

ANTIBIOTICS STEWARDSHIP

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ABSTRACT

Inappropriate antibiotic use and antibiotic resistance are now major global issues. Antimicrobial stewardship programmes are increasingly being used to optimize antibiotic prescribing in acute care. Antibiotic resistance has become a global menace. As the resistance patterns and numbers are progressively increasing, it has become a major cause of morbidity and mortality in hospitalized patients, especially children. Efforts are being put world-over to curb the rising resistance by various means, especially by promoting Antibiotic Stewardship Program. These are cluster of interventions targeted towards the improvement and monitoring of appropriate antimicrobial use by selecting the most optimal drug regimen, including the type of drug used, the dose, the duration of therapy and the route of administration. India has also been working consistently to control antibiotic resistance and promote implementation of antibiotic stewardship program. Although the success rates are yet not very high, due to lot of barriers, but it is important to take measures to overcome the barriers and curb the rising resistance at the earliest.

KEYWORDS: Antibiotic stewardship Antibiotic resistance, Antibiotic stewardship, Challenges, Implementation, Antimicrobial resistance, Antimicrobial stewardship.

INTRODUCTION

Among the most important discoveries of the 20th century are antibiotics. But there's a chance that we might soon go back to a time before antibiotics.^[1,2] The use of older antibiotics is becoming more challenging due to the advent of germs that are resistant to them; this issue has already been faced in several healthcare disciplines. Methicillin-resistant

Staphylococcus aureus (MRSA) and *Enterobacteriaceae* that produce extended-spectrum beta-lactamases (ESBLs) were the most troublesome antibiotic-resistant bacteria in the healthcare industry just 20 years ago. However, ten years ago, carbapenem-resistant *Acinetobacter baumannii* (CRAB) became a significant issue due to its widespread spread. Although they remain a concern, *Enterobacterales* that produce carbapenems (CPE) are currently a significant public health concern.^[3] Unlike other medications used in therapeutic settings, antibiotics have the potential to impact people in the future. In other medical specialities, like treating dementia or cancer, the newest or most developed medications are employed to treat patients first. However, when it comes to antibiotics, attempts are made to minimise antibiotic exposure by using fewer new medications. Antibiotic stewardship is an emerging idea to address these issues, with the primary objective being to prolong the useful life of the antibiotics we now use.^[4,5] Numerous initiatives are underway to achieve this goal, and the "One Health" concept—which takes into account not only medicine but also veterinary medicine and the environment—has been established to prolong the shelf-life of antibiotics.^[6,7,8]

ANTIMICROBIAL STEWARDSHIP

AMS is a system-wide or organisational strategy created to encourage and track the prudent use of antibiotics in order to maintain their efficacy.^[9] In order to maximise the selection, dosage, mode of administration, and length of antimicrobial therapy without adversely influencing patient outcomes, AMS basically entails the strategic application of measures [Figure 1]. By using these coordinated tactics, AMS helps to lower infection rates, improve patient care and outcomes, and stop the spread of infections that are resistant to treatment.^[10] The ICMR has started taking steps to assist the urgent demand for AMS infrastructure in healthcare facilities around the nation. Creating an AMS curriculum and holding seminars to raise awareness and educate people are two examples of these efforts.^[11]

