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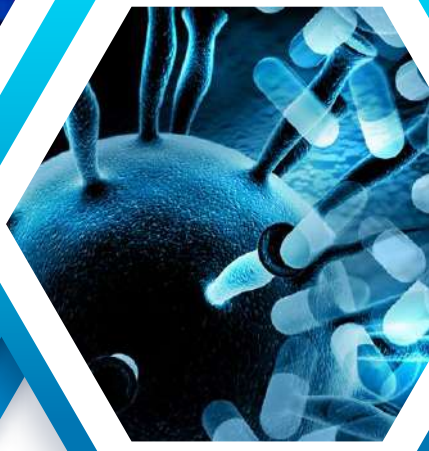
Ministry of Health Malaysia



PROTOCOL ON ANTIMICROBIAL STEWARDSHIP (AMS) PROGRAMME IN HEALTHCARE FACILITIES

Second Edition 2022

Ministry of Health Malaysia

PROTOCOL ON ANTIMICROBIAL STEWARDSHIP (AMS) PROGRAMME IN HEALTHCARE FACILITIES

Second Edition 2022

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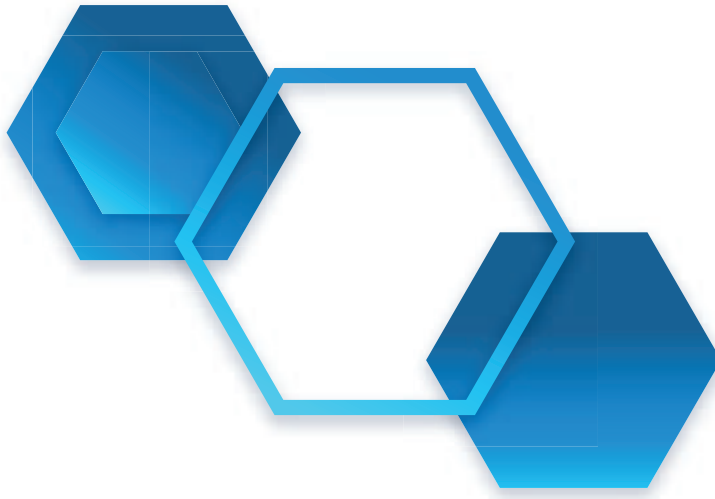

FOREWORD FROM
DIRECTOR-GENERAL OF HEALTH MALAYSIA

MESSAGE FROM
SENIOR DIRECTOR OF PHARMACEUTICAL SERVICES

MESSAGE FROM
HEAD OF CLINICAL SERVICES (INFECTIOUS DISEASES)

Foreword

TAN SRI DATO' SERI DR. NOOR HISHAM ABDULLAH
Director-General of Health Malaysia

Antimicrobial resistance poses a significant threat to human health around the world. It adversely impacts infectious diseases, deaths, hospital length of stay, and healthcare costs. Containment of antimicrobial resistance is critical in ensuring the continuity of successful treatment with antimicrobials and preventing the emergence of infections of multidrug-resistant organisms. In the Global Action Plan on Antimicrobial Resistance, the World Health Organization (WHO) Member States are called to provide stewardship programmes that monitor and promote optimisation of antimicrobial use at national and local levels in accordance with international standards.

Antimicrobial stewardship is based on fundamental principles to guide the implementation of efforts in promoting judicious antimicrobial use and, therefore, advance patient safety and improve outcomes. It requires an integrated and multidisciplinary approach that involves a physician, microbiologist, pharmacist, and infection control practitioner. Judicious use of antimicrobials includes an appropriate selection of antimicrobials for proper patients with proper duration and route to minimise the risk of developing antimicrobial resistance.

The antimicrobial stewardship team provides feedback on prescribing practices, antimicrobial use, medication safety incidents, local antimicrobial resistance patterns, and antimicrobial resistance-related infections. They also advise prescribers

on necessary changes in antimicrobial policies and guidelines, therapeutic options, and diagnostic interventions. This programme has been proven highly successful in promoting the rational use of antimicrobials through evidence-based interventions.

To support the nationwide implementation of antimicrobial stewardship, the Ministry of Health developed the "Protocol on Antimicrobial Stewardship Program in Healthcare Facilities – First Edition" in 2014. This second edition of the protocol is published given current development and references. The revised protocol provides more detailed and comprehensive guides for all healthcare facilities to start or strengthen the antimicrobial stewardship programme.

I want to congratulate all contributors, reviewers, Pharmaceutical Services Programme, Medical Development Division, and Family Health Development Division for their commendable efforts in reviewing and updating this protocol. I hope this updated protocol will be implemented effectively at the healthcare facilities to ensure rational use of antimicrobials, reducing antimicrobial resistance.

Thank you.

Message

NORHALIZA A HALIM
Senior Director of Pharmaceutical Services

The first edition of Protocol on Antimicrobial Stewardship Programme in Healthcare Facilities was published by the Ministry of Health in 2014. Since then, a lot of references have been made available and various toolkits have been developed to guide the implementation of the antimicrobial stewardship programme. Hence, it is high time to review and update the protocol and keep up with the current development, with the purpose that this protocol remains relevant.

Overuse and misuse of antimicrobials have been associated with more rapid emergence of antimicrobial resistance. Therefore, promoting the appropriate use of antimicrobials through a coordinated programme is important to improve patient outcomes, reduce antimicrobial resistance and decrease the spread of infections caused by multidrug-resistant organisms.

As described in this protocol, pharmacists play prominent roles in antimicrobial stewardship programme and must be able to work collectively with other healthcare professionals in the multidisciplinary antimicrobial stewardship team. To contribute effectively, pharmacists should equip themselves with knowledge in antimicrobial pharmacotherapy, as well as soft skills.

I believe this protocol will benefit all healthcare professionals in implementing antimicrobial stewardship programme at their facilities and subsequently improve the quality of antimicrobial utilisation.

Last but not least, I would like to thank the secretariat, contributors and reviewers for their hard work in reviewing and updating this protocol.

Message

DATO' DR. MAHIRAN MUSTAFA
Senior Consultant Infectious Diseases Physician
Head of Infectious Diseases Services
Ministry of Health, Malaysia

Antimicrobial stewardship programmes have shown to decrease inappropriate antimicrobial use, improve healthcare outcomes and reduce adverse consequences of antimicrobial use including antimicrobial resistance, toxicity and unnecessary costs. This protocol serves as a guide for facilities and healthcare professionals in implementing antimicrobial stewardship programme in a structured manner.

The first edition of this protocol marked an important step at the national level for nationwide implementation of antimicrobial stewardship programme especially at Ministry of Health facilities. Since then, antimicrobial stewardship has been given more priority and implementation has expanded to include many other facilities including the private hospitals. This revised edition has taken into consideration the latest available guidelines, recommendations and toolkits from established sources to ensure it remains relevant. It also incorporates more detailed guides on how to initiate an antimicrobial stewardship programme and manage antimicrobial stewardship interventions, as well as tips to run antimicrobial stewardship activities for small hospitals and hospitals with limited resources.

Finally, I would like to take this opportunity to thank all contributors from multidisciplinary healthcare professions, Pharmaceutical Services Programme as the secretariat for this protocol, Medical Development Division and Family Health Development Division for their joint effort in reviewing and updating this protocol. Notably, I am looking forward positively for all practitioners from various levels to make full use of this protocol to improve antimicrobial utilisation in the healthcare facilities.

"Antimicrobial stewardship is a team game with the patient at the centre and it's our teamwork that makes the dream work."

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"The Secretariat would like to thank all parties who have directly or indirectly involved in reviewing and updating this protocol"

CONTENTS

INTRODUCTION

The introduction of antimicrobial agents has contributed to the reduction of infectious diseases as the major cause of premature death. Treatment with antimicrobial agents seems so effective and safe that they are sometimes prescribed for dubious indications and for longer than necessary, with little concern for adverse effects and the development of resistance.

In the last 40 years, the prevalence of multidrug-resistant microorganisms (e.g. extended spectrum beta-lactamase-producing Enterobacterales) have risen alarmingly. Antimicrobial resistance (AMR) occurs when microorganisms change in ways that render the medications used to cure the infections they cause ineffective. There is evidence that overall rates of antimicrobial resistance correlate with the use of antimicrobials. Certain antimicrobials like quinolones promote the emergence of resistance more than others. Quinolone usage has been linked to an increase in methicillin-resistant Staphylococcus aureus and with increased quinolones resistance in Gram-negative bacilli.

The emergence of AMR can cause the resistance to first-line medicines and leads to the use of second or third-line drugs which is less effective, more toxic and costlier. As more resistance is acquired, we are eventually left without any effective antimicrobial therapies. Hence, AMR can negatively impact patient outcomes, become a major threat to patient safety, increase healthcare expenditure, and limit treatment options for common infections.

Antimicrobial management or stewardship programme has been developed as a response to these issues. Antimicrobial Stewardship (AMS) is a coordinated systematic approach to improve the appropriate use of antimicrobials by promoting the selection of the optimal antimicrobial drug regimen; right choice of antimicrobial, right route of administration, right dose, right time, right duration and minimize harm to the patient and future patients.

The development of antimicrobial resistance strains in hospitals is intensified because of a high level of antimicrobial use and concentration of patients with multiple pathogens. Ongoing monitoring and prospective audits have shown to improve patient care, decrease unnecessary antimicrobial use and antimicrobial resistance and reduce healthcare expenditures.

OBJECTIVES

1. To optimize antimicrobial therapy in order to maximize clinical cure or prevent infections by optimizing selection, dosing, route, and duration of antimicrobial therapy.

2. To minimize the unintended consequences such as the emergence of antimicrobial resistance and adverse drug events.

3. To improve patient outcomes (e.g. reduce morbidity and mortality from infection).

4. To reduce healthcare costs without adversely impacting the quality of care.

Antimicrobial Stewardship Implementation

Introduction

At the healthcare facility level, different contexts and types of facilities will face different challenges. The essential healthcare facility core elements in the WHO toolkit: Antimicrobial Stewardship Programmes in Healthcare Facilities in Low- and Middle-income Countries (Appendix 2) have been stratified into basic core elements requiring fewer resources and more advanced core elements requiring more resources. However, this differentiation may vary from facility to facility based on size, needs, priorities, resources and context. (Refer Table 2).

Governance

Hospital

The Antimicrobial Stewardship Programme in hospitals is under the purview of the Hospital Infection and Antibiotic Control Committee and is supported by the:

a. Hospital Director
b. Head of various clinical departments
c. Head of Pharmacy Department
d. Head of Medical Microbiology

Implementing and maintaining an effective AMS requires a dedicated multidisciplinary team and involves ongoing communication and collaboration among multiple disciplines and departments. The AMS team should be appointed by the Hospital Director.

The role of the Hospital Director is critical in ensuring the success of the Antimicrobial Stewardship Program initiatives by:

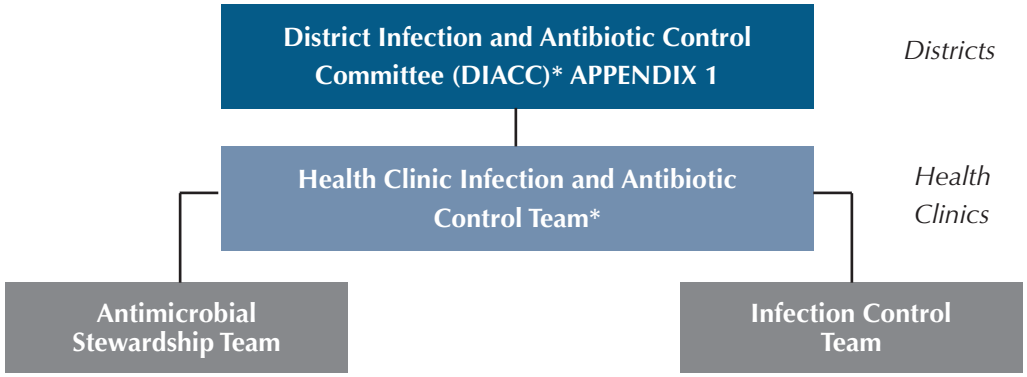
- ensuring AMS becomes strategic goal of the organisation
- communicating on why change is needed to staff and other leaders of Departments
- allocating adequate resources in terms of manpower and time for dedicated AMS team activities
- reviewing progress by the team, identifying barriers and providing advice
- assigning high-performing staff to the team and resourcing them adequately
- endorsing the AMS team and the activities

Primary Care

The Antimicrobial Stewardship Programme (AMS) in Primary Care shall be implemented at both District and Health Clinic levels and is within the purview of the District Infection and Antibiotic Control Committee (DIACC). The committee at the district level should be appointed by the District Health Officer.

All Health Clinics with Family Medicine Specialists (FMS) or Medical Officers In Charge (MOIC) and pharmacists shall have an AMS team at the clinic level. Members of the AMS team at the clinic level shall be appointed by FMS/ MOIC. Implementing and maintaining an effective AMS requires a dedicated multidisciplinary team and involves ongoing communication and collaboration among team members.

Functional structure of AMS at districts and health clinics



** Responsible in Infection Control and the implementation of AMS*

General Policies

1. Formulation of AMS team in each hospital, Health District Office and Health Clinics

The core members of AMS team should be multidisciplinary and appointed by Hospital Director/ District Health Officer/ FMS/ Medical Officer In Charge.

2. Development and documentation of local antimicrobial policy

Every healthcare facility shall develop and document their local antimicrobial policy. The policy should be endorsed by the Drugs and Therapeutics Committee (JKUT) and ultimately the Hospital Director/ District Health Officer/ FMS/ Medical Officer In Charge and publicized to the whole health care facility.

The antimicrobial policy shall include as below:

- Indications for antimicrobials are to be explicitly spelt out at the time of prescribing to assist with audit efforts.
- Appropriate microbiology investigations (culture or serology) prior to antimicrobial commencement. **
- Clinicians to prescribe antimicrobials guided by the National Antimicrobial Guidelines or local antimicrobial guideline where applicable.
- A list of restricted antimicrobials and the procedures for obtaining approval.
- To limit the use of broad-spectrum antimicrobials unless necessary.
- To review patient's antimicrobial therapy on a regular basis based on microbiology result and the patient's progress.

**according to availability in primary care setting

3. Educational programme on AMS via continuous medical education (CME) and antibiotic awareness campaign

Provide regular updates on antimicrobial prescribing, practice and usage for healthcare professionals.

Specific Policies

Implementation of AMS activities according to category & type of facilities.

