EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 10
Issue: 5
67-71
Year: 2023

ANTIMICROBIAL STEWARDSHIP PROGRAMME: PRACTICES, PRINCIPLES AND INTERVENTIONS

[1]*Dr. Deeksha Sharma and [2]Dr. Akshay Sharma

[1]MD Pharmacology, Dr. RPGMC Kangra At Tanda, HP.
[2]Senior Resident, Department of Radiology, Dr RPGMC Kangra At Tanda, HP.

***Corresponding Author: Dr. Deeksha Sharma**
MD Pharmacology, Dr. RPGMC Kangra At Tanda, HP.

Article Received on 24/02/2023 **Article Revised on 16/03/2023** **Article Accepted on 06/04/2023**

INTRODUCTION

With the discovery of penicillin, antibiotics are a critical part of global health, including cancer chemotherapy and advanced surgical procedures. Antimicrobial agents are not like other drugs. They are unique in that both the individual patient and the broader society bear the consequences of their use with each prescription. With the slow development of antimicrobials, accelerated emergence, and spread of resistant organisms, antimicrobial stewardship is of utmost importance to optimize the use of existing antimicrobials.[1]

In 1996, John McGowan and Dale Gerding first applied the term antimicrobial stewardship, where they suggested a causal association between antimicrobial agent use and resistance.[2]

Antimicrobial Stewardship (AMS) refers to the optimal selection, dosing, and duration of antimicrobial treatment resulting in the best clinical outcome with minimal side effects to the patients and minimal impact on subsequent resistance.[3]

In simple terms, it refers to a coherent set of actions to promote the responsible use of antimicrobials. AMS is one of the three pillars of an integrated approach to strengthening the health care system. The other two include infection prevention and control (IPC) and patient and medicine safety. The critical components like Antimicrobial Resistance (AMR) surveillance and sufficient supply of quality medicines linked with three pillars help promote equitable and quality health care.[4]

The World Health Assembly's endorsement of the Global Action Plan on Antimicrobial Resistance (AMR) in May 2015, and the Political Declaration of the High-Level Meeting of the General Assembly on AMR in September 2017, both recognize AMR as a global threat to public health. These policy initiatives acknowledge overuse and misuse of antimicrobials as a main driver for development of resistance, as well as a need to optimize the use of antimicrobials. The Global Action Plan on AMR sets out five strategic objectives as a blueprint for countries in developing national action plans (NAPs) on AMR.[5]

Objective 1: Improve awareness and understanding of AMR through effective communication, education and training.
Objective 2: Strengthen the knowledge and evidence base through surveillance and research.
Objective 3: Reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures.
Objective 4: Optimize the use of antimicrobial medicines in human and animal health.
Objective 5: Develop the economic case for sustainable investment that takes account of the needs of all countries, and increase investment in new medicines, diagnostic tools, vaccines and other interventions.[6]

FUNCTION

According to the Center for Disease Control (CDC), 20 to 50% of all antibiotics prescriptions in the acute care hospital setting in the USA are either unnecessary or inappropriate.[7]

The current scientific literature emphasizes on reduction of inappropriate use of antimicrobials in all healthcare settings. Along with the Centers for Medicare and Medicaid Services (CMS), CDC, and Society for Healthcare Epidemiology of America (SHEA), the Joint Commission developed the AMS standard for hospitals, critical access hospitals, and nursing care centers. The standard for ambulatory settings and office-based surgery practices is still under development.[8]

