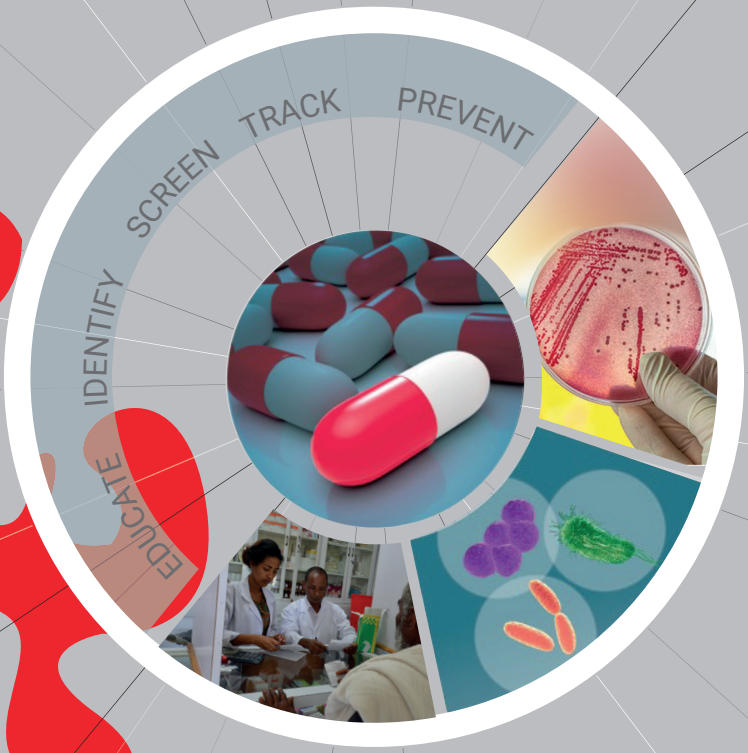
# A Practical Guide to Antimicrobial Stewardship Program in Ethiopian Hospitals




May, 2018
Addis Ababa, Ethiopia

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# Preface

It is known that one of the major breakthroughs in the history of mankind is the dis¬covery of antimicrobials which were considered "miracle drugs" that changed the life of human being. Their use in animal husbandry and veterinary medicine has also resulted in healthier and more productive farm animals, ensuring the welfare and health of both animals and humans. Unfortunately, from the first use of penicillin, the resistance countdown started to tick whereby the problem was recognized early by Sir Alexander Fleming. He expressed his concern and rang the wake-up call to use these vital supplies rationally and save them for the next generation. Despite this fact, Antimicrobial Resistance (AMR) was denied of proper attention for the last many years. However, AMR is getting more focus for the couple of decades and reached its peak in the last few years as its impact is not only on health, but also on the economy. At the micro level it affects individuals while at the macro level it has societal impact and reduction on GDP. The issue is multidimensional that require participation of many stakeholders. Accordingly, Ethiopia organized multisectoral advisory committee since 2008, and it is one of the initiatives in the five years (2015/16-2019/20) Health Regulatory Sector Transformation Plan (HRSTP).

Though the National AMR Prevention and Containment Advisory Committee recorded many appreciable results, there are still long way to go. To single out few endeavors, the 2011 version of National Strategic Framework for Prevention and Containment of AMR, and the second edition of the same strategy, 2015-2020 are relevant to mention here. The second edition is well aligned with the Global Action Plan (GAP) which is endorsed as a blue print by the global community, still effort is underway to update by undertaking just minor adjustments.

The fourth Strategic Objective of the aforementioned document indicates: Optimize the use of antimicrobials in human and animal health through effective stewardship practices. This objective encompasses many interventions. It is natural process that when microbes are exposed to antimicrobials, susceptible organisms die while resistant ones persist, passing on their resistant genes to off-spring by replication or to other species through horizontal gene transfer. Hence, we need to use the available antimicrobials wisely, rationally; avoid irrational use that expose microbes to antimicrobials and enhance development of resistance. Consequently, this Antimicrobial Stewardship guide for Ethiopian Hospitals will help as one important tool for implementation of the fourth strategic objective. We know it requires commitment at all levels and is believed that best practices from this effort will be scaled-up to the lower health tier system, private health facilities as well as the livestock sector.

Finally, I would like to express my gratitude to all those who extended their effort for the development of this guide and in particular to USAID/GHSC-PSM for the technical and financial support to develop this guide. Besides, I also assure that EFMHACA is committed for the implementation of same and would like to extend my urge to all concerned health professionals and interested parties to collaborate with us in the promotion of the prudent use of antimicrobials.

Yehulu Denekew
Director General,
Ethiopian Food, Medicine and Healthcare Administration and Control Authority
May 2018

## ACRONYMS

| | |
|---|---|
| AMR | Antimicrobial Resistance |
| ASP | Antimicrobial StewardshipProgram |
| AST | Antimicrobial Sensitivity Test |
| CAP | Community-Acquired Pneumonia |
| CDC | Center for Disease Control and Prevention |
| CEO | Chief Executive Officer |
| CLSI | Clinical and Laboratory Standard Institute |
| CPE | Carbapenemase-Producing Enterobacteriaceae |
| DDD | Defined Daily Dose |
| DTC | Drug and Therapevtics Committee |
| EFMHACA | Ethiopian Food Medicine and Healthcare Administration and Control Authority |
| EPHI | Ethiopian Public Health Institute |
| EUCAST | European Committee on Antimicrobial Susceptibility Testing |
| GAP | Global Action Plan |
| GDP | Gross Domestic Product |
| HAIs | Healthcare Associated Infections |
| HAP | Hospital-Acquired Pneumonia |
| ICP | Infection Control Professional |
| ICU | Intensive Care Unit |
| IEC | Information Education Communication |
| IP | Infection Prevention |
| IPC | Infection Prevention and Control |
| IPP | Infection Prevention Practice |
| IT | Information Technology |
| IV | Intravenous |
| LOS | Length of Stay |
| MDROs | Multi Drug Resistant Organisms |
| MDR-TB | Multi-Drug Resistance –Tuberculosis |
| MOH | Ministry of Health |
| MRSA | Methicillin-Resistant Staphylococcus Aureus |
| OPAT | Outpatient Parenteral Antimicrobial Therapy |
| PPS | Point Prevalence Survey |
| QA | Quality Assurance |
| QI | Quality Improvement |
| RHBs | Regional Health Bureaus |
| SARA | Service Availability and Readiness Assessment |
| SSI | Surgical Site Infection |
| STG | Standard Treatment Guideline |
| VAP | Ventilator-Associated Pneumonia |
| WAAW | World Antibiotic Awareness Week |
| WHO | World Health Organization |
| XDR-TB | Extensive Drug resistance –Tuberculosis |

# Definition of terms

**Antibiogram:** An antibiogram is an overall profile of antimicrobial susceptibility testing results of a specific microorganism to a battery of antimicrobial drugs.

**Antibiotic resistance:** The ability of bacteria and other microorganisms to resist the effects of an antibiotic to which they were once sensitive

**Antibiotics:** Antibiotics are a type of antimicrobial medicine used in the treatment and prevention of bacterial infections

**Antimicrobial resistance:** Antimicrobial resistance (AMR) is the ability of a microorganism (like bacteria, viruses, and some parasites) to stop an antimicrobial (such as antibiotics, anti virals and anti malarial) from working against it.

**Antimicrobial stewardship:** refers to a set of coordinated strategies to improve the use of antimicrobial medications with the goal of enhancing patient health outcomes, reducing resistance to antibiotics, and decreasing unnecessary costs

**Antimicrobials:** Antimicrobials are agents that destroy or inhibit the growth of microorganisms and especially pathogenic microorganisms.

**De-escalation:** Antibiotic de-escalation is defined as changing the empiric antibiotic regimen to a culture-directed single agent with a narrower spectrum than the original empiric regimen upon identification of the causative organisms. Patients who were treated empirically with broad-spectrum antibiotics or an antibiotic regimen consisting of multiple agents will be considered candidates for de-escalation.

**Dose Optimization:** It involves "optimization of antimicrobial dosing based on patient characteristics (e.g., weight, renal/liver function), causative organism, site of infection (e.g., central nervous system, blood) and pharmacokinetic and pharmacodynamic characteristics of the drug (e.g., concentration or time dependent activity) … It frequently involves the reduction of doses for renally eliminated agents in patients with renal dysfunction; however, increasing doses for certain disease states (central nervous system infections, endocarditis, bone and joint infections), specific organisms (methicillin-resistant Staphylococcus aureus, multi-drug resistant Pseudomonas aeruginosa) and obesity is also important.

**Formulary Restriction:** is a method of limiting access of some selected medication from prescribed by specific practitioners. Hence, prescription for these selected medicines by the identified practitioners requires preapproval by someone responsible for assessing the appropriateness of the request before dispensing such medicines.

**Hospital acquired infection/nosocomial infection:** A hospital-acquired infection (HAI), also known as a nosocomial infection, is an infection that is acquired in a hospital or other health care facility.

**Key medicines:** are medicines that their availability is critical for providing the major target of the health facility, it calls for proper stock management that nullifies stock out of such medicines.

**MDR-TB:** Multi-drug-resistant tuberculosis (MDR-TB) is a form of tuberculosis (TB) infection caused by bacteria that are resistant to treatment with at least two of the most powerful first-line anti-TB medications (drugs), isoniazid and rifampin.

**Misuse**: It is one form of irrational use manifested when a person takes a legal prescription medication for a purpose other than the reason it was prescribed, or when that person takes a medicine not prescribed to him or her.

**Over use:** occurs when a drug or treatment is given without medical justification. It includes treating people with antibiotics for simple infections – or failing to follow effective options that cost less or cause fewer side effects. For example, antibiotics are inappropriately prescribed for children's ear infections 80 percent of the time despite the finding that these infections get better within three days without antibiotics.

**Point of care interventions:** Point-of-care interventions are interventions that occur at the ward level with the treating medical team, often soon after empirical therapy has been initiated. They are one of the most effective aspects of antimicrobial stewardship in hospitals

**Point prevalence survey:** A prevalence survey is a count of the number of patients with a particular condition/treatment (in this case either a healthcare-associated infection or an antimicrobial agent) at a particular time (in this case a day), as a proportion of the total number of patients who are hospitalized at that particular time.

**Preauthorization:** is a way of restriction where by preapproval of restricted antimicrobials before or shortly after dispensing the drug to ensure adherence to institutional criteria.

**Streamlining:** Streamlining refers to the process of converting patients from a broad spectrum antibiotic, which covers several different types of disease-causing bacteria to a narrow spectrum antibiotic that targets a specific infecting organism. The streamlining process involves monitoring the patient's clinical response and microbiology culture and sensitivity (C&S) data. It also includes switching the parenteral therapy to oral.