State and Major Specialist Hospitals	Minor and Non-Specialist Hospitals
i. Surveillance and feedback mechanism on specific antimicrobial consumption. **(Core Strategy)** ii. Implementation of prospective audit and feedback according to local needs. **(Core Strategy)** iii. Formalize regular antimicrobial rounds by AMS team especially in State and Specialist Hospital. **(Core Strategy)** iv. Establishment of formulary restriction and preauthorization/ approval system. **(Core Strategy)** v. Establishment of antimicrobial order tools for restricted antimicrobials. vi. De-escalation/ streamlining the antibiotic usage. vii. Antimicrobial selection and dose optimization of the antimicrobial. viii. Establishment of intravenous (IV) to oral (PO) switch programme.	i. Surveillance and feedback mechanism on specific antimicrobial consumption. **(Core Strategy)** ii. Implementation of prospective audit and feedback according to local needs. **(Core Strategy)** iii. Establishment of formulary restriction and preauthorization/ approval system. **(Core Strategy)** iv. Establishment of antimicrobial order tools for restricted antimicrobials. v. De-escalation/ streamlining the antibiotic usage. vi. Antimicrobial selection and dose optimization of the antimicrobial. vii. Initiation of intravenous (IV) to oral (PO) switch programme.

Primary care*** with Family Medicine Specialist (FMS)
i. Surveillance and feedback mechanism on specific antimicrobial consumption (DDD). **(Core Strategy)** ii. Implementation of process audit (clinical audit, structure audit, and Point Prevalence Survey) and feedback according to local needs. **(Core Strategy)** iii. Establishment of formulary restriction and preauthorization/ approval system. **(Core Strategy)**

***for primary care without FMS, AMS team from the main clinic shall conduct a minimal AMS activity such as clinical audit

SECTION A:

ANTIMICROBIAL STEWARDSHIP PROGRAMME IN HOSPITAL

The judicious use of antibiotics is an important strategy to preserving efficacy in the treatment of infectious diseases. Thus, this protocol was developed to provide practical recommendations to healthcare professionals in the hospitals in implementing antimicrobial stewardship programme to improve the quality of antibiotic usage and prescribing as well as improve patient clinical outcomes. The recommendations in this protocol are based on reviews of several published guidelines such as IDSA Guidelines, CDC – Core Elements Antimicrobial Stewardship in Hospitals, WHO Practical Guide to Antimicrobial Stewardship in Hospital and other guidelines from other countries where appropriate.

A.1 ANTIMICROBIAL STEWARDSHIP TEAM

Antimicrobial stewardship team in-charge of rational and responsible use of antimicrobials in healthcare facilities.

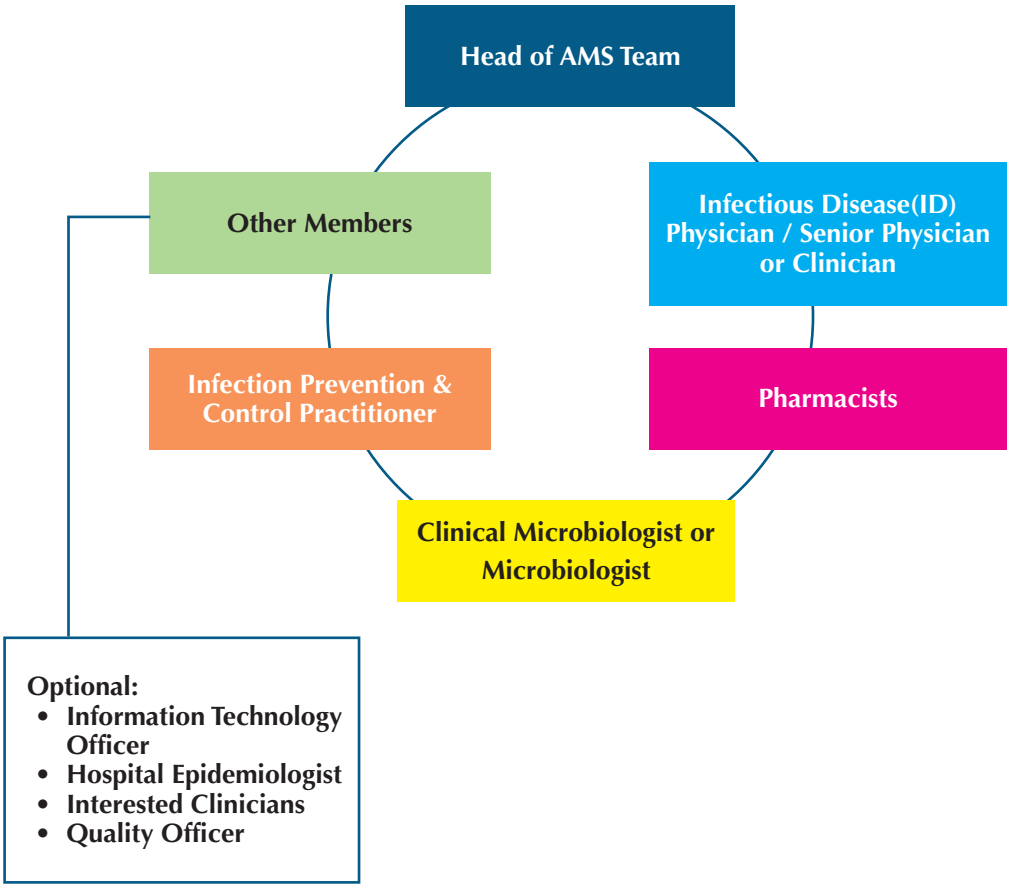
General Role of Antimicrobial Stewardship Team

1. Strengthens formulary restriction and approval systems.
2. Regularly reviews antimicrobial prescribing with intervention and direct feedback to the prescribers.
3. Educates prescribers, pharmacists and nurses about good antimicrobial prescribing practice and antimicrobial resistance.

4. Evaluates compliance to clinical guidelines and reports on process measures, outcomes measures (e.g. clinical and financial) and antimicrobial resistance patterns to Hospital Infection and Antibiotic Control Committee (HIACC) and Hospital Director.

Antimicrobial Stewardship Team Members

3.1 AMS team members in hospital include:



Every AMS team member shall meet regularly to discuss about any plan for AMS activities, to review current activities, to measure the outcome of intervention that has been done and to deliberate any problem that arise.

Head of AMS team

Is either an Infectious Disease Physician/ Paediatrician, senior physician or clinician deemed to be suitable by the Hospital Director.

Represents the AMS team in the Hospital Infection and Antibiotic Control Committee (HIACC) and gives feedback on AMS programme.

Co-opted in the Drugs and Therapeutics Committee (JKUT) when considering changes of antimicrobials in the hospital formulary.

Prepares surveillance and audit reports for submission to state and national level.

Proposes annual AMS activities with the Hospital Director and various departments.

Infectious Disease Physician / Senior Physician or Clinician

Leads the technical component of Antimicrobial Stewardship team.

Advises on specific stewardship related cases and issues.

Pharmacist

A dedicated pharmacist trained in AMS for pharmacy under the Ministry of Health (MOH).

Clinical role in conjunction with other members of the AMS Team:

- Gives technical input on finer aspects of antimicrobials.
- Identifies potential patients for stewardship interventions (e.g. de-escalation etc.)
- Ensures dose optimization is carried out especially for complex antimicrobials and complex clinical scenarios.
- Enforces the approval system of restricted antimicrobials.

Ensures safe and effective use of medication to reduce risk for errors and adverse events.

Surveillance of antimicrobial use

- Collection and analysis of local consumption and expenditure.
- Provision of data to regional/ national surveillance programmes.
- Carries out and analyses point prevalence studies on antimicrobial usage.

Audit and feedback

- Leads and conducts appropriate antimicrobial audits
- Provides timely feedback for future improvement

Clinical Microbiologist

Provision of guidance on appropriate diagnostic tests in microbiology, as part of 'diagnostic stewardship'.

Ensures the appropriateness of microbiology request, sample collection (types, time, date taken and documentation) and sample quality.

Provision of timely and accurate reporting of culture and antimicrobial susceptibility data.

Ensures selective reporting of antimicrobial susceptibilities and interpretative reporting of microbiology results.

Provision of yearly data on antimicrobial resistance patterns in hospital.

Information Technology Officer

Hospitals with existing IT systems may consider including an IT specialist/ personnel in the AMS team to assist with:

- Creating localized electronic decision-making systems that can be available through the hospital network system.
- Providing AMS team access to microbiological data and antibiotic utilisation data.
- Producing automated antimicrobial utilisation data and other programmed clinical data.

Infection Control Practitioner

AMS teams frequently chance upon opportunities to tighten infection control practices during their course of the work. Having an Infection Control Practitioner within the team complements the efforts of the AMS team in bringing down resistance rates.

A.2 ANTIMICROBIAL STEWARDSHIP ACTIVITIES

i. General Overview

The core elements below need to be in place prior to start antimicrobial stewardship activities:

CORE ELEMENTS	
1	Governance structure
2	Formulation of hospital antimicrobial policy *(Refer to General Policies - Development and documentation of local antimicrobial policy)*
3	Establishment of AMS team
4	Hospital-endorsed guideline (preferably based on local antimicrobial guideline e.g. National Antimicrobial Guideline (NAG)
5	Assessment of current practice and available resources • Antimicrobial utilisation data (e.g. defined-daily dose (DDD), Days of therapy (DOT) of selected antimicrobial, trending antimicrobial use) • Rates of resistance among common pathogens
6	Identify areas of intervention • Specific location (e.g. medical wards or ICU) • Specific disease conditions (e.g. Pneumonia, UTI) • Specific antimicrobial (e.g. Broad-spectrum antimicrobial (carbapenem), High usage of specific antimicrobial (vancomycin))
7	Development and implementation of effective strategies to address any inappropriate antimicrobial usage
8	Regular educational and awareness programme related to AMR & AMS

ii. Getting Started

Before starting the AMS initiatives, a facility should analyse its local current situation and identify areas of concern. The AMS programme must be individualized to the facility's financial, structural, organizational and human resources and to the patient mix case. A large tertiary facility with various specialties will need more comprehensive AMS plans and actions compared to a district hospital. Therefore, it is important for the AMS team to analyse, discuss and decide what are the antimicrobial issues that require intervention and the best strategies to implement.

The checklist below can be used to analyse the facility current situation and navigate the AMS activities:

Healthcare facility elements	Yes	No
1. Governance Conduct regular (yearly) situational analysis of the AMS programme requirement to identify gaps to implementation of an AMS programme (e.g. surveillance programme, human & financial resources etc.)		
2. Antimicrobial policy The healthcare facility has a written policy that requires prescribers to clearly document the antibiotics prescribed and its indication in the prescription chart and medical record.		
3. Hospital-endorsed guideline		
4. Formation of AMS team		
5. AMS team discussion • Discussion should be done periodically to review antimicrobial utilisation data, multidrug-resistance organism rates and identify antibiotic/ clinical conditions that require interventions. • Strategic discussion with infection control team regarding usage of antimicrobial during the time of nosocomial outbreak.		
6. Audit and feedback Periodic audit and feedback to hospital management and prescribers on antimicrobial utilisation.		
7. Healthcare facility drug formulary with a list of • Approved antibiotics • Restricted antibiotics* *Require approval by the hospital director or appointed physician.		

Note: Strategies to achieve the missing elements needs to be documented for future AMS planning.

iii. AMS Actions/ Interventions

Introduction

AMS interventions should begin in a stepwise build on existing systems and available data and encourage participation of clinical staff and prescribers. Start with a simple intervention on a small scale and keep it doable.

Below are the steps for AMS actions. It involves monitoring, surveillance and audit of antibiotic utilisation.

Step 1	Identify areas for improvement based on available data such as • Antimicrobial utilisation data. • Rates of resistance among common pathogens. • Assessing current prescribing practices (e.g. from point prevalence survey, audits etc.) (*Refer Table 1.*)
Step 2	Develop and implement targeted AMS interventions based on the identified areas of concern in step 1. Choose specific location (e.g. wards or unit) or disease condition or specific antibiotic where it is feasible to intervene. Involve stakeholders (prescribers) in the development of intervention programme to enhance sustainability. Determine the outcome and process measures that will be used to monitor effectiveness of the intervention. (*Refer to section A.3*)
Step 3	Assess the effectiveness of interventions and decide if further action needs to be taken based on the target set.

Step 1 - Identify areas for improvement based on available data

1.1 Surveillance data

Surveillance of antimicrobial use can show us how and why antimicrobials are being used by healthcare providers. Situation analysis via monitoring of antimicrobial prescription and consumption with comparison to national data provides insights and helps determine the area (ward/service/discipline) or antibiotic to be targeted for intervention. Access to information on antimicrobial consumption is an important source for healthcare professionals and policy makers and is the first step in increasing awareness of the importance of careful antibiotic use. Routine measurement and display of consumption information to healthcare professionals and policy makers can help monitor progress in our effort towards a more prudent use of antimicrobials. Prescribers should be made aware of their own prescribing practices. Thus, feedback to prescribers is one potential form of intervention.

Collection and analysis of local antimicrobial consumption

- Data collection and analysis of antimicrobial use should be done periodically (at least three monthly). The report of antimicrobial use should be disseminated to clinician and discuss the results in relevant meeting.

Indicators for reporting antimicrobial consumption

- Daily Defined Dose (DDD) per 1000 Patient Days is used to determine the antimicrobial utilisation in adult patients.
- Days of Therapy (DOT) per 1000 Patients days is used to determine the antimicrobial utilisation in paediatric patients.
- ABC VEN analysis is used to justify the selection of antibiotic in a facility.
- Identify marked increase in antimicrobial utilisation.

Provision of data to regional/ national surveillance programmes

- The data should be reported and presented at local and state levels. It also has to be submitted to Pharmacy Practice and Development Division, MOH for National Surveillance on Antibiotic Utilisation (NSAU).
- Comparisons between similar services in different institutions with similar capacity and case-mix may yield useful information.
- Identify hospital/ ICU with high usage of antimicrobial at the state or national level.

1.2 Audit

AMS intervention is done by identifying areas of concerns with regards to antimicrobial prescribing patterns. This can be achieved by conducting an audit. Audit activities involves multidisciplinary team efforts and can be done in a prospective or retrospective manner.

1.2.1 Audit on Antibiotic Usage

A quick audit of prescribing patterns (e.g. 10-30 patients) can be done prospectively or retrospectively with real-time feedback to the prescribers. Audit is conducted in response to incidences e.g. when there is significant increase of a specific antibiotic usage or if a particular antibiotic in the facility is an outlier at the hospital, state or national level. The evaluation of antimicrobial usage is determined by using standardized methods like antibiotic utilisation DDD or DOT data.

The audit measures utilisation patterns such as the choice of antibiotic, dose, frequency and duration, against local or national antimicrobial guidelines. Additional criteria such as empirical or definitive therapy (with cultures and antimicrobial susceptibility results) can also be included. Deviations from accepted standards will be documented.

Certain antimicrobials should be prioritized for audits and monitored. These antibiotics include antimicrobials under a restricted list and those that are monitored for usage at regional or national level (e.g. carbapenem, colistin, cephalosporin, vancomycin, piperacillin/ tazobactam).

