



2018 ANTIBIOTIC USE UPDATE IN THE UNITED STATES

PROGRESS AND OPPORTUNITIES



**U.S. Department of
Health and Human Services**
Centers for Disease
Control and Prevention

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Introduction

Antibiotics are the most powerful tools we have to fight life-threatening infections, like those that can lead to sepsis. However, anytime antibiotics are used, they can cause side effects and contribute to antibiotic resistance. The Centers for Disease Control and Prevention (CDC) is working to promote appropriate use by helping prescribers use the right antibiotic, at the right dose, for the right duration, and at the right time, and reduce unnecessary antibiotic use.

Improving the way we prescribe and use antibiotics, or “antibiotic stewardship,” is critical to effectively treat infections, protect patients from harms caused by unnecessary antibiotic use, and combat antibiotic resistance. The United States has made some progress in improving antibiotic prescribing and use in human health, but many opportunities remain.

In 2017, CDC released “[Antibiotic Use in the United States, 2017: Progress and Opportunities](#),” which included information about antibiotic use in healthcare settings and highlighted programs and resources to support stewardship.

The report also demonstrates the specific roles and actions for:

- healthcare providers
- patients and their families
- health systems, hospitals, and clinics
- nursing homes
- healthcare quality organizations
- health insurance companies
- healthcare provider professional organizations
- federal, state, and local health agencies

This 2018 update highlights new antibiotic stewardship data, programs, and resources since the July 2017 report. CDC continues to work to improve antibiotic prescribing and use through data for action, implementation, innovation, and education.

In 2016, Congress recognized the urgent need to combat antibiotic resistance and appropriated financial resources for CDC to implement the **Antibiotic Resistance Solutions Initiative**, which is improving the United States’ capacity to:



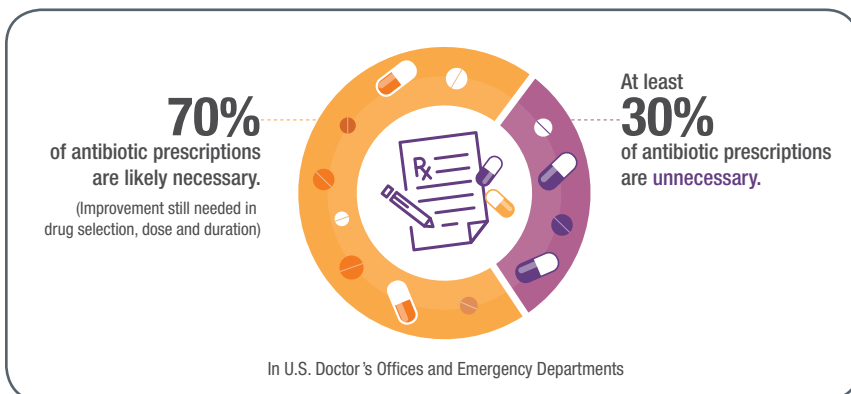
Detect, respond to, and contain emerging resistance.



Prevent and stop spread of resistant infections in healthcare and community settings.



Improve antibiotic use.



