



Implementation of **Antibiotic Stewardship Core Elements** at Small and Critical Access Hospitals



**Centers for Disease
Control and Prevention**
National Center for Emerging and
Zoonotic Infectious Diseases

This document provides guidance on practical strategies to implement antibiotic stewardship programs in small and critical access hospitals.^{1,2} It was developed as a collaboration between The Centers for Disease Control and Prevention, The American Hospital Association, The Federal Office of Rural Health Policy and The Pew Charitable Trusts.

The suggestions provided here are based on discussions with staff in small and critical access hospitals, several of which have implemented all of the CDC Core Elements.

Introduction

Improving antibiotic use in hospitals is imperative to improving patient outcomes. Antibiotic use has well known unintended consequences, including *Clostridium difficile* (*C. difficile*) diarrhea and other adverse events.³ *C. difficile* infections alone affect more than 500,000 patients and are associated with more than 15,000 deaths in the United States each year.⁴ Moreover, antibiotic use is an important driving factor in the growing crisis of antibiotic resistance in the United States. The Centers for Disease Control and Prevention (CDC) estimates that each year in the United States, more than 2 million patients are infected by an organism that cannot be treated by the recommended antibiotic and more than 20,000 of these patients die. Not only does antibiotic resistance threaten the well-being of patients on a daily basis, the loss of effective antibiotics imperils our ability to deliver life-saving medical care like surgery and cancer chemotherapy.

Fortunately, programs focused on improving antibiotic use or “antibiotic stewardship programs” have proven to be effective in mitigating these threats.⁵ Published evidence demonstrates that antibiotic stewardship programs can: improve infection cure rates and reduce *C. difficile* infections, other adverse events from antibiotics and antibiotic resistance. Furthermore, they achieve all of these gains while saving money.⁵

CDC has called on all hospitals across the country to implement antibiotic stewardship programs⁶ and the [American Hospital Association](#) has highlighted antibiotic stewardship as one of the ways that hospitals can more appropriately use medical resources. [The Pew Charitable Trusts](#) has also supported antibiotic stewardship policies and [developed resources](#)⁷ that profile how hospitals have been able to implement stewardship programs utilizing available resources.

To help hospitals implement and expand effective stewardship programs, in 2014, CDC released in 2014 “[The Core Elements of Hospital Antibiotic Stewardship Programs](#)”¹ that identifies key structural and functional aspects of effective programs. The seven core elements were designed to be flexible to facilitate implementation in hospitals of any size.

Since 2014, CDC has used the National Healthcare Safety Network (NHSN) annual hospital survey to query hospitals about their implementation of the core elements. Results have shown disparities among hospital types, specifically according to bed size. In 2015, more than 50% of hospitals with more than 50 beds reported meeting all seven core elements compared to 26% of hospitals with 25 or fewer beds.

While small and critical access hospitals face special challenges in implementing the CDC core elements, in part due to limitations in staffing, infrastructure and resources, antibiotic stewardship is no less important in these settings. Patients in small and critical access hospitals have not been spared the problems of antibiotic resistance and *C. difficile*. However, small and critical access hospitals also have some factors that can support improvements in care, as they are often tight-knit communities where collaboration is the norm. Encouragingly, over 200 critical access hospitals reported implementation of all seven core elements in 2015, demonstrating that it is feasible to implement all of the core elements in smaller hospitals.

Implementation Suggestions

Our goal is to present a range of implementation options that might be useful. Each hospital is unique and will need to consider which options might be most effective based on discussions with providers. Flexibility and tailoring approaches to local needs is essential. The options presented are not intended as a checklist of “must-dos.” Rather, the goal is to present options that might help small and critical access hospitals ensure that each of the core elements is in place.



Photo courtesy of Lincoln County Hospital

Core Elements 1 and 2: Leadership Commitment/Accountability

Leadership commitment by hospital executives and board trustees in small and critical access hospitals is important to ensuring allocation of the necessary resources to support antibiotic stewardship programs. Obtaining leadership commitment from the chief medical officer (CMO), pharmacy director, and nursing leaders can facilitate physician, pharmacist, infection preventionist, and nurse engagement to implement stewardship initiatives to create a strong and sustainable program.

