# INTERDISCIPLINARY PRACTICAL GUIDELINES ON ANTIMICROBIAL STEWARDSHIP PROGRAMMING IN LIBERIA (2022-2027)



## MINISTRY OF HEALTH
## REPULIC OF LIBERIA

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# Preface

Like access to clean water and air, antibiotics have been taken for granted for too long. Since the discovery of Penicillin in 1928, antibiotics have significantly improved global health, by being the cornerstone of modern medicine, including cancer chemotherapy and advanced surgical procedures.[1] While decades of overuse and misuse of antibiotics have accelerated the emergence and spread of resistant bacteria, access to quality antibiotics remains a major challenge in many parts of the world, including Liberia.

This has further been confounded by the void in discovery of new classes of antibiotics that target drug-resistant organisms. Existing antibiotics must therefore, be used more responsibly and managed carefully to extend their lifespan while being made available to the patients who truly need them. They should be prescribed only when indicated as misuse may accelerate the development and spread of AMR. This practical Antimicrobial Stewardship (AMS) Guidelines and Toolkits for implementing AMS in healthcare facilities is meant to help Liberia, a low-income country to achieve this goal. It provides practical, hands on guidance to support the implementation of Objective Four (4) of both the Global Action and Liberia's National Action Plans on AMR: Optimizing the use of antimicrobial medicines.

The ultimate goal of an AMS program is sustainable behavioral change of prescribers towards antibiotic prescribing and use. The toolkit provides guidance on how to set up an antimicrobial stewardship program (ASP), including the structures and resources that should be put in place at the national and healthcare facility levels. It provides a stepwise approach that any healthcare level facility can use. Additionally, the toolkit provides detailed guidance on how to plan, perform and assess AMS interventions - including feedback on antibiotic use over time. Finally, the AMS Guidelines and Toolkits provide an overview of the competencies an AMS team needs to guide healthcare professionals in changing their antibiotic prescribing behaviour.

It is my sincere hope that this toolkit will be helpful in various healthcare facilities, especially hospitals throughout Liberia and even other countries in addressing one of the key strategies in their National Action Plans on AMR, optimizing their use of antimicrobials. Time is indeed running out, but we still have several windows of opportunities to turn the tide on AMR and ensure continued effective treatment of bacterial infections for future generations. This is however only possible if we all act now with collectivism.

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[1] *WHO. (2019).* Antimicrobial stewardship programs in healthcare facilities in low-and middle-income countries. A practical toolkit, accessed 13/11/2010 at http://apps.who.int/iris. Geneva: WHO

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## Abbreviations and Acronyms

| | |
|---|---|
| AMC | Antimicrobial Consumption |
| AMR | Antimicrobial Resistance |
| AMS | Antimicrobial Stewardship |
| ASP | Antimicrobial Stewardship Program |
| AWaRe | Access, Watch, Reserve |
| CAESAR | Central Asian and European Surveillance of Antimicrobial Resistance |
| CAP | Community-acquired Pneumonia |
| CLSI | Clinical and Laboratory Standards Institute |
| DDD | Defined Daily Dose |
| DOTs | Days of Therapy |
| EML | Essential medicines list |
| GLASS | Global Antimicrobial Resistance Surveillance System |
| GNI | Gross National Income |
| HCF | Healthcare Facility |
| HCW | Healthcare Worker |
| HSS | Health Systems Strengthening |
| ICU | Intensive Care Unit |
| IPC | Infection Prevention and Control |
| IT | Information Technology |
| KPC | Carbapenem-resistant Klebsiella Pneumoniae |
| LMIC | Low- and Middle-Income Country |
| M&E | Monitoring and Evaluation |
| MDR | Multidrug-Resistant |
| MOH | Ministry of Health |
| NAP | National Action Plan |
| NEML | National Essential Medicines List |
| OECD | Economic Co-operation and Development |
| PPS | Point Prevalence Survey |
| SMART | Specific, Measurable, Achievable, Relevant, Time bound |
| SOP | Standard Operating Procedures |
| STGs | Standard Treatment Guidelines |
| SWOT | Strengths, Weaknesses, Opportunities and Threats |
| TrACSS | Tripartite AMR Country Self-Assessment Survey |
| TWG | Technical Working Group |
| UTI | Urinary Tract Infection |
| WASH | Water, Sanitation and Hygiene |
| WHO | World Health Organization |

# Glossary of Selected Terms

| |
|---|
| **AMS Champion:** An individual/professional who helps in telling everyone about why antibiotics are important, why they need to be used appropriately. |
| **Antibiogram:** A periodic summary or profile of antimicrobial susceptibility test results of bacterial isolates submitted by the hospital's clinical microbiology laboratory. It may be a collaborative effort involving pharmacy, infection preventionists, clinicians and the laboratory. |
| **Antibiotic:** Refers to an antimicrobial agent or substance that is produced by or derived from a microorganism that kills or inhibits the growth and multiplication of bacteria. Antibiotic substances can be synthetic, semi-synthetic, or derived from plants or animals. |
| **Antimicrobial resistance (AMR**): WHO's definition is "development of resistance in a microorganism – bacterium, virus, fungus, or parasite – to an antimicrobial agent to which it was previously sensitive." It is also the ability of a microorganism – bacterium, virus, fungus, or parasite – to withstand the effects of antimicrobial medicines to which it was previously sensitive. |
| **Antimicrobial Stewardship (AMS):** A coherent set of actions which promote the responsible use of antimicrobials. It can be applied to actions at the individual level as well as the national and global levels, and across human health, animal health and the environment. |
| **Antimicrobial Stewardship Committees:** A stand-alone committee or integrated into an existing structure that provides leadership and overall coordination of the ASP in a healthcare facility (HCF). |
| **Antimicrobial Stewardship Program (ASP):** An organizational or system-wide healthcare strategy promoting appropriate use of antimicrobials via implementation of evidence-based interventions. |
| **Antimicrobial Stewardship Team:** A multidisciplinary team that collectively possess the competencies and undertake functions to successfully deliver and implement ASP in a HCF. |
| **Antimicrobial:** An agent or substance derived from any source (microorganisms, plants, animals, synthetic or semi-synthetic) that acts against any type of microorganism, such as bacteria (antibacterial), mycobacteria (anti-mycobacterial), fungi (antifungal), parasite (anti-parasitic) and viruses (antiviral). All antibiotics are antimicrobials, but not all antimicrobials are antibiotics. |
| **Antibiotic audit:** This refers to the prospective (real-time) or retrospective collection of antibiotic prescription data on hospitalized patients |
| **Antibiotic Time Outs:** An active reassessment of an antibiotic prescription (usually within 48-72 hours) after first administration, taking into account laboratory culture and sensitivity testing results, response to therapy, patient condition. It is also a scheduled time for the clinician to re-evaluate the appropriateness of the patient's antibiotic treatment, to determine if the therapy is working and change if needed. |
| **AWaRe:** WHO classification of antibiotics into three stewardship groups: Access, Watch and Reserve, to emphasize the importance of their optimal use and potential for AMR. Details of each group are presented in the guidelines. |
| **Community-Acquired Infection (CAI):** An infection acquired in the community, outside of a healthcare setting. |
| **Competencies:** The development of observable ability of a person (or individual health worker) that integrates knowledge, skills and attitudes in their performance of tasks. Competencies are durable, trainable and, through the expression of behaviour, measurable. |
| **Days of therapy (DOTs):** The number of days a patient receives an antibiotic independent of dose. |
| **Defined Daily Dose (DDD):** Assumed average maintenance dose per day for a medicine used for its main indication in adults as established by WHO's Collaborating Center for Drug Statistics and Methodology. It's the units of antibiotics purchased quarterly, monthly or amount of drugs dispensed to individual patients. |
| **Empirical antibiotic treatment:** Initial antibiotic treatment targeted at the most probable causative microorganism; based on local susceptibility data, available scientific evidence or expert opinion, when evidence is lacking. |
| **Falsified:** Medical products that deliberately/fraudulently misrepresent their identity, composition or source. |

**Fixed Dosed Combination (FDC**): Medicine that contains two or more active ingredients combined in a single dosage form with each of the ingredient contributing to the overall therapeutic effect.

**Healthcare worker (HCW):** Any employee in a HCF who has close contact with patients, patient-care areas or patient-care items; also referred to as healthcare personnel or healthcare provider.

**Health Systems Strengthening (HSS):** Actions that establish sustained improvements in: provision, utilization, quality, efficiency, and resilience of promotive, preventive and curative health services.

**Healthcare professional (HCP):** A member of the medical, pharmacy or nursing professions or any other person who in the course of his/her professional activities provide essential services that promote health, prevent diseases and deliver healthcare services to individuals, families, and communities.

**Healthcare-associated infection (HAI), "nosocomial" or "hospital-acquired infection":** An infection occurring in a patient during care in a hospital or other HCFs, which was not present or incubating at the time of admission. HAIs can also appear after discharge. They are the most frequent adverse events associated with patient care.

**Low- and middle-income country (LMIC):** A collective term for low income- lower-middle-income- and higher-middle-income countries, based on the World Bank's grouping of countries according to gross national income (GNI) per capita for a specified year. For 2019, low-income countries are defined as having a GNI per capita of US$ 995 or less in 2017.

**Multidrug-resistant (MDR) bacteria:** Bacteria that are resistant to at least one agent in three or more antibiotic categories. Extensively drug-resistant (XDR) is non-susceptibility to at least one agent in all but two or fewer antibiotic categories (i.e. bacterial isolates remain susceptible to only one or two categories), and pan drug-resistant (PDR) is non-susceptibility to all agents in all antibiotic categories.

**Optimizing the use of antibiotics:** Outcome of the coherent set of actions which promote the responsible use of antimicrobials. Optimal outcomes include: Achievement of cure, avoidance of toxicity and other adverse effects; and emergence or propagation of AMR in the larger population.

**Outcome measures or indicators for AMS programs:** They capture quantitative change e.g. patient or economic outcomes (cost saving), but most of all in antibiotic use. Antibiotic consumption is expressed with a numerator indicating the quantity used (i.e. DDDs or DOTs) per defined denominator (i.e. patient-days, admissions, consultations), for comparisons over time in the same setting or in other settings. Other examples are mortality, antimicrobial use, re-admission, cost saving, incidence of nosocomial infections.

**Point prevalence survey (PPS):** The collection of antibiotic treatment data from hospitalized inpatients (all patients or a sample) at a point in time according to a recognized international methodology such as the WHO methodology for PPS on antibiotic use in hospitals.

**Process measures or indicators:** They capture information about the key processes that contribute to achieving the desired outcome(s). An example in AMS would be proportion of patients prescribed antibiotic treatment in compliance with the STGs; management of infection such as urinary tract infection, substance, duration, oral and switch.

**Structural measures or indicators for AMS programs:** The characteristics (capacity, systems and processes) of the setting in which ASPs are conducted**.** They may be material or human resources, such as availability of: financial resources, number of personnel, guidelines, information technology tools, rules or responsibilities rights, team meetings, surveillance, guidelines and training, etc.

**Substandard:** Are authorized medical products that fail to meet either their quality standards or specifications or both.

**SWOT Analysis:** A SWOT (strengths, weaknesses, opportunities and threats) analysis (also called a situational analysis) is a popular method of identifying internal and/or present strengths and weaknesses, and external and/or future opportunities and threats to aid a decision-making.

**Technical Working Group (TWG):** Group responsible for providing strategic leadership on AMS/ optimize the use of existing antimicrobials and prevent the spread of resistant infections.

**WHO Model List of Essential Medicines:** This contains medications considered to be most efficacious, safe and cost-effective medicines to meet the most important needs in health systems. It informs national EML, their selection, procurement, supply and the use of essential medicines.

# 1. Introduction

## 1.1 Background

For decades, microbes in particular bacteria, have become increasingly resistant to various antimicrobials, including antibiotics. The World Health Assembly's endorsement of the Global Action Plan on Antimicrobial Resistance (AMR) in May 2015, and the Political Declaration of the High-Level Meeting of the General Assembly on AMR in September 2017, both recognize AMR as a global threat to public health. These policy initiatives acknowledge the overuse and misuse of antimicrobials as a main driver for the development of resistance as well as the need to optimize the use of antimicrobials. The Global Action Plan on AMR sets out five strategic objectives as a blueprint for countries in developing national action plans (NAPs) on AMR, these are:

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

To this end, the toolkit aims to support Liberia in implementing Objective 4 of both the Global Action Plan and the National Action Plans on Prevention and Containment of Antimicrobial Resistance in Liberia – ''optimize the use of antimicrobial medicines" – by providing practical guidance on how to implement antimicrobial stewardship programs (ASPs) in the human health sector at the national and healthcare facility levels. Antimicrobial stewardship programs optimize the use of antimicrobials, improve patient outcomes, reduce HAIs and rate of development of AMR, and save healthcare costs amongst others. According to the Organization for Economic Cooperation and Development (OECD) report, Stemming the superbug tide: just a few dollars more, implementing AMS programs together with other policies to reduce overuse of antibiotics and promote hospital hygiene could save up to 1.6 million lives by 2050 and US$4.8 billion per year in the OECD countries.[1]

This document will therefore serve as a compass to all AMR-related activities at the facility, district, county and national levels in Liberia's health system and perhaps other sectors at like, since it is the Country's first AMS Guidelines and Toolkits aimed at addressing AMR.

[1] OECD. (2018). Stemming the superbug tide: just a few dollars more. *Paris:*

## 1.2 Antimicrobial stewardship - Key concepts and definitions

### Definitions of AMS

An integral component of health systems, stewardship is broadly defined as, "The careful and responsible management of something entrusted to one's care.[2]" It was originally applied in the healthcare setting as a tool for optimizing antimicrobial use, termed "antimicrobial stewardship" (AMS). Stewardship has since been applied in the context of governance of the health sector as a whole, taking responsibility for the health and well-being of the population and guiding health systems at the national and global levels.

AMS is now one of three pillars of an integrated approach to health systems strengthening. The other two are infection prevention and control (IPC) and medicine and patient safety. When applied in conjunction with antimicrobial use surveillance, and the WHO essential medicines list (EML) AWaRe Classification (ACCESS, WATCH, RESERVE), AMS helps to control AMR by optimizing the use of antimicrobials.[3] Linking all three pillars to other key components of infection management and health systems strengthening, such as AMR surveillance and adequate supply of quality assured medicines, promotes equitable and quality healthcare towards the goal of achieving Quality Universal Health Coverage (UHC). See Figure 1.

AMS principles also apply to the use of antimicrobials in animal and agriculture sectors, typically with emphases on the responsible and prudent use of these agents. Although increasing levels of viral, fungal and parasite resistance to antimicrobials are of concern, this document will focus on the public health challenges of bacterial resistance to antibiotics. The specific aim of the toolkit is to enhance AMS activities in healthcare facilities and the health system of Liberia.

Although drug resistance data is limited in Liberia, available information shows that Liberia shares the worldwide increasing rates of resistance, with an estimated 2.6% of new cases of MDR-TB, 18% MR-TB in previously treated cases, with 24% resistance to Rifampicin.[4] With rates of AMR increasing worldwide, and very few new antibiotics being developed, existing antibiotics are becoming a limited resource. It is therefore essential that antibiotics only be prescribed – and that last-resort antibiotics (RESERVE group) be reserved-for patients who truly need them. Hence, AMS and its defined set of actions for optimizing antibiotic use are of paramount importance.

### Effectiveness of AMS

Today, many countries have developed and are implementing their National Action Plans on AMR, in which AMS is a key priority.[5] Although there is a scientific evidence for AMS and

[2] McGowan, J. E & Gerding, D.N. (1996). *Does antibiotic restriction prevent resistance? New Horiz., 4:370.*

[3] *WHO. (2019).* Antimicrobial stewardship programs in healthcare facilities in low-and middle-income countries. A practical toolkit, accessed 13/11/2020 at http://apps.who.int/iris. Geneva: WHO.

Ibid

[4] WHO. Global Tuberculosis Report 2017

[5] WHO. (2016). Antimicrobial resistance: a manual for developing national action plans. Geneva: WHO.

national, regional and global guidance documents exist, there is a growing need for more specific guidance on how to establish, implement, monitor and evaluate effective AMS programs at the national and healthcare facility levels.

To meet this need, the National AMR Technical Working Group (AMR-TWG), in collaboration with WHO and other partners has adapted the WHO AMS Guidelines and Toolkits to guide the implementation, monitoring and evaluation of AMS programs in healthcare facilities in Liberia.

## The aims of the AMS program are to:

- Optimize the use of antibiotics;
- Promote behavior change in antibiotic prescribing and dispensing practices;
- Improve quality of care and patient outcomes;
- Save on unnecessary healthcare costs;
- Reduce further emergence, selection and spread of AMR;
- Prolong the lifespan of existing antibiotics;
- Limit the adverse economic impact of AMR; and
- Build best-practices and capacity of healthcare professionals regarding the rational or judicious use of antibiotics.

AMS cannot be effective on its own, rather it is a product of coordinated activities that include IPC, surveillance both microbiology guiding directed therapy, antimicrobial consumption, and utilization and AMR sensitive interventions such as immunizations. AMS also contributes to the overall goal of quality UHC.

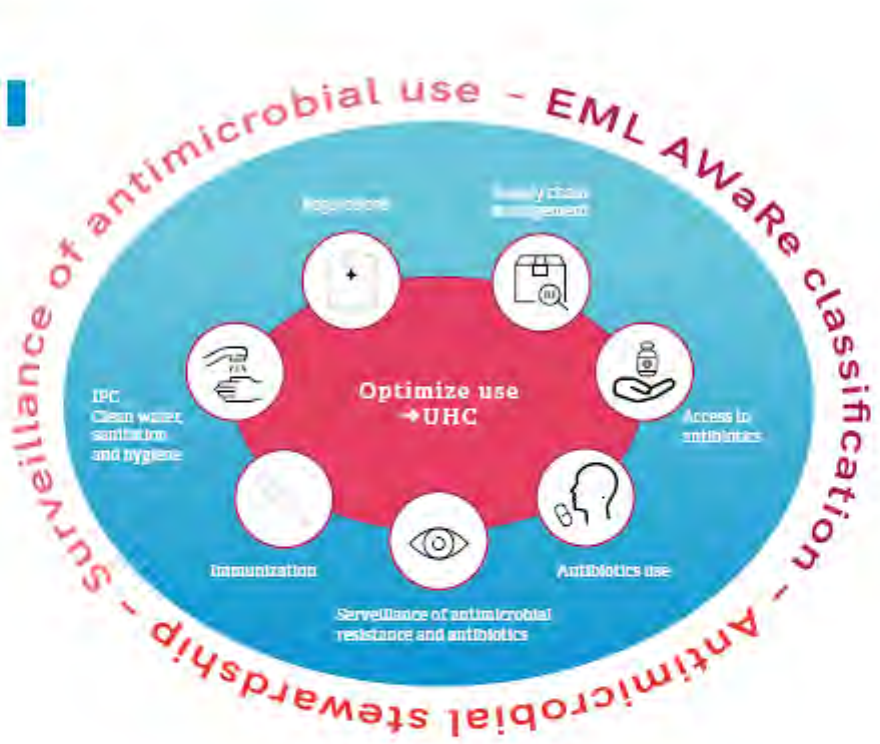



*Figure 1: Integrated approach to optimizing use of antimicrobials towards achieving UHC*

## 1.3 Integrated approach for optimizing the use of antimicrobial towards achieving UHC

### *Regulations*

- Regulate social triggers and remuneration policies that promote responsible antimicrobial prescription and dispensing behaviors.[6]
- Legislate and regulate responsible and appropriate use and disposal of antimicrobials.
- Tackling sub-standard and falsified medical products is an important component of ensuring access to quality-assured antimicrobials. At facility level mechanisms are needed to reduce the amount of antimicrobials being inappropriately prescribed, dispensed or administered e.g. Pay-for-performance initiatives showed that they helped in some settings to reduce the prescription of broad-spectrum antibiotics by health workers (Balinskaite, et al., 2021).
- Identify and incorporate health worker behavioral change principles in policies to address optimal diagnostic processes, antimicrobial prescription, dispensing and administration as part of national integrated AMS activities and national plans on AMR.
- Encourage and empower individual champions, institutions and facilities to implement innovative measures or rewards to reduce the inappropriate diagnosis of infectious diseases as well as the inappropriate prescription, dispensing, administration and use of antimicrobials, e.g. incentivize appropriate stewardship activities.

### *Supply chain management*

- Strengthen national procurement and supply chain management for quality and effective antimicrobials, including new antibiotics.
- The EML and AWaRe classification provide a selection framework to develop and or update the national EMLs and relevant efforts to strengthen national pharmaceutical supply chains, financing and reimbursement mechanisms and pharmaceutical information management systems that will ensure availability of affordable and culturally acceptable antimicrobial medicines at all levels of care.
- Establish a robust supply chain and pharmacy information system with capacity to provide advance notice of possible shortages and stock-outs of antimicrobial medicines to allow rapid action.
- Leverage pooled procurement mechanisms to ensure the supply of quality-assured medicines, with predictability of demand for manufacturers and promoting sustainable procurement practices.
- Encourage regulatory agencies to publish the active pharmaceutical ingredients source of registered antimicrobial medicines for transparency and to enable countries to design solutions to maintain predictable supply and mitigate against drug shortages.

[6] WHO. 2021. WHO policy guidance on integrated antimicrobial stewardship activities. Geneva: WHO.

## *Access to antibiotics*

- Equitable and affordable access to quality-assured, safe and effective antimicrobial medicines and their appropriate use anchor UHC. More people however die from lack of access to antimicrobials than drug-resistant infections in some parts of the world, especially LMICs.[7]
- Instituting interventions that prevent HAIs and community-acquired infections, including implementation of core components of IPC, WASH and optimizing vaccination coverage.
- Improving access to essential, quality-assured, safe, effective and affordable antimicrobials.

## *Surveillance on AMR and antibiotics*

- Monitoring shortage or stock-outs of antimicrobials, and outcomes of interventions aimed at changing behaviour; assessing quality of prescribing against practice guidelines, monitoring and evaluation of AMS activities.
- Facility monitors antibiotic use (consumption) at the unit and/or facility wide level by one of the following metrics (by counts of antibiotic(s) administered to patients per day (Days of Therapy; DOT), number of grams of antibiotics used (Defined Daily Dose, DDD) or by direct expenditure for antibiotics (purchasing costs).
- Conduct surveillance of AMR to inform the planning, implementation and monitoring of progress of integrated AMS activities and for better patient outcomes.
- Strengthen laboratory capacities, processes and procedures to optimize diagnosis of infectious diseases and to improve pathogen identification and AST.
- Facilitate the linkage of surveillance data on AMR, antimicrobial use and consumption with similar surveillance data in the animal sector to inform policy decisions to contain AMR.

## ***IPC & WASH:***

- In LMICs, about 40% of healthcare facilities do not have a reliable water supply, 19% do not provide adequate sanitation and 35% do not have hand hygiene facilities.[8] In Liberia, 81% of healthcare facilities have available safe disposal of human wastes, sanitation facilities and 53% with an improved source of water and power supply (62%); a manifestation of poor quality of health services, especially during the night hours and in the context of IPC (SARA, 2018).
- WASH and safe waste management complement AMS activities by reducing the incidence of infection and the need for antimicrobials.
- Ensuring that every HCF has safely managed WASH and waste management facilities and implementing effective, evidence-based interventions and practices to prevent

[7] Ibid

[8] *Araya, P. 2016. The impact of water and sanitation on diarrheal disease burden and over-prescription of antibiotics. Final capstone report for the Master of Public Administration. London School of Economics and Political Science; (https://amr review.org/sites/default/files/LSE%20AMR%20Capstone.pdf, accessed 17 July 2021).*

infections in health workers, patients and all facilities users is important. Safe WASH in communities can prevent infection and avoid 60% of WASH-related antibiotic use.[9]

- Employ the WHO WASH Facility Improvement (WASHT-FIT) Tool, in collaboration with the relevant programs to assess WASH in HCFs, as part of integrated AMS activities to make the necessary improvements and sustain quality WASH services.
- Exercise health sector leadership for strengthened governance and investment in community WASH services, with a focus on sanitation and capacity for sustained service delivery as part of integrated AMS activities.
- Advocate for WASH; understanding the link between AMS and IPC; the infection chain (i.e., organism, source, route of transmission and susceptible host); and the importance of practicing hand hygiene to prevent transmission.
- Promote awareness of AMR, appropriate antimicrobial use amongst all HCWs, patients and the general public to protect the effectiveness of antimicrobials as a public good.
- Include preventive actions such as hand hygiene and vaccinations, discourage self-medication and promote responsible and appropriate use of antimicrobials as well as the importance of proper and optimized diagnosis in campaigns.
- Implement IPC core components in HCFs and enhance WASH in HCFs and communities.

### *Immunization*

- Vaccination services also play an important role in preventing infection and minimizing the use of antimicrobials.
- Advocate for WASH and scaling up vaccines for common infections; understand the link between AMS and IPC*;* the implementation of core components of IPC, enhancing water, sanitation and hygiene (WASH), and optimizing vaccination coverage.

### *Optimize use of antimicrobials*

- The overall goal of the AMS program is to reduce unnecessary use of antimicrobials, including the inappropriate use of Watch group and Reserve group antibiotics (the antibiotics most crucial for human medicine and at higher risk of resistance), and to increase the use of access antibiotics where appropriate.
- AMS prevents antibiotic selection pressure and optimize use.
- It promotes and facilitate data sharing to optimize antimicrobial use and establish a system for routine support supervision, audit, and feedback of prescribing and dispensing practices based on antimicrobial use data.
- Healthcare facility should provide a range of educational resources to support staff training and education on how to optimize antimicrobial prescribing as well as patients.
- The availability of proper and optimized diagnosis, including timely and accurate microbiological tests help to reduce inappropriate use of antimicrobials and improve patient outcomes.

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*[9] WHO.2019. WASH in health care facilities – practical steps to achieve universal access to quality care. Geneva: WHO; (https://www.who.int/water_sanitation_health/publications/wash-in-health-care-facilities/en/, accessed 16 July 2021).*

### *Universal Health Coverage (UHC)*

- Equitable and affordable access to quality-assured, safe and effective antimicrobial medicines and their appropriate uses anchor UHC; and essential components of achieving UHC.
- AMR makes lifesaving medical procedures riskier to perform and has a broader societal and economic impact which threatens the achievement of UHC and the Sustainable Development Goals (SDGs 2030). Ensure strong and effective linkages and synergies between the relevant areas and disciplines related to AMR, including national infectious diseases and infection prevention programs such as HIV, tuberculosis (TB), malaria, sexual, reproductive, maternal, newborn, child and adolescent health, etc, and the UHC agenda at all levels. Access to high-quality and affordable antimicrobials to combat communicable diseases is a challenge in many settings affecting the quality of health care. Other programs, such as IPC, WASH, TB, malaria, HIV, UHC and primary healthcare (PHC) should integrate AMS activities within their action plans and national strategies.

### *Core Elements of AMS*

- ***Structures:*** Core elements that should be in place to support AMS programs at both national and facility levels, i.e. Quality Management Team, IPC or AMS Team, clinical treatment guidelines, and surveillance of resistance and antibiotics.
- ***Interventions:*** There are several interventions that should be put in place as part of the implementation of the AMS program. These are addressed in sections 5 and 5.5.
- ***Education & Training:*** Education and continuing professional development (CPD) is key to the success of the AMS program (e.g. educating clinicians about resistance and optimal prescribing). Key competencies need to be acquired and these are addressed in section 7.1 on page 65. There is ongoing effort by MOH and stakeholders to develop CPD programs for core healthcare professionals which will be relevant to the AMS Team.

## 1.4. How to establish AMS programs

The following box shows the steps to follow when setting up an AMS Program. This process takes into consideration our health system as a country. Establishing ASPs will be driven through various processes and people, leveraging on existing structures and utilizing entry points and champions to be identified.

**Box 1: Key steps in establishing the national AMS program to enhance facility AMS activities**

**Audience:** *MOH (DPS, County and District Health Teams, healthcare facilities, etc) responsible for delivering quality-assured medical care and access to and rational use of medicines.*

1. Establish a governance structure – e.g. a national AMS technical working group (TWG) (Annex I) linked to the national AMR -TWG and or One Health Technical Committee.
2. Review and prioritize the national core elements:
   2.1. Identify what is already in place and the level of implementation required.
   2.2. Identify short, medium and long-term priority core elements.
   2.3. Identify the resources required.
3. Identify pilot healthcare facilities (public and private) for initial AMS rollout:
   3.1. Tertiary teaching facilities.
   3.2. Regional, county and district facilities.
   3.3. Primary care and/or community (as part of community AMS programs).
4. Develop a national AMS strategy with national indicators.
5. Dedicate financial and human resources as required.
6. Monitor and evaluate implementation of the national AMS strategy.
7. Facilitate access to and/or support pre- and in-service training on optimized antibiotic prescribing.

***Source: Adapted from WHO AMS Toolkit***

Following the steps above, use the following process as part of the operation and setting up of the AMS Program.

**Box 2: Key steps to establishing a healthcare facility AMS program**

**Audience:** *Healthcare facility leadership, healthcare facility quality management team (HFQMT), IPC Committees, AMS Team.*

1. Undertake a facility AMS situational/SWOT analysis of:
   1.1 Healthcare facility core elements - identify what is in place and the implementation level required.
   1.2 Available data on antimicrobial consumption (AMC) and/or use, prescription audits and AMR surveillance data; and
   1.3 Existing AMS competencies in the facility.
2. Establish a sustainable AMS governance structure based on existing structures.
3. Prioritize the healthcare facility core elements based on the situational analysis:
   3.1 Identify the immediate priorities.
   3.2 Identify the resources required.
4. Identify AMS interventions starting with the low-hanging fruit.
   4.1 Identify who, what, where and when.
5. Develop the AMS action plan that specifies human and financial resources required.
6. Implement AMS interventions.
7. Monitor and evaluate AMS interventions.
8. Provide basic, continued educational resources & training on optimized antibiotic or antimicrobial prescribing.

The table below shows a practical example of the AMS Program that was set up in Barbados, an eastern Caribbean island, British Commonwealth Nation. Box 3 describes how a healthcare facility in Barbados set up its AMS program based on an outbreak of a drug-resistant bacterium.

**Box 3: Case Study**

How a facility outbreak underpinned the establishment of facility AMS in Barbados.

In a 600-bed hospital in Barbados, an outbreak of Carbapenem-resistant Klebsiella Pneumoniae (KPC) resulted in the establishment of an AMS program linked to the existing IPC program. In 2012, an all-facility PPS (point prevalence survey) was undertaken which showed that one in five patients was colonized with KPC, and one in seven of the KPC-affected patients had an active infection. The results also showed a statistically significant correlation between KPC colonization and average length of hospital stay and antibiotic use of piperacillin and tazobactam* and fluoroquinolones, resulting in increased hospital costs.

At the time of the outbreak, the facility's IPC program consisted of a single nurse, but was then expanded with an infectious disease (ID) physician and a pharmacist. The IPC team used data to demonstrate to the hospital management that an AMS program was critically needed and that it would involve minimal cost. Leadership commitment led to establishing an AMS team consisting of an infectious disease physician, pharmacist and microbiologist, as well as IPC-trained personnel who were all already employed in the facility.

The AMS team determined that the KPC outbreak and the three antibiotics associated with it accounted for 64% of the hospital costs of antibiotics during the preceding 6 months. The AMS set a target for decreasing the overall cost of antibiotics and hospital length of stay over the next 6–12 months. The AMS intervention began in the surgical intensive care unit (ICU) because of eager support from the head anesthesiologist, an AMS champion. The targets were achieved faster than anticipated, and interest grew from other wards to be included in the AMS program. A 60% decline in the use of carbapenems and vancomycin was documented.

Additional core elements that led to the success of AMS in the facility included facility-wide training on AMS; development of a facility antibiogram with regular feedback to the prescribers; a strong relationship and trust built between healthcare professionals and the laboratory, which allowed for timely delivery of laboratory reports to inform prescribing; and media engagement.

**Piperacillin & tazobactam, a combination penicillin antibiotic that is used to treat infections caused by bacteria, such as stomach infections, skin infections, pneumonia, and severe uterine infections*.