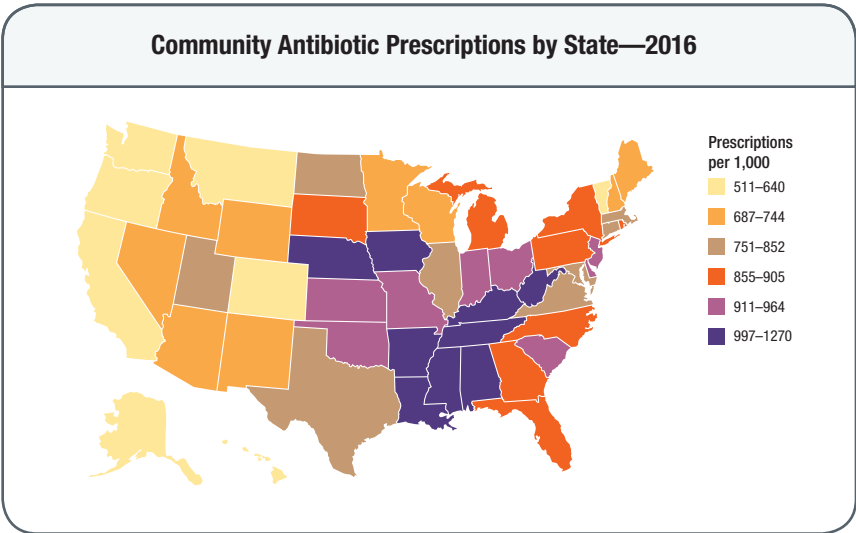
Data for Action

One of the most important ways CDC helps improve antibiotic use is producing and analyzing data to support healthcare facilities and providers in making the best choices for their patients. Healthcare facilities, providers, health departments, and other partners can use these data to identify opportunities to improve antibiotic stewardship efforts.

2016 Outpatient Antibiotic Prescribing Data

Too many antibiotics are prescribed unnecessarily in the United States. CDC estimates about 47 million antibiotic courses each year are prescribed for infections that don't need antibiotics in U.S. doctors' offices and emergency departments each year. That's about 30% of all antibiotics prescribed.

Antibiotic prescribing nationally has improved, with a 5% decrease from 2011 to 2016, but more progress needs to be made. In 2016, 270.2 million antibiotic prescriptions were written in the United States. That's enough antibiotic courses for five out of every six Americans (on average) to receive an antibiotic prescription. Prescribing rates vary by state, with a 2.5-fold difference between the lowest and prescribing states, suggesting there are opportunities for improvement.

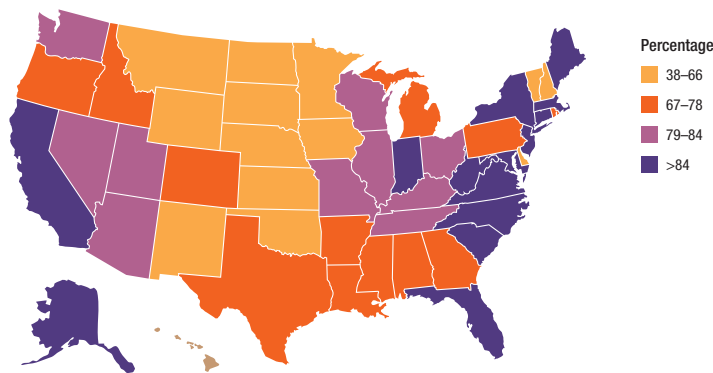


2017 Hospital Antibiotic Stewardship Program Data

The number of hospitals that reported having an antibiotic stewardship program meeting all seven of CDC's **Core Elements of Hospital Antibiotic Stewardship Programs** almost doubled from 2014 to 2017. Of the 4,992 acute care hospitals responding to the 2017 National Healthcare Safety Network (NHSN) Annual Hospital Survey, 3,816 (76.4%) reported uptake of all seven Core Elements. This increase is likely driven by a number of factors, including new accreditation requirements for hospitals.

CDC is working with accreditation organizations to improve assessment of the quality of antibiotic stewardship programs. The national goal is 100% by 2020.

Percentage of Hospitals Meeting all 7 Core Elements, by State—2017



Core Elements of Antibiotic Stewardship for Hospitals



Leadership Commitment

Dedicating necessary human, financial, and information technology resources.



Accountability

Appointing a single leader responsible for program outcomes.



Drug Expertise

Appointing a single pharmacist leader responsible for working to improve antibiotic use.



Action

Implementing at least one recommended action, such as systemic evaluation of ongoing treatment need after a set period of initial treatment.



Tracking

Monitoring antibiotic prescribing and resistance patterns.



Reporting

Regular reporting information on antibiotic use and resistance to doctors, nurses, and relevant staff.



Education

Educating clinicians about resistance and optimal prescribing.