**XDR-TB:** Extensively drug-resistant TB (XDR TB) is a rare type of multidrug-resistant tuberculosis (MDR TB) that is resistant to isoniazid and rifampin, plus any fluoroquinolone and at least one of three injectable second-line drugs (i.e., amikacin, kanamycin, or capreomycin).

# 1. Introduction

During the past century, discoveries of microorganisms as causes of infections and antibiotics as effective therapeutic agents have contributed to significant gains in public health in many parts of the world. Antibiotics are chemical substances that kill bacteria or slow bacterial growth; they are naturally produced by fungi and other microorganisms. Antibiotics definition is also extended to synthesized medicines that are used to treat bacterial infections. The term "antimicrobial" on the other hand broadly refers to drugs that are used to treat infections caused by a variety of microorganisms (e.g., bacteria, viruses, fungi, parasites) (1, 2).

Despite the innovation of many antibiotics in the world, the emergence of drug resistant bacterial strains becomes the top global public health agenda. Tackling the global spread of antibiotic resistance is a high priority for the World Health Organization (WHO). As part of the implementation of Global Action Plan (GAP) on Antimicrobial Resistance, WHO is coordinating a global campaign to raise awareness and encourage best practices among the public, policymakers, as well as health and agriculture professionals (3). Promoting Antimicrobial stewardship program (ASP) is among the efforts in the prevention and containment of Antimicrobial resistance(AMR) included in GAP and is practiced by countries and institutions that produced fruitful results.

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

Antimicrobial Resistance is a global threat to the effectiveness of antimicrobials, challenging their value for both the prevention and treatment of infections. Recent assessment indicates that the potential impact of antimicrobial resistance if left unchecked can cause huge impacts both in health and economic aspects. In 2014, Untreatable infections due to multiple-drug resistance caused 25,000 and 23,000 deaths per year across European Union (EU) and United States of America (USA), respectively. Currently, each year about 700,000 deaths are reported to be associated with AMR. It is projected to cause 10 million deaths every year by the year 2050s with greatest impact expected to occur in developing countries. In Africa and Asia, the annual total death is expected to reach 4,150,000 and 4,700,000 respectively. The overall economic impact of AMR results in 2 to 3.5 percent reduction in GDP, costing the world up to $100 trillion from 2014-2050 G.C (4).

In Africa, AMR is spreading and caused increased morbidity and mortality from infections due to drug resistant microbial. Since 2006, the continent witnessed an increasing emergence and incidence of Multi-drug-resistant tuberculosis (MDR-TB) and Extensive drug-resistant tuberculosis (XDR-TB). Between January 2004 and December 2011, 42 countries reported a total of 53,798 MDR-TB cases. Similarly, 8 countries reported about 3,231 XDR-TB cases. Moreover, reports from 18 countries, between year 2008 and 2009, have shown that 78% of the Shigella isolates were resistant to the primary drugs used to treat this bacterium(5)

The situation of Ethiopia is not different from the global, if not worse. AMR baseline survey conducted in 2009, revealed that most bacteria that are commonly involved in causing infections to human beings showed a considerable degree of resistance to commonly used first line antibacterial agents. In another study conducted in 2016, about 67% were found to be resistant to ciprofloxac in from 362 specimens collected. Similarly, the Service Availability and Readiness Assessment (SARA, 2016)showed that 2.3% of new and 17.8% of previously treated TB cases were estimated to have MDR (6). According to the MOH report, there were 12 XDR TB cases as of June 2017.

The concept of antimicrobial stewardship program has developed as response to the problem of resistance. Antimicrobial stewardship is the coordinated program that promotes the appropriate use of antimicrobials including antibiotics, improve patient outcomes, reduce microbial resistance and decrease the spread of infections caused by drug resistance. Furthermore, antimicrobial stewardship deals with enter professional effort; across the continuum of care, involves timely and optimal selection, dose and duration of antimicrobial for the best clinical outcome for the treatment or prevention with the minimal toxicity to the patient.

## 2. Rationale

There are evidences of misuse of antimicrobials by health care providers, unskilled practitioners, and animal husbandry and drug users. These, coupled with the rapid spread of resistant microbes and inadequate surveillance, have exacerbated the emergence and spread of AMR. Up to 85% of antibiotics have a non-human use and up to 75% have a non-therapeutic use. Antibiotic use in hospitals and the community is often inappropriate (7).Multi drug resistant bacterial infections are increasing in hospital settings and in the community.

Recent meta-analyses data in Ethiopia revealed that the pooled prevalence of methicillin resistant Staphylococcus aureus (MRSA) was 32.5%. These MRSA strains were highly resistant to penicillin, ampicillin, erythromycin, and amoxicillin, with a pooled resistance ratio of 99.1, 98.1, 97.2 and 97.1%, respectively (8).

A cross sectional study involving 201 pediatric patients (≤12 years) was conducted from October 2011 to February 2012 in Tikur Anbessa Specialized Hospital (TASH) and Yekatit 12 Hospital pediatrics units showed that 27 .9% cultures were positive. Gram negative and Gram-positive bacteria constituted 51.8% and 46.4%, respectively. Staphylococcus aureus 23.2%, Serratia marcescens 21.4%, Coagulase negative Staphylococcus (CoNS) 19.6%, Klebsiellaspp16% and Salmonella spp 5.4% were the

dominant bacterial isolates associated with septicemia. Majority of the isolates had resistance to Ampicillin, Penicillin, Co-trimoxazole, Gentamicin and Tetracycline with resistant rate of 84.6 %, 92.3 %, 61.5 %, 30.8 % and 53.8% respectively (9).

Moreover, Colonization study depicted that high gastrointestinal colonization rate with extended-Spectrum ß-Lactamase-Producing Enterobacteriaceae in hospitalized Patients of TASH were observed (52 %). ESBL-E. coli and K.pneumoniae accounted for 68% and 32% among neonates, children and adults patients. Surprisingly, 2% of the E. coli and K.pneumoniae were resistant to Carbapenem drugs exacerbating the problem of resistance in the country (10).

Resistant bacterial infection is exhibited from dairy farms and animal in Ethiopia. Out of 132 animals, 10 (7.6 %) had Salmonella infection. Out of 1203 fecal samples analyzed 30 were positive for Salmonella with prevalence of 2.3 %. Nine different serotypes were identified using standard serological agglutination tests. All isolates were resistant or intermediately resistant to at least one of the 18 drugs tested. Twenty-six (86.7 %), 19 (63.3 %), 18 (60 %), 16 (53.3 %) of the Salmonella species were resistant to streptomycin, nitrofurantoin, sulfisoxazole and tetracycline, respectively. Farms located outside Addis Ababa had the highest rate of MDR Salmonella infection (11).

The healthcare delivery system in Ethiopia is changing from time to time. For instance; transplantation, hemodialysis, complicated surgeries and other similar intervention are emerging. Despite such interventions patients are always at risk of healthcare associated infection. These complex scenarios require a concerted effort to curb the rapid expansion of drug resistant microbes, minimize length of hospital stay, cost related to admission, treatment, laboratory tests and other diagnostic approaches. Currently there is no comprehensive mechanisms to monitor changes in resistance patterns and incidence of hospital associated infection because of irrational antimicrobial use. Hence it is high time to institute a functional Antimicrobial Stewardship Program in Hospitals. This program is part and parcel of the national strategic frame work for prevention and containment of antimicrobial resistance which is well aligned with the Global Action Plan.

Thus, this practical Guide to Antimicrobial Stewardship Program in Ethiopian hospitals act as a blueprint for the necessary steps to enact ASP at hospitals.

## 3. Scope

This practical guide is intended to be implemented in Ethiopian Hospitals (Public and private) preferably with microbiological laboratory facility. The guideline is an extension to build on the previous efforts and promote evidence based recommendations for developing ASP. Furthermore, it can also be customized for use by other healthcare facilities in Ethiopia.

## 4. Goals

The ultimate goal of ASP is to improve patient outcome through rational use of antimicrobials. The three main goals of antimicrobial stewardship program are listed below (7).

**Goal 1:** Improve patient outcome

- Improve infection cure rate
- Reduce surgical site infection rate
- Reduce mortality and morbidity
- Reduce antimicrobial consumption
- Controlling the use of High risk antibiotics

**Goal 2:** Reduce prevalence of Antimicrobial Resistance

- Improve patient Adherence to Antimicrobial Treatment
- Enhance Rational Antimicrobial Prescribing and Dispensing Practice
- Protecting the environment from inappropriate exposure from antimicrobials through proper handling and disposal of antimicrobials
- Enhance surveillance on AMR
- Expand microbiological laboratories performing Antimicrbial Sensitivity Test (AST)

**Goal 3:** Reduce healthcare cost without adversely affecting quality of care

## 5. General guiding principles of Antimicrobial stewardship program

### 5.1. Principles of Testing

- Diagnostic test should be used wisely to avoid unnecessary antimicrobial therapy or therapy that is unnecessarily broad-spectrum, with consideration of healthcare value.
- Rapid diagnostic tests, biomarkers, and decision rules that have acceptable performance characteristics to differentiate bacterial vs. non-bacterial infection should be used to avoid use of unnecessary antibiotic therapy.
- Bacterial cultures with susceptibility testing should be collated, handled and processed promptly and appropriately to identify specific bacteria causing infection and facilitate use of narrow-spectrum antibiotics whenever possible.
- When available and appropriate for the infection and the bacterial isolate, molecular testing to identify specific resistance genes (for example, mec in staphylococcus, van in Enterococcus) or novel non-culture based phenotypic assays of susceptibility may be used to target antibiotic therapy toward susceptible or resistant isolates.
- Avoid diagnostic testing without an appropriate clinical indication when the results may have unintended consequences. For instance, a urine culture, rapid strep test, or C. difficile testing should not be performed unless the patient meets criteria for testing.