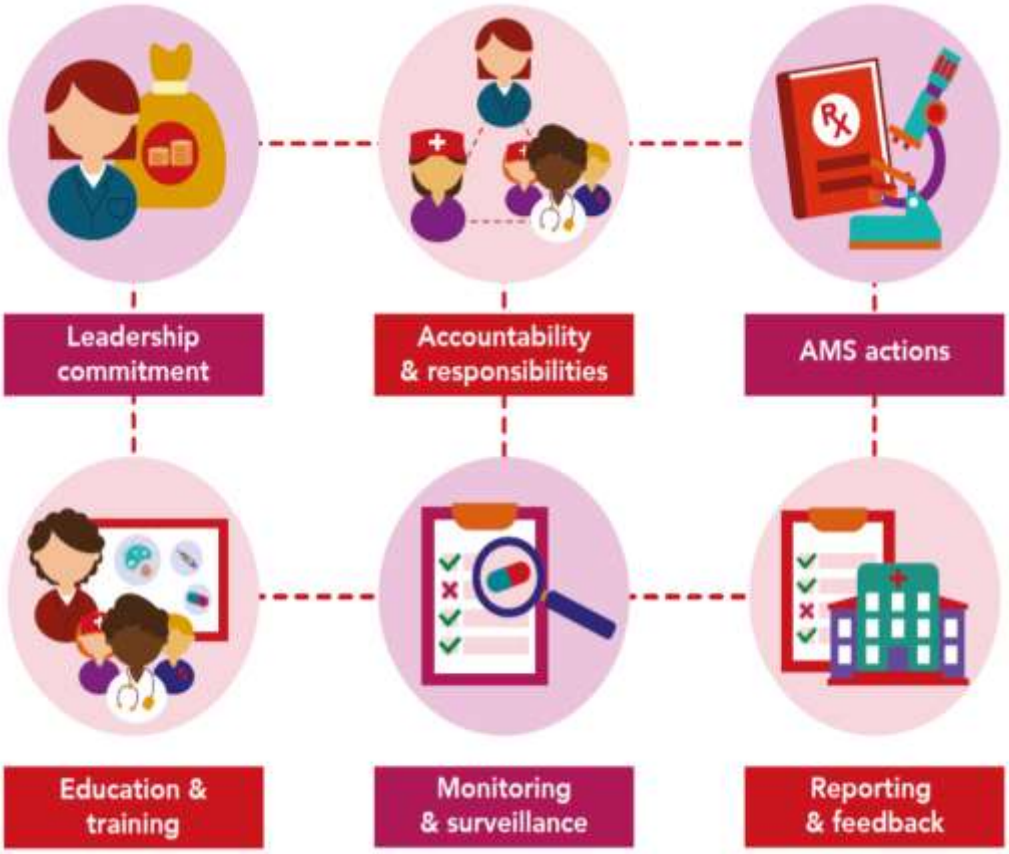
The AMS programs have the following goals[1]

1. To work with healthcare practitioners to prescribe **5 "D"s** of antimicrobial therapy, which is the right **D**rug, correct **D**ose, right **D**rug-route,

suitable **D**uration, timely **D**e-escalation to pathogen-directed therapy.
2. To prevent antimicrobial overuse, misuse, and abuse in inpatient, outpatient, and community settings, including the agriculture industry.
3. To reduce antibiotic-related adverse effects, for example, Clostridium difficile.
4. To minimize resistance
5. To reduce healthcare-associated cost

With the above goals in target, the AMS programs include the following core elements[9]:

1. Leadership commitment
2. Accountability
3. Drug expertise
4. Action
5. Tracking
6. Reporting
7. Education



ANTIMICROBIAL STEWARDSHIP PROGRAMME

CORE ELEMENTS

1) Leadership Commitment

Leadership support is crucial for the success of antimicrobial stewardship programs. They can be in different forms, including:

- Formal statements to improve and monitor the antimicrobial use
- Supporting training and education and ensuring that staff from the relevant departments are given sufficient time to contribute to stewardship activities.
- Dedicate financial and information technology resources dedicated to the program.

2) Accountability and Drug Expertise

To identify a single leader as a stewardship program leader who will be responsible for the program outcome. Literature has shown that physician leaders have highly successful programs. Physicians with formal training in infectious disease and AMS benefit stewardship program. Similarly, appointing a single pharmacist leader as co-leader has shown improved outcomes.[9]

3) Action

Action includes implementing policies supporting optimal antibiotic use, utilizing specific interventions to improve antibiotic use, and prioritizing intervention based on the needs of the care setting.[10]

Interventions directed towards stewardship can be categorized into

1) Broad intervention includes antibiotics time out, prior authorization, and prospective audit and feedback.[11]

2) Pharmacy-driven interventions, especially for dose adjustments/optimization based on drug, organ dysfunction, therapeutic drug monitoring.[12]

3) Infection and syndrome-specific interventions focus on improving prescriptions for specific syndromes. For example, many people who get antibiotics for urinary tract infections (UTI) might have asymptomatic bacteriuria and

not infection.[13] Similarly, there are interventions for community-acquired pneumonia, skin and soft tissue infections, Methicillin-Resistant Staphylococcus Aureus(MRSA), Clostridoides difficile infection(CDI), and treatment of culture-proven invasive infections.

4) Tracking and Reporting of Antimicrobial use and Outcomes

Keeping track of the evaluation of both policies and outcomes is critical to identify areas of improvement and assess the impacts of improvement efforts. For example, determining if the prescriber has applied the diagnostic criteria accurately; prescribed the antimicrobial agent for a particular indication with documentation of duration and relevant tests before treatment.