# 2. STRUCTURES FOR NATIONAL AMS PROGRAM IN LIBERIA

***Audience:*** *The DPS of MOH, Veterinary Services of the MOA, National Fisheries and Aquiculture Authority of Liberia (NaFAA), Division of Environmental and Occupational Health (DEOH), NPHIL, National Standard Laboratory (NSL), Liberia Pharmacy Board, and Pharmacy Departments at the subnational levels; County and District Health Teams and healthcare facilities (hospitals, health centers, clinics), LMHRA; Liberia Board of Accreditation and Licensure of Medical Laboratory, other entities and institutions responsible for delivering quality-assured medical care and access to rational use of medicines.*

## 2.1 Context

Antimicrobial Stewardship (AMS) Programs or ASPs can be successfully implemented when certain structures are in place.[10] A list of essential national core elements: national plans and strategies, legislations, policies or regulations and guidelines, awareness, education and training and supporting technologies and data (see Figure 3 below) has been developed to help countries build the necessary structures at the national and subnational levels to enable healthcare facility AMS program, taking into account the country's context.

Ensuring that key stewardship elements are in place is essential for sustainable actions. The checklist of national core elements aims to guide the country in identifying the most critical elements, supporting the implementation of the NAP on AMR and AMS. Some of these core elements include:

1. National plans and strategies
2. Legislations, regulations, policies and guidelines
3. Awareness, education and training
4. Technologies and data (e.g. embedding relevant information and protocols at the point of care such as immediate access to facility-specific guidelines at point of prescribing; implementing clinical decision support for antibiotic use; creating prompts for action to review antibiotics in key situations and facilitating the collection and reporting of antibiotic use data (monitoring and evaluation or M&E).

It is important for healthcare facilities to build on structures that are already in place, to use them as entry points for AMS initiatives, e.g. basic healthcare package review and implementation, National EMLs and treatment guidelines, National Healthcare Quality Strategy review, National IPC Guidelines, Guidelines for the Safe Management of Healthcare Waste. The core elements have been stratified as basic, which require fewer resources, and advanced, which require more resources.

Prioritizing antimicrobial stewardship is key, because when there is antimicrobial stewardship instituted in hospitals and the Ministry as a whole, then the monitoring, surveillance, etc comes after that.[11]

[10] Pulcini, C. et al. (2018). Developing core elements and checklist items for global hospital antimicrobial stewardship programs: a consensus approach. *Clin Microbiol Infect*.;25:20–25.

[11] *WHO. (2019).* Antimicrobial stewardship programs in healthcare facilities in low-and middle-income countries. A practical toolkit, accessed 13/11/2020 at http://apps.who.int/iris. Geneva: WHO

## 2.2 AMS Steering Committee Structures (AMS-SC)

**National Steering Committee**

The AMS Steering Committee shall compose members representing relevant sectors, especially the human, animal and environmental health, regulatory, professional bodies and partners.

The purpose of the AMS-SC is to oversee and to coordinate AMS-related activities in all relevant sectors to ensure a systematic, comprehensive approach to controlling, monitoring and or containing the global threat of AMR. The AMS-SC shall be charged with the responsibility to address all AMS-related activities from central to county levels. The scope shall be broad enough to address all core sessions of the AMS Guidelines, as well as complementing the five strategic objectives of the Global Action Plan (GAP) and National Action Plan (NAP) on AMR, prioritizing activities in a step-wise approach.

A major guiding principle of the AMS-SC to find the most appropriate ways to facilitate and provide synergy with new or existing work so that the overall objectives of the programs are achieved. Furthermore, the AMS-SC shall be appropriately integrated and have clearly defined roles and responsibilities in the existing health system, public health and disease-specific programs, animal health and production, the food sector and environmental initiatives. The cross-cutting nature of AMR shall add value to these systems and programs, not supplant them.

The AMS-SC shall meet at least three times a year; at least a 2 weeks' notice with an agenda given to members for the AMS-SC meeting. Leadership structures shall include the following:

**Chairperson:** Chief Pharmacist of Liberia or his or her designee.

**Deputy:** MOA

**Secretariat:** EPA

Members of the AMS-SC shall include the following:

1. MOH, DPS, HQMU, EPI, One Health, NPHIL (NRL, DEOH),
2. Line Ministries (MOA, Commerce).
3. Agencies, Regulatory Authorities (LMHRA: Pharmacovigilance/Laboratory, LPB, Laboratory Board, LMDC, Liberia Board for Nursing and Midwifery).
4. Professional bodies (LMDA, Physician Assistant Association, Nurses Association, Liberian Association of Nurse Anesthetists).
5. Ministry of Agriculture-Animal Health Sciences/Epidemiological Unit; Central Veterinary Laboratory.
6. Environmental Protection Agency-Compliance /Laboratory.
7. Ministry of Commerce and Industry - Inspector/Laboratory Units.
8. Ministry of Justice- Codification Unit.
9. Ministry of Education (MOE).
10. Liberia Water and Sewer Cooperation.
11. Academic (CU-College of Health Science, UL- College of Health Science, UMU- College of Health Science, Mother Patter College of Health Sciences (MPCHS), Tubman University, Adventist University-College of Health Sciences, etc).

The AMS-SC shall be accountable to the National Delegating Authority, One Health Technical Committee (OHTC). Periodic briefs shall be given to the OHTC status implementation of the AMS Guidelines and Toolkits. The OHTC shall further refer matters to the One Health Steering Committee (OHSC).

### County/Hospital Steering Committee

At the County level, the lead Departments (Health, Agriculture and Environment) shall establish or incorporate a **County CAMS-SC into existing coordinating platform,** comprising County Executive Committee or Board members, County Chief Officers of relevant Departments, Technical County Directors and experts; the CAMS-SCC will be responsible for approving budgets and work plans, resource mobilization and implementation of the AMS-Guidelines including the AMR NAP at the county level.

- About 15 members from the CHT (CHO, CDO & CSO), Administrators, Medical Directors, other doctors, Pharmacies, Nurses, Lab Supervisors IPC Focal Persons, etc) & partners.
- Meets Quarterly
- **Chairperson:** The CHO of each County
- **Deputy:** The Medical Director of each major referral Hospital.

## 2.3 Catchment and System Approach for addressing AMR

Adopting a system and catchment approach through which all actors relevant to strengthen the public health sector (Community health, health facilities, county/district health teams), especially in service delivery and emergency preparedness and response at all levels of the health system can actively operate and collaborate under the One-Health umbrella as depicted below in Figure 2 is core to ASP. The figure presents the concept of the catchment approach (simplified schematics) to embed system approach between different tiers of health services in coordination with Public Health and Animal Health in the implementation of AMS programs and the NAP on AMR. This approach is being used in Liberia, in the implementation of the Korea International Cooperation Agency (KOICA) Health Service Resilient Project and has been reported by all stakeholders (national, county, district, healthcare and community as useful.

A catchment and system approach would be useful in operationalizing AMS interventions at all levels of the health system while supporting interlinkages with human/public, environmental and animal health functions in Liberia. This would enable a system approach (both vertical and horizontal) for systematic consideration of quality such as AMS Team or QMT, and emergency preparedness implementation; community health programs, animal health workers; starting smaller number of county or facility in the first phase and gradually scaling-up as resources allow. The framework highlights the critical role of the community health systems in tackling AMR, especially fostering behavior change on non-judicious used antimicrobials, antibiotics.

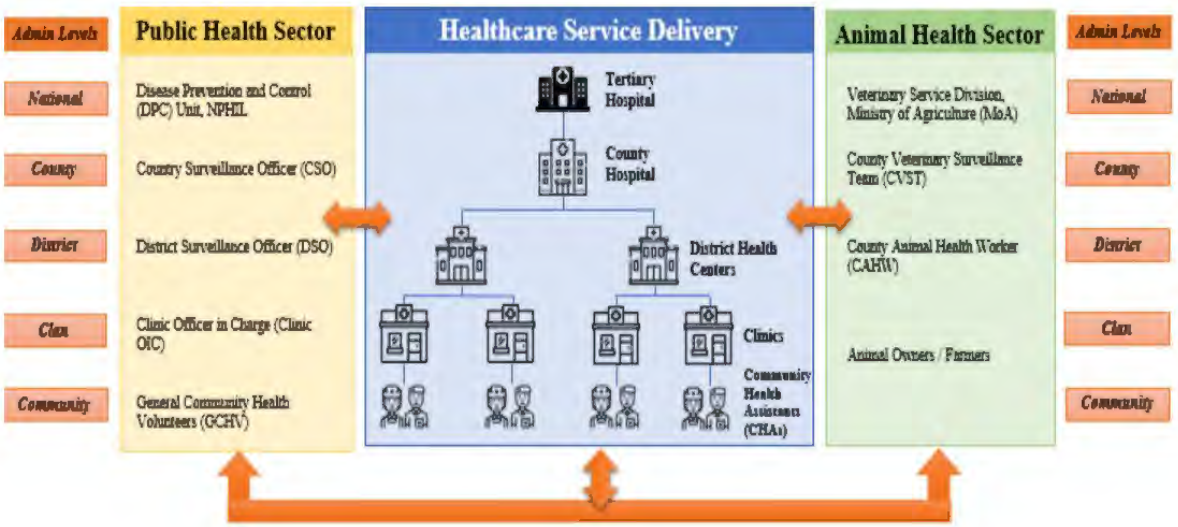



*Figure 2: Catchment and system approach across relevant sectors and administrative levels, adopted from the KOICA health service resilient project, country situational assessment report, 2019*

***Public Health Functions:*** DPC: Disease Prevention and Control; CSO: County Surveillance Officer; DSO: District Surveillance Officer; Clinic OIC: Clinic Officer in Charge; GCHV: General Community Health Volunteers.
***Healthcare Service Delivery:*** District HC: District Health Centre; CHA: Community Health Assistant
***Animal Health Functions (for Zoonotic Disease):*** MOA: Ministry of Agriculture; CVST: County Voluntary Surveillance Team; CAHW: Community Animal Health Worker. All play very critical roles in addressing AMR.

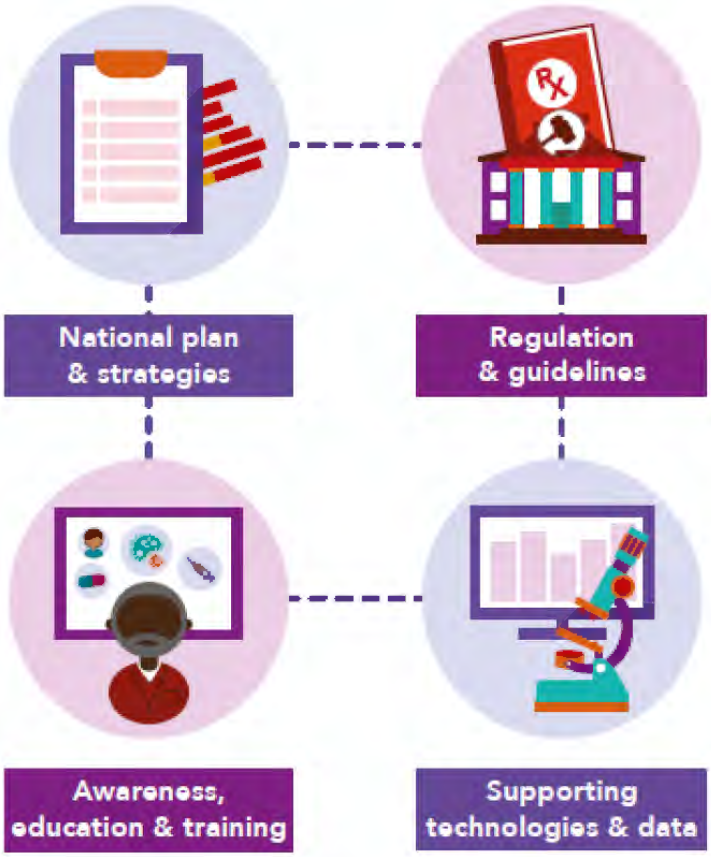



*Figure 3: National core elements for AMS programs*

## 2.3 Selecting the national core elements

A group of international experts conducted a literature review to identify key publications in developing the national core elements, which can be used by any country. A structured consensus procedure (>80%) was then used to identify core elements relevant to national AMS programs to enable healthcare facility AMS, and these elements were categorized based on resources required (ranging from basic to advanced). [12], [13]

## 2.4 How to use the national core elements

Decision makers responsible for national AMS programs are encouraged to go through the checklist, identify what is already in place and the level of implementation (see Figure 4), that is which core elements require accelerated implementation (partially implemented) and what is missing. A stepwise short- and medium/long-term implementation plan should be developed for the core elements that are prioritized as important by each facility based on availability of the needed resources.

A recommended place to start in establishing the national or subnational AMS program is to ensure leadership commitment to AMS by providing dedicated funding and human resources for the AMR and AMS activities; and putting in place a national TWG on AMS, education and training, surveillance of antibiotic use as part of a national monitoring system as well as standard treatment guidelines.

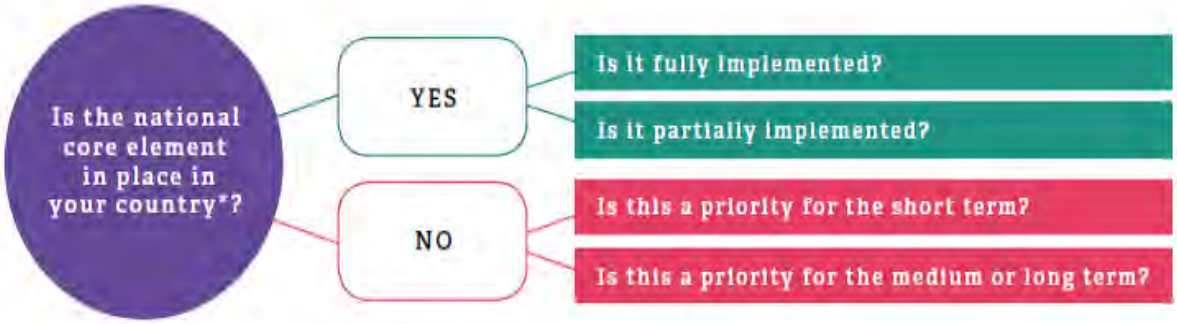



*Figure 4: A guide to exploring the national core elements checklist*

[12] Baur, D. et al. (2017). Effect of antibiotic stewardship on the incidence of infection and colonization with antibiotic-resistant bacteria and Clostridium difficile infection: a systematic review and meta-analysis. *Lancet Infect Dis. (9):*990–1001,

[13] US - CDC. (2018). Core elements of antibiotic stewardship programs in resource-limited settings. Atlanta, GA:

# 3. THE STRUCTURE FOR HEALTHCARE FACILITY AMS PROGRAMS

***Audience**: All health care workers (Healthcare facility leadership, hospital pharmacists, healthcare quality management team, including IPC Team and Quality Management Team or AMS Team), supply chain actors.*

## 3.1. Context

Different contexts and types of facilities will face different challenges at the healthcare facility level. A list of healthcare facility (HCF) core elements has been developed (see Figure 5) to guide facility management in building the structures required to enhance the implementation of sustainable AMS programs within the HCF.

## 3.2 Selecting the healthcare facility core elements

In developing the HCF core elements for AMS programs, experts have reviewed the key literature in particular the approach, suggesting additions and deletions and taking into account the low- and middle-income setting. A structured consensus procedure (>80%) was undertaken to develop the final list of core elements for healthcare facilities and the list was stratified based on the resources required (basic or advanced).

## 3.3 How to use the healthcare facility core elements

The HCF core elements in the checklist shown in ***Appendix 1*** have been stratified into basic core elements, requiring fewer resources and more advanced core elements, requiring more resources. However, this differentiation may be used from country to country and facility to facility based on size, needs, priorities, resources and context. Even within a small facility, the HCF administrator/manager, AMS committee and/or AMS team/person are encouraged to go through the checklist, identify which core elements are already in place and the level of implementation, what requires accelerated implementation and what is missing.

The AMS program therefore addresses AMR-related issues including IPC/WASH based on the various levels (primary, secondary and tertiary) of care and systems organization (shown in Table 1 on page 20), consistent with the national health policy and essential package for health services (EPHS), using key AMS modifiable structures, including the following:

*Table 1: Levels of healthcare and structures or composition of AMS Team/QMT*

| Clinic Level | Health Center Level | County Hospital Level | Tertiary Hospital Level |
|---|---|---|---|
| ▪ Office-in-Charge (OIC)<br>▪ Health Facility Development Chairman (HFDC)<br>▪ Midwife<br>▪ Lab Assistant<br>▪ Dispenser<br>▪ Hygienist/Cleaner<br>▪ Vaccinator<br>▪ IPC Focal Person (IPC FP)<br>▪ Community Health Workers (CHVs, CAWS) | ▪ Medical Director /OIC<br>▪ Administrator<br>▪ Pharmacist/Pharmacy Technician/Dispenser<br>▪ Nursing Director<br>▪ Maternal & Child Health Supervisor (MCH) Supervisor<br>▪ Environment Health Technician (EHT) Supervisor<br>▪ Physician Assistant<br>▪ Lab Technician/Assistant<br>▪ IPC Focal Person<br>▪ Anesthetist (when available)<br>▪ Vaccinator | ▪ Medical Director<br>▪ Pharmacist/Pharmacy Technician/Dispenser<br>▪ Nursing Director<br>▪ Physician Assistant<br>▪ MCH Supervisor<br>▪ EHT Supervisor<br>▪ Anesthetist<br>▪ Vaccinator<br>▪ Laboratory Supervisor<br>▪ IPC Focal Person<br>▪ Medical records or Data Manager<br>▪ IT Officer<br>▪ Unit Supervisors | ▪ Chief Educative Officer (CEO)<br>▪ Chief Medical Officer (CMO) or Deputy (CEO)<br>▪ Pharmacist<br>▪ Administrative<br>▪ Physician Assistant<br>▪ Nursing Director<br>▪ MCH Supervisor<br>▪ Anesthetists<br>▪ Laboratory Supervisor<br>▪ IPC Focal Person (IPC FP)<br>▪ Medical Records or Data Manager<br>▪ IT personnel |
| ***Note:*** *Other members could be specialist nurses, for example infection prevention or stewardship nurses, quality improvement, clinicians with an interest in infection or IPC.*<br><br>*The QMT is responsible for all quality management activities in the facility, including IPC (e.g. ensuring that the AMS Guidelines & Toolkits, AMR Action Plan, IPC Guidelines and related guidelines e.g. healthcare quality strategy, healthcare waste management are implemented and monitored). The exact composition of the QMT varies based on facility type. For more details, refer to the ToR for Healthcare Facility Quality Management Team, Annex 2 on page 85.* | | | |

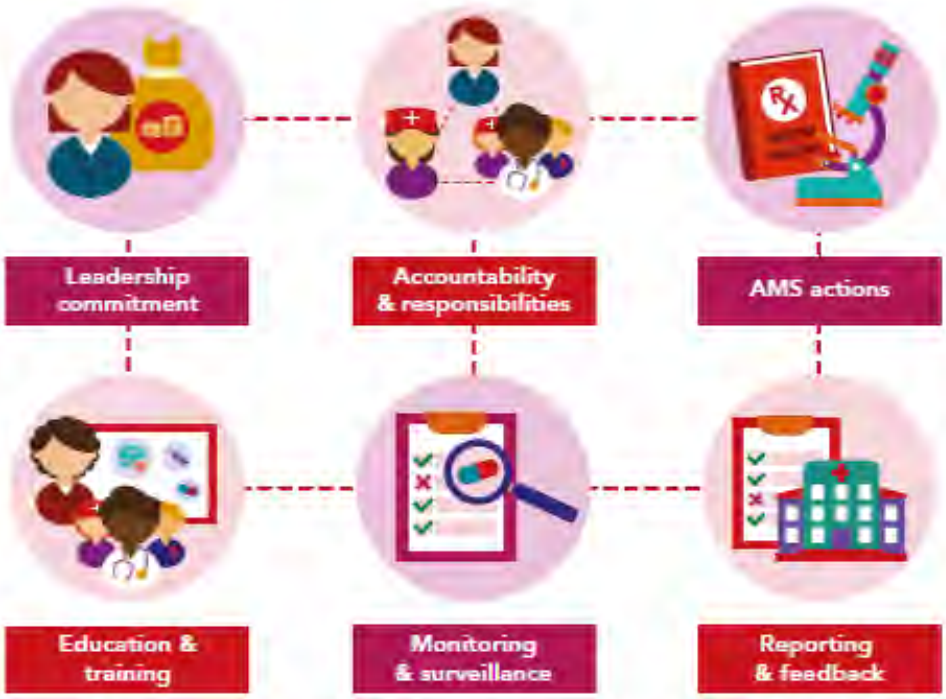



*Figure 5: Healthcare facility core elements for AMS programs in Liberia*

## *Leadership Commitment:*

- This involves dedicating necessary human, financial and information technology resources.
- Leadership support is critical to the success of AMS programs and can take a number of forms, including:
    - Ensuring that the facility has formal statements that supports efforts to improve and monitor antibiotic use (antibiotic stewardship).
    - Including stewardship-related duties in job descriptions and performance reviews.
    - Ensuring staff from relevant departments are given sufficient time to contribute to stewardship activities.
    - Supporting training and education.
- Integrating microbiology laboratory staff into the functions of the antibiotic stewardship program; their expertise is important in the areas of diagnostic stewardship, development of antibiograms to support optimal antibiotic use, the introduction of new diagnostic tests into the laboratory, the implementation of new AST interpretative criteria, and education of clinicians on laboratory testing practices.

## *Accountability:*

- Identify or appoint or leader or co-leaders (e.g. Physicians, Pharmacist, Nurses), responsible for AMS program activities management and outcomes.
- Accountability refers to the requirement of a person providing services or having some authority, to provide information or justification for their actions or services to another actor who has the power to make these demands and apply sanctions for non-

compliance.[14] Social accountability has the potential to improve the effectiveness and quality of services provided, to improve the responsiveness of public agencies and government to citizen demands and expectations, and to increase the ability of disadvantaged or poorly served sections of the community to claim their rights.[15]

### *AMS Action:*

- Implementing at least one recommended action, such as systemic evaluation of ongoing treatment need after a set period of initial treatment, i.e. "antibiotic time out" after 48 hours.
- Formal procedure for all clinicians to review the appropriateness of all antibiotics 48 hours after the initial orders (e.g. antibiotic time out).
- Specifying antibiotic agents that need to be approved by a physician or pharmacist prior to dispensing (i.e., pre-authorization) at your facility.
- Prescribers (e.g. physician or pharmacist review courses of therapy for specified antibiotic agents; i.e., prospective audit with feedback) at your facility.
- Conducting prospective audit and feedback; regularly reviewing the way AST is performed in the laboratory, the drugs tested, interpretation, and communicating results.

### *Education & training:*

- Educating clinicians about resistance and optimal prescribing.
- The AMS program should provide education to clinicians and other relevant staff on improving antibiotic prescribing:
    - Promote education and communication between the laboratory and clinicians about test characteristics (e.g., test performance, expected turn-around-time, etc.).
    - Teach staff about best practices in specimen collection.
    - Educate clinicians how to interpret test reports, including understanding report language used, such as categorical interpretations and understanding the principles behind selective reporting and how to contact the laboratory if questions arise regarding additional drug susceptibility results.

### *Monitoring & Surveillance:*

- Measurement is critical to identify opportunities for improvement and assess the impact of improvement efforts. For antibiotic stewardship, measurement may involve evaluation of both process (Are policies and guidelines being followed as expected?) and outcome (Have interventions improved antibiotic use and patient outcomes?).
- Track or monitor antibiotic prescribing and resistance patterns.

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[14] Lodenstein, E et al. 2016. Health provider responsiveness to social accountability initiatives in low-and middle-income countries: a realist review', *Health Policy and Planning*, vol. 32, no. 1, pp. 125-140.

[15] Patel, et al. 2009. Antibiotic use in neonatal intensive care units and adherence with Centers for Disease Control and Prevention 12 Step Campaign to Prevent Antimicrobial Resistance. *The Pediatric infectious disease journal*;28(12):1047–1051.

- AMS team works with hospital leadership, in-house information systems technology, electronic health record systems, or partners to enroll and successfully submit data to the GLASS Platform through the National AMR-TWG (***See Annex 27***).

## *Reporting and feedback:*

- Provide direct, personalized communication to prescribers on how they can improve their antibiotic prescribing
- Sharing facility-specific reports on antibiotic use with prescribers
- Regular reporting information on antibiotic use and resistance to doctors, nurses and relevant staff.
- At least annually, update institution antibiograms following published guidance by WHO.

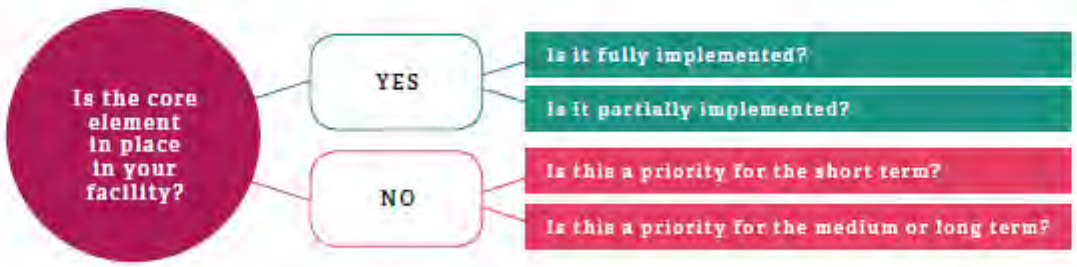



*Figure 6: Guide to navigating HF core elements checklist to identify, prioritize and develop a stepwise implementation plan*

This information will be useful in developing a stepwise implementation plan over the short, medium and long term for the prioritized missing core elements and accelerate implementation of existing ones at the national and subnational levels. For a small facility, it may be necessary to collaborate with other healthcare facilities to put certain core elements in place, e.g. AMS expertise, education and training, standard treatment guidelines and AMC surveillance.

The key components of the structure and governance of the AMS are:

1. Dedicated resources, including dedicated personnel time for stewardship activities, education, and measuring/monitoring antimicrobial use.
2. A multidisciplinary AS team [AST] with core membership of:
    - an infectious diseases physician (or lead doctor or physician champion)
    - a **clinical microbiologist**
    - a **clinical pharmacist** with expertise in infection.
3. Governance within the hospital's quality improvement and patient safety governance structure.
4. Clear lines of accountability between the chief executive, clinical governance, drug and therapeutics committee, IPC control committees and the AST. Annex 12, page 73 illustrates such an organization structure.

Other members could be specialist nurses, for example infection prevention and control focal person, stewardship nurses, quality improvement, risk management/patient safety managers and clinicians with an interest in infection.

# 4. PLANNING AN AMS PROGRAM IN A HEALTHCARE FACILITY

**Audience:** Healthcare facility leadership, Quality Management Team, IPC Team, AMS Committee or AMS Team.

## 4.1 Context

AMS programs in healthcare facilities should not be vertical programs, but cut across other existing programs to optimize antibiotic use, thereby improving quality of care and infection prevention, control and management.

Healthcare facilities are often differentiated as follows as per the EPHS:

- Government or Public, non-governmental organization (NGO/Not-for-profit), private-for-profit, Mission/Faith Based;
- Clinics, health centers, hospitals. There are also district county, regional and tertiary hospitals in Liberia.

Other settings or facilities of interest, where health services can be obtained include:

- Pharmaceutical outlets (Medicine Stores, Pharmacy);
- Veterinarian clinic with or without pharmacy;

Healthcare facilities may be with or without a fixed financial budget; with or without their own pharmacy; with or without an on-site microbiology laboratory.

Independent of the characteristics of the healthcare facility, including size, an AMS program should be adapted to the facility's human, financial, structural and organizational resources, and to the patient mix. An AMS program in a tertiary hospital (e.g. JKF Hospital), with different specialties will necessarily be larger and more complex than one in a district hospital (e.g. Kolahun Hospital). It is therefore important that healthcare facility management and an AMS committee and/or AMS team together decide which strategies best fit their local setting, based on a situational analysis and development of an action plan (Table 5, page 27). The implementation of an AMS program is a step-by-step dynamic process, with each facility building on what they already have in place.[16]This section provides insights that can help inform the design of healthcare facility AMS programs.

[16] Mendelson, M. et al. (2019). How to start an antimicrobial stewardship program in a hospital. *Clin Microbiol Infect*.

*Table 2: Planning for developing and implementing an AMS program in the healthcare facility*

| | |
|---|---|
| Situational or SWOT analysis | **Conduct a situational or SWOT analysis using the checklist of healthcare facility core elements to identify existing and missing (but priority) elements, as well as possible enablers or levers and barriers to implementing a facility AMS program. Pay attention to:**<br>• **Structures, policies and guidelines:** Identify which structures, policies and guidelines are in place and which are critically in need of being put in place according to the checklist of facility core elements (see Annex 1).<br>• **Human resources:** Identify the existing and required human resources, including competencies needed for a functioning governance structure for AMS, including the AMS Committee or AMS Team (QMT), and healthcare providers and other staff to be involved in implementing AMS activities.<br>• **Antimicrobial use and resistance data:** Review data on antimicrobial consumption and/or use, and identify challenges related to antibiotic prescribing practices in the facility and/or departments. Review existing surveillance data on AMR and aggregate antibiograms from the facility.<br>• **AMS activities:** Identify any existing AMS activities, including ad hoc in the facility/wards that can be built on and made sustainable. |
| Facility AMS action plan | Based on the situational analysis, develop a healthcare facility AMS action plan to ensure accountability, prioritize activities and measure progress. This should include the following key components:<br>• ***Core elements**:* Determine priority core elements to be implemented in the short, medium and long-terms, including accountability, timeline and indicator.<br>• ***Governance**:* Identify leadership commitment and oversight, and establish an AMS Committee (new or incorporated into an existing structure) and an AMS team that is endorsed by the facility leadership.<br>• ***AMS activities**:* Identify areas for improvement, implement AMS interventions (who, what, where, when and how), monitor and evaluate, and report and feedback the results.<br>• ***Healthcare facility-wide engagement**:* Ensure facility-wide engagement in the AMS program, and empower the Quality Management Team or AMS Team to undertake AMS interventions and monitor their implementation.<br>• ***Education and training**:* Identify competencies that need to be strengthened to effectively implement AMS, and develop a facility AMS education and training plan.<br>• ***Budget:** Develop a budget for the AMS program, including human and financial resources required for the day-to-day running of the program as well as for education and training of the AMS team and healthcare professionals. The budget should be endorsed by the HCF leadership.* |

## 4.2 Conducting a situational or SWOT analysis

Before an AMS program is developed and implemented, **a situational or SWOT analysis** should be performed. For AMS programs, this information is important in determining what needs to be done and what can be done. This analysis does not need to be a complex exercise, but rather a pragmatic one that includes the following:

- mapping which core elements are in place in the facility;
- undertaking a baseline antibiotic use analysis;
- identifying main challenges related to antibiotic prescribing and use; and

- identifying available human and financial resources.

The situational analysis should include:

- strengths, weaknesses, opportunities and threats
- (SWOT) and problem analysis at different levels in the facility
- possible barriers and enablers for the full participation
- different healthcare professionals and departments in the AMS program.

The situational or SWOT analysis will help the healthcare facility in developing a stepwise AMS action plan that identifies what is already in place (healthcare facility core elements), what needs to be put in place over time (short, medium & long-term priorities), the human resources needed (including champions), the composition of an AMS team and other core elements (including guidelines) based on the facility core elements checklist and priorities.

Table 3 on page 23 provides an example of a SWOT analysis for planning an AMS program in a healthcare facility. It lays out the strengths, weaknesses, opportunities and threats involved in determining how ready the facility is to implement AMS and paves the way for developing a facility AMS action plan.

Putting the core elements in place in the facility enables sustainable action on AMS, even if that means through collaboration with neighboring facilities. For example, if there is no facility antibiotic guideline or a pharmacist to analyze antimicrobial consumption data, an option may be to adopt the guideline from a neighboring facility with a similar context and collaborate with their pharmacist to analyze the AMC data.