## 5.2. Principles of Treatment

- When appropriate for the infection, source removal (e.g., drainage of abscess, removal of an implicated device) should be accomplished early in the course of treatment.
- Recommendations for initial antimicrobial therapy choices should balance treatment efficacy, severity of illness (i.e, sepsis), and the potential for adverse events including the development of antibiotic resistance. When multiple therapeutic options are available, a hierarchy of antibiotic treatment recommendations should be provided with "first choice" options being those with adequate therapeutic efficacy, the lowest risk of facilitating antimicrobial resistance, and the lowest risk of healthcare value.
- Recommendations for optimal dosing of antibiotics should be based on efficacy studies and pharmacokinetic and pharmacodynamics principles.
- Recommendations for duration of therapy should be made, emphasizing the shortest effective duration.
- Recommendations for de-escalation of initial empiric antimicrobial therapy should be provided, including:
    - Using the results of bacterial cultures and diagnostic tests to discontinue or narrow unnecessarily broad-spectrum antibiotic therapy.
    - Using other stewardship tools, such as consultation with an antimicrobial stewardship team and/or infectious diseases specialist, daily review of antibiotic therapy, and automatic stop orders after adequate treatment duration.
    - Potential adverse events related to antimicrobial treatment should be noted in the guideline; so that providers may opt not prescribe an antimicrobial, or to choose a recommended agent that has a lower potential for adverse events.

## 6. Core Elements for ASP

- For effective implementation of ASP, the core elements listed below are important (12, 13),
- Leadership Commitment: Dedicating necessary human, financial and information technology resources
- Accountability:Head of clinical or appropriately appointed clinician and other health professionals responsible for program outcomes.
- Appropriate Expertise: Appointing a single pharmacist or microbiologist or infection prevention expert, leader responsible for working to improve antibiotic use.
- 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 48-72 hours)
- Tracking: Monitoring antimicrobial rational use and resistance patterns
- Reporting: Regular reporting information on antimicrobial use and resistance to health professional and other relevant staff as well as appropriate regional and federal organization

- Education: Educating clinicians, other healthcare professionals, hospital communities, patients and societies at large about resistance and optimal use of antimicrobials

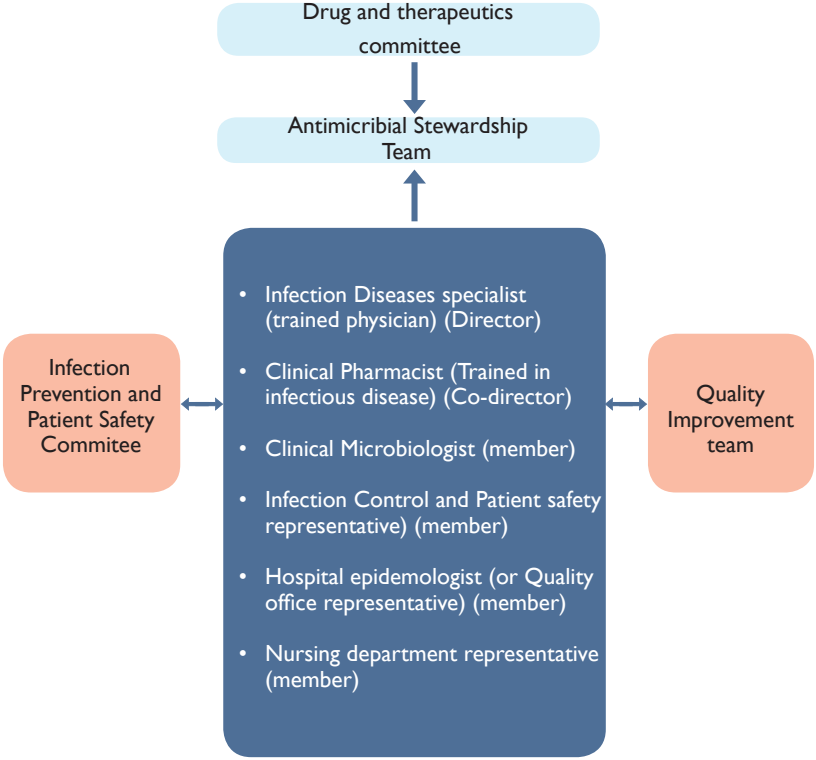

Figure 1: Core Elements of ASP (14)

## 7. Establishing antimicrobial stewardship program in hospitals

To ensure appropriate use of antimicrobialsi.e the right antimicrobial is prescribed at the right time, the right dose, the right route, for the right diagnosis, for the right patient with affordable price and reduce resistance, and to contain an escalating problem that threatens the ability to effectively treat often life-threatening infections; hospitals need to implement antimicrobials stewardship programs.

### 7.1. Organizational Structure

The hospital management should give due emphasis for the establishment and functionality of ASP in the hospital. Hence, the management should be committed to organize ASP team which will be accountable to the DTC. It is important that antimicrobial stewardship team functions in close collaboration with the quality assurance team, infection prevention and patient safety committee as shown below;




## 7.2. Antimicrobial Stewardship Team

It is essential that the antimicrobial stewardship team is multi-disciplinary (15) including:

- Infectious diseases physician (preferred)/internist/general practitioner
- Clinical pharmacist/clinical oriented pharmacist/pharmacologist or pharmacist with infectious diseases training;
- Clinical microbiologist / medical microbiologist / diagnostic microbiologist / public health microbiologist/clinical laboratory technologist who can provide surveillance data on antimicrobial resistance;
- Nurse representative
- Infection control and patient safety representative
- Environmental Health (Optional)
- Hospital epidemiologist/public health officer (Optional)
- IT Professional (Optional)

The program is usually directed by an Infectious diseases physician (preferred)/ internist/general practitioner and co directed by clinical pharmacist/clinical oriented pharmacist/pharmacologist or pharmacist with infectious diseases training. As soon as its establishment, the ASP team should develop TOR and the antimicrobial stewardship

strategic plan that should be presented to and approved by the DTC in the presence of chief executive officer which will be endorsed by the hospital management. ASP team members need to be updated on antimicrobial stewardship on regular basis.

### 7.3. Duties and Responsibilities of ASP Team

The team is responsible for developing, implementing, and managing the ASP. Major duties and responsibilities include (15);

1. Develop Terms of Reference of the ASP Committee indicating the roles of director, secretary and members as well as meeting schedule, norm and related issues.
2. Plan the work of stewardship program,
3. Secure the support and commitment of the hospital management and DTC, to maintain ASP to ultimately acquire adequate authority and expected outcomes for the program.
4. Develop and implement antimicrobial drug use policy, formulary restriction and preauthorization deploying evidence-based practical guidelines.
5. Incorporate local microbiological profile and resistance pattern data to improve antimicrobial utilization.
6. Perform prospective audit of antimicrobial use with direct interaction and feedback to the prescribers and other healthcare providers.
7. Organize training on antimicrobial stewardship to health professionals and other concerned staff.
8. Organize patient education sessions on the rational use of antimicrobial
9. Carry out advocacy, communication and social mobilization on antimicrobial stewardship (Commemorate antimicrobial stewardship and World Antibiotic Awareness Week (WAAW))
10. Encourage parenteral (IV) to oral conversion when appropriate
11. Promote streamlining or de-escalation of therapy on the basis of culture results
12. Negotiate with development partners and other organizations for the implementation of this program in achieving the expected outcomes and for the assurance of its sustainability.
13. Keep records, document, report, and Monitor ASP activities

Furthermore, the team may consider implementation of antimicrobial cycling (substituting one antimicrobial for another may transiently decrease selection pressure and reduce resistance to the restricted agent)

## Major Roles and Responsibilities of each ASP Team

### a. Director of ASP team

- Leads the technical component of Antimicrobial Stewardship team.
- Represents the ASP team and gives feedback on ASP.
- Designated into the Drugs and Therapeutics Committee when considering changes of antimicrobials in the hospital formulary
- Prepares surveillance and audit reports for submission to the next hierarchy.
- Proposes annual ASP activities with the hospital director and various departments
- Consults and advises on specific stewardship related cases and issues

- Follow the implementation of decision of ASP team

### b. Secretary of ASP team

- Delegates ASP director in his absence
- Prepares agenda for regular and extra ordinary ASP meetings
- Take minutes of the meeting and keep records of the ASP as well as other documentations
- Gives technical know how on finer aspects of antimicrobials and newer agents
- Works with and educates ward pharmacists to identify potential patients for stewardship interventions (e.g. de-escalation etc.)
- Ensures dose optimization is carried out especially for complexantimicrobials and complex clinical scenarios.
- Enforces the approval system of restricted antimicrobials
- Ensures safe and effective use of medication to reduce risk for errors and adverse events
- Surveillance of antimicrobial use
    - Collection and analysis of local consumption and expenditure
    - Provision of data to regional /national surveillance programs
    - Carries out and analyses point prevalence studies on antimicrobial usage
- Audit and feedback
    - Leads and conducts appropriate antimicrobial audits
    - Provides timely feedback for future improvement

## 8. Strategies of Antimicrobial Stewardship Program (ASP)

The problem is critical, and it is high time to prevent and contain AMR using different strategies (16, 17). In order to attain the goals of ASP several strategies can be designed considering local antimicrobial use, AMR problems, availability of resource, and collaboration with an effective infection control program to minimize secondary spread of resistance. Experiences from both developed and developing countries indicated that there is no single best strategy to combat AMR. The following core and supplemental antimicrobial stewardship strategies are recommended to be implemented in Ethiopian hospitals, details for each is highlighted next to the outline.

### 8.1 Active Antimicrobial Stewardship Strategies

- Prospective audit with intervention and feedback
- Formulary restriction and preauthorization requirements for specific agents.

### 8.1.1. Prospective audit with intervention and feedback

Prospective audit with intervention and feedback is an intervention that engages the provider after an antimicrobial is prescribed. In this strategy, antimicrobials are reviewed after antimicrobial therapy has been initiated. Prospective audit of antimicrobial use with direct interaction and feedback to the prescribers and other healthcare providers

can result in reduced inappropriate use of Antimicrobials. The advantage is timely de-escalation of antibiotics and reduction in inappropriate use. The ASP team should assign a team of experts led by either an Infectious diseases physician (preferred)/internist/general practitioner and clinical pharmacist/clinical oriented pharmacist/pharmacologist or pharmacist with infectious diseases training.

### 8.1.1.1. Antimicrobial review methods

Antimicrobial review methods are employed post-prescription as outlined below.

Review:-

- Indication for antimicrobial and compliance with policy/guideline/formulary; note any recording of exception
- Appropriateness of antibiotic choice, dose, route and planned duration; review of drug allergy, review of agents that may provide duplicative therapy [potential overlapping spectra]
- directed therapy based on culture and susceptibility test results
- Potential conversion from IV to oral route
- Requirement for therapeutic drug monitoring
- Any antibiotic related adverse events
- Drug interaction

### 8.1.1.2. Audit and direct feedback to prescribers

The audit and feedback process can be managed by either the Infectious diseases physician (preferred)/internist/general practitioner and clinical pharmacist/clinical oriented pharmacist/pharmacologist or pharmacist with infectious diseases training. However, depending on the intervention, a nurse can also be trained to support this process. During clinical review, a range of point-of-care stewardship interventions are useful to provide direct and timely feedback to the prescriber at the time of prescription or laboratory diagnosis; and provide an opportunity to educate clinical staff on appropriate prescribing.

