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Antimicrobial Stewardship: Balancing Innovation and Responsible Use

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Introduction

Antimicrobial Stewardship (AMS) is a crucial strategy in the fight against antibiotic resistance, ensuring that antimicrobials are used responsibly to maximize their efficacy while minimizing the emergence of resistant pathogens. The overuse and misuse of antibiotics in healthcare, agriculture, and veterinary medicine have accelerated the development of Multidrug-Resistant (MDR) bacteria, leading to infections that are increasingly difficult to treat. At the same time, there is an urgent need for new antimicrobial innovations, including next-generation antibiotics, alternative therapies, and novel drug discovery approaches. However, the challenge lies in balancing innovation with responsible use, ensuring that new treatments are preserved for future generations. Antimicrobial stewardship programs (ASPs) aim to optimize the selection, dosage, and duration of antimicrobial therapy, reduce unnecessary prescriptions, and promote infection prevention measures to curb the spread of resistance. This paper explores the significance of antimicrobial stewardship, its role in preserving existing and future antimicrobial therapies, and the strategies needed to balance innovation with sustainable use [1].

Description

Antimicrobial Resistance (AMR) arises when bacteria, viruses, fungi, and parasites evolve mechanisms to withstand the effects of drugs, rendering standard treatments ineffective. The misuse of antibiotics such as prescribing antibiotics for viral infections, incomplete courses of treatment, and the overuse of broad-spectrum antibiotics has accelerated resistance development. This trend is particularly concerning in hospital settings, where resistant pathogens such as Methicillin-*Resistant Staphylococcus Aureus* (MRSA), Carbapenem-Resistant *Enterobacteriaceae* (CRE), and multidrug-resistant *Pseudomonas aeruginosa* contribute to increased morbidity, mortality, and healthcare costs. AMS programs focus on optimizing antibiotic use to slow resistance while ensuring that patients receive the most effective treatment. These programs involve guidelines for appropriate antibiotic selection, de-escalation strategies, diagnostic stewardship, and surveillance of antimicrobial use. One key component of AMS is the implementation of rapid diagnostic tests, which allow healthcare providers to distinguish between bacterial and viral infections, ensuring that antibiotics are only prescribed when necessary. Point-of-care testing, biomarker-based diagnostics (such as procalcitonin levels), and whole-genome sequencing are being integrated into clinical practice to improve targeted therapy and reduce empirical antibiotic use [2].

Another critical aspect of antimicrobial stewardship is reducing unnecessary antibiotic use in agriculture and livestock farming. The widespread practice of administering antibiotics for growth promotion and disease prevention in animals has contributed to the spread of resistant bacteria through the food chain and the environment. Policies restricting non-therapeutic antibiotic use in food production, along with the promotion of alternatives such as probiotics, vaccines, and improved biosecurity measures, are essential for mitigating resistance. While stewardship efforts focus on preserving existing antibiotics, there is an equally pressing need for new antimicrobial development. The decline in antibiotic discovery over the past few decades has been attributed to scientific, economic, and regulatory barriers, with many pharmaceutical companies abandoning antibiotic research due to low financial returns. To address this issue, governments and global health organizations are implementing incentives such as push and pull funding mechanisms, priority review pathways, and antibiotic subscription models that provide financial support for new drug development [3].

In addition to traditional antibiotics, alternative antimicrobial strategies are gaining attention. Bacteriophage therapy, which uses viruses that selectively infect and kill bacteria, has shown promise in treating MDR infections. Antimicrobial Peptides (AMPs), CRISPR-based antimicrobials, and microbiome-based interventions are also being explored as innovative solutions to combat resistant infections while minimizing the impact on beneficial bacteria. However, the success of these innovations depends on their responsible implementation to prevent the rapid emergence of resistance against new therapies. At the core of AMS is the rational use of antimicrobials, which involves prescribing the right drug, at the right dose, for the right duration, and only when necessary. One of the main drivers of AMR is inappropriate antibiotic prescribing, including overuse of broad-spectrum antibiotics, unnecessary antibiotic use for viral infections, and failure to complete prescribed courses. To address this, healthcare institutions implement AMS programs that promote evidence-based prescribing guidelines, antimicrobial de-escalation, dose optimization, and surveillance of antimicrobial use and resistance patterns. These programs also incorporate rapid diagnostic tools, such as Polymerase Chain Reaction (PCR) tests, next-generation sequencing, and biomarker-based assays, to improve the accuracy of diagnosis and reduce unnecessary antibiotic use [4].

