Pigs	2018	Farms: • Poultry broiler farm • Poultry layer farm • Pig farms	MOA • DVS
2. AMR surveillance in food of animal origin. • Poultry • Pigs	2018	• Poultry slaughterhouse • Pig abbatoir	MOA • DVS
3. Establish AMR surveillance and monitoring in aquaculture	2018	Registered aquaculture premises	MOA • DOF
4. Strengthen AMR surveillance in food • AMR in poultry, pork, fish and ruminant (beef and mutton) at retail markets	2017	Retail market (wet markets and hypermarkets)	MOH • FSQD • FSQL • State Health Department • PHL
5. Conduct AMR study	2019	Isolates from surveillance activities	MOHE • UPM MOH • IMR • MDD MOA • DVS

Evaluation Indices for Strategy 2.3

- Number and type of samples obtained from surveillance of AMR in food-producing animals and slaughter houses / abattoir
- Number of poultry broiler farm, poultry layer farm,pig farm, poultry slaughter house and pig abattoir surveyed
- Prevalence of AMR in poultry broiler farm, poultry layer farm, pig farm, poultry slaughter house and pig abattoir
- Number and type of samples obtained from surveillance of AMR in aquaculture
- Number and type of samples of food obtained from retail markets (poultry, pork, fish and ruminant

Strategy 2.4: Establish a comprehensive One Health Surveillance System for AMR that promotes participation in regional and global networks and sharing of information.

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
1. Develop Malaysian Integrated Antimicrobial Resistance Surveillance System (MARSS) a) Human health b) Animal health c) Food	2018	MOH • MDD • DCD • IMR • FSQD MOA • DVS • DOF	MOH • Corporate Communication Unit • MDD • DCD • IMR • FSQD MOA • DVS • DOF
2. Develop Malaysian One Health Antimicrobial Resistance webpage.	2018	MOH: • IMR • MDD • PSD • FSQD MOA • DVS • DOF	MOH: • IMR • MDD • PSD • FSQD • Information Management Division MOA • DVS • DOF
3. Develop Malaysian Integrated Surveillance Manual on Antimicrobial Resistance	2018	MOH: • IMR • MDD • PSD • FSQD MOHE: • Universities MOA • DVS • DOF	MOH: • IMR • MDD • PSD • FSQD MOHE: • Universities MOA • DVS • DOF MyOHUN

Evaluation Indices for Strategy 2.4

- Comprehensive integrated AMR surveillance report
- Malaysian One Health Antimicrobial Resistance webpage developed

- Manual on Malaysian Integrated Surveillance on Antimicrobial Resistance developed

Strategy 2.5: Develop an alert mechanism for AMR detection and reporting of newly emerged resistance that may constitute a public health emergency of international concern (PHEIC)

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
1. Establish an alert mechanism for AMR detection and reporting of newly emerged resistance that may constitute a public health emergency of international concern • Develop event based surveillance protocol	2018	MOH • MDD • IMR • FSQD • Hospitals	MOH • MDD • IMR • NPHL • FSQD

Evaluation Indices for Strategy 2.5

- Event based surveillance protocol developed

3 OBJECTIVE

Reduce the Incidence of Infection through Effective Sanitation, Hygiene and Infection Prevention Measures

Strategies

3.1. Strengthen educational programme on hygiene and infection prevention and control measures in healthcare care settings, animal husbandry and food processing.

3.2. Strengthen national policies and standards of practice regarding infection prevention and control activities in health facilities.

3.3. Strengthen national surveillance on healthcare associated infections prevalence.

3.4. Strengthen infection prevention & control practices in animal health through implementation of the standards published in the World Organisation for Animal Health (OIE).

