

Antibiotic Misuse in Hospital, Outpatient, and Long-Term Care Settings

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Antibiotic misuse is common in the United States, but the causes of antibiotic misuse may differ from one health care setting to another. In this commentary, we describe the factors associated with inappropriate antibiotic prescriptions in hospital, outpatient, and long-term care settings, along with specific measures that can help prevent antibiotic misuse.

The Centers for Disease Control and Prevention (CDC) estimates that up to 50% of all antibiotics prescribed for people are either not needed or are inappropriate [1]. Antibiotic misuse is a major factor in the emergence of multidrug resistant pathogens [2] and is associated with adverse drug reactions, *Clostridium difficile* infections, and increased health care costs [2].

When prescribing an antibiotic, a provider must determine whether the drug is truly indicated in a particular clinical scenario. If so, the provider must consider several factors. The prescribed antibiotic has to be the correct choice for that indication. The dosage, frequency, route of administration, and duration must all be optimal for the prescription to qualify as appropriate. Lastly, the provider must consider drug-drug interactions for the antibiotic prescription to be truly effective and appropriate.

In order to improve antibiotic use in a particular setting, efforts have to be directed to the most relevant factors applicable to that setting. The following are descriptions of challenges related to antibiotic misuse and recommendations for prevention in hospital, outpatient, and long-term care settings.

Antibiotic Misuse in Hospitals

Antibiotics are commonly prescribed in the hospital setting. The CDC reported that in 2010, 55.7% of patients discharged from 323 hospitals received antibiotics during their hospitalizations [3]. Furthermore, the authors of the CDC report found opportunities for improvement in antibiotic prescriptions in over one-third (37.2%) of cases reviewed.

The Surviving Sepsis Campaign promotes the use of early goal-directed therapy and recommends using effective intravenous antimicrobials earlier in sepsis management to decrease mortality secondary to sepsis [4]. This recommendation automatically results in more frequent initiation of broad-spectrum antibiotics in hospitals. After initiation

of an antibiotic, de-escalation of antibiotic use is the important next step, but in practice, de-escalation occurs infrequently. This and other common reasons for unnecessary antibiotic use in hospitals—administration for longer than recommended durations, administration for a noninfectious or nonbacterial syndrome, and treatment of colonizing or contaminating microorganisms [5]—trigger interventions by antimicrobial stewardship programs (ASPs) that work to reduce inappropriate antibiotic use.

In March 2015, the White House released its *National Action Plan for Combating Antibiotic-Resistant Bacteria*. The plan calls for the establishment of ASPs in all acute care hospitals by 2020 [6]. ASPs are best led by infectious diseases physicians [5, 7]. However, many hospitals lack the expertise of infectious diseases physicians. In these scenarios, other physicians who have an interest in infectious diseases can take leadership roles. Hospitalists are frequently involved in quality improvement and safety projects, so they are particularly well suited to take on this role [5]. Clinical pharmacists with formal infectious disease training are also valuable to ASPs but may not be available in many hospitals. For pharmacists with no formal training in infectious diseases, online certification programs are offered by groups such as Making a Difference in Infectious Diseases [8] and the Society of Infectious Diseases Pharmacists [9].

Another way to expand antimicrobial stewardship in smaller community hospitals that are using electronic medical record (EMR) systems is to develop remote ASPs. We successfully established a remote program for 6 community hospitals within our system. All the services are being provided to these smaller hospitals remotely from a 909-bed tertiary care center through our common EMR system [10].

Rapid diagnostic tests such as rapid viral testing for respiratory pathogens and rapid diagnostic testing of blood specimens can also help ASPs reduce the inappropriate use of antibiotics. Recent guidelines on antimicrobial steward-

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ship by the Infectious Diseases Society of America and by the Society for Healthcare Epidemiology of America (SHEA) support the use of these tests to complement other stewardship measures for preventing antibiotic misuse [7].

Another way to encourage appropriate antibiotic use in hospitals is to compare antimicrobial use between different hospitals. The CDC has already developed an antimicrobial use and resistance module that provides a mechanism for facilities to report and analyze antimicrobial use and/or resistance [11].