Beyond healthcare settings, AMS extends to agriculture and livestock production, where antibiotics have historically been used for growth promotion and disease prevention rather than therapeutic purposes. The misuse of antibiotics in food production has led to the spread of resistant bacterial strains through the food chain and the environment, necessitating stricter regulations. Many countries have introduced bans on non-therapeutic antibiotic use in animal husbandry and promoted alternatives such as probiotics, vaccines, and improved hygiene measures to maintain animal health without excessive reliance on antimicrobials. While AMS focuses on preserving existing antibiotics, there is also an urgent need for novel antimicrobial innovations. The traditional antibiotic pipeline has slowed, with fewer new drugs entering the market due to scientific, economic, and regulatory challenges. Large pharmaceutical companies have shifted away from antibiotic research due to the low return on investment, as antibiotics are typically used for short durations compared to chronic disease medications. To counteract this, governments and global health organizations have introduced push-and-pull incentives, including grant funding, public-private partnerships, and market entry rewards, to stimulate the development of new antimicrobial agents. The antibiotic subscription model, which provides financial incentives to companies regardless of sales volume, is one such approach aimed at reinvigorating antibiotic innovation [5].

Beyond traditional antibiotics, alternative therapies are gaining attention in the fight against resistance. Bacteriophage therapy, which involves using viruses to selectively kill bacteria, has shown promise in treating MDR infections while minimizing disruption to beneficial microbiota. Similarly, Antimicrobial Peptides (AMPs), CRISPR-based antimicrobials, microbiome-based therapies,

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and nanotechnology-based drug delivery systems are being explored as potential solutions. However, the integration of these new technologies into clinical practice requires careful stewardship to prevent the rapid emergence of resistance to these novel treatments. A key challenge in AMS is ensuring global cooperation and policy implementation. AMR knows no borders, and coordinated international efforts are required to address the crisis effectively. Organizations such as the World Health Organization (WHO), Centers for Disease Control and Prevention (CDC), and Global Antibiotic Research and Development Partnership (GARDP) play a vital role in establishing guidelines, funding research, and promoting awareness campaigns. Countries must work together to harmonize regulations, improve access to essential antibiotics in underserved regions, and invest in infection prevention measures such as vaccination programs, sanitation improvements, and public education on antimicrobial use. In summary, antimicrobial stewardship is a multifaceted approach that seeks to balance the need for antimicrobial innovation with responsible use to combat resistance effectively.

Conclusion

Antimicrobial stewardship is essential for preserving the effectiveness of existing and future antimicrobials, ensuring that treatments remain viable for generations to come. By integrating evidence-based prescribing practices, rapid diagnostics, infection prevention strategies, and regulatory policies, AMS programs help curb resistance while maintaining optimal patient care. At the same time, investments in new antimicrobial innovations, including novel antibiotics and alternative therapies, are critical for addressing the growing burden of MDR infections. However, the introduction of new treatments must be accompanied by responsible use strategies, preventing the same patterns of overuse and misuse that have led to the current resistance crisis. Through global collaboration between healthcare providers, researchers, policymakers, and pharmaceutical companies, it is possible to strike a balance between antimicrobial innovation and sustainable stewardship, ensuring that effective treatments remain available for future generations.

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Conflict of Interest

No potential conflict of interest was reported by the authors.

References

1. Ma, Dongxin, Lei Li, Kaiou Han and Leping Wang, et al. "The antagonistic interactions between a polyvalent phage SaP7 and β-lactam antibiotics on combined therapies." *Veter Microbiol* 266 (2022): 109332.
2. Moradpour, Zahra, Nesa Yousefi, Dorna Sadeghi and Abdollah Ghasemian. "Synergistic bactericidal activity of a naturally isolated phage and ampicillin against urinary tract infecting Escherichia coli O157." *Iran J Basic Med Sci* 23 (2020): 257.
3. Valerio, Nadia, Cristiana Oliveira, Vania Jesus and Tatiana Branco, et al. "Effects of single and combined use of bacteriophages and antibiotics to inactivate Escherichia coli." *Virus Res* 240 (2017): 8-17.
4. Jo, Ara, Jeongjin Kim, Tian Ding and Juhee Ahn. "Role of phage-antibiotic combination in reducing antibiotic resistance in *Staphylococcus aureus*." *Food Sci Biotechnol* 25 (2016): 1211-1215.
5. Suh, Gina A., Thomas P. Lodise, Pranita D. Tamma and Jane M. Knisely, et al. "Considerations for the use of phage therapy in clinical practice." *Antimicrob Agents Chemother* 66 (2022): e02071-21.

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