National Anti-Microbial Stewardship Quality Improvement (QI) Framework

Quality Improvement Secretariat

HEU, Health Service Division, MOHFW

www.qis.gov.bd

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Zahid Maleque, MP
Minister
Ministry of Health of Family Welfare
Govt. of the People's Republic of Bangladesh

Message

The government of Bangladesh is constitutionally committed to provide its citizen with basic necessities of life including healthcare. Accordingly, Bangladesh has operated lots of initiatives in healthcare and meanwhile has made tremendous of successes in the Health Sector. There have been significant gains in terms of Child health, infectious disease control, population control, improvement of overall hygiene and sanitation standard etc.

In 2010, the UN recognized Bangladesh for its exemplary progress towards Millennium Development Goal (MDG) 4 in child mortality and for being on track to achieve the maternal mortality reduction.

Healthcare quality improvement remains a big challenge in health services as an overarching issue. Rational use of antimicrobials is also under this purview. Anti-microbial resistance is not a unique problem for Bangladesh, it is rather a global phenomenon. Bangladesh is rather a fertile place of the indiscriminate use of antibiotics which is going without challenge progressively. It is unexpected that the antibiotics, which are supposed to be an instrument against threatening infections, have practically appeared as a health hazard. Anti-microbial resistance is posing a menace to our MDG gains and risking SDGs. It is so a serious concern for Bangladesh and we can't simply ignore it. Quality Improvement Secretariat (QIS), HEU, MOHFW has correctly focused the issue to improve the situation as a timely initiative by developing Anti-Microbial Stewardship (AMS) framework. I am very much thankful to all the clinical experts and public health professionals for contributing to developing this important document.

I am confident that this document will tremendously improve the anti-microbial resistance situation, not only because it was developed after an extensive review of relevant literature and consultation with experts, professional groupings, and other stakeholders, but also because its contents are realistic, practical, and designed to meet local needs.

I wish every success of this effort.

Joy Bangla, Joy Bangabandhu

Long live Bangladesh.

Zahid Maleque

Dr. Md. Murad Hassan, MP
State Minister
Ministry of Health of Family Welfare
Govt. of the People's Republic of Bangladesh

Message

The Government of Bangladesh is committed to protect and improve the nation's health and wellbeing, and reduce health inequalities through delivery of quality health care services. Antibiotics are life-saving drugs when used properly. However, inappropriate use of antibiotics is associated with emergence of resistance organisms.

The prevalence of antimicrobial resistance has risen alarmingly over the last 40 years, and few truly novel antimicrobials have been developed during this period. This has led to increased pressure on existing antibiotics and greater challenges in treating patients. Inappropriate use of antimicrobials increases the risk to patients of colonization and infection with resistant organisms and subsequent transmission to other patients.

Antimicrobial stewardship is an important element of quality improvement strategy for patient safety. The aims of such stewardship initiatives are to improve the safety and quality of patient care, and to contribute significantly to reductions in the emergence and spread of antimicrobial resistance. I am very happy that the Quality Improvement Secretariat of Health Economics Unit (MOH&FW) has taken the important initiative and developed the guideline for rational use of antibiotics involving all the experts and stakeholders. I would like to thank the stakeholders and experts (DGHS, DGFP, Save the Children, USAID, UNICEF, UNFPA and other development partners, health research organizations, professional bodies and specialists) who have contributed in developing this document under the leadership of QIS.I hope this guideline will be followed by the practicing physicians at all levels and be able to reduce inappropriate prescribing of antibiotics.

Joy Bangla, Joy Bangabandhu

Long live Bangladesh.

Dr. Md. Murad Hassan, MP
21/5/19

Md Ashadul Islam
Secretary
Health Service Division
Ministry of Health of Family Welfare
Govt. of the People's Republic of Bangladesh

Message

Effective antimicrobial stewardship is of particular importance in developing countries like Bangladesh. Inappropriate antimicrobial use has led to widespread drug resistance among not only bacterial isolates, but also among parasites and other infectious agents. This in turn becomes a global problem, as resistance spreads throughout the world quickly. However, effective stewardship programs in developing settings are constrained by, among other things, shortage of human and technological resources, limited microbiology laboratory support (and thus limited surveillance data), inadequate support from policymakers and funding sources. The large burden of infectious diseases combined with poor stewardship creates a fertile environment for the rapid development of antimicrobial resistance.

The need for effective antimicrobial stewardship programs in these settings is therefore great, perhaps even more acute than in the developed world. Unfortunately, examples of successful programs in developing countries have been sparse to date.

Antimicrobial stewardship programs are being implemented globally for ensuring proper use of antimicrobials in order to provide the best patient outcomes, to reduce the risk of adverse effects, to promote cost-effectiveness, and to reduce or stabilize levels of resistance. Until recently, their focus has been on the first three goals (patient outcome, toxicity, and cost). Along with infection prevention and control, hand hygiene and surveillance, antimicrobial stewardship is considered a key strategy in local and national programs to prevent the emergence of antimicrobial resistance and decrease preventable healthcare associated infection.

I am happy that Quality Improvement Secretariat of Ministry of Health & Family Welfare has developed an AMS QI Frameworks for public & private facilities. I sincerely believe that this Framework will help to improve the safe and appropriate use of antimicrobials, reduce patient harm and to decrease the incidence of antimicrobial resistance. This in turn, will help to improve the quality of care in our country.

I wish our health care professionals will use this Framework and help to combat the issue of rising concern of antimicrobial resistance in our country.

Md Ashadul Islam

Prof Dr Abul Kalam Azad
Director General
Directorate General of Health Services

Message

Antimicrobial resistance (AMS) is a worldwide problem. The selection and spread of resistant organisms in developing countries that can often be traced to complex socioeconomic and behavioral antecedents contribute to the escalating problem of antibiotic resistance. Factors such as unregulated dispensing and manufacture of antimicrobials, truncated antimicrobial therapy, inadequate access to effective drugs and sometimes drugs of questionable quality and overall poverty are likely to be contributing to antimicrobial resistance.

Antimicrobial agents, including antibiotics, have saved millions of lives, substantially reduced the burden of diseases, improved quality of life, safety, and helped increase life expectancy. The emergence and spread of antimicrobial resistance (AMR) in several microorganisms are complicating the management of many infectious diseases. AMR is a major threat to human development and the fight against infectious diseases. At Sixty-eighth World Health Assembly in May 2015, has endorsed a global action plan to tackle antimicrobial resistance, including antibiotic resistance, the most urgent drug-resistance trend.