To ensure the success of the audit, a two-way system for communication or feedback should be established. Mode of feedback includes email/ letter to head of units/ individual prescribers, presentation at ward or unit meetings, presentation at Drugs and Therapeutics Committee (JKUT) meeting and Hospital Infection and Antibiotic Control Committee (HIACC) meeting.

Example of Antibiotic Audit Format & Work Process (Appendix 3).

1.2.2 Antibiotic Point Prevalence Survey (PPS)

PPS is a cross-sectional survey that analyzes compliance against antibiotic guidelines. The auditing team comprises of physicians, pharmacists and the infection control team. PPS provides an insight of antibiotic prescribing pattern to identify target for quality improvement in antibiotic prescribing. Sequential

PPS audit allows the hospital to measure changes in practice and determine the impact of interventions.

Example of Point Prevalence Survey Forms & Work Process (Appendix 4).
Example of Point Prevalence Survey User Manual & Assessment Tool – Google Drive link:
https://drive.google.com/drive/folders/1rRhsRQKW8XHNATDKrispuxekWwCUaLo9?usp=sharing

1.2.3 Surgical Antibiotic Prophylaxis (SAP) Audit

Surgical antibiotic prophylaxis is the use of antibiotic before a surgical procedure to reduce the risk of post-operative surgical site infections (SSI). However, if administered inappropriately, antibiotic prophylaxis will not be effective and may be harmful. An audit can be done to monitor and measure inappropriate use of antibiotics (antibiotic necessity, antibiotic selection, time of administration and duration) for surgical prophylaxis.

Table 1. Common concerns of antimicrobial prescribing practice that can be targeted

Areas of Concern	Description
Overprescribing	Antibiotics are prescribed when not needed, e.g. fever without evidence of infection, asymptomatic urinary tract colonization, viral infections, malaria, and inflammatory conditions.
Broad-spectrum	More broad-spectrum antibiotics are prescribed than are necessary (e.g. surgical prophylaxis).
Unnecessary combination therapy, including certain fixed dose combinations	Multiple antibiotics are used, particularly with overlapping spectra and in combinations that have not been shown to improve clinical outcomes.
Wrong antibiotic choice	Wrong antibiotic(s) are prescribed for particular indications/ infections.
Wrong dose	Antibiotics are prescribed with the wrong dose (overdosing or underdosing).

Wrong dose interval	Antibiotics are prescribed with the wrong dose interval (too much time between doses).
Wrong route	Antibiotics are prescribed by the wrong route (e.g. IV instead of oral).
Wrong duration	Duration of antibiotic treatment is not at optimized period (e.g. antibiotics prescribed for too long a period, prolonged surgical prophylaxis).
Delayed administration	Administration of the antibiotic(s) is delayed from the time of prescription. Repeat doses are not administered in a timely way, which is critical in the case of septic shock and other serious infections.

Example of Surgical Antibiotic Prophylaxis Forms & Work Process (Appendix 5).
Example of Surgical Antibiotic Prophylaxis Audit Data Collection Protocol – Google Drive link: *https://drive.google.com/drive/folders/1rRhsRQKW8XHNATDKrispuxekWwCUaLo9?usp=sharing*

Step 2 - Develop and implement targeted AMS interventions based on the identified areas of concern in Step 1

After areas of intervention has been identified through audits (i.e. specific location, e.g. ward or unit or disease condition or antibiotic with high usage), the AMS team should discuss on the interventions that can be applied. If the intervention involves a unit/discipline, the AMS team should meet up with the respective unit/ discipline, select a champion from the unit/discipline that can give commitment to make changes, set goals of what to achieve in changing the antimicrobial practice and discuss on possible strategies and interventions that can be implemented tailored to the local settings.

AMS interventions should be implemented in a stepwise approach. Start with strategies that are simple and doable, building on the existing structures, maximizing teamwork and encouraging champions among clinical staff including prescribers in developing the intervention. AMS interventions should align with local needs.

Determine the outcome and process measures that will be used to monitor the effectiveness of the intervention. Outcomes of the interventions must be measurable. (Refer to section A.3)

Below is the example of AMS activities or interventions for improving antimicrobial prescribing practice:

a) Antimicrobial treatment guideline and SAP guideline

Antimicrobial treatment guideline and SAP guideline can be adapted from the NAG and endorsed at hospital level. These guidelines should be made accessible and promoted to all healthcare professionals. Automatic stop orders might be applied if the prescriptions do not adhere to these guidelines.

b) Antimicrobial Selection

Empirical antimicrobial selection is determined by the indication, suspected causative organism and site of infection as per antimicrobial guidelines. A review of a patient's antimicrobial therapy after microbiology results are available is important to avoid polypharmacy e.g. duplication of treatment, overlapping bacterial coverage (e.g. metronidazole added on top of another antibiotic with anaerobic cover). Co-administered medications should also be reviewed to prevent interactions with other medicines.

c) Formulary Restriction and Pre-authorization

Formulary restriction is one of the pillars of AMS Programme. A list of restricted antimicrobials shall be mentioned in the hospital antimicrobial policy (Appendix 6).

Restriction can be implemented in a number of ways:

- pre-approval (can only be started after getting a specific approval)
- temporary approval (can be started but would need approval for continued usage and this can be done via antimicrobial order tools)

Methods to acquire approval:

- antimicrobial order tools
- telephone

d) Antimicrobial Order Tools

The order tools are designed to encourage the clinician to review basic clinical and laboratory information and to categorize antimicrobial use as prophylactic, empirical and therapeutic. An antimicrobial order tool may improve the quality of prescriptions by increasing the awareness of clinicians of desired antimicrobial spectrum.

Antimicrobial order tools can be an effective measure to decrease antimicrobial consumption by implementing automatic stop orders and/or requiring clinicians to justify antimicrobial use.

Example of Antibiotic Order Form (Appendix 7).

e) Dose Optimization

Dose optimization will tailor therapy to the patient's clinical characteristics, causative organism, site of infection, and pharmacokinetic and pharmacodynamic characteristics of the antimicrobial agent.

Strategies that may be considered for dose optimization include:

- extended or continuous infusion of beta-lactams (cefepime, piperacillin/ tazobactam)
- once-daily dosing of aminoglycosides (gentamicin)
- appropriate dosing of antimicrobials with narrow therapeutic range (vancomycin)
- dosing of certain antimicrobials in special populations (obesity, pregnancy)
- dose adjustments for patients with renal or liver dysfunction (polymyxins)
- dose adjustments for patients with hypoalbuminemia (ertapenem)
- dose adjustments for patients on renal replacement therapy

f) De-escalation/ Streamlining

Antimicrobial streamlining or de-escalation is a process which converts broad-spectrum antimicrobial therapy to a narrower-spectrum antimicrobial treatment that targets a more specific organism once culture reports are available. Unnecessary exposure to a broad-spectrum empirical antimicrobial treatment will increase the risk of developing subsequent antimicrobial resistance.

Occasionally, patients may be treated with one or more antimicrobials before causative organism is identified, where this approach is referred to as empiric therapy. Empiric therapy takes into account the type of infection suspected, and the patient's clinical status. Once test and culture results are available, the antimicrobial choice should be streamlined to definitive therapy based on the results.

De-escalation/ streamlining can be typically conducted in several ways:

- Review by prescribers whether empirical treatment is according to the guidelines (diagnosis, drug, dose, interval, administration route, duration). Discontinue dual antimicrobial therapy if there is overlapping in the spectrum of activity.

- When cultures and sensitivity results become available, antibiotic treatment should be streamlined accordingly; choose susceptible antibiotic with the least toxicity, narrowest spectrum and lowest cost.
- Discontinue empiric antimicrobial therapy if sensitivity testing or clinical correlation subsequently does not support the presence of infection.

Example of 72-hour Antimicrobial Review Form (Appendix 6).

g) Intravenous (IV) to Oral (PO) Antimicrobials Conversion

This describes the practice of converting intravenous antimicrobials therapy to an effective oral formulation. Evidences have demonstrated the efficacy, safety and economic impact of IV to PO antimicrobials conversion.

IV to PO antimicrobials conversion also benefits the patient by eliminating adverse events associated with IV therapy, increasing patient comfort and mobility as well as enabling early hospital discharge.

The optimal time to consider switching a patient to oral therapy is after 48 to 96 hours of intravenous therapy. This period of time allows the clinician to evaluate the patient's microbiology results and assess their response to treatment. Before switching to oral antimicrobial, patient must meet a number of criteria:

A. Display signs of clinical improvement AND

B. Able to tolerate oral therapy AND

C. Good compliance to oral therapy.

D. Not having a condition in which higher concentrations of antibiotic are required in the tissue or a prolonged course of IV therapy is essential.

Conditions to consider for IV to PO Conversion:

i. Pneumonia
ii. Skin and soft tissue infections
iii. Urinary tract infections
iv. Uncomplicated Gram-negative bacteremia
v. Intra-abdominal infection without deep-seated collections

Conditions require adequate parenteral therapy with approval from ID physicians or AMS-led physicians prior to IV to PO conversion:

i. Osteomyelitis
ii. Septic arthritis

iii. Infected implant or prostheses
iv. Necrotising soft tissue infection
v. Melioidosis (at least 10 to 14 days of IV therapy)
vi. Deep-seated infection e.g. abscesses/empyema
vii. Complicated orbital cellulitis (abscess or other complication)

Conditions not recommended for IV to PO conversion:
i. Endocarditis
ii. Central nervous system infections (e.g. meningitis, brain abscess, etc.)
iii. Staphylococcus aureus bacteremia

If patient deteriorates clinically after the conversion from IV to PO antibiotic (which indicates failure of oral therapy), IV therapy should be reinitiated.

Example of Antimicrobials That Can Be Included in IV to PO Therapy Conversion and Bioavailability of Selected Antimicrobials Available in Both IV and PO Formulations (Appendix 8).

h) AMS Round

Audit and feedback can also be done in a real-time manner during AMS rounds or normal everyday ward rounds. Appropriateness of a prescribed antimicrobial can be assessed during the round and immediate oral or written feedback can be delivered. Issues that can be assessed include compliance to guidelines, streamlining after microbiology test results are released, dose optimization, IV to oral switch, duration of the treatment and any further investigation required.

The frequency of the AMS round shall depend on the facility's resources and the urgency of interventions. For example:

- Patients on one or more restricted antimicrobials (Appendix 9)
- Patients on prolonged antimicrobials i.e. more than 2 weeks
- Patients on ≥2 antibiotics without overlapping spectrum (excluding patients on HIV-opportunistic infections, anti-tuberculosis and *H. pylori* treatment)
- Other cases as deemed necessary by ward pharmacists (e.g. antibiotic indication not clear or not in keeping with antimicrobial guideline)

i) Education

AMS team should prepare a formal or informal teaching and training to engage prescribers and other healthcare workers i.e. pharmacists and nurses in improving antibiotic prescribing, dispensing and administration practices. By engaging them, it will help to enhance and increase the acceptance of AMS strategies. This program shall be included in the induction training for all newly reporting medical, nursing and pharmacy staff.

Example of educational key points (Appendix 10).

Recommended Educational Programs

- Educational meetings (e.g. basics on antibiotic use, case-based discussions, morbidity and mortality, significant event analysis, lectures on specific topics) Continuous Nursing Education (CNE)/ Continuous Medical Education.
- Antimicrobial Newsletter/including a sub-topic on antimicrobials in any hospital publications
- Using local key opinion leaders (champions) to advocate for key messages
- Reminders provided verbally, on paper or electronically
- AMS e-learning resources made available to all healthcare personnel
- Prescribing aids
    - ✓ Educational aids to guide prescribers at the point of prescribing. These may include clinical algorithms for the diagnosis of infection, or methods to standardize documentation of treatment decisions, such as infection stamps or stickers to be included in the clinical notes.
    - ✓ Surgical prophylaxis guideline may be disseminated through poster in the operating theatre, leaflet, smartphone applications or other electronic platforms.
    - ✓ Where possible, information technology support for prudent antimicrobial use should be introduced. This includes electronic patient records, computerized prescribing and clinical decision support software.

Step 3 - Assess the effectiveness of interventions

Once AMS interventions have been implemented or performed, analyse and present changes made (with the respective unit, if applicable). Discuss whether the interventions should be continued or changed and follow up with a continuous improvement cycle i.e. Plan-Do-Study-Act.

Tips to run AMS activities for small hospital and limited resources

Studies have demonstrated a number of interventions to improve antibiotic use for each of these three disease conditions; community- acquired pneumonia (CAP), urinary tract infection (UTI) and skin and soft tissue infection (SSTI). Hence, these are often high-yield targets for improvement.

Key opportunities to improve antimicrobial usage:

	Diagnostic considerations	Guide empiric therapy	Assess duration of therapy including discharge prescription
CAP	Review cases at 48 hours to confirm pneumonia diagnosis versus non-infectious etiology.	Avoid empiric use of antipseudomonal beta-lactams and/or methicillin-resistant Staphylococcus aureus (MRSA) agents unless clinically indicated.	Uncomplicated pneumonia can be treated for 5-7 days in the setting of timely appropriate clinical response.
UTI	Implement criteria to ensure urine culture sent for those clinically indicated.	Establish checklist/criteria to distinguish asymptomatic/ symptomatic bacteriuria. Avoid antibiotic therapy for asymptomatic bacteriuria except for certain clinical conditions.	Use the shortest duration for antibiotic therapy where clinically appropriate.

SSTI	Develop diagnostic criteria to distinguish purulent and non-purulent infections and severity of illness (i.e., mild, moderate and severe) to ensure infections can be treated appropriately according to guidelines.	Avoid empiric use of antipseudomonal beta-lactams and/or anti-anaerobic agents unless clinically indicated.	Uncomplicated bacterial cellulitis can be treated for 5 days if there is a timely clinical response.

AMS also can be done by focusing on certain broad-spectrum antibiotic, especially reviewing when it was started as empirical therapy. Three important questions can be used when reviewing are:

- Is the antibiotic still needed?
- If so, is the antibiotic tailored to the culture results (e.g. is the narrowest spectrum agent being used?)
- How long the antibiotic should be used?

Daily activities done by pharmacists are also a part of AMS, such as:

- Monitor response to antibiotic therapy with feedback to the treating clinician.
- Review unnecessary polypharmacy of the same antimicrobial coverage.
- Opportunities for IV to PO switch.
- Monitor safety of antimicrobial therapy (e.g. renal dose adjustment and drug-drug interaction).

Any AMS activities can be incorporated appropriately where applicable.

A.3 ANTIMICROBIAL STEWARDSHIP PROGRAMME MEASUREMENT

Successful AMS programme includes all the elements of successful quality improvement programmes and measuring the effectiveness of their activities is a key component. Monitoring and analysis of antimicrobial usage is critical to measure the effects of stewardship interventions in order to reduce antimicrobial resistance and to support appropriate antimicrobial prescribing. Structural, process and outcome measures should be incorporated into the AMS plan. All the program measurement should be reported to the local, state and national level.