Opportunities to Improve Antibiotic Use

While progress has been made to improve antibiotic use, there is still more work to be done. CDC studies show that, across all healthcare settings, antibiotics are being prescribed for illnesses that don't require antibiotics. The studies also show that when antibiotics are required to treat infections, the wrong antibiotic type, dose, and duration are often prescribed. Improving antibiotic use is important to effectively treat infections, protect patients from harms caused by unnecessary antibiotic use, and combat antibiotic resistance, one of the most urgent threats to the public's health.

Antibiotics are often unnecessarily prescribed for common respiratory conditions in outpatient settings.

[“Comparison of Antibiotic Prescribing in Retail Clinics, Urgent Care Centers, Emergency Departments, and Traditional Ambulatory Care Settings in the United States,”](#) published in *The Journal of the American Medical Association: Internal Medicine* in July 2018, found that healthcare providers in outpatient settings often prescribed antibiotics for respiratory illnesses for which antibiotics are not needed, such as the common cold and bronchitis. Four outpatient settings were studied:

- urgent care centers
- emergency departments (EDs)
- retail health clinics
- traditional medical offices

Healthcare providers in urgent care centers prescribed antibiotics unnecessarily for respiratory illnesses that don't require antibiotics 46% of the time, compared to 25% in EDs, 17% in medical offices, and 14% in retail health clinics. Urgent care centers also had the highest percentage of all visits that led to an antibiotic prescription.

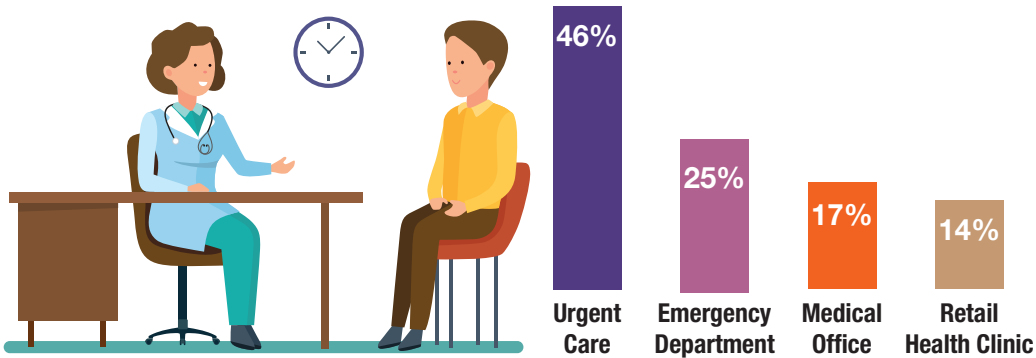
Based on these new data representing all outpatient visits, unnecessary antibiotic prescribing in the United States could be higher than the previously estimated 30% reported in a 2016 study, [“Prevalence of Inappropriate Antibiotic Prescriptions Among U.S. Ambulatory Care Visits, 2010–2011.”](#)

CDC is **actively collaborating** with organizations in the urgent care space to **identify successes, challenges, and opportunities for improvement related to antibiotic use.**

The Urgent Care Association (UCA), the largest urgent care professional organization, is incorporating antibiotic stewardship as an essential component of any UCA-accredited organization's quality plan.



Percent of Visits for Respiratory Illnesses With an Unnecessary Antibiotic Prescription



Fluoroquinolones are unnecessarily prescribed for urinary tract infections and respiratory conditions.

“[Opportunities to Improve Fluoroquinolone Prescribing in the United States for Adult Ambulatory Care Visits](#),” published in *Clinical Infectious Diseases* in January 2018, reported that about 5% of all fluoroquinolone antibiotics prescribed for adults in medical offices and EDs in 2014 were unnecessary. This study also reported that about 20% of all fluoroquinolone prescriptions in these two settings were not the recommended first-line treatment. Nearly 32 million fluoroquinolone prescriptions were dispensed from U.S. outpatient pharmacies.

