

Antimicrobial Resistance

An Antimicrobial/Diagnostic Stewardship and Infection Prevention Approach

Edward Joel Septimus, MD

KEYWORDS

- Antimicrobial resistance • Antimicrobial stewardship • Diagnostic stewardship
- De-escalation • Audit and feedback

KEY POINTS

- Antimicrobial resistance (AR) is one of the most serious public health threats today, which has been accelerated by the overuse and misuse of antimicrobials in humans and animals plus inadequate infection prevention.
- Antimicrobial stewardship refers to a collaborative, multidisciplinary program designed to improve antimicrobial prescribing to optimize clinical outcomes while minimizing unintended consequences of antimicrobial use, such as toxicity, selection of pathogenic organisms, and emergence of resistance.
- The accurate and timely microbiology provided by the laboratory supports the application of medical knowledge and judgment to achieve the best outcomes for patients with an infectious disease, especially in an era of increased AR.
- Interventions include audit and feedback with or without preauthorization. De-escalation and prescribing an antibiotic for the appropriate duration are important components as well.
- A multipronged approach is necessary combining human and animal stewardship, preventions of health care-associated infections, development of new vaccines, and better diagnostic testing.

INTRODUCTION

Antimicrobial resistance (AR) is one of the most serious public health threats today, which has been accelerated by the overuse and misuse of antimicrobials in humans and animals plus inadequate infection prevention (IP) measures.¹ Numerous studies have shown a relationship between antimicrobial use and resistance.^{2,3} The increasing incidence of multidrug-resistant organism (MDRO) infections has become a safety concern for patients across the continuum of patient care, especially in patients in the intensive care unit (ICU) who develop a health care-associated infection (HAI).

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Texas A&M College of Medicine, 4257 Albans Street, Houston, TX 77005, USA

E-mail address: eseptimus@gmail.com

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MRDO infections are more difficult to treat, incur greater treatment costs, and have greater morbidity and mortality than infections caused by organisms susceptible to antibiotics. Unlike other medications, the misuse of antibiotics can adversely impact the health of patients who have not received them. The human and economic cost of AR in the United States was revealed in the Centers for Disease Control and Prevention (CDC) report, *Antibiotic Resistance Threats in the United States, 2013*.⁴ Using conservative estimates, the CDC determined that antibiotic resistant organisms are responsible for more than 2 million infections and 23,000 deaths per year in the United States in 2008, at a direct cost of \$20 billion with additional loss to society for lost productivity as high as \$35 billion per year. In 2014 a report commissioned by the Prime Minister of the United Kingdom and the Wellcome Trust projected that without global action, 10 million deaths from AR infections will occur worldwide by 2050.

Furthermore, antibiotic misuse and overuse not only facilitates the development of MDROs but they also increase unintended consequences, such as *Clostridium difficile* infections (CDIs) and antibiotic-associated adverse drug events (ADEs), making antimicrobial stewardship (AS) an important component of HAI prevention.⁵ A recent meta-analysis showed AS programs reduced the incidence of infections and colonization with multidrug-resistant gram-negative bacteria, extended-spectrum β -lactamase-producing gram-negative bacteria, methicillin-resistant *Staphylococcus aureus*, as well as the incidence of CDI infections. The same study emphasized that AS programs, when implemented alongside infection control measures, especially hand-hygiene interventions, were more effective than implementation of AS alone confirming that a well-functioning IP program is a key component to a successful AS strategy.⁶ Similar data have also shown that the addition of AS interventions can enhance results of robust IP measures, particularly when addressing an outbreak.⁷

AS refers to a collaborative, multidisciplinary program designed to improve antimicrobial prescribing (right drug, dose, duration, and route of administration when antibiotics are needed) to optimize clinical outcomes while minimizing unintended consequences of antimicrobial use, such as toxicity, selection of pathogenic organisms, and emergence of resistance.^{8,9}

AS programs have been shown to improve patient outcomes, reduce antimicrobial adverse events, and decrease AR.^{6,10} The CDC published core elements associated with successful AS programs: 7 elements for hospitals and long-term care facilities^{11,12} and 4 elements for outpatient facilities.¹³ These elements provide a framework for implementation. For acute care and long-term care, the 7 elements include leadership commitment, accountability, drug expertise, action, tracking, reporting, and education. For outpatient facilities, the 4 core elements include commitment, action of policy and practice, tracking and reporting, and education and expertise. Common to all 3 are the following:

1. Leadership commitment dedicating necessary human, financial, and information technology resources
2. Drug expertise
3. Tracking and reporting offering regular feedback to clinicians to improve prescribing behavior
4. Education providing educational resources to clinicians and patients on antibiotic prescribing

PREVENTION

There is a synergy between IP and AS in reducing AR. Targeted coordination and prevention strategies are critical to stopping the spread of MDROs. The use of prevention

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