To achieve Sustainable development goal (SDG) 3 to "ensure healthy lives and promote well-being for all at all ages", we need to address a critical issue: the quality of health care. MOHFW has duly emphasized the quality issue and created Quality Improvement Secretariat (QIS) in MOHFW and the QIS is relentlessly trying to develop guidelines, protocols, frameworks etc to ensure expected actions by health providers of all level both in Govt. & private sector. Anti-microbial stewardship (AMS) framework is one of its appreciable endeavours.

This framework presents principles that are developed to provide a coordinated approach to the preventionof the inappropriate use of antimicrobials. Theprinciples are based on the best available current evidence and built on existing international guidelines and reviews, as well as systematic reviews of the evidence.

I hope the AMS framework will have a great impact on preventing the indiscriminate use of antimicrobials in Bangladesh.

Prof Dr Abul Kalam Azad

Md Shahadt Hossain Mahmud
Director General (Additional Secretary)
Health Economics Unit

Message

Antimicrobial resistance (AMS) happens when microorganisms (such as bacteria, fungi, viruses, and parasites) change when they are exposed to antimicrobial drugs (such as antibiotics, antifungal, antiviral, antimalarial, and anthelminthic). Microorganisms that develop antimicrobial resistance are sometimes referred to as "superbugs". As a result, the medicines become ineffective and infections persist in the body, increasing the risk of spread to others.

New resistance mechanisms are emerging and spreading globally, threatening our ability to treat common infectious diseases, resulting in prolonged illness, disability, and death. Without effective antimicrobials for prevention and treatment of infections, medical procedures such as organ transplantation, cancer chemotherapy, diabetes management and major surgery (for example, caesarean sections or hip replacements) become very high risk.

Antimicrobial resistance increases the cost of health care or lengthier stays in hospitals with more intensive care. As a result, it is putting the gains of the Millennium Development Goals (MDGs) at risk and endangering achievement of the Sustainable Development Goals (SDGs). Since antimicrobial resistance is a complex problem that affects all of society and is driven by many interconnected factors, single or isolated interventions have limited impact on it. As such coordinated action is required to minimize the emergence and spread of antimicrobial resistance. And to this end, greater innovation and investment are required in research and development of new antimicrobial medicines, vaccines, and diagnostic tools.

Antimicrobials are the most commonly prescribed group of drugs in general practice and in hospitals. The depressing fact is that most of the antimicrobials are prescribed without proper investigation but based on best-guess empiric therapy. In fact, majority of the prescribers in Bangladesh diagnose infection by clinical assessment and thoughts. As a negative consequence of this trend infectious diseases are ruining as purity public health problem. Quality Improvement Secretariat (QIS) under HEU of MOHFW has taken an initiative for development of AMS QI framework. It is expected that this document will be used in the facility level to prevent the antibiotics resistance and also will help to develop the organizational culture.

Md Shahadt Hossain Mahmud

Preface

Antimicrobial stewardship is a coordinated program that promotes the appropriate use of antimicrobials (including antibiotics), improves patient outcomes, reduces microbial resistance and decreases the spread of infections caused by multidrug-resistant organism in the facility level.

Misuse and overuse of antimicrobials is one of the world's most pressing public health problems. Infectious organisms adapt to the antimicrobials designed to kill them, making the drugs ineffective. People infected with antimicrobial-resistant organisms are more likely to have longer, more expensive hospital stays, and may be more likely to die as a result of an infection.

Antimicrobial resistance (AMR) occurs when microorganisms such as bacteria, viruses, fungi and parasites change in ways that render the medications used to cure the infections they cause ineffective. AMR is a global public health concern. It is a problem related to you and me as AMR could affect anyone, of any age, in any country, resulted in reduced efficacy of antimicrobials, making the treatment of patients difficult, costly or even impossible. AMR can occur naturally, but misuse of antimicrobials in humans and animals is accelerating the process. Therefore, responsible use of antimicrobials is the key success factor for AMR containment.

Concerted efforts of the healthcare sector, general public and all stakeholders in the community and all over the world are required to combat AMR. Primary care is the first level of care in the whole healthcare system and family doctors are the main providers. They play a pivotal role in tackling AMR problem by reducing unnecessary antibiotic use. In connection to this, Centre of Health Protection of the Department of Health rolled out the "Antibiotic Stewardship Programme in Primary Care", aiming to optimize the use of antibiotics by providing evidence-based antibiotic prescription guidance for common infections in community for doctors and healthcare professionals as reference. The guidance notes will be kept updating based on local epidemiology and international best practice.

As members of the public, your pledge to judicious use of antibiotics indeed is very important. Only use antibiotics when prescribed by a qualified health professional. Never share or use leftover antibiotics. Trust your family doctors and never demand antibiotics. Always follow their advice when using antibiotics. Besides, simple infection prevention and control measures like practicing good hand hygiene, maintain cough etiquette, ensure vaccinations up to date and prepare food hygienically, in fact are able to contribute in containment of AMR.

Antimicrobial resistance (AMR) occurs when microorganisms such as bacteria, viruses, fungi and parasites change in ways that render the medications used to cure the infections they cause ineffective. AMR is a global public health concern. It is a problem related to you and me as AMR could affect anyone, of any age, in any country, resulted in reduced efficacy of antimicrobials, making the treatment of patients difficult, costly or even impossible. AMR can occur naturally, but misuse of antimicrobials in humans and animals is accelerating the process. Therefore, responsible use of antimicrobials is the key success factor for AMR containment.

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There are several solution like Discover new drugs faster than emergence of resistance, Promote discovery, development and dissemination of new antimicrobial agents, Awareness development of the community, Strong control mechanism for OTC drugs (Antibiotics), Strong Multi disciplinary approach (MOHFW/MOA/MOLS), Rationalize the use of available antimicrobial agents, Implement a AMS QI framework in hospital settings.

This document mainly focus on facility level initiative to prevent antibiotics resistance and ensure Quality of Care and at the same time AMS activities will be on board. It will also help to develop the culture of good and rational use of antibiotics in the facility level.