*Table 3: Example of a SWOT analysis for AMS readiness in a healthcare facility*

| | Helpful | Harmful |
|---|---|---|
| INTERNAL/PRESENT FACTORS | **Strengths**<br>***Core elements:***<br>• Prescription audit is conducted in some wards.<br>• AMR and AMS are a leadership priority.<br>• IPC program, committee is active at national and subnational levels or structures in place<br>***Human resources:***<br>• Availability some personnel with enthusiasm for AMS in the facility, quality improvement.<br>***Antimicrobial use and resistance data:***<br>• Prescription audit is conducted in one ward.<br>• Available data tracking system (Electronic Logistics Management Information System or e-LMIS)<br>• Facility aggregate antibiogram is available.<br>***AMS activities:***<br>• A pharmacist is involved in some AMS activities in one ward. | **Weaknesses**<br>***Core elements:***<br>• No medical record or prescription chart is available<br>• Poor documentation<br>• Limited required guidelines e.g. AMS guidelines, STGs<br>• No standardized training curricular on AMR/AMS<br>• Limited buy-in from Government<br>***Human resources:***<br>• No dedicated healthcare professional is available to lead the AMS team.<br>• Limited or no define knowledge on AMR activities at health facility<br>• Demotivated staff & staff attrition<br>***Antimicrobial use and resistance data:***<br>• Limited supply of microbiology reagents<br>• Limited supply of antibiotics<br>***AMS activities:***<br>• Healthcare professionals have competing priorities and little time for AMS work.<br>• Limited compliance monitoring/feedback on use of guidelines, e.g. STGs. |
| EXTERNAL/FUTURE FACTORS | **Opportunities**<br>***Core elements:***<br>• Active implementation of the NAP on AMR<br>• Increasing national awareness of AMR and its consequences for health<br>• One Health Platform<br>• Available regulatory or health policy<br>***Human resources:***<br>• Incorporating AMS responsibility into the IPC committee<br>***Antimicrobial use and resistance data:***<br>• Funds for conducting a facility PPS<br>***AMS activities:***<br>• Presenting findings from AMS activities to other wards/ healthcare professionals | **Threats**<br>***Core elements:***<br>• Unstable/limited access to essential antibiotics<br>• Increased costs for antibiotics<br>• Prioritization of issues other than AMS in the facility<br>• Low budget for health facility<br>***Human resources:***<br>• Too many nonfunctional committees in the HF<br>***Antimicrobial use and resistance data***<br>• Increasing AMR rates, including carbapenem resistant Enterobacteriaceae (CRE)<br>***AMS activities:***<br>• Opposition from clinical leaders<br>• AMS activities implementation lack funding |

## 4.3 Identifying human resources

It is essential for the AMS Team to have a governance structure (Annex 12 found on page 73) that includes the different functions needed to effectively implement the healthcare facility AMS Program.[17] The governance structure may vary in size and complexity depending on the facility. The most important thing is to identify the responsibility and accountability of the facility management, and of those who are to coordinate and implement the AMS Program.

The healthcare facility leadership or management should formally endorse the facility AMS action plan and provide organizational and structural support by allocating the required financial and human resources for AMS activities. It is essential that the healthcare facility leadership or management endorse the healthcare facility AMS governance structure to empower the AMS committee, AMS Team and/or AMS champions to implement the AMS program effectively.

The healthcare **AMS Committee, also refers to in this document as the Healthcare Facility Quality Improvement Team (HFQMT)** should provide leadership and overall coordination of the AMS Program.

The AMS committee can be a stand-alone committee or be integrated into an existing structure, such as the infection control, patient safety or drug and therapeutics committee with clear terms of reference (ToR). It can be an opportunity to revitalize or empower existing committees. If integrated into an existing committee, AMS must be a standing item on the committee's agenda (see Sample ToR for AMS Committee in Annex 1). The chair of the AMS committee (representing the facility management) should be responsible for providing leadership support and is accountable for the overall implementation of the AMS program.

A **multidisciplinary AMS Team** (or individual, depending on availability and the size of the healthcare facility) of different healthcare professionals should be established, who collectively possess the competencies and undertake functions to successfully implement AMS programs in the healthcare facility. Ideally, the AMS team should comprise a prescribing clinician, a pharmacist, a nurse and a (clinical) microbiologist or laboratory technician in facilities with a microbiology laboratory (see the checklist of healthcare facility core elements Appendix 1). If available, an infectious disease physician, a clinical pharmacologist, and/or a nurse with expertise in IPC are also recommended. The nominated staff in the team need dedicated time to implement the program, and their AMS role should be in their job description and performance contract.

In addition, a **clinical leader** for the AMS team should be identified who has sufficient training in AMS or infection management to manage the most common issues.

**In smaller healthcare facility**, the AMS clinical leader may sometimes be the only member of the AMS program. Where the AMS clinical lead is not a doctor, one (inside or outside the facility) should be identified (on-site or off-site) to provide medical advice and support to the AMS team, can be led by a pharmacist or nurse, when required. Similarly, if a pharmacist is not

[17] Colligan, P, et al. (2018). Anthropological and socioeconomic factors contributing to global antimicrobial resistance: a univariate and multivariable analysis. *Lancet Planet Health; 398–405.*

a member of the AMS team on-site, it is useful to identify a pharmacist (inside or outside the facility) from whom advice can be sought.

In many settings a hierarchical healthcare facility structure may pose a barrier for this kind of teamwork. In such cases it may be important to formally endorse pharmacists and nurses as part of the AMS team. Moreover, the AMS team members should be given the responsibility and authority required to perform AMS activities, recognizing a team of different individuals and professions with complementary competencies provides for more opportunities to perform AMS interventions adapted to local clinical settings. Healthcare facility administrative and managerial support is essential.

The **skill sets of professionals** who traditionally undertake roles in AMS are defined below. How these human resources are secured and how AMS tasks are assigned depend on the local context, needs, resources, healthcare landscape and availability of expertise. Roles often require adaptation, with different professionals taking on different or multiple roles. Nevertheless, the emphasis must be to ensure that whoever undertakes the core tasks has the required generic skill sets and competencies. (See Section 7, page 76).

**Expertise in infection management** is provided by an infectious disease or infection specialist, or a physician with interest and experience in infectious diseases. In the AMS team this person is the main source for supporting prescribers in diagnosing and managing patients, including optimal use of antibiotics to treat infections. In addition, the infection management expert supports guideline development, pre-authorization and post-prescription AMS interventions, including review and feedback, and solicited or unsolicited consultations, as well as review and analysis of progress reports. The person also supports the development, coordination, dissemination, delivery and evaluation of educational programs, which are then included in the implementation of the AMS education strategy and framework. The physician often leads the AMS team, but increasingly pharmacists and nurses are taking on this role, while recognizing the need to be able to consult with a physician in certain areas of infection management.

**Expertise in antimicrobials** is often the domain of a pharmacist or pharmacologist (if available). In healthcare facilities they traditionally help to develop guidelines and formularies and oversee the purchasing and supply of antimicrobials, dispense antimicrobials in wards/units and review the prescription order, identify and find solutions to stock-outs and shortages, perform surveillance of AMC and use (e.g. AMC data, PPS or prescription audits), and participate in their analyses. In wards they perform reviews of antibiotics prescribed (through prospective or retrospective audit with feedback), optimize antibiotic dosing in patients with organ dysfunction and comorbidities, and promote best practice in prescribing, dispensing and administering medicines, including antibiotics.

**Expertise in patient care** is typically provided by nurses. They are considered crucial because they have first-hand information about patients. Focusing more on supporting optimal care and patient safety rather than strictly on antibiotic prescriptions; may facilitate greater engagement from nurses, as this is part of quality nursing care. This AMS team member should promote timely antibiotic administration without missing doses, therapeutic drug monitoring (if available), quality microbiological sampling and communication of laboratory results to prescribers to support antibiotic prescription decisions. Furthermore, nurses should encourage monitoring of patients' clinical progress and the side effects or ineffectiveness of medicines, identify opportunities to switch antibiotics from IV to oral and to monitor the correct handling

of patients' invasive devices. Nurses may engage in data collection for audits and surveillance of antimicrobial consumption and use, and educate patients, families and colleagues (if empowered by the healthcare facility leadership to do so) about optimal antimicrobial use as well as recommended IPC and water, sanitation and hygiene (WASH) behaviour and practices.

**Expertise in microbiology** is often provided by a microbiologist or laboratory technician to process samples for diagnosis and antibiotic susceptibility testing, and to feed back the results to the prescribers as well as to develop and regularly update the healthcare facility's aggregate antibiogram. Not all healthcare facilities have a microbiology laboratory; for smaller healthcare facilities, this service could be provided through collaboration with other facilities.

For effective and sustainable stewardship initiatives, the roles individual team members undertake may naturally change over time. For example, a nurse who initially had a supporting role in the AMS program may develop skills that will allow him or her to undertake surveillance, or an education or safety role, and a pharmacist may move from implementation to more of a governance role over time.

**Additional expertise** is essential to complement the skills of the AMS team, such as local champions and healthcare professionals who can participate in performing and facilitating stewardship interventions on their wards. Also, if a healthcare facility has a quality improvement, patient safety or IPC program (Box 3) with dedicated staff, securing some of their time to focus on AMS activities is advantageous.




*Figure 7: Example of an AMS governance structure for healthcare facilities in low-income countries*

## 4.4 Linkage between IPC and AMS

AMS and IPC are interlinked. The case study from Barbados (Box 3) is a good illustration of how AMS programs are often initiated in facilities or countries due to an outbreak of multidrug-resistant (MDR) bacteria. Likewise, it is often the same people involved in issues related to IPC and AMS both at the facility and the national levels. This is because IPC and AMS are two sides of the same coin when it comes to development and spread of AMR, optimizing antibiotic use and providing quality health care, as shown in Figure 8 and Box 4.

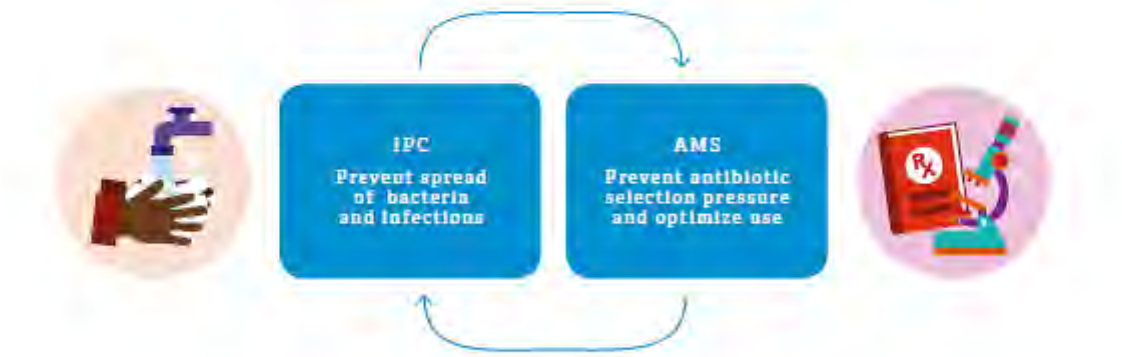



*Figure 8: Links between IPC and AMS in delivering quality health care and optimizing antibiotic use*

**Box 4**

**Core components of IPC and the link to AMS**

IPC is a practical, evidence-based approach which aims to prevent patients and healthcare workers (HCWs) from being colonized with bacteria or getting infections. The implementation of IPC interventions does not only prevent healthcare -associated infections and deaths, but also save money, reduce the spread of AMR and support high-quality, people centered health services.

Comprehensive and effective IPC consists of establishing IPC programs with strong links to other program, e.g. AMS programs and other initiatives addressing AMR. According to the relevant WHO core components guidelines, implementing IPC promotes adoption of appropriate IPC practices during healthcare delivery, thus enhancing patient safety and quality of care (Figure 7). This approach is complementary to that of AMS, which aims to prevent the spread of MDR bacteria and infections by reducing overuse and misuse of antibiotics. Both IPC and AMS are interdependent program programs that require coordinated efforts and interventions to achieve the greatest impact.




*Figure 9: Linkage of AMS and the IPC core components*

## 4.5 Use of antibiotics in healthcare facility settings

The main purpose of collecting data on the use of antibiotics is to assess the extent and quality of antibiotic use, identify problematic prescribing practices, and compare appropriate use across healthcare facilities and within a healthcare facility, department or ward over time. Measuring the quantity and appropriateness of antibiotic prescribing and use will identify where there is room for improvement in targeting and monitoring AMS interventions.

The human and IT resources required for collecting this data are often regarded as a barrier to effective measurement. Therefore, it is advised to collect only the data essential for providing feedback to healthcare professionals on their antibiotic use and to try to get them involved in the data collection. Integrating data collection as part of the requirements for other initiatives

(e.g. infection control, patient safety and antisepsis programs) is also an efficient way to collect critical data without duplication. Data should be collected according to a protocol, and the data quality should be validated. Although electronic data collection is ideal, paper-based collection is very common and acceptable.

Three main types of antibiotic data are used to provide baseline information and evaluate AMS interventions. Each type of data – antibiotic consumption, antibiotic use and antibiotic audit data – has advantages and disadvantages. Different data sets require different data sources, as shown in Figure 10 on antimicrobial consumption vs antibiotic use data sources.

Using these data for AMS programs requires certain drug expertise as well as knowledge and training in data collection, management and analysis. For more detailed information on how to assess the impact of AMS programs, see the structural indicators in the healthcare facility core elements checklist (Appendix 1), and advice on assessing AMS programs in Section 6.

### 4.5.1 Quantity – Antimicrobial consumption (AMC) data

Consumption data is very important part of surveillance activities. Surveillance contains both microbiology data and consumption data. Consumption or used refers to estimates that are derived from aggregated data sources, mainly procurement and dispensing data, and serves as a proxy for actual antibiotic use. These data sources do not contain any patient information or treatment indications, but they can provide an estimate on the quantity and types of medicines consumed at the national, subnational or facility level over time. Data should be collected according to a protocol from a recognized international methodology such as the WHO methodology on national/hospital surveillance of AMC.[18] This can be collected at the national or healthcare facility level and stratified using the AWaRe classification and/or other relevant clinical categories. A step-by-step guide on setting up a national AMC surveillance program at the facility level is shown in Box 5 on page 15.

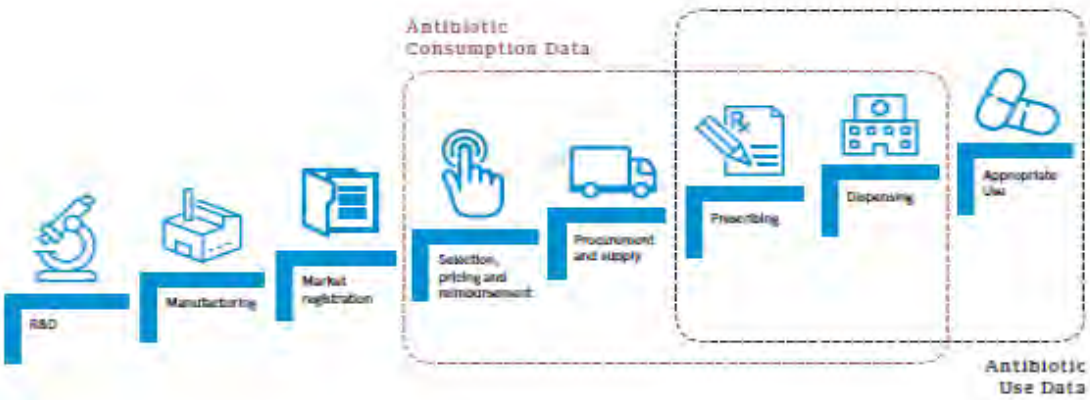



*Figure 10: Pharmaceutical value chain indicating potential data sources for surveillance of antimicrobial consumption and use*

[18] WHO. (2019). WHO methodology for a global programme on surveillance of antimicrobial consumption. Version 1.0. Geneva: WHO
(http://www.who.int/medicines/areas/rational_use/ WHO_AMC surveillance, accessed 15 May 2020.

**Box 5**

**Step-by-step guide for setting up an AMC surveillance program at the facility level**

**Step 1: Structures and governance**

- Appoint a person/team to manage and coordinate the local surveillance system at the facility level (part of an already existing structure such as the AMS or IPC committee).
- Assign tasks and responsibilities with clear terms of reference.

**Step 2: Objectives and methodology**

- Define the objectives and outputs of the facility surveillance program.
- Determine the surveillance framework with respect to hospital structure, antimicrobial classes and frequency of data collection.
- Identify the sources of consumption data and the type of hospital activity indicator.

**Step 3: Data collection and validation**

- Collect consumption and hospital activity data.
- Validate and clean the data**.**

**Step 4: Data analysis and reporting**

- Identify the target groups for the results.
- Analyze and report data, taking into account the identified target groups.
- If applicable, report the data to the national surveillance system.

**Step 5: Use of the data and follow-up**

- Support the AMS and hospital medicines management in analyzing the data.
- Improve the system to meet the requirements of the target groups.

Data on antimicrobial consumption are often readily available and measured using the WHO ATC/DDD (Anatomical Therapeutic Chemical Classification/ Defined Daily Dose) methodology. This method refers to routine surveillance of existing data at no additional cost. Data at the facility level are collected from procurement, and dispensing data are ascertained from the facility pharmacy or other available sources along with the number of occupied beds or patient admissions during the study period.

Independent of how the data are obtained, there are several possible sources of error. For example, the facility purchase data may not capture all the antibiotics used in the facility, or the facility may accept donations outside the formal procurement process. If there is no fixed population per healthcare facility, it may be difficult to calculate the denominator. Because the information is not as detailed as in a PPS or audit study, and the indication is missing, consumption data ensure only the quantity and types of antibiotics, not the quality of prescribing. Nonetheless, this method still provides a valuable estimate, especially for analyzing trends. Expressing antimicrobial consumption in DDDs for pediatric populations is biased, as dosage is often age and weight dependent, with marked differences to adult DDDs.

### 5.1.2 Quality – Antibiotic use data (PPS)

Antibiotic use data refers to estimates derived from individual patient data and may include information on patient characteristics and indications for treatment. Collection of use data is more resource demanding than consumption data, but the additional information provided is important for e.g. AMS programs and to identify areas for improving antibiotic use. Point

prevalence survey is the collection of antibiotic treatment data from hospitalized inpatients (all patients or a sample) at a point in time according to a recognized international methodology such as the WHO methodology for PPS on antibiotic use in hospitals. A step-by-step guide for setting up a health facility PPS is shown in Box 6.

The healthcare facility PPS data provide an overview of how antibiotics are used in a facility. A PPS also allows assessment of compliance to guidelines because it includes more specific data, such as indications for antibiotic treatment, prescribed antibiotic (s), dosage, timing of administration of first dose, dose interval and drug administration route, though not duration of treatment. It is recommended that local PPSs be performed regularly. A PPS can be integrated with other surveys (e.g. of surgical site infections) to optimize resources.

**Limitation***:* Data are collected at a point in time (5–7 days) and may not be representative, as less frequent practices might be missed. Conversely, if data are collected during outbreaks, higher use would be reported. Doing a PPS is more resource-intensive than collecting antimicrobial consumption data, as data are collected on individual patients.

### 4.5.3 Quality – Antibiotic audit data

Antibiotic audit refers to the prospective (real-time) or retrospective collection of antibiotic prescription data on hospitalized patients. The data are analyzed and then fed back to the prescribers. Though auditing may sometimes be laborious, it is an essential part of any AMS program and should be encouraged.[19] This method can begin with weekly or bimonthly quick audits (only a few patients) during ward rounds, with real-time feedback to the prescribers, similar to a repeated and small-scale PPS. For more detailed information and examples, see Chapter 5.8 on prospective and retrospective audit with feedback.

[19] Ivers, N. et al. (2012). Audit and feedback: effects on professional practice and healthcare outcomes. *Cochrane Database Syst Rev*. June 13;6:

**Box 6**

**Step-by-step guide for setting up a healthcare facility PPS**

**Step 1: Structures and governance**

- Identify the team/committee in the facility with the overarching responsibility for the PPS, often the committee also responsible for AMS.
- As part of this team/committee, appoint a facility PPS focal point responsible for coordination and day-to-day management of the survey and investigators (surveyors).

**Step 2: Objectives and methodology**

- Define the objectives and output of the PPS in the facility.
- Select a standardized PPS protocol for the survey, e.g. WHO PPS protocol, Global PPS.
- Train the hospital PPS focal point, team and investigators in the methodology**.**

**Step 3: Preparation**

- Obtain ethical approval and or other necessary permissions to undertake the survey.
- Agree on the days for conducting the surveys in the respective wards.
- Prepare the necessary materials for undertaking the survey.

**Step 4: Data collection and validation**

- Conduct a pilot survey in one ward to validate the data, and operationalize the survey procedures.
- Conduct the survey in all wards according to predefined timelines.
- Transfer data from paper to electronic format when applicable, and validate the data**.**

**Step 5: Data analyses and reporting**

- Clean and analyze the data based on a predefined data analysis plan according to target groups.
- Report results to the responsible team/committee, the facility management, etc.
- Identify areas for improving antimicrobial prescribing and use based on results, and agree on AMS interventions to address these areas.
- Monitor and evaluate the AMS interventions with e.g. a targeted PPS or audits**.**

## 4.6 Essential Medicines List (EML) and AWaRe classification (WHO, 2019)

The EML AWaRe classification of commonly used antibiotics into three groups – ACCESS, WATCH and RESERVE – provides a tool to support antibiotic monitoring and AMS activities, with recommendations on when to use the antibiotics in each category. Selected AWaRe antibiotics are included on the WHO Model EMLs as recommended treatment options for specific infectious syndromes (Figure 11).

The AWaRe database, along with further guidance on how to apply the WHO AWaRe classification for developing and updating national EMLs, developing and updating treatment guidelines, and for monitoring AMC/U (including more intense surveillance of the RESERVE antibiotics) are available on the WHO website. Some examples of how the AWaRe classifications can be incorporated at the national level to enable HCF AMS include:

- review/update national EMLs with AWaRe groups;
- review/update SDGs with AWaRe groups;
- align empirical antibiotic treatment guidelines with ACCESS antibiotics;
- target WATCH and RESERVE groups for AMS;
- review antimicrobial consumption and use surveillance data with AWaRe; and/or
- include in health professional curricula.

**Note**: The antibiotic categorization under AWaRe in Liberia will be reproduced and disseminated to all healthcare facilities once adapted and adopted in the revised National Standard Therapeutic Guidelines and Essential Medicines List and or the National Formulary.

Stratifying total antimicrobial consumption data by the AWaRe groups can be undertaken at multiple levels, including at the national (state/regional), facility and ward level. This allows benchmarking and overall monitoring of national and global progress towards WHO's goal of increasing the proportion of global consumption of antibiotics in the ACCESS group to ≥60%.51 Figure 12 shows an example of how the AWaRe groups can be integrated into national AMC surveillance data to highlight the proportion of AMC the categories.

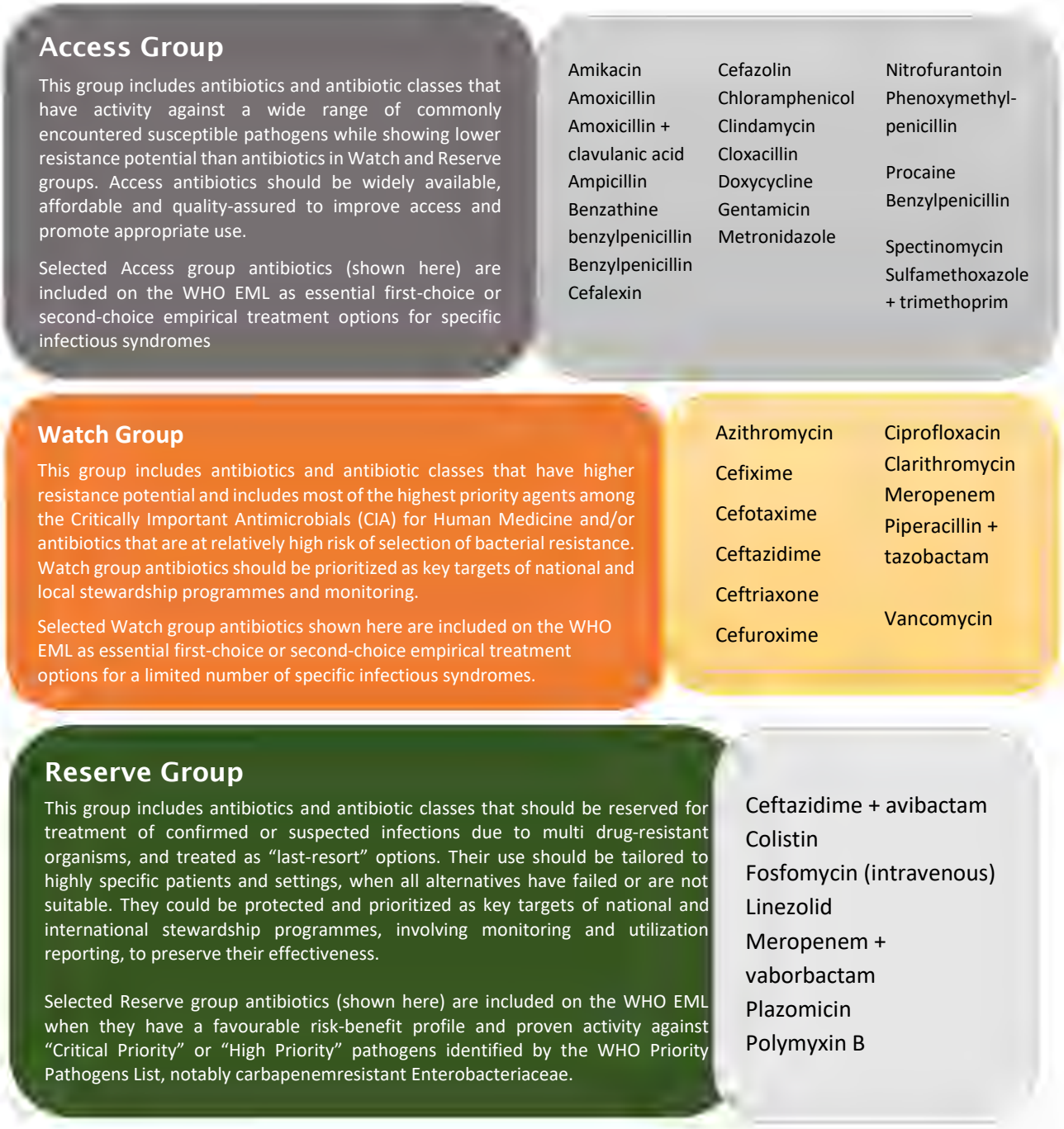



Figure 11: Overview of the WHO AWaRe groups and essential antibiotics on the WHO EM

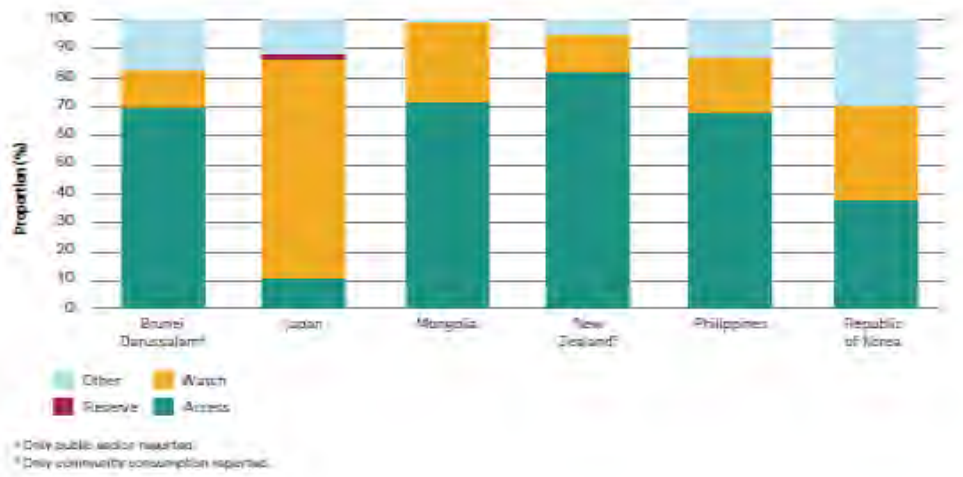



*Figure 12: Proportional consumption of antibiotics by AWaRe classification in six countries of the Western Pacific Region, 2015*

## 4.8 Microbiology

Most patients, both in hospitals and in primary healthcare settings, receive initial antibiotic treatment based on a clinical assessment, without the use of microbiological tests. Treatment is chosen according to the microbes that are most likely to cause different infections.

This strategy works well when resistance rates are low, or AMR surveillance can guide recommendations for empirical antibiotic treatment. There is a need for affordable, sensitive, specific and rapid diagnostic tests that provide prescribers with quality-assured information about whether or not a patient has a bacterial infection, and which antibiotics the causative bacteria are sensitive to. Microbiology laboratories play a key role in informing the appropriate use of (ACCESS) antibiotics, ensuring first and second-line antibiotics are used as possible. The quality of clinical diagnosis is essential, as the tests need to be interpreted in light of it.

Many countries, and healthcare facilities lack appropriate microbiology laboratories with external quality assurance and microbiology expertise altogether. However, with the implementation of NAP on AMR, countries are encouraged to collect and analyze local resistance data and establish national AMR surveillance systems reporting to GLASS. A brief introduction to GLASS is in Box 7.

**Box 7**

**Snapshot of GLASS**

Launched in 2015, GLASS is being developed to support the Global Action Plan on AMR. The aim is to support global surveillance and research in order to strengthen the evidence base on AMR and antimicrobial use and to help inform decision-making and drive national, regional and global actions.

GLASS promotes and supports a standardized approach to the collection, analysis and sharing of AMR and antimicrobial consumption or use data at a global level. GLASS does this by encouraging and facilitating the establishment of national AMR surveillance systems capable of monitoring AMR and antimicrobial use trends and producing reliable and comparable data.

**GLASS objectives:**

- Foster national surveillance systems and harmonized global standards;
- Analyze and report global data on AMR and antimicrobial use on a regular basis;
- Estimate the extent and burden of AMR globally by selected indicators;
- Detect emerging resistance and its international spread;
- Inform implementation of targeted prevention and control programs; and assess the impact of interventions

Countries benefit from participation in GLASS through enhanced capacity building, access to training and implementation tools, and support in collecting AMR and antimicrobial use data at the local (HCF, District and County); and national levels.

Efforts are being made to meet country needs, including capacity building for specimen collection, antibiotic susceptibility testing and IT systems for analyzing AMR patient data (using the GLASS Platform in Liberia. [20]

The main function of microbiologists (or laboratory technicians) in an AMS program is to interpret and communicate microbiology results to prescribers, and to develop and update antibiograms and communicate their value and limitations. Microbiologists support the AMS Team or QMT in developing antibiotic guidelines and policy based on local resistance surveillance, and to educate clinical staff on quality sampling for microbiology testing and AMR rates. In addition, microbiologists require support from the AMS Team to ensure they receive basic demographic and clinical data to help in analyzing laboratory results. Finally, where possible, microbiologists support the AMS Team or QMT by reporting on MDR organisms and selectively reporting susceptibility data to the facility management and prescribers.

[20] WHO. 2016. Diagnostic stewardship: a guide to implementation in AMR surveillance sites. Geneva: WHO.

# 5. PERFORMING AMS INTERVENTIONS IN A HEALTHCARE FACILITY

**Audience:** *Multidisciplinary Healthcare Quality Management Team or AMS Team.*

## 5.1 Implementing an AMS Program

One main outcome of performing AMS interventions in a healthcare facility is behaviour change in antibiotic prescribing practices, leading to more responsible use of antibiotics. Implementing AMS programs is a strategy for changing this behaviour over time.

The HCF core elements reflect some of the evidence that has been shown to inform clinical or professional practice, e.g. leadership commitment, data on antimicrobial consumption and use, standard treatment guidelines, and AMS or QMT Teams and Champions. **SWOT analysis** is important in highlighting possible barriers and enablers to implementation of an AMS program (e.g. data on antimicrobial consumption and use), helping to identify areas for improvement and monitoring use over time. The HCF AMS Action Plan provides an overview of the facility AMS program with overall goals, how they will be reached and by whom, and how progress will be measured. However, having a plan is not enough - it must be implemented.

However, intrinsic factors may also influence antibiotic prescribing behaviour and need to be addressed. Examples of intrinsic factors include the following:

- Perception that AMR is an immediate threat (due to lack of awareness, knowledge, attitude about AMR);
- Fear of losing a patient;
- Belief that broad-spectrum antibiotics are very effective and low risk;
- Influence of a senior physician's preferences on a junior physician's prescribing;
- Physician autonomy in prescribing what he or she thinks is best;
- Provider's uncertainty about cause of illness (inadequate microbiology lab services);
- Treatment history; and
- Drugs (antibiotics) availability.

