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Core Elements of Hospital Antibiotic Stewardship Programs From the Centers for Disease Control and Prevention

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Abstract

The proven benefits of antibiotic stewardship programs (ASPs) for optimizing antibiotic use and minimizing adverse events, such as *Clostridium difficile* and antibiotic resistance, have prompted the Centers for Disease Control and Prevention (CDC) to recommend that all hospitals have an ASP. This article summarizes *Core Elements of Hospital Antibiotic Stewardship Programs*, a recently released CDC document focused on defining the infrastructure and practices of coordinated multidisciplinary programs to improve antibiotic use and patient care in US hospitals.

Keywords

antibacterial agents/therapeutic use; drug utilization; hospitals; practice guidelines as topic; program development

Improving the use of antibiotics is an important patient safety and public health issue, and was identified by the Centers for Disease Control and Prevention (CDC) as a key strategy to address antibiotic resistance [1]. Hospital-based programs dedicated to improving antibiotic use, commonly referred to as antibiotic stewardship programs (ASPs), can increase the frequency of appropriate prescribing, optimize the treatment of infections, and minimize adverse events associated with antibiotic use, including *Clostridium difficile* infections (CDIs) [2]. Recent national data from the CDC highlighted that more than half of all hospital patients receive an antibiotic; antibiotic use rates among similar patient-care locations differ by up to 3-fold, and many opportunities exist to improve prescribing in common clinical scenarios [3]. In recognition of the urgent need to improve antibiotic use in hospitals and the benefits of ASPs, the CDC recommends that all acute care hospitals

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implement ASPs [3]. To support this recommendation, the CDC recently released *Core Elements of Hospital Antibiotic Stewardship Programs*, a document to assist hospitals in effectively implementing antibiotic steward-ship [4].The document complements existing antimicrobial stewardship guidelines from various organizations [5, 6]. Elements common to successful stewardship programs are summarized in Table 1. We will outline those elements and provide suggestions on how they might be implemented, while recognizing that variability in the size, staffing, and type of care among US hospitals requires flexibility in implementation. The goal of this article is to briefly summarize the contents of *Core Elements of Hospital Antibiotic Stewardship Programs*.

LEADERSHIP COMMITMENT, ACCOUNTABILITY, AND DRUG EXPERTISE

Facility leadership support is critical to the success of ASPs. Formal statements of support for antibiotic stewardship should be accompanied by stewardship-related duties in job descriptions and ensuring that staff from relevant departments is given sufficient time to contribute to stewardship activities. Financial support greatly augments the capacity and impact of a stewardship program; these programs will often pay for themselves, through savings in both antibiotic expenditures and indirect costs [7–11]. To ensure accountability, facilities should identify a single leader responsible for coordinating and reporting on the needs and outcomes of the program to an executive-level or patient quality–focused hospital committee. Physicians have been highly effective in this role. In addition, because drug expertise is needed, a pharmacist should be involved. A pharmacist may also be an appropriate program leader. Formal training in infectious diseases and/or antibiotic stewardship benefits stewardship program leaders. Larger facilities have achieved success by hiring full-time staff to develop and manage stewardship programs, while some smaller facilities have reported other arrangements including use of part-time, off-site expertise and hospitalists [12]. Hospitalists can be ideal physician leaders for efforts to improve antibiotic use, given their increasing presence in inpatient care, the frequency with which they use antibiotics, and their commitment to quality improvement [13, 14]. The Pharmacy and Therapeutics Committee should not be considered the stewardship team within a hospital if it is only performing the traditional duties of managing the formulary and monitoring drug-related patient safety, although in some smaller facilities this committee has an expanded role to assess and improve antibiotic use [15].

The work of stewardship program leaders is greatly enhanced by the support of other key groups in hospitals in which they are available: Clinicians and department heads can provide input for policies and interventions; laboratory staff can guide the proper use of tests and empiric therapy by creating and interpreting facility antibiotic resistance reports; hospital epidemiologists and infection preventionists can provide surveillance data on multidrug-resistant organisms and CDIs to inform priorities or impact of ASPs [16]; nurses can review medications and prompt discussions of antibiotic treatment; and information technology staff can integrate stewardship protocols and relevant information into electronic medical records and ordering systems at the point of care [17].

ACTIONS TO IMPROVE ANTIBIOTIC PRESCRIBING

Actions to improve prescribing include both institution-wide policies related to antibiotic use and disease state management as well as patient-specific interventions. These actions should be implemented in ways that do not delay the timely initiation of antibiotics for management of severe sepsis and septic shock [18]. Policies that support optimal antibiotic prescribing practices include documentation of the dose, duration, and indication for all prescriptions to inform future decisions to modify and/or discontinue antibiotics, and facility-specific treatment recommendations based on national guidelines and local susceptibilities, particularly for common indications for antibiotic use such as community-acquired pneumonia, urinary tract infections, intra-abdominal infections, skin and soft tissue infections, and surgical prophylaxis. However, policies alone do not translate into action and must be accompanied by interventions chosen based on the needs of the facility as well as the availability of resources. Programs should be careful not to implement too many interventions at once. Examples of stewardship interventions presented in the CDC's *Core Elements of Hospital Antibiotic Stewardship Programs* are summarized below.