Dr Md Aminul Hasan
Director Hospitals & Clinics. DGHS
& Focal Person
Quality Improvement Secretariat
Ministry of Health of Family Welfare

List of Abbreviations and Acronyms

AMS	Antimicrobial Stewardship
AMR	Antimicrobial resistance
CNE	Continuous Nurse Education
CRBSI	Catheter Related Blood Stream Infection
CS	Culture and Sensitivity
CSF	Cerebro Spinal Fluid
DDD	Daily Defined Dose
IV	Intravenous
MDGs	Millennium Developmental Goals
NBM	Nil by Mouth
NG	Nasogastric
PO	Per Oral
QI	Quality Improvement
QIS	Quality Improvement Secretariat
SDG	Sustainable Development Goal
SSI	Surgical Site Infection
SMRs	Standardized Mortality Rates
URTI	Upper Respiratory Tract Infection
WBC	White Blood Cell
WHA	World Health Assembly
WHO	World Health Organization

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Part-1

National Anti-Microbial Stewardship QI Framework Initiative

a. Introduction:

Inappropriate and over use of antimicrobials contributes to the emergence of resistant bacteria and causes patient harm. Patients with antimicrobial - resistant infections are more likely to experience ineffective treatment, recurrent infection, delayed recovery or even death.

The development and widespread use of antimicrobial agents has been among the most important public health interventions in the last century. The effect of these agents, along with improved sanitation and the broad application of vaccination (in those countries where these are available), has been a substantial reduction in infectious mortality. Antimicrobials are not a human invention per se, having been present (albeit invisible to humans) in the environment for millennia. Humans have co-opted the molecules that fungi, soil actinomycetes, and other microorganisms use to secure their ecologic niche in a world teeming with competitors

Soon after the widespread use of natural antimicrobial products in medicine, human pathogens expressing resistance to these agents were isolated. Genes encoding resistance had likely been present for thousands of years, either as countermeasures to the effects of antimicrobials or for as-yet undetermined functions, and incorporation of these genes by human commensal and pathogenic flora rapidly followed. What has been remarkable has been microorganisms' ability to rapidly develop resistance to antimicrobials that have been modified to evade the original mechanisms of resistance, as well as to those novel synthetic agents that had never been present in the environment previously. This is a testament to the impressive reproductive rate of most microorganisms, the tremendous selective pressure that antimicrobial agents apply to these populations, and the huge number of unculturable organisms in the environment that may be serving as reservoirs of antimicrobial resistance genes.

Antimicrobial stewardship programs have been pursuing this goal for decades globally. These programs focus on ensuring the proper use of antimicrobials to provide the best patient outcomes, lessen the risk of adverse effects, promote cost-effectiveness and reduce or stabilize levels of resistance. Until recently, their focus has been on the first three goals (patient outcome, toxicity, and cost).

It is likely that in the decade to come, the latter objective of mitigating antimicrobial resistance will be paramount. In this review we will address the rationale, structure, analysis, and outcomes of antimicrobial stewardship programs with a special interest in their impact on antimicrobial resistance.

Antimicrobial stewardship (AMS) programs also have been shown to decrease inappropriate antimicrobial usage, improve patient outcomes and reduce adverse consequences of antimicrobial use (including antimicrobial resistance, toxicity and unnecessary costs). Along with infection prevention and control, hand hygiene and surveillance, antimicrobial stewardship is considered a key strategy in local and national programs to prevent the emergence of antimicrobial resistance and decrease preventable healthcare associated infection

The aim of the Antimicrobial Stewardship for QI framework initiative is to improve the safe and appropriate use of antimicrobials, reduce patient harm and decrease the incidence of antimicrobial resistance and ensure Quality of Care.

b. Objectives AMS QI framework:

- To ensure patient safety by development a QI monitoring and surveillance system that captures the emergence of resistance, trends in its spread and utilization of antimicrobial agents in hospital setting
- To promote safe, appropriate & rational use of antimicrobial agents in health service delivery.
- To initiate the infection control measures to reduce the disease burden.
- To improve patient outcomes (e.g. reduce morbidity and mortality from infection)
- To optimize antimicrobial therapy, by promoting judicious use of antimicrobials, optimizing antimicrobial selection, dosing, route and duration of therapy in order to maximize clinical cure or prevent infections.
- To limit the unintended consequences such as the emergence of antimicrobial resistance and adverse drug events.
- To reduce healthcare cost without adversely impacting quality of care.

c. Association Between Antimicrobial Use and Resistance

To optimally manage antimicrobial use to attenuate antimicrobial resistance, it is necessary to have a precise understanding of the relationship between antimicrobial use and resistance. The spectrum of requisite knowledge stretches from the in vitro interactions between antimicrobial molecules and their microbial targets, to the individual risks associated with administering an antimicrobial to a given patient, to the ecologic level where the aggregate effects of antimicrobial use are studied using hospitalwide or nationwide data. The nature of these drug-organism relationships is likely to be highly variable depending on the particular drug-bug combination of interest, although some common themes may emerge. Despite thousands of scientific investigations on the subject, we are only beginning to understand many of these complex relationships, especially at an ecologic level.

d. Definition and Prevalence of Antimicrobial Stewardship

The terms used to refer to antimicrobial stewardships programs may vary considerably: antibiotic policies, antibiotic management programs, antibiotic control programs, and other terms may be used more or less interchangeably. These terms generally refer to an overarching program to change and direct antimicrobial use at a health care institution, which may employ any of a number of individual strategies . The variety of activities that can be considered antimicrobial stewardship under the broadest definition are large. Substitution among antimicrobials in the same class for cost-saving purposes, intravenous-to-oral switching programs for highly bioavailable drugs, and pharmacokinetic consultation services may all impact on antimicrobial use. However, these measures are less likely to have an impact on overall antimicrobial use or antimicrobial resistance, and we will not consider them here except as part of more comprehensive programs.

During an outbreak of infections due to antimicrobial-resistant organisms, temporary restrictions on antimicrobial use may be applied along with enhanced infection control measures to terminate the outbreak. In general, unless these interventions are part of an ongoing program to optimize antimicrobial use, we will not focus on these temporary interventions. Thus, we will define an antimicrobial stewardship program as an ongoing effort by a

health care institution to optimize antimicrobial use among hospitalized patients in order to improve patient outcomes, ensure cost-effective therapy and reduce adverse sequelae of antimicrobial use (including antimicrobial resistance). In reality, many early programs were designed to control rising acquisition cost of antimicrobial drugs. Reduction in total or targeted antimicrobial use, increase in appropriate drug use, improvement in susceptibility profiles of hospital pathogens, and improvement in clinical markers (such as reduced length of stay) are now being increasingly targeted as outcomes by antimicrobial stewardship programs.

e. Roles of Individuals in Antimicrobial Stewardship Programs

Infectious Diseases Physicians

Essential to a successful antimicrobial stewardship program is the presence of at least one infectious diseases-trained physician who dedicates a portion of their time to the design, implementation, and function of the program. Supervision by an infectious diseases physician is necessary to ensure that therapeutic guidelines, antimicrobial restriction policies, or other measures are based on the best evidence and practice and will not put patients at risk. Having the program led by an infectious diseases specialist may also lend the program legitimacy among physicians practicing at the hospital, and reduce the chance of the program simply being seen as a pharmacy-driven cost-savings scheme.