The Point-of-care interventions can include:

- Appropriate use of guidelines,
- Indication for antibiotic,
- Choice of agent,
- Route [IV vs. oral] of administration of treatment,
- Timeliness of treatment,
- Likelihood of on-going infection or not,
- Use of investigation including diagnostic aid,
- Interpretation of microbiology results with a view to de-escalation or stopping therapy,
- Frequency and duration of therapy.

The types of interventions selected, how they are delivered and by whom, will be determined by local resources, need and available expertise. Feedback on antimicrobial prescribing should be provided regularly to prescribers in the critical care setting, and areas of high and/or poor quality antimicrobial use.

One way of evaluating prescribing within a unit or hospital is through regular point prevalence surveys (PPS). These data can be used in an audit process to provide structured feedback to prescribing teams and to define areas for improvement. At a national level such point prevalence surveys can be used to establish baseline prescribing information and identify priorities for quality improvement.

Parameters to be measured in point prevalence survey (PPS) are:

- Number of patients surveyed
- Number of patients (%) prescribed antimicrobials
- Number of patients (%) prescribed single antimicrobial
- Number of prescriptions (%) for parenteral antimicrobials
- Number of prescriptions (%) with indication recorded in notes
- Number of prescriptions (%) compliant with local policy
- Number of surgical prophylaxis prescriptions (%) with duration single dose
- Number of surgical prophylaxis prescriptions (%) with duration = 1 day
- Number of surgical prophylaxis prescriptions (%) with duration >1 day

### 8.1.1.3. Use of diagnostic tools

Rapid tests in antimicrobial stewardship are recognized. Integration of diagnostics with other ASP interventions, to provide fast accurate identification and susceptibility testing, will achieve a better clinical outcomes and timely streamlining/de-escalating of empiric broad-spectrum antibiotics use in seriously ill patients. Molecular diagnostics and biomarkers providing a faster result play an important role in pathogen detection in critically ill patients which will improve antibiotic stewardship and clinical outcomes, potentially for tertiary settings.

Parameters to be measured in auditing use of diagnostic tools (8) are:

- No. of Antimicrobials (%) prescription produced using antimicrobial data
- No. of specimen analyzed for culture and antimicrobial susceptibility testing from all clinically suspected patients
- Turn around time to produce culture and antimicrobial susceptibility testing
- No. of events where culture and antimicrobial susceptibility testing not performed but antimicrobials prescribed

### 8.1.2. Formulary restrictions and preauthorization system

Hospitals should implement formulary restrictions and preauthorization requirements for specific antimicrobial agents to reduce microbial resistance. Based on spectrum of activity, cost or associated toxicity.

Antimicrobial restriction either through formulary limitation by DTC or by the requirement of preauthorization and justification is the most effective method of achieving the process goal of controlling antimicrobial use. Formulary restriction and preauthorization requirements can lead to immediate and significant reductions in antimicrobial use and cost that may be beneficial as part of a multifaceted response to a Nosocomial outbreak of infection.

Preauthorization is a strategy to improve antibiotic use by requiring clinicians to get approval for certain antibiotics before they are prescribed. The use of preauthorization requirements is commonly implemented as means to restrict last resort antimicrobials. In institutions that use preauthorization to limit the use of selected antimicrobials, monitoring overall trends in antimicrobial use is necessary to assess and respond to such shifts in use.

## 8.2. Supplemental Antimicrobial Stewardship Strategies

- Education and training
- Facility specific guidelines.
- Streamlining or de-escalation of therapy
- Combination therapy
- Dose optimization.
- Communication

### 8.2.1. Education and Training

Education is a key component of any ASP. It should include healthcare professionals from all care settings, hospital management, as well as patients and the public. The training is usually delivered by the ASP team.

By increasing people's knowledge and understanding of how antimicrobials should be used to treat common infections and why inappropriate use may lead to resistance which results in the loss of effective treatments, these valuable antimicrobials can be protected for future generations. Strategies may include; educational meetings with didactic lectures and distribution of educational or informational pamphlets and materials. As education is a key component of any ASP, hospitals should design and implement educational and training program for healthcare professionals from all care setting, hospital management as well as patients and the general public.

#### 8.2.1.1. Target groups for an education in ASP in hospital

A) Physicians, Health Officers, Pharmacists, Nurses, Laboratory professionals: modules for these health professionals should be adapted to their background profession and which include, but not limited to:

- Local Epidemiology,
- Basic knowledge on infection management,
- Basic Microbiology Lab,
- Safe and effective administration and monitoring of antimicrobial therapy.,
- Good Antimicrobial Prescribing and Dispensing Practice.

B) Hospital Management and other staff: It includes high level policy makers, hospital CEOs, medical directors, finance managers, human resource managers and other staffs should be made aware of the necessary information and evidence on the need, benefit and implementation strategies of the antimicrobial stewardship program.

The content of the training for managers and other staffs may have the following objectives:

- Demonstrating the impact of Hospital-Acquired Infections (HAIs) and antimicrobial resistance on clinical and economic outcomes.
- Summarize the goals of ASP in health systems and the role of health care team in such programs.
- Explain strategies essential for implementation antimicrobial stewardship initiatives.

C) Patients and the general public: Educating patients and the general public about hygiene and antimicrobials use is also important, and may indirectly support hospital education efforts.

### 8.2.1.2. Designing an educational program on ASP

Designing an educational program should include a passive educational measures and active interventions, as summarized in table below.

*Table 1: Passive and Active Educational Measures*

| | |
|---|---|
| Passive educational measures | • Developing/updating local antimicrobial guidelines<br>• Educational sessions, workshops, local conferences |
| Active interventions | • Clinical rounds discussing cases<br>• Prospective audit with intervention and feedback<br>• Reassessment of antibiotic prescriptions, with streamlining and de-escalation of therapy<br>• Academic detailing, educational outreach visits |

Education and Training materials will be prepared, disseminated and periodically updated by a group of experts. Hospitals are encouraged to develop their own educational materials tailored to the context.

### 8.2.1.3. Facility specific guidelines and clinical pathways

Hospitals should prepare facility specific guidelines or clinical pathways on the bases of national STG and other standards. It should be based on local microbiology and antimicrobial susceptibility patterns, as well as local resource and priorities, clinician preference/views and potential risk or unintended consequences. Guidance on what advice to give for treatment and prophylaxis is available in the local Standard Treatment Guidelines although this will depend on local burden and epidemiology. Local guidelines are strongly encouraged. These guidelines and policies should ideally be supported by a program of on-going education for all relevant healthcare professionals.

### 8.2.2. Streamlining or de-escalation of therapy

Streamlining or de-escalation of empirical antimicrobial therapy should be implemented by hospitals on the basis of culture and sensitivity results. The result should be reviewed within 48-72 hours. Implementing Streamlining or de-escalation therapy would eliminate unnecessary / redundant combination therapy so that specific causative pathogen can more effectively targeted. Consequently, reduced antimicrobial exposure and substantial cost savings will be achieved.

### 8.2.3. Combination therapy:

Combination of antimicrobial therapy has long been used, particularly in well-established indications, depending on patients' condition and available antimicrobials. This therapeutic approach offers potential strategies for controlling the evolution of drug resistance in certain infectious conditions (TB and HIV). In addition, combination of two or more antimicrobial drugs increases the breadth of coverage and effectiveness of initial empirical therapy for severe and life-threatening infections, suspected to be caused by drug-resistant pathogens. On the other hand, unwise use of combination therapy may contribute to the emergence of drug resistance. Moreover, the possibility of drug-drug interactions is a possible pitfall to this approach, and must be taken into consideration in case of selection of combination antimicrobial therapy. While considering combination therapy the ASP has to develop and avail guidelines for appropriate and effective combination therapy emphasizing strict patient follow up and treatment outcome evaluation.

### 8.2.4. Dose optimization

Optimization of antimicrobial dosing that accounts for individual patient characteristics (e.g. age, renal function, and weight), causative organism and site of infection (e.g., endocarditis, meningitis, and osteomyelitis), and pharmacokinetic and pharmacodynamics characteristics of the drug is an important part of antimicrobial stewardship. Examples of these principles in practice include prolonged or continuous infusion of ß-lactams, extended-interval dosing of aminoglycosides, and dosing of fluoroquinolones for Streptococcus pneumonia in community-acquired pneumonia and for Pseudomonas in Hospital Acquired Pneumonia (HAP) and Ventilator Associated Pneumonia (VAP).

### 8.2.5. Conversion from parenteral to oral therapy

Antimicrobial therapy for patients with serious infections requiring hospitalization is generally initiated with parenteral therapy. Enhanced oral bioavailability among certain antimicrobials allows conversion to oral therapy once a patient meets defined clinical criteria. This can result in reduced length of hospital stay, health care costs, and potential complications due to intravenous access.

A systematic plan development of clinical criteria and guidelines allowing conversion to use of oral antimicrobial agents can facilitate implementation at the institutional level.

### 8.2.6. Communication

Communication is a key component of the success of an ASP. Clear, simple communication should show the vision and the benefits of the program, with core clinical messages. Hospitals should follow at least the following communication approaches (3).

Approach One: -is to identify and communicate to prescribers' specific situations where antimicrobial should be withheld and guidance in relation to the duration of antimicrobial use, which is often an area of misuse. The importance of communicating, sharing and learning from data is also important. Face-to-face meetings with prescribers, where there is an opportunity for reflection about their prescribing practices, or attending multidisciplinary teams, conferences, etc. are all important in promoting learning about prudent prescribing. Discussions during ward round in the presence of multidisciplinary team are important.