Structural Measures

It is an overview of the AMS programme in an organization at a point in time. The criteria to measure is stated in the table below.

Table 2. Criteria to measure for an AMS programme

CRITERIA TO MEASURE	INDICATOR
1. AMS team members	a. Does your hospital have a dedicated AMS team? b. Number of AMS Doctors/ number of beds in your hospital? c. Number of AMS Pharmacists/ number of beds in your hospital?
2. AMS committee meeting	a. Does your hospital have regular AMS committee meeting? b. How frequent is the meeting?
3. Antimicrobial policy	a. Does your hospital have an antimicrobial policy?
4. Formulary Restriction & Preauthorization	a. Do you practice formulary restriction & preauthorization in your hospital? b. What type of antimicrobial is being restricted?
5. Antimicrobial guidelines or clinical pathway	a. Do you have a local antimicrobial guideline in your hospital? b. Do you have a clinical pathway in your hospital? c. When is the latest updated version?

6. Education	a. How many trained personnel in your AMS team? • Number of AMS personnel trained under MOH AMS training module. • Number of AMS personnel trained under other certified organization besides MOH. Please specify the name of organization and date. • Number of AMS personnel attended any AMS short courses. Please specify the name of the course and date.
7. Antibiogram	a. Does your hospital have a local antibiogram? b. Does your hospital distribute the current antibiogram to the prescribers?

Note: Not all of the examples listed may be necessary and/or feasible in all hospitals.

Process Measures

INDICATOR	INDICATOR CONSTRUCTION
Documented indication for antibiotic use	Number of patients with a written indication for antibiotic treatment/ Total number of patients treated with antibiotic(s).
Stop/review date	Number of patients with a written stop/review date for antibiotic treatment/ Total number of patients treated with antibiotic(s).
Compliance with current clinical treatment guidelines	Number of patients with an indication receiving empirical treatment with antibiotic(s) according to clinical guidelines/ Total number of patients with this indication.
Length of therapy by indication	Total number of days of antibiotic treatment for a specific indication/ Total number of patients treated with antibiotic(s) for that indication.
48-hour review	Number of patients where a 48-hour review is performed/ Total number of patients treated with antibiotic(s) hospitalized >48 hours.

De-escalation	Number of patients where a de-escalation from the initial therapy is performed/ Total number of indicated empirical treatments.
IV-to-oral switch	Number of regimens switched to oral route/ Total number of regimens that can be switched to oral route based on predefined criteria.
Compliance with current guidelines for surgical prophylaxis (antibiotics)	Number of patients receiving surgical antibiotic prophylaxis according to guidelines/ Total number of surgical patients receiving antibiotic prophylaxis.
Surgical prophylaxis within the previous 60 minutes	Surgeries with prophylaxis administered within 60 minutes prior to surgery/ Total number of surgeries that require prophylaxis.
Surgical prophylaxis stopped within 24 hours after surgery	Surgeries with prophylaxis stopped within 24 hours after surgery/ Total number of surgeries that require prophylaxis.

(Adapted from WHO toolkit: Antimicrobial Stewardship Programmes in Healthcare Facilities in Low- and Middle-income Countries)

Outcome Measures (After AMS Interventions)

i. Outcomes related to antimicrobial use:
- DDD per 1000 patient-days
- DDD per 100 admissions
- DOTs per 1000 patient-days
- Proportion of DDDs in AWaRe and OTHER groups

ii. Outcomes related to patients and microbiology:
- **Patient outcomes**
  In-hospital mortality, length of stay, readmission within 30 days after discharge.

- **Microbiology outcomes**
  Clostridium difficile / MDR organisms:
  Number of healthcare-associated infections in a period of time/ Total number of patient days within that period x 100 000.

SECTION B:

ANTIMICROBIAL STEWARDSHIP PROGRAMME IN PRIMARY CARE

Inappropriate use of antimicrobials, primarily involving therapeutic agents used to treat infections, is considered one of the world's most significant public health problems. In addition to diminishing the therapeutic benefit of essential medications, inappropriate use of antimicrobials also facilitates the development and spread of multidrug-resistant organisms.

The National Infection Control and Antibiotic Committee introduced AMS in primary care in 2014 as a strategy to combat antibiotic resistance.

Successful implementation of AMS requires a continuous commitment from all levels of management in MOH primary care and therefore shall be incorporated in existing meetings such as Drugs & Therapeutics Committee Meetings, Infection and Antibiotic Control Committee Meetings and Management Meetings at all levels.

B.1 ANTIMICROBIAL STEWARDSHIP TEAM

Strategies and activities of Antimicrobial Stewardship Programme

AMS strategies and activities shall be carried out as follows:

1. Implement the National Antimicrobial Guideline, clinical guidelines and pathways for common infections.

2. Report the surveillance and clinical audit findings and ensure the necessary actions are taken.
3. Establish formulary restrictions and approval systems, especially for broad-spectrum antimicrobials.
4. Select and optimize the antimicrobial dose tailored to patient characteristics.
5. Educate prescribers, pharmacists, and paramedics on good antimicrobial prescribing practices and antimicrobial resistance.

Antimicrobial Stewardship Team Members

AMS team members in health facility include:

a. Family Medicine Specialist/ Medical Officer In Charge/ Medical Officer in charge of the program (Leader)
b. Pharmacist (Secretariat)
c. Assistant Medical Officer
d. Infection Control/ Link Nurse (Optional)
e. Medical Lab Technician (Optional)
f. Information Technology Officer (Optional)

Roles and responsibilities

1. Family Medicine Specialist/ Medical Officer In Charge/ Medical Officer in charge of the programme

- Head of AMS Team.
- Leads the technical components of Antimicrobial Stewardship team.
- Plans and ensures the implementation of AMS activities.
- Consults relevant specialists on antimicrobial stewardship related issues.
- Advises on antimicrobial stewardship related issues.
- Represents the AMS Health Clinic team in the district AMS meeting and gives feedback on AMS program.
- Collaborates with the District Drugs and Therapeutics Committee (JKUT) to determine the availability of antimicrobials in the District Drug Formulary.
- Plans and conducts AMS Process and Structure Audits and provides timely feedback for improvement.
- Prepares reports on AMS activities for submission to district level.

2. Pharmacist

- Ensures the implementation of AMS activities.
- Plans, conducts and analyses data of the antimicrobial surveillance and survey.
- Provides timely feedback on antimicrobial utilisation.
- Ensures dose optimization for antibiotics is carried out.
- Enforces the approval system of restricted antimicrobials prescriptions.

3. Assistant Medical Officer

- Assists in ensuring implementation of AMS activities.

4. Infection Control/ Link Nurse (optional)

- AMS teams frequently take opportunities to tighten infection control practices during their course of work. Having an Infection Control/ Link Nurse within the team complements the efforts of the AMS team in bringing down resistance rates.

5. Medical Laboratory Technologist (optional)

- Provides technical advice on correct sample collection and management.
- Ensures timely results of culture and antimicrobial sensitivity tests.
- Documents antimicrobial sensitivity test results.

6. Information Technology Officer (optional)

- Creates localized electronic decision-making systems that can be available through the health clinic network system.
- Provides AMS team access for microbiological data and antibiotic utilisation data.
- Produces automated antibiotic utilisation data and other clinical data.

B.2 ANTIMICROBIAL STEWARDSHIP PROGRAMME ACTIVITIES

1. Implementation of Treatment Guidelines and Clinical Pathways

AMS team should ensure the implementation of clinical guidelines and pathways in the management of URTI, UTI, SSTI, Pneumonia and Acute Bronchitis and AGE. (*Refer NAG 2019*).

2. Surveillance and Feedback

The surveillance on the use of antimicrobials enables us to compare the trend of antimicrobial utilisation. It shall focus on the use of selected antimicrobial in primary care and shall be

conducted at least twice a year. Access to information on antimicrobial utilisation can be an important source for healthcare professionals and policy makers to monitor progress towards a more prudent use of antibiotics. The results of antimicrobial use should be discussed with prescribers and necessary action should be taken based on relevant findings.

2.1 Measurement to determine the antimicrobial utilisation

- Defined Daily Dose (DDD) per 100 patient admissions.

2.2 Provision of data to district, state and national surveillance programs

- The report should be submitted twice a year to DIACC, State Infection and Antibiotic Control Committee (SIACC) and Pharmacy Practice and Development Division, MOH for National Surveillance on Antibiotic Utilisation annually.

3. Audit and Feedback

The AMS audit in primary care consists of process and structure audits

Process Audits generally are carried out annually to ensure adherence to clinical guidelines and pathways and to evaluate the antibiotic prescribing practices. The AMS Process Audits include Clinical Audit (Appendix 11) and Point Prevalence Survey (Appendix 12).

In addition, Structure Audit evaluates the implementation of AMS core elements and reviews the progress of stewardship activities once a year. (Appendix 13).

The AMS Audit shall be conducted at:

Type of Audit	Frequency	Responsibility	Indicator	Reports/ Data to
Clinical Audit	Minimum of once a year and when indicated. * Minimum of 30 cases per clinic	Clinic AMS Team	1. Percentage of clinics implementing clinical audits 2. Percentage of good practices in antibiotic prescription (> 80 %)	1. PKD 2. State 3. National

Point Prevalence Survey (PPS)	Once a year in a selected clinic.	Clinic AMS Team	1. Percentage of clinics implementing PPS 2. Percentage of appropriate antibiotic prescription for URTI	1. PKD 2. State 3. National
Structure Audit	Once a year as a cross audit.	Clinic AMS Team	1. Percentage of clinics implementing Structure Audit 2. Percentage of clinics with score of > 80%	1. PKD 2. State 3. National

Reports of the AMS audit shall be presented in Infection and Antibiotic Control Committee Meeting at the District, State and National level. Remedial actions on the shortfall in quality shall be discussed and communicated to the implementation level.

In order to ensure the success of the program, two-way system communication has to be established within the institution. Any feedback may be disseminated via:

a) Email/letter to heads of units

b) Email/letter to individual prescribers

c) Newsletter or bulletin

d) Presentation at unit or district meetings

4. Formulary Restriction

Formulary restriction is one of the pillars of AMS Programme. MOH drug formulary implements restrictions based on category of prescribers; however, these restrictions may not be adequate to guide the local prescribers about judicious use of antibiotic. Therefore, each district is required to formulate their own district's formulary with consideration of specific MOH program such as Integrated Management of Childhood Illnesses and Modified Syndromic Approach.

All prescribers should comply with formulary restriction either from local or national formulary which can be implemented through pre-approval (can only be started after getting a specific approval) either written or verbally.

5. Antibiotic Selection and Dose Optimization

Antimicrobial selection and dose optimization should be tailored to patient characteristics/ allergic history, causative organism, site of infection, and pharmacokinetic and pharmacodynamic characteristics of the antimicrobial agent. Concomitant drug use should be reviewed to prevent interaction.

Strategies that may be considered include:

- Weight-based dosing of certain antimicrobials for paediatric.
- Dose adjustments for patients with renal dysfunction, liver dysfunction and elderly.
- Selection based on local sensitivity and resistance pattern.

6. Education

Antimicrobial Stewardship team should provide continuous education for prescribers, pharmacists and paramedics to enhance knowledge and promote good prescribing behavior especially to new staffs. Educational Key Points (Appendix 10) must be highlighted during these sessions to instill appropriate use of antimicrobial.

Recommended Educational Programs

1. Continuous Medical Education (CME)
2. Newsletter including a sub-topic on antibiotics in any publications

3. Prescribing aids
    - Educational aids to guide prescribers at the point of prescribing. These may include clinical algorithms for the diagnosis of infection, or methods to standardize the documentation of treatment decisions, such as infection stamps or stickers to be included in the clinical notes.
    - Information technology support to provide guidance for prudent antimicrobial use.
    - Electronic patient record which is able to highlight potential antibiotics interaction and allergy.

Public awareness activities should be planned and carried out with the aim of creating awareness towards the judicious use of antibiotics and challenges of antimicrobial resistance.

B.3 ANTIMICROBIAL STEWARDSHIP PROGRAM MEASUREMENT

Successful antimicrobial stewardship programme includes all the elements of successful quality improvement programs and measuring the effectiveness of program activities is a key component. Monitoring and analysis of antimicrobial usage is critical to measure the effectiveness of stewardship interventions. Process and outcome measures should be incorporated into the AMS plan.

A. Process indicators

- Percentage of clinics implementing structure audits.
- Percentage of clinics implementing clinical audits.
- Percentage of clinics implementing antibiotic PPS.

B. Outcome indicators

- Percentage of clinics with structure audit score of > 80%.
- Percentage of good practices in antibiotic prescription (clinical audit score > 80 %).
- Percentage of appropriate antibiotic prescription for URTI from PPS (based on National Antimicrobial Guideline/ clinical guidelines/ pathways for URTI patients).
- Pattern of selected antibiotics utilisation using DDDs.

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34. Barlam, T. F., Cosgrove, S. E., Abbo, L. M., MacDougall, C., Schuetz, A. N., Septimus, E. J., ... & Hamilton, C. W. (2016). Implementing an antibiotic stewardship program: guidelines by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America. *Clinical Infectious Diseases*, 62(10), e51-e77
35. National Antimicrobial Guideline 2019

APPENDICES

APPENDIX 1: District Infection and Antibiotic Control Committee (DIACC)

a) Composition of District Infection and Antibiotic Control Committee. The following will be members of the DIACC:

1. Medical Officer of Health- chairman
2. Appointed District Pharmacist - (Secretariat)
3. Public Health Specialist (Primary Care) - (Infection Control Coordinator)
4. Public Health Specialist (Epidemiology)
5. Public Health Specialist (KPAS)
6. Appointed Family Medicine Specialist (AMS Coordinator)
7. District Matron
8. District Assistant Medical Officer
9. Appointed Infection Control Nurse/Personnel
10. Appointed District Medical Laboratory Technologist
11. Information and Communication Technology Officer (ICT)
12. Three (3) Representatives of Pharmacist from Health Clinic
13. Three (3) Representatives of Link Nurse/Personnel from Health Clinic

b) Chairman

The committee will be chaired by the District Health Officer and the chairman:

- Leads facilitation and coordination of district public health efforts in promoting good infection control practice and judicious use of antimicrobial.
- Provides a platform for programme planning and implementation.
- Leads DIACC meetings.
- Reviews and approves DIACC output.
- In the absence of the Chairman, the meeting will be chaired by a delegate assigned by the chairman.

c) Infection Control and AMS District Coordinator

- Represents District Infection and Antibiotic Control Committee (DIACC) meeting.
- Assists Chairman in facilitation and coordination of the district infection and antibiotic control stewardship activities.
- Prepares reports on progress and performance of infection and antibiotic control stewardship activities.
- Recommends necessary intervention and improvement to the chairman and committee.