Clinical and Hospital Pharmacists

The origin of many antimicrobial stewardship programs as cost-saving measures initiated by the pharmacy department has put pharmacists at the forefront of many antimicrobial stewardship programs. Pharmacists often act as the effect or arms for antimicrobial stewardship programs. They are well positioned for this effort because of their role in processing medication orders and their familiarity with the hospital formulary. Different hospital-based pharmacists may play different roles in antimicrobial stewardship programs. Pharmacists whose primary role is in processing medication orders and dispensing drugs in the hospital may note when restricted antimicrobials are ordered and notify the prescriber that authorization is required. They may also flag orders for review by infectious diseases specialists, in addition to their usual role in assuring proper dosing and safety. However, the broad responsibilities of these pharmacists generally do not allow adequate time for a comprehensive review of antimicrobial therapy. In

addition, these pharmacists may not have adequate training in infectious diseases to feel comfortable providing recommendations for complex cases. Thus, having a clinical pharmacist with specialized training in infectious diseases dedicated full- or part-time to the administration of the antimicrobial stewardship program is increasingly common.

Clinical Microbiologists

The clinical microbiology laboratory is a key component in the function of antimicrobial stewardship programs. Summary data on antimicrobial resistance rates allow the antimicrobial stewardship team to determine the current burden of antimicrobial resistance in the hospital, facilitating decisions as to which antimicrobials to target for restriction or review. Ideally, resistance data should be able to be sliced in multiple ways to answer more sophisticated questions as to the nature of resistance in the institution. For example, if the laboratory processes samples from outpatient clinics, exclusion of these isolates will give a better sense of the true state of resistance within the hospital. Preparation of antibiograms specific to certain patient care areas, especially intensive care units, may allow identification of local problems and focused antimicrobial stewardship and infection control efforts. Also, having resistance data available on a monthly or quarterly basis allows closer tracking of trends and facilitates well-designed studies of interventions.

A number of challenges face clinical microbiologists today, including a surge in new biotechnology-based tests, increasing centralization of laboratory services, and an increasing shortage of skilled workers. Because of the importance of the clinical microbiology laboratory to implementation of antimicrobial stewardship, funding for antimicrobial stewardship programs should include compensation for the microbiology laboratory's contributions to the program. At the same time, the antimicrobial stewardship program's educational initiatives should incorporate recommendations for proper culturing and submission of tests, which may improve the use of laboratory resources and result in cost savings to the lab. A centrally well equipped microbiology lab will be established and develop rapid disgnostic strategy and monitor all of the laboratory test in microbiology unit!

Infection Control Staff

The problem of spread of antimicrobial-resistant organisms within hospitals has long been a concern of infection control professionals. While some resistant

organisms have primarily been thought to be infection control problems and others antibiotic-use problems, an absolute distinction is artificial and both transmission and selection play important roles in the spread of antimicrobial resistance.

There are a number of avenues for collaboration between infection control and antimicrobial stewardship programs. Infection control staff gather highly detailed data on nosocomial infections which may assist in the antimicrobial stewardship team's evaluation of the outcomes of their strategies. Hospital epidemiologists have the expertise in surveillance and study design to lend to efforts studying the effect of antimicrobial stewardship measures. In turn, antimicrobial stewardship programs may be able to assist in efforts to control outbreaks by focused monitoring and/or restriction of antimicrobials in the targeted units. Any antimicrobial stewardship program should either be fully integrated with or work closely with a hospital's infection control program; such collaboration has the opportunity to synergistically reduce antimicrobial resistance and improve patient outcomes.

Hospital Administrators/ Director/Superintendent

None of the efforts of infectious diseases physicians, pharmacists, microbiologists, or infection control practitioners to establish an antimicrobial stewardship program are likely to be successful without at least passive endorsement by hospital leadership. Program funding, institutional policy, and physician autonomy are core issues in the development of antimicrobial stewardship programs that must be addressed by hospital administration. Without adequate support from hospital leadership, program funding will be inadequate or inconsistent since the programs do not generate revenue (although they may result in significant cost savings). And if hospital leadership is not publicly committed to the program, recalcitrant prescribers may thwart attempts to improve antimicrobial use without fear of sanction.

F. Context

Antimicrobial resistance is recognized as one of the principal threats to public health throughout the world: its impact is felt all areas of health, and it affects the whole of society. Although antimicrobial resistance is a natural phenomenon, it is exacerbated by the misuse of antimicrobial medicines, poor or non-existent IPC programmes, poor-quality medicines, weak laboratory

capacity, inadequate surveillance and poor regulation or enforcement of regulations to assure access to high-quality antimicrobial medicines and their appropriate use. On 7 April 2011, on the occasion of World Health Day1, World Health Organization (WHO) introduced a policy package to combat antimicrobial resistance, which lists critical actions by all stakeholders to stimulate change. Although widely recognized as an urgent problem by many international organizations and ministries of health, not all countries have a response plan to tackle antimicrobial resistance. Some regions face other, more pressing problems, and many low- to middle-income countries do not have the resources to implement response mechanisms. A "country situation analysis" was subsequently conducted in countries in each of the six WHO regions to assess current practices and to determine the structures that were in place to control antimicrobial resistance. At the Sixty-seventh World Health Assembly (WHA), in May 2014, Member States approved a resolution, WHA 67.25, requesting WHO to draft a global action plan on antimicrobial resistance. The draft plan will be reviewed at the Sixty-eighth World Health Assembly2. It is based on input received during broad multisectoral consultations with countries, international organizations, nongovernmental organizations and other stakeholders and sets out five strategic objectives: to improve awareness and understanding of antimicrobial resistance, to gain knowledge through surveillance and research, to reduce the incidence of infection, to optimize the use of antimicrobial medicines and to ensure sustainable investment in countering antimicrobial resistance.

At the Sixty-eight World Health Assembly in May 2015, the World Health Assembly endorsed a global action plan to tackle antimicrobial resistance, including antibiotic resistance, the most urgent drug resistance trend.