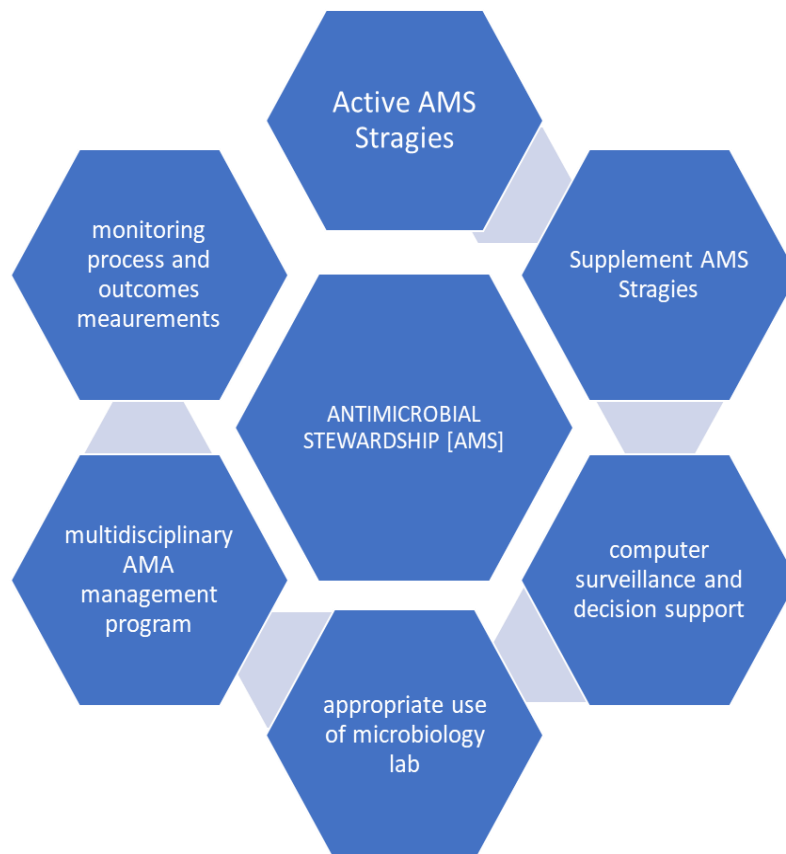


Figure 1: Antimicrobial Stewardship.

DEVELOPMENT AND IMPLEMENTATION OF AMSP IN INDIA

In order to address the AMR problem in India, The Indian council of medical research [ICMR] launched the anti-microbial resistance surveillance and research network [AMRSN] in 2013. The main goal of the network, known as AMSP, was to improve antibiotic use by using research to inform treatment plans.^[11]

In India, the AMSP has a number of main and subsidiary objectives.

Optimising the safe and proper use of antibiotics is the main objective in order to enhance therapeutic results and reduce antibiotic side effects. This involves making certain that the appropriate antibiotic is prescribed at the appropriate dosage, for the appropriate amount of time, and via the appropriate administration route. Reducing undesirable collateral effects, mainly AMR but also other adverse antimicrobial events, is the goal of using antibiotics sensibly and efficiently. Without negatively affecting the standard of patient treatment, the secondary objectives centre on cutting medical expenses and minimising collateral damage linked to antibiotics. Reducing the frequency of side effects brought on by antibiotics is another factor.^[11]

To advance and improve AMSP practices, the ICMR has launched a number of initiatives:^[11]

- Establishing a network of centres: For AMR surveillance, the ICMR established 20 regional centres and six nodal centres throughout India.
- Academic initiatives: To increase knowledge in this area, the council held workshops and created an AMSP curriculum.
- Professional training: Microbiologists, pharmacologists, and doctors received training under the ICMR's antibiotic stewardship, prevention of infection, and control program.
- Multidisciplinary collaboration: A multidisciplinary strategy comprising a range of specialists, including a clinical chemist, an infectious disease specialist, a clinical microbiologist, and an informatics specialist, was used to implement Effective AMSP.
- Evaluating AMSP practices: In order to inform AMSP development, a study was carried out to assess current AMSP practices in India, comprehend ground realities, and identify gaps.
- Cooperation with other agencies: To create an AMR network for veterinary pathogen susceptibility testing and molecular characterisation, the ICMR is collaborating with other government departments and stakeholders, including international organisations like the Food and Agriculture Organisation and NEIVDI.
- Control of antibiotic usage: ICMR is advocating for the elimination of the use of antibiotics such as colistin as a growth promoter in poultry and livestock as well as the decrease of their use in treatment.