Examples of implementation strategies:

- Designate a physician (e.g., CMO) in the C-suite or individual that reports to C-suite to be accountable for the outcomes of the antibiotic stewardship program.
- Approve a policy for the creation and/or expansion of the antibiotic stewardship program to include all core elements.
- Integrate stewardship activities into ongoing quality improvement and/or patient safety efforts in the hospital (e.g., efforts to improve sepsis management)
- Create a reporting structure for the stewardship program to ensure that information on stewardship activities and outcomes is shared with facility leadership and the hospital board (e.g., semi-annual stewardship update at the board meeting).
- Issue a formal board-approved statement on the importance of the antibiotic stewardship program and include in the hospital's annual report.
- Issue a statement from the hospital leadership (e.g., medical, pharmacy and nursing) to all providers and patients highlighting the hospital's commitment to improving antibiotic use.
- Support training for hospital stewardship leaders on antibiotic stewardship through on-line or in-person courses.



Some small and critical access hospitals have found it helpful to seek off-site support for their antibiotic stewardship efforts. Some examples include:

- Enrolling in multi-hospital, collaborative efforts to improve antibiotic use. Consider contacting state hospital associations, state or local public health agencies, and/or large academic medical centers to identify existing antibiotic stewardship collaboratives.
- Funding remote consultation or telemedicine with experts in antibiotic stewardship (e.g., infectious diseases physicians and pharmacists).
 - Even when remote expertise is used, it is important to have a leader of the program who is on staff at the hospital.
- Placing stewardship requirements into the contractual responsibilities of any external pharmacy services including a requirement that pharmacy contractors have formal stewardship training.

Core Element 3: Drug Expertise

In most critical access hospitals, a pharmacist, usually one who is on-site, provides the leadership and expertise for the antibiotic stewardship program. When possible, having a physician leader is helpful to support the pharmacist. Leaders of stewardship programs can expand their knowledge and experience through a variety of educational programs and through participation in multi-hospital stewardship collaboratives. External expertise via remote or on-site consultation has also been helpful in some critical access hospitals.

Examples of implementation strategies:

- Appoint a pharmacist leader, ideally someone who is on-site either full- or part-time. Consider having stewardship as part of the job description or service contract of the pharmacist leader and ensure that leaders have dedicated time to spend on developing and maintaining a stewardship program.
- Appoint a physician leader to provide physician support to the antibiotic stewardship program, ideally someone who is on-site either full- or part-time.
- Offer access to training courses on antibiotic stewardship to help develop local expertise.
- Seek additional expertise by joining multi-hospital improvement collaboratives or through remote consultation (e.g. telemedicine).



Core Element 4: Action

There are a number of evidenced-based interventions that can improve antibiotic use. Decisions on which one(s) to implement should be based on local needs, which are best determined through discussions with providers and review of local information on antibiotic use.

The majority of all antibiotic use in hospitals is driven by just three conditions: community-acquired pneumonia (CAP), urinary tract infections (UTIs) and skin and soft tissue infections (SSTIs). Studies have demonstrated a number of interventions to improve antibiotic use for each of these and hence these are often high-yield targets for improvement.

Studies have also shown important opportunities to stop or narrow the spectrum of therapy in cases where certain important and/or broad spectrum antibiotics are prescribed as initial therapy. Resources can be maximized by reviewing courses of therapy of certain key antibiotics like carbapenems, piperacillin-tazobactam and anti-MRSA agents like vancomycin. Determining which agents to focus on should be driven by discussions with providers. Data suggest that the yield of reviews is maximized when they are done after about 2 days of treatment when culture results are generally available. These reviews can focus on three important questions: Is an antibiotic still needed? If so, is the antibiotic tailored to the culture results (e.g. is the narrowest spectrum agent being used?) And, how long should the antibiotic be used?

The table below summarizes some of the key areas where studies and guidelines suggest important opportunities to improve antibiotic use. Ideally, treatment decisions should be driven by local data on antibiotic resistance. If local antibiograms are unavailable, consider using regional resistance data. Many critical access hospitals have found it most useful and efficient to adapt antibiotic treatment recommendations from nearby hospitals, collaborative efforts or from on-line resources. Adoption of recommendations can be enhanced by requiring an indication for therapy when antibiotics are ordered and by embedding recommendations in computer order entry systems where possible.