- Acts as head of the secretariat for DIACC
  - Schedule and prepare the agenda of bi-annual DIACC
  - Draft minutes for DIACC meetings
  - Maintain a spreadsheet to track progress on recommendations
  - Facilitate DIACC correspondence
  - Draft and maintain DIACC documents, reports and meeting minutes as appropriate

d) Members of District Infection and Antibiotic Control Committee (DIACC)

- Participate in the biannual DIACC meeting.
- Provide technical input.

e) Meeting format for District Infection and Antibiotic Control Committee

i) Frequency of meetings

- Meetings shall be held at least twice a year.
- Members of the committee shall be notified of the date and agenda of the meeting at least two weeks prior to the meeting.
- Minutes should be kept and ratified.

ii) Agenda of the meetings

The agenda of the meeting should include:

- Report on the incidence and prevalence of MDRO organisms and/or emerging resistant organisms where applicable
- Report on District Surveillance of Antibiotic Resistance (Primary Health Care) where applicable
- Report on Healthcare-Associated Infection Surveillance
- Report on Infection Prevention and Control Performance (Primary Health Care)
  - Infection Prevention and Control Audit
  - Hand Hygiene Compliance Surveillance
- Report on AMS Performance (Primary Health Care)
  - Antibiotic Utilisation Surveillance (DDD)
  - Point Prevalence Survey
  - AMS Clinical and Structure Audit
  - Antibiotic Awareness Program
- Report on Sharp Injuries among Healthcare Worker (Primary Health Care)
- Report on Tuberculosis among Healthcare Worker (Primary Health Care)

iii) Members of the meeting

- The quorum of meeting shall consist of at least 2/3 of the committee members.

iv) Emergency meetings and outbreak control

- The Chairman may call for an emergency meeting of the DIACC at any time and all members or their representatives will be notified accordingly.
- Emergency meetings are arranged for the control of infection outbreak, when the Infection Control Team requires additional support and notifications of the problem, in accordance with the Major Outbreak Policy.

Appendix 2: Antimicrobial Stewardship Programmes in Healthcare Facilities in Low- and Middle-income Countries

Checklist of essential health-care facility core elements for AMS programmes in LMICs – basic (light grey) and advanced (dark grey) core elements

	HEALTH-CARE FACILITY CORE ELEMENTS	Yes	No
1. LEADERSHIP COMMITMENT	**1. AMS identified as a priority for health-care facility management** The facility management has formally identified AMS as a priority objective for the facility and included it in its key performance indicators. Financial and human resources have been allocated for AMS activities.	☐	☐
	2. Health-care facility AMS action plan endorsed that prioritizes activities and measures progress and accountability A health-care facility AMS action plan is endorsed that prioritizes activities and measures progress and accountability for ensuring appropriate antibiotic use, based on existing national or international guidelines and/or an existing national strategy. The AMS action plan is updated regularly as required.	☐	☐
	3. Dedicated financial support for the health-care facility AMS action plan There is dedicated, sustainable and budgeted financial support for AMS activities in the action plan (e.g. support for salary, training and information technology (IT) support).	☐	☐
2. ACCOUNTABILITY AND RESPONSIBILITIES	**4. Multidisciplinary AMS leadership committee in place with clear terms of reference*** This AMS committee can be either stand-alone or embedded in another existing committee structure (e.g. drug and therapeutics committee, pharmacy committee, infection control committee, patient safety committee). If embedded in another committee, AMS must be a standing item on the committee's agenda. The AMS committee is explicitly in charge of setting and coordinating the AMS programme/strategy according to its terms of reference.	☐	☐
	5. Dedicated AMS leader/champion identified for the health-care facility A health-care professional has been identified as a leader/champion for AMS activities at the facility and is responsible for leading the AMS team in implementing the AMS programme.	☐	☐
	6. Multidisciplinary AMS team with terms of reference* An AMS team of multidisciplinary health-care professionals who will implement the day-to-day AMS activities in the health-care facility. In resource-limited settings or small facilities it is often difficult to have an AMS team, and an AMS champion can be identified instead. The composition of the AMS team is flexible and should be based on existing recommendations and adapted to the local context: • option 1: >2 health-care professionals constituting a multidisciplinary team (e.g. tertiary hospitals); • option 2: a prescriber and a nurse or pharmacist (e.g. secondary or small hospitals); or • option 3: an AMS champion, e.g. a physician, nurse or pharmacist leading the stewardship programme, with access to expert advice.	☐	☐
	7. Other health professionals identified and involved in AMS activities Other health-care professionals apart from the AMS team (e.g. from the ICU, internal medicine and surgery, health informatics, or pharmacy or nursing personnel) participate in AMS activities based on the priorities of the health-care facility AMS action plan.	☐	☐
	8. Clearly defined collaboration between the AMS and IPC programmes A document clearly specifies the process of collaboration between the AMS team/committee and the IPC programme and/or committee. In many low-resource settings the IPC and AMS committees may be merged into one.	☐	☐
	9a. Regular (descriptive) activity reports on the implementation of the AMS programme Regular activity reports are produced and disseminated to health-care facility personnel and regional/national AMS TWGs. These reports include data on antibiotic use/consumption and describe the interventions implemented by the AMS team.	☐	☐
	9b. Regular activity reports (status and outcomes) on the implementation of the AMS programme Regular activity reports are produced and disseminated to health-care facility personnel and regional/national AMS TWGs with timelines for measurable short- and long-term targets/goals, based on analysis of local antibiotic use and evaluation of the impact of stewardship interventions.	☐	☐

	HEALTH-CARE FACILITY CORE ELEMENTS	Yes	No
3. AMS ACTIONS	**10. Up-to-date standard treatment guidelines** The health-care facility has available, up-to-date recommendations for infection management based on international/national evidence-based guidelines and local/national susceptibility patterns (where possible), to assist with antibiotic selection for common clinical conditions (indication, agent, dose, route, interval, duration). A process is in place for regular review and updating of the guidelines based on new evidence or other external input.	☐	☐
	11. Regular AMS team review/audit of specified antibiotic therapy or clinical conditions at the health-care facility Depending on available resources, this can be conducted by prioritizing wards or specific patient conditions.	☐	☐
	12. Advice/feedback from AMS team members is easily accessible/available to all prescribers This can be achieved through various methods, including facility ward rounds, bedside consultations and dedicated telephone lines.	☐	☐
	13. The AMS team conducts regular ward rounds and other AMS interventions in select health-care facility departments The AMS team conducts regular ward rounds (in one or more wards) and other AMS interventions in select facility departments (one or more) identified in the health-care facility AMS action plan.	☐	☐
	14a. Health-care facility formulary with a list of approved antibiotics The health-care facility has a formulary with a list of approved antibiotics that may be based on national recommendations or the WHO EML.	☐	☐
	14b. Health-care facility formulary with a list of restricted antibiotics The health-care facility has a formulary with a list of antibiotics approved for use in the facility and specifies a list of restricted antibiotics that require approval by the designated AMS team member (or infectious disease physician if available, physician or AMS champion) when used and/or are only permitted for specific conditions, e.g. the WATCH and RESERVE groups of antibiotics.	☐	☐
	15. Laboratory and imaging services accessible to support AMS interventions The health-care facility has access to (on-site or off-site) laboratory and imaging services, and to timely, quality-assured results to support diagnosis of the most common infections.	☐	☐
	16. Health-care facility access to IT services to support AMS activities The specific requirements need to be defined at local/regional/national level. This could include, for example, measurement of antibiotic use.	☐	☐
	17a. Standardized facility prescription chart and medical records The health-care facility ensures the availability and use of standardized prescription charts, medical records and transfer notes.	☐	☐
	17b. Health-care facility policy for documenting prescribed medicines The health-care facility has a written policy that requires prescribers to clearly document the indication and antibiotics prescribed (agent, dose, route, interval, duration and review dates) in the prescription chart, medical record and transfer notes to other health-care institutions.	☐	☐

	HEALTH-CARE FACILITY CORE ELEMENTS	Yes	No
4. EDUCATION AND TRAINING	**18. Basic training in optimal antibiotic use for health-care professionals** The health-care facility offers basic induction training (e.g. sensitization on AMR and use of standard treatment guidelines) to staff on how to optimize antibiotic prescribing, dispensing and administration.	☐	☐
	19. Continued training in optimal antibiotic use for health-care professionals The health-care facility offers continued educational resources (e.g. regular training on infection management) to train staff on how to optimize antibiotic prescribing, dispensing and administration.	☐	☐
	20. Initial and regular training of the AMS team in infection management The health-care facility offers initial and regular training of the AMS team in infection management (diagnosis, prevention and treatment) and AMS. This training is usually not offered at the facility level, but is likely to be available at the regional, national or international level. The facility should, however, ensure that members of the AMS team are adequately trained, according to local/national requirements.	☐	☐
5. MONITORING AND SURVEILLANCE	**21. Monitoring appropriateness of antibiotic use at the unit and/or facility-wide level through audits or PPSs[i]** The AMS team undertakes audits or PPSs, at the unit and/or health-care facility level, to assess the appropriateness of infection management and antibiotic prescription (e.g. indication, agent, dose and duration of antibiotic therapy in specific infectious conditions such as pneumonia or surgical prophylaxis) according to policy/guidance.	☐	☐
	22. Monitoring quantity and types of antibiotic use (purchased/prescribed/dispensed) at the unit and/or facility-wide level In collaboration with the facility pharmacy, the AMS team monitors the quantity and types of antibiotic use (purchased/prescribed/dispensed) at the unit and/or health-care-facility level.	☐	☐
	23. Monitoring of antibiotic susceptibility and resistance rates for a range of key indicator bacteria The AMS team monitors antibiotic susceptibility and resistance rates for a range of key indicator bacteria at the health-care facility-wide level, in alignment with national and/or international surveillance systems (e.g. GLASS).	☐	☐
	24. Monitoring compliance of AMS interventions by the AMS committee The AMS committee monitors compliance with one or more of the specific interventions put in place by the AMS team (e.g. indication captured in the medical record for all patients on antibiotics).	☐	☐
6. REPORTING AND FEEDBACK	**25. Regular evaluation and sharing of health-care facility data on antibiotic use with prescribers** Health-care-facility reports on the quantity of antibiotics purchased/prescribed/dispensed are reviewed and analysed, and key findings are shared with prescribers along with specific action points.	☐	☐
	26. Regular evaluation and sharing of health-care facility resistance rates with prescribers The facility reports on antibiotic susceptibility rates are reviewed, and analyses and key findings are shared with prescribers along with specific action points.	☐	☐
	27. Evaluation of appropriateness of data on antibiotic use is shared with prescribers Findings from audits/reviews of the quality/appropriateness of antibiotic use are communicated directly to prescribers along with specific action points.	☐	☐
	28. Health-care facility antibiogram for key antibiotics informed by data on antibiotic use and resistance The health-care facility aggregate antibiogram is developed and regularly updated based on a review and analysis of facility antibiotic use and antibiotic-resistant bacteria. The antibiogram may help to inform updates of clinical guidelines.	☐	☐

* In resource-limited settings, the functions of the AMS committee and AMS team may fall under the same team.
[i] Indicator in the Tripartite M&E framework for the Global Action Plan on AMR.

Example of Terms of Reference:

Annex II: Sample terms of reference – health-care facility AMS committee

Purpose

The health-care facility AMS committee provides oversight and coordination of the implementation and review of the AMS programme at the facility. The AMS programme involves a systematic approach to optimizing the use of antimicrobials in the facility to improve patient outcomes, reduce inappropriate antimicrobial prescribing and reduce adverse consequences of antimicrobial use (including AMR and unnecessary costs).

Accountable to (adapted to the national context)

1. National AMS TWG (or as applicable)
2. Health-care facility leadership/management

Responsibilities and activities

- Liaises closely with other existing committees, including the drug and therapeutics committee, IPC committee and patient safety committee.
- Reviews the health-care facility core elements checklist, undertakes a SWOT analysis.
- Develops, endorses and implements a stepwise facility plan of action for AMS that includes setting targets for optimized antimicrobial use.
- Ensures that an education and training plan on AMS is in place for clinical staff in the facility.
- Ensures allocation of financial and human resources for implementing an AMS programme in the facility.
- Formalizes a health-care facility AMS team that reports to the AMS committee.
- Endorses the implementation of systems to monitor AMC and/or use and resistance.
- Reviews, endorses and implements clinical guidelines for antimicrobial prescribing.
- Endorses the implementation of an education programme for appropriate prescribing and AMS, in liaison with clinical educators in the facility.
- Monitors and evaluates compliance with one or more of the specific interventions put in place by the AMS team and reports back to the AMS team and prescribers on a regular basis.
- Facilitates the development and dissemination of regular activity reports that include data on antibiotic use and describe the interventions implemented by the AMS team.
- Undertakes risk assessment and plans action to improve the effectiveness of the AMS programme.

Membership and roles (to be adapted based on the facility context)

The membership of the health-care facility AMS committee will consist of the following:

- health-care facility administrator (executive sponsor/chair)
- director medical services (deputy chair)
- infectious diseases physician and/or clinical microbiologist (AMS team clinical lead)
- AMS pharmacist or physician (secretary);
- directors of other departments
- patient safety and clinical quality manager
- nursing representative
- pharmacy representative
- medical staff representatives from the different wards
- microbiology representative
- IT representatives (if applicable)
- drug and therapeutics committee representative (if the AMS committee is not embedded in the drug and therapeutics committee)
- IPC committee representative (if the AMS committee is not embedded in the IPC committee)
- Patient safety committee representative (if the AMS committee is not embedded in the patient safety committee).

Other personnel may be co-opted as required to assist the work of the committee.

Frequency of meetings

The meetings should be held on a regular basis, ideally monthly, with a minimum of quarterly. It is advised that regular meetings also be held either with other relevant groups (e.g. drug and therapeutics committee, IPC) or that members from those other groups be invited to participate in the AMS committee meeting as needed.

Agenda preparation and circulation of minutes

Papers for the committee will be prepared by the AMS committee secretary and circulated 1 week prior to the meeting date. The agenda will be determined by the AMS committee chair prior to meetings. Minutes will be distributed to members within 2 weeks of the meeting date by the AMS committee secretary.

In addition to committee members, minutes will be made available to:

- the drug and therapeutics committee;
- the IPC committee;
- the patient safety committee; and
- others as needed.

Annex III: Sample terms of reference – health-care facility AMS team

Purpose

- To implement the health-care facility AMS action plan and to facilitate optimized use of antimicrobials in the departments and wards.