Antimicrobial resistance is occurring everywhere in the world, compromising our ability to treat infectious diseases, as well as undermining many other advances in health and medicine. The goal of the draft global action plan is to ensure, for as long as possible, continuity of successful treatment and prevention of infectious diseases with effective and safe medicines that are quality-assured, used in a responsible way, and accessible to all who need them.

To achieve this goal, the global action plan sets out five strategic objectives:

- to improve awareness and understanding of antimicrobial resistance;
- to strengthen knowledge through surveillance and research;

- to reduce the incidence of infection;
- to optimize the use of antimicrobial agents; and
- 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.

For development of QI framework , QIS has focused on strategic objective 4, which is to optimize the use of antimicrobial agents; and

To help prevent the development of current and future bacterial resistance, it is important to prescribe antibiotics according to the principles of antimicrobial stewardship, such as prescribing antibiotics only when needed (and not for mild infections such as colds, earache or sore throats).

The Antimicrobial Stewardship QI framework consists of some selective Clinical Care Standards with the aims to ensure that a patient with a bacterial infection receives optimal treatment with antibiotics for ensuring safety. 'Optimal treatment' means treating patients with the right antibiotic to treat their condition, the right dose, by the right route, at the right time and for the right duration based on accurate assessment and timely review.

Central to the delivery of patient-centred care identified in this Clinical Care Standard of QI framework is an integrated, systems-based approach supported by hospital services.

g. Scope

This Clinical Care Standard relates to the care that patients should receive when they have, or are suspected of having, a bacterial infection. It covers the care from the time of diagnosis to cure of an infection. The Antimicrobial Stewardship Clinical Care Standard has been developed for use in a variety of healthcare settings.

h. Goal

To ensure patient safety by appropriate use and review of antibiotics to optimise a patient's health outcomes, lessen the risk of adverse effects and reduce the emergence of antibiotic resistance.

Part-2

i. Clinical Standards of QI Frameworks

Clinical Care Standard is a small number of quality statements that describe the clinical care that a patient should be offered for a specific clinical condition. The Clinical Care Standard supports:

No	Standard	Remarks
Standard 1	Antibiotics with life threatening condition	Patient with a life-threatening condition due to a suspected bacterial infection receives prompt antibiotic treatment without waiting for the results of investigations.
Standard 2	Antibiotics with microbiology testing	A patient with a suspected bacterial infection has samples taken for microbiology testing as clinically indicated, preferably before starting antibiotic treatment.
Standard 3	Antibiotics with clinical protocol	When a patient is prescribed antibiotics, whether empirical or directed, this is done in accordance with the current protocol
Standard 4	Antibiotics with communication	When a patient is prescribed antibiotics, information about when, how and for how long to take them, as well as potential side effects and a review plan, is discussed with the patient and/or their carer.
Standard 5	Antibiotics with proper documentation	When a patient is prescribed antibiotics, the reason, drug name, dose, route of administration, intended duration and review plan is documented in the patient's health record.
Standard 6	Antibiotics with close monitoring	A patient who is treated with broad-spectrum antibiotics has the treatment reviewed and, if indicated, switched to treatment with a narrow-spectrum antibiotic. This is guided by the patient's clinical condition and the results of microbiology tests.
Standard 7	Antibiotics with suspected bacterial infection	If investigations are conducted for a suspected bacterial infection, the responsible clinician reviews these results in a timely manner (within 24 hours of results being available) and antibiotic therapy is adjusted taking into account the patient's clinical condition and investigation results.
Standard 8	Antibiotics with prophylaxis	If a patient having surgery requires prophylactic antibiotics, the prescription is made in accordance with the current Therapeutic Guidelines1 (or local antibiotic formulary), and takes into consideration the patient's clinical condition.

j. Description of Standards

Quality Standard 1: Antibiotics with life threatening condition

A patient with a life-threatening condition due to a suspected bacterial infection receives prompt antibiotic treatment without waiting for the results of investigations.(Sample will be collected before starting antibiotics)

Purpose

To reduce the time taken to provide antibiotic treatment for suspected life-threatening bacterial infections.

Quality Statement means:

For patients: If you are extremely unwell with a suspected bacterial infection, you are given antibiotics as soon as possible.

For clinicians: Prescribe and administer appropriate empirical antibiotic treatment to patients with a suspected life-threatening bacterial infection, obtain clinical specimens as appropriate but do not delay administration of antibiotics or wait for results of investigations.

For health services: Ensure the availability of relevant clinical pathways and local antibiotic formulary so clinicians give patients with life-threatening bacterial infections appropriate antibiotic treatment without delay.

Quality Standard 2: Antibiotics with microbiology testing

A patient with a suspected bacterial infection has samples taken for microbiology testing as clinically indicated, preferably before starting antibiotic treatment.

Purposes

To support appropriate antibiotic selection through the appropriate use of microbiology testing (smear, culture & sensitivity)

This quality statement aims to encourage all clinicians to undertake microbiology testing whenever indicated.

Quality statement means

For patients: Before you are prescribed antibiotics, samples may be taken to try to work out which antibiotic is the best to treat the infection. The samples may include blood tests, urine samples or wound swabs, sputum, endotracheal aspirate, aspirate Cerebro Spinal Fluid (CSF) and other body fluids for Culture and Sensitivity (CS), GRAM staining and serological test.

For clinicians: Obtain samples for microbiology testing when clinically indicated and before starting antibiotic therapy whenever possible. This ensures that treatment is specifically directed against the infecting organism.

For health services : Ensure systems are in place for clinicians to take samples for microbiology testing before starting antibiotic therapy as clinically indicated, and for the results to be available to clinicians in a timely manner.

Quality Standard 3: Antibiotics with clinical protocol

When a patient is prescribed antibiotics, whether empirical or directed, this is done in accordance with the Clinical protocol

Purpose

To ensure the right antibiotic treatment is given (i.e. the right drug, dose, route and duration of therapy is chosen).

Quality statement means

For patients: If you are prescribed an antibiotic, your doctor or nurse chooses which one,based on national or local recommendations. They should take into account any allergies and other health conditions you may have.

For clinicians: Prescribe an antibiotic according to the current clinical protocol. Consider the individual patient's characteristics, such as allergy status, other medicines prescribed and other health conditions.

For health services: Ensure clinicians have access to and use the current version of Therapeutic Guidelines1 or local antibiotic formulary when prescribing antibiotics.

Quality Standard 4: Antibiotics with communication

When a patient is prescribed antibiotics, information about when, how and for how long to take them, as well as potential side effects and a review plan, is discussed with the patient and/or their carer.