Antibiotic Misuse in Outpatient Settings

For various reasons, antibiotic misuse is very common in outpatient settings in the United States [12]. These factors can be either provider- or patient-related (see Table 1). Common diagnoses for which antibiotics are prescribed in outpatient settings include respiratory tract infections, otitis media, and uncomplicated urinary tract infections (UTIs) [12]. When dealing with these diagnoses, physicians need to carefully evaluate the complete clinical picture. For example, antibiotic prescriptions are not required for most upper respiratory infections [13].

Data on the true prevalence of antibiotic misuse in the outpatient setting in the United States are difficult to find. The CDC recently estimated that 30% of antibiotic prescriptions given during ambulatory care visits in 2010 and 2011 were inappropriate [14]. The CDC has been promoting the appropriate use of antibiotics in the outpatient setting since 1995, when it initiated the National Campaign for Appropriate Antibiotic Use in the Community [15]. In 2003, this campaign was branded and launched as “Get Smart: Know When Antibiotics Work,” which aims to promote adherence to appropriate prescribing guidelines among health care providers and to decrease demand for antibiotics among healthy adults and parents of young children. The CDC website provides links to various educational resources that can help reduce antibiotic misuse in outpatient settings. In addition, the website reports US outpatient antibiotic prescription data and provides information on how to partner with the CDC on this campaign [15].

Another way to decrease antibiotic misuse in the outpatient setting is to use a clinical decision support system (CDSS), which can easily be integrated with an EMR system and e-prescribing functionality. One study of treatment for acute respiratory infections showed that inappropriate prescriptions of the targeted antibiotic decreased from 22% to 3% when, upon order entry, a CDSS guided providers to the right indications for drug use [16]. Development of point-of-care rapid diagnostic tests that can distinguish viral infections from bacterial infections can also decrease antibiotic misuse in the outpatient setting [17].

Antibiotic Misuse in Long-Term Care Settings

Some reports suggest that up to 75% of antibiotic use in long-term care facilities is inappropriate [18]. The most

TABLE 1.
Reasons for Antibiotic Misuse in Outpatient Settings

- Unreasonable expectations or demands related to antibiotics by patients (or parents).
- Inadequate time available to physicians for providing explanation to patients (or parents) about why antibiotics are not required.
- Misdiagnosis of nonbacterial infections by providers.
- Diagnostic and treatment uncertainty of providers.
- Providers having inadequate knowledge or failing to act on knowledge.
- Providers honoring a patient’s request for an antibiotic prescription to maintain a good relationship even when a viral infection is suspected.
- Concerns of litigation.

commonly reported infections in nursing homes are UTIs, lower respiratory tract infections, skin and soft tissue infections, and gastroenteritis [19]. Residents in long-term care facilities are frequently started on an antibiotic course without an adequate clinical evaluation [19]. Even though experts have developed minimum criteria for the initiation of antibiotics for residents of long-term care facilities (Loeb criteria), providers’ adherence to this guidance is poor [19, 20]. Even when an antibiotic is indicated, the inappropriateness of the prescription sometimes results from an incorrect drug choice, dosage, or duration. When we evaluated inappropriate antibiotic use in 4 nursing homes in our area, the top reasons for inappropriateness were incorrect duration (40.5%), lack of indication for antibiotic use (28.4%), incorrect antibiotic choice (24.3%), and incorrect dose (8.1%) [21].

ASPs have demonstrated effectiveness in reducing inappropriate antibiotic use in nursing home settings [18]. However, we currently lack comprehensive studies looking into the different outcomes of ASP implementation in nursing homes, which can include antimicrobial utilization, health care utilization, costs, resistance, and clinical outcomes (eg, adverse events) [18]. Most nursing homes in the United States do not have a formal ASP. The White House’s *National Action Plan for Combating Antibiotic-Resistant Bacteria* recommends expanding existing programs for antibiotic resistance prevention and antimicrobial stewardship, developing new programs, and monitoring the progress and efficacy of these interventions [6]. These recommendations apply to inpatient, outpatient, and long-term care settings. In July 2015, the Centers for Medicare & Medicaid Services proposed new rules for long-term care facilities. One of the proposed recommendations would require all nursing homes to have an ASP that includes antibiotic use protocols and a system for monitoring antibiotic use [22]. Since then the CDC has released a document describing in detail 7 core elements of antimicrobial stewardship, including facility leadership commitment, accountability, drug expertise, actions to improve use, education, tracking, and reporting [23]. The document provides guidance on how to establish an ASP in a nursing home.