Approach Two: The "Start Smart - Then Focus" approach in the UK is a good example of such an approach as shown in the figure below:

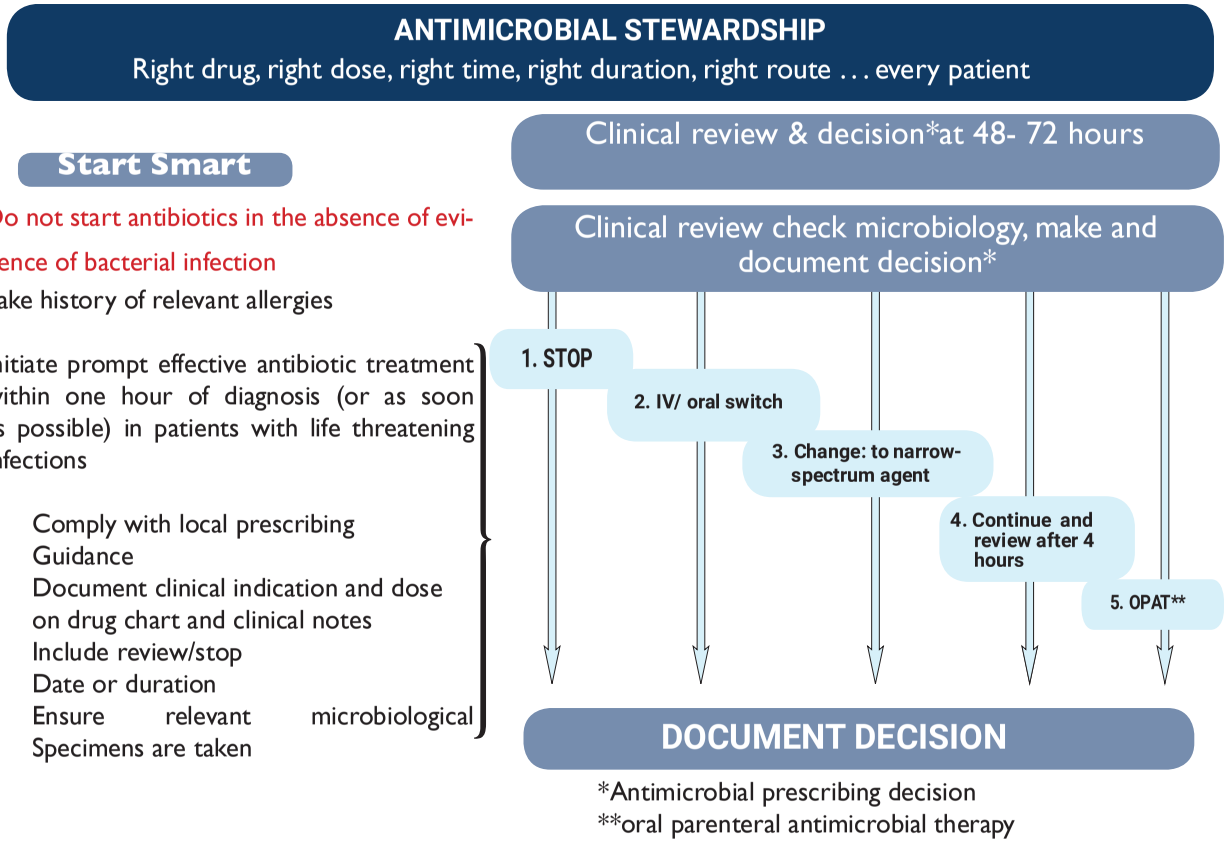
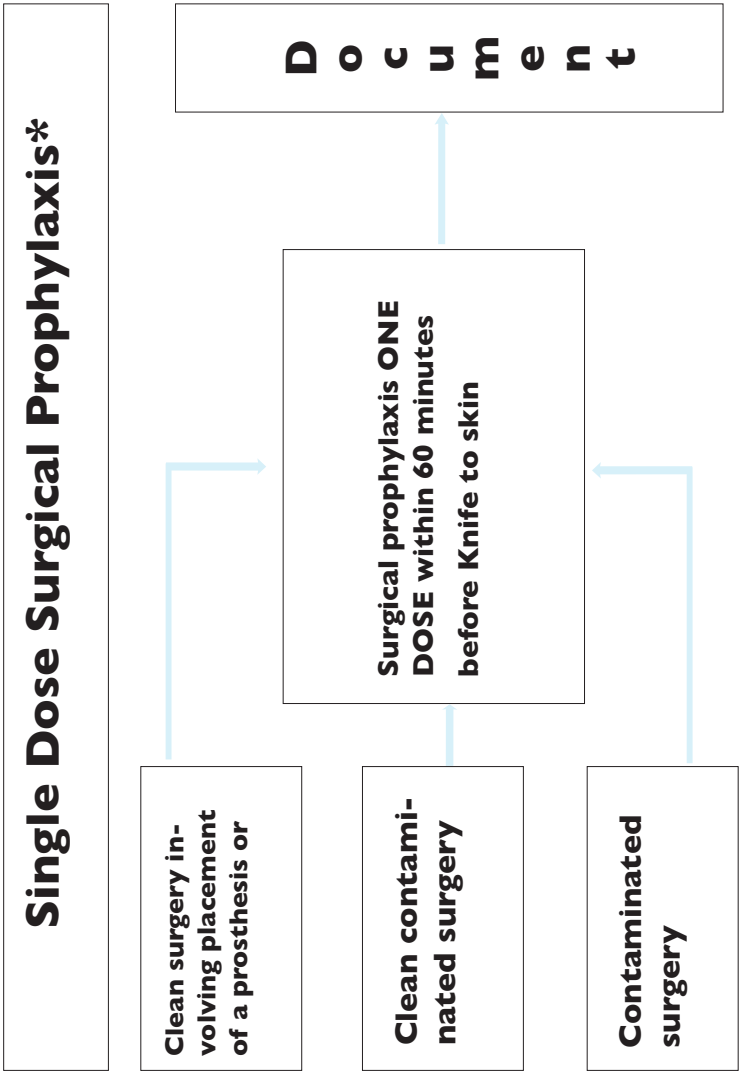



*Figure 2. Start Smart ... Then Focus approach*

Source: Biomeriuex, Practical Guide to antimicrobial stewardship in Hospitals or http://www.biomerieux.co.uk/sites/subsidiary_uk/files/antimicrobial-stewardship-booklet-final.pdf




*A repeated dose of prophylaxis may be required for prolonged procedure or whether there is significant blood lose. A treatment course of antibiotics may also need to be given (in addition to appropriate prophylaxis) in case of dirty surgery or infected wounds. The appropriate use and choice of antibiotics should be discussed with infection specialists for each case.

*Figure 3. Start Smart ... Then Focus approach*

The five 'Antibiotic Stewardship Decision' options are Stop, Switch, Change, Continue and OPAT:

1. Stop antibiotics if there is no evidence of infection
2. Switch antibiotics from intravenous to oral
3. Change antibiotics – ideally to a narrower spectrum – or broader if required
4. Continue and review again at 72 hours
5. Outpatient Parenteral Antibiotic Therapy (OPAT)

### 8.2.7. Surveillance and Decision Support

Surveillance is a systematic collection of data that can identify baseline rates of infection and alert out breaks to concerned health professional and bodies so as to focus on intervention and resource mobilization. Surveillance data also can be used to identify risk factors for infection, compare rates between institutions, and evaluate process and outcome measures. Moreover, prevention and early intervention through surveillance improves patient safety and helps control costs.

Surveillance system can generate data pertaining to prescribing, dispensing, antimicrobial consumption, adherence to antimicrobial treatment, compliance to different practice guidelines, antimicrobial resistance patterns and identify emerging pathogens of public health importance. It will help to develop a system that provides prompt methods to detect and intervene healthcare associated infections.

Even though there are various surveillance methods, patient level surveillance and population-based surveillance are the most widely used methods that can be implemented prospectively and retrospectively.

***Patient-level Surveillance:*** **-** Involves collecting data about the dose, dosage interval and duration of therapy for individual patients.

This approach gives the most accurate information, particularly if the aim is to link excessive antimicrobial use with development of resistance in a particular area of practice. Such information is usually only available through reviews of drug usage, although electronic prescribing and recording of drug administration will make patient level surveillance more practical in the future.

**Population-surveillance:** - involves aggregating antimicrobials use data, mostly supplied through pharmacy reports, and summarized at the level of a hospital or unit. Currently, this type of surveillance is the only realistic alternative for ongoing and systematic monitoring of antimicrobials use. Another data collection method is to use pharmacy purchase data; however, this is less representative than aggregation of ward issues and individual inpatient supplies.

The following are some of the surveillance activities that can be used by the ASP team

for decision making by using one or more of the surveillance methods mentioned below:

### 8.2.7.1. Surveillance of antimicrobial use

Information concerning prescribing, dispensing, antimicrobial consumption, adherence to antimicrobial treatment and compliance to different practice guidelines could be collected in a regular time period to assess the rationality of antimicrobial use. Each hospital shall plan the frequency of antimicrobial use surveillance activities at least annually.

### 8.2.7.2. Surveillance for AMR

Effective surveillance of AMR using screening of patients for certain Multi Drug Resistant Organism (MDROs, such as carbapenemase-producing Enterobacteriaceae (CPE), MRSA, VRE, ESBL can provide critical information for the team of ASP for effective decision making. Each hospital could implement one of the following surveillance approaches to identify AMR:

***a. Program based surveillance of AMR***

Program based AMR surveillance could be conducted in a regular manner at national and or regional level by engaging participant hospitals. Hence, this is indicated here so that hospitals can prepare themselves for such endeavour which is commonly conducted every three to five years. This could include all types of microbial agents that cause potential infection and antimicrobial resistance.

***b. Routine surveillance of AMR***

This type of surveillance utilizes routine microbiology data for tracing resistant patterns of the various microbes to different antimicrobial agents. Use of routine data is cost effective and it does not require separate budget for microbiology laboratories. Basic demographic and epidemiological information will be collected on each patient and on the population covered to identify their characteristics. Antimicrobial sensitivity test (AST) results will thus be combined with the patient data that accompany every request for AST and related to population data from the surveillance site.

***C. Surveillance AMR for Priority pathogens***

Both program based and routine surveillance AMR data could be too broad and sometimes it is difficult to address specific antimicrobial resistance. Therefore, such pathogen specific surveillance could be conducted at least quarterly in the hospital ASP. Good examples of priority pathogens are those which cause blood stream infection, urogenital infections, gastrointestinal infection and cervical infections. The hospital microbiology laboratory shall follow and or adopt Clinical and Laboratory Standards Institute (CLSI) or the European Committee on Antimicrobial Susceptibility Testing (EUCAST) as required.

| *Can be easily summarized as follows: -* | | | |
|---|---|---|---|
| **Specimens** | **Laboratory case definition** | **Surveillance type and sampling setting** | **Priority pathogens for surveillance** |
| Blood | Isolation of pathogen from blood[a] | from blood[a] Selected sites or national coverage Continuous Patients in hospital and in the community | E. coli<br>K. pneumoniae<br>A. baumannii<br>S. aureus<br>S. pneumoniae<br>Salmonella spp. |
| Urine | Significant growth in urine specimen[b] | Selected sites or national coverage Continuous Patients in hospital and in the community | E.coli<br>K. pneumoniae |
| Faeces | Isolation of Salmonella spp.[c] or Shigella spp. from stools | Selected sites or national coverage Continuous Patients in hospital and in the community | Salmonella spp. Shigella spp. |
| Urethral and cervical swabs | Isolation of N. gonorrhoea | Selected sites or national coverage Continuous Patients in hospital and in the community | N. gonorrhoea |

### 8.2.7.3. Surveillance of Infection Prevention

Infection Prevention and Control (IPC) Standards provide a framework to plan, implement, and evaluate an effective IPC program based on evidence and best practices in the field. The literature shows that well-designed IPC programs are cost-effective because they reduce healthcare associated infections, shorten the length of hospital stays, and decrease the cost of treating healthcare associated infections.