All six of the studies that focused on the application of AMSP in India demonstrated that following AMSP standards correctly in healthcare institutions was essential to lowering the use of antibiotics and other antimicrobials while also having a positive financial impact.^[12,13,14,15,16,17] In order to understand the main factors that aided in the adoption of stewardship activities as well as the difficulties the hospital encountered in implementing the stewardship program, Baubie et al. interviewed 45 hospital faculty members for their 2019 study on AMSP implementation in a tertiary care hospital in Kerala.^[14] Initial compliance to AMSP was at least 40% to 50% in all hospitals, according to studies by Singh et al. (a quasi-experimental study in a tertiary care hospital in Kerala in 2019), Afzal et al. (a case study in a tertiary care hospital in Hyderabad in 2017), and Walia and Ohri (a survey in 2015). This compliance progressively

increased in the postinterventional period.^[12,15,18] According to a 2012 study by Jaggi et al. in Gurugram, Haryana, AMSP played a significant role in limiting the development of extended spectrum beta-lactamase enzymes, which degrade and eventually render ineffective the active ingredients in antimicrobials, thereby lowering costs.^[16]

INFECTION CONTROL

The majority of research on infection control was carried out at tertiary care hospitals, where following infection control protocols was essential to reducing expenses. The hospital personnel was instrumental in putting these standards into practice and was supportive of infection control actions, informational campaigns, and education initiatives.^[19,20,21,22] In three of four investigations, these tactics produced favourable results, with notable decreases in infection control observed in the postinterventional phase. Anchalia and D'Ambruso's 2011 study in Gujarat showed that surgical infection control had significantly decreased from 30% in the periinterventional phase to 4.4% in the postinterventional phase.^[19] The findings of a 2008 study by Agarwal et al. in Nagpur that examined the effect of infection control recommendations in reducing disinfectant expenditures showed that the guidelines were effective in reducing costs from 6.2% to 1.95%.^[22] When alcohol-based hand rub was used as an intervention to lower infection, a small difference in infection control was seen in the study by Saramma et al. (conducted in 2011 in Kerala).^[20]

CLINICAL GUIDELINES

Contradictory findings were found when research based on clinical recommendations as an intervention in healthcare institutions were analysed. Only one study demonstrated that the creation and implementation of clinical guidelines decreased reliance on antibiotics and encouraged their prudent use, whereas the other two studies demonstrated that the use of clinical guidelines alone did not reduce reliance on antibiotic/antimicrobial use and that the application of multiple AMSP components and strategies was necessary to achieve positive outcomes.^[23,24,25] Between 2015 and 2017, Watal et al. carried out two research on clinical guidelines as a way to execute stewardship efforts in a Delhi tertiary care hospital. The findings of these two investigations were not comparable; the 2017 study found that physicians' prescribing behaviours were unaffected by clinical guidelines. Antibiotics were still prescribed at low rates by low prescribers and at high rates by high prescribers.^[23] Similar findings were found in a 2015 study that found that following clinical recommendations only led to a 1.88% reduction in antibiotic use.^[24] In contrast, Jimmy et al.'s 2008 study in Manipal, Karnataka, demonstrated that following antibiotic use guidelines resulted in 93% indication, 94% dose, 98% frequency of administration, 90% therapy duration, and 86% conversion of IV to oral therapy during the post implementation phase.^[25]

PROSPECTIVE AUDIT

There were only two studies that used prospective audit as an AMSP component, and both of them found that audits carried out under the guidance of stewardship specialist team members, including ID specialists and microbiologists, significantly reduced antimicrobial dependence as measured by a decrease in days on antimicrobial therapy (DOT) and drug and dose selection.^[26,27] According to the findings of a 2018 study by Rupali et al. in a tertiary care hospital in Vellore, Tamil Nadu, antimicrobial use dropped from 831.5 days on antimicrobial therapy per 1000 patient-days at baseline to 717 DOT during the intervention period.^[26] In a similar vein, Ravi et al. examined 121 prescriptions from a tertiary care facility in Kolkata in 2017. They found that 97% of the prescriptions had the right drug choice, 96% had the right dose, 97% had the right duration, 98% had the right route of administration, and 95% had the right combination of drugs.^[27]