Antibiotic prescribing practices are complex process associated with both intrinsic (prescribers) and external (patients and institutional environments). Besides educating prescribers (e.g., in-service, or continuing education or training), it is equally important, if not more to educate patients, break incentives and nurture professional culture within the institution. External factors both in individual level (patient pressure, i.e., expectations for antibiotics, time pressure, and financial incentives); and institutional level (setting and socio-economic development or factor) - are potential determinants of antibiotic use, with physician's actual practices. Regulations and surveillance of drug supply is also key.

Consequently, when performing AMS interventions, they must be tailored to address the different factors that may influence antibiotic prescribing and use in a specific context. Two ways of tailoring AMS interventions are to involve clinical staff in identifying local or HCF targets for improving antibiotic use (section 5.3, page 21) and to have a systematic approach to

implementing AMS interventions, review progress over time and make changes when appropriate, such as over-prescribing of antibiotics (Section 5.4).

## 5. 2 Implementing AMS interventions and behaviour change

It is often said that using evidence-based interventions is no guarantee of success, because success depends on implementing the interventions. Implementation research is defined as "**methods to promote the uptake of proven clinical treatments, practices, organizational and management interventions into routine practice, and hence to improve health**." It identifies the behavior of healthcare professionals and healthcare organizations as key sources of variance requiring improved empirical and theoretical understanding before effective uptake can be reliably achieved.[21] Hence, implementing evidence-based AMS interventions to change prescribing behaviour means taking into account factors that influence prescribing and use at the facility, department, unit or ward level. Many structural and organizational factors, also called extrinsic factors, are addressed in developing a facility AMS program/action plan.

## 5.3 Identifying local or healthcare facility targets for improving antibiotic use

Table 4 below lists some common, generic areas for improving antibiotic prescribing. In a smaller facility, the overall goal identified in the AMS action plan may be sufficient, and the same AMS interventions may be implemented over the whole facility. However, in a larger facility, a surgical department may have different priorities to a medical department. In that case, it is more meaningful for each department to set their own SMART (specific, measurable, achievable, relevant, time-bound) goals.

## 5.4 A systematic approach to implementing AMS interventions

The continuous quality improvement model provides a systematic approach for involving clinical staff in AMS team efforts to set SMART goals for change, tailoring and implementing interventions appropriate for the context, and assessing their success. This model can be applied at the facility level in small facilities or at departmental or ward level in larger facilities. For assessing the outcomes of AMS interventions, see Section 6. It is important to agree on a set time period (e.g. 3–6 months) to review the impact of AMS interventions and adjust them accordingly.

***Key message:*** **"**AMS interventions should be implemented in a stepwise approach, build on existing structures and reporting, maximize teamwork, and encourage champions and clinical staff – including prescribers – to participate. Start small and keep it simple and doable."

[21] Implementation Science (https://implementationscience.biomedcentral.com/about, accessed 15th August 2021).

*Table 4: Twelve common areas for improving antibiotic prescribing*

| SN | Prescription | What to improve |
|---|---|---|
| 1 | Overprescribing | Antibiotics are prescribed when not needed, e.g. fever without evidence of infection, asymptomatic urinary tract colonization, viral infections, malaria, inflammatory conditions. |
| 2 | Overly broad spectrum | More broad-spectrum antibiotics (WATCH and RESERVE antibiotics) are prescribed than are necessary (e.g. surgical prophylaxis). |
| 3 | Unnecessary combination therapy, e.g. certain fixed dose combinations | Multiple antibiotics are used, particularly with overlapping spectra and in combinations that have not been shown to improve clinical outcomes. |
| 4 | Wrong antibiotic choice | Wrong antibiotic(s) are prescribed for particular indications/infections |
| 5 | Wrong dose | Antibiotics are prescribed with the wrong dose (over- or under-dosing). |
| 6 | Wrong dose interval | Antibiotics are prescribed with the wrong dose interval (too much time between doses). |
| 7 | Wrong route | Antibiotics are prescribed by the wrong route (e.g. IV instead of oral). |
| 8 | Wrong duration | Duration of antibiotic treatment should be optimized (e.g. antibiotics prescribed for too long a period, prolonged surgical prophylaxis. |
| 9 | 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. |
| 10 | Unclear prescriptions | At times prescriptions or orders are not clearly or legibly written by clinicians |
| 11 | Wrong dispensing | Educational interventions (to improve prescription and dispensing of antibiotics); persuading clinicians to modify their practice performance by communication clinical information and communication skills; group-sessions rounds, conferences, lecturers, seminars, feedback to prescribers, reminders, patient education, etc. |
| 12 | Different forms of prescription (generic name) | Antibiotics are prescribed by the wrong names (generic vs trade names). One form of prescription (generic name) should be prioritized |

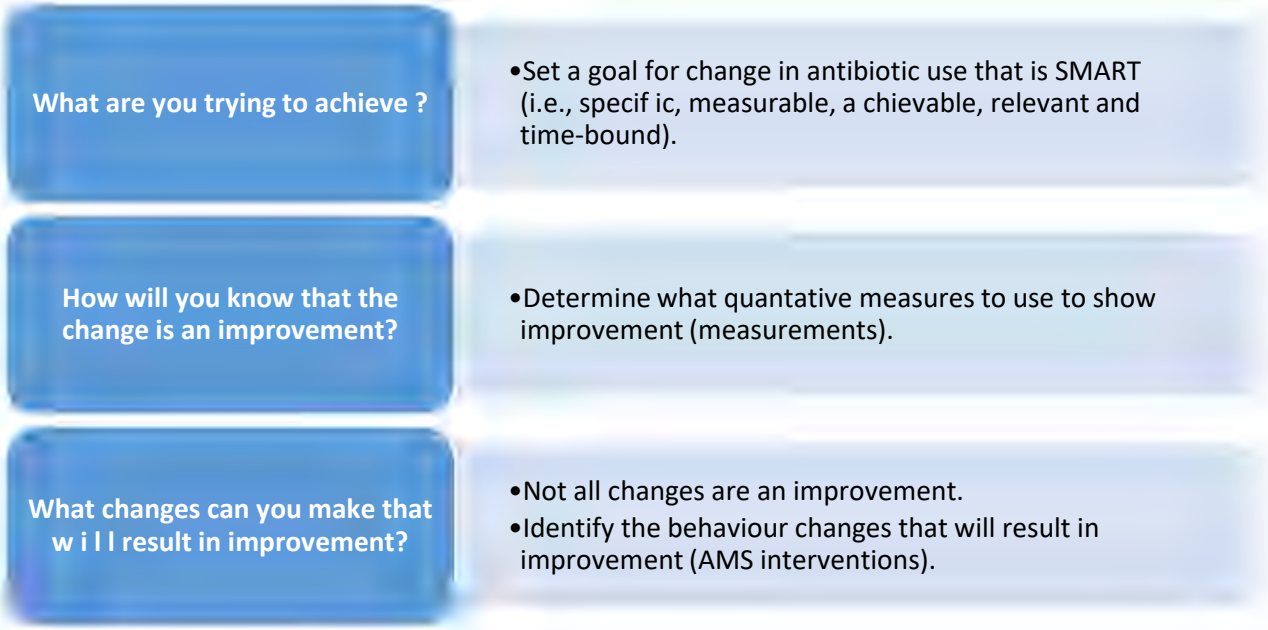



*Figure 13: Questions to address when applying the quality improvement model for AMS interventions*




*Figure 14: Quality-improvement model following the continuous improvement cycle*

| | |
|---|---|
| 1. Prepare | •Map possible enablers (champions) and barriers in the unit.<br>•Obtain managers' and champions' commitment to change.<br>•Prepare to talk about AMR, the unit's antibiotic use and "what can be done" (AMS). |
| 2. Plan | • Present the AMR problem, challenges in antibiotic use and discuss "what we can do".<br>•Set SMART goals for changing the unit's antibiotic use<br>•Decide on AMS interventions, how to implement them and how to measure change. |
| 3.Do | •Perform AMS interventions (e.g. education, ward rounds and audit) and measurements (See Annex 4 on page 81 for AMS review form). |
| 4.Study | •Analyse the measures (process and outcome). What do they show?<br>•Evaluate AMS interventions and their implementation. To be continued or changed?<br>•Prepare to discuss the results, AMS interventions and implementation with the units<br>•Review resource use and costs, and determine whether there have been savings. |
| 5.Adjust | •Discuss the results and AMS interventions with the unit.<br>•Agree on any adjustments to the AMS interventions, implementation and measurement<br>•Follow up with a continuous improvement cycle (Plan, Do, Study, Adjust). |

*Figure 15: The quality-improvement model-more details*

## 5.5 Basic AMS Interventions

AMS interventions can be performed in all types of healthcare facilities. The interventions should align with local needs and address areas where observations or data suggest the need for improvement, and/or where the outcomes of the implemented interventions are measurable.

In facilities where many core elements are not yet in place, the simple interventions shown in Box 8 may be a place to start to improve antibiotic prescribing. These interventions can be implemented one at a time or in a bundle.

The AMS review form in Annex 4 can be used/adapted to collect data needed to measure change in the areas listed in Box 8 for improvement involving reviews.

**Box 8: Basic AMS Interventions**

1. Educate: prescribers, health personnel involved in antibiotic use and patients. (See Section 7, page 76).
2. Develop and update a standardized medical record and medical chart to ensure that information on patients' medicines is all in one place (see Annex VI).
3. Review whether patients who receive antibiotic treatment have written indications.
4. Review antibiotic treatment for patients prescribed three or more broad-spectrum antibiotics.
5. Review the dose of antibiotics prescribed.
6. Review surgical antibiotic prophylaxis where it is prescribed for >24 hours and where a single dose is appropriate.
7. Develop local guidelines for surgical prophylaxis and treatment of common clinical conditions such as community acquired pneumonia, UTIs, skin and soft tissue infection (SSTIs), as well as common HAIs such as pneumonia, UTIs and catheter-related infections.
8. Work to ensure leadership and identify expertise in infection management.
9. Improve the supply and management of medicines, including essential antibiotics, e.g. by establishing a drug and therapeutics committee.
10. Work to establish basic microbiology laboratory facilities.
11. Work to establish regular surveillance activities (e.g. AMR, AMC/U, HAIs).

## 5.6 Moving beyond basic AMS interventions

To fully benefit from an AMS program, facilities should aspire to put core elements for healthcare facilities in place, including to secure supplies of essential antibiotics, provide treatment guidelines and establish a multidisciplinary AMS Team. An option for smaller HCFs may be to collaborate with other HCFs on certain areas, i.e. developing guidelines, expertise, microbiology laboratory services, etc. This will facilitate the necessary structures, expertise and skills to implement more AMS interventions aimed at improving antibiotic prescribing related to treatment – diagnosis, and prescribe, review and stop treatment (Figure 17) – and to surgical prophylaxis indication, and prescribe and stop prophylaxis (Figure 18). This in turn will improve not only antibiotic prescribing, but also dispensing and use.




*Figure 16: Appropriate antibiotic treatment – indication and prescribe, review and stop treatment*




*Figure 17: Appropriate antibiotic surgical prophylaxis – indication, and prescribe and stop prophylaxis*

* Antibiotic prophylaxis should not be prescribed for more than 24 hours after surgery. Beyond that, evidence is lacking to show reduced rates of complications, including surgical site infections.

## 5.7 More detailed AMS interventions to improve antibiotic prescribing

Different types of AMS interventions (in Table 5) included in facility AMS programs to improve antibiotic prescribing have proven successful. To bring about change in antibiotic prescribing, a bundle of AMS interventions or multimodal strategy is often implemented. These may include (Table 6) educational outreach (formal or informal), and/or audit and feedback activities (real-time, either written or oral, or retrospective) and/or restrictive interventions, such as pre-authorization of targeted antibiotics. Restrictive interventions have been shown to provide quick positive results in reducing antibiotic use. However, after around 6 months, restrictive and persuasive interventions are equally effective. Finally, structural interventions which often refer to IT interventions have also proven to promote more appropriate antibiotic prescribing.

It may be useful to change things up over time, either to switch the target for change and/or what interventions are performed, and/or how they are performed. This is where local context and local expertise come in play. Each facility, department, unit and ward can try different ways to target change, and tailor the AMS interventions to their own setting.

Table 5 below identifies AMS interventions to improve antibiotic prescribing practices. The ease or difficulty of implementation will depend on the availability of local resources and competencies. Facilities need to prioritize interventions based on resources available, and to ensure that local or regional networking and sharing of resources, including e-learning resources, are considered to support their implementation.

*Table 5: Types of AMS interventions for improving antibiotic prescribing practices*

| SN | Intervention | What it is |
|---|---|---|
| 1 | Persuasive education | • Educational meetings (e.g. basics on antibiotic use, case-based discussions, morbidity and mortality, significant event analysis, lectures on specified topics<br>• Distribution of, and training on educational material (e.g. clinical practice guidelines)<br>• Using local key opinion leaders (champions) to advocate for key messages<br>• Reminders provided verbally, on paper or electronically<br>• AMS e-learning resources made available to all healthcare personnel<br>• AMS education as part of continuing medical education, in-service |
| 2 | Persuasive (feedback) | • Audit with feedback to prescribers on their prescribing practice<br>• AMS as a component of ward rounds (real-time feedback with educational component), discussing cases<br>• Patient handover meetings between two shifts with real-time feedback by consultants<br>• Reassessment of antibiotic prescriptions, with streamlining and de-escalation of therapy<br>• Local consensus processes for changes in antibiotic treatment or surgical prophylaxis |
| 3 | Restrictive | • Formulary restriction<br>• Restricted prescribing of identified antibiotics (expert approval prior to prescription) (see Annex V)<br>• Compulsory order forms for targeted antibiotics<br>• Automatic stop orders (e.g. after a single dose of surgical |
| 4 | Structural | • Rapid laboratory testing made available<br>• Therapeutic drug monitoring |

*Table 6: Comprehensive list of AMS interventions for improving antibiotic prescribing practices*

| Intervention | How to do it | Advantages | Disadvantages |
|---|---|---|---|
| **Education**<br>Formal or informal teaching and training to engage prescribers and other HCWs in improving antibiotic prescribing, dispensing and administration practices. | Basic and continuous education of clinical staff, clinical case discussions, classes and regular sharing of information, reminders and AMS e-learning resources. | • Can be performed by well-informed HCWs in informal settings (i.e. ward rounds).<br>• Necessary for better adoption of most AMS interventions.<br>• Improve prescribing behaviour when combined with other AMS interventions (bundle). | Few AMS team members a barrier for formal training of HCWs. |
| **Treatment Guidelines**<br>Facility treatment recommendations for common infection syndromes based on national or facility clinical guidelines, and on local susceptibility data, if available. | WHO manual for developing antibiotic policy guidance. | Empirical antibiotic prescribing guidelines and standard treatment guidelines lead to:<br>• Improve, standardize care for common infectious diseases<br>• Help prescribers select initial therapy<br>• improve antibiotic use, and decrease cost and length of stay. | Requires broad dissemination through multiple formats and channels to ensure uptake. |
| **Surgical Prophylaxis Guidelines**<br>Facility recommendations for common surgical procedures. | • Adapt surgical prophylaxis guidelines to local needs, providing antibiotic choice, dose and duration.<br>• Disseminate well: poster in the operating theatre, leaflet, apps, electronic platform.<br>• Automatic stop orders might be incorporated (see below). | • Ensure timely administration and stop of appropriate antibiotic(s).<br>• Significantly reduce surgical site infections.<br>• Easier to implement than other guidelines due to few controversies around the recommendations.<br>• Need to be disseminated to surgeons and/or anesthetists, and supervised by pharmacists.<br>• Low-hanging fruit: once the process is optimized, only periodic monitoring. | Require coordination and collaboration of many disciplines in the facility. |

| Intervention | How to do it | Advantages | Disadvantages |
|---|---|---|---|
| **Feedback Interventions** | | | |
| **Audit with Feedback**<br>• Refers to the assessment of prescribed antibiotic treatment, with feedback on antibiotic treatment considered as inappropriate<br>• Prospective (preferred) or retrospective assessment of antibiotic therapy in in-patients, performed by trained HCWs or AMS team members. | See Annex 4: AMS review form<br>and Chapter 5 for details on how to perform audits, with feedback and examples. | • Essential to prescribers' education; provides specific feedback on what antibiotics they prescribe and how they prescribe them.<br>• Identifies antibiotic prescribing challenges in the unit, and shows the impact of AMS interventions on antibiotic prescribing and use (e.g. de-escalation, duration).<br>• Data may include information on indication for treatment, prescribed antibiotic(s), dosage, interval, administration route, timing of administration of first dose and duration if collected after stop of treatment.<br>• Can be performed from very basic (only indication and antibiotics prescribed per patient) to more advanced. | Time-consuming. Can be perceived as intrusive; if so, ensure data is only used confidentially for improvement in the unit. |
| **Wards Rounds**<br>Real-time assessment of antibiotics to be prescribed, or which are already prescribed, with instant feedback to prescriber. | • Assess appropriateness of prescribed antibiotics for all inpatients or a group of patients (ICU, surgery, etc.), and provide real-time feedback.<br>• AMS members do ward rounds preferably with clinical staff, providing oral or written feedback. | • Provide real-time feedback on inpatient antibiotic treatment and training of prescribers.<br>• Can be performed by clinical experts who are not AMS team members (e.g. on handover | Ward rounds are often performed by AMS teams.<br>Frequency of ward rounds<br>depends on human resources and burden of antibiotic use. |

| | | | |
|---|---|---|---|
| | Issues to consider are redundant therapy, antibiotics prescribed (compliance with guidelines or microbiology test results), dose optimization, IV-to-oral switch and duration (see below, Annex 4: AMS review form). | meetings between shifts). | |
| Antibiotic self-revision<br>By prescribers<br>Scheduled reassessment of need for and choice of antibiotics. | Involves prescribers performing a post-prescription review of antibiotics, combined with audit and feedback.<br>A checklist may improve compliance<br>(see Annex 4: AMS review form).<br><br>Consider indication for treatment, redundant therapy, antibiotics prescribed (compliance with guidelines or microbiology test results), dose optimization, IV-to-oral switch, duration (see below). | • Directly involves prescribers in charge of patients in reviewing prescribed antibiotic treatment.<br>• Facilitates prescriber education and maintains prescriber autonomy.<br>• Less resource-intensive than audit and feedback. | Opposition from prescribers and lack of facility policy for implementing it.<br>May not happen if prescribers are not prompted or comfortable with making changes.<br><br>May not lead to improved appropriateness if prescribers lack expertise in infection management. |
| **Redundant Therapy**<br>Review of antibiotic therapy, revealing unnecessary or undesirable therapy**.** | A quick review of a patients' antibiotic therapy may reveal undesirable antibiotic combinations: duplication of treatment, overlapping bacterial spectra (e.g. metronidazole and clindamycin) or interactions with other medicines. | • A relatively easy target for AMS interventions.<br>• Cost savings on antibiotics, and potentially reduces AMR.<br>• Reduces adverse events (e.g. nephrotoxicity, gastrointestinal side effects). | Need for trained staff who can review antibiotic therapy and provide expert advice. |
| **Review of Prescribed Antibiotics**<br>1. De-escalation by prescribers.<br><br>2. De-escalation changes. according to guidelines.<br><br>3. De-escalation according to microbiology test | • Self-revision by prescriber irrespective of time and availability of microbiology test results.<br>• Self-revision by prescribers or review on ward rounds on whether empirical treatment is according to guidelines (diagnosis, drug, dose, interval, administration route, duration) and patient characteristics. | Can reduce costs for broad-spectrum antibiotics, and potentially reduces AMR and further facility and patient costs. | 1–2. May not occur if prescribers are not prompted or are not comfortable making changes.<br><br>3. Requires that microbiology sampling be done correctly, as well as quality-assured microbiology testing, timely release of results and good |

| | | | |
|---|---|---|---|
| results +/– 48 hours after prescription. | • When microbiological results become available, antibiotic treatment should be streamlined accordingly: choose the most active antibiotic(s) with least toxicity, narrowest spectrum and lowest cost.<br>• De-escalation is safe for sepsis and septic shock, and is associated with decreased mortality | | communication with trained prescribers. |
| **Dose Optimization**<br>Review of antibiotic doses based on infection, patient characteristics, antibiotic(s) and guidelines. | • Optimize dose based on age, weight, organ dysfunction (kidney) and tissue penetration.<br>• Consider therapeutic drug monitoring, if available, especially for nephrotoxic antibiotics (aminoglycosides).<br>• Evaluate the need for loading dose and/or prolonged/continuous infusions.<br>• Integrate into pharmacists' review during ward rounds | Improves patient outcomes,<br>and reduces suboptimal drug concentrations and adverse events (mainly nephrotoxicity). | • Requires patient-specific data to perform the assessment, e.g. weight, renal function, indication and recommendations for dosing in special patient populations (e.g. obesity, renal dysfunction), which are not always available.<br>• May also require microbiology laboratory results (minimum inhibitory concentration) for correct dose. |
| **Intervention** | **How to do it** | **Advantages** | **Disadvantages** |
| **FEEDBACK INTERVENTIONS** | | | |
| **Iv-To-Oral Switch**<br>Promotes the use of oral antibiotics instead of IV when clinically indicated. | **Consider based on:**<br>• Clinical condition and availability of adequate oral antibiotic;<br>• Oral intake and gastrointestinal absorption (not impaired);<br>• Adequacy of oral intake in terms of diagnosis (e.g. not in the case of endocarditis or meningitis). | • Reduces unnecessary days of IV lines and common complications.<br>• Reduces length of stay, as patients can complete antibiotic treatment at home. | May meet opposition from<br>prescriber (and patient). |
| **Duration**<br>Review (real-time or retrospective) of stop<br>dates for antibiotic | **Can be performed by:**<br>• prescribers during self-revision;<br>• The entire AMS team during ward rounds; | • Addresses a common area for improvement with regard to antibiotic prescribing. | May need to be individualized in e.g. immune-compromised patients or patients with |

| | | | |
|---|---|---|---|
| treatment in patients. | • Pharmacists collecting prescriptions in every unit; retrospectively. | • Improves patient outcomes, and prevents selection of MDR bacteria and adverse events (i.e. Clostridium difficile infection and nephrotoxicity). | central nervous system or bone infection. |
| **RESTRICTIVE INTERVENTIONS (LIMITATIONS TO PRESCRIBING TARGETED ANTIBIOTICS)** | | | |
| **Restriction**<br>Restricted dispensing of targeted antibiotics on the hospital's formulary, according to approved criteria (e.g. use the AWaRe categories). | • Restrictions on antibiotics are by diagnosis or unit.<br>• Selection of restricted antibiotics is done by facility authorities, the AMS team and heads of units based on spectrum, cost or toxicities.<br>• Antibiotics are restricted before use; ensures expert approval before initiation. | • Controlling targeted antibiotics defined by the AMS team or hospital formulary.<br>• Effective, especially in the early stages of an AMS program, in an outbreak situation or as part of a response to an increase in or current high use of certain antibiotics in the facility.<br>• Reduce medicine costs for hospitals over time. | • May delay initiation of treatment.<br>• Opposition from prescribers due to lack of autonomy.<br>• Risk of misusing other antibiotics that do not require authorization.<br>• Labor-intensive and time-consuming because it requires enforcement to be effective. |
| Use of restricted antibiotics may be limited to certain indications, prescribers, services, patient populations or a combination of these. | • Practical approach that allows attending physician to use the drug pending approval by physician or AMS team after +/− 48 hours.<br>• See Annex V for an example of a preauthorization form. | | |
| Selective susceptibility reporting. | Report susceptible first-line narrow spectrum antibiotics to regular wards. | May reduce use of broad-spectrum antibiotics. | Opposition from prescribers, lack of guidelines, poor system support, insufficient resources. |
| **Automatic stop Orders**<br>Stop dates automatically applied to an antibiotic order when the duration is not specified to ensure that antibiotics are continued no longer than necessary. | • Automatic stop orders are mostly used for a single dose of surgical antibiotic prophylaxis, or prescribing some antibiotics.<br>• Useful in small facilities and with limited pharmacy staff.<br>• Use only in a context with good control mechanisms to avoid unsafe treatment interruptions.<br>• Nurses can play a role in alerting the attending physician. | A simple measure, considering the high burden of antibiotics unnecessarily used for surgical prophylaxis. | • IT is needed, which is often missing.<br>• Unintended treatment interruptions if not properly supervised by the AMS team. |

| | | | |
|---|---|---|---|
| **Rapid laboratory Testing**<br>Stop dates automatically applied to an antibiotic order the duration is not specified to ensure that antibiotics are continued no longer than necessary. | Rapid diagnostic tests allow for more accurate diagnosis and targeted antibiotic treatment. | Provides quicker diagnostic results than traditional microbiology testing | Tests are often expensive and/or require advanced, expensive equipment that is not available in many facilities. |
| **Therapeutic drug Monitoring**<br>To be performed for concentration-dependent Antibiotics when used >3 days**.** | • There should be a standardized procedure for collecting blood samples.<br>• The concentration of the antibiotic is measured in blood to allow for optimal adjustment of daily dose. | Fewer adverse events related to specific antibiotic treatments. | Therapeutic drug monitoring is not available in many healthcare facilities. |
| **Computerized Physician Order Entry (CPOE)**<br>Replaces a facility's paper-based ordering system with an electronic one. | Allows users to place electronic orders, and the facility to maintain an online medical record. | Orders made and the online medical records, incl. medical charts, can be read and reviewed by HCWs attending to a patient. | Requires healthcare IT systems which are not available in many healthcare facilities. |
| **Antibiotic allergy Assessments**<br>Replaces a facility's paper-based ordering system with an electronic one. | Establish guidance for antibiotic allergy assessment, e.g. a penicillin allergy assessment protocol, with recommendations on which patients might benefit from skin testing. | Promote the use of old narrow spectrum antibiotics, which are also potentially more effective. | Requires healthcare IT systems which are not available in many healthcare facilities. |

### 5.7.1 Change ideas on AMS Programming

1. Identify clinical providers as champions to be thought leaders about AMS.
2. Work with administrators to ensure that they understand the rationale and goals for AMS and interventions and provide support (financial and non-financial).
3. Engage a physician or doctor champion and core team to enhance the focus of AMS into the current process of care.
4. Bring disciplines together to improve communication and collaboration about improving antibiotic use.
5. Consider having the multidisciplinary team performs a gap analysis of antimicrobial use at the facility to identify priority areas for improvement.

## 5.8 Roles of Diagnostic Tools

The role of rapid diagnostics and biomarkers in AMS is recognized as a key recommendation by the Infectious Disease Society for America (IDSA). The IDSA policy statement for combating AMR and saving lives recommends "Greater Investment in Rapid Diagnostics Research and Development (R&D) and Integration into Clinical Practice" as one of the key strategies.

Integration of diagnostics with other AMS interventions, to provide fast identification and susceptibility testing, will achieve better clinical outcomes and timely streamlining/de-escalating of empiric broad-spectrum antibiotics in seriously ill patients. Many studies have assessed algorithms based on procalcitonin (PCT) as a rapid-reacting biomarker of bacterial infection for antibiotic stewardship. Recent systematic reviews showed benefits of PCT among patients with respiratory tract infection and sepsis by significantly reducing antibiotic exposure as well as a trend towards reduced costs and reduced length of ICU stay *[Schuetz et al., 2011; Agarwal et al., 2011; Heyland et al., 2011; Mann et al., 2011; Matthaiou et al., 2012].* Near-patient rapid tests, e.g. influenza, Strep A, can be useful to identify patients with bacterial *versus* viral infections.

Molecular diagnostics or screening tests providing a faster result play an important role in pathogen detection in critically ill patients which will improve antibiotic stewardship and clinical outcomes *[Afshari et al., 2012].* However, the availability of these interventions in resource-limited environments is likely to be a challenge to their introduction.

### 5.8.1 Back-end *versus* front-end strategies

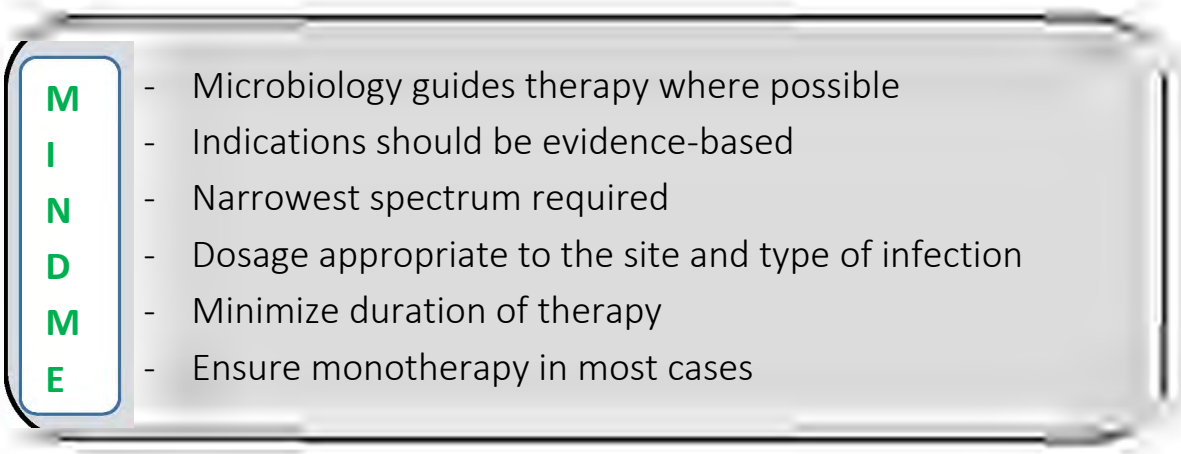
Two core antimicrobial stewardship (ASP) strategies have emerged: back-end *versus* front-end strategies. The back-end strategies, although more labor-intensive, are:

- More widely practiced
- More easily accepted by clinicians
- Provide a higher opportunity for educational opportunities.

They probably provide a more sustained impact of improving the overall quality of antimicrobial prescribing.

Front–end strategies: Antimicrobials are made available through an approval process (formulary restrictions and preauthorization).

Back-end "strategies: Antimicrobials are reviewed after antimicrobial therapy has been initiated (prospective audit with intervention and feedback)




The Golden Rules of Antimicrobial Prescribing "MINDME"

*Adapted from Antibiotic Expert Group. Therapeutic guidelines: antibiotic. Version 14. Melbourne: Therapeutic Guidelines Limited; 2010.*

## 5.9 Prospective (real-time) audit with feedback

Prospective audit with feedback (e.g. on ward rounds) involves the assessment of antibiotic therapy by trained individuals (usually physicians and/or pharmacists), who make recommendations to prescribers in real time when therapy is considered suboptimal.

A prospective audit should be prioritized over a retrospective audit. It may be performed alongside clinical personnel on ward rounds, providing oral recommendations for changes in antibiotic treatment in real time. Alternatively, the physician and/or pharmacist in the AMS team may perform ward rounds on their own, providing written recommendations for changes in antibiotic treatment. See Annex IV for an AMS review (audit) form and Section 5, 4 for an example of patient audit data.

### 5.9.1 Retrospective audit with feedback

Retrospective audit with feedback is a method of collecting antibiotic data to evaluate the impact of AMS interventions (baseline and follow-up data) on antibiotic use, but is inferior to a prospective audit and real-time feedback. An audit involves assessing antibiotic therapy in hospitalized patients, and is often coordinated by a physician or administrator but performed by pharmacists and/or nurses. Antibiotic audit data are collected as follows:

- at baseline to identify areas for improvement of antibiotic prescribing for the whole hospital, a department or ward;
- for a defined period of time to evaluate any improvements; and

- to provide regular and structured feedback both on the quality and quantity of antibiotic prescribing and use to prescribers.

Audit with feedback provides an opportunity for clinical staff to discuss their own prescribing practices, to identify priority areas for change and to set specific goals for themselves at the facility, department and/or ward level.

### 5.9.2 Selecting one or more infections for audit

#### To what degree are infections treated according to guidelines?

The audit should provide figures on compliance with the guidelines and suggest where there is room for improvement. Data are collected on ward rounds or directly from patients' medical charts. A sample medical record form can be found in Annex VI.