Accountable to

1. Health-care facility AMS committee

Responsibilities and activities

- Delineates the roles and responsibilities of each team member in the AMS team.
- Implements day-to-day AMS activities, including conducting regular ward rounds and other AMS interventions in select facility departments identified in the health-care facility AMS action plan.
- Undertakes audits or PPSs to assess the appropriateness of infection management and antibiotic prescription according to policy/guidance.
- In collaboration with the facility pharmacy, monitors, analyses and interprets the quantity and types of antibiotic use at the unit and/or facility-wide level.
- Monitors antibiotic susceptibility and resistance rates for a range of key indicator bacteria at the facility-wide level or uses the data from existing groups that are monitoring this information.
- Facilitates education and training on AMS in the facility.

Membership (to be adapted based on the country context)

Option 1: >2 health-care professionals constituting a multidisciplinary team (e.g. tertiary hospitals). The multidisciplinary team should comprise a physician, a pharmacist or clinical pharmacologist, a nurse with expertise in infections or IPC, and in facilities with a microbiology laboratory, a microbiologist or laboratory technician.

Option 2: a physician and a nurse or pharmacist, with access to expert advice (e.g. secondary or small facilities).

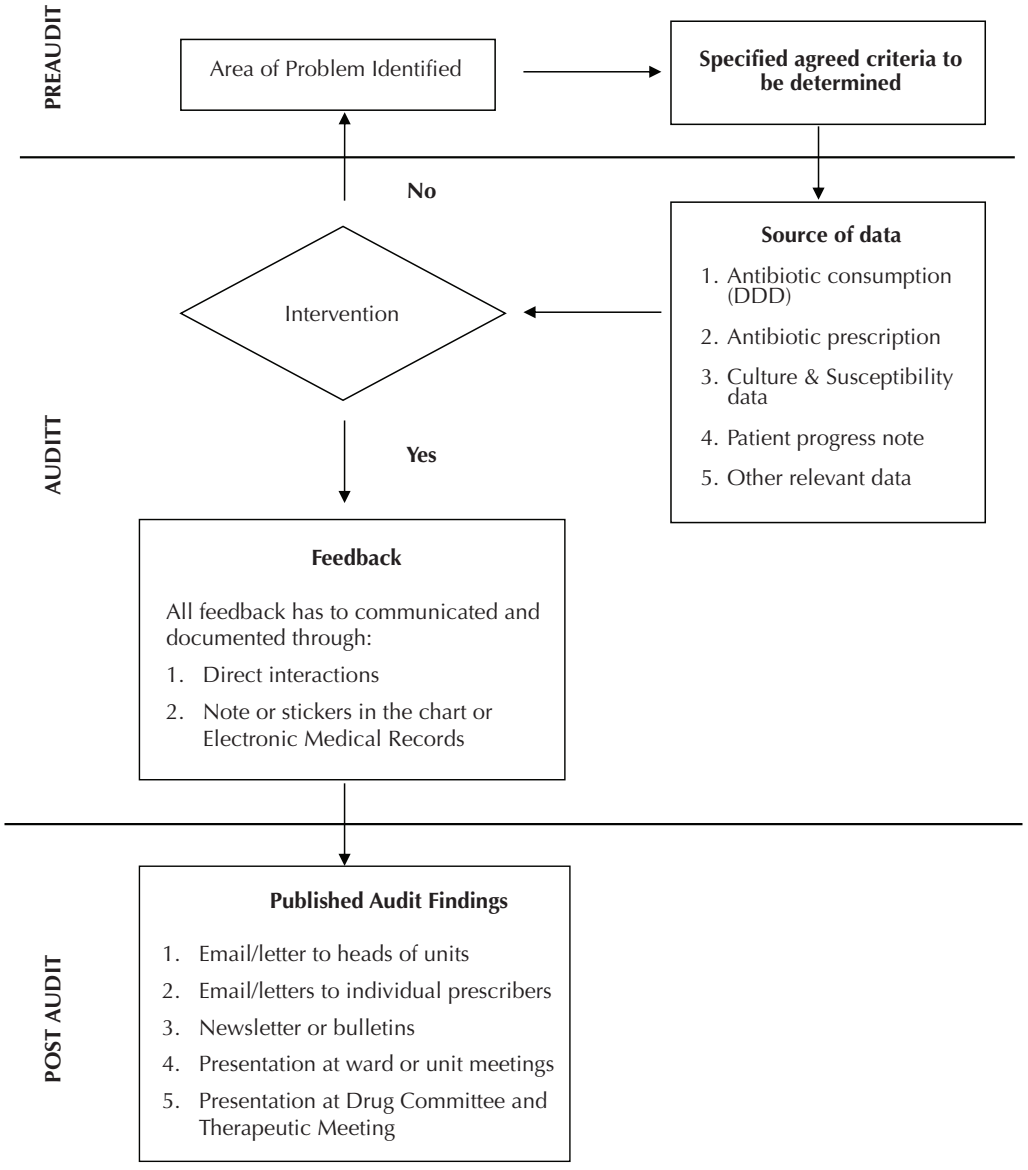
Option 3: a nurse or pharmacist leading the stewardship programme, with access to expert advice (e.g. secondary or small facilities with limited resources).

Frequency of meetings

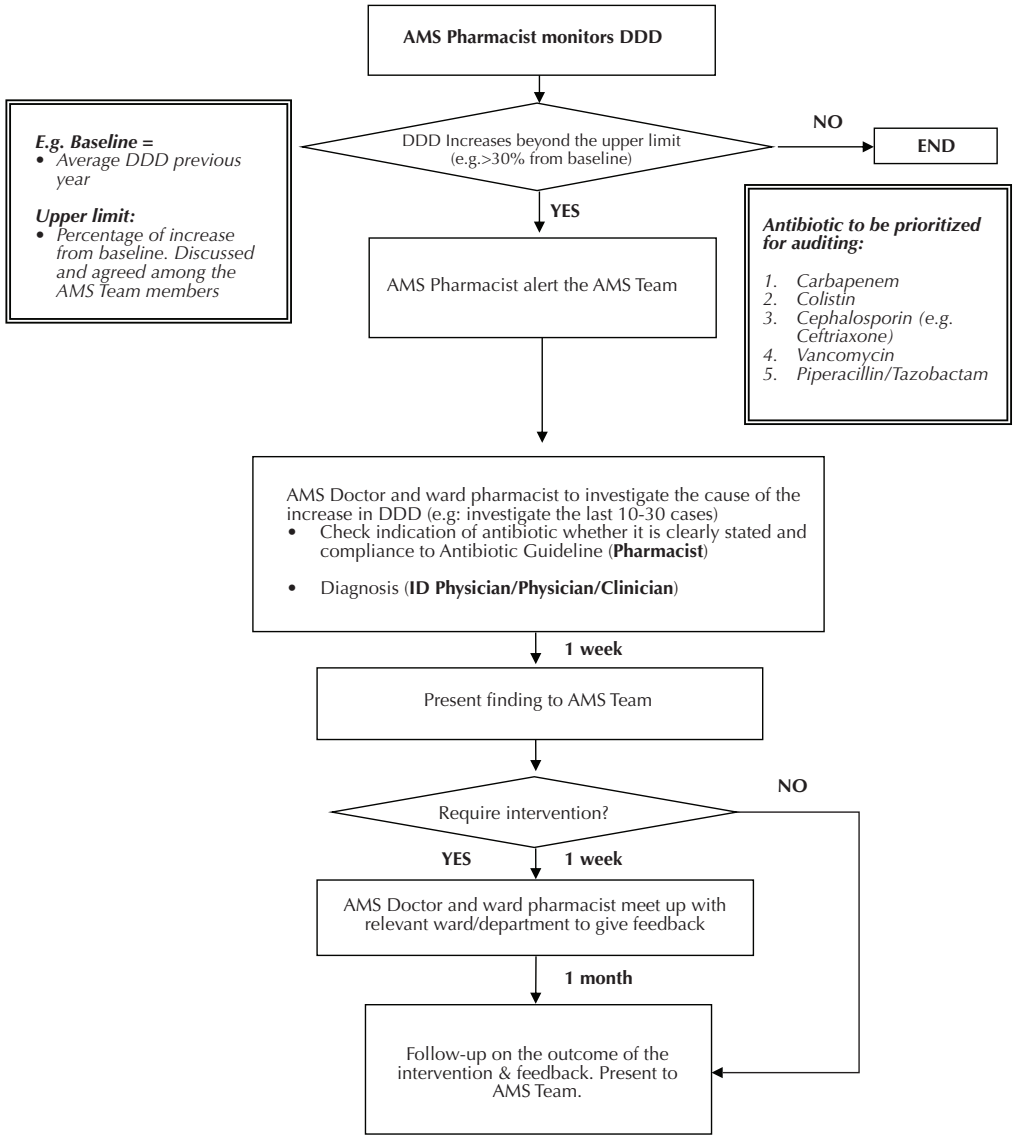
- Weekly to two times a month

Appendix 3: How to Perform an Audit

WORK PROCESS OF PROSPECTIVE AUDIT



EXAMPLE OF AUDIT USING DDD DATA



EXAMPLE OF ANTIBIOTIC AUDIT FORM

ANTIBIOTIC:															
Month	Ward	Dose & Frequency	Patient	MRN	Indication of Antibiotic	Empiric/ Definitive/ Empiric to Definitive	Compliance to guideline	Start Date	Stop Date	Treatment Duration (Days)	If Definitive/ Empiric to Definitive		If Empiric	Prescriber	Remarks
											Culture	Source	Reason for cont. beyond 72 hours		

Appendix 4: How to Perform Antibiotic Point Prevalence Survey (PPS)

EXAMPLE OF PPS WARD DATA COLLECTION FORM

ABX-PPS/MOH/2021/1

PHARMACY PRACTICE & DEVELOPMENT DIVISION
MINISTRY OF HEALTH
ANTIBIOTIC POINT PREVALENCE SURVEY
WARD DATA COLLECTION FORM

Note: Kindly fill in the details accordingly based on the figures captured during the survey.

Name of Hospital	:	_____
Ward	:	_____
Discipline *(majority)*	:	_____
Date of Survey	:	_____
Total Beds in Ward	:	_____
Total Patients in Ward	:	_____
No. of Patients on Antibiotic	:	_____
Survey is done by	:	_____ (Pharmacist's Name & Initial)

List of Patients on Antibiotic(s) on the Day of PPS Audit

(This list to be shared with Infection Control Unit for the PPS HCAI Audit)

No	Patient's PPS ID (Hosp Code/Ward/Running No) e.g.: (HSgB/4A/001)	Bed No	Patient's Name	Patient's MRN
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				

EXAMPLE OF PPS FORM

ABX-PPS/MOH/2021/2

ANTIBIOTIC COMMITTEE, PHARMACY DIVISION
MINISTRY OF HEALTH
ANTIBIOTIC POINT PREVALENCE SURVEY FORM

Audit date: / /	Gender: M / F	Weight (kg):	Cr (µmol/L):	CGA:
Patient's Reg No:	Age:	Height (cm):	CrCl (ml/min):	BSA:
Ward:	Bed No:	Discipline:	**Patient's PPS ID:**	

	Antibiotic 1	*Antibiotic 2*	*Antibiotic 3*	*Antibiotic 4*
Start Date (dd/mm/yy)	/ /	/ /	/ /	/ /
Antibiotic Name				
Antibiotic Group *(refer coding in user manual)*				
Route: *(IV/ IM/ Intrathecal (IT)/ Intraperitoneal (IP)/ Oral)*				
Dose & Frequency				
Indication documented within 24H ? *Yes (Y)/ No (N)*	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
Indication of antibiotic *(Refer to latest indication - can be either documented in clinical notes / BHT / prescription or verbal)*				
Infection / Disease group (by system) *(refer coding in user manual)*				
Infection / Disease type *(refer coding in user manual)*				
Indication category: *Empiric (E)/ Definitive (D)/ Surgical Prophylaxis (S)/ Non-surgical prophylaxis (N)*	☐ E ☐ D ☐ S ☐ N	☐ E ☐ D ☐ S ☐ N	☐ E ☐ D ☐ S ☐ N	☐ E ☐ D ☐ S ☐ N
For Healthcare Associated Infection (HCAI) assessment, to be done by infection control unit (*if available*):				
***HCAI Assessment:** *CAI (C) /HCAI (H) /Not Assessable (NA)*	☐ C ☐ H ☐ NA	☐ C ☐ H ☐ NA	☐ C ☐ H ☐ NA	☐ C ☐ H ☐ NA
***If HCAI, confirmed?** *Yes (Y)/ No (N)*	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
Assessment of antibiotic compliance to guideline (to be done by pharmacist):				
Compliance to guideline (1-5)	1 / 2 / 3 / 4 / 5	1 / 2 / 3 / 4 / 5	1 / 2 / 3 / 4 / 5	1 / 2 / 3 / 4 / 5
For antibiotic issue(s) (guideline non-compliance), please specify (tick all that applies):				
Indication does not require antibiotic	☐ Not indicated	☐ Not indicated	☐ Not indicated	☐ Not indicated
Wrong choice	☐ Wrong choice	☐ Wrong choice	☐ Wrong choice	☐ Wrong choice
Wrong dose/ frequency	☐ Wrong dose/frequency	☐ Wrong dose/frequency	☐ Wrong dose/frequency	☐ Wrong dose/frequency
Antibiotic spectrum too broad	☐ Spectrum too broad	☐ Spectrum too broad	☐ Spectrum too broad	☐ Spectrum too broad
Antibiotic spectrum too narrow	☐ Spectrum too narrow	☐ Spectrum too narrow	☐ Spectrum too narrow	☐ Spectrum too narrow
Antibiotic spectrum overlapping	☐ Spectrum overlapping	☐ Spectrum overlapping	☐ Spectrum overlapping	☐ Spectrum overlapping
Surgical prophylaxis given >24hours	☐ Prophylaxis >24hours	☐ Prophylaxis >24hours	☐ Prophylaxis >24hours	☐ Prophylaxis >24hours
Description of non-compliance to guideline *(Please specify: 1. Which antibiotic guideline you are referring to. 2. Which section of the antibiotic guideline in no 1 you are referring to. 3. Explain the details of antibiotic non-compliance.)*				
For inappropriate antibiotic assessment, to be done together with physician/microbiologist (*if available*)				
***Appropriateness assessment (1-3)**	☐ 1 ☐ 2 ☐ 3	☐ 1 ☐ 2 ☐ 3	☐ 1 ☐ 2 ☐ 3	☐ 1 ☐ 2 ☐ 3
Description of inappropriate antibiotic:				
***Relevant Microbiology sample taken? [Yes (Y) / No (N) / Not Applicable (NA)]**	☐ Y ☐ N ☐ NA	☐ Y ☐ N ☐ NA	☐ Y ☐ N ☐ NA	☐ Y ☐ N ☐ NA

History of allergy/ADR to antibiotics? ☐ No ☐ Yes. *(If yes, please specify):*	Microbiology specimen notes and comments : *(eg: Source, organism & susceptibility):*	Clinical notes and comments: *(eg: Renal replacement therapy within 24H/ Surgical procedure performed, etc)*

