Antimicrobial Stewardship for the Infection Control Practitioner

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KEYWORDS

- Antimicrobial stewardship • Antibiotic management
- Antibiotic resistance infection control • Education • Multidrug resistance

KEY POINTS

- Antibiotic misuse is a serious patient safety concern and a national public health priority.
- Years of indiscriminant antibiotic use have led to selection of antibiotic-resistant bacteria and *Clostridium difficile* infection, which ultimately led to poor patient outcomes.
- Antimicrobial stewardship programs are designed to promote judicious use of antimicrobials by optimizing antimicrobial selection, dose, route, and duration.
- Infection preventionists can enhance stewardship efforts through patient identification, prevention of device-related infections, and through input in the development of drug and disease state bundles.

CONSEQUENCES OF ANTIMICROBIAL RESISTANCE: IMPACT ON PUBLIC HEALTH AND SAFETY

One of the greatest achievements in science and medicine of the last century was the discovery and the subsequent development of antibiotics for human use. Antibiotics have enabled many of the achievements in modern medicine including transplantation, invasive forms of surgery, chemotherapy, and successful management of the critically ill.[1] Unfortunately, this situation has become compromised due to the introduction and vast expansion of antimicrobial resistance. The impact that antimicrobial resistance has on the international community is well recognized by governing bodies. The World Health Organization has identified antimicrobial resistance as 1 of the 3 greatest

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threats to human health,[2] placing it in the same category as climate change and widespread poverty. In 2004, the Infectious Diseases Society of America (IDSA) raised the alert level in the United States with their Bad Bugs, No Drugs campaign introducing the cleverly titled ESKAPE pathogens,[3] which can escape the effects of the antimicrobial armamentarium and to which vulnerable patients cannot escape the devastating outcomes due to infections with these organisms. The ESKAPE pathogens include the Gram-positive pathogens methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant *Enterococcus* (VRE), as well as the Gram-negative pathogens *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, and Enterobacter species.[3] The Centers for Disease Control (CDC) built on this awareness and call for action in their 2013 Antibiotic Resistance Threats Report, in which they detailed the unfathomable impact that resistant organisms have on patient outcomes. In this report, the CDC estimates that each year in the United States at least 2 million people become infected with bacteria that are resistant to antibiotics and at least 23,000 people die each year as a direct result of these infections, with even more perishing from conditions that were complicated by these infections.[4]

THE IMPACT OF ANTIMICROBIAL USE, MISUSE, AND OVERUSE

The overuse and misuse of antimicrobial agents have detrimental effects to the individual patient, the health care system, and society as a whole. Among other negative consequences, inappropriate antimicrobial use has contributed to the rising costs of health care, the emergence of multidrug-resistant organisms (MDROs) and superinfections (most notably *Clostridium difficile* infections), and unnecessary adverse drug reactions. It is estimated that up to 50% of antimicrobial use is inappropriate in acute care settings[5] and up to 75% of antibiotic use in inappropriate in long-term care facilities.[6] These staggering numbers add considerable costs to patient care. According to the Office of Technology Assessment, antibiotics are the second most commonly prescribed class of drugs in the United States.[7] Upwards of 40% of all hospitalized patients receive antibiotics annually.

Although it is intuitive that use of a particular antimicrobial, through the process of selective pressure, will lead to the development of resistance to that agent or class of agents in an organism present in a patient; it is actually a much more complex process. Cross-resistance to structurally unrelated antimicrobials can also occur with alarming frequency. This can occur by 1 of 2 main methods. First is the presence of shared resistance pathways (eg, multidrug-resistant efflux pumps that pump structurally unrelated drugs out of the bacterial cell). Second is the presence of resistance islands within the genetic material of certain pathogens that carry diverse resistance mechanisms to structurally different antimicrobials. In this second scenario, receipt of antibiotic A can select for the strain of bacteria with resistance to that antibiotic. However, because that resistance determinant exists in combination with other resistance determinants for other antimicrobials, the strain selected actually displays multidrug resistance. Therefore, scrutiny of every antimicrobial exposure is warranted to prevent the emergence of MDROs. For example, the impact of each antimicrobial exposure on the development and subsequent isolation of carbapenem-resistant Enterobacteriaceae (CRE), an organism the CDC has given the highest threat level, is well described. In addition to data showing carbapenem exposure as a risk factor for isolation of CRE,[8] there are equally convincing data showing that any antimicrobial exposure,[9] each additional antimicrobial exposure,[10] and each additional day of antimicrobial exposure[11] are all associated with an increased risk of CRE isolation. Furthermore, a recent meta-analysis showed an independent association with virtually every class of antimicrobial agents and the