3.5. Promote vaccination as a method of reducing infections in human and food animals.

Strategy 3.1: Strengthen educational programme on hygiene and infection prevention and control measures in healthcare care settings, animal husbandry and food processing

Actions	Target Implementation Date	Target Group	Responsible Unit(s)

1. Development of Infection Prevention & Control (IPC) educational tool kits for human health (to be made available online)
• Infection precaution in patient care
• Outbreak management
• Central venous catheter care bundle
• Urinary catheter care bundle
• Vaccination in infection prevention
	2017	• Healthcare practitioners
		• Undergraduate Students:
		  • Medicine
		  • Dentistry
		  • Pharmacy
		  • Allied Health Sciences
			MOH
			MOHE

2. Training the trainer of IPC educational tool kits for human health.	2018	MOH (For each state) • 1 specialist • 1 infection control nurse • Infection control personnel (primary care) MOHE and MINDEF • 1 specialist • 1 infection control nurse	MOH MOHE
3. Orientation on IPC for newly appointed staff using educational tool kits for human health	2018	Human Health Sector: • Medical officers • Dental Officer • Pharmacist • Paramedics • Concessional staff (housekeeping)	Healthcare Facilities
4. Development of Infection Prevention & Control (IPC) educational tool kits for animal health.	2021	• Veterinary practitioners • Fish Health Professionals • Undergraduate Students: Veterinary	MOHE MOA • DVS • DOF

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
5. Orientation on IPC for newly appointed staff using educational tool kits for animal health	2021	Animal Health Sector: • Veterinary Officer (VO) • Assistant Veterinary Officer (AVO) • Para-veterinarians • Fisheries officer	MOA • DVS • DOF
6. Increase number of Infection Prevention and Control Personnel 6.1 Increase number of healthcare personnel with recognised courses: • Asia Pacific Society on Infection Control (APSIC) - Basic Course in Infection Control 6.2 Increase number of paramedics with IPC post basic training: • Post Basic Training in Infection Control (MOH)	2018 2018	• Medical officers • Paramedics	MOH
7. Training on IPC and Biosecurity at various level. conference/seminar/ workshop • National • State • Institution	Annually	Human Health Sector: All Categories of HCW Animal Health Sector: All Veterinary personnel All Fisheries personnel	MOH MOA • DVS • DOF
8. Continuous Medical Education (CME) Programme on Infection Prevention & Control and Biosecurity	2017	Human Health Sector: All Categories of HCW Animal Health Sector: All Veterinary personnel All Fisheries personnel	MOH MOHE MOA • DOF • DVS

Evaluation Indices for Strategy 3.1

- Number of healthcare facilities adopting the IPC toolkits
- Number of IPC courses (conference/seminar/workshop) conducted at institution, state and national level
- Number of personnel attending IPC course (excluding orientation IPC course)
- Number of IPC personnel attended APSIC, post basic course or accredited training

Strategy 3.2: Strengthen national policies and standards of practice regarding infection prevention and control (IPC) activities in health facilities

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
1. To revise the current edition of National Policies and Procedures on Infection Control (2009)	2017		MOH • MDD
2. Strengthen Hand Hygiene programme in all healthcare facilities			
2.1 To include MOH primary health care in Hand Hygiene Compliance Rate Surveillance in Malaysian Patient Safety Goals (MPSG)	2019	MOH (Primary Health Care)	MOH
2.2 To strengthen Hand Hygiene Programme in critical care facilities (HDU, ICU, CCU, NICU, PICU)	2018	MOH Hospitals with critical care facilities	MOH Hospital Director