Purpose

To improve patients' compliance to prescribed antibiotic treatment.

Quality statement means

For patients: If you are prescribed antibiotics, your doctor or nurse discusses with you and/or your carer about when and how to take your antibiotics, how long to take them and any potential side effects. You may need to be seen again to review your progress.

For clinicians: Discuss with the patient and/or their carer the importance of taking antibiotics as prescribed, how long to take them, any potential side effects and whether the treatment will need to be reviewed.

For health services: Ensure systems are in place so that clinicians discuss with patients and/or their carers the need to take antibiotics as prescribed, how long to take them, any potential side effects and whether their treatment requires review.

Quality Standard 5: Antibiotics with proper documentation

When a patient is prescribed antibiotics, the reason, drug name, dose, route of administration, intended duration and review plan is documented in the patient's health record.

Purpose

To improve communication of antibiotic treatment between clinicians through a variety of mechanisms, including the Electronic Health Record.

Quality statement means

For patients: Your health record contains the details of your antibiotic treatment. This includes information on why you were prescribed antibiotics, the medicine name, the dose, how you take them (i.e. as tablets or an injection), how long to take them and any plans to review your treatment.

For clinicians: When prescribing antibiotics document the clinical reason, the medicine name, the dose, the route of administration, the intended duration and any review plan in the patient's health record.

For health services: Ensure a system is in place so that when clinicians prescribe antibiotics they document the clinical reason, the medicine name, dose, route of administration, the intended duration and any treatment review plan in the patient's health record.

Quality Standard 6 : Antibiotics with close monitoring

A patient who is treated with broad-spectrum antibiotics has the treatment reviewed and, if indicated, switched to treatment with a narrow-spectrum antibiotic. This is guided by the patient's clinical condition and the results of microbiology tests.

Purpose

To reduce the unnecessary use of broad-spectrum antibiotics, particularly when microbiology tests indicate that a bacterial infection can be treated just as effectively with a narrow-spectrum antibiotic.

Quality statement means:

For patients: If it is unclear which bacteria may be causing your infection, you may be prescribed an antibiotic that works against a wide range of bacteria (i.e. a broad-spectrum antibiotic). In this case, your doctor or nurse may order tests to review your progress and, on seeing the results, your treatment may change to a more specific antibiotic (i.e. a narrow-spectrum antibiotic).

For clinicians: When prescribing a broad-spectrum antibiotic, review the patient's clinical status and any microbiology results to determine whether the patient's treatment can be switched to a narrow-spectrum antibiotic.

For health services: Ensure processes are in place to support clinicians changing broad-spectrum antibiotics to appropriate narrow-spectrum antibiotics once the pathogen and its susceptibilities are known.

Quality Standard 7: Antibiotics with suspected bacterial infection

If investigations are conducted for a suspected bacterial infection, the responsible clinician reviews these results in a timely manner (within 24 hours of results being available) and antibiotic therapy is adjusted taking into account the patient's clinical condition and investigation results.

Purpose

To optimise patients' antibiotic treatment by using clinical assessment and review of microbiology results.

Quality statement means

For patients: If tests have been done to identify a suspected bacterial infection, your doctor or nurse reviews these results as soon as they are available (usually within 24 hours of being available). These results may lead to your antibiotic treatment changing or stopping.

For clinicians: If microbiology tests are ordered, review the results within 24 hours of them being available, and use this information to consider whether changing or stopping antibiotics is appropriate.(Need consultation with microbiologists)

For health services: Ensure systems are in place so clinicians review microbiology test results as soon as they are available and use the information to guide antibiotic treatment decisions.

Quality Standard 8: Antibiotics with prophylaxis

If a patient having surgery requires prophylactic antibiotics, the prescription is made in accordance with the current Therapeutic Guidelines1 (or local antibiotic formulary), and takes into consideration the patient's clinical condition.

Purpose

To reduce unwarranted variation in the use of antibiotics for surgical prophylaxis. This quality statement relates to any setting/service that undertakes surgery. The statement has been included due to prevalence of unwarranted variations in the use of antibiotics for surgical prophylaxis

Quality statement means

For patients: Antibiotics may be given to you before surgery to reduce the risk of an infection after surgery. The prescription is also based on national or local recommendations.

For clinicians: Prescribe and administer a surgical prophylactic antibiotic in accordance with the recommendations outlined in current Therapeutic Guidelines1 (or local antibiotic formulary), and taking into account the patient's clinical condition.

For health services: Ensure systems are in place for clinicians to provide appropriate prophylactic antibiotic therapy to patients undergoing surgery, and that this is based on the current protocol.

Part-3

AMS QI framework Implementation Plan:

k. Core areas for focus:

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

1. Formulation of AMS team in each hospital:

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

2. Conduct situation analysis

Conduction of situation analysis after finalization of action plan and target areas

3 Develop the Antimicrobial Guideline and protocol for specific areas.

The AMS team of the hospital should develop necessary guideline and protocols for AMS programme.

Local antibiotics guidelines & clinical pathways should be formulated based on the national antibiotic guideline, evidence in the literature and local microbiology and resistance patterns. Clinical pathways such as common infections can be produced to bring about uniformity in prescribers approaches in local setting.

4. Surveillance and feedback mechanism on specific antimicrobial consumption.

Surveillance of antimicrobial use can show us how and why antimicrobial are being used and misused by patients and healthcare providers. Monitoring antimicrobial prescription and consumption behavior provides insights and tools needed to inform therapy decisions, to assess the public health consequences of antimicrobial misuse, and to evaluate the impact resistance containment interventions.

Access to information on antimicrobial consumption can be an important source for healthcare professionals and policy makers to monitor progress towards a more prudent use of antimicrobials.

- **Collection and analysis of local antimicrobial consumption and expenditure:**

  Data collection and analysis of antimicrobial use and expenditure should be undertaken regularly (at least every 6 months).

  The results of antimicrobial use and expenditure should be fed back to prescribing clinician and discuss the results in relevant meeting.

- **Indicators for reporting antibiotic consumption:**

  Daily Defined Dose (DDD) per 100 patient admission and DDD per 1000 Patient Days are used to determine the antibiotic consumption.

  Provision of data to regional /national surveillance programs

  The data should be reported and presented at local and state level. It also has to be submitted to Pharmaceutical Services Division for National Surveillance on Antibiotic Utilisation

5.1 Formulation of AMS team in each hospital :

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

5.2 Elements of audit

Guideline / Protocol

For any selected antimicrobial to be audited by following the protocol and guideline.