TABLE 1. KEY OPPORTUNITIES TO IMPROVE ANTIBIOTIC USE

	Diagnostic Considerations	Guide Empiric Therapy	Assess Duration of Therapy including discharge prescription
Community-acquired pneumonia⁸	Review cases at 48 hours to confirm pneumonia diagnosis versus non-infectious etiology.	Avoid empiric use of antipseudomonal beta-lactams and/or methicillin-resistant <i>Staphylococcus aureus</i> (MRSA) agents unless clinically indicated.	Guidelines suggest that in most cases, uncomplicated pneumonia can be treated for 5-7 days in the setting of a timely clinical response.
Urinary tract infections⁹⁻¹¹	Implement criteria for ordering urine cultures to ensure that positive cultures are more likely to represent infection, rather than bladder colonization. Examples include: -Only order a urine culture if the patient has signs and symptoms consistent with UTI such as urgency, frequency, dysuria, suprapubic pain, flank pain, pelvic discomfort and acute hematuria. -For patients with urinary catheters, avoid culturing urine based solely on cloudy appearance or foul smell in the absence of signs and symptoms of UTI. Non-specific signs and symptoms such as delirium, nausea, vomiting should be interpreted with caution as by themselves they have a low specificity for UTI.	Establish criteria to distinguish between asymptomatic and symptomatic bacteriuria. Avoid antibiotic therapy for asymptomatic bacteriuria except in certain clinical situations where treatment is indicated, such as for pregnant women and those undergoing an invasive genitourinary procedure. Fluoroquinolones are often not optimal empiric therapy.	Use the shortest duration of antibiotic therapy that is clinically appropriate.
Skin and soft tissue infections¹²	Develop diagnostic criteria to distinguish purulent and non-purulent infections and severity of illness (i.e., mild, moderate and severe) so that skin and soft tissue infections can be managed appropriately according to guidelines.	Avoid empiric use of antipseudomonal beta-lactams and/or anti-anaerobic agents unless clinically indicated.	Guidelines suggest that most cases of uncomplicated bacterial cellulitis can be treated for 5 days if there is a timely clinical response.

There are also key stewardship actions that can be implemented by other team members in small and critical access hospitals. Indeed, experts working on stewardship in these hospitals emphasize the value of a team-based approach.

- The following items are daily activities that can also be performed by a pharmacist:
 - Review antibiotics for unnecessary duplicative antibiotic therapy, such as double anaerobic (e.g., piperacillin/tazobactam AND metronidazole) or double anti-MRSA coverage.
 - Review for opportunities for intravenous to oral conversion (e.g. patients taking other oral medications).
 - Monitor for medication safety (e.g., renal dose adjustments) though these represent general pharmacy practices and are not specific to stewardship.
- Nurses play an important role in implementing stewardship actions in critical access hospitals.¹³ For example, nurses can:
 - Review culture techniques to ensure that microbiology cultures are collected properly.
 - Review culture results with the treating clinician and pharmacist.
 - Monitor response to antibiotic therapy with feedback to the treating clinician and pharmacist.
 - Assess oral intake and clinical status to alert providers and pharmacist when there are opportunities to convert antibiotics from intravenous to oral therapy.
 - Educate patients about potential adverse events associated with antibiotics, especially *C. difficile* infection.
 - Nurses are also well positioned to initiate “antibiotic time-outs” with the treating clinician and pharmacist, and review antibiotic therapy after 48 hours of treatment.



Core Element 5: Tracking

Data are essential for informing and assessing stewardship actions. A variety of data options are outlined below, and some hospitals might also have more individualized measures. Small and critical access hospitals can review options and make decisions based on local needs and resources. The ultimate key is to have a measure that is useful for stewardship activities, meaningful to providers and that can be tracked over time to assess improvements.

Days of therapy is considered the most useful measure of antibiotic use to inform stewardship efforts. Facilities can electronically capture, analyze and benchmark days of therapy through the [CDC's National Healthcare Safety Network \(NHSN\) Antimicrobial Use \(AU\) Option](#).¹⁴ Tracking adherence to treatment recommendations and performance of interventions such as antibiotic time-outs can be useful to further guide quality improvement efforts. In addition, small and critical access hospitals are well positioned to monitor antibiotic use at the provider level. This type of individual-level feedback can be very helpful. Stewardship programs can work with infection control programs to track data on *C. difficile* and antibiotic-resistant infections. Finally, antibiotic expenditures should not be used as a way to track the effectiveness of stewardship efforts as antibiotic expenditures do not always correlate with antibiotic use.



Examples of implementation strategies:

- Submit antibiotic use and resistance through CDC NHSN AU and Resistance Module.
 - Alternative approach (if NHSN AU Option not feasible): Calculate defined daily dose (DDD) per [WHO ATC DDD Guidelines](#)¹⁵ for top 5 commonly used antibiotics (e.g., ceftriaxone, azithromycin, vancomycin, piperacillin-tazobactam, and fluoroquinolones). This can be useful in tracking antibiotic use over time at a given hospital. Note that the DDD metric has limitations in [pediatrics](#).¹⁶
- Monitor adherence to facility-specific treatment recommendations (see above in Action) for CAP, UTI and SSTI. If feasible, consider tracking adherence to treatment recommendations per provider.¹
- Monitor the performance of antibiotic time-outs to see how often these are being done and if opportunities to improve use are being realized during time-outs.
- Perform a medication use evaluation to assess courses of therapy for selected antibiotics (e.g., piperacillin-tazobactam, carbapenems, vancomycin, fluoroquinolones) to see if there are opportunities to improve use.
- Monitor how often patients are converted from intravenous to oral therapy and assess to see if there are missed opportunities to convert.
- Assess how often patients are prescribed unnecessary duplicate therapy (e.g., two antibiotics to treat anaerobes).