The key routine practices and additional precautions necessary for an effective IPC program, including:

- Point-of-care risk assessment
- Hand hygiene
- Aseptic techniques
- Personal protective equipment
- Cleaning and disinfection of the physical environment
- Waste handling, disposal and linen

Promoting a collaborative approach to protecting the safety of clients and staff, the Infection Prevention and Control Standards contain the following sections:

1. Planning and Developing the IPC Program
2. Implementing the IPC Program
3. Evaluating the Impact of the IPC Program

Infection Prevention and Control activities priority areas: Diagnostic Imaging, Operating Rooms, Long term Ambulatory Care, ICP, in patient Room, pediatrics and Obstetrics

### 8.2.8. Availing and enhancing the capacity of Microbiology laboratory

The clinical microbiology laboratories play a pivotal role in the diagnosis, treatment and prevention of infectious diseases both at hospital and community settings. Many antimicrobial agents have been used for the treatment of many infectious diseases. However, due to selective pressure, microbial factors and non-prudent use of antimicrobial agents, drug resistance develops by many of the pathogenic microorganisms. As a consequence, the limited antimicrobial agents manufactured could fail to treat infections.

The clinical microbiology laboratory is considered as one of the key components of the ASP and it can provide substantial evidences to prescribers and dispensers for appropriate use of antimicrobials. For efficient function of the microbiology laboratories, it is paramount to standardize the microbiology laboratories, avail all consumables and supplies without interruptions. Mechanisms should be in place to reassure that the evidence generated in the laboratories are accurate, precise and result in change in patient care and reduce overall health care costs. Moreover, engagement of a dedicated microbiologist and other laboratory personnel is imperative. These professionals can actively engage in ASP and provides the following activities:

a. Isolation, identification of specific bacterial / microbial agents to clinicians
b. Provide the antimicrobial susceptibility patterns of a given bacterial agents (General and or selective antibiotics)
c. Generate an antibiogram for specific microbes over time for optimizing drugs for treatment and prophylaxis purpose.
d. Actively involve in surveillance of antimicrobial resistance in hospitals and community settings

e. Generate evidence on the effective use of antiseptics and disinfectants for infection prevention activities
f. Provide training on appropriate specimen collection, handling and transport for clinical staffs
g. Actively involve in the identification of source of infectious agents during outbreaks and epidemics
h. Involve actively in overall quality assurance process in microbiology laboratories.
i. Adopt and optimize emerging and available diagnostic tools for the diagnosis of antimicrobial resistant microbes
j. Record, Document and Maintain microbiological data using computer-based system and hard copies

## 9. Research Priorities and Future Directions

In order to have evidence based antimicrobial stewardship program, further research as well as regular evaluation and monitoring are needed to identify the best strategies for the prevention and containment of antimicrobial resistance. Priority areas of research (16) are including but not limited to the following: -

1. Develop Terms of Reference of the ASP Committee indicating the roles of director, secretary and members as well as meeting schedule, norm and related issues.
2. Plan the work of stewardship program,
3. Secure the support and commitment of the hospital management and DTC, to maintain ASP to ultimately acquire adequate authority and expected outcomes for the program.
4. Develop and implement antimicrobial drug use policy, formulary restriction and preauthorization deploying evidence-based practical guidelines.
5. Incorporate local microbiological profile and resistance pattern data to improve antimicrobial utilization.
6. Perform prospective audit of antimicrobial use with direct interaction and feedback to the prescribers and other healthcare providers.
7. Organize training on antimicrobial stewardship to health professionals and other concerned staff.
8. Organize patient education sessions on the rational use of antimicrobial
9. Carry out advocacy, communication and social mobilization on antimicrobial stewardship (Commemorate antimicrobial stewardship and World Antibiotic Awareness Week (WAAW))
10. Encourage parenteral (IV) to oral conversion when appropriate
11. Promote streamlining or de-escalation of therapy on the basis of culture results
12. Negotiate with development partners and other organizations for the implementation of this program in achieving the expected outcomes and for the assurance of its sustainability.
13. Keep records, document, report, and Monitor ASP activities

## 10. Monitoring and Evaluation of ASP

The progress of every effort needs to be checked at different levels so as to track that activities that need to be implemented at various stated target. Monitoring and evaluation is the cornerstone of the implementation and achievement of the goal of this guideline.

The monitoring and evaluation system includes techniques and processes that continuously collect, analyze and interpret data for determining the appropriateness of the activities on process and provide up-to-date information for responsible body. Such information will be used as an input in taking corrective actions that help to achieve the planned outcomes and objectives.

The success or otherwise of an intervention is measured by tools termed as indicators. These indicators are powerful tools for monitoring and communicating critical information about the program. As a general principle, "what gets measured gets done," " if you don't measure results, you can't tell success from failure and thus you can't claim or reward success or avoid unintentionally rewarding failure," " if you can't recognize success, you can't learn from it; if you can't recognize failure, you can't correct it," "if you can't measure it, you can neither manage it nor improve it," but what eludes many of us is the easy path to identifying truly strategic measurements without falling back on things that are easier to measure such as input, or operational process measurements.

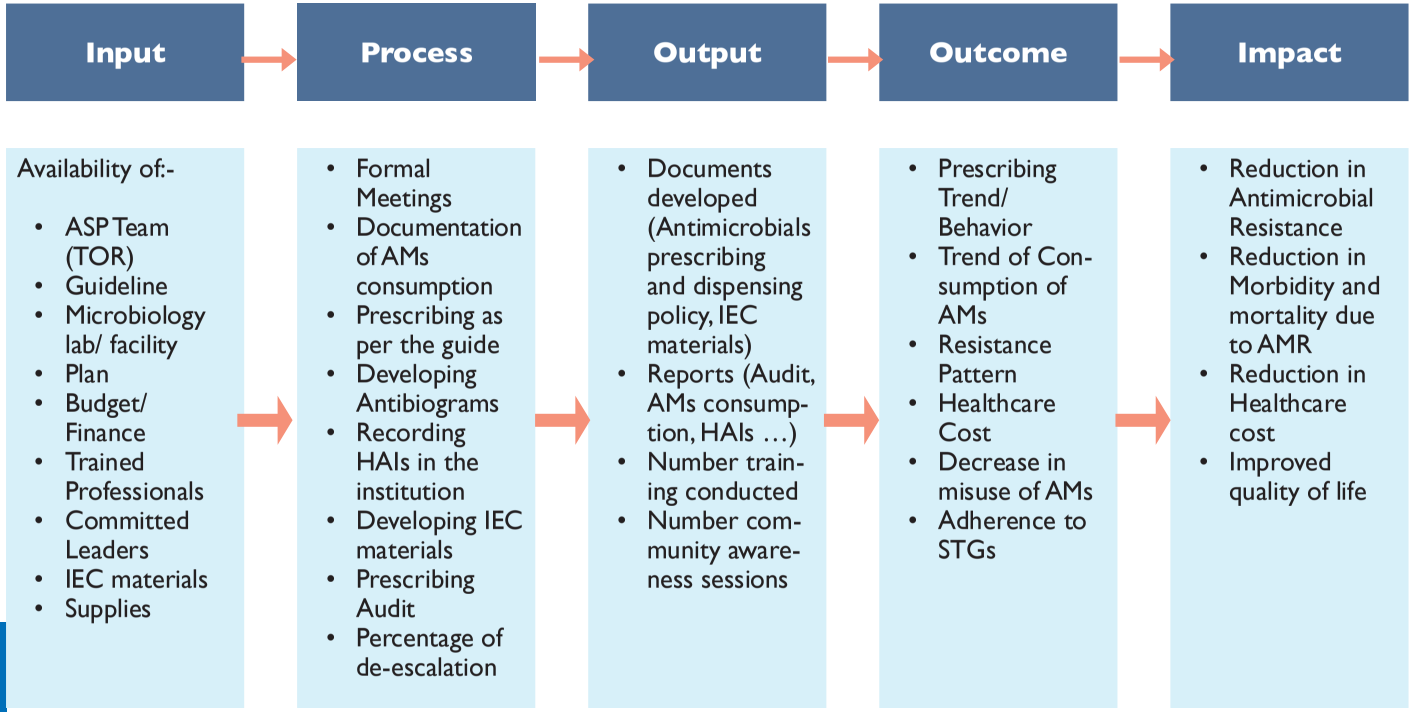
## 10.1. Good Performance Measures

Characteristics of good performance measures are listed below:

- Relevance: An indicator should reflect progress toward stated national or program goals, objectives, or standards. Provide a way to see if our strategy is working
- Focus employees' attention on what matters most to success
- Allow measurement of accomplishments, not just of the work that is performed
- Provide a common language for communication
- Are explicitly defined in terms of owner, unit of measure, collection frequency, data quality, expected value (targets), and thresholds
- Valid: measure what we mean to measure (close to the truth values), to ensure measurement of the right things
- Are verifiable, to ensure data collection accuracy
- Clear: easily understandable by everybody
- Useful: represent all the important dimensions of performance
- Measurable
- Quantitative: rates, proportions, and percentage
- Qualitative: "yes" or "no"
- Reliable: can be collected consistently by different data collectors

## Log Frame for ASP

Problem Statement – There is increased trend of prevalence of Antimicrobial Resistance which is accelerated by irrational use of Antimicrobial. This resulted in increased mortality and morbidity as well as high healthcare costs.
Goal – To improve patient outcome, Reduce healthcare cost without adversely affecting quality of care and Reduced Prevalence Antimicrobial Resistance



## 10.2. Hospital Level ASP Performance Indicators

Hospital level ASP performance indictor based performance assessment should be specified in advance. The responsible body for performing this performance based assessment using the standard indicators will be assigned by the DTC.
Indicators could have different classification like:

- leading and lagging,
- core and additional, or
- input, process, output, outcome and impact indicators.

The latter method is used to track the implementation at health facility level and it can be further categorized as core and additional (supplementary). This will be supported by regular recording, documenting, reporting and communication of critical activities and effects.