Appendix 5: How to Perform Surgical Antibiotic Prophylaxis Audit

EXAMPLE OF SURGICAL ANTIBIOTIC PROPHYLAXIS FORM

Pharmacy Practice & Development Division
Ministry of Health

SURGICAL PROPHYLAXIS CASE REPORT FORM

SECTION A: DEMOGRAPHIC DATA

RN: _____ Age: ☐ years

Gender: ☐ Male ☐ Female

Allergy: ☐ Yes ☐ No

Discipline: _____ If yes, please state: _____

SECTION B: SURGERY INFORMATION

Date of surgery: / /

Name of surgical procedure: ☐ Total joint replacement ☐ Internal fixation of closed fracture

Time of surgery: From: _____ To: _____

☐ Not documented ☐ Not documented

SECTION C: ANTIBIOTIC ADMINISTRATION

Antibiotic 1

Name of antibiotic: _____ ☐ Not documented

Dose of antibiotic: _____ ☐ Not documented

Time of dose given: _____ ☐ Not documented

Antibiotic 2

Name of antibiotic: _____ ☐ Not documented

Dose of antibiotic: _____ ☐ Not documented

Time of dose given: _____ ☐ Not documented

1. Was a second dose indicated? ☐ Yes ☐ No
2. Please state the indication for second dose: ☐ Prolonged surgery ☐ Delayed surgery
   ☐ Others, please specify: _____
3. Was second dose given? ☐ Yes ☐ No

Pharmacy Practice & Development Division
Ministry of Health

SURGICAL PROPHYLAXIS CASE REPORT FORM

SECTION D: APPROPRIATENESS OF ANTIBIOTIC USE AS SURGICAL PROPHYLAXIS

1. Was antibiotic prophylaxis indicated? ☐ Yes ☐ No ☐ Not in guideline

2. Was antibiotic prophylaxis given? ☐ Yes ☐ No (Proceed to 5) ☐ Incomplete documentation (Proceed to 7)

3. Was antibiotic prophylaxis continued after surgery? ☐ Yes ☐ No (Proceed to 5)

4. How long was antibiotic prophylaxis continued after surgery? ☐ ≤ 24 hours ☐ > 24 hours

5. Tick the following if relevant:

   ☐ Antibiotic prophylaxis given was different from guideline

   ☐ Additional antibiotic was given

   ☐ Dose given was different

   ☐ Timing of antibiotic prophylaxis administration was more than 1 hour before the first incision, or after the first incision.
   Kindly exclude Vancomycin as it should be administered 120 minutes before first incision

   ☐ Duration of antibiotic prophylaxis > 24hours after surgery

   ☐ Second dose indicated but not given

6. If any of the above is true, antibiotic prophylaxis is considered to be inappropriate according to guideline.

   ☐ Appropriate use of antibiotic prophylaxis ☐ Inappropriate use of antibiotic prophylaxis

7. Categories of incomplete documentation

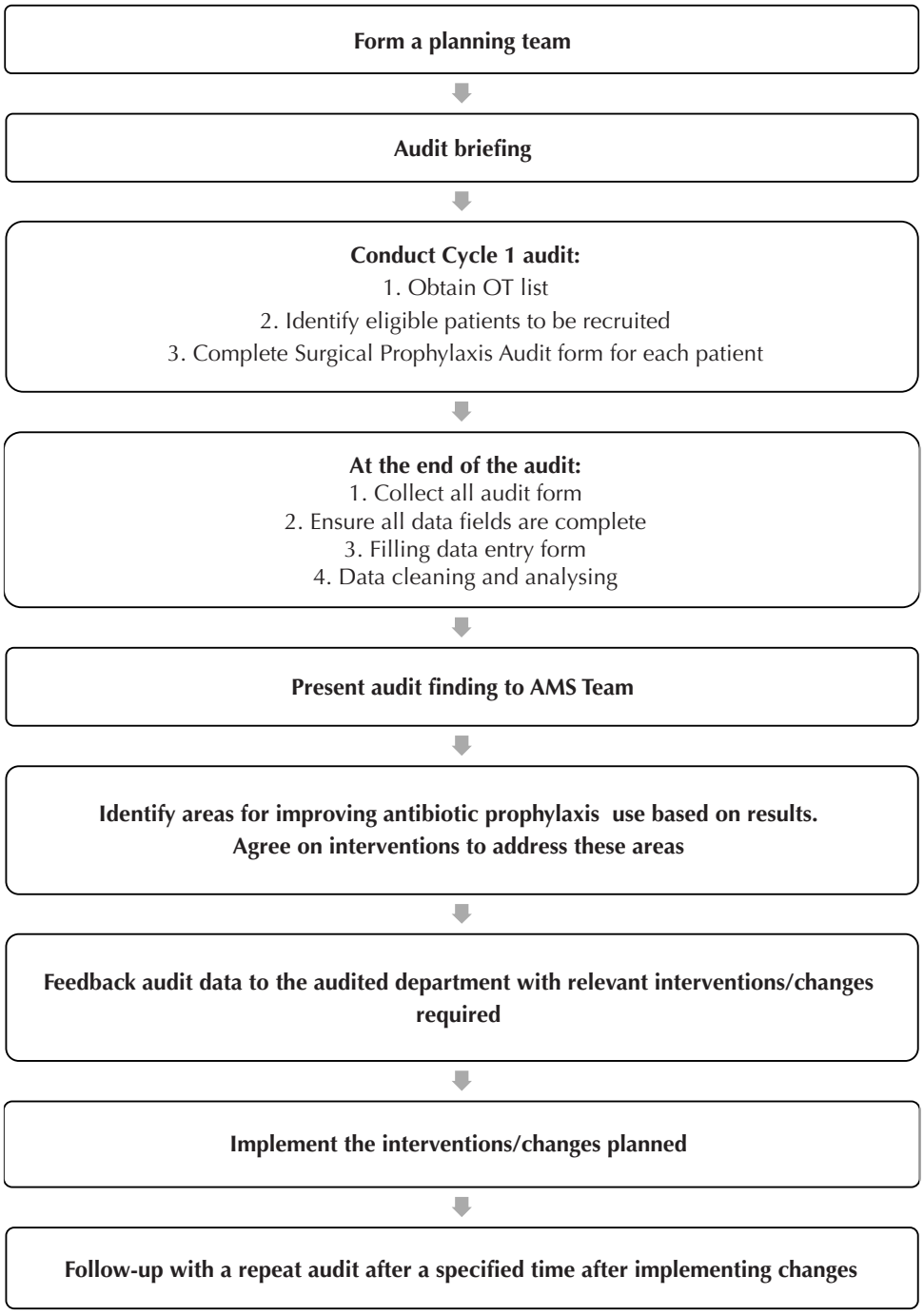
   ☐ Name of antibiotic

   ☐ Dose of antibiotic

   ☐ Administration time of antibiotic

Audit Conducted by: _____ Date: _____

SURGICAL PROPHYLAXIS AUDIT WORK PROCESS (Continuous Improvement Cycles)



Appendix 6: Example of Formulary Restriction

Antimicrobials are divided into 3 categories – the first being antimicrobials that require preauthorization before it can be prescribed. Authorization is issued by the relevant consultant of the department and in accordance with preapproved indications. The second category involves antimicrobials that can be prescribed for certain indications which will be subject to a review by the stewardship team within 3 working days and justification for its continuation is required. The last category is other antimicrobials that do not require pre-approvals.

Example:

PREAUTHORIZATION (by ID only)	CONDITIONAL (subject to AMS team review)	AVAILABLE
Linezolid Tigecycline Caspofungin Variconazole Anidulafungin Pentamidine Gancyclovir	Carbapenems Vancomycin 3rd & 4th GC Antipseudomonal BL/BLI Fluconazole Aminoglycoside Fluoroquinolos Colistin	Other antimicrobials

Appendix 7: Example of Antibiotic Order Form

Patient name:			
RN:		Ward:	
Antibiotic requested:			
Dosage & Frequency			
Indication	**Nosocomial** **≥48 hrs of hospitalization** **colonization should not be treated*		**Community**
Diagnosis			
Culture sent prior to antibiotic initiation (Please Underline)	Samples: Blood/ Sputum / BAL / Urine / Tissue /Pus/ CSF/ Body Fluid (Specify):_____		
Culture result (Please attach the sensitivity results if available)	1. 2. 3. 4.		
Authorized Specialist's signature		Date	

72 HOURS ANTIBIOTIC REVIEW FORM

Patient name:			
RN:		Ward:	
Antibiotic requested:			
Dosage & Frequency			
Justification for continuation			
Culture result (if available)			
Authorized Specialist's signature		Date	

72 HOURS ANTIBIOTIC REVIEW FORM

CARBAPENEM STOP/REVIEW ORDER FORM

Name:			
SB No.:			
[1]Discipline:			
Ward Admission:	Day :	Month :	Year :
Specialist Name:			
[2]Indication/Diagnosis:			

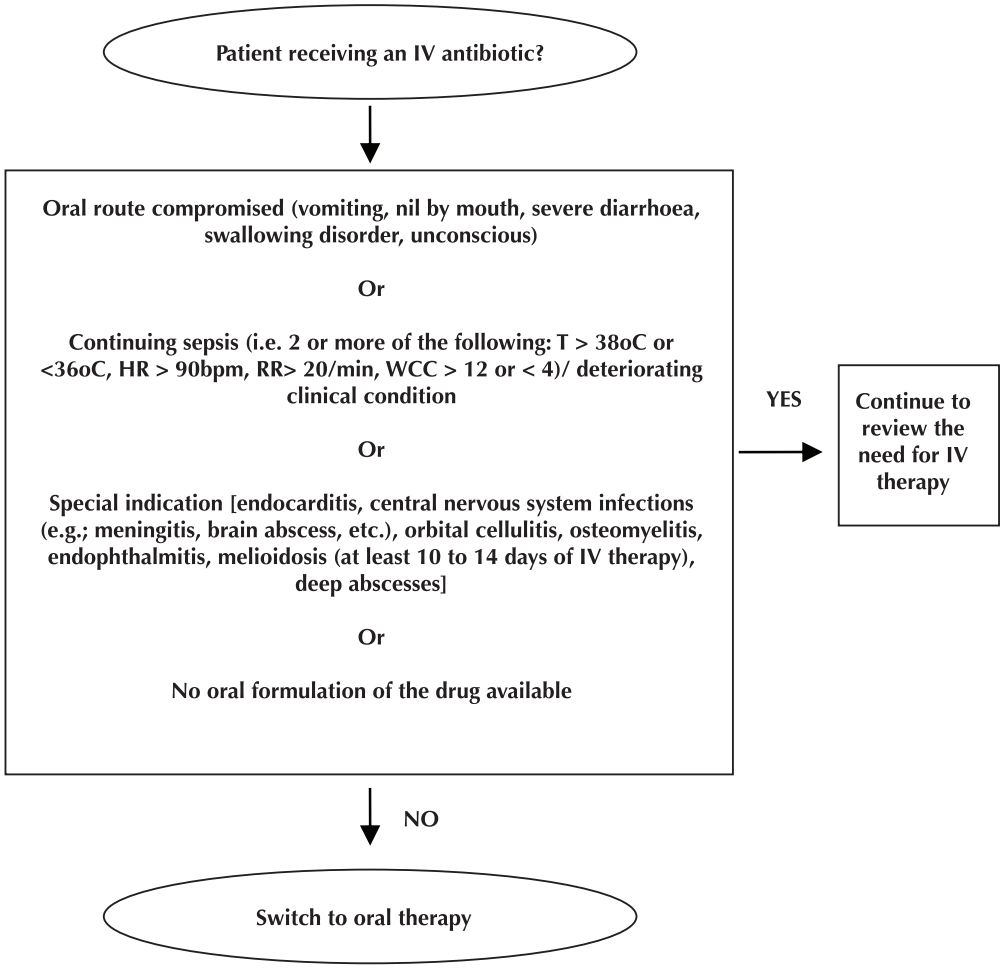
Types of Carbapenem (please √):	Imipenem		Date Start:	
	Meropenem		Date Start:	
	Ertapenem		Date Start:	

Reason for initiating Carbapenem Group (please √) :

1. Empirical Therapy	
2. Based on preliminary result of susceptible pathogen to Carbapenem	
3. Definitive Therapy	
3. Empirical & Can't be deescalated because (please state reason) :	

Appendix 8: Example of IV to PO Therapy Conversion

IV-Oral Antibiotic Switch Therapy Protocol



Example of Anmicrobials That Can Be Included in IV to PO Therapy Conversion (Not all IV Antimicrobial are available in Oral formulation)

Current parenteral regimen		Oral Regimen (Adult dose)	Oral Bioavailability
Ampicillin/Sulbactam 1.5gm IV q6h	>	Amoxicillin/Clavulanate 625mg PO q12H	Amoxicillin: 80% Clavulanate: 30-98%
Ampicillin/Sulbactam 3gm IV q6H	>	Amoxicillin/Clavulanate 625mg PO Q8H	Amoxicillin: 80% Clavulanate: 30-98%
Azithromycin 500mg IV once daily	≈	Azithromycin 500mg PO once daily	Azithromycin: 34-52%
Cefazolin 1g IV q8H	>	Cephalexin 500mg PO Q6H	Cephalexin: 90%
Cefepime 2g IV q8-12H	>	Amoxicillin/Clavulanate 625mg PO Q8H Pseudomonas: Seek advice from Infectious disease specialist or Clinical microbiology	Amoxicillin: 80% Clavulanate: 30-98%
Cefazolin 2g IV q8H	>	Cephalexin 1000mg PO Q6H	Cephalexin: 90%
Ceftazidime 1-2g IV q8H	>	Amoxicillin/Clavulanate 625mg PO Q8H Pseudomonas: Seek advice from Infectious disease specialist or Clinical microbiology	Amoxicillin: 80% Clavulanate: 30-98%
Ceftriaxone 1-2g IV once daily	>	Amoxicillin/Clavulanate 625mg PO Q8H 0r Cefuroxime axetil 500mg PO Q12H	Amoxicillin: 80% Clavulanate: 30-98% Cefuroxime axetil: 37-52%
Cefuroxime 750mg-1.5g IV q8H	≥	Cefuroxime axetil 500mg PO Q12H	Cefuroxime axetil: 37-52%
Ciprofloxacin 400mg IV q12H	≥	Ciprofloxacin 500mg PO Q12H	Ciprofloxacin: 50-85%
Ciprofloxacin 400mg IV q8H	≥	Ciprofloxacin 750mg PO Q12H	Ciprofloxacin: 50-85%
Clindamycin 300mg IV q6-8H	≥	Clindamycin 150mg PO Q6-8H	Clindamycin: ~90%
Clindamycin 300mg IV q6-8H	≥	Clindamycin 300mg PO Q6-8H	Clindamycin: ~90%
Cloxacillin 1-2g IV q6H	≥	Cloxacillin 500mg-1g PO Q 6H	Cloxacillin: ~50% (1H before meal)
Erythromycin lactobionate 500-1000mg IV q6H	≈	Erythromycin base: 500-1000mg PO Q6H Erythromycin Ethylsuccinate: 800mg PO Q12H	Erythromycin: 18-45% (ethylsuccinate maybe better absorbed with food)
Fluconazole 200mg-400mg IV once daily	≈	Fluconazole 200mg-400mg PO once daily	Fluconazole: >90%
Levofloxacin 500mg-750mg IV once daily	≈	Levofloxacin 500mg-750mg PO once daily	Levofloxacin: ~99%
Linezolid 600mg IV q12H	≈	Linezolid 600mg PO Q12H	Linezolid: ~100%
Metronidazole 500mg IV q8-12H	≈	Metronidazole 400mg-500mg PO	Metronidazole: 100%

≈ =Sequential therapy with direct conversion (same medication but different IV to oral dose)
≥ =Sequential therapy without direct conversion (same medication but different IV to oral dose)
> =Switch or step-down therapy (same or different class of medication with same/similar spectrum of activity)

(Source: National Antimicrobial Guideline 2019)

Appendix 9: The WHO EML AWaRe classification of commonly used antibiotics

ACCESS GROUP

This group includes antibiotics and antibiotic classes that have activity against a wide range of commonly encountered susceptible pathogens while showing lower resistance potential than antibiotics in Watch and Reserve groups. Access antibiotics should be widely available, affordable and quality-assured to improve access and promote appropriate use.