Core Element 6: Reporting

The reporting for critical access hospitals should be consistent with the action and tracking components of the antibiotic stewardship program (e.g., optimizing diagnosis and treatment for the commonly encountered infections, reducing unnecessary duplicate therapy, etc). As mentioned above, data on stewardship efforts should be reported not just to providers, but also to the hospital leadership and board. A key to success is to discuss reporting options with stakeholders to determine optimal timing, format and delivery method(s) for the reports.

Examples of implementation strategies:

- Prepare regular reports on the measures being tracked related to antibiotic use. Include these data as a standing report to key stakeholders within the facility, e.g., pharmacy and therapeutics, patient safety/quality, medical staff leadership/committees, and hospital board.
- If feasible, share provider-specific reports with individual clinicians confidentially.
- Distribute data and key messaging through staff newsletters and emails.



Core Element 7: Education

The limited number of providers, along with the collaborative nature of many small and critical access hospitals, create some unique advantages for providing individualized education compared to larger hospitals. The pharmacist and/or physician leader can provide stewardship education (e.g., optimizing diagnosis and treatment for the commonly encountered infections, reducing unnecessary duplicate therapy, etc.) to individual providers and pharmacists. Specific education for nurses could also be very helpful, for example, criteria for intravenous to oral conversion, optimal technique for culture collection, and criteria for when to obtain a urine culture. Lastly, patient and family education can also help drive improvements in antibiotic use and empower patients and families to help monitor for important adverse events, like *C. difficile* infection. To help with patient and family education, the CDC developed a [fact sheet on antibiotic use for hospitalized patients](#).¹⁷

Examples of Implementation Strategies:

- Integrate regular (e.g., monthly or at least quarterly) updates on antibiotic stewardship and resistance into communications tools with particular focus on interventions related to CAP, UTI and SSTI (e.g., blogs, website, intranet, and employee newsletters).
- Provide targeted in-person or web-based educational presentations and messages to key provider, pharmacist and nursing groups at least annually (e.g., staff meetings for sections).
- One-on-one provider education/coaching (e.g., academic detailing).
- Incorporate antibiotic stewardship education into orientation for new medical, pharmacist and nursing staff and required annual provider educational programs.
- Incorporate antibiotic stewardship into (re)credentialing education
- Ask the patient-family advisory committee for input on patient education material.
- Develop stories to share how patients' lives are affected by complications of antibiotic use (e.g. *C. difficile* infection).
- Include information on antibiotics in patient education materials.