### 1. Input Indicators

1.1. Availability of the national Antimicrobial stewardship practical guide
1.2. Presence of institutional base line data
1.3. Existence of Antimicrobial stewardship team
1.4. Availability of National STG/facility level guideline
1.5. Availability of functional diagnostic microbiology laboratory
1.6. Availability of necessary supplies
1.7. Availability of appropriately AMR trained professionals
1.8. Availability of ASP plan
1.9. Availability of IEC materials

### 2. Process Indicators

2.1. Percentage of formal meetings conducted in the planning period
2.2. Registration of Antimicrobial consumption
2.3. Level of infection prevention practice (IPP)
2.4. Practice of developing Regular Antibiogram data
2.5. Registration about the availability and proper use of IPC supplies
2.6. Recording of HAIs in the institution
2.7. Availability of audit and feedback system
2.8. Availability of management system for microbiology lab
2.9. Percentage of appropriate de-escalation (Spectrum)
2.10. Percentage of appropriate switch from IV to oral (route de-escalation)

## 3. Output indicators

3.1. Developed/RevisedAntimicrobial prescribing and dispensing policy
3.2. Antimicrobial consumption trend or Amount of antimicrobial in DDD/100 bed days
3.3. Restricted antimicrobials
3.4. IEC materials developed
3.5. Percentage of availability and proper use of IPC supplies
3.6. Evidences for Communication of findings to staff and management
3.7. Percentage of awareness sessions provided against the plan
3.8. Number of trainings given against the plan
3.9. Performance of microbiology laboratory
3.10. Number of Antimicrobial therapy problem detected and resolved
3.11. Provision of data to regional/national surveillance program
3.12. Compliance with surgical prophylaxis (<60 min from incision, <24 hours and compliance with local policy
3.13. Compliance with care "bundles" – all or nothing (3-day antimicrobial review bundle, ventilator-associated pnemonia, community- acquired pneumonia, sepsis)

## 4. Outcome Indicators

4.1. percentage of HAI in the institution
4.2. percentage of adherence to STG
4.3. percentage of Adherence to Antimicrobial prescribing and dispensing policy
4.4. percentage of cost reduction in surgical infection rates (SSIs)
4.5. Improvement in infection cure rates
4.6. percentage of Adherence to microbiological data for definitive therapy
4.7. Patient outcome (Mortality, clinical cure, patient readmission within 30 days of discharge, Length of stay (LoS))
4.8. Readmission within 30 days of discharge

## 5. Impact

5.1. Prevalence of Resistance
5.2. Trend in healthcare costs
5.3. Improved quality of life

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## Annex I: ASP Indicators description

The indicator description is given for some selected indicators that require explanation, and it is to be noted that indicators labelled in section 10.2 are all to be monitored.

### 1. Selected Process Indicators

| *Indicator code* | *ASP-P01* |
|---|---|
| Definition | Percentage of formal meetings conducted is the ratio of meetings to the expected/planned number of meetings in the reference year. |
| Interpretation | This indicator shows how much active the team is. The higher the percentage the more active the ASP team and vice versa. |
| Formula | Percentage is calculated as the sum of the numbers of meetings conducted (MC) divided by the total number of expected/planned meetings as per the TOR (MP)and multiplied by 100.<br>Percentage M=((∑ MC)/(∑ Mp))x100. |
| Disaggregation | By quarters. |
| Source | Minutes/record |
| Data collection methods | Document Review: Interviewing members and leaders |
| Frequency | Quarterly |
| Target | |

### 2. Selected Output Indicators

| *Indicator title* | *Trend of Antimicrobials consumption* |
|---|---|
| Indicator code | ASP-OP01 |
| Definition | Trend of Antimicrobials consumption indicates the change of the cost of consumption/ use of antimicrobials over a certain period. Though there is increment of population, the trend should not increase over time. The actual consumption will be compared with the minimum standard. |
| Interpretation | The lower the percentage in the antibiotic consumption rate,the higher in the success of the ASP efforts or accomplishment of targets. |

| | |
|---|---|
| Formula | It can be calculated by dividing the difference of antimicrobials consumed in the reference peroid (CR) from that of the base-line (CB) divided by the baseline consumption and multiplying by 100. Trend of consumption=((CB-CR)/CB)x100<br>DDD consumption of the year |
| Disaggregation | By bi-annual, years, category of antimicrobial, adjusted to DDD. |
| Source | Hospital records (patient chart, prescription paper, cash sales ticket, free/credit registry) |
| Data collection methods | Prospective and retrospective document review |
| Frequency | bi-anually, Annually |

| *Indicator title* | *Percentage of awareness sessions provided* |
|---|---|
| Indicator code | ASP-OP02 |
| Definition | It is the Percentage of awareness sessions held to create awareness on use and misuse of antimicrobials for the public against the plan. |
| Interpretation | Conducting community awareness is important to promote the proper use of antimicrobials that have contribution in the development pace of resistance. As this indicator helps to check the performance in curbing the problem, the plan needs to be stretched in such a way that maximum effort will be exerted. The higher the percentage, the higher the performance is and vice versa. |
| Formula | The numerator is the sum total of sessions provided while the denominator is the number of planned sessions for the period. (% of awarenesssessions=((Total sessions provided)/Planned-sessions))x100%) |
| Disaggregation | Regions, topic categories and method of awareness creation |
| Data source | • EFMHACA<br>• Regional health Bureaus (RHBs)<br>• Ethiopian Hospitals |
| Data collection methods | • Document review<br>• Interview |
| Frequency | Quarterly, Annually |

% availability of IPC supplies can be compared with Availability of key medicines (WHO Operational package for assessing, monitoring and evaluating country pharmaceutical situations. Guide for coordinators and data collectors, December 2007, pp71)

| *Indicator title* | *Availability of IPC supplies.* |
|---|---|
| Indicator code | ASP -OP03 |
| Definition | All essential IPC supplies should be available at required sections/areas in all times. Adequate availability of each supply in every required area at the time of the survey will be checked and recorded. The percentage will be the actual divided by expected and ideally closer to 100% is expected. |
| Interpretation | The more closer to the 100% the more efficient the system |
| Formula | Availability of IPC supplies is calculated as the sum of actual availability divided by the sum of total of expected availability and multiplied by 100.<br>% Availability =((∑actual availability)/(∑ Expected availability))x100. |
| Disaggregation | By department, inter facility level |
| Source | Availability of copy of list of essential IPC supplies, Records, observation of IPC supplies. |
| Data collection methods | Observation/Survey records/checklist |
| Frequency | Quarterly, Annually |
| Target | 100% |

## 3. Selected Outcome Indicators

% of Adherence to STG

| *Indicator title* | *Percentage of Adherence to STG* |
|---|---|
| Indicator code | ASP -OC01 |
| Definition | The percentage adherence to STG is actual compliance of treatment as per the standard protocol out of the total chart reviewed. Ideally, 100% adherence to STG is expected |
| Interpretation | The more closer to the 100% the more efficient the system |
| Formula | Adherence to STG is calculated number of actual compliance to STG divided by the sum total of charts reviewed and multiplied by 100.<br>% Adherence to STG =((Total complying to STG)/(Total Charts reviewed))x100. |

| | |
|---|---|
| Disaggregation | By department, inter facility level |
| Source | Document/chart Review |
| Data collection methods | Observation/Review records |
| Frequency | Every six month, Annually |

% of HAIs in the institution

| **Indicator title** | **Percentage of HAIs in the institution** |
|---|---|
| *Indicator code* | ASP-OC02 |
| *Definition* | Percentage of HAIs in the institution is the actual HAIs divided by the total patients reviewed. Ideally close to zero HAI is expected. |
| *Interpretation* | The more closer to zero the more efficient the system is. |
| *Formula* | Percentage of HAIs in the institution is calculated number of actual HAIs divided by the total patients observed and multiplied by 100.<br><br>% HAIs in the institution =((Total HAIs)/(Total patients observed))x100. |
| *Disaggregation* | By department, inter facility level |
| *Source* | Document Review |
| *Data collection methods* | Observation/review records |
| *Frequency* | bi-[annually, Annually |

## 4. Selected Impact Indicators

Prevalence of Antimicrobial Resistance – compared with baseline

| *Indicator title* | *Prevalence of Antimicrobial Resistance* |
|---|---|
| Indicator code | ASP-I01 |
| Definition | Antimicrobial resistance is a cumulative effect of genetic or use and misuse in human and animals. It requires multi-sectorial effort and comprises preventable as well as some which can't be avoided. Hence, this indicator measures how far the effort of every stakeholder is bringing fruits as compared to the baseline. |

| | |
|---|---|
| Interpretation | The lower the prevalence or no growth in culture and sensitivity test, the better the performance of the ASP efforts or accomplishment of targets. |
| Formula | The numerator is the total resistant pathogens with selected antimicrobials (No growth) while the denominator is the total pathogens tested (Sample total) and multiplying by 100. Prevalence of Antimicrobial Resistance=((No of resistant pathogens)/(Total Pathogens tested))x100. |
| Disaggregation | By Species of organism, Antimicrobial, Period, Region. |
| Source | microbiology data/records |
| Data collection methods | Surveillance, Document review |
| Frequency | Bi-annually, Annually |

| *Trend in healthcare costs - compared with baseline* | |
|---|---|
| **Indicator title** | **Trends in health costs** |
| Indicator code | ASP-I02 |
| Definition | Statistics on The actual costs of providing services related to the delivery of health care, including the costs of procedures, therapies, and medications |
| Interpretation | The lower the cost the better the performance of ASP |
| Formula | The numerator is the difference of baseline cost (TB)and current cost (TC) while the denominator the baseline cost(TB) and multiplying by 100.<br>Trends in health care cost=((TB-TC)/TB)x100. |
| Disaggregation | Period, department, |
| Source | Reports |
| Data collection methods | Review |
| Frequency | Annually |