Selected Access group antibiotics (shown here) are included on the WHO EML as essential first-choice or second-choice empirical treatment options for specific infectious syndromes.

- Amikacin
- Amoxicillin
- Amoxicillin + clavulanic acid
- Ampicillin
- Benzathine benzylpenicillin
- Benzylpenicillin
- Cefalexin
- Cefazolin
- Chloramphenicol
- Clindamycin
- Cloxacillin
- Doxycycline
- Gentamicin
- Metronidazole
- Nitrofurantoin
- Phenoxymethyl-penicillin
- Procaine benzylpenicillin
- Spectinomycin
- Sulfamethoxazole + trimethoprim

WATCH GROUP

This group includes antibiotics and antibiotic classes that have higher resistance potential and includes most of the highest priority agents among the Critically Important Antimicrobials (CIA) for Human Medicine and/or antibiotics that are at relatively high risk of selection of bacterial resistance. Watch group antibiotics should be prioritized as key targets of national and local stewardship programmes and monitoring.

Selected Watch group antibiotics (shown here) are included on the WHO EML as essential first-choice or second-choice empirical treatment options for a limited number of specific infectious syndromes.

- Azithromycin
- Cefixime
- Cefotaxime
- Ceftazidime
- Ceftriaxone
- Cefuroxime
- Ciprofloxacin
- Clarithromycin
- Meropenem
- Piperacillin + tazobactam
- Vancomycin

RESERVE GROUP

This group includes antibiotics and antibiotic classes that should be reserved for treatment of confirmed or suspected infections due to multi drug-resistant organisms, and treated as "last-resort" options. Their use should be tailored to highly specific patients and settings, when all alternatives have failed or are not suitable. They could be protected and prioritized as key targets of national and international stewardship programmes, involving monitoring and utilization reporting, to preserve their effectiveness.

Selected Reserve group antibiotics (shown here) are included on the WHO EML when they have a favourable risk-benefit profile and proven activity against "Critical Priority" or "High Priority" pathogens identified by the WHO Priority Pathogens List, notably carbapenem-resistant Enterobacteriaceae.

- Ceftazidime + avibactam
- Colistin
- Fosfomycin (intravenous)
- Linezolid
- Meropenem + vaborbactam
- Plazomicin
- Polymyxin B

Appendix 10: Educational Key Points

The educational programs should include the interventions points as below:-
Adapted from recommendations produced by the UK Specialist Advisory Committee on Antimicrobial Resistance (SACAR)

- Antimicrobials should be used after a treatable infection has been recognized or there is a high degree of suspicion of infection. In general, colonization or contamination should not be treated. Antimicrobials should be used for the prevention of infection where research has demonstrated that the potential benefits outweigh the risks. Long-term prophylaxis should be avoided unless there is a clear clinical indication (for example, rheumatic fever and post-splenectomy).
- The choice of antimicrobial should be determined by the sensitivity of the identified causative organism when this is known. Empiric therapy, for the likely causative organism (s) should be governed by local guidelines that have been informed by recent information about trends in antimicrobial sensitivities.
- Targeted therapy should be used in preference to broad-spectrum antimicrobials unless there is a clear clinical reason (for example, mixed infections or life-threatening sepsis). The prescription of broad-spectrum antimicrobials should be reviewed as soon as possible and promptly switched to narrow spectrum agents when sensitivity results become available. Mechanisms should be in place to control the prescribing of all new broad-spectrum antimicrobials.
- The timing, regimen, dose, route of administration and duration of antimicrobial therapy should be optimized and documented. The indication for which the patient is being prescribed the antimicrobials should be documented in the drug chart and case notes by the prescriber.
- Wherever possible, antimicrobials should be given orally rather than intravenously. Clear criteria should be defined for when intravenous therapy is appropriate. As soon as possible the prescription should be switched to an oral equivalent. The intravenous prescription should be reviewed after 48 hours as a minimum.
- Antimicrobial treatment should be stopped as soon as possible. A stop date or review date should be recorded by the prescriber on the drug chart. In general, antimicrobial courses should be reviewed within five days.

To ensure rapid treatment and infection control, mechanisms should be in place to ensure that patients receive antimicrobial drugs in a timely manner.

Appendix 11: Clinical Audit Guidelines in Health Clinic

Introduction:

Clinical audit for AMS is a tool that looks into details in clinical practice by individual health care provider that prescribed antibiotic and overall trend of prescription by health clinic. This can be further used for quality improvement cycle that involves assessment of the effectiveness of clinical services against agreed standards of best practice.

Stage of implementation:

STAGE 1 - PREPARATION:

- Done annually by random sampling of minimal 30 case notes as samples or as needed whenever there are issues in the trend of antibiotic prescription.
- Identify available resources, e.g. audit team headed by FMS in charge of health clinic.
- Existing guidelines defining desired standards as reference, such as NAG and clinical pathways.
- Define criteria: All antibiotic prescription on any health care provider to be randomly selected with minimum of 30 record within the past 1 month.

STAGE 2 - MEASURING LEVEL OF PERFORMANCE:

- Data collection maybe from computerised records or manual collection. Data entered in excel format with embedded formulas.
- Audited clinical record will be scored based on criteria of best practice with score of 80% and above would be consider as appropriate.
- Analyse the data collected:
    - o Compare actual performance with the set standard based on previous scoring.
    - o Discuss how well the standards were met.
    - o If the standards were not met, note the reasons for this.

STAGE 3 – MAKING IMPROVEMENTS:

- Present the results and discuss them with the relevant individual or teams in the -organisation.
- The results should be used to develop an action plan, specifying what needs to be done, how it will be done, who is going to do it and by when.

STAGE 4 - MAINTAINING IMPROVEMENTS:

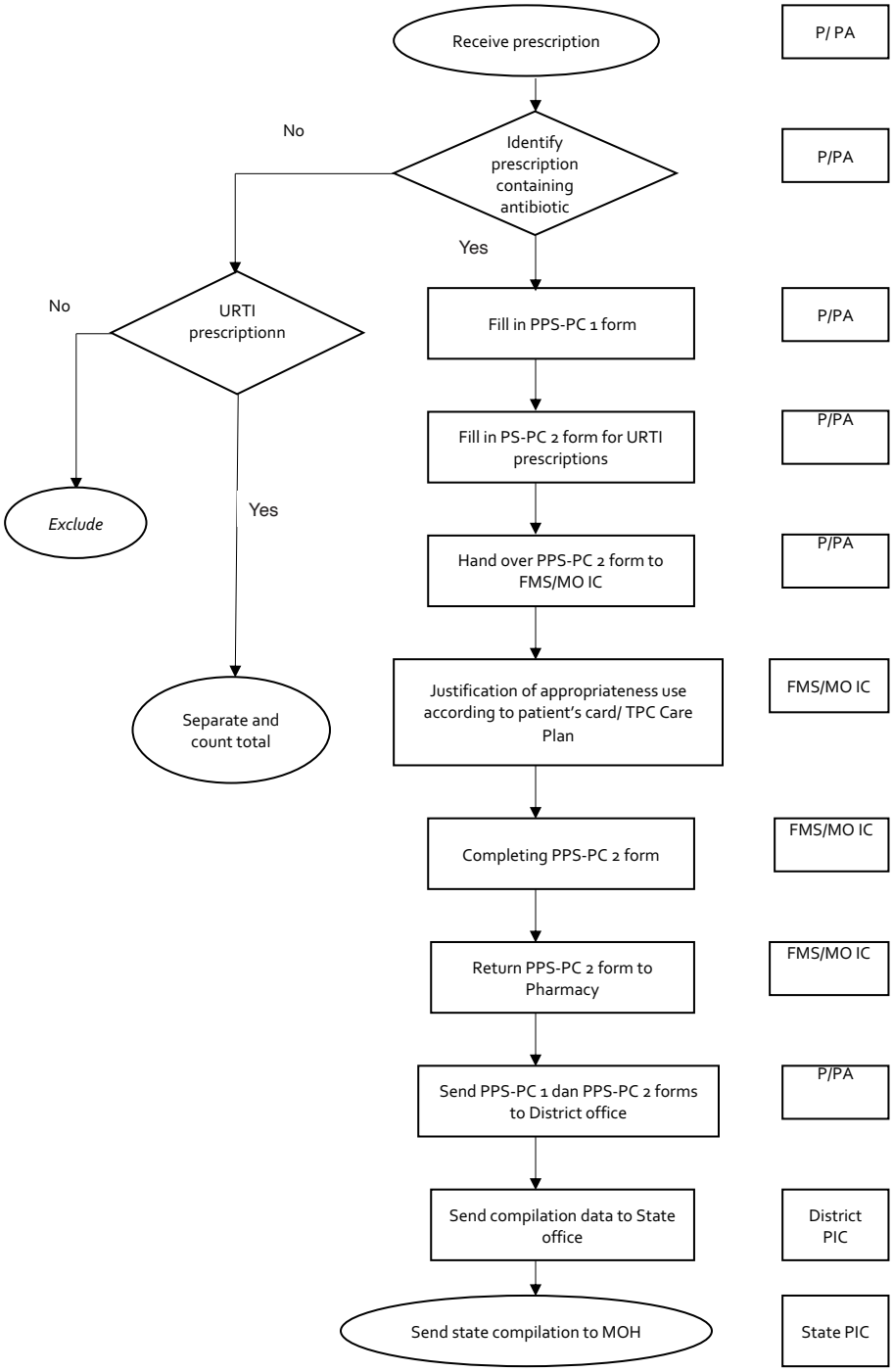
- This follows up the previous stages of the audit, to determine whether the actions taken have been effective, or whether further improvements are needed.
- It involves repeating the audit (i.e. targets, results, discussion); hence the terms “audit cycle”.

Any adhoc audit for individual prescriber or health clinic performance in AMS prescription performance can be done when necessary throughout the year. Data can be used for self-monitoring audit that does not require any report submission.

Excel format for clinical audit:

1	AUDIT KLINIKAL ANTIMICROBIAL STEWARDSHIP					
2	KLINIK KESIHATAN :					
3	TAHUN :					
4						
5	Case	1	2	3	4	5
6	Instruction:	DONE=1, NOT DONE=0, NOT APPLICABLE=(empty)				
7	Diagnosis					
8	Patient ID					
9	Care provider					
10	Date of consultation					
11	Date of audit					
12	Reason for coming to the clinic/ history taking					
13	Vital sign					
14	Physical examination					
15	Relevant investigations and interpretation of results					
16	Accurate Diagnosis					
17	Notification if indicated					
18	Availability of drug allergic alert system					
19	Clinically Indicated for antibiotic usage					
20	Correct antibiotic based on NAG/ clinical pathway					
21	Prescription driven by C&S (if indicated)					
22	Antibiotic Prescription using Pharmacological name					
23	Correct Dosing and dose adjustment if indicated					
24	Correct Frequency					
25	Correct Duration					
26	Health Education (compliance or side effect)					
27	Appropriate Consultation if indicated					
28	Appropriate follow up / plan if indicated					
29	Phone call for outcome if indicated					
30	Identification of practitioner: Name/ Chop					
31	ASP SCORE	0	0	0	0	0
32	Denominator	0	0	0	0	0
33	% ASP PERFPORMANCE	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Appendix 12: Workflow of PPS in Health clinic



Structure Audit Checklist for AMS

Use this checklist as a baseline assessment of policies, practices to review progress in expanding stewardship activities on a regular basis.			
1. Commitment			
Does your facility demonstrate dedication to and accountability for optimizing antibiotic prescribing and patient safety related to antibiotics? Select all that apply.		Weight-age	Audit Score
a. Has dedicated AMS team	□ Yes □ No	15	
b. Incorporates AMS agenda in clinic management meeting	□ Yes □ No	5	
c. Uses consistent message when communicating with patient about antibiotic indications	□ Yes □ No	5	
Subtotal		25	
2. Action			
Has your facility implemented at least one policy or practice to improve antibiotic prescribing? Select all that apply.			Audit Score
a. Availability of treatment guidelines and clinical pathways	□ Yes □ No	10	
b. Formulary restriction based on category of prescriber and local setting	□ Yes □ No	10	
c. Implementation of AMS clinical audit.	□ Yes □ No	10	
Subtotal		30	
3. Tracking and Reporting			
Does your facility monitor at least one aspect of antibiotic prescribing? Select all that apply.			Audit Score
a. Track and report antibiotic utilisation using Defined Daily Dose (DDD)	□ Yes □ No	10	
b. Implementation of antibiotic Point Prevalence Survey (PPS)	□ Yes □ No	10	
c. Assess and share performance on AMS surveillance and audit	□ Yes □ No	5	
Subtotal		25	
4. Education and Expertise			
Does your facility provide resources to clinicians and patients on evidence-based antibiotic prescribing? Select all that apply.			Audit Score
a. Continuous Medical Education (CME)	□ Yes □ No	10	
b. Prescribing aids: educational aids for prescribers (e.g. information technology support, weight-based dosing etc.)	□ Yes □ No	5	
c. Public awareness-raising tools (poster/pamphlet)	□ Yes □ No	5	
Subtotal		20	
Total Audit Scores	**...../100**		

Ministry of Health Malaysia

Pharmaceutical Services Programme
Medical Development Division
Family Health Development Division
Ministry of Health Malaysia

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