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
3. Strengthen Infection Prevention and Control in hospitals 3.1 Implementation of IPC Audit • Training the trainers • Propose integration of IPC audit training into the current Post Basic Infection Control course • 6 monthly audit - IPC Audit - Central Venous Catheter (CVC) Care Bundle Compliance Audit - Urinary Catheter Care Bundle Compliance Audit	2017 2018 2018 2017 2017 2019	MOH, MOHE, MINDEF Hospitals	MOH • MDD • Hospital Infection Control Unit • Hospital Infection Control Unit
3.2 Infection Control Nurse (ICN) placement is in accordance to standard norms (1 ICN:110 beds)	2020	All MOH hospitals	• Hospital Director
3.3 Application for new designated ICN post in "Dasar Baru"	2021		• MDD
3.4 Designated ICN in critical care units for implementation, supervision and monitoring of IPC practices.	2020	MOH Hospitals with critical care facilities	MOH Hospital Director
3.5 To improve isolation facilities for patient care • 2 isolation room for every 30 beds • single rooms isolation ward (preferably with negative pressure room)	2018 2021	• current state and major hospitals • new hospital (>400 beds)	MOH • MDD • Hospital Director
4. To review IPC chapter in "Arahan Prosedur Tetap Veterinar Malaysia" (APTVM)	2021		MOA • DVS

Evaluation Indices for Strategy 3.2

- Number of primary healthcare facilities participating in hand hygiene compliance in MPSG
- Compliance target rate of hand hygiene: critical care facilities ≥85%, others ≥75%
- Number of MOH Hospitals participating in IPC audit
- Specialist hospitals: number of hospitals fulfil the standard norms of ICN to hospital bed ratio of 1:110
- Non specialist hospitals: number of hospitals with minimum of 1 doctor and 1 Infection control personnel managing the IPC activities
- Number of hospitals with dedicated ICN in critical care facilities
- IPC chapter in "Arahan Prosedur Tetap Veterinar Malaysia" (APTVM) revised

Strategy 3.3: Strengthen national surveillance on healthcare associated infections prevalence.

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
1. Strengthen Healthcare Associated Infection (HCAI) surveillance. • To revise the HCAI manual • To improve reporting system and data • collection	2018	Hospitalised patient at Health care facilities under • MOH • MOE • MINDEF	MOH • MDD

Evaluation Indices for Strategy 3.3

- HCAI surveillance manual revised

Strategy 3.4: Strengthen Infection Prevention & Control practices in animal health through implementation of the standards published in the World Organisation for Animal Health (OIE).

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
1. Strengthen biosecurity programme in animal health sector • Annual audit in farm with MyGAP certification and processing plants with VHM certification	On-going	• Unregistered and Registered farms • Farmers/ live stocks owners • Abattoir • Processing plant • Aquaculture	MOA • DVS • DOF

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
2. Strengthen biosecurity programme in animal premises • Periodic audit of farm emphasising on good husbandry, health programme and biosecurity practices based on state enactment	On-going	• Unregistered and Registered farms • Farmers/ live stocks owners • Abattoir • Processing plant Aquaculture	MOA • DVS • DOF

Evaluation Indices for Strategy 3.4

- No. of registered premises (farm/abattoir/processing plants, etc complied to MyGAP and certified with VHM (DVS)

Strategy 3.5: Promote vaccination as a method of reducing infections in human and food animals.

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
1. Strengthen promotion on awareness of vaccines preventable diseases			MOH • FHDD • DCD • FSQD
1.1 World Immunization Week	On-going	Healthcare Workers & Public	MOHE Private Health Facilities (hospital)
1.2 Vaccines under National Immunization Programme (NIP)	On-going	Public	
1.3 Other vaccines			
• Pneumococcal	On-going 2021	High risk patients Children	
• Salmonella Typhii	On-going	Food Handlers	
1.4 Vaccine for Healthcare workers	On-going	High risk HCWs with direct exposure to infective source	
2 Optimize animal health programme by vaccination • Pet • Livestock	On-going	Animal clinics Registered farm owners	MOA • DVS

Evaluation Indices for Strategy 3.5

- Measles vaccination coverage ≥ 95% in children
- Number of registered farms participating in vaccination programme

4 OBJECTIVE

Optimize the Use of Antimicrobial Medicines in Human and Animal Health

Strategies

4.1 Ensure activities of distribution, prescription & dispensing of antimicrobials in accordance with national legislation.