#### How to choose which infections to audit?

- Common infections, such as community-acquired pneumonia (CAP), UTIs, and SSTIs.
- When a problem is detected, a specific intervention might be designed. For example, an increase in infections after surgery or in urine cultures referred to the microbiology lab, which might indicate that patients with asymptomatic bacteriuria are wrongly being treated for UTIs.
- Infections treated for a long duration (e.g. >7 days).

**Example #1:**

**The AMS team pharmacist notes that during the past week, three patients admitted to the internal medicine unit with non-severe CAP received a combination of ceftriaxone and clarithromycin. Clinical guidelines at your hospital recommend ampicillin alone for most non-severe CAPs.**

***What can be done?***

1. List all patients admitted with non-severe CAP to the internal medicine unit during the last 2–3 months.
2. If samples (i.e. sputum, blood cultures) have been submitted, review medical records for severity (e.g. CRB-65) as well as microbiology test results. Also note recorded reasons for prescribing ceftriaxone and clarithromycin and whether a review (de-escalation) of treatment has been carried out.
3. Hold a meeting with a smaller group of prescribers on the ward to discuss your initial findings. Discuss further steps and possible actions (training of health personnel, ward rounds, audit, etc.).
4. Hold a further meeting with the heads of the unit and all the medical staff (including residents and fellows) to discuss why broad-spectrum antibiotics and frequent combinations should be avoided for CAP. Agree on further action, such as targets for changes to prescribing, training and other AMS interventions.
5. Continue active surveillance through audit for a specified time period and meet again with the unit to discuss progress.

**Example #2:**

**During ward rounds or in specific patient consultations, a member of the AMS team has the impression that many patients with urinary catheters are being treated with antibiotics.**

***What can be done?***

1. Together with ward staff, list all patients with a urinary catheter. Draw up a chart (table) that includes the main variables to be evaluated (see the following points).
2. Review every patient history looking for signs of UTI, including fever or sepsis without another focus of infection.
3. Determine which patients (with or without clinical signs of infection) have had urine samples taken for culture, to find out whether patients without clinical signs of UTI have had urine cultures taken as well as whether no urine or blood culture has been taken when a true infection is suspected.
4. Review any prescription of antibiotics for patients with a urinary catheter, whether asymptomatic or symptomatic. Again, this will detect the prevalence of prescriptions in both circumstances.
5. For patients with clinical signs of UTI, assess whether the treatment is appropriate according to local epidemiology and/or guidelines (selection of antibiotic(s), dose, de-escalation and duration).
6. Depending on sample size, extend the assessment retrospectively (e.g. 1 month) by searching patient medical records.
7. Once these first analyses are done, discuss the results with the medical staff on the ward, suggesting targets for change and which data to collect for a specified time period. Agree on further interventions (i.e. any necessary training and follow-up) and on when to meet again to discuss the results of the new audit.

## 5.9.3 Selecting antibiotic (s) for audit

### To what degree is an antibiotic used according to guidelines?

The audit should provide figures on who is receiving antibiotic(s), indications for treatment and whether the patient is receiving the right antibiotic treatment (see the audit sample below).

***How to choose which antibiotics to audit?***

- Antibiotics with consumption increased significantly over time.
- Antibiotics with a higher potential of inducing and propagating resistance (e.g. WATCH and RESERVE antibiotics).
- Broad-spectrum antibiotics (e.g. piperacillin/tazobactam, ticarcillin/clavulanate, carbapenem).
- Last-resort antibiotics (e.g. polymyxins, linezolid).
- Expensive antibiotics.

*Note: Remember that restricting one antibiotic may increase the use of others*

Depending on the strategy adopted in the facility, audit might be done via ward rounds, pharmacy alerts, a process of pre- or post-authorization, self-revision by physicians, pharmacist or a combination of all of these.

***Department/ward:*** ***Year:***

| *Week* | *Pat. ID* | *Age* | *Gender (M/F)* | *Indication* | *Medicine(s)* | *Dose* | *Adm. interval* | *Adm. route* | *Guideline compliance* | *Comments: allergy, etc.* |
|---|---|---|---|---|---|---|---|---|---|---|
| 15 | **01** | **55** | **M** | Cellulitis | **Ceftriaxone** | **1g** | **X1** | **IV** | **No** | **No allergy** |
| | 02 | 18 | M | Meningitis | Ceftriaxone | 2g | X2 | IV | Yes | |
| | 02 | 42 | F | Gastroenteritis | Ceftriaxone | 1g | X1 | IV | No | No fever or bloody stool |
| | 02 | 25 | F | UTI | Ceftriaxone | 1g | X1 | IV | Yes | |
| | 03 | 36 | M | CAP | Ceftriaxone | 1g | X1 | IV | No | CRB65 = 1 |

## Example #1:

**The pharmacist who picks up medication request forms in the ICU has noted that for some time now, there has been an increase in the use of meropenem in higher doses and of colistin.**

***What can be done?***

1. Hold a meeting with the head of the ICU to convey your concern and suggest a meeting to gather most of the ICU staff, including physicians who only are on call in the ICU.

2. Discuss with prescribers their perception of this increase (e.g. more severe septic patients, an increase in MDR gram-negative pathogens).

3. Review and discuss the patients receiving treatment with one or both antibiotics studied.

4. Perform a retrospective audit of patients who were treated with one or both antibiotics.

5. Analyze with the AMS team the appropriateness of the prescriptions: indication, dose, duration, microbiology test results and the existence (or not) of alternative treatments with regard to both ecology and cost.

6. Once this analysis is done, meet again with the ICU medical team to discuss the results. Try to reach agreement regarding what changes are feasible, what training and other interventions might be useful, and how to measure change through active surveillance (audit) for a specified time period.

7. Meet once again to discuss the results of the new audit.

**Example #2:**

**As part of the stewardship strategy, the AMS team decides to assess what is happening with antibiotic surgical prophylaxis. Your hospital has not yet updated clinical practice guidelines for this indication, but national guidelines are in place.**

***What can be done?***

1. Review the list of all surgical procedures done or performed over at least the last 2 weeks (depending the number of surgical procedures performed by different specialties).

2. Produce a form (e.g. Excel or electronic platform) that includes essential issues for evaluation: indication (type of surgery), gender and age of the patients, main comorbidities, antibiotic (s) prescribed as prophylaxis, dose, time of administration and duration.

3. Review the appropriateness of the prophylaxis: the antibiotic (s) prescribed, dose, timing and duration.

4. Hold a meeting with the surgical services and anesthesia for feedback on the findings. The meeting might be general (the whole surgical department) or by specialty depending on the results and the size of the department.

5. Adapt national or international guidelines to your facility situation (epidemiology and drug availability), and involve every specialty in developing the guidelines to increase ownership

6. Repeat the audit after a specified time (e.g. 4–6 months) after implementing new guidelines for surgical antibiotic prophylaxis in the facility.

## 5.9 Role of IT in an AMS Program

Even a successful AMS program needs to be adequately measured to be efficient. The use of proper and updated information is essential. Often, data can be collected and analyzed without technology. Point prevalence surveys are an example of this. Table 7 identifies areas where IT can be of additional benefit.

*Table 7: Areas where IT can benefit AMS interventions*

| Basic Level | Intermediate Level | Advanced Level |
|---|---|---|
| ▪ Database on procurement and ward dispensing at the facility pharmacy level<br>▪ Database of AMR surveillance in different units | ▪ Calculation of antimicrobial consumption (e.g. in DDD/ 1000 inpatients/day)<br>▪ Alerts on specific antibiotic use<br>▪ Time-sensitive automatic stop orders for surgical prophylaxis<br>▪ Electronic guidelines (via electronic mailings to prescribers, intranet)<br>▪ Apps for doing a PPS | ▪ CPOE system<br>▪ Estimations of clinical outcomes related to antibiotic treatment<br>▪ Apps for national, regional or facility guidelines<br>▪ Point-of-care access to microbiological results from all units<br>▪ Clinical decision-support systems (commercial or self-developed) of different levels of complexity<br>▪ Computerized patient dispensing billing data<br>▪ Automatic submissions/reporting of computerized facility-level data to the national center |

## 5.10. Quality health systems conceptual framework for AMS

A high-quality health system is one that optimizes healthcare in a given context by consistently delivering care that improves or maintains health outcomes, by being valued and trusted by all people, and by responding to changing population needs *such the emerging AMR threats* (*Kruk et al., 2018).* Health systems should seek to improve performance on six dimensions of quality of care (including: Safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity). The conceptual framework for high-quality health systems has three key domains: Foundations, processes of care, and quality impacts (Figure 19).

This framework stems from the definition of high-quality health systems and is informed by past frameworks in the fields of health systems and quality improvement, including Donabedian's framework, WHO's building blocks and maternal quality of care frameworks, Judith Bruce's family planning quality framework and the Deming quality cycle.

High-quality health systems are underpinned by four values: for people and are equitable, resilient, and efficient. A focus on people begins with the self-evident of access as a prerequisite for benefiting from healthcare. The emphasis on people centeredness is especially crucial in healthcare because of the asymmetry of power and information between provider and patient. This involves corrective action that reduces the imbalance through patient empowerment and better accountability. A focus on equity means that high-quality healthcare needs to be available and affordable for all people, regardless of underlying social disadvantages, including rational prescription of antibiotics.

Resilient system is defined as systems that can prepare for and effectively respond to crises while maintaining core functions and reorganizing if needed. Quality health systems also need everyday resilience to respond to routine challenges such as AMR; and this requires accountable leaders who respect and motivate their frontline staff.

The high-quality health system framework focuses on health system functions, user experience, and how people benefit from healthcare. It is believed that the quality of health systems should be primarily measured by these processes and impacts rather than by inputs. Facilities staffed by health workers and equipped with running water, electricity, and medicines are essential for good quality care, but the presence of these inputs is not itself a measure of high-quality care. Empirical work shows that the quantity of such inputs does not predict the care that people receive and whether their health will improve - poor care often happens in the presence of adequate tools.

The foundations alone will not create good care, and the system will not be able to adapt to new challenges without built-in mechanisms for learning and improvement, including timely information on performance, assessment of new ideas, and the means to retire ineffective approaches.




*Figure 18: Components of the three framework domains (quality impacts, processes of care, and foundations).*

# 6. ASSESSING AMS PROGRAMS

**Audience:** Healthcare facility leadership, Healthcare Quality Management Team, Drug or Therapeutic Committee, IPC Team, AMS Committee and/or AMS Team, veterinarian service providers (e.g. Community Animal Health Worker or CAHWs), community pharmacies, health facility health information system (HIS), Healthcare Facility Development Committee (HFDC).

## 6.1 Context

Data play an important role in assessing AMS interventions (to identify problems or evaluate the benefits of AMS interventions), although qualitative improvement can be achieved even in the absence of data. However, from a mid- to long-term perspective, efficiently prioritizing interventions and allocating resources for AMS requires data to identify key challenges in antibiotic use and to demonstrate the impact of targeted interventions. Indicators of antibiotic use are thus an essential part of any AMS strategy.

This section aims to advise on metrics for assessing the impact of the AMS interventions. Because assessing all indicators is unrealistic, the collection of indicators shown in Tables 8–10 is not intended to be comprehensive. AMS programs are encouraged to select the most relevant and feasible metrics for a particular setting or healthcare facility. Note also that the resources required for assessing the indicators will vary, depending on the setting and the available infrastructure. Nonetheless, given the complexity of antibiotic use, a single indicator will probably not suffice. How to assess structural indicators of ASPs (e.g. leadership commitment, human resources and guidelines) is covered in sections 2 and 3. Finally, in as much as local indicators will vary, this toolkit does not specify targets or methods.

## 6.2 Structural measures or indicators

**Structural measures** are used to assess the capacity, systems and processes in a facility or an organization. The national and healthcare facility core elements present essential structures for implementing national and healthcare facility level AMS programs.

## 6.3 Process measures or indicators

The implementation of AMS interventions aims to optimize antibiotic prescribing and use. It is therefore recommended to also include process indicators as a proxy measure for improvement (Table 10). Process measures may specify how patient medical charts are reviewed (e.g. how many times a week over a given period of time) and how antibiotic prescribing and use is improving. Apply the process indicator that corresponds to the AMS intervention (s) implemented.




*Figure 19: Structural, process and outcome measures for assessing AMS Programs*

## 6.4 Outcome measures or indicators

The aim of an AMS program is often achieved by reducing AMC and perhaps reducing overall use of specific (broad-spectrum) antibiotics. However, it is equally important to document that this reduction is not associated with unintended negative ***patient outcomes***. Furthermore, AMS aims not only to prevent negative patient outcomes, but also to improve patient outcomes, providing further arguments for assessing outcome measures. In healthcare settings without established surveillance programs for AMR and HAIS, or electronic health records, it may be difficult to obtain reliable data about the **clinical outcome** measures in Table 8 of page 44. Given the sound evidence for the safety and effectiveness of AMS programs, it may be justifiable as a first step to focus on ***outcome measures related to antimicrobial use*** *(Table 8).*

Regardless of whether electronic prescribing is available, many facilities have pharmacy systems that can provide information on antimicrobials supplied to wards and other clinical areas. These data can be collected manually and used as a proxy for antimicrobials given to patients. In an AMS program, when it comes to measuring and expressing antibiotic use in numerical terms, a standardized measure is required. The most common standardized measure is DDDs. Other outcome measures used are described on page 43.

The potential cost savings (direct and indirect) as a result of the shift from more expensive broad-spectrum to less expensive first-line narrow-spectrum antibiotics should be partly used/reinvested in sustaining or maintaining the AMS program in the facility.

**How to begin assessing AMS programs**

Below is an example of a stepwise approach for applying different indicators when assessing an AMS program.

***Structural measures/indicators***

The national and healthcare facility core elements can be used as checklists for assessing the structures of national and healthcare facility AMS programs.

***Initial outcome measures or indicators***

An essential part of any AMS program, both national and facility, is to study antibiotic prescribing and use over time. Either antimicrobial consumption surveillance data, PPS data or audit data can be applied. The most sustainable and least laborious way to measure antibiotic use over time is through routine collection of antimicrobial consumption data. The study of the indicators DDD per 100 (0) patient-days and/or DDD per admission should be prioritized. A simple way to initiate further analyses of the consumption data is to look at the proportion of DDDs in AWaRe and other groups or any other relevant clinical categories. It is recommended that antibiotic use should be expressed in at least two metrics simultaneously.

***Other outcome measures or indicators***

Although evidence shows that AMS interventions do not lead to increased mortality, study of *clinical patient outcomes* e.g. mortality and length of stay – is recommended to ensure that implemented interventions do not have unintended consequences for patients.

***Process measures or indicators***

Process indicators are often used as a proxy measure of improvement, e.g. that antibiotic prescribing practices are moving in the right direction. For example, if the target is to improve adherence to recommended empirical treatment of a particular infection, a corresponding process measure would be the proportion of all patients with this particular infection who receive recommended empirical treatment.

*Table 8: Outcome measures or indicators related to antimicrobial use*

| Indicators | Indicator construction | Possible data sources | Comment |
|---|---|---|---|
| DDD per 100(0) patient-days | **Numerator:** DDD of an agent (based on ATC code) purchased/ dispensed/consumed in a period of time (i.e. total antibiotic used)<br><br>**Denominator:** Total number of patient-days within that period of time<br><br>**Multiplier:** x 100(0) to obtain data per 100(0) patient-days | Pharmacy dispensing Data healthcare facility purchasing data<br>Nursing chart administrative data (paper)<br>Electronic drug administrative data<br>E-prescribing records | DDD per 100 (0) patient-days is the most commonly used quantity measure of antibiotic use, because the data needed to calculate it are available in many settings (unlike days of therapy, DOTs); no individual-level data are needed.<br>It should, however, be noted that differences in data sources and definitions may influence this indicator, for instance:<br>• the list of antibiotics included (e.g. all ATC class J01 antibiotics, or subsets of ATC class J01, or additional antibiotics and antimicrobials not included in ATC class J01);<br>• the data source used-it has, for example, been shown that pharmacy dispensing data tend to overestimate antibiotic use compared with actual drug administration data; and<br>• how patient-days are calculated (e.g. "days present", an alternative measure).<br><br>Detailed guidance on how to calculate DDDs is available elsewhere. DDDs can be calculated for overall use, specific antibiotic, classes or other categories (such as AWaRe). It is very important to clearly define how the metric is calculated (i.e. antibiotics included, data sources, ATC version and year, calculation of patient- |

| | | | |
|---|---|---|---|
| | | | days) and to be consistent over time. |
| DDD per admission | **Numerator:** See above **Denominator:** Total number of patients admitted within a period of time | See above | DDD per admission gives different information than does DDD per patient-days. The length of stay may affect patient days and admissions differently. |
| DOTs per 1000 patient-days | **Numerator:** Days of therapy with an agent during a period of time **Denominator:** Total number of patient-days within that period of time **Multiplier:** x 1000 to obtain data per 1000 patient-days | Nursing chart administrative data (paper)<br><br>Electronic drug administrative data E-prescribing records | The major disadvantage of DOTs compared with DDDs is the need for individual-level patient data (instead of aggregated data, such as pharmacy data, which are sufficient to calculate DDDs). (On the other hand individual-level data make it possible to assess the duration of treatment, redundant therapy, etc.). |
| Proportion of DDDs in AWaRe and OTHER groups | Classify DDDs according to AWaRe and OTHER groups, and calculate the percentage of each | Pharmacy dispensing Data Hospital drug purchase data Nursing chart administrative data (paper).<br><br>Electronic drug administrative data E-prescribing records. | |

*Table 9: Outcome measures or indicators related to patients and microbiology*

| Indicators | Indicator construction | Possible data sources | Comment |
|---|---|---|---|
| Patient outcomes | **In-hospital mortality:** Number of deaths during hospitalization /total number of hospitalizations | In-hospital mortality: hospital administrative data; 30-day mortality: population office administrative data Infection-specific mortality: chart review and administrative data | Can be assessed as in-hospital mortality (i.e. death during hospitalization) or mortality at a specific time point after admission (e.g. 30 days). The latter has better face validity as it is not influenced by differences in length of Stay; data needed to calculate it are more difficult to obtain in most settings.<br><br>Ideally, infection-specific mortality rates (e.g. for CAP) would also be calculated. Since it Is difficult to assess whether a specific death was caused by an infection or by AMR, the assessment of infection-specific mortality can be tricky (and time-consuming). The numerator & denominator must be defined. |
| | **Length of stay:** Days of hospitalization by type of infection /total number of patients with that infection | Infection-specific chart; Review administrative data | There are many different ways of defining length of stay. It is important to use consistent definitions. |
| | **Readmission within 30 days after discharge:** Patients with infections readmitted <30 days after discharge / Total number of patients discharged with that specific infection | Infection-specific chart review and administrative data | Only unscheduled readmissions should be counted (e.g. a planned admission for a surgical intervention should not be counted). |
| Microbiology outcomes | ***Clostridium difficile:*** Number of healthcare-associated *C. difficile* infections in a period of time / Total number of patient days within that period x 100 000 MDR organisms (e.g. MRSA, ESBL-E/CPE, MDR *Pseudomonas* and *Acinetobacter* spp*., vancomycin-resistant **enterococci):** Number of HAIs in a period of time / Total number of patient-days within that period x 100, 000 | • Microbiology data<br>• Epidemiology data<br>• IPC surveillance data<br>• Administrative data<br>• Chart review<br>• Microbiology data<br>• Epidemiology data | *C. difficile* definitions may vary, & a detailed discussion is beyond the scope of this document. Interested readers may consult the respective surveillance protocols & guidelines. See GLASS-http:// www.who.int/glass/en |

*A group of bacteria (germs) commonly found in the environment (soil and water), with many types, but most common cause of infections is Acinetobacter baumannii, which accounts for most Acinetobacter infections in humans.*

*Table 10: Process measures or indicators of antimicrobial use*

| Indicators | 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. |

# 7. EDUCATION AND TRAINING

**Audience:** Ministries of Health (Pharmacy, Laboratory & Nursing Division, HQMU), Education and Agriculture, NPHIL (NRL), LMHRA, EPA, National Aquiculture and Fisheries Authority (NaFAA), Liberia Board for Nursing & Midwifery, academic institutions, healthcare facilities, institutions and/or related entities responsible for planning and delivering pre-service and in-service education and training.

## 7.1 AMS Competencies

Competencies are defined as the development of observable ability of a person or individual health worker that integrates knowledge, skills and attitudes in their performance of a task. Competencies are durable, trainable and, through the expression of behaviour, measurable. AMS competencies are the guiding set of knowledge, skills and attitudes that result in durable, trainable and measurable behaviour facilitating better prescribing of antibiotics (Table 11).

Some of the key concepts to keep in mind when prescribing antibiotics include the following:

- awareness of the healthcare facility's standard therapeutic guidelines and essential medicines list (STGs & EMLs), including the national formulary;
- the importance and rationale for using recommended empirical antibiotic agents for patients, but also the potential immediate and long-term harm of broad-spectrum therapy;
- the benefit and safety of de-escalation antibiotic treatment after cultures; and
- the opportunity and benefits of IV-to-oral switching.

Individuals must objectively assess their current level of knowledge and skills (basic, competent, advanced) related to the topics and their ability to apply them in practice. Table 11 provides a comprehensive set of competencies in five core domains at three different levels. Local programs need to decide what level of competency is expected depending on the healthcare professional. These competencies may change or evolve over time depending on the job function/role. Once a realistic assessment of competencies (knowledge, skills and attitudes) has been established, learning needs (e.g. training curricula and learning materials), and how these needs can be met, are then determined.

**Level of competency:**

- **Basic:** The professional is aware of, has knowledge of or understands the core principles of an area.
- **Intermediate:** The professional is aware of the core principles of an area, understands them and knows how to apply them in his/her practice.
- **Advanced – expert:** The professional is aware of the core principles of an area, understands them, knows how to apply them in his/her practice, can show others how to apply them and provides leadership, expertise or support to others in this area.

*Table 11: Competencies for HCWs involved in AMS Programs in Healthcare Facilities*

| Topics | Descriptions/Purpose |
|---|---|
| **1. Introduction to AMR** | |
| Drivers of AMR | Discuss the morbidity, mortality and economic threats of AMR to human health:<br>○ Use of antibiotics in humans, animals, plants and environment:<br>○ Understand the development and main drivers of AMR.<br>○ Know the importance of optimizing use of antimicrobials in the human and animal sectors to prevent development of resistance.<br>○ Explain how travel, recent hospitalization or previous microbiology findings of resistant bacteria are factors that predispose to colonization/infection with a resistant pathogen. |
| WASH and IPC | ▪ Advocate for WASH and scaling up vaccines for common infections.<br>▪ Identify the link between AMS and IPC.<br>▪ Explain the infection chain: Organism, reservoir, portal of exist, mode of transmission, portal of entry, susceptible host, and the importance of practicing standard precautions to prevent transmission. |
| Call for action | Promote awareness of AMR and appropriate antimicrobial use amongst all HCWs, patients and the general public to protect the effectiveness of antimicrobials as a public good. |
| **2. Antibiotics** | |
| Different antibiotic classes | • Discuss the clinically relevant spectrum of activities for commonly prescribed antibiotics, and use this knowledge when prescribing.<br>• Explain mechanisms of actions for commonly prescribed antibiotics. |
| PK/PD, formulations And patient characteristics | • Discuss the basic principles of pharmacokinetics and pharmacodynamics (PK/PD), and use this knowledge when prescribing.<br>• Discuss the use of antibiotics in special care groups (e.g. pediatrics, pregnancy, breastfeeding, renal diseases and obese persons). |
| Prescribing principles Prophylaxis, empirical therapy, definitive therapy and drivers of excess antibiotic use | ▪ Explain the principles of empirical, syndromic or culture-based treatment options in relation to the selection of antibiotics.<br>▪ Discuss single prophylactic antibiotic dosing for surgical and other procedures for which prophylaxis has been shown to be effective, and use this knowledge when prescribing.<br>▪ Explain the inflammatory response can be due to both infectious and noninfectious causes (e.g. acute pancreatitis).<br>▪ Explain when not to prescribe antibiotics (e.g. for viral infections, or when there is bacterial colonization).<br>▪ Discus best practices for some infections may not include antibiotic treatment (e.g. incision and drainage of abscesses, removal of foreign material, most upper respiratory tract infections).<br>▪ List key considerations for initiating antibiotic therapy:<br>○ Indication for antibiotic therapy, including assessment of the severity of the infection (sepsis syndrome recognition) to inform urgency of therapy.<br>○ Bacterial infection, infection site, probable causative bacteria. |

| | |
|---|---|
| | ○ Antibiotic choice, dosage, interval, duration, preparation and administration of antibiotics, review and stop dates.<br>○ Importance of avoiding unnecessary use of antibiotics.<br>○ Empirical treatment guided by local antibiotic susceptibility patterns.<br>○ Broad- and narrow-spectrum antibiotics and the importance of avoiding unnecessary use, especially of those with broad-spectrum activity. |
| Documentation and communication on antibiotic prescription and use | ▪ Communication is a key component of the success of an AMS Program.<br>▪ Clear, simple communication should show the vision and the benefits of the program, with core clinical messages.<br>▪ The "Start Smart - Then Focus" approach is a good example of such an approach (Figures 10 and 11).<br>▪ Discuss need to document important details of antibiotic treatment plan (e.g. agent, dosing, administration route, clinical indication, duration and review dates) in the prescription chart, medical records and transfer notes to other health care institutions.<br>▪ Ensure appropriate documentation of antibiotics dispensed, including route, time, dose, therapeutic drug monitoring and response for individual patients.<br>▪ Demonstrate how to communicate with patients on the appropriate use of antibiotics, including patient counselling etiquette, discussion techniques and psychology for patient communication:<br>○ Promote better patient understanding of all treatment issues, such as safety concerns (including alerts) and adherence.<br>○ Promote a standard for the appropriate use of antibiotics, and manage patient expectations and demands especially when the use of antibiotics is not indicated. |
| Allergies, cross reactions, adverse effects | ▪ Discuss the significance of common antimicrobial and drug/food interactions, and utilize strategies to avoid interactions.<br>▪ Explain that optimizing antimicrobial use can limit common side effects and collateral damage related to treatment (e.g. disruptive effects on host normal flora, which may lead to *C. difficile* infection, superinfection with Candida spp.).<br>▪ Explain common side effects of antimicrobials, including allergy, and use this knowledge when prescribing:<br>○ Discuss allergy types: immediate, non-life-threatening, severe adverse drug reactions (e.g. Stevens- Johnson syndrome).<br>○ Explain mechanisms and risks of beta-lactam cross reactions.<br>▪ Explain how to monitor common side effects, and use this knowledge when prescribing.<br>▪ Explain what to do when common side effects of antimicrobial therapy are suspected (e.g. documenting allergic reactions in patient records, reporting side effects). |
| EML and the AWaRe classification | ▪ Encourage adherence to antimicrobial formulary/protocol restrictions.<br>▪ Discourage use of fixed-dose combinations of different antibiotics that have not been shown to improve clinical outcome.<br>▪ Ensure regular and timely supply of appropriate medicines.<br>▪ Discuss that antimicrobials have different resistance potential (AWaRE groups). |

| | |
|---|---|
| | ▪ Explain rationale of promoting appropriate use of antimicrobials according to their AWaRe groups to implement specific resistance-prevention actions for these antimicrobials. |
| **3.Microboiolgy** | |
| Important terms | ▪ Explain differences between colonization (e.g. isolation of bacteria from a skin wound or urine with no sign of inflammation or infection) and infection.<br>▪ Explain the difference in microorganisms and resistance patterns for infections acquired in the community compared with hospital settings. |
| Common causative Agents and resistance mechanisms | ▪ Explain the common and important gram-positive and gram-negative bacteria (WHO priority pathogens list plus *C. difficile*).<br>▪ Explain the nature and classification of microorganisms that commonly cause infections in humans.<br>▪ Recognize common mechanisms of resistance within an institution for different antimicrobial/organism combinations.<br>▪ Discuss local AMR epidemiology, resistance and susceptibility patterns. |
| Data collection and analysis | ▪ Demonstrate collection of microbiology samples correctly.<br>▪ Ensure timeliness in the handling of microbiology samples and communication of susceptibility results.<br>▪ Act as first line of surveillance in the correct use and reporting of microbiological tests and diagnostic tools.<br>▪ Interpret and use basic antimicrobial susceptibility testing results (in settings where they are commonly used) and screening cultures.<br>▪ Interpret and use new, more advanced microbiology samples, biomarkers, point-of-care tests:<br>o Explain how to use and interpret investigations that can help inform diagnosis of an infection (e.g. microbiological investigations, biomarkers, point-of-care tests).<br>o Demonstrate the use and interpretation of investigations (e.g. microbiological investigations, biomarkers, point-of care tests) that can help in monitoring the response to treatment of infections. |
| Selective sensitivity reporting/antibiogram | ▪ Advocate for and comply with guidelines regarding antimicrobial susceptibility testing.<br>▪ Explain how to implement selective sensitive reporting to minimize broad-spectrum antimicrobial use.<br>▪ Discuss the basic principles of antibiograms and other reporting tools and their interpretation.<br>▪ Demonstrate understanding in the use of antibiograms in detecting and reporting AMR patterns. |
| Bug-drug combination chart | Discuss the common microbiological etiology and treatment of human infections. |
| **4. Clinical Syndromes** | |
| Guidance and best Practice in antibiotic prescribing | ▪ Explain how and where to access relevant guidance on antimicrobial prescribing and AMS, and use this knowledge when prescribing.<br>▪ Explain how empirical treatment should be guided by local antimicrobial susceptibility patterns.<br>▪ Promote best practice approaches by developing and implementing guidelines and/or clinical pathways. |

| | |
|---|---|
| Common infections | ▪ Explain the decision process for appropriate antibiotic use: clinical assessment and clinical symptoms probable diagnosis, causative agents, diagnostics incl. microbiology sampling, patient characteristics including comorbidities and risk factors for AMR, whether or not to treat with antibiotics, and how to choose antibiotics to treat or prevent common infections including, but not limited to:<br>○ CAP, UTI, Diarrhea, SSI, Sepsis, Surgical antibiotic prophylaxis;<br>○ Bacterial infections that resolve by themselves e.g. sinusitis and otitis media<br>○ Influenza, malaria and other nonbacterial infections Symptoms not indicative of a bacterial infection, e.g. nonspecific uro-gynecological symptoms<br>○ Common HAIs e.g. UTIs, SSI, CAUTIs |
| **5. AMS** | |
| Planning an AMS program | Plan AMS activities:<br>▪ Provide clear mechanisms for the governance of AMS, including addressing responsibility and accountability for the quality and quantity of antimicrobials prescribed within a system.<br>▪ Ensure that health workers have the knowledge and awareness of effective approaches/interventions to control AMR, and have the skills to implement change according to their role.<br>▪ Explain the basic principles of behaviour change in the context of prescribing antimicrobials and model good prescribing behaviour to colleagues.<br>▪ Discuss the use of quality-improvement frameworks to address gaps and to improve antimicrobial use. |
| Performing AMS interventions | ▪ Discuss the key elements of a logical approach to continuation and appropriateness of antimicrobial therapy to implement AMS interventions:<br>○ Adjusting doses (e.g. for patients with renal impairment), and where to seek advice about this.<br>○ Monitoring antibiotic levels when indicated, and where to seek advice about this.<br>○ Reviewing antibiotic therapy at 48–72 hours and regularly thereafter in hospitalized patients, and in appropriate situations in the community.<br>○ Switching antibiotics from intravenous to oral administration as soon as possible when indicated (according to guidelines).<br>○ Changing antibiotics, ideally to a narrower spectrum (de-escalation) or broader (escalation) spectrum, according to microbiology results and clinical condition.<br>○ Stopping antibiotics if there is no evidence of infection based on clinical findings and investigations, e.g. negative microbial cultures, imaging reports. |
| Assessing an AMS program | ▪ Discuss the types of indicators (structure, process and outcome measures).<br>▪ Identify sources of data, recognizing the benefits and limitations of each.<br>▪ Be able to use PPSs.<br>▪ Demonstrate how to measure and calculate antimicrobial use metrics (DDDs, DOTs, etc.). |

| | |
|---|---|
| | ▪ Ensure timely and appropriate feedback to prescribers and other care groups.<br>▪ Engage with any locally or nationally agreed quality measures for assessing antibiotic prescriptions (e.g. compliance with guidance, adverse events, reviews of antibiotic therapy at 48–72 hours in hospitalized patients).<br>▪ Explain the principles of AMR surveillance and the use of surveillance data.<br>▪ Monitor and report on the performance of hospital AMR and related AMS programs. |

## 7.2 Education and training

Once the facility has outlined the competencies required for the different staff groups, it needs to develop a training delivery plan, in other words, identify a leader, teachers and participants, and make a time plan. The opportunity to use real-world clinical opportunities for training (e.g. ward rounds, clinical case discussions) should be emphasized. In addition, those in training should be encouraged to access external training opportunities, including available e-learning options (Figure 21).