In addition, the Agency for Healthcare Research and Quality supported the development of 4 tool kits to help nursing homes and prescribing providers make evidence-based decisions about antibiotics [24]. Two of these tool kits were developed to improve communication and decisions about the use of antibiotics for commonly suspected infections in nursing homes. The other tool kits focus on developing and implementing a nursing home antibiogram program to facilitate selection of the right antibiotic.

Factors that should be considered when developing programs to decrease antibiotic misuse in nursing homes are described in Table 2. Physicians who consult with nursing homes rely heavily on the reports of nurses and nursing assistants when making decisions regarding initiation of antibiotics for a perceived infection [19]. Therefore, developing educational programs for nursing staff on basic concepts of antimicrobial stewardship is important. Other educational programs are needed to discourage nursing home residents and their family members from pressuring physicians to write unnecessary antibiotic prescriptions [19]. If residents and their family members are educated on the dangers of antibiotic overuse, they can exert a positive influence on providers, thus decreasing antibiotic misuse.

An ideal scenario would bring the expertise of both a physician specializing in infectious diseases and a pharmacist with special training in infectious diseases to long-term care facilities to address antibiotic misuse. When an infectious disease consult service was implemented at a 160-bed Veterans Affairs long-term care facility, a 30% reduction in total antimicrobial use was seen, along with a significant decline in positive *C. difficile* infection [18]. However, it is not practical for most nursing homes to establish this kind of program unless local hospitals share their resources with nursing homes. Hospitals should consider supporting such programs in nursing homes, as these programs are likely to reduce antibiotic resistance in hospitals. Infections are among the most frequent cause of transfer to acute care hospitals, and 30-day hospital readmissions from long-term care facilities are associated with increased mortality in this population [19].

In the absence of hospital support, nursing homes may need to consider alternative strategies for assembling

expertise. Many long-term care facilities use central pharmacies to fill prescriptions for several facilities. Training pharmacists at these central pharmacies through antimicrobial stewardship certification programs may help bring expertise to the nursing homes [18]. Within nursing homes, medical directors or other providers who have an interest in antimicrobial stewardship can also take an antimicrobial stewardship course and lead efforts to decrease antibiotic misuse at their facilities. SHEA now offers a course on infection prevention and antimicrobial stewardship in long-term care settings at its annual spring conference [25].

Conclusion

Antibiotic misuse is prevalent in all health care settings in the United States. A multifaceted approach is required to combat this problem. Health care workers, administrators of health care facilities, public health organizations, governmental agencies, educational entities, and the general population will all need to be involved in the solution. Focus has to be directed towards educating medical students, postgraduate trainees, pharmacy students, and residents in established concepts of antimicrobial stewardship [2]. Such education should also be incorporated into the curriculum of ancillary provider schools. Continuing medical education programs directed towards this issue should be offered to all health care providers at regional and national levels. In addition to educating providers, national media campaigns to educate the general population about the risks of antibiotic misuse have been found to be effective in various countries and should be an integral part of a comprehensive strategy [26]. Future research should focus on developing and evaluating ASPs specific to various kinds of settings, keeping in mind the different resources and challenges of each setting. **NCMJ**

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TABLE 2.
Factors to Consider When Developing Programs to Decrease Antibiotic Misuse in Long-Term Care Facilities

- Lack of on-site physicians in many nursing homes.
- Reliance on reports of nurses and nursing assistants when decisions are made to start antibiotics.
- Influence of family members of long-term care residents on treatment decisions.
- Limited financial resources of nursing homes compared to hospitals.
- Limited availability of diagnostic tests.
- Absence of personnel with expertise in infectious diseases (eg, infectious diseases physicians or infectious diseases-trained pharmacist).

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