4.2 Regular review of the National Essential Medicines Lists and National Antibiotic Guideline to ensure purchasing and prescribing of antimicrobial medicines are based on current recommendation

4.3 Strengthen the laboratory capacity for efficient identification of pathogens & their antimicrobial susceptibility.

4.4 Provision of stewardship programmes in healthcare facilities

4.5 Introduction of incentives to optimize appropriate use of antimicrobial agents.

4.6 Development of policies on the use of antimicrobial agents in terrestrial and aquatic animals including reduction in nontherapeutic use of antimicrobial medicines in animal health.

Strategy 4.1: Ensure activities of distribution, prescription & dispensing of antimicrobials in accordance with national legislation.

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
1. Monitoring of antimicrobial importation at entry points. 1.1 Listing of colistin/ polymyxin under Perintah Kastam (*Larangan Import*). 1.2 To monitor the import quantity of 13 antibiotics. a) 7 antibiotics for human & veterinary usage: (Ampicillin, cefotaxime, trimethoprim/sulphamethoxazole, streptomycin, gentamicin, ciprofloxacin, colistin) b) 3 antibiotics for human usage: (Ampicillin/sulbactam, amoxicillin/clavulanate, cefuroxime) c) 3 antibiotics for veterinary usage: (ceftiofur, tetracycline, chloramphenicol)	2018 2018	Type B license holder	MOH • PSD (Pharmacy Enforcement Division)
2. Regular inspections/audits on the sale of antimicrobial agents in community pharmacies.	2018	Community pharmacist	MOH: • PSD (Pharmacy Enforcement Division)

Action	Target Implementation Date	Target group	Responsible Unit(s)
3. To propose condition under the existing licensing regulation			
3.1 Review of licensing condition under State Enactment • To include Antimicrobial usage (AMU) report as a condition for license application or renewal	2018	Farm	MOA • DVS
3.2 To propose regulation on prescription of antimicrobial in animal feed (Section 19 Feed Act 2009)	2018	Feed miller Home mixer	
3.3 To include in the regulation under the Fish Act that all antimicrobials used in aquaculture premises shall only be approved by DOF.	2018		MOA • DOF
4. Strengthening of AMU surveillance in animal health sector			
4.1 Harmonization of veterinary AMU monitoring programme	2018	Poultry farms Swine farms Animal feed industry	MOA • DVS
4.2 Establish AMU surveillance system in fish and shrimp aquaculture	2019	Fish feed processing company, Import Fish Health Professionals, Aquaculture farms	MOA • DOF

Evaluation Indices for Strategy 4.1

- Quantity of antibiotics imported under Type B Licenses (Poison Act)
- Number of community pharmacy premises being audited/inspected
- Number of state that has included AMU report as a condition for license application and renewal
- Number of farms licensed with revised regulation
- Number of feed miller and home mixer licensed with revised regulation
- Report of AMU surveillance in veterinary
- Report of AMU surveillance in fish and shrimp aquaculture

Strategy 4.2: Regular review of the National Essential Medicines Lists and National Antibiotic Guideline to ensure purchasing and prescribing of antimicrobial medicines are based on current recommendation

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
1. Regular revision of the National Essential Medicines List.	3-5 years (2018-2020)	-	MOH: • PSD (Pharmacy Practice and Development Division)
2. Regular revision of the National Antibiotic Guideline	3-5 years (2017-2019)	-	MOH: • PSD (Pharmacy Practice and Development Division)

Evaluation Indices for Strategy 4.2

- Publication of revised National Essential Medicine List every 3-5 years
- Publication of revised National Antibiotic Guideline every 3-5 years

Strategy 4.3: Strengthen the laboratory capacity for efficient identification of pathogens & their antimicrobial susceptibility.