**Key message:** Integrated learning translates into integrated practice, ***pre- and in-service training.***

AMS linked with IPC should be incorporated or strengthened in preservice training, curricula and textbooks. Voluntary or mandatory in-service training on AMS and IPC is also encouraged, such as through inclusion of relevant AMS and IPC competencies in continuing medical education.

### *Face-to-face workshops*

A possible structure for a face-to-face workshop, with content aligned with the required competencies for AMS, is presented in Table 11 on page 49. However, this is a “menu” of options which can be used to design a local training program that meets local needs, contexts and resources.

### *Blended learning*

Blended learning, with its mix of technology and traditional face-to-face instruction, is an approach that is commonly used. Blended learning combines classroom learning with online learning and is becoming increasingly popular, as students can partly control the time, pace and place of their learning.

## *Practical training at centers of excellence*

As centers of excellence and WHO collaborating centers for AMS are established globally, AMS teams and AMS champions are encouraged to gain practical hands-on training through these centers. Countries can also set up twinning or mentoring programs with successful counterparts, using context-relevant examples to support the establishment, implementation and monitoring of stewardship interventions.

## *On the job learning*

A common approach to successful training makes use of both existing structures and opportunities that arise in the clinical environment. For example, a member of the AMS team is reviewing a patient with sepsis who has been started empirically on broad-spectrum antibiotics (piperacillin/tazobactam), in contradiction to the antibiotic combination recommended by the STGs and EML (amoxicillin/gentamicin and metronidazole). The empirical treatment was continued despite blood cultures that revealed *Escherichia coli* susceptible to amoxicillin. A brief discussion with the attending physicians and nurses could provide an opportunity for training in one or more areas:

- Raising awareness of the facility's standard treatment guidelines
- Importance and rationale for using recommended empirical agents for patients, but also the potential immediate and long-term harm of broad-spectrum therapy;
- Benefit and safety of de-escalation of antibiotic treatment following cultures; and
- Opportunity and benefits of IV-to-oral switching.

As described in previously, holding ward rounds jointly with the unit health personnel and the AMS team is among the most dynamic instances of learning. Every member of the team attending to the patient has the opportunity to give their opinion, debate the pros and cons of each diagnostic or therapeutic decision, and understand what is best for this and future patients.

Recently, the organizational, resource-related and fiscal benefits of learning for healthcare professionals have been outlined in an excellent systematic review. This pragmatic approach to on-the-job training and its relevance for optimal patient management can be instructive, valued and is often retained.

## *E-learning*

The importance of directing participants to local, national and international e-learning resources is important in ensuring the long-term sustainability of these educational activities, and various resources already exist. Indeed, e-learning has been commended as one important form of effectively delivering education in AMS. However, e-learning is a means to an end, rather than the end in itself. Using e-learning can result in greater educational opportunities for students while simultaneously enhancing faculty effectiveness and

efficiency. However, this potential of e-learning assumes a certain level of institutional readiness in human and infrastructural resources that is not always present in LMICs. Institutional readiness for e-learning adoption ensures the alignment of new tools to the educational and economic context.

### *Others*

Other examples of facility structures and meetings where training could be provided include morbidity and mortality meetings, audit meetings, quality improvement and safety briefs, significant event analysis, risk management meetings and journal clubs. Where possible and relevant, using team-based or multidisciplinary teaching and training events also provides an excellent opportunity for interprofessional learning. As infection prevention and management is very much a team-based approach, it enhances the philosophy of learning together and delivering care together to achieve better patient outcomes. The challenge for AMS facility training is to ensure that the capacity and capability exist for delivering a quality, effective and sustainable program or course. Therefore, having a simple model to ensure implementation of this program is important.




*Figure 20: Education and training delivery modes for AMS-related competencies*

## 7.3 Effectiveness of different training and education delivery

While face-to-face training methods are the norm in many LMICs, more active methods such as e learning are increasingly used. Furthermore, blended programs that encompass some or many components of e-learning to augment traditional face-to-face training are becoming more popular. There is evidence that the use of online and mobile digital education in the

management of antibiotics for post-registration healthcare professionals is associated with increased professional knowledge compared with traditional education. E-learning approaches have been shown to provide flexible, low-cost, user-centered and easily updated learning. However, the effectiveness of e-learning varies from context to context and has been shown to make considerable demands on users' motivation, levels of "digital literacy" and on the capacity of providing institutions.

These considerations must be taken into account when developing e-learning courses. A range of teaching methods, described in Table 12 are used to deliver training. Broadly speaking, active methods are more effective than passive methods in changing prescribing behaviour.

*Table 12: Teaching methods for AMS interventions*

| Indicators | Method |
|---|---|
| Passive | ▪ Printed educational materials<br>▪ Clinical practice guidelines<br>▪ Formal lectures<br>▪ Seminars, conferences<br>▪ Educational courses<br>▪ Reminders<br>▪ Distance learning, e-learning |
| Active | ▪ Discussion groups, journal clubs<br>▪ Educational outreach visits and academic discussions<br>▪ Audit and feedback<br>▪ Interactive role play, case scenarios, interactive educational workshops<br>▪ Sequenced educational sessions (learn-work-learn), learning by working (practice)<br>▪ Distance learning, e-learning. |

# ANNEXES

*Annex 1: Sample terms of reference - National AMS technical working group*

**Purpose**

- Provide strategic leadership on AMS measures under the national action plan on AMR.
- Provide a coordinated approach for national, healthcare facility and community AMS (rational use of antimicrobials) program.
- Support national and international efforts as required.

The overall aim of the AMS-TWG is to optimize the use of existing antimicrobials and prevent the spread of resistant infections.

**Accountable to:**

- National AMR-TWG, professional organizations and others as applicable

**Responsibilities and activities**

- Oversees and co-ordinates the development and implementation of national strategy and/or policy for controlling AMR by optimizing the use of antimicrobials through the implementation of AMS programs.
- Ensures sufficient resources (human and financial) to achieve the objectives and outcomes of the national AMS strategy or policy.
- Ensures that relevant education and training on AMS are provided to pre- and in-service healthcare professionals.
- Undertakes M&E of AMS interventions at the national, healthcare facility and community level based on the national AMS strategy or plan on an annual or biannual basis.

**Membership (to be adapted based on the country context)**

The membership of the national AMS-TWG should comprise members representing the relevant departments within the Ministry of Health responsible for the selection, procurement, supply, distribution, prescribing and use of antimicrobials at the national level. Inclusion of additional sectors, notably the animal health, food and environment sectors, is advisable. Representatives should be given sufficient authority by their institutions to make decisions. The TWG should remain small enough to be functional, striking a balance between full representation and the functionality of the group to coordinate a national AMS strategy, policy or plan and be linked with other relevant groups (AMR and AMC surveillance, etc.).

**Frequency of meetings**

The meeting format and rules should conform to national norms. Standard operating procedures may be elaborated transparently and according to the principles of best practice to guide the activities of the TWG. A chairperson should be selected based on his/her expertise in leadership. Rotation of the chair among members of the TWG could be considered. The TWG should meet on a regular basis, at a minimum monthly.

**Conflict of interest**

It is recommended that the group should have a mechanism (with appropriate records) to ensure that its members have no conflicts of interests and that, the work of the TWG in the interests of public health is transparent.

*Annex 2: Sample terms of reference – healthcare facility AMS Committee*

**Purpose**

The healthcare facility AMS Team provides oversight and coordination of the implementation and review of the AMS program at the facility. The AMS program 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). This committee shall be incorporated/integrated in the existing quality management team, where it exists to prevent multiple parallel structures with similar functions. This will also avoid overlapping of functions.

**Accountable to (adapted to the healthcare facility context)**

1. National AMS-TWG (or as applicable)
2. Healthcare 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 healthcare 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 program in the facility.
- Formalizes a healthcare facility AMS team that reports to the AMS committee.
- Endorses the implementation of systems or QMT to monitor AMC and/or use and resistance.
- Reviews, endorses and implements clinical guidelines for antimicrobial prescribing.
- Endorses the implementation of an education program 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 program.

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

The membership of the healthcare facility AMS committee will consist of the following healthcare facility's employees and will be embedded in the existing hospital quality management team (QMT) structures, where it exists:

- Medical Director (Chair or Lead)
- Hospital Pharmacist (Deputy Chair)

- Laboratory technician or Clinical microbiologist (Secretary)
- Departments or wards or unit heads/supervisors (including: OB/GNY, ER, Pediatric, M/S, OR, Hygienist)-member
- Hospital Quality Management Team Lead
- Hospital IPC Focal Person
- County IPC Focal Person
- Physician Assistant
- Patient safety or quality improvement champion (if identified; if not identified one)
- Hospital record manager or record department representative
- Hospital IT representative
- Other personnel may be co-opted as required to assist the work of the committee

Option 1: >2 healthcare 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 program, with access to expert advice (e.g. secondary or small facilities with limited resources).

**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 3: High-quality health system framework components*

| Components | |
|---|---|
| **Impacts of Quality** | |
| Better health | *Level and distribution of patient-reported outcomes:* function, symptoms, pain, wellbeing, quality of life, and avoiding serious health-related suffering, reduced morbidity and mortality. |
| Confidence in system | Satisfaction (patient-reported measures), adherence to recommendations, trust in HCWs, appropriate care uptake, willingness to use healthcare and retention |
| Economic benefit | Ability to work or attend school, economic growth, reduction in health system waste, and financial risk protection, reducing premature deaths, prevent inappropriate admissions. |
| **Processes of care** | |
| Competent care and systems | Evidence-based, effective care: systematic assessment, correct diagnosis, appropriate treatment, counselling, and referral; ***capable systems***: safety, prevention and detection, continuity and integration, timely action/care (short waiting time), population health management, attention to people's values and preferences (people-centeredness) |
| Positive user experience | **Respect:** dignity, privacy, non-discrimination, autonomy, confidentiality, and clear communication; user focus: choice of provider, short wait times, patient voice and values, affordability, and ease of use |
| **Foundations** | |
| Population | Individuals, families, and communities as citizens-as partners, producers of better health outcomes, and system users: health needs, knowledge, health literacy, preferences, and cultural norms |
| Governance | **Leadership:** Political commitment, change management; policies: regulations, standards, norms, and policies for the public and private sector, institutions for accountability, supportive behavioral architecture, and public health functions; financing: funding, fund pooling, insurance and purchasing, provider contracting and payment; learning and improvement: institutions for evaluation, measurement, and improvement, learning communities, and trustworthy data; intersectoral: roads, transport, water and sanitation, electricity, and higher education, inspire & sustain professionalism-excellence. |
| Platforms | **Assets:** number and distribution of facilities, public and private mix, service mix, and geographic access to facilities; care organization: roles and organization of community care, primary care, secondary and tertiary care -referral, prehospital transport, engagement of private providers; connective systems: emergency medical services, referral systems, and facility community outreach |
| Workforce | Health workers, laboratory workers, planners, managers: number and distribution, skills and skill mix, training in ethics and people-centered care, supportive environment, education, team work, and retention |
| Tools | **Hardware:** equipment, supplies, medicines, and information systems; software: culture or mindset of quality, ability and willingness to learn from, data, supervision, and feedback |

*Adapted from Kruk, M. E et al., 2018. High-quality health systems in the Sustainable Development Goals era: time for a revolution; Lancet Glob Health; 6: 1196–252, accessed May April 13, 2021*

*Annex 4: Sample AMS Review Form*

| **General Information** | | | | |
|---|---|---|---|---|
| **Review date: (DD/MM/YYYY):** | | **Week #:** | **Hospital:** | |
| Ward/Unit: | | | Bed #: | Hosp #: |
| Patient name: | Age: | Weight: | Sex: Male ☐ Female ☐ | |
| Person completing the form: | | | Title: | |

| **Antibiotic prescriptions** | | | | |
|---|---|---|---|---|
| Antibiotics prescribed | Dose (mg/g) | Adm. Route | Adm. Interval | Start date |
| 1. Ampicillin | | | | |
| 2. Amoxicillin | | | | |
| 3. Augmentin | | | | |
| 4. Azithromycin | | | | |
| 5. Cotrimoxazole | | | | |
| 6. Doxycycline | | | | |
| 7. Erythromycin | | | | |
| 8. Metronidazole | | | | |
| 9. Others: | | | | |
| | | | | |
| | | | | |
| | | | | |

| **Indication for antibiotic treatment** | | | | |
|---|---|---|---|---|
| Prophylaxis ☐ | UTI ☐ | Pneumonia ☐ | Gastrointestinal infection ☐ | Bloodstream infection ☐ |
| CNS ☐ | Skin infection ☐ | Bone infection ☐ | Others: | |

| **Initial review of antibiotic treatment** | | |
|---|---|---|
| Is indication for antibiotic treatment documented?<br>Yes ☐<br>No ☐ | Is antibiotic treatment prescribed according to guideline?<br>Yes ☐<br>No ☐ Why not? | Comments: |
| Correct dose?<br>Yes ☐<br>No ☐ | Appropriate route?<br>Yes ☐<br>No ☐ | Treatment duration or review date stated?<br>Yes ☐<br>No ☐ |

| **48-hour review of antibiotic treatment** | | | | |
|---|---|---|---|---|
| Is antibiotic treatment reviewed? Yes ☐ No ☐ | | | If yes, what action? | |
| Escalate ☐ | Continue ☐ | De-escalate ☐ | Stop ☐ | IV---oral switch ☐ |
| Why antibiotic treatment is been continued? | | | | |
| Continuing clinical signs of infection ☐ | | Confirmed infection ☐ | Others (Comments): | |
| Microbiology specimens collected? Y/N<br>☐Date: | | Microbiology results received? Y/N<br>☐Date: | Microbiology results acted upon? ☐<br>**Comment:** | |

**General comments (*e.g. allergy, no allergy, guideline compliance)***

**Date**: (DD/MM/YY):_____ **Name/signature (reviewer**): _____

*Annex 5: Ward data collection form on Antimicrobial Use/Point Prevalence Survey*

**Instruction: Please print inside character and date frames blank spaces or place a cross the appropriate box using black or blue pen**

| **General information** | **Survey date (DD/MM/YYYY):** | **Patient's admission date (DD/MM/YYYY):** | |
|---|---|---|---|
| Hospital name: | Hospital code: | Ward/Unit: | Bed #: |
| **Sex:** ☐M ☐F | Date of birth (DD/MM/YYYY): | If patient is below 1 year old, enter age in month: | |
| Patient hospital #: | If female, please indicate if she is: ☐Pregnant; ☐Non-pregnant ☐Breastfeeding ☐ Unknown ☐ NA | | |
| Date of the visit (Day 1, DD/MM/YYYY): | | | |
| Name of the AMS team member: | | | |
| **2.Disease (Please Check Suggested Specimen For Microbiological Analysis In Brackets)** | | | |
| ☐ Meningitis (CSF, blood for culture)<br>☐Gastroenteritis (Stool, blood for culture)<br>☐Skin & soft tissue infections or SSTI (swab, skin, blood for culture)<br>☐Surgical site infection (swab, blood for culture)<br>☐Pneumonia (blood culture, pleural aspiration)-community acquired<br>☐UTI (urine)<br>☐ Bloodstream infection<br>☐ Pneumonia<br>Others (please specify) | | | |
| **3. Samples Taken to Confirm Diagnosis (please check)** | | | |
| ☐ Blood for culture<br>☐ Stool<br>☐CSF<br>☐ Swab<br>☐ Pleural aspiration<br>☐ Urine<br>☐ None | | | |
| **4. Antibiotics Currently Prescribed (Please Check; Write the Dosage, Formulation and Duration)** | | | |

| DRUG | Dosage (MG, G,IU) | 1X/Day (QD) | 2X/Day (BID) | 3X/DAY (TID) | 4X/DAY (QID) | Formulation (PO, IV) | Duration (Days) |
|---|---|---|---|---|---|---|---|
| Ampicillin | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Amoxicillin | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Augmentin | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Azithromycin | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Ceftriaxone | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Chloramphenicol | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Ciprofloxacin | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Cotrimoxazole | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Doxycycline | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Erythromycin | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Metronidazole | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Other, please specify | | | | | | | |

4.**Indication for antibiotic treatment (please check as appropriate)**

☐ **Surgical prophylaxis:** Antibiotics administered within 24 hours prior to surgery to prevent contamination.

☐ **Medical Prophylaxis**: Antibiotics prescribed during non-surgical intervention or procedure (e.g. endoscopy or cystoscopy) to prevent infectious complication of a disease.

☐ **Empiric Therapy**: Antibiotics administered prior to the receipt of blood culture and AST results.

☐ **Targeted/Definitive Therapy**: Antibiotics given subsequent to receipt of blood culture and AST results.

☐ **Unknown:** Indication not recorded in note; record **No** in the reason recorded in the notes field.

☐ Others

**5.RECOMMENDATION OF THE AMS TEAM (CHECK AND WRITE DOSAGE, FORMULATION, DURATION OR CHECK, STOP)**

| Drugs | Stop the antibiotic | No change necessary | Change dosage (Write new dosage here) | 1X/DAY (QD) | 2X/Day (BID) | 3X/DAY (TID) | 4X/DAY (QID) | Formulation (PO or IV) | Duration (Days) |
|---|---|---|---|---|---|---|---|---|---|
| Ampicillin | ☐ | ☐ | | ☐ | ☐ | ☐ | ☐ | | |
| Amoxicillin | ☐ | ☐ | | ☐ | ☐ | ☐ | ☐ | | |
| Augmentin | ☐ | ☐ | | ☐ | ☐ | ☐ | ☐ | | |
| Azithromycin | ☐ | ☐ | | ☐ | ☐ | ☐ | ☐ | | |
| Ceftriaxone | ☐ | ☐ | | ☐ | ☐ | ☐ | ☐ | | |
| Chloramphenicol | ☐ | ☐ | | ☐ | ☐ | ☐ | ☐ | | |
| Ciprofloxacin | ☐ | ☐ | | ☐ | ☐ | ☐ | ☐ | | |
| Cotrimoxazole | ☐ | ☐ | | ☐ | ☐ | ☐ | ☐ | | |
| Doxycycline | ☐ | ☐ | | ☐ | ☐ | ☐ | ☐ | | |
| Erythromycin | ☐ | ☐ | | ☐ | ☐ | ☐ | ☐ | | |
| Metronidazole | ☐ | ☐ | | ☐ | ☐ | ☐ | ☐ | | |
| Other, please specify: | | | | | | | | | |

| **6.FOLLOW UP ON DAY 3 RECOMMENDATION (PLEASE CHECK)** | |
|---|---|
| ☐ Recommendation not followed<br>☐ Recommendation followed<br>☐ Recommended drug is not available | |
| **7: TREATMENT OR PATIENT OUTCOME** | |
| ☐ Improving<br>☐ No change<br>☐ Deteriorated<br>☐ Discharged home<br>☐ Discharged against medical advice (AMA)<br>☐ Referral<br>☐ Died | |

*Adapted from GIZ, Health Focus & MOH report form on AMS Post-Ebola health system strengthening & epidemic prevention support to the implementation of the National Anti-Microbial Resistance Strategy, Liberia*

*Annex 6: Data Collection Protocol*

**2.1 Inclusion/Exclusion Criteria**

The following hospitals, wards and patients are included in the PPS:

**Hospitals:**

- All hospitals, private and public (secondary, tertiary).

***Wards***

- All wards including long-term care wards and acute psychiatric wards within the hospitals. Day units, accident and emergency units, labor wards, and operating theatres are excluded.

***Patients***

- All patients admitted to the ward by 8am on the morning of the survey with the exception of day patients. All ages are included. Mothers and babies should have a form completed each.
- Patients transferred into the ward after the start of the survey are excluded.

***Please note: Patient age in months if less than 1 year.*** *If age is less than 4weeks old, record as age=0. If patient between 4 weeks older but less than 1 years of age, round their age to nearest month.*

**2.2 Data Collection Methods**

- Data collection will be undertaken by health and hospital staff during specified (e.g. months of February, March and May). For each patient, the data collector should review:
  - ✓ Current nursing notes
  - ✓ Current medical notes
  - ✓ Temperature charts
  - ✓ Drug charts
  - ✓ Surgery/operation notes
  - ✓ Laboratory report e.g. microbiology results
  - ✓ Other relevant charts e.g. wound charts, stool charts, care plans.

If any of the information is not clear from the notes, the data collector should professionally approach a member of ward staff for clarification.

Ward-level data should be obtained by discussion with the ward supervisor, nurse in charge or other ward staff at the start of the survey.

***Please note:*** *Each ward should be started and completed within the specified period of the survey when staff are available on the wards to clarify any doubt. Wards where patients are admitted for elective procedures should be surveyed between Monday and Friday.*

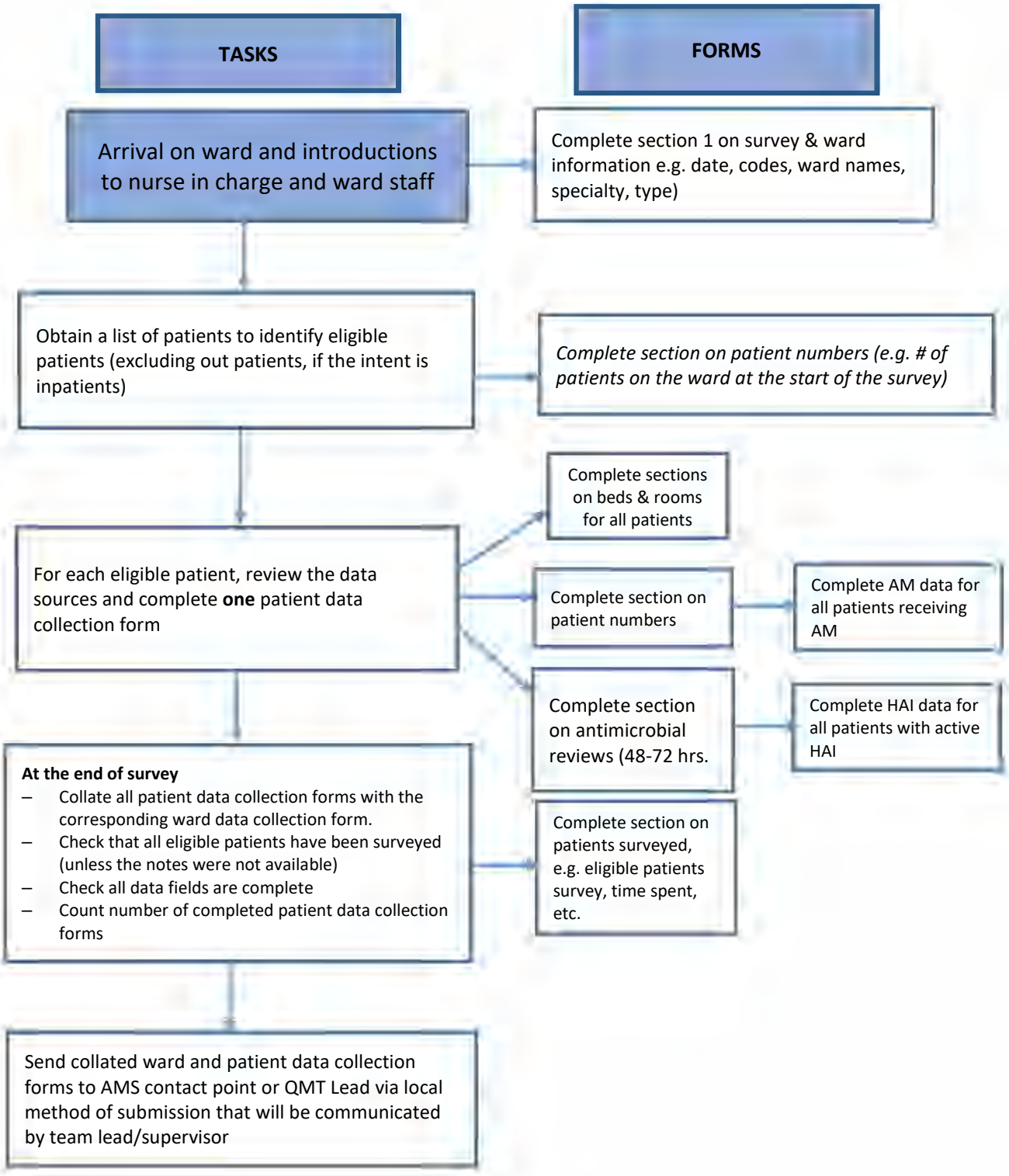
- Data will be collected using paper forms and/mobile apps (one form per patient).
- These should be returned to the supervisor or send the forms designated data manager for data entry, quality checking, analysis and reporting.
- Please send completed forms in regular small batches if possible, rather than in one batch.

All forms should be received by data manager no later than agreed timeline.

**2.3 Completion of data collection forms**

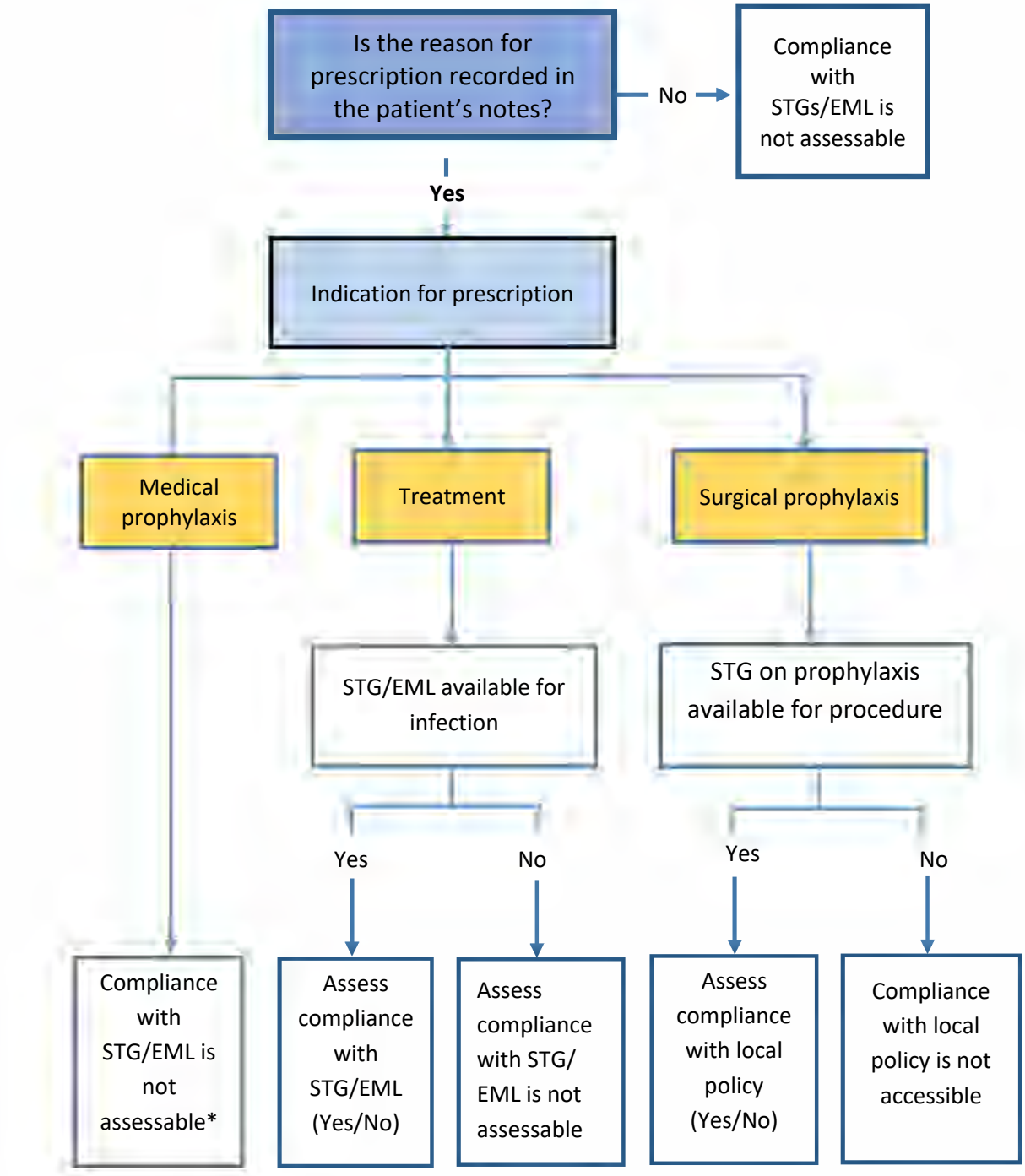
- To ensure the accuracy and effectiveness of scanning, please follow these instructions when completing the data collection forms:
    - Use a dark ink pen or biro
    - Place a cross in appropriate box
    - Correct errors by completely filling the incorrect box and checking (with a cross) the correct box
    - Be thorough in completion
    - Write clearly
    - Write within boxes, without writing onto the box lines.
- Please do not:
    - Use light pens e.g. green/red
    - Leave gaps/blank
    - Use correction fluid
    - Forget to completely fill a box that has been checked in error.
    - Forget to check (with a cross) a new box if an error has been corrected (by completely filling it).