CDC has developed an Antibiotic Use (AU) option as a part of the National Healthcare Safety Network (NHSN). AU automatically collects data and monthly reports for the duration of therapy data and is later analyzed in aggregate by specific agents and patient care locations. The AU module is available to facilities with the capability to submit electronic medication administration records.[14]

5) Education

Regular updates to prescribers on antibiotic prescribing, antibiotic resistance, and infectious disease management motivate optimization in antimicrobial prescription. However, didactic presentations, electronic messages to staff groups are few options to provide education. Education has been most effective when paired with corresponding interventions and outcome measurements.[14]

Nine common areas for improving antibiotic prescribing[15]

Prescriptions	What to improve
1) Overprescribing	1) Antibiotics are prescribed when not needed, e.g. fever without evidence of infection, asymptomatic urinary tract colonization, viral infections, malaria, inflammatory conditions.
2) Overly broad spectrum	2) More broad-spectrum antibiotics are prescribed than are necessary (e.g. surgical prophylaxis.
3) Unnecessary combination therapy, including certain fixed dose combinations	3) Multiple antibiotics are used, particularly with overlapping spectra and in combinations that have not been shown to improve clinical outcomes.
4) Wrong antibiotic Choice.	4) Wrong antibiotic(s) are prescribed for particular indications/infections
5. Wrong dose.	5) Antibiotics are prescribed with the wrong dose (over- or under dosing)
6. Wrong dose interval	6) Antibiotics are prescribed with the wrong dose interval (too much time between doses).
7. Wrong route.	7) Antibiotics are prescribed by the wrong route (e.g. IV instead of oral)
8. Wrong duration	8) Duration of antibiotic treatment should be optimized (e.g. antibiotics prescribed for too long a period, prolonged surgical prophylaxis).
9. Delayed administration	9) Administration of the antibiotic(s) is delayed from the time of prescription. Repeat doses are not administered in a timely way, which is critical in the case of septic shock and other serious infections

The antimicrobial stewardship programs are greatly enhanced by interdepartmental communication and coordination. The significant support from below mentioned groups can play a vital role;

1. Clinicians: All clinicians at any point during patient care have prescribed antibiotics to the patients. Therefore it is crucial that all clinicians fully engage and support antibiotics optimization. Hospitalists and primary care physicians are particularly essential as they comprise a majority of the prescribers. Prescribers can act as good stewards by following the **5 "D"s** of antimicrobial stewardship; right **D**rug, correct **D**ose, right **D**rug-route, suitable **D**uration, timely **D**e-escalation to pathogen-directed therapy. Example actions include making accurate diagnoses, following local antimicrobial guidelines, and timely reviewing the need for therapy.[4]
2. Pharmacy and therapeutics committee: Pharmacists are an integral part of the team. They help in developing and implementing policies that will optimize antibiotic use.[12]
3. Nurses can especially play an essential role in optimizing diagnostic tests or diagnostic stewardship and patient education. Examples include triaging patients for isolation, a timely collection of culture samples before antimicrobial use, educating patients on how to take antimicrobials at discharge from the hospital.[4]
4. Microbiology lab staff can assist as a part of diagnostic stewardship by guiding proper use of the test. They also help in creating local anti-microbiogram, which help optimize antimicrobial prescriptions.
5. The infection prevention team and epidemiologist assist in tracking, analyzing, and reporting antimicrobial resistance and adverse effect trends.
6. Quality improvement and patient safety teams can advocate for resources dedicated to stewardship interventions.
7. Information technology staff are crucial to incorporating protocols into the stewardship work map. Examples include developing prompts to review

antimicrobials and their indication, incorporating order sets in electronic medical records;

8. At an individual level, a patient can act as a good antimicrobial steward by using antimicrobials responsibly. Patient participation can be done by taking antimicrobials directed by the prescriber and not storing or using leftover antimicrobials.[12]

CONCLUSION AND RECOMMENDATIONS

AMS' practices, principles, and interventions are critical steps towards containing and mitigating AMR. They are designed to promote, improve, monitor, and evaluate the rational use of antimicrobials to preserve their future effectiveness, along with the promotion and protection of public health. ASP has proven highly successful in promoting the rational use of antimicrobials through the implementation of evidence-based interventions. Its principles and core elements are embedded in the WHO Global Action Plan on AMR and should be factored in national strategies against AMR. The WHO recognized this global threat and strongly recommended implementing this approach at the national and global levels.

Moreover, at the healthcare system and organizational level, the implementation of an ASP is of utmost importance as it: i) transforms clinical and educational interventions, ii) facilitates the incorporation of new and more efficient diagnostic tools, iii) establishes AMR patterns through effective surveillance, and iv) reduces the cost of health-care expenditure by better outcomes in patients in clinical and veterinary settings.

Lastly, healthcare professionals must address the challenge of managing AMR's growing problem by leadership in human and veterinary medicine, pharmacy, and policy. The rational use of antimicrobials, "One Health" approach, vaccination protocols, healthcare workers' and patients' education, and the broader public awareness about AMR must be guided by strict evidence-based policy.

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