Predetermined audit criteria

Any predetermined audit criteria will be discussed its suitability and practicality prior to implementation. It consists of:

i. **Approved indications based on available guidelines/protocol. The antimicrobial audit may be conducted for:**

   a. Surgical prophylaxis

   b. Empirical therapy where patient's clinical conditions, supported by laboratory findings are executed

   c. Definitive therapy, whereby antimicrobial is prescribed following the availability of microbiological results

ii. **Utilisation patterns derived from process indicators which measures one or all the following:**

a. Time and date of administration of antimicrobials

b. Appropriate dose or frequency based on existing renal function

c. Available cultures and their antimicrobial susceptibilities

d. Duration of antimicrobial treatment

iii. **Outcome of the therapy**

All data must be documented and reviewed periodically. Any deviations from agreed criteria has to be communicated, discussed and documented.

5.3 Feedback

In order to ensure the success of the program, two-way system or communications has to be established within the institution. Feedback may occur through direct interaction with the prescribing clinician or through notes or stickers left in the chart or electronic medical records.

Mode of feedback:

a. Email/letter to heads of units/individual prescribers

b. Newsletter or bulletins

c. Presentation at ward or unit meetings

6. Formulary Restriction and Pre-authorization

Formulary restriction is one of the pillars of AMS Program. A list of restricted antimicrobials would need to be included in the antimicrobial policy which will be reviewed on regular basis.

Restriction can be implemented through a number of ways:

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

Methods to acquire approval:

- antimicrobial order
- tools telephone

6. Antimicrobial Order Tools

The order tools are designed to encourage the clinician to review basic clinical and laboratory information and to categorize antimicrobial use as prophylactic, empirical and therapeutic.An antimicrobial order tools may improve the quality of prescriptions by increasing the awareness of clinicians of desired antimicrobial spectrum. By filling in the antimicrobial order tools, the prescribers also provide themselves the data for drug utilisation surveillance. Antimicrobial order tools can be an

effective measure to decrease antimicrobial consumption by implementing automatic stop orders and/or requiring clinicians to justify antimicrobial use.

7. Antimicrobial Streamlining

7.1 Spectrum of Antimicrobial Coverage

Occasionally patients are started on two or more intravenous antimicrobials simultaneously. There can be overlapping in the spectrum of antimicrobial coverage leading to unnecessary cost and adverse events.

7.2 De-Escalation

The use of empirical broad spectrum antimicrobial treatment may increase the risk of antimicrobial resistance.

The de-escalation strategy has the potential to improve patient outcomes without compromising patient safety. Studies show that de-escalation was associated with reduced mortality, shorter length of stay and lower costs in intensive care unit patients with pneumonia.

Streamlining can be typically conducted in several ways:

a. Antimicrobials streamlined to narrow-spectrum agents once cultures and sensitivities are available.

b. If the dosage was initially high, it can be de-escalated to a standard dosage for a susceptible organism.

c. Discontinuing empiric therapy if testing subsequently fails to demonstrate evidence of infection.

d. Discontinuing dual antimicrobial therapy if there is overlapping in the spectrum of activity

e. Advising on the optimal choice of antimicrobials for the specific clinical setting

How to carry out de-escalation:

1. Target broad spectrum antimicrobials that are used empirically
2. Review at :
    i. 72 hours after antimicrobial initiation or;
    ii. Once a week review of a specific ward, unit, hospital
3. Identify de-escalation opportunities
    i. Were appropriate cultures taken initially?
    ii. Has there been any growth from the cultures?
    iii. If there is no growth, can the antimicrobial be stopped?

7.3 Antimicrobial Selection and Dose Optimization

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

Strategies that may be considered for dose optimization include:

extended or continuous infusion of beta-lactams once-daily dosing of aminoglycosides

appropriate dosing of antimicrobials (e.g.; vancomycin, polymyxins, cefepime) weight-based dosing of certain antimicrobials

dose adjustments for patients with renal dysfunction

8. Intravenous (IV) to Oral (PO) Antibiotics Conversion

This describes the practice of converting intravenous antimicrobials therapy to an effective alternative oral formulation. Several clinical trials have been conducted that demonstrate the efficacy and safety of IV to PO antimicrobials conversion, and several studies have also addressed the economic impact of this conversion.

Cost savings are achieved through lowering direct acquisition costs, eliminating the need for ancillary supplies, reducing pharmacy and nursing time, and shortening the length of hospital stay.

IV to oral antimicrobials conversion also benefits the patient by eliminating adverse events associated with Intravenous (IV) therapy, increasing patient comfort and mobility and increasing the possibility of earlier discharge.

Conversion to oral therapy also reduces the risk of adverse effects associated with intravascular lines like catheter-related blood stream infection (CRBSI) and thrombophlebitis.

Example of Antimicrobials That Can Be Included in IV to PO Therapy Conversion and Bioavailability of Selected Antimicrobials Available in Both IV and PO Formulations

Criteria used to determine Patients for IV to PO Therapy Conversion:

(A) Intact and functioning gastrointestinal (GI) tract

Criteria Indicating Absorption of Oral Medications May Be Compromised

- Nil by mouth (NBM) status (and no medications are being administered orally)
- Nasogastric (NG) tube with continuous suction
- Severe/persistent nausea or vomiting
- Gastrointestinal transit time too short for absorption such as malabsorption syndromes, partial or total removal of the stomach, short bowel syndrome
- Active upper gastrointestinal bleeding
- High doses of vasopressor medications (typically in persistent hypotension despite high dose of vasopressor)
- Difficulty swallowing or loss of consciousness and no NG access available
- Documented ileus or gastrointestinal obstruction
- Continuous tube feedings that cannot be interrupted and patient requires a medication known to bind to enteral nutrition formulas

(B) Improving clinical status

The patient should be clinically stable and deterioration should not be expected.

- Should be afebrile or have had a maximum temperature of less than 38oC in the previous 24 hours.
- White blood cell (WBC) count should be trending downward.

  It is important to examine the patient's medication therapy for other medications that can cause an increase or sustained high WBC count such as steroids.
- Patients who are neutropenicare typically excluded from IV to PO therapy conversion.
- It is also important to review the cultured pathogen (bacteria, fungus, etc.) and ensure that it is susceptible to the oral medication.