## AnnexII: Checklist for Core Elements of Hospital ASP

The following checklist is a companion to Core Elements of Hospital ASPs. This checklist should be used to systematically assess key elements and actions to ensure optimal antibiotic prescribing and limit overuse and misuse of antibiotics in hospitals. Facilities using this checklist should involve one or more knowledgeable staff to determine if the following principles and actions to improve antibiotic use are in place. The elements in this checklist have been shown in previous studies to be helpful in improving antibiotic use though not all of the elements might be feasible in all hospitals

| *Core element* | *Implemented in the hospital* | *Yes* | *No* |
|---|---|---|---|
| Leadership Support | Does your facility have a formal, written statement of support from leadership that supports efforts to improve antimicrobial use (antimicrobial stewardship)? | | |
| | Does your facility receive any budgeted financial support for antimicrobial stewardship activities (e.g., support for salary, training, or IT support)? | | |
| Accountability | Is there an Infectious diseases physician (preferred)/ internist/general practitioner leader responsible for program outcomes of stewardship activities at your facility? | | |
| Appropriate Expertise | Is there a pharmacist or microbiologist or infectious disease specialist, leader responsible for working to improve antibiotic use for working to improve antimicrobial use at your facility? | | |
| Key support for ASP | Does any of the staff below work with the stewardship leaders to improve antimicrobial use?<br>A. Clinicians<br>B. Infection Prevention and Healthcare Epidemiology<br>C. Quality assurance<br>D. Microbiology (Laboratory)<br>E. Nursing<br>F. Information Technology (IT) | | |

| | | | |
|---|---|---|---|
| Actions to support optimal antimicrobial use | Does your facility have a policy that requires prescribers to document dose, route of administration, duration, and indication for all antimicrobial prescriptions in the medical record or during order entry? | | |
| | Is there a formal procedure for all clinicians to review the appropriateness of all antimicrobial 48 hours after the initial orders (e.g. antimicrobial time out)? | | |
| | Does a physician or pharmacist review courses of therapy for specified antimicrobial agents (i.e., prospective audit with feedback) at your facility? | | |
| | Is there a practice of Automatic changes from IV to oral antimicrobial therapy in appropriate situations? | | |
| | Does your facility adjust Antimicrobials dose in cases of organ dysfunction? | | |
| | Is there Dose optimization (pharmacokinetics/ pharmacodynamics) to optimize the treatment of organisms with reduced susceptibility? | | |
| | Does automatic alerts exist in situations where therapy might be unnecessarily duplicative? | | |
| | Is there a time-sensitive automatic system to stop orders for specified antimicrobial prescriptions? | | |
| | Does the facility have availability of Diagnosis and specific intervention for the following specific conditions<br>A. CAP<br>B. Urinary tract infection<br>C. Skin and soft tissue infections<br>D. Surgical prophylaxis<br>E. Empiric treatment of Methicillin-re sistant Staphylococcus aureus (MRSA)<br>F. Non-Clostridium difficile infection | | |

| | | | |
|---|---|---|---|
| Tracking | Does your stewardship program monitor adherence to a documentation policy (dose, route of administration, duration, and indication)? | | |
| | Does your stewardship program monitor adherence to facility-specific treatment recommendations? | | |
| | Does your stewardship program monitor compliance with one or more of the specific interventions in place? | | |
| | Does your facility track rates of C. difficile infection? | | |
| | Does your facility produce an antibiogram (cumulative antibiotic susceptibility) report? | | |
| | Does your facility monitor antimicrobial use (consumption) at the unit and/or facility wide level by one of the following metrics:<br>A. By counts of antimicrobial(s) administered to patients per day (Days of Therapy; DOT)?<br>B. By number of grams of antimicrobial used (Defined Daily Dose, DDD)?<br>C. By direct expenditure for antimicrobials (purchasing costs)? | | |
| Communication | Does your stewardship program share facility-specific reports on antimicrobial use with prescribers? | | |
| | Has a current antibiogram been distributed to prescribers at your facility? | | |
| | Do prescribers ever receive direct, personalized communication about how they can improve their antimicrobial prescribing? | | |
| | Does your facility ASP share antibiogram data to regional or national database? | | |
| Education | Does your stewardship program provide education to clinicians and other relevant staff on improving antimicrobial prescribing? | | |

## Annex III: Chart Stickers for Intravenous to Oral Antimicrobial Switch Reminder

IV to Oral Antimicrobial Interchange Program

Date_____ Time_____ Patient Name _____
This patient currently has orders for:_____

Responsible or authorized person from the ASP team has approved an IV to oral conversion for patients meeting specific clinical criteria.
Your patient's therapy has been changed to:_____

Completed by: _____

## Annex IV: Chart stickers

### A. Chart Sticker for Organ Specific Dysfunction Regimen and Dose Adjustment Reminder

Organ Dysfunction based Regimen and Dose Adjustment reminder

Date_____ Time_____ Patient Name _____

This patient currently has orders for:_____

The Antimicrobial Stewardship Team identified Renal/liver dysfunction demanding clinical criteria for regimen and Dose adjustment.You are kindly reminded to adjust the treatment based on the clinical guideline recommendations.

Completed by: _____

### B. Chart sticker for Antibiotic discontinuation after recommended treatment duration

Treatment duration reminder

Date_____ Time_____ Patient Name _____

This patient currently has orders for:_____

The Antimicrobial Stewardship Team identified that your patient received the recommended duration of antimicrobial therapy. This is to kindly remind to stop the antimicrobial therapy.
Completed by: _____

## Annex V: Template for Hospital antimicrobial policy

**Summary of contents of the template used to produce hospital antimicrobial policy**

1. **Title page**
   Name of policy ( ___Hospital antimicrobial use policy) , date, version, review date, and contact details for normal hours and out-of-hours enquiries

2. **Introduction section**
   Background, Rationale, purpose, scope and relevant information.

3. **Body**

4. **Summary list of available antimicrobials**
   Unrestricted, restricted (approval of a specialist is required) or permitted for specific conditions

5. **Regimens for treatment of common infections**
   Treatment, prophylaxis and rules for switching from intravenous to oral route

## Annex VI: Roadmap of implementation

The road for implementation of the core elements through the proposed strategies may not be as such smooth and may involve some ups and downs on the maze. Though the ultimate goal remains the same, there may be different approaches of translating an ASP guide into action depending on the institutional or local context. It may be merging some steps or splitting to the details, it is also advisable to start with relatively simple exercise to get the low hanging fruits, aim big but act small. For this document purpose only, the road is simplified as "ESCORT" in addressing the core elements in our hospital setting and is described below:

**1. Exploring the environment and ensuring commitment (E)**
It is good to carry out rapid assessment or use recent data and understand the current status so as to inflict and motivate actors for better performance. It could be done by the think tank professionals with full awareness and support from the leadership whereby these professionals would report the findings / with recommendations as well as with draft TOR that help to organize team (spring board for take-off in step 2, swift inception).

**2. Sailing, Come together, get organized and kick-off (S)**
Ensuring leadership commitment will be reflected in step 1 and continues by gathering responsible experts, organizing platform for kick off or laying the foundation, birth of the ASP by organizing the ASP team. It will be preceded by report of the assessment of step 1, brainstorming on the proposed organizational structure and TOR followed by approval of same in the presence responsible participants, sharing accountability and responsibility as indicated in section 6 of this document.

ASP should have participatory/ embracing governance as the definition itself states "coordinated interventions designed to improve and measure the appropriate use of antimicrobials by promoting the selection of the optimal drug regimen including dosing, duration of therapy, and route of administration". Hence, it should bring all actors on board and fit into the formal structure, the output of the kick off meeting paves the way for the succeeding tasks and responsibilities.

**3. Cultivation of life and Governance (C)**
Once the birth of ASP team ensured, next is nurturing for proper physiology of life or functionality and management. In this connection, the first step of management function, planning, will be initiated with support and monitoring of the leadership. The plan of actions (POA) should consider smooth unpacking of issues indicated in the strategy section 8 of the document with selection interventions aligned with the context and prioritization in mind.

The plan should be developed through consultation and also define responsibility, time-frame, targets and monitoring framework to establish process and outcome measures, who will do what by when and how. It should be communicated to all responsible persons.

Though it may be difficult to consider in the infancy of the ASP team, points to be considered in the plan includes;

- Development of antimicrobials use policy, formulary restriction and pre-approval system.
- Development categorized list of antimicrobial medicines.

**4. Organization of Events(O)–**

The event could stay for a week and be accompanied by different actions, inter alia:

- Public awareness campaign using different educational materials (printed and electronic materials, shows (Seven days - seven Actions).
- Dissemination of relevant study findings and educational sessions to technical staff
- Recognition of champions

**5. Record, Report and communication (R)**

Develop tools and make culture to document all the planned interventions, the successes and challenges in the ASP of the hospital. Check the guiding principles and strategies and contribution of members and non-members of the ASP team as well as collect report/information from members.

Communicate the intermediate periodic results with responsible people and use this result during staff meetings and demonstrate effectiveness.

**6. Tracking (T)**

Tracking is one of the core elements of ASP. Summarize the detailed report and compare it with the milestone, monitor progress of the year. This may be the last but the result will be an input for beginning of the following year as depicted in the PDCA (Plan-do-Check-Act) cycle.

Each step starting from the inception, birth, cultivation through tracking requires leadership commitment, support and ownership of the actors in the ASP. The proposed roadmap can be considered as guide but could be adjusted base on the context of the hospital.

## Annex VII: List of Technical Working Group Members and Workshop Participants

| S. No. | Name | Organization |
|---|---|---|
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| 2. | Abrehet Ghidey | EFMHACA |
| 3. | Admassu Tenna (Dr) | AAU, Tikur Anbessa Specialized Hospital |
| 4. | Asnakech Alemu | EFMHACA |
| 5. | Aster Tsegaye (Dr) | AAU-EPHA |
| 6. | Bahiru zewdie | EFMHACA |
| 7 | Belete Ayalneh | GHSC-PSM |

| | | |
|---|---|---|
| 8. | Berhanu Amare (Dr) | CDC |
| 9. | Betelhem Dagnachew | EFMHACA |
| 10. | Bitsat shemelis | EFMHACA |
| 11. | Desalew Mekonnen (Dr) | AAU, Tikur Anbessa Specialized Hospital |
| 12. | Eyob Alemayehu | University of Gondar |
| 13. | Gessie Jebessa | Gambella Regulatory Agency |
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| 16. | Kassu Desta | AAU/Eth. Medical Laboratories Association |
| 17. | Keyredin Redi (Dr) | EFMHACA |
| 18. | Kidu Hailu | EPA |
| 19. | Maru Legesse | FMoH |
| 20. | Melese Hailu | AAU/ Eth. Medical Laboratories Association |
| 21. | Mengistab W/Aregay | WHO-EFMHACA |
| 22. | Minilik Mesfin | EFMHACA |
| 23. | Misrak Feleke | St. Paul's Hospital Millennium Medical College |
| 24. | Muley Abrah | Ayder College of Health Sciences |
| 25. | Mulugeta Olika | Oromia Regional Health Bureau |
| 26. | Muluneh Guadie | Bahir Dar |
| 27. | Remedan Ebrahim | Harari Regional Health Bureau |
| 28. | Roman kassahun | Ministry of Environment Forest and Climate Change |
| 29. | Shimeles Mengistu | EFMHACA |
| 30. | Solomon Abdellah | Hawassa University |
| 31. | Solomon Assefa | AAU School of Pharmacy |
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| | | |
|---|---|---|
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