Fluoroquinolones are not the recommended first-line treatment for urinary tract infections (UTIs) or sinusitis, but these conditions accounted for an estimated 6.3 million prescriptions in 2014. Fluoroquinolones were the most commonly prescribed antibiotic for UTIs. Colds and bronchitis, which should not be treated with antibiotics, led to an estimated 1.6 million unnecessary fluoroquinolone prescriptions in medical offices and EDs in 2014.

Fluoroquinolones can cause disabling and potentially permanent side effects, including damage to tendons, muscles, joints, nerves, and the central nervous system. Fluoroquinolone use can also lead to life-threatening [Clostridioides difficile \(C. difficile\) infection](#), which causes diarrhea that can lead to severe colon damage and death.



[CDC Commentary: Thinking of a Fluoroquinolone? Think Again](#)

View this video on Medscape [4:38]

Summary of CDC study published in *Clinical Infectious Diseases* that provides data on fluoroquinolone prescribing and use, and information on why appropriate fluoroquinolone prescribing is an important patient safety issue.



In 2016, the [Food and Drug Administration \(FDA\) issued a warning](#) advising healthcare providers to use fluoroquinolones only for patients with conditions for which no alternative, effective treatment options are available. In December 2018, [FDA issued another warning about fluoroquinolone use](#) due to the increased risk of ruptures or tears in the aorta blood vessel in certain patients.

Nearly 70% of antibiotic courses for sinus infections were longer than recommended.

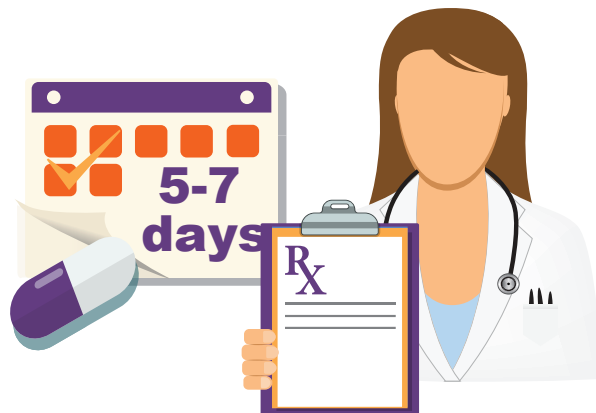
“[Antibiotic Therapy Duration in U.S. Adults With Sinusitis](#),” published in *The Journal of the American Medical Association: Internal Medicine* in July 2018, reports that primary care physicians are prescribing longer durations of antibiotics for sinus infections than recommended by clinical practice guidelines.

A key antibiotic stewardship principle is to use the shortest, most effective length of antibiotic treatment recommended by guidelines.

This 2018 study also reports that nearly 70% of antibiotic prescriptions were for 10 days or longer. Yet the [Infectious Diseases Society of America guidelines](#) recommend treating adults with uncomplicated sinus infections with five to seven days of antibiotics, when antibiotics are needed for sinus infections. “Uncomplicated” means that the patient:

- is at low risk of developing an antibiotic-resistant infection
- does not have any signs that the infection is spreading beyond the sinuses
- starts getting better in the first few days with antibiotics

Guidelines recommend **five to seven days** of antibiotic treatment for most sinus infections in adults. However, **almost 70%** of antibiotic prescriptions for sinus infections are for **10 days**.