References

1. Centers for Disease Control and Prevention. Core Elements of Hospital Antibiotic Stewardship Programs. Atlanta, GA: US Department of Health and Human Services, CDC; 2014 <http://www.cdc.gov/getsmart/healthcare/implementation/core-elements.html> Accessed 5/26/2017
2. National Quality Forum. National Quality Partners Playbook: Antibiotic Stewardship in Acute Care. Washington, DC. 2016. http://www.qualityforum.org/Publications/2016/05/National_Quality_Partners_Playbook_Antibiotic_Stewardship_in_Acute_Care.aspx Accessed 5/26/2017.
3. Centers for Disease Control and Prevention. Antibiotic resistance threats in the United States, 2013 Atlanta, GA: CDC; 2013.
4. Lessa FC, Mu Y, Bamberg WM, et al. Burden of *Clostridium difficile* infection in the United States. New England Journal of Medicine 2015; 372:825-34.
5. Dellit TH, Owens RC, McGowan JE, Jr., et al. Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. Clinical infectious diseases: an official publication of the Infectious Diseases Society of America. 2007; 44:159–177.
6. The White House. NATIONAL STRATEGY FOR COMBATING ANTIBIOTIC RESISTANT BACTERIA. 2014. https://obamawhitehouse.archives.gov/sites/default/files/docs/carb_national_strategy.pdf Accessed 5/26/2017.
7. The Pew Charitable Trusts Report. A Path to Better Antibiotic Stewardship in Inpatient Settings. 10 case studies map how to improve antibiotic use in acute and long-term care facilities. Washington, DC. April 2016. <http://www.pewtrusts.org/~media/assets/2016/04/apathbetterantibioticstewardshipininpatientsettings.pdf> Accessed 6/26/2017.
8. Mandell LA, Wunderink RG, Anzueto A, et al. Infectious Diseases Society of America/American Thoracic Society Consensus Guidelines on the Management of Community-Acquired Pneumonia in Adults. Clinical Infectious Diseases: an official publication of the Infectious Diseases Society of America. 2007; 44:S27–72.
9. Nicolle LE, Bradley S, Colgan R, et al. Infectious Diseases Society of America guidelines for the diagnosis and treatment of asymptomatic bacteriuria in adults. Clinical infectious diseases: an official publication of the Infectious Diseases Society of America. 2005; 40:643–654.
10. Hooton TM, Bradley SF, Cardenas DD, et al. Diagnosis, prevention, and treatment of catheter-associated urinary tract infection in adults: 2009 International Clinical Practice Guidelines from the Infectious Diseases Society of America. Clinical infectious diseases: an official publication of the Infectious Diseases Society of America. 2010; 50:625–663.
11. Gupta K, Hooton TM, Naber KG, et al. International clinical practice guidelines for the treatment of acute uncomplicated cystitis and pyelonephritis in women: A 2010 update by the Infectious Diseases Society of America and the European Society for Microbiology and Infectious Diseases. Clinical infectious diseases: an official publication of the Infectious Diseases Society of America. 2011; 52:e103–20.
12. Stevens DL, Bisno AL, Chambers HF, et al. Practice Guidelines for the Diagnosis and Management of Skin and Soft Tissue Infections: 2014 Update by the Infectious Diseases Society of America. Clinical infectious diseases: an official publication of the Infectious Diseases Society of America. 2014; 59:e10–52.
13. Olans RN, Olans RD, and DeMaria A Jr. The critical role of the staff nurse in antimicrobial stewardship – Unrecognized, but Already There. Clinical infectious diseases: an official publication of the Infectious Diseases Society of America. 2016; 62:84–89.
14. Centers for Disease Control and Prevention. National Healthcare Safety Network Antimicrobial Use and Resistance (AUR) Module. Atlanta, GA: CDC; 2017. <https://www.cdc.gov/nhsn/acute-care-hospital/aur/index.html> Accessed 6/27/2017.
15. World Health Organization Centre for Drug Statistics Methodology and Norwegian Institute of Public Health. ATC/DDD Index 2017. https://www.whocc.no/atc_ddd_index/ Accessed 6/26/2017.
16. World Health Organization ATC/DDD Toolkit <http://www.who.int/medicines/regulation/medicines-safety/toolkit/en/> Accessed 6/26/2017.
17. Centers for Disease Control and Prevention. Get Smart Know When Antibiotics Work. You've Been Prescribed an Antibiotic Now What? https://www.cdc.gov/getsmart/healthcare/pdfs/16_265926-antibioticfactsheet_v7_508-final.pdf Accessed 6/26/2017.

Appendix: Additional Resources for Antibiotic Stewardship Programs (that are not part of text)

General Resources

- [The National Quality Partners Playbook: Antibiotic Stewardship in Acute Care:](#) Comprehensive list of suggested tools and resources for each core element for antibiotic stewardship.
- [Joint Commission Resources.](#) Regulatory and Accreditation Requirements

Certificate Training Programs

- Making a Difference in Infectious Diseases (MAD-ID) [Antimicrobial Stewardship Certificate Training Program.](#)
- Society of Infectious Diseases Pharmacists (SIDP) [Antimicrobial Stewardship Certificate Training Program.](#)

Implementation Tools

- Centers for Disease Control and Prevention (CDC) and The Pew Charitable Trusts. [Strategies to assess antibiotic use to drive improvements in hospitals](#)
- EQUIP (Education, Quality, Infection Prevention, Training, and Professional Development Program). [Jump Start Stewardship. Implementing Antimicrobial Stewardship in a Small Rural Hospital.](#)
- Kansas Department of Health and Environment. [Antimicrobial Stewardship Programs a Toolkit for Critical Access Hospitals in Kansas.](#)
- The Society for Healthcare Epidemiology of America. Antimicrobial stewardship: [Implementation tools & resources.](#)

Tracking and Reporting:

- Centers for Disease Control and Prevention (CDC). [Multidrug-Resistant Organism & Clostridium difficile Infection module. Atlanta, GA: CDC; 2017.](#)
- Society of Infectious Diseases Pharmacists (SIDP). [Software vendors who support the CDC Antimicrobial Use and Resistance Initiative.](#)

Education:

- [CDC Get smart about antibiotics week website.](#)