- *Broad interventions* generally focus on formally reviewing the need, choice, and duration of antibiotics. Prior approval or prescription preauthorization are reviews conducted at or shortly after prescribing to ensure selected drugs are used optimally. This approach should never limit prompt treatment of suspected sepsis. Another approach is to formally reassess the continued need for and choice of antibiotics after 48 hours when the patient's clinical status is clearer and more diagnostic information is available. These reviews can be performed by the attending physician or treating team, referred to as an antibiotic "time out," or by staff other than the treating team such as ASP staff (ie, prospective audit and feedback). The effectiveness of prospective audit and feedback has been shown in multiple studies, but the scalability of this intervention is dependent on the capacity of the ASP [5, 19]. Some smaller facilities have shown success by engaging external experts to assist in performing such reviews [12]. The antibiotic "time out" approach may be more feasible for facilities that have ASPs with limited staffing and capacity.
- *Staff–pharmacy interventions include* automatic changes from intravenous to oral antibiotic therapy when appropriate; dose adjustments and optimization; therapeutic monitoring; automatic alerts in situations in which therapy might be unnecessarily duplicative; duration-specific stop orders; and detection of antibiotic-related drug–drug interactions. Pharmacists also often play critical roles in other types of interventions, such as reviewing clinical information for antibiotic time-outs, prospective audits, or disease-stage management, and giving direct feedback to prescribers.
- *Infection- and syndrome-specific interventions* can focus on the diagnostic evaluation, optimal empiric treatment, and reevaluation of the need for and choice of prescribed antibiotic (s) for defined infections, such as community-acquired pneumonia, urinary tract infections, skin and soft tissue infections, and methicillin-resistant *Staphylococcus aureus* infections, as well as the

discontinuation of unnecessary antibiotics in patients diagnosed with CDI and the timely modification of empiric treatment to culture and susceptibility results. Interventions to minimize the misuse of antibiotics in noninfectious syndromes such as asymptomatic bacteriuria and blood culture contamination are equally important.

TRACKING AND REPORTING ANTIBIOTIC USE AND OUTCOMES

Measurement may involve the evaluation of processes, such as whether prescribers documented treatment indications, adhered to facility-specific treatment guidelines, obtained appropriate diagnostic tests, and modified antibiotic choices to microbiological findings. Ideally, measurement should focus on patient outcomes to assess the impact of interventions, identify potential areas for improvement, and provide feedback to clinicians. Improving antibiotic use has a significant impact on rates of hospital-onset CDI, thus making CDI in hospitals an important patient-centered target for stewardship programs [7, 20, 21]. Reducing antibiotic resistance is another important goal of antibiotic stewardship and presents an option for measurement, particularly for specific patient care locations with active stewardship interventions.

Tracking actual antibiotic use is an objective indicator of prescribing practices. Hospital ASPs should measure overall use of antibiotics as well as conduct focused analyses on specific antibiotic(s) and hospital locations where stewardship actions are implemented. For example, the assessment of an intervention to improve the treatment of community-acquired pneumonia would be expected to impact the use of specific antibiotic agents on medical wards, rather than surgical wards. As part of the National Healthcare Safety Network surveillance system, the CDC has developed an Antibiotic Use Option that electronically collects and reports monthly antibiotic use data, which can be analyzed in aggregate and by specific agents and patient care locations [22]. As more facilities enroll in the Antibiotic Use Option, the CDC will begin to establish risk-adjusted facility benchmarks for antibiotic use. Antibiotic use rates, however, do not necessarily reflect appropriateness of use, and further work is needed to explore the factors associated with high and low use [23].

EDUCATION

ASPs should provide regular updates on antibiotic prescribing, antibiotic resistance, and infectious diseases management that address both national and local issues [24]. Sharing facility-specific information on antibiotic use is a tool to motivate improved prescribing, particularly if wide variations in the patterns of use exist among similar patient care locations [25]. Reviewing deidentified cases with providers in which changes in antibiotic therapy could have been made is another useful approach. Avariety of Web-based educational resources are available that can help facilities develop educational content [26]. Education has been found to be most effective when paired with corresponding interventions and measurement of outcomes [5].

FUTURE DIRECTIONS

The integration of information technology into the clinical data presentation and decision making for antibiotic use will expand with increased uptake and capabilities of electronic health records. The use of rapid diagnostic tests is an area of great interest, and further research is needed to determine how they can best be applied to stewardship efforts. As more facilities engage in efforts to optimize antibiotic use, future work is needed to evaluate which interventions or antibiotic targets yield the greatest benefit in improving patient care, reducing patient risk of CDI and other adverse events, and combating antibiotic resistance.

CONCLUSIONS

ASPs directed at improving antibiotic use can be implemented in a variety of ways that are feasible in any US hospital. In general, success is dependent on defined leadership and a coordinated multidisciplinary approach to implement improvement strategies, monitor antibiotic prescribing, and educate. The proven benefits of ASPs, combined with the urgent need to address *C. difficile* and antibiotic resistance, have prompted the CDC to recommend that all hospitals have an ASP. The CDC's *Core Elements of Hospital Antibiotic Stewardship Programs*, as well a variety of resources available on the Get Smart for Healthcare Web site, is designed to assist hospitals in both starting and expanding ASPs [4, 27].

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Table 1.

Core Elements of Hospital Antibiotic Stewardship Programs

Leadership commitment	Dedicating necessary human, financial, and information technology resources
Accountability	Appointing a single leader responsible for program outcomes and accountable to an executive-level or patient quality–focused hospital committee. Experience with successful programs shows that a physician or pharmacist leader is effective
Drug expertise	Appointing a single pharmacist leader responsible for working to improve antibiotic use
Action	Implementing at least 1 recommended action, such as systemic evaluation of ongoing treatment need after a set period of initial treatment (ie, antibiotic “time-out” after 48 h)
Tracking	Monitoring process measures (eg, adherence to facility-specific guidelines, time to initiation or de-escalation), impact on patients (eg, *Clostridium difficile* infections, antibiotic-related adverse effects and toxicity), antibiotic use and resistance
Reporting	Regular reporting of the above information to doctors, nurses, and relevant staff
Education	Educating clinicians about disease state management, resistance, and optimal prescribing

Source: Centers for Disease Control and Prevention [4].

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