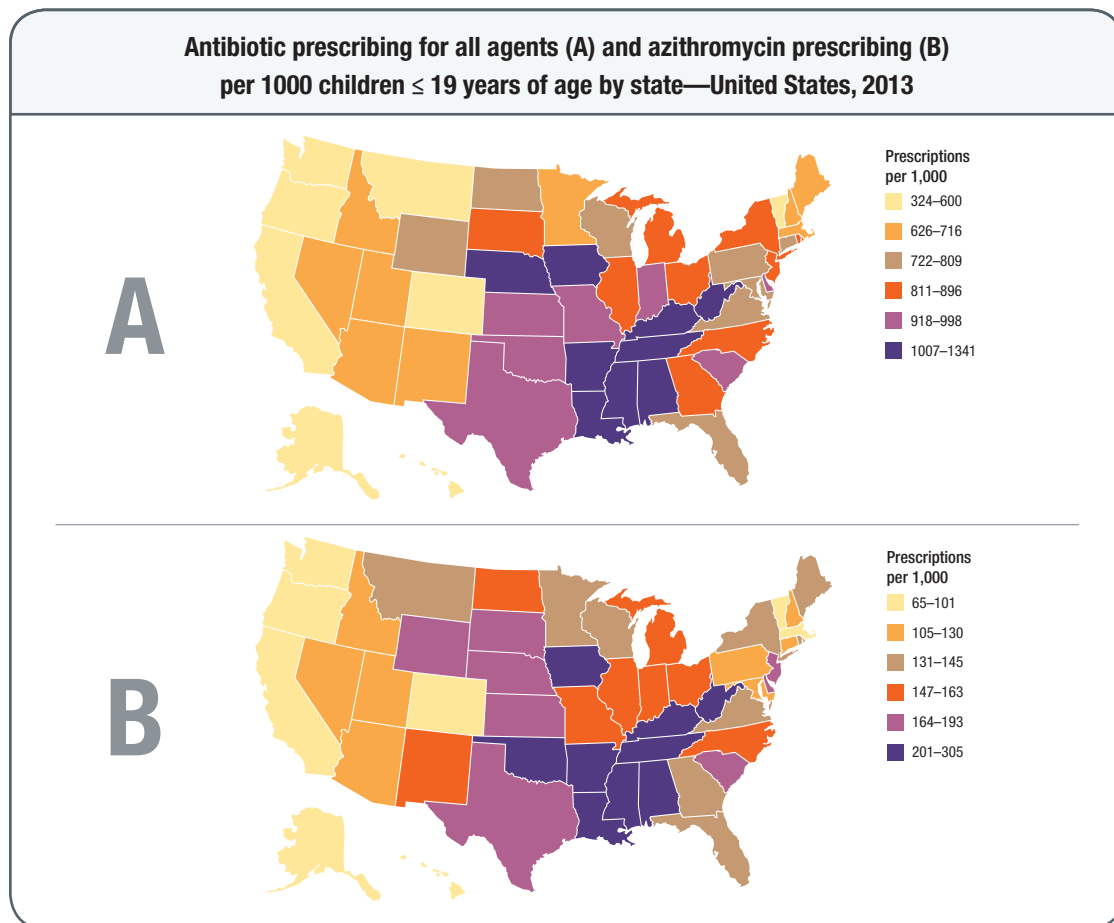
Five days of azithromycin use accounted for more than 20% of antibiotics prescribed for sinus infections. However, treatment guidelines recommend against prescribing azithromycin due to high rates of existing resistance to this drug and others in its class.

As noted in a 2016 study, **“Prevalence of Inappropriate Antibiotic Prescriptions among US Ambulatory Care Visits, 2010–2011,”** antibiotics are prescribed for sinus infections more than any other illness in outpatient settings.

Improvement is needed in antibiotic selection in children.

“Variations in Antibiotic and Azithromycin Prescribing for Children by Geography and Specialty—United States, 2013,” a CDC study released in the *Pediatric Infectious Disease Journal* in January 2018, found that azithromycin, a commonly prescribed antibiotic in children, is often prescribed when it’s not recommended or not the recommended first-line drug by clinical guidelines. The study also found that when antibiotics were prescribed, family practitioners were more likely to choose azithromycin than pediatricians.

In 2013, nearly 67 million antibiotics were prescribed to children younger than 19, the most common of which were amoxicillin (35%) and azithromycin (18%). Amoxicillin is a recommended first-line antibiotic for many common illnesses in children, including ear infections, sinus infections, and strep throat. But azithromycin, with a few exceptions, is not a recommended treatment for common pediatric infections. This misuse of azithromycin is concerning because patients might not be receiving the best therapy, and it contributes to antibiotic resistance.



