Role of Education in Antimicrobial Stewardship

Inge C. Gyssens, MD, PhD[a,b,*]

KEYWORDS

• Responsible antibiotic use • Antimicrobial stewardship • Education • Postgraduate • Undergraduate

KEY POINTS

- Education is the cornerstone of every antimicrobial stewardship program.
- Teaching of the principles of antimicrobial stewardship should start at the undergraduate level.
- Multidisciplinary input is needed for building the curricula in an attractive format.
- Strong political support is necessary for a curriculum program to be successfully implemented.

INTRODUCTION

Antimicrobial Resistance: An Unavoidable Threat

The ability to treat infectious diseases with antimicrobials is regarded as an essential component of medical management. The loss of antibiotics' effectiveness endangers routine medical and surgical procedures, including organ transplants and joint replacements. Timely administration of effective antibiotics; that is, antibiotics to which the causative pathogen is still susceptible, is crucial in the treatment of sepsis. In 2013, the Centers for Disease Control and Prevention (CDC) published a report outlining the top 18 drug-resistant threats to the United States. These threats were categorized based on level of concern: urgent, serious, and concerning.[1] In 2017, the World Health Organization published a list of the 12 pathogens that pose the greatest threat to human health because they are resistant to antibiotics (http://www.who.int/mediacentre/factsheets/fs194/en/). Novel antibiotics against these resistant organisms are needed. For many years, few new antibiotics with novel targets and mechanisms of action were in the research and development pipeline. Recently, there seems to be a

Disclosure Statement: There are no commercial of financial conflicts of interest for this article. No funding was obtained.

[a] Department of Medicine, Radboud University Medical Center, AIG 463, PO Box 9101, Nijmegen 6500 HB, The Netherlands; [b] Faculty of Medicine, Research Group of Immunology and Biochemistry, Hasselt University, Martelarenlaan 42, BE 3500, Hasselt, Belgium
* Department of Medicine, Radboud University Medical Center, AIG 463, PO Box 9101, Nijmegen 6500 HB, The Netherlands.
E-mail address: Inge.Gyssens@radboudumc.nl

Med Clin N Am 102 (2018) 855–871
https://doi.org/10.1016/j.mcna.2018.05.011
0025-7125/18/

new interest by research and development companies to meet the need of antibiotics in the gram-negative spectrum.[2] Another problem is the recurring shortage of older, still-active antibiotics.[3]

The Common Good: Effective Antimicrobial Drugs

Antimicrobials differ from other drugs in a particular way. They are the only drugs that do not directly target the patient but instead inhibit or kill invading pathogens and commensal microorganisms. Antimicrobial therapy is not only based on the characteristics of a patient and a drug but also on the characteristics of the microorganisms and the colonizing flora causing the infection. A useful didactic tool that describes the complex interrelationship between humans, microorganisms, and antimicrobial drugs is the pyramid of infectious diseases (**Fig. 1**). Activity of the antimicrobial is obtained at the cost of the development of resistance by the pathogen, as well as in the microbiome. The selection of the appropriate antimicrobial therapy is a complex decision, depending on the knowledge of many different aspects of infectious diseases: immunologic and genetic host factors, microbial virulence, microbial resistance, and the pharmacokinetic-pharmacodynamic effects of drugs.

Due to the selection pressure on the environment, prescribers of antimicrobial drugs face an ethical dilemma when treating an individual patient with maximally broad empirical therapy to cover all potential pathogens. On the other hand, prescribers have a responsibility toward future generations to preserve the efficacy of antibiotics and minimize the development of resistance.[4] The former responsibility tends to promote overtreatment; the latter is usually overlooked. However, prudent antibiotic use is the only option to delay the emergence of resistance.

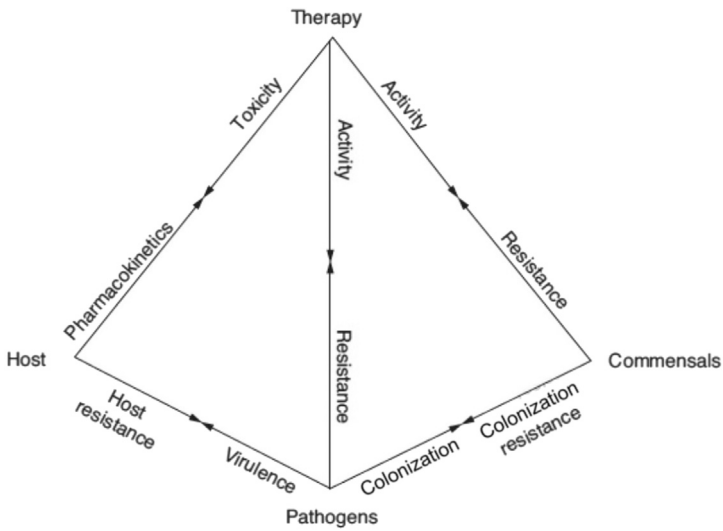

Fig. 1. Pyramid of infectious diseases. The arrows in the pyramid illustrate the multiple interactions between the patient, the drug, the pathogen or pathogens, and the colonizing microflora or microbiome. (*From* Pulcini C, Gyssens IC. How to educate prescribers in antimicrobial stewardship practices. Virulence 2013;4(2):193; with permission.)