Does not meet any of the following exclusion criteria

- endocarditis
- central nervous system infections (e.g.; meningitis, brain abscess, etc.)
- orbital cellulitis
- osteomyelitis
- endophthalmitis
- melioidosis (at least 10 to 14 days of IV therapy)
- abscesses

9. Education

Antimicrobial Stewardship team would prepare a program of ongoing education for pharmacists, doctors and nurses to influence prescribing behavior and to provide knowledge that will enhance and increase the acceptance of Antimicrobial Stewardship strategies. This program should ideally be included in the induction training for all newly reporting medical, nursing and pharmacy staff.

1. Continuous Nurse Education (CNE) / Continuous Medical Education.
2. Antimicrobial newsletter/including a sub-topic on antimicrobials in any hospital publications

3. Prescribing aids

- Educational aids to guide prescribers at the point of prescribing. These may include clinical algorithms for the diagnosis of infection, or methods to standardize documentation of treatment decisions, such as infection stamps or stickers to be included in the clinical notes.
- Where possible, information technology support for prudent antimicrobial use should be introduced.
- This includes electronic patient records, computerized prescribing and clinical decision support software.

10. Formalize regular antimicrobial rounds by AMS team in Hospital

Identify and suggest streamlining of antimicrobial (e.g.choice of antimicrobial; de-escalation; dose optimization; IV to oral switch) during the rounds. Impact on antibiotic utilization data and acceptance rate should be documented.

l. Organizational framework

Governance

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

a. Hospital Director/Superintendent

b. Head of various clinical departments

c. Head of Pharmacy Department

d. Head of Medical Microbiology

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

Role of Hospital Director:

- Ensuring the implementation of AMS clinical standards
- Communicating on why change is needed to staff and other leaders of Departments.
- Allocating adequate resources in terms of manpower and time for dedicated AMS team activities
- Reviewing progress by the team, identifying barriers and providing advice assigning high-performing staff to the team and resourcing them adequately endorsing the AMS team and the activities.

General Role of Antimicrobial Stewardship Team:

1. Strengthens formulary restriction and approval systems.
2. Regularly reviews antimicrobial prescribing with intervention and direct feedback to the clinicians.
3. Educates prescribers, pharmacists and nurses about good antimicrobial prescribing practice and antimicrobial resistance.
4. Evaluates compliance to clinical guidelines and reports on process measures, outcomes measures (e.g. clinical and financial) and antimicrobial resistance patterns to Hospital Infection and Control Committee and Hospital Director.

m. Antimicrobial Stewardship Team Members

- Prof of Internal Medicine: Head of AMS team—Team Leader
- Infectious Control Physician – Member secretary
- Prof / Consultant Clinical microbiologist-member
- Prof/ Consultant- Pharmacology-Member
- Nursing Supervisor-Member
- Interested Clinicians- Member

Part-4

Role and Responsibilities

n. Head of the Team:

- ❖ Is either an Infectious Disease Physician, senior physician, internal medicine or clinician deemed to be suitable by the Hospital Director.
- ❖ Represents the AMS team in the hospital infection control committee and gives feedback on AMS program.
- ❖ Play key role for development of protocol/guideline
- ❖ Take initiative for situation analysis
- ❖ Develop action plan
- ❖ Prepares surveillance and audit reports for submission to QIS

Infection Control Physician:

- ❖ Leads the technical component of Antimicrobial Stewardship team.
- ❖ Consults and advises on specific stewardship related cases and issues

Clinical Microbiologists:

- ❖ Provision of guidance on appropriate diagnostic tests in microbiology.
- ❖ Provision of timely and accurate reporting of culture and antimicrobial susceptibility data.
- ❖ Ensures selective reporting of antimicrobial susceptibilities and interpretative reporting of microbiology results.
- ❖ Provision of antimicrobial resistance patterns data in individual hospital on yearly basis.
- ❖ Ensure the appropriateness of microbiology request, sample collection (types, time, date taken and documentation) and sample quality.
- ❖ Work closely with the attending clinician, infectious diseases specialist and antimicrobial pharmacist in the management of patients with infections

o. Quality Indicators for AMS QI framework

Structure Indicators

- Availability of multi-disciplinary antimicrobial stewardship team
- Availability of guidelines for empiric treatment and surgical prophylaxis
- Provision of education in the last 2 years

Process Indicators

- Compliance of choice of antimicrobial agent(s) with hospitals antimicrobial guidelines
- Compliance with IV-PO switch policy for IV antimicrobials
- Proportion of restricted antimicrobial use that is in accordance with hospital prescribing guidelines/local antimicrobial restricted use policy
- Documentation of indication for antimicrobial use
- Compliance with appropriate time to first dose of antimicrobials
- Compliance with guidelines for surgical prophylaxis (choice of agent(s), and duration of agent(s))
- Compliance with antimicrobial app (where applicable) uptake and usage by prescribers

Outcome Indicators

- Surgical Site Infection (SSI) rates
- Surveillance of resistance
- Mortality: Standardized Mortality Rates (SMRs)

Impact Indicators

- Number of antimicrobial agents for which resistance against nationally identified microorganisms has stabilized or decreased.

  (At least five drugs for which resistance has stabilized or decreased by 2020)

- Number of antimicrobial agents of which the annual use has declined by 25% as indicated by defined daily doses (DDD) by 1000 patient days.)

  (At least five antimicrobial agents with annual utilization reduced by 25% as indicated by DDD by 2020.)

- Per cent of hospitals in the public and private sector in a country with a policy for rational use of antimicrobials.

Part-5

Monitoring & Evaluation:

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

A. Process measures

- Number of clinical audits including antibiotic
- Annual report of antibiotic Prescriber Profiling for Electronically enabled clinic annually

B. Outcome indicators

- Annual report of total antimicrobial expenditure Specific antibiotic DDDs annually
- Reduction of URTI patient prescribed with antibiotic for Electronically enabled clinic annually
- Increase in appropriate antibiotic prescription.

Action Plan

SL	Activities	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
1	Formation of AMS committee												
2	Formation of AMS team												
3	Selection of Piloting areas												
4	Develop Implementation plan												
5	Conduction of situation analysis												
6	Develop Antimicrobial guideline and protocol												
7	Surveillance and feedback mechanism on specific antimicrobial consumption.												
8	Implementation of prospective audit and feedback according to local needs												
9	Formulary Restriction and Pre-authorization												
10	Antimicrobial Order Tools												
11	Antimicrobial Streamlining												
12	Antimicrobial Selection and Dose Optimization												
13	Intravenous (IV) to Oral (PO) Antibiotics Conversion												
14	Education												
15	Formalize regular antimicrobial rounds by AMS team in Hospital												
16	Monitoring and Feedback												

Annex-1

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