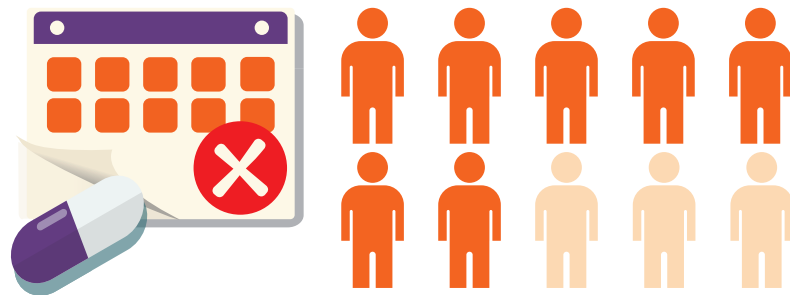
Antibiotic duration is too long in adult hospitalized patients with community-acquired pneumonia.

“[Duration of Antibiotic Use Among Adults With Uncomplicated Community-Acquired Pneumonia Requiring Hospitalization in the United States](#),” published in *Clinical Infectious Diseases* in April 2018, reported that antibiotic therapy was too long—just under 10 days—for 70% of adult patients hospitalized for community-acquired pneumonia. Previous studies have suggested that length of antibiotic treatment for community-acquired pneumonia often exceeds national recommendations and represents an important opportunity to improve antibiotic use nationally.

In 2007, the Infectious Diseases Society of America and the American Thoracic Society published national guidelines for treatment of community-acquired pneumonia, recommending a minimum of five days of therapy, with seven or more days rarely necessary. Better adherence to recommended community-acquired pneumonia treatment guidelines, including recommended duration of therapy at hospital discharge, is an important target for antibiotic stewardship programs.

Most adults patients need **five days** of antibiotic therapy for community-acquired pneumonia.

However, **70%** of adult patients hospitalized for community-acquired pneumonia receive almost **10 days** of therapy.



CDC Efforts to Improve Antibiotic Use

CDC uses data to guide efforts to promote appropriate use when antibiotics are needed and reduce unnecessary antibiotic use. To accelerate improvements, support innovation, and help healthcare facilities and providers make the best decisions to treat and protect their patients, CDC provides technical expertise and tools for implementation, data for action, and educational resources.

Evidence and Tools for Implementation: CDC's Core Elements of Antibiotic Stewardship provide frameworks for antibiotic stewardship programs and practices in [outpatient settings](#), [nursing homes](#), and [hospitals](#), including [small hospitals in rural areas](#).

CDC works with public health and healthcare partners, including health systems, hospital associations, professional organizations, academic investigators, private industry, patient and consumer organizations, state and local health departments, and federal partners to promote and facilitate implementation of the Core Elements and explore new ways to improve use.

Measuring Antibiotic Use in Healthcare: One of the most important ways CDC helps improve antibiotic use is producing and analyzing data to support healthcare facilities and providers in making the best choices for their patients. Healthcare facilities can use these data to identify opportunities to ensure appropriate antibiotic use, assess the impact of antibiotic stewardship efforts, and improve patient care. For example, hospitals participating in [CDC's NHSN Antibiotic Use Option](#) can compare their antibiotic use to others, monitor use over time, and use the data to direct hospital antibiotic stewardship programs. CDC is working with partners in all settings to identify, track, and understand antibiotic use data to use these data for improvement.

Education: CDC is also educating healthcare providers and the public about the importance of improving antibiotic use. [Be Antibiotics Aware](#) aims to raise awareness about antibiotic resistance and the importance of appropriate antibiotic prescribing and use. [Get Ahead of Sepsis](#) emphasizes the importance of sepsis early recognition, timely treatment, and reassessment of antibiotic therapy, as well as the importance of preventing infections that can lead to sepsis. Together, these two educational efforts promote the importance of integrating antibiotic stewardship efforts with sepsis management.