EDUCATION AND TRAINING

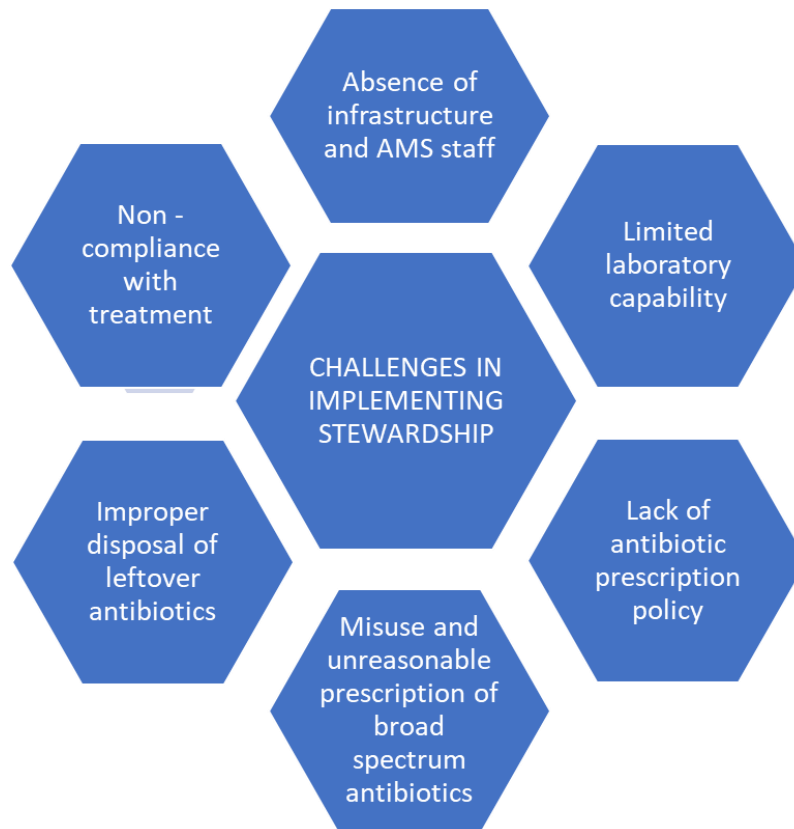
For elements like education and training and the four dimensions (4D: right drug, right dose, dosing interval, and right duration), there was just one study discovered. Since education and training efforts in AMSP were found to be fragmented and circumstances were poorer in public health-care facilities, there is a need for greater support for this component. Singh et al. conducted surveys and interviews in Kerala in 2019. The study's findings showed that 69% (27/39) of the respondents had received AMSP-related education and training during their undergraduate or graduate studies, while 88% (15/17) had not received any induction or training. Therefore, there appears to be greater room for using training and education as a tool to improve stewardship efforts.^[28]

Four dimensions: Right drug, right dose, dosing interval, and right duration Lastly, Singh et al. (2017) investigated the application of the 4Ds (right drug, right dose, dosing interval, and right duration) in a Kerala tertiary care hospital. Of the 868 patients who were targeted, 50% complied with the 4Ds policies. Adjustments were needed for medicine selection, method, dose, or duration in over 51% of prescriptions. Antibiotic expenditures decreased as a result of better adherence to appropriate drug selection, route, dose, and duration.^[29]

CHALLENGES IN IMPLEMENTING AMSP

The implementation of AMSP projects in India is fraught with significant obstacles^[30]:

- Absence of infrastructure and AMS staff: A lot of hospitals do not have a formal AMSP, and there is a severe dearth of qualified individuals to manage and participate in AMS teams.
- Limited funding and resources: Absence of funding for AMS rollout and surveillance systems
- Limited laboratory capability: Microbiological laboratories with high-standard capacity and skills to assist surveillance and decision-making activities are lacking in many healthcare facilities.
- Lack of antibiotic prescription policy: Many hospitals lack an antibiotic prescription policy, which limits the appropriate use of antibiotics.
- Misuse and unreasonable prescription of broad-spectrum antibiotics: The risk of resistance is increased by the frequent misuse and inappropriate prescription of broad-spectrum antibiotics.
- Self-medication and ignorance: Self-medication, which is fuelled by simple over-the-counter access to antibiotics and ignorance of the dangers involved, increases antibiotic abuse.
- Improper disposal of leftover antibiotics: Improper disposal of antibiotics can have a detrimental effect on human health and the environment, as well as exacerbate the issue of resistance.
- Lack of regulation: Unchecked access and usage of antibiotics are caused by lax restrictions governing their sale and use.
- Non-compliance with treatment: Patients frequently skip part of the prescribed course, which may result in resistance.



Benefits

AMSPs have been shown to offer a number of advantages, such as:^[9]

- Better patient outcomes: An efficient AMSP can result in decreased rates of illness and death, fewer treatment failures, and a higher percentage of accurate prescription for preventative and therapeutic purposes.
- Decrease in AMR: AMSP can aid in reducing the emergence and dissemination of organisms resistant to antibiotics by promoting the prudent use of antibiotics.
- Save health care costs: Since improper use of antibiotics accounts for a large portion of medical expenses, cutting back on needless use can save costs.
- Effective stewardship programs can reduce antimicrobial expenses by 10–30%, according to the report.
- Antimicrobial Utilisation Optimisation: AMSP can assist in ensuring the best possible therapeutic outcomes by concentrating on the choice, dose, duration, and mode of administration of antibiotics.
- Improved Knowledge of Antimicrobial Usage: Healthcare facilities are better able to comprehend trends of antibiotic resistance and use inside the organisation thanks to the surveillance and monitoring components of AMS.
- Education and Awareness: AMSP places a strong emphasis on the value of educating medical professionals on the proper use of antibiotics so they can make more educated prescription decisions.
- Less Negative Environmental Impact: AMSP can assist in lowering the environmental buildup of antimicrobials and, consequently, their ecological footprint by limiting their inappropriate use and disposal. This is a key element in stopping environmental AMR.

CONCLUSION

Antibiotic stewardship is a critical component of healthcare that aims to promote the responsible use of antibiotics to combat antibiotic resistance, improve patient outcomes, and reduce healthcare costs. Effective stewardship requires a multifaceted approach involving healthcare providers, patients, and policymakers, who must work together to address the complex issues surrounding antibiotic use. By educating healthcare providers and patients about the risks and benefits of antibiotics, leveraging technology and data analytics to monitor and optimize antibiotic use, and promoting a culture of responsible antibiotic use, we can reduce antibiotic resistance, improve patient outcomes, and ensure the long-term effectiveness of antibiotics.

Furthermore, antibiotic stewardship programs can help reduce healthcare costs, decrease the length of hospital stays, and minimize the risk of adverse reactions associated with antibiotic use. Additionally, these programs can improve patient satisfaction, enhance the quality of care, and reduce the risk of antibiotic-related complications. Ultimately, antibiotic stewardship is essential for protecting public health, and its success relies on continued education, innovation, and collaboration among stakeholders, including healthcare providers, patients, policymakers, and industry leaders.

By working together, we can promote responsible antibiotic use, combat antibiotic resistance, and ensure that antibiotics remain effective for generations to come. This requires a sustained commitment to antibiotic stewardship, including ongoing education and training, regular monitoring and evaluation, and continuous quality improvement. Moreover, it demands a paradigm shift in how we approach antibiotic use, from a culture of overuse and misuse to a culture of responsible use and conservation.

The consequences of inaction are dire, with antibiotic resistance projected to claim millions of lives and trillions of dollars in economic losses in the coming decades. However, by prioritizing antibiotic stewardship and working together to promote responsible antibiotic use, we can mitigate this threat and ensure a healthier, safer future for all.

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