*Annex 7: Algorithm for collecting PPS Data*




*Adapted from the National Health Services Scotland 2016 protocol for the collection of patient- and ward-level data v1.0.*

*Annex 8: Algorithm for determining compliance with the data flow*



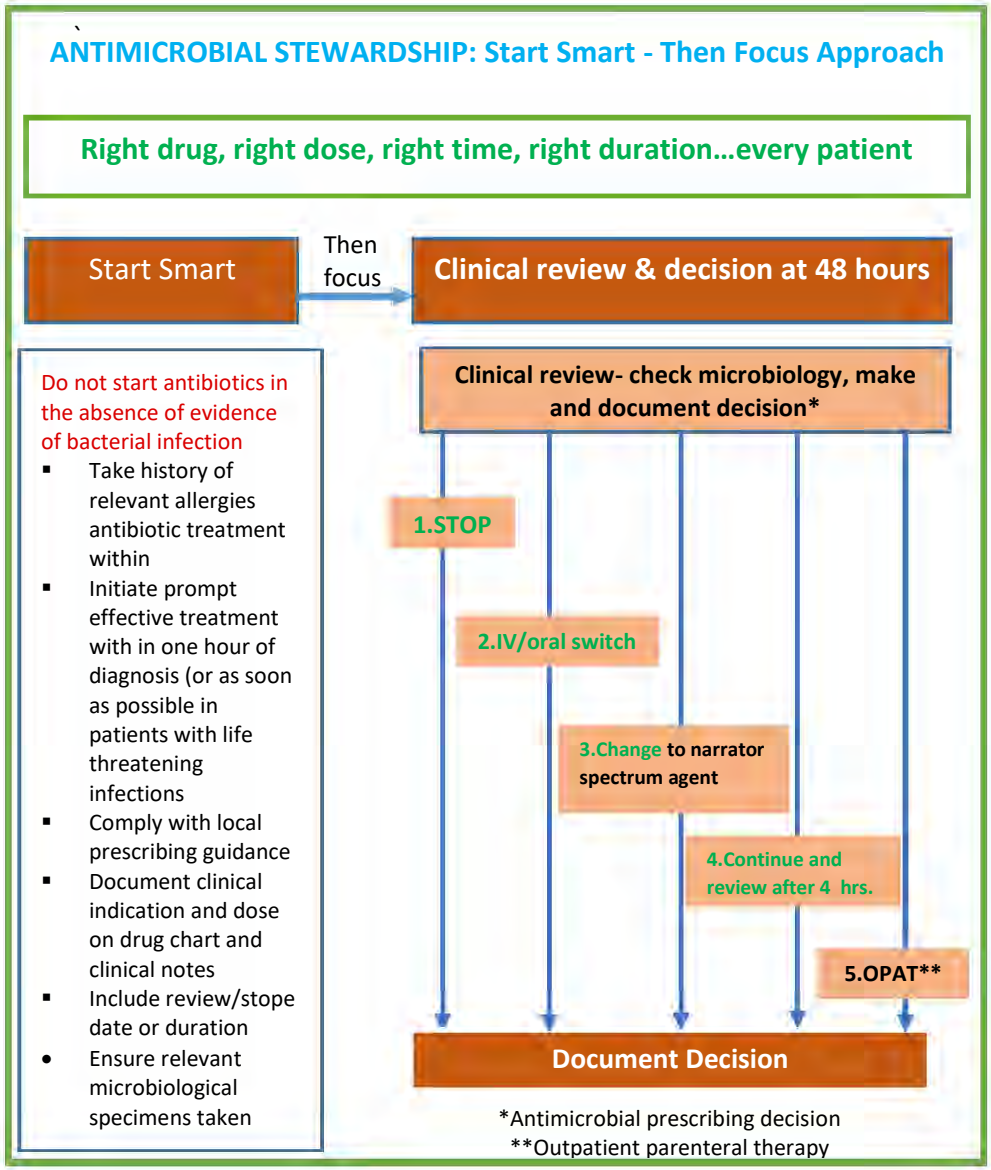

The following prescriptions should be recorded as "**not assessable**" against the prescribing guide:

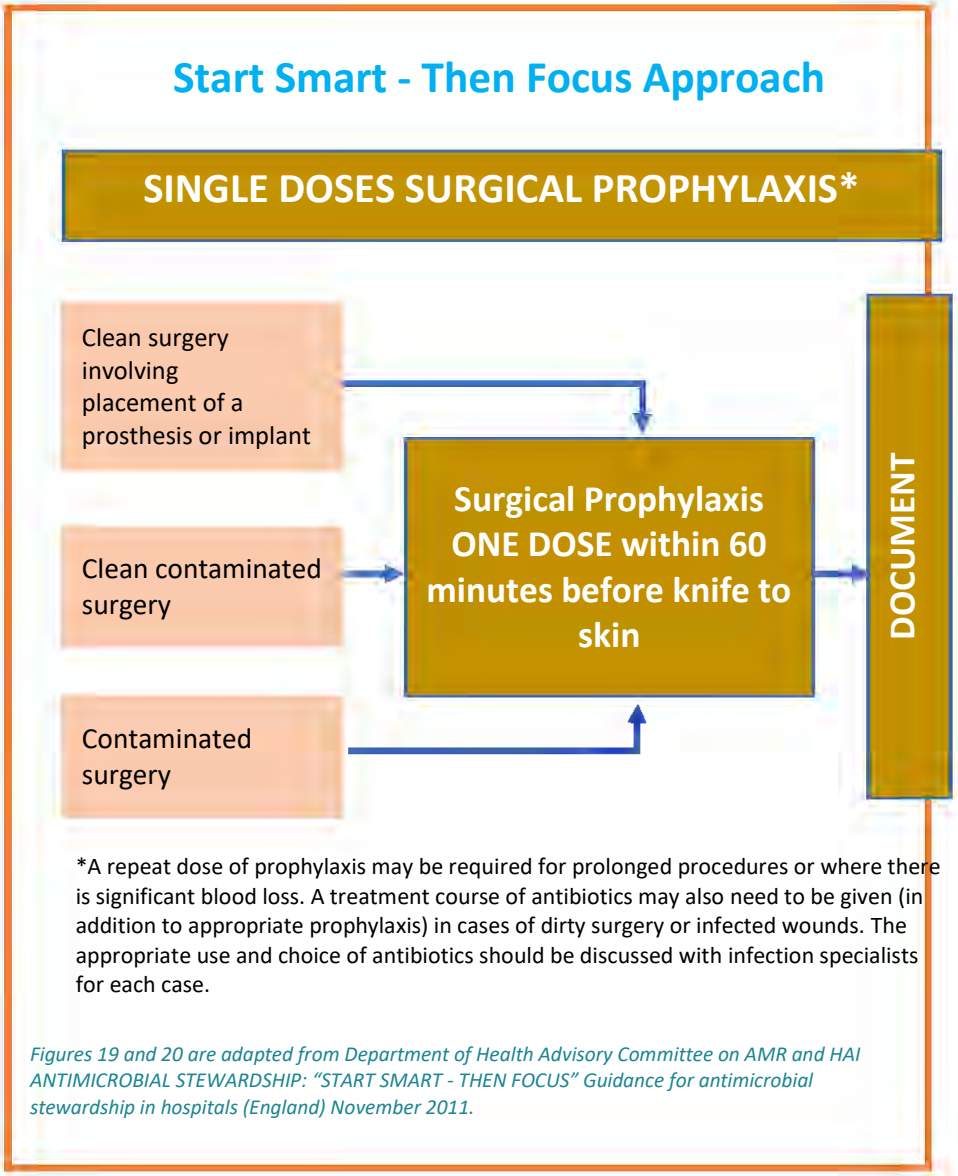
- Medical prophylaxis
- Prescriptions where the reason is not recorded in the notes
- Prescriptions where the indication was not known or not recorded
- No empirical policy/guidelines available for specific diagnosis
- No surgical prophylaxis policy/guidelines available for specific surgical procedure
- Non-empirical prescribing on advice of Microbiologist/Lab Technician
- Other reason for not following local policy/guidelines e.g. drug allergy
- If the notes are not available for review, "**not known**" should be recorded

*Annex 9: Sample AMS pre-authorization/restricted prescribing form*

| | | | | |
|---|---|---|---|---|
| **Patient information** | | | | |
| *Date:* | *Department:* | | Ward: | |
| Patient name: | Sex: Male ❑ Female ❑ | | Allergies | |
| Age: | | | | |
| **Indication for antibiotic Treatment** | | | | |
| **Request for pre-authorized/restricted antibiotics** | | | | |
| Antibiotic(s) requested | Does and duration | Administration | Interval | Reason for request |
| 2. | | | | |
| 3. | | | | |
| 4. | | | | |
| Are there microbiology test results with in the HCF? Sensitivity testing available Yes ☐ No ☐ yes provide details: | | | | |
| Date | Specimen | Pathogen identified as suspected and susceptibility | | |
| **Has the patient already received antibiotics?** Yes ☐ No ☐. If yes, what? | | | | |
| Antibiotic requested | Does and duration | Administration route | Interval | Why if treatment is not education? |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| **Requesting physician's name/contact number:** | | | | |
| **Requesting physician assistants** | | | | |
| **Comments from the AMS team and during and therapeutic committee or Pharmacy Department:** | | | | |
| **Approval:** | | | | |
| ❑ Approved | | ❑ Not approved | | |
| **Remarks:** | | | | |
| Name/signature of specialists:_____Date: _____ | | | | |

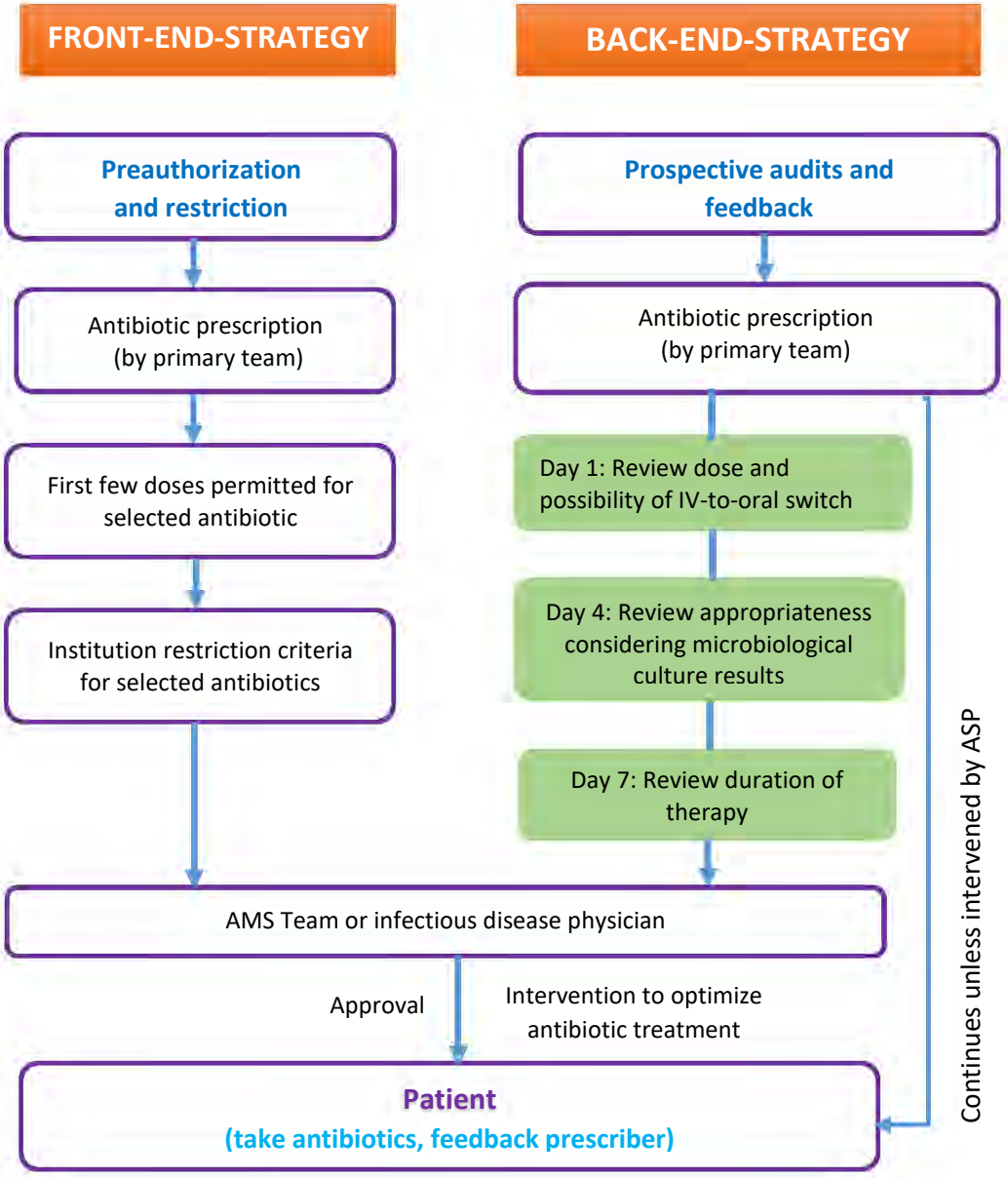
*Annex 10: Start Smart, then focus approach*



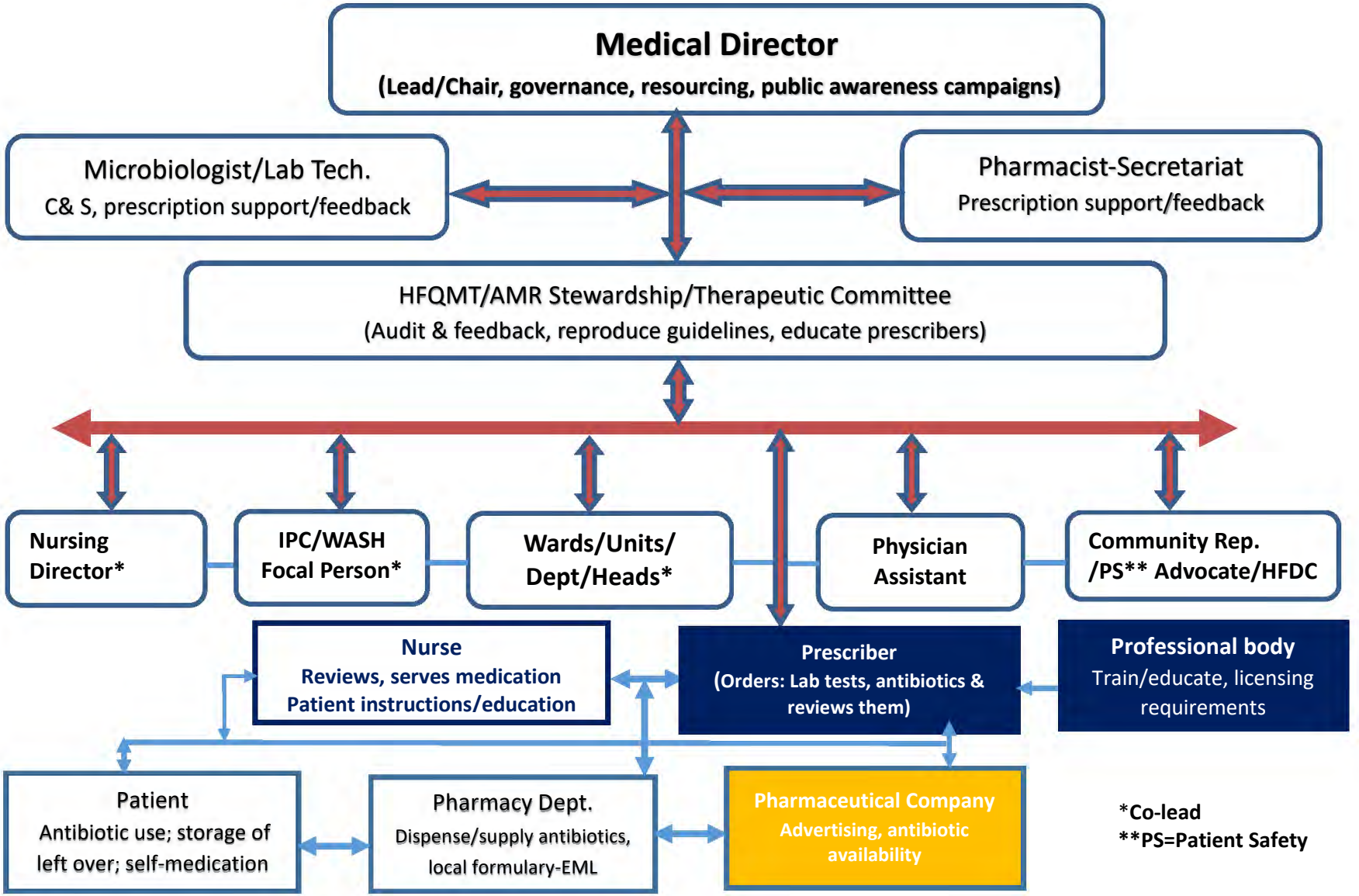

*Figures 19 and 20 are adapted from Department of Health Advisory Committee on AMR and HAI ANTIMICROBIAL STEWARDSHIP: "START SMART - THEN FOCUS" Guidance for antimicrobial stewardship in hospitals (England) November 2011.*

*Annex 11: Front- and Back-end Antimicrobial Stewardship Strategy*




*Adapted from Chung GW et al. Virulence 2013; 4:1-7.*

*Annex 12: Hospital Quality Management and AMS Team Structure and Prescribing Pathway*



*Annex 13: WHO surgical safety checklist*



# Surgical Safety Checklist

World Health Organization | Patient Safety

## Before induction of anaesthesia

(with at least nurse and anaesthetist)

**Has the patient confirmed his/her identity, site, procedure, and consent?**
- ☐ Yes

**Is the site marked?**
- ☐ Yes
- ☐ Not applicable

**Is the anaesthesia machine and medication check complete?**
- ☐ Yes

**Is the pulse oximeter on the patient and functioning?**
- ☐ Yes

**Does the patient have a:**

**Known allergy?**
- ☐ No
- ☐ Yes

**Difficult airway or aspiration risk?**
- ☐ No
- ☐ Yes, and equipment/assistance available

**Risk of >500ml blood loss (7ml/kg in children)?**
- ☐ No
- ☐ Yes, and two IVs/central access and fluids planned

## Before skin incision

(with nurse, anaesthetist and surgeon)

- ☐ **Confirm all team members have introduced themselves by name and role.**
- ☐ **Confirm the patient's name, procedure, and where the incision will be made.**

**Has antibiotic prophylaxis been given within the last 60 minutes?**
- ☐ Yes
- ☐ Not applicable

**Anticipated Critical Events**

To Surgeon:
- ☐ What are the critical or non-routine steps?
- ☐ How long will the case take?
- ☐ What is the anticipated blood loss?

To Anaesthetist:
- ☐ Are there any patient-specific concerns?

To Nursing Team:
- ☐ Has sterility (including indicator results) been confirmed?
- ☐ Are there equipment issues or any concerns?

**Is essential imaging displayed?**
- ☐ Yes
- ☐ Not applicable

## Before patient leaves operating room

(with nurse, anaesthetist and surgeon)

**Nurse Verbally Confirms:**
- ☐ The name of the procedure
- ☐ Completion of instrument, sponge and needle counts
- ☐ Specimen labelling (read specimen labels aloud, including patient name)
- ☐ Whether there are any equipment problems to be addressed

**To Surgeon, Anaesthetist and Nurse:**
- ☐ What are the key concerns for recovery and management of this patient?

This checklist is not intended to be comprehensive. Additions and modifications to fit local practice are encouraged.

Revised 1 / 2009

© WHO, 2009

*Annex 14: Moments for hand hygiene for a patient with a post-operative wound*



*Annex 15: AMS in wound swabbing/management: A glance*

Reducing inappropriate use of antibiotics by promoting, facilitating and teaching the use of antibiotic options or alternatives in wound management across all healthcare settings is important in combating AMR.

**Wound Swabbing/Aseptic Technique**

Lipsky et al (2016) suggestions:

- There is generally no need to culture a clinically uninfected wound, as these do not require antimicrobial therapy.
- All clinically infected wounds should be cultured -preferably by obtaining tissue (either by curettage or biopsy), which provides more sensitive and specific results than swabbing.

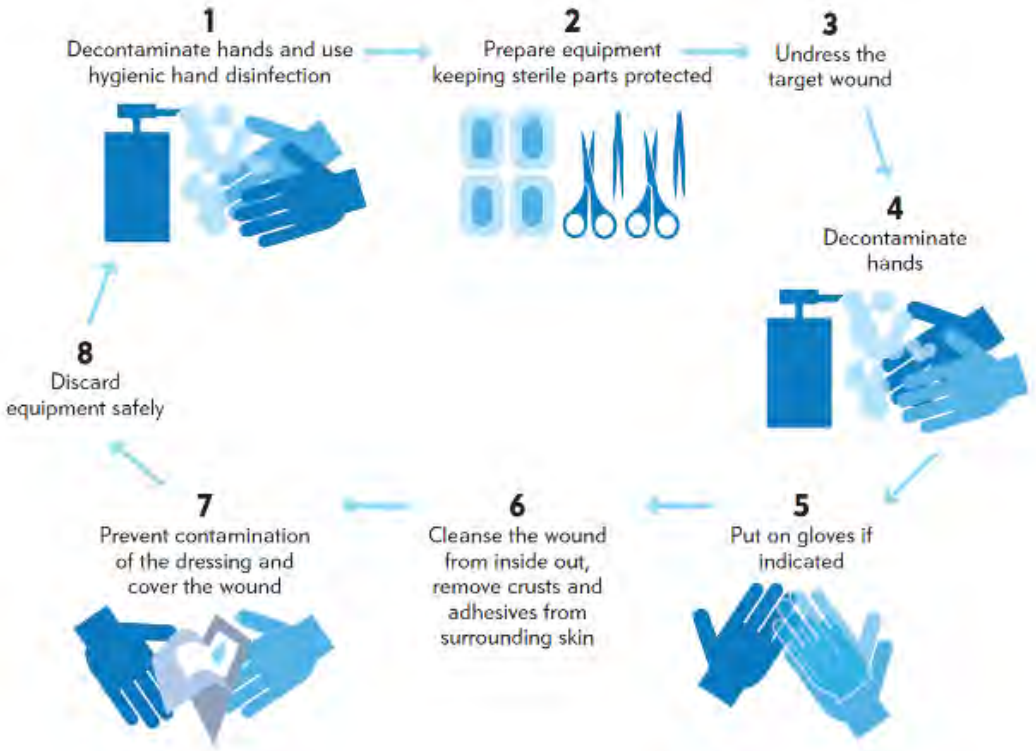
**Wound Swab**

- All wounds should be cleansed and debrided prior to swabbing.
- Collect a specimen for culture before starting antibiotic therapy.
- If there are signs of systemic inflammatory response syndrome, blood cultures should be ordered.
- Consider obtaining a bone culture in case of any complications that can arise due to osteomyelitis.
- Does not confirm or deny infection.
- Reveals type/number of bacteria on wound surface
- Ensures correct antibiotic sensitivity testing.
- Results should be reviewed in context of clinical symptoms –never in isolation
- Levine technique is more effective than the Z-swab technique

**IPC in Wound Management**

- Aseptic/clean procedure
- A risk assessment should be conducted prior to performing wound management procedures.
- Use sterile gloves and equipment when touching a wound directly.
- Asepsis is supported by standard precautions, including:
  - Practicing regular and effective hand hygiene
  - Appropriate use of sterile and non-sterile gloves
  - Use of personal protective equipment (e.g. mask and gown)
  - Conducting wound care in a clean environment
  - Strategic sequencing of care
  - Sharps management
  - Environmental controls

*Annex 16: Aseptic technique: IPC in Clinical Practice, Elsevier Health Sciences (Wilson, 2019)*



*Annex 17: Levine technique*

| Step | Actions | Further information |
|---|---|---|
| 1 | Cleanse and debride wound prior to wound culture | ▪ Inform and seek permission from patient to obtain specimen<br>▪ Cleanse wound using warm saline<br>▪ Debride non-viable tissue as required<br>▪ Cleanse wound again |
| 2 | Moisten culture tip | ▪ Moisture culture tip with sterile normal saline especially with dry wound |
| 3 | Where to obtain specimen | Obtain specimen from cleanest are in the wound<br>***Do not obtain (if possible) from slough or necrotic tissue*** |
| 4 | Technique | ▪ Inform the patient that procedure may cause discomfort<br>▪ Place wound culture into wound<br>▪ Firmly press swab into wound and rotate<br>▪ Using a sterile technique, place swab into culture container |
| 5 | Label appropriately | ▪ Patient label on culture container and pathology slip<br>▪ Provide site, time and initials of the obtained specimen (e.g. right medial distal malleolus wound)<br>▪ Provide as much relevant history as appropriate:<br>– Current antibiotic or medication (steroid)<br>– Co-morbidity (diabetes mellitus)<br>– Specific microbe suspected (Pseudomonas)<br>– Provisional diagnosis of wound<br>– Duration of wound |
| 6 | Apply dressing as appropriate | ▪ Medicated dressing may be appropriate<br>▪ Moisture management and wound bed preparation principles should be adhered to |

***International Wound Infection Institute (IWII) Wound infection in clinical practice. Wounds International 2016; (Table 3, page 12)***

*Annex 18: Health Facility Quality Management Team Term of Reference (ToR)*

**Ministry of Health**
**Quality Management Unit**

**Terms of Reference: Healthcare Facility Quality Management Team (HFQMT)**

**Introduction**

The National Health Quality Strategy (NHQS) has been developed to improve the capacity of the health system, provide quality* health services and restore the public's trust. The aim is to provide responsive services through improved leadership, governance, accountability, and community engagement. Quality management is about delivering effective care in an environment that is safe for patients, staff and the public. It also ensures that health care teams are accountable for the quality, safety and satisfaction for patients in the care they have delivered. County and District Health Teams play critical supervisory roles, while the health facility is responsible for the provision of routine health services with the highest quality standard. This terms of reference (TOR) will provide the guidance for health care facility quality management teams (HFQMT).

**Purpose of HCQMT**

To provide leadership, direction and is accountable for regular monitoring and implementation of healthcare quality in the health facility. All members of HFQMT are expected to carry out specific quality management activities and should see those tasks as part of their routine responsibilities rather than additional duties.

**Overall roles and responsibilities**

The HQFMT oversees quality and safety of all personnel and patients accessing the health facility. A HQFMT should be a multidisciplinary team whose roles are directly concerned with establishing, developing and implementing quality within the health facility. It focuses on driving the supervision of all the issues in quality and safety as prescribed by the NHQS.

**Specific roles and responsibilities of the HFQMT**

- Develop and implement quality improvement activities in the health care facility;
- Use facility data to drive the agenda and action plans for quality improvement;
- Conduct monthly quality management meetings to review facility activities and available data. All meetings should have minutes and identified action points with responsible persons noted for appropriate follow up;
- Provide monthly progress reports to District Health Team on quality improvement activities;
- Provide regular feedback to staff within the health facility;
- Support the implementation of the Essential Package for Health Services (EPHS) using the Joint Integrated Supportive Supervision (JISS) findings;
- Mentor health care workers to improve their knowledge and skills on quality improvement;
- Ensure that monthly meeting minutes are written and made available at the facility.

**Proposed issues for discussion at the HFQMT meeting**

- HFQMT will work closely with the OIC to conduct monthly quality improvement meetings at the health care facility to discuss key quality and safety issues/activities within the facility (e.g., prolonged waiting times, lack of adherence to guidelines/protocols/standards, medication errors, patient complaints, etc.);
- Conduct root cause analysis for adverse events along with facility staff to identify systemic defects;
- Follow up on action plans generated from JISS supervisions conducted for prompt redress and improvement within the facility.

**Deliverables**

- HFQMT is established and functional (e.g., holds regular meetings with minutes and data);
- Monthly quality improvement reports submitted to District and County Quality Management Teams;
- Monthly feedback provided to staff on quality activities;
- JISS scorecard and action plan reviewed and updated on a regular basis and shared with County and District Health Teams.

**Membership and governance**

The HFQMT at the **clinic and health center** level will comprise of the following members:

- Officer in Charge – Lead
- Midwife/MCH Supervisor – Co-Lead
- IPC Focal Person – Co-Lead
- Vaccinator – Member
- Cleaner – Member
- Dispenser – Member
- Community representative - Member

The HFQMT at the health center and clinic level will be led by the OIC; co-leads will be the midwife/MCH Supervisor and IPC Focal Person. The HFQMT reports directly to District and County Health Services. The HFQMT will meet monthly.

The HFQMT at the **hospital** level will comprise of the following members:

- Medical Director – Lead
- Nursing Director – Co-Lead
- PC Focal Person – Co-Lead
- All unit supervisors – Member
- Registrar – Member
- Hospital pharmacist – Member
- Community representative – Member

The HFQMT at the hospital level will be led by the Medical Director; co-leads will be the Nursing Director and IPC Focal Person. The HFQMT reports directly to District and County Health Services. The HFQMT will meet monthly.

*"**Quality** is defined as the degree to which health services for individuals and populations, and all components of the health system, increase the likelihood of desired health outcomes and are consistent with current professional knowledge, standards, and health structures." Institute of Medicines (2001).*

*Annex 19: Facility IPC Focal Person TOR*

**Ministry of Health**
**Quality Management Unit**

**Terms of Reference: Healthcare Facility Infection Prevention and Control (IPC) Focal Person**
**Introduction**

The National Health Quality Strategy (NHQS) has been developed to improve the capacity of the health system so that it provides safe and quality health services and restores public trust in the health system to provide robust services through improved leadership, governance, accountability and community engagement.

Quality management is about delivering effective care in an environment that is safe for patients, staff and public. It also ensures that health care teams are accountable for the quality, safety and satisfaction of patients in the care they have delivered. County and district health teams play critical supervisory roles, while the health care facility is responsible for the provisions of routine health services with the highest quality standard. This term of reference (TOR) will provide guidance for the Healthcare Facility Infection Prevention and Control (IPC) Focal Person of the Healthcare Facility Quality Management Team (HFQMT).

**Purpose**

To provide updates and recommendations for key IPC issues arising within the healthcare facility and submit to the District Quality Management Team (DQMT) on a regular basis and share with the County Health Team IPC Focal Person. The Healthcare Facility IPC Focal Person is expected to carry out specific IPC activities / tasks and should see those tasks as part of their routine responsibilities rather than extra duties.

**Qualification**

The Healthcare Facility IPC Focal Person must have had basic training in IPC (e.g., the Safe and Quality Health Services, or SQS, training package) and should preferably be a clinician.

**Overall roles and responsibilities**

The Healthcare Facility IPC Focal Person reports to the HFQMT and oversees all IPC activities and patient safety as prescribed in the national infection prevention and control guidelines. He/she focuses on driving the supervision of all issues related to IPC as well as:

- Implementation of the national IPC program, policies, guidelines, and SOPs;
- In collaboration with key stakeholders, conduct healthcare facility assessments including the Joint Integrated Supportive Supervision (JISS), hand hygiene audits, etc. to monitor and evaluate implementation of IPC standards;
- In collaboration with the District Health Team, provide quarterly feedback from JISS (including scorecard and action plans) and other IPC assessments to key stakeholders and develop action plans to address identified gaps;
- Support antimicrobial resistance (AMR) activities as required (e.g., antibiotic stewardship);
- Oversee the implementation of the IPC training package for use during orientation of new staff and in-service training of various cadres of health care workers;
- Coordinate training for health care workers who will be responsible for IPC activities at the healthcare facility;
- Work with the facility pharmacist to ensure continuous availability of IPC materials in the healthcare facility, including personal protective equipment (PPE), handwashing supplies (soap and alcohol based hand rub), and other relevant materials;
- Co-lead HFQMT meetings within the healthcare facility and provide feedback from these meetings to the DQMT;
- Ensure coordination and alignment of all IPC activities of implementing partners at the facility;
- Support the monitoring and evaluation of an enabling and supportive healthcare environment, including water, sanitation, and hygiene (WASH).

**Deliverables**

- All staff are oriented on national IPC program, guideline, and SOPs (as applicable to their healthcare facility);
- In collaboration with key stakeholders, healthcare facility assessments including the Joint Integrated Supportive Supervision (JISS), hand hygiene audits, etc. are regularly conducted, monitored, and evaluated;
- Feedback on the quarterly JISS (including scorecard and action plans) and other IPC assessments is provided to the district and healthcare facilities;
- All assessment results are shared with key stakeholders and developed action plans are implemented; and
- All newly hired staff are provided with IPC orientation and refresher training provided on a needs basis.

*"**Quality is defined as the** degree to which health services for individuals and populations, and all components of the health system, increase the likelihood of desired health outcomes and are consistent with current professional knowledge, standards, and health structures." Institute of Medicines (2001).*

*Annex 20: National core elements for AMS programs*

## Periodic Antimicrobial Stewardship Assessment Tool

**Purpose**

Antimicrobial stewardship (AMS) programs are successfully implemented when specific structures are in place at the national and healthcare facility levels. WHO has developed a list of essential national and healthcare facility core elements to assist countries in developing and strengthening the necessary structures at the national level to enable effective healthcare facility AMS programs, within national context.

The WHO periodic AMS assessment tool aims to help countries and healthcare facilities identify their AMS preparedness in terms of their national and healthcare facility core elements, to develop a stepwise implementation plan, and to monitor progress in implementing AMS programs and activities over time. The tool helps to assess baseline information on national and healthcare facility core elements to facilitate the implementation of AMS programs and to monitor progress during program implementation

### Intended audience or user

The intended users of the assessment tool are two-fold 1**) a national audience and 2) a healthcare facility audience.** For the national core elements of the assessment tool, the intended users are national health authorities responsible for the implementation of national action plans on AMR, in particular, those responsible for activities related to optimizing the use of antimicrobials/AMS, national AMS TWGs, and other partners supporting national and regional AMS efforts.

For the healthcare facility core elements of the assessment tool, the intended users are healthcare facility managers/leadership, AMS committees/teams or AMS champions responsible for the overall coordination and implementation of healthcare facility AMS programs.

The users are encouraged to fill out the checklist (national or healthcare facility) based on their function, to identify core elements that are already in place and their level of implementation, core elements that require accelerated implementation and any gaps. This will provide the user with the baseline information to inform the current status of their AMS program and a visual tool to develop a stepwise implementation plan to develop the areas of the core elements that are either missing or strengthen the implementation of existing core elements. The user is also encouraged to periodically (e.g. quarterly, annually) re-assess their AMS program with the assessment tool to monitor and evaluate progress over time and to disseminate these reports.

### When and how to conduct the assessment

The tool will be used as an annual activity to review the national and healthcare facility AMR response. Responses will be gathered through interviews with members of the AMS Team, focus group discussions among stakeholders and from healthcare facility records. A verifier section has been provided to serve as a guide.