Promoting appropriate antibiotic use in sepsis management: When sepsis is suspected, it's critical to start antibiotics as soon as possible. An important component of antibiotic stewardship in sepsis care is to reassess antibiotic therapy to stop or change therapy as needed, based on patients' clinical condition and culture results. This ensures patients are treated with the right antibiotic, at the right dose, for the right duration, and at the right time.

CDC is encouraging hospitals to integrate antibiotic stewardship efforts with sepsis management and ensuring that sepsis work at CDC is integrated with overall plans for combating antibiotic resistance. CDC and partners recently conducted the first assessment of national sepsis burden among adults that was based on electronic medical records, identified factors that put children and adults at higher risk for sepsis, and is now field testing tools to help healthcare facilities track sepsis. Additionally, CDC is collaborating with partners, clinical organizations, and consumer groups to implement sepsis awareness efforts and improve antibiotic prescribing and use.



Antibiotic-related Adverse Drug Events Data

Anytime antibiotics are used, they can cause side effects. Healthcare providers should carefully weigh the risks and benefits of prescribing an antibiotic and discuss these risks and common side effects with patients. Side effects can include rash, dizziness, nausea, diarrhea, and yeast infections, but also more serious conditions like *C. difficile* infection and severe or life-threatening allergic reactions.

Antibiotic-related adverse drug events (ADEs) are a common cause of adult emergency department visits.

“National Estimates of Emergency Department Visits for Antibiotic Adverse Events Among Adults – United States, 2011–2015,” published in the *Journal of General Internal Medicine* in April 2018, reveals that antibiotic-related adverse drug events (ADEs) led to 145,000 adult ED visits in the United States each year from 2011 to 2015. Young adults (20–34 years) visited the ED for antibiotic-related ADEs from oral antibiotics twice as often as older adults (≥ 65 years).



Antibiotics save lives and are critical tools for treating infections,

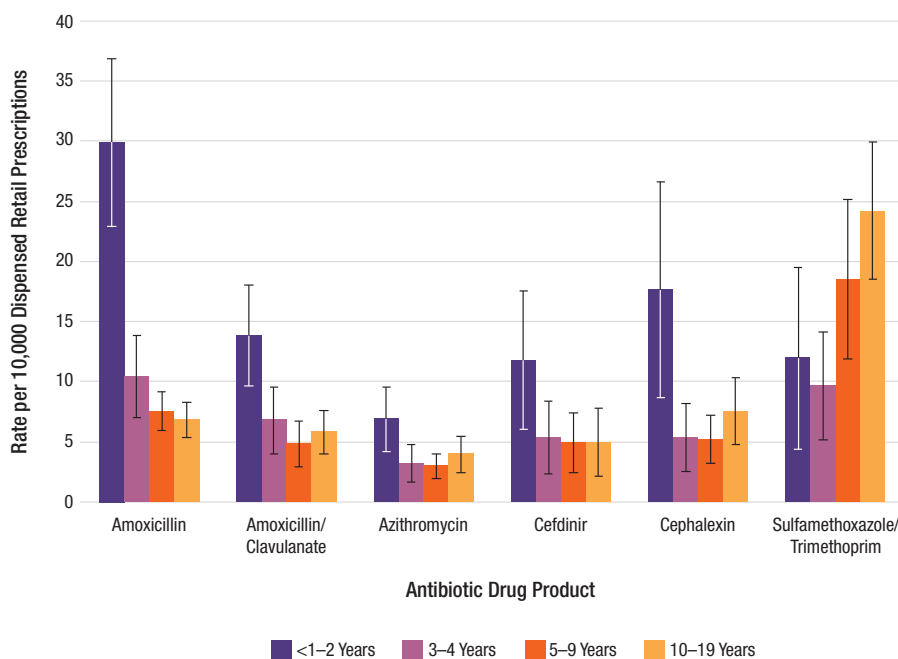
like those that can lead to sepsis, but they can lead to adverse drug events. Healthcare providers, parents, and caregivers should minimize unnecessary antibiotic use to reduce allergic reactions and other ADEs—this is the best way to protect children from these risks, including severe allergic reactions.



Optimize Antibiotic Prescribing and Use to Reduce ADEs in Children.

In children, antibiotics are the leading cause of ED visits for ADEs, according to “[U.S. Emergency Department Visits for Adverse Drug Events from Antibiotics in Children, 2011–2015](#),” published in the *Journal of the Pediatric Infectious Diseases Society* in August 2018. The study estimates that from 2011 to 2015, 70,000 children 19 years or younger visited the ED for antibiotic-related ADEs each year. Many of these visits (41%) were from children 2 years or younger. Most visits (86%) involved allergic reactions, such as rash, pruritus (itching), and angioedema (severe swelling beneath the skin).

**Rates of ED Visits for ADEs from Common Oral Antibiotics
in Children <19 Years Old—U.S., 2011-2015**



New CDC Antibiotic Stewardship Resources

CDC develops tools to help U.S. and international healthcare facilities and providers implement antibiotic stewardship activities. When antibiotic stewardship programs and practices are adopted, patients receive the best antibiotic treatment.



Online antibiotic stewardship training offers free continuing education for healthcare providers.

In 2018, CDC released a four-section [online antibiotic stewardship training course](#) for healthcare providers. The course offers up to eight hours of continuing education (CE) and covers various topics related to appropriate antibiotic prescribing practices and antibiotic resistance, including:

- **Section 1:** Antibiotic resistance and the benefits of antibiotic stewardship
- **Section 2:** Antibiotic stewardship in outpatient settings
- **Section 3:** Antibiotic stewardship considerations for the management of common outpatient conditions and dentistry
- **Section 4:** Antibiotic stewardship in emergency departments, hospitals, and nursing homes

While this course is primarily for healthcare providers who prescribe antibiotics, CDC recognizes that everyone plays an important role in improving antibiotic use. This course is open to:

- physicians
- nurse practitioners
- physician assistants
- certified health education specialists
- nurses
- pharmacists
- public health practitioners with a master's degree in public health

This course fulfills Improvement Activities (IA) Patient Safety and Practice Assessment (PSPA) 23 and PSPA_24 under the Centers for Medicare & Medicaid Services (CMS) Merit-Based Incentive Programs, or MIPS.



CDC's new Core Elements aims to help resource-limited settings improve antibiotic use.

In September 2018, CDC released [Core Elements of Human Antibiotic Stewardship Programs in Resource-Limited Settings: National and Hospital Levels](#), a guide for antibiotic stewardship program implementation in resource-limited settings that have fragile health systems and lack robust, regulatory frameworks.

Implementing stewardship programs in resource-limited settings is challenging for a variety of reasons. One main reason is that most antibiotic stewardship guidance is for high-resource settings. This new guide provides practical, high-impact stewardship strategies for resource-limited settings to improve antibiotic use and combat antibiotic resistance.

The guide discusses national-level policies and programs grouped by capacity and the resources needed to ensure that they are feasible and sustainable. National-level activities are a critical complement to the activities undertaken in hospitals and other healthcare facilities. At the facility level, the guide presents a practical, stepwise framework for acute care facilities to develop antibiotic stewardship programs.

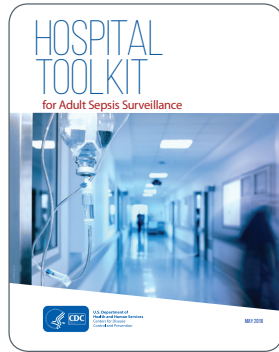
Many resource-limited settings face challenges in implementing all antibiotic stewardship activities recommended by global or local public health agencies—but meaningful steps are possible in any setting. While the Core Elements are not an exhaustive list of approaches, they serve as a starting point for stakeholders.



This guide builds off the Core Elements resource originally created for U.S. healthcare settings to outline structures and functions associated with effective programs:

- [Core Elements of Hospital Antibiotic Stewardship Programs](#)
- [The Core Elements