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
1. Capacity building of MOH hospital laboratories 1.1 Placement of clinical microbiologist in all major specialist hospitals 1.2 Upgrading the microbiology laboratory in all major specialist hospitals. 1.3 MS ISO/IEC 15189 certification for microbiology laboratory in major specialist hospitals	2020	Major MOH specialist hospital	MOH • MDD
2. Capacity building of private hospital laboratories 2.1 MS ISO/IEC 15189 certification for microbiology laboratory in major hospitals.	2020	Major private hospital	MOH • MDD
3. Expand the coverage of Total Laboratory Information System in MOH hospitals.	2020	MOH hospital	MOH • MDD
4. Networking/web-based system between MOH, university and private hospitals.	2020	MOH, university and private hospitals	MOH • MDD

Evaluation Indices for Strategy 4.3

- Number of major MOH hospitals with clinical microbiologist.
- Number of hospitals with MS ISO/IEC 15189 certification for microbiology laboratory.
- Number of MOH hospitals with Total Laboratory Information System (TLIS).

Strategy 4.4: Provision of stewardship programme in healthcare facilities

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
1. Development and distribution of guideline/consensus on antibiotic use in primary care • Clinical pathway for common infections.	2017	Primary healthcare facilities (MOH and non-MOH including GP)	MOH • PSD • FHDD
2. Audit on adherence to the National /local Antibiotic Guideline: • To integrate audit with point prevalence survey of antibiotic utilisation.	On-going	Public hospitals	MOH • PSD
3. Implementation of AMS programme in healthcare facilities 3.1 Development of AMS policies in public healthcare facilities	2018	Public healthcare facilities	MOH: • PSD • MDD
3.2 Establishment of AMS teams in public and private healthcare facilities. • To incorporate establishment of AMS team as KPI under Malaysian Patient Safety Goal.	2017: 14 MOH State & 15 Major Specialist Hospitals 2018: 14 MOH State & 27 Major Specialist Hospitals 2019: 14 MOH State, 27 Major Specialist & 18 Minor Specialist Hospitals 2020: All MOH hospitals (excluding Special Medical Institutions)	All MOH hospitals Hospitals with more than 100 beds (MOE and private)	MOH: • PSD • MDD • Hospital Directors

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
3.3 Establishment of at least one dedicated and trained pharmacist in AMS	2020	All MOH State Hospitals	MOH: • PSD
3.4 Establishment of AMS as one of the criteria in the Hospital Accreditation	6th Edition	Public and private hospitals	MOH • MDD • PSD

Evaluation Indices for Strategy 4.4

- Number of facilities with AMS team
- Number of hospital with dedicated and trained pharmacist in AMS.

Strategy 4.5: Introduction of incentives to optimize appropriate use of antimicrobial agents.

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
1. To facilitate market access for products from farm with MyGAP certification.	2018	Farmers	MOA • DVS • DOF

Strategy 4.6: Development of policies on the use of antimicrobial agents in terrestrial and aquatic animals including reduction in nontherapeutic use of antimicrobial medicines in animal health.

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
1. Development of National guideline on antimicrobial drugs use in veterinary sector e.g. National Veterinary Antibiotic Guideline (NVAG) and list of controlled antibiotics for food producing animal	2018	Feed millers, farmers	MOA • DVS

Actions	Target Implementation Date	Target Group	Responsible Unit(s)
2. To reduce by phase certain critically important antibiotic for human health from the veterinarian and aquaculture usage: 2.1 To propose regulation/guidelines to phase-out critically important antibiotics for human in veterinary/aquaculture	2018	Feed millers Farmers Aquaculture	MOH • PSD MOA • DVS DOF
2.2 Determine trend of antibiotic usage by AMU Surveillance Programme 2.3 Establish research and trials for use of alternative antimicrobials			
3. Development of guideline on disposal of unused/expired antibiotics in the public, private and animal sectors to prevent environment contamination.	2018	Public, private, animal sectors	MOH • PSD MOA • DVS • DOF NRE • DOE

Evaluation Indices for Strategy 4.6

- National guideline on antimicrobial use in veterinary sector developed
- Number of critically important antibiotics phased out in veterinary use
- Publication of guideline on disposal of unused/expired antibiotics

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