The Pharmacoeconomic Aspects of Antibiotic Stewardship Programs

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KEYWORDS

• Antimicrobial stewardship • Pharmacoeconomics • Oral antibiotic therapy • Cost

KEY POINTS

- Antibiotic stewardship programs offer significant cost saving to institutions and will ultimately pay for themselves.
- Interventions with the highest cost-saving focus on intravenous to oral and oral-only therapy.
- Certain therapies that may seem less costly at first look may hold hidden costs (both direct and indirect) that actually make them less desirable options.

INTRODUCTION

The objective of antimicrobial stewardship programs (ASPs) is to promote optimal use of antimicrobial therapy. Optimal antibiotic use is based on several factors that vary in importance depending on the patient and hospital area.[1–3] The traditional basis of selection takes into account the following:

1. Antibiotic spectrum (appropriate for the usual pathogens that are site-dependent)
2. Tissue penetration (drug must reach site of infection in therapeutic concentrations)
3. Resistance potential (use in an individual case may be effective, but depending on the antibiotic, may also induce resistance)
4. Good safety profile (few infrequent serious side effects)
5. Should be relatively cost-effective (vs alternatives)

PHARMACOECOMONIC PERSPECTIVE

Pharmacoeconomics of antimicrobial therapy must take into account the abovementioned factors, and appropriately, cost is usually not the most important factor in antibiotic selection. The least expensive drug is usually accompanied by

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Med Clin N Am ■ (2018) ■–■
https://doi.org/10.1016/j.mcna.2018.05.010 **medical.theclinics.com**

other concerns, such as high resistance potential, poor side effect profile, pharmacokinetic (PK) properties that limit penetration into target tissue (site of infection), and/or suboptimal activity against the presumed/known pathogen. It is false economy to preferentially select the least expensive antibiotics solely because of its cost.[2–4] It is false economy and not good for ASPs, if the inexpensive antibiotic selected fails or causes resistance problems (in other patients/hospitals). Therapeutic failure, in the end, requires retreatment with a more costly, but effective antibiotic.[2,5]

ANTIBIOTIC PHARMACOKINETIC COST DETERMINANTS

Antibiotic costs depend on several cost determining factors, which when combined are the basis of antibiotic cost to the hospital/patient. The first cost factor is acquisition cost to the hospital or patient cost from the pharmacy.[2,3] Because the main thrust of ASP is in hospital, this article primarily focuses on inpatient aspects; added to the cost of the antibiotic is the cost to the hospital of administering the drug intravenously (IV). Obviously, with oral (PO) there is only acquisition cost and no cost for IV administration.[2,6] The average wholesale price is used for comparative purposes but varies considerably (volume discounts) among hospitals, buying groups, and consortia.

Generally, acceptance of administering an IV dose of antibiotic is $10/dose. This cost includes pharmacy costs of storage, labeling/dispensing, and IV administration (diluent, syringes/bags) and IV team or nursing time to administer the IV formulation (**Box 1**).

Obviously, the cost of daily administration may exceed, in cases of inexpensive antibiotics, the acquisition cost of the antibiotic, eg, IV ampicillin q4h costs $60/day to administer which is in excess (and must be added to) the acquisition cost of the drug. Therefore, the actual cost to the hospital of an antibiotic with a short half-life (t ½) may be more expensive when added administrative costs are factored in.[7,8]

OTHER ANTIBIOTIC COST DETERMINANTS

As mentioned earlier, an antibiotic with suboptimal activity or spectrum and suboptimal PK characteristics that prevent penetration at the infection site frequently fail and require retreatment cost multiplier.[3,5,7] There is also a hidden cost of inducing resistance. Treating multidrug-resistant organisms (MDROs) usually requires expensive antibiotics. It is difficult to assess this factor in ASP programs but is a daily problem in the inpatient and outpatient settings. Every effort should be made to use "low resistance potential" antibiotics; only those with a "high resistance potential" should be used to minimize the emergence of resistance among Gram-negative bacilli (GNB).

The acquisition cost plus the IV administration cost may be modest but often results in the more expensive and clinically difficult problem of trending MDR GNB infection[4,9–11] (see **Box 1**).

Other indirect cost factors include the cost of collateral damage, that is, side effects, *Clostridium difficile*, and drug-drug interactions. It is important to recognize from an ASP perspective that most antibiotics (eg, macrolide, tetracycline, aztreonam, colistin, polymyxin B, tigecycline, Q/D, nitrofurantoin, fosfomycin, and aminoglycosides) do not cause *C difficile* infection. Carbapenems and quinolones (FQ) may cause *C difficile* infection, but the antibiotics within the highest *C difficile* potential are clindamycin and the β-lactams (excluding ceftriaxone). Some