To complete the assessment tool, the user should provide one response per question based on the following options:

1. No (**0=Red**): The core element is not in place and is not a priority;
2. No, but a priority (**1=Orange**)- The core element is a priority but there is no plan in place to initiate it;
3. Planned but not started (**2=Yellow**)- The core element is planned but no action has taken place;
4. Partially implemented (**3=Light green**)-The core element is in place, but it is only partially implemented requiring further strengthening;
5. Fully implemented (**4=Green**)-The core element is in place and is fully implemented without requiring strengthening but needing to be sustained.

The component for the assessment is chosen either from 0, 1, 2, 3, 4 from the dropdown menu, when using excel or by ticking the appropriate box in the world document or circling the appropriate score that matches each answer of the current AMS activities.

*Annex 21: Indicators from the Tripartite M&E framework for the Global Action Plan on AMR relevant to AMS Programs*

The Tripartite M&E framework for the Global Action Plan on AMR includes outcome indicators for optimizing use of antimicrobials that may be useful in monitoring national AMS programs.[22] These indicators are also expected to aid reporting in the Annual Tripartite AMR Country Self-assessment Survey (TrACSS), in particular regarding a national monitoring system for consumption and rational use of antimicrobials in human health.

| Measurement | Indicator Name | Source of data at the global level |
|---|---|---|
| **Use of antimicrobials in humans** | Total human consumption of antibiotics for systemic use (Anatomical Therapeutic Chemical classification code J01) in DDDs per 1000 population (or inhabitants) per day | GLASS-sectional PPS |
| **Access to antibiotics** | Percentage of health facilities that have a core set of relevant antibiotics available and affordable on a sustainable basis | SDG 3.b.3, with ACCESS antibiotics disaggregated |
| **Appropriate use of antimicrobials** | Percentage of inpatient surgical procedures with appropriate timing and duration of surgical antibiotic prophylaxis | PPSs |
| **Optimize antimicrobial use and regulation** | Legislation or regulation that requires antimicrobials for human use to be dispensed only with a prescription from an authorized health worker | TrACSS |

[22] WHO & FAO. 2019. Monitoring and evaluation of the GAP on AMR: framework and recommended indicators. Geneva: WHO

*Annex 22: How to become a good antimicrobial stewards*

| Actor | What it means to be good antimicrobial stewards | Example actions |
|---|---|---|
| **Prescribers** | Use antimicrobials responsibly by: | ▪ Making accurate diagnoses<br>▪ Following STGs, EML, formulary on antimicrobials<br>▪ Regularly reviewing the need for therapy |
| **Nurses** | Help ensure antimicrobials are used responsibly by | ▪ Ensuring patients understand how to take antimicrobials on discharge |
| **Microbiologists/laboratory** | Help ensure antimicrobials are used responsibly by | ▪ Taking cultures at appropriate times and feedback |
| **Patients** | Use antimicrobials responsibly by: | ▪ Taking antimicrobial courses as recommended by the prescriber<br>▪ Not storing or using leftover antimicrobials |
| **Antimicrobial stewardship teams** | Help others in the institution use antimicrobials responsibly by: | ▪ Developing guidelines for antimicrobial use<br>▪ Supporting audit and feedback for prescribers<br>▪ Educating prescribers |
| **Hospital governance** | The institution uses antimicrobials responsibly by: | ▪ Ensuring sufficient sustainable and dedicated funding for antimicrobial stewardship teams<br>▪ Monitoring antimicrobial use and resistance<br>▪ Investing in a Clinical Decision Support System<br>▪ Enabling formulary restrictions |
| **Producer/farmer** | Use antimicrobials responsibly by: | ▪ Diagnosing selectivity<br>▪ Not using antimicrobials as growth promoters |
| **Pharmaceutical company** | Ensures antimicrobials are used responsibly by: | ▪ Limiting advertising of antimicrobials, especially broad spectrum<br>▪ Helping ensure there is a continuous supply of antimicrobials |
| **National policy makers** | The Country uses antimicrobials by: | ▪ Prioritizing and funding antimicrobial stewardship activities<br>▪ Supporting the use of quality metrics and pay for performance |

*Adapted on 31/01/2021 from Clinical Microbiology and Infection 23 (2017) 793e798; available at www.clinicalmicrobiologyandinfection.com*

*Annex 23: Healthcare facility reflection and action planning for improving antibiotics prescribing*

**(Reflection: *What will be done differently? E.g., Conduct ward rounds to review antibiotic prescribing with clinical staff….)***

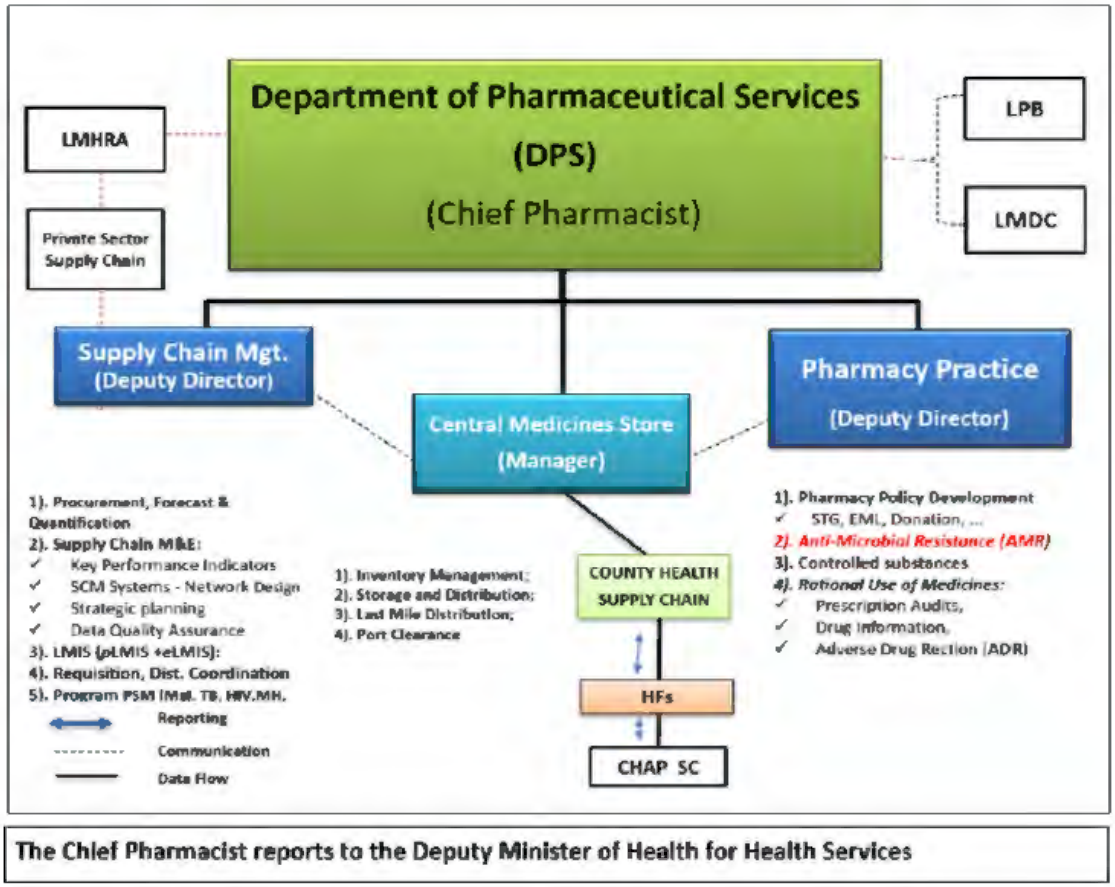
| CE# | Actions/Activities | Core Elements | Resources (HR, Finance..) needed | Responsible person | Start date | End date |
|---|---|---|---|---|---|---|
| 1.1 | | | | | | |
| 1.2 | | | | | | |
| 1.3 | | | | | | |
| 2.1 | | | | | | |
| 2.2 | | | | | | |
| 2.3 | | | | | | |
| 3.1 | | | | | | |
| 3.2 | | | | | | |
| 3.3 | | | | | | |
| 4.1 | | | | | | |
| 4.2 | | | | | | |
| 4.3 | | | | | | |
| 5.1 | | | | | | |
| 5.2 | | | | | | |
| 5.3 | | | | | | |
| 6.1 | | | | | | |
| 6.2 | | | | | | |
| 6.3 | | | | | | |

*Annex 24: Sample of health facility inventory of essential/tracer IPC commodities*

| **County:** | | | **Facility:** | | | **Reporting Date:** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Category** | **No** | **Product name** | **Unit** | **Opening Balance** | **Quantity Received** | **Date Received** | **Qty. Issued** | **Closing Balance** | **# of days of stock out** | **Comment** |
| PPE | 1 | Surgical mask | Each | | | | | | | |
| | 2 | Medical mask | Each | | | | | | | |
| | 3 | N95-respirator mask | Each | | | | | | | |
| | 4 | Face shield | Each | | | | | | | |
| | 5 | Goggles | Each | | | | | | | |
| | 6 | Examination gloves (S) | Each | | | | | | | |
| | 7 | Examination gloves (M) | Each | | | | | | | |
| | 8 | Examination gloves (L) | Each | | | | | | | |
| | 9 | Examination gloves (XL) | Each | | | | | | | |
| | 10 | Surgical Gown (M) | Each | | | | | | | |
| | 11 | Surgical Gown (L) | Each | | | | | | | |
| | 12 | Surgical Gown (XL) | Each | | | | | | | |
| | 13 | Surgical gown disposable | Each | | | | | | | |
| | 14 | Head cover | Each | | | | | | | |
| | 15 | Boot covers | Each | | | | | | | |
| | 16 | Gumboots (assorted sizes) | Each | | | | | | | |
| | 17 | Gown, disposable, (Isolation Gown) | Each | | | | | | | |
| | 18 | Apron, plastic, disposable | Each | | | | | | | |
| | 19 | Apron, plastic, heavy duty reusable | Each | | | | | | | |
| | 20 | Coverall (PPE suite) | Each | | | | | | | |
| | 21 | Surgical cap | Each | | | | | | | |
| | 22 | Reusable Aprons | Each | | | | | | | |
| | 23 | Heavy Duty, rubber gloves-universal | Each | | | | | | | |
| | 24 | Heavy Duty, rubber Gloves (size 8) | Each | | | | | | | |
| | 25 | Heavy Duty Plastic Gloves (size 9) | Each | | | | | | | |
| **Hand Hygiene** | 26 | Alcohol (Ethanol) 70% | Bottle | | | | | | | |
| | 27 | Hand sanitizer (70% alcohol) | Bottle | | | | | | | |
| | 28 | Bucket with lids and faucet, 20L | Pcs | | | | | | | |
| | 29 | Soap (liquid) | Bottle | | | | | | | |
| | 30 | Bar soap | Pcs | | | | | | | |
| | 31 | Tissues/paper towel | | | | | | | | |
| **Temperature Monitors** | 32 | Battery for thermoflash | Pcs | | | | | | | |
| | 33 | Infrared thermometers | Pcs | | | | | | | |
| **Cleaning & Disinfectant** | 34 | Sharp containers/ safety boxes | Pcs | | | | | | | |
| | 35 | Bucket with lid, 20 L or more | Pcs | | | | | | | |

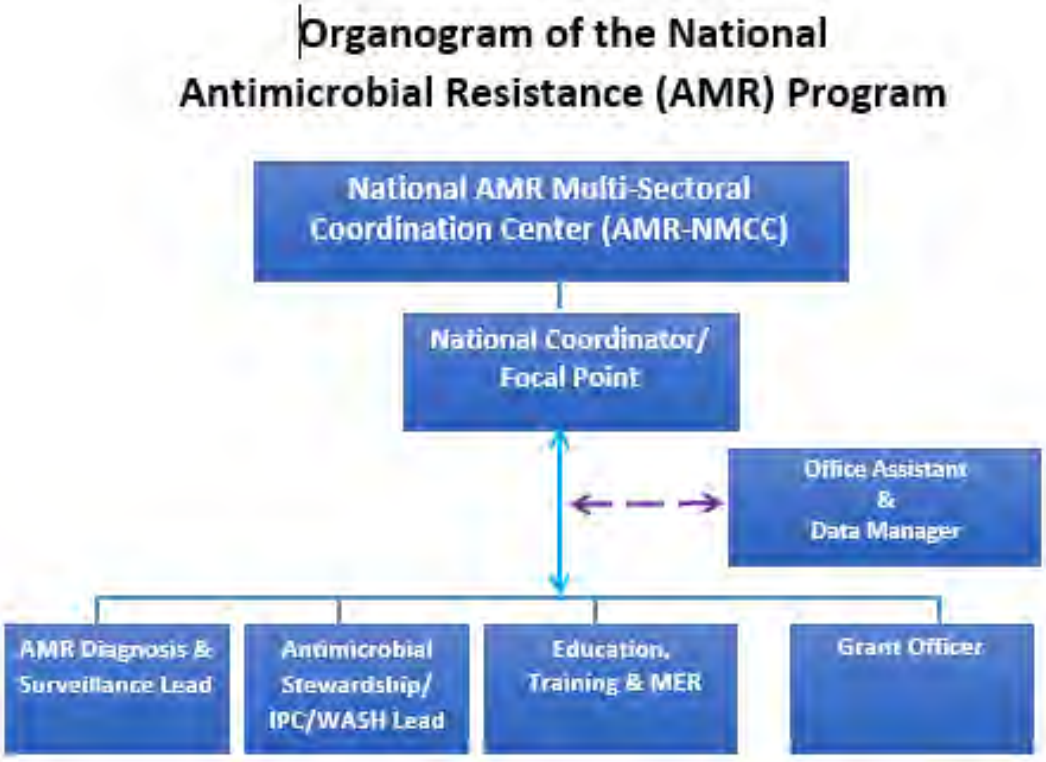
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 36 | Chlorine (Sodium hypochlorite, NaDDC, HTH 70% | Bucket Bottle | | | | | | | |
| | 37 | Bio-hazard bags | Each | | | | | | | |
| | 38 | Chlorhexidine | Bottle | | | | | | | |
| | 39 | Hand sprayer (1.5L) | Each | | | | | | | |
| | 40 | Hand sprayer (12-16L) | Each | | | | | | | |
| **Others (Specify)** | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
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*Annex 25: Organogram of the Department of Pharmaceutical Services (DPS), MOH*

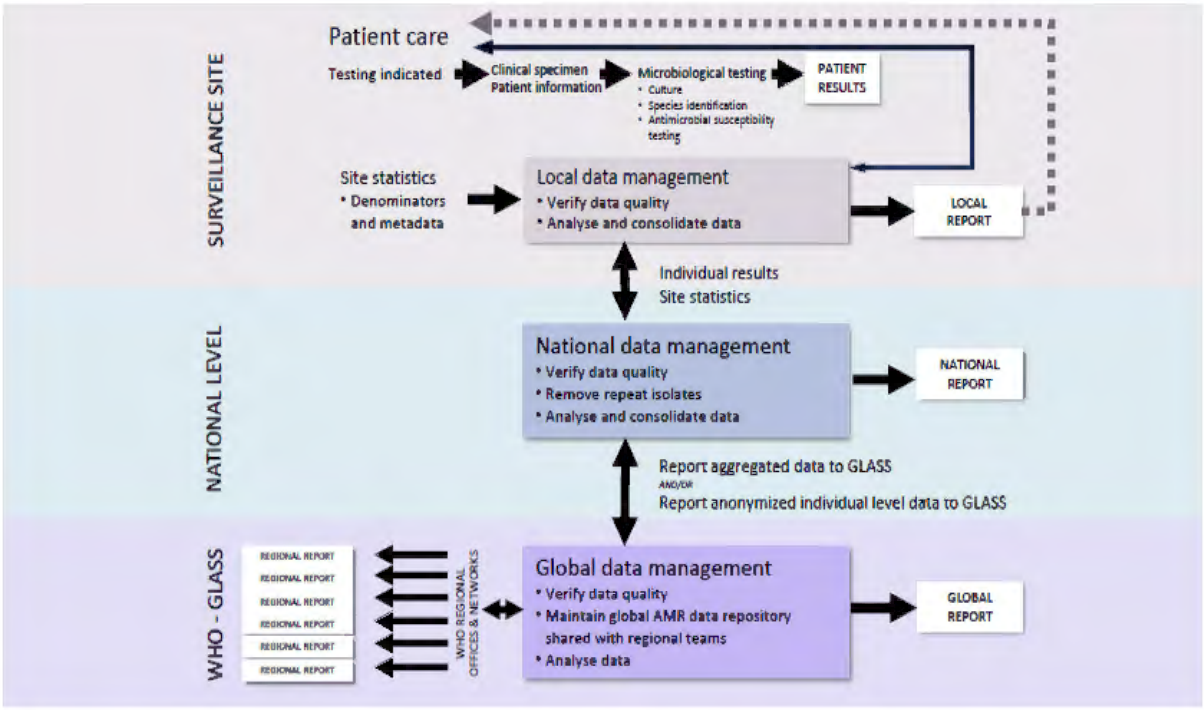



***LPB:*** *Liberia Pharmacy Board****, LMDC:*** *Liberia Medical and Dental Council;* ***LMHRA****: Liberia Medicines and Health Products Regulatory Authority;* ***HFs:*** *Healthcare Facility;* ***Mgt****: Management;* ***CHAP SC****: Community Health Assistant Program Supply Chain.*

*Annex 26: Organizational Chart for the National AMR Coordination Unit, MOH*



*Annex 27: GLASS-AMR data flow, core components and country's participation*




## HOW CAN COUNTRIES PARTICIPATE IN GLASS?

Countries can participate in GLASS by establishing **national AMR surveillance systems**, in a stepwise manner, that can gather data on resistance and communicate that data to GLASS.

There are **3 core components** of a national AMR surveillance system:

- a national coordinating centre, at least one national reference laboratory and one or more surveillance sites. The data gathered at the surveillance sites flows through the national coordinating centre to GLASS.

### Surveillance Site:

collects basic demographic, clinical, epidemiological and microbiological information from patients

- usually a hospital, clinic or out-patient community health facility with access to relevant epidemiological and laboratory support

### National Reference Laboratory:

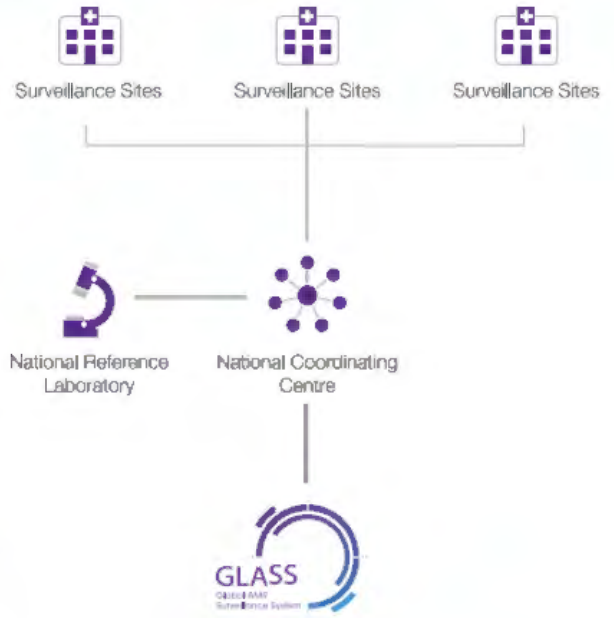
promotes good laboratory practices and supports laboratories in the national surveillance system

- usually at least one national laboratory as designated by the government

### National Coordinating Centre:

establishes and oversees the national surveillance programme, gathers national AMR data and communicates with GLASS via a national focal point

- usually a public health institute



*Annex 28: Institutional/health facility pledge form for Antimicrobial Stewardship Program*

National AMR Coordination Center
Department of Pharmaceutical Services (DPS)
Ministry of Health
Monrovia, Liberia

**To**: _____
***Name of Hospital/Institution***

**From**: **N**ational AMR **C**oordination **C**enter (AMR-CC)
Ministry of Health, Liberia

**Date**: _____
***(DD/MM/YYYY)***

***Re: "Pledge to Support Implementation of Antimicrobial Stewardship Program (ASP)"***

The incidence of infections attributed to multidrug-resistant organisms (MDROs) among hospital patients continues to rise despite widespread efforts to control their spread globally. Infections caused by MDROs are associated with worsened clinical outcomes, including an increased risk of death and significantly increased costs, mostly attributable to increased length of stay. In response to this emerging concern, the ***Ministry of Health*** *has* created an Antibiotic Stewardship (AMS) Program or ASP aimed at promoting rational antimicrobial prescribing with the goal of reducing the incidence of MDROs infections.

There is a strong correlation between antibiotic prescribing patterns and antibiotic resistance. The goal of the ASP is to optimize the selection, dose, duration, and route of therapy with the most appropriate drug for the patient's condition. The ASP is a coordinated effort between the Infection Prevention Control, Pharmacy and the other all departments or units. A member from this multidisciplinary team will review patient charts in real-time and may be contacting you with recommendations to tailor a patient's antibiotic regimen according to microbiologic data, local resistance patterns, evidence-based practices, national or institutional guidelines, and the patient's clinical condition. The recommendation may be to use an alternative therapy, de-escalate to an oral alternative, or to use no therapy, when necessary.

It is hoped that this core strategy of the ASP will improve outcomes for individual patients by optimizing treatment of infectious process (es) and minimizing resultant complications of therapy. In turn, improving outcomes for the larger population will reduce length of stay and mitigate antibiotic resistance by controlling antimicrobial selection pressure. The efforts of the ASP are essential to preserving the efficacy of the limited number of effective antibiotics at our disposal and improving patient care. Your participation in this important initiative is vital to the program's success. You may contact the National AMR Focal Point for further questions you may have regarding this program.

*Annex 29: Sample recommendation chart stickers-No Infection*

| | |
|---|---|
| **Antimicrobial Stewardship Program**<br><br>**Date**: _____ **Patient Name:** _____<br><br>This patient currently has orders for:<br>_____<br>Antibiotic therapy has been evaluated by QMT/AMS Team:<br>☐There are no obvious signs of infection _____<br>☐Indication for current regimen not documented _____<br>☐Infection resistant to antibiotic (see lab report) _____<br>I authorize the above antibiotic (s) to be discontinued. New therapies may be written on Doctor's Order Form.<br><br>**Physician Signature:** _____#_____ | **Antimicrobial Stewardship Program**<br><br>**Date**: _____ **Patient Name:** _____<br><br>This patient currently has orders for:<br>_____<br>Antibiotic therapy has been evaluated by QMT/AMS Team:<br>☐There are no obvious signs of infection _____<br>☐Indication for current regimen not documented _____<br>☐Infection resistant to antibiotic (see lab report) _____<br>I authorize the above antibiotic (s) to be discontinued. New therapies may be written on Doctor's Order Form.<br><br>**Physician Signature:** _____#_____ |
| **Antimicrobial Stewardship Program**<br><br>**Date**: _____ **Patient Name:** _____<br><br>This patient currently has orders for:<br>_____<br>Antibiotic therapy has been evaluated by QMT/AMS Team:<br>☐There are no obvious signs of infection _____<br>☐Indication for current regimen not documented _____<br>☐Infection resistant to antibiotic (see lab report) _____<br>I authorize the above antibiotic (s) to be discontinued. New therapies may be written on Doctor's Order Form.<br><br>**Physician Signature:** _____#_____ | **Antimicrobial Stewardship Program**<br><br>**Date**: _____ **Patient Name:** _____<br><br>This patient currently has orders for:<br>_____<br>Antibiotic therapy has been evaluated by QMT/AMS Team:<br>☐There are no obvious signs of infection _____<br>☐Indication for current regimen not documented _____<br>☐Infection resistant to antibiotic (see lab report) _____<br>I authorize the above antibiotic (s) to be discontinued. New therapies may be written on Doctor's Order Form.<br><br>**Physician Signature:** _____#_____ |
| **Antimicrobial Stewardship Program**<br><br>**Date**: _____ **Patient Name:** _____<br><br>This patient currently has orders for:<br>_____<br>Antibiotic therapy has been evaluated by QMT/AMS Team:<br>☐There are no obvious signs of infection _____<br>☐Indication for current regimen not documented _____<br>☐Infection resistant to antibiotic (see lab report) _____<br>I authorize the above antibiotic (s) to be discontinued. New therapies may be written on Doctor's Order Form.<br><br>**Physician Signature:** _____#_____ | **Antimicrobial Stewardship Program**<br><br>**Date**: _____ **Patient Name:** _____<br><br>This patient currently has orders for:<br>_____<br>Antibiotic therapy has been evaluated by QMT/AMS Team:<br>☐There are no obvious signs of infection _____<br>☐Indication for current regimen not documented _____<br>☐Infection resistant to antibiotic (see lab report) _____<br>I authorize the above antibiotic (s) to be discontinued. New therapies may be written on Doctor's Order Form.<br><br>**Physician Signature:** _____#_____ |

*Annex 30: Sample recommendation chart stickers-IV to PO (antibiotic time outs)*

| | |
|---|---|
| **IV to Oral Switch (Antibiotic Time Outs)**<br><br>Date_____ Time_____ Patient Name _____<br><br>This patient currently has orders for:<br>_____<br>The ***QMT/AMS Team*** including the Hospital Pharmacist and attending Physician have reviewed the patient therapy recommend an IV to oral conversion for the patient meeting specific clinical criteria. The patient's therapy has been changed to:<br>_____<br><br>Completed by: _____<br>***Physician/Clinician/Signature Title*** | **IV to Oral Switch (Antibiotic Time Outs)**<br><br>Date_____ Time_____ Patient Name _____<br><br>This patient currently has orders for:<br>_____<br>The ***QMT/AMS Team,*** including the Hospital Pharmacist and attending Physician have reviewed the patient therapy recommend an IV to oral conversion for the patient meeting specific clinical criteria. The patient's therapy has been changed to:<br>_____<br><br>Completed by: _____<br>***Physician/Clinician/Signature Title*** |
| **IV to Oral Switch (Antibiotic Time Outs)**<br><br>Date_____ Time_____ Patient Name _____<br><br>This patient currently has orders for:<br>_____<br>The ***QMT/AMS Team*** including the Hospital Pharmacist and attending Physician have reviewed the patient therapy recommend an IV to oral conversion for the patient meeting specific clinical criteria. The patient's therapy has been changed to:<br>_____<br><br>Completed by: _____<br>***Physician/Clinician/Signature Title*** | **IV to Oral Switch (Antibiotic Time Outs)**<br><br>Date_____ Time_____ Patient Name _____<br><br>This patient currently has orders for:<br>_____<br>The ***QMT/AMS Team*** including the Hospital Pharmacist and attending Physician have reviewed the patient therapy recommend an IV to oral conversion for the patient meeting specific clinical criteria. The patient's therapy has been changed to:<br>_____<br><br>Completed by: _____<br>***Physician/Clinician/Signature Title*** |
| **IV to Oral Switch (Antibiotic Time Outs)**<br><br>Date_____ Time_____ Patient Name _____<br><br>This patient currently has orders for:<br>_____<br>The ***QMT/AMS Team*** including the Hospital Pharmacist and attending Physician have reviewed the patient therapy recommend an IV to oral conversion for the patient meeting specific clinical criteria. The patient's therapy has been changed to:<br>_____<br><br>Completed by: _____<br>***Physician/Clinician/Signature Title*** | **IV to Oral Switch (Antibiotic Time Outs)**<br><br>Date_____ Time_____ Patient Name _____<br><br>This patient currently has orders for:<br>_____<br>The ***QMT/AMS Team*** including the Hospital Pharmacist and attending Physician have reviewed the patient therapy recommend an IV to oral conversion for the patient meeting specific clinical criteria. The patient's therapy has been changed to:<br>_____<br><br>Completed by: _____<br>***Physician/Clinician/Signature Title*** |

# References


Araya, P. 2016. The impact of water and sanitation on diarrheal disease burden and over prescription of antibiotics. Final capstone report for the Master of Public Administration. London: London School of Economics and Political Science; (https://amr review.org/sites/default/files/LSE%20AMR%20Capstone.pdf, accessed 17 July 2021.

Balinskaite, V, et al. 2021. The impact of a national antimicrobial stewardship program on antibiotic prescribing in primary care: an interrupted time series analysis. *Clin Infect Dis.* 2019; 69(2): 227–32 (https://doi.org/10.1093/ cid/ciy902, accessed 16 July 2021.

Baur, D. et al. 2017. Effect of antibiotic stewardship on the incidence of infection and colonization with antibiotic resistant bacteria and clostridium difficile infection: a systematic review and meta-analysis. *Lancet Infect Dis. (9):* 990–1001.

Colligan, P, et al. (2018). Anthropological and socioeconomic factors contributing to global antimicrobial resistance: a univariate and multivariable analysis. *Lancet Planet Health; 398-405.*

Dellit, T. H et al. (2007). IDSA and SHEA Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship. *Clin. Infect. Dis. 7; 44:159-77.*

Health Protection Scotland-National Health Services. 2016. P*rotocol for the collection of patient- and ward-level data v1.0.* Hospitals, Dundee, Scotland, UK.

McGowan, J. E & Gerding, D.N. *(*1996). *Does antibiotic restriction prevent resistance? New Horiz.,4:370.*

Mendelson, M. et al. (2019). How to start an antimicrobial stewardship program in a hospital; *Clin Microbiol Infect*.

Republic of Liberia, MOH. (2018). Service Availability Readiness Assessment (SARA).

Nathwani, D. (2018). Antimicrobial stewardship: from principles to practice. British Society for Antimicrobial Chemotherapy; (http://www.bsac.org.uk/ antimicrobial stewardship book/BSAC-Antimicrobial Stewardship from principles to Practice eBook.pdf, accessed 13 May 2021.

O'Neill, J. (2016). Tackling drug-resistant infections globally: final report & recommendations. The review on antimicrobial resistance. London: Wellcome Trust.

OECD. (2018). Stemming the superbug tide: just a few dollars more. *Paris:*

Pulcini, C. et al. (2018). Developing core elements and checklist items for global hospital antimicrobial stewardship programmes: a consensus approach. *Clin Microbiol Infect*.; 25:20-25.

Republic of Liberia, MOH. (2018). National Infection Prevention and Control Guidelines.

Republic of Liberia MOH. (2020). *Guidelines for the Safe Management of Health Care Waste in Liberia.*

Republic of Liberia, MOH. (2018). National Action Plan on Prevention and Containment of Antimicrobial Resistance in Liberia.

US - CDC. (2018). Core elements of antibiotic stewardship programs in resource-limited settings. Atlanta, GA.

WHO. (2016). Antimicrobial resistance: a manual for developing national action plans. Geneva: WHO.
WHO. (2016). *Global Guidelines for the Prevention of Surgical Site Infection.* Geneva: WHO.

WHO. (2016). *Guidelines on Core Components for Infection Prevention and Control Programs at the National and Acute Health Care Facility Level.* Geneva: WHO.
*WHO. (2019).* Antimicrobial stewardship programs in healthcare facilities in low-and middle income countries. A practical toolkit, accessed 13/11/2010 at http://apps.who.int/iris. Geneva: WHO.
*WHO. (2019).* Antimicrobial stewardship programs in healthcare facilities in low-and middle-income countries. A practical toolkit, accessed 13/11/2010 at http://apps.who.int/iris. Geneva: WHO.

*WHO. (2019).* Antimicrobial stewardship programs in healthcare facilities in low-and middle-income countries. A practical toolkit, accessed 13/05/21 at http://apps.who.int/iris. Geneva: WHO.
WHO. (2020). Global Antimicrobial Resistance and Use Surveillance System (GLASS) Report. Early implementation.
WHO. (2019). Progress on household drinking water, sanitation and hygiene: 2000–2017. Special focus on inequalities. Geneva: WHO (https://www.who.int/water_sanitation_health/publications/jmp-report-2019/en/, accessed 17 July 2021).
WHO. (2019). WASH in healthcare facilities-practical steps to achieve universal access to quality care. Geneva: WHO; (https://www.who.int/water_sanitation_health/publications/wash-in-health-care facilities/en/, accessed 16 July 2021).
WHO. (2014). *Infection Prevention and Control of Epidemic- and Pandemic Prone Acute Respiratory Infections in Health Care*. Geneva: WHO.

WHO. (2021). WHO policy guidance on integrated antimicrobial stewardship activities. Geneva: WHO.