

Clinical Microbiology: Antimicrobial Stewardship

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Abstract

Antimicrobial resistance is increasing; however, antimicrobial drug development is slowing. Now more than ever before, antimicrobial stewardship is of the utmost importance as a way to optimize the use of antimicrobials to prevent the development of resistance and improve patient outcomes. This review describes the why, what, who, how, when, and where of antimicrobial stewardship. Techniques of stewardship are summarized, and a plan for implementation of a stewardship program is outlined. Antimicrobial stewardship is the systematic effort to educate and persuade prescribers of antimicrobials to follow evidence-based prescribing, in order to stem antimicrobial overuse, and thus antimicrobial resistance. AMS has been an organized effort of specialists in infectious diseases, both in Internal Medicine and Pediatrics with their respective peer-organizations, hospital pharmacists, the public health community and their professional organizations since the late 1990s. It has first been implemented in hospitals. In the U.S., within the context of physicians' prescribing freedom (choice of prescription drugs), AMS had largely been voluntary self-regulation in the form of policies and appeals to adhere to a prescribing self-discipline until 2017, when the Joint Commission prescribed that hospitals should have an Antimicrobial Stewardship team, which was expanded to the outpatient setting in 2020.

In the early days of antibiotics, booming drug development meant that even when resistance developed, a new drug was always available to treat the increasingly resistant bacteria. Fourteen new classes of antibiotics were introduced between 1935 and 2003. However, rapid antimicrobial development came with a cost antimicrobial resistance. In the hospital, resistance to antibiotics and antifungals poses the greatest concern. The use of the term 'antimicrobial stewardship' has grown exponentially in recent years, typically referring to programmes and interventions that aim to optimize antimicrobial use. Although antimicrobial stewardship originated within human healthcare, it is increasingly applied in broader contexts including animal health and One Health.

Antimicrobial resistance (AMR) has been clearly identified as a major global health challenge. It is a leading cause of human deaths and also has a toll on animals, plants, and the environment. Despite the considerable socio-economic impacts, the level of awareness of the problem remains woefully inadequate, and antimicrobials are not generally recognized as a global common good, one that everyone has a role and responsibility to conserve. It is imperative for antimicrobial stewardship to be more widely implemented to achieve better control of the AMR phenomenon. The Food and Agriculture Organization (FAO) of the United Nations plays an important role in promoting and facilitating antimicrobial stewardship.

Keywords: Antimicrobial Stewardship; Human healthcare; Techniques of stewardship; Hospital pharmacists

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Introduction

There are 2 major approaches to antimicrobial stewardship, with the most successful programs generally implementing a combination of both. The front-end or preprescription approach to stewardship uses restrictive prescriptive authority [1]. Certain antimicrobials are considered restricted and require prior authorization for use by all except a select group of clinicians. Clinicians without authority to prescribe the drug in question must contact the designated antimicrobial steward and obtain approval to order the antimicrobial. Antimicrobial stewardship choosing surveillance technology Vendor List Compendium Construction issues Definitions & surveillance Environmental services Healthcare personnel immunization Joint Commission NPSG Pneumonia prevention Position statements [2].

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 organisms [3].

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 [4].

The pipeline of new antibiotics has almost completely dried up and use of the antibiotics we have will inevitably lead to resistance. Antibiotic-resistant pathogens found in Australia include:

1. Methicillin-resistant *Staphylococcus aureus* (MRSA)
2. Multi-resistant *Streptococcus pneumoniae*
3. Vancomycin-resistant enterococci
4. Multi-resistant *Escherichia coli* and other enterobacteriaceae.

Antimicrobial stewardship

The term 'antimicrobial stewardship' is encountered in a growing number and increasingly diverse range of contexts, from antimicrobial stewardship programmes in hospitals and the community, to veterinary antimicrobial stewardship, One Health antimicrobial stewardship, and the WHO global stewardship framework [5]. Although the term has now become commonly accepted, there are some challenges associated with it. Due to the rapidly increasing use of the term without a sole clear definition, it has evolved differently in different settings, influenced by local interpretations; this legacy shapes discussions, perceptions and assumptions surrounding antimicrobial stewardship [6]. This has produced two inter-related problems: it can be difficult to classify what is and what is not antimicrobial stewardship, and consequently stewardship practitioners can face difficulties defining and communicating what their roles are. Importantly, there is potential for the term to become a meaningless catchword. An additional challenge of the term is that its meaning

is often not self-evident to lay people and professionals who are not specialists in infectious diseases. Historically, 'antimicrobial stewardship' was mostly used in the narrow context of programmes within individual hospitals. During the 1990s and 2000s, programmes were developed and implemented in many countries, often led by pharmacists in the USA, and in Europe by specialists in infectious diseases or clinical microbiology, often together with a pharmacist [7, 8].

Antimicrobial stewardship has been conceptualized in many ways, including as a set of coordinated interventions, as a programme, as a philosophy, and as an ethic. The origin of the word 'stewardship' is grounded in daily actions that are often multi-faceted: the steward of a large household carefully and responsibly manages the household [9]. As antimicrobial stewards, we need to carefully and responsibly manage antimicrobials. We suggest that it is best to view the collective daily actions within antimicrobial stewardship as a strategy. Strategy comes from the Greek *strategos* meaning a general, but coherent, set of manoeuvres carried out to overcome an enemy. A key word here is 'general', rather than specific. Specific sets of manoeuvres (i.e. types of intervention) are within the local jurisdiction of those who translate strategy into operations [10].

Conclusion

Antimicrobial stewardship is central to efforts to ensure access to effective antimicrobials for all who need them, today and tomorrow. The term antimicrobial stewardship emerged relatively recently, and is being applied in an increasingly diverse range of contexts; many current definitions of antimicrobial stewardship are technical and focus on prescriptions. We have suggested that it is now best to view antimicrobial stewardship more broadly, as a strategy, a coherent set of actions which promote using antimicrobials responsibly. The specific actions vary depending on the actor, but share many commonalities at different levels within a healthcare system, as well as between human and animal health. Our suggested definition for antimicrobial stewardship is a tool: each actor can ask if they or their organizations are undertaking actions to use antimicrobials responsibly, and if these actions are coherent. Going forward, there is a continuous need for 'responsibly' to be defined and translated into context-specific and time-specific actions.

Antimicrobial stewardship in hospitals reduces the inappropriate use and consequences of antibiotics and improves patient outcomes. Aspects of stewardship are already in place in the community. Many of these are led by NPS Medicine Wise. Adopting novel stewardship strategies in the community could provide a systematic approach to the growing threat of antibiotic resistance.

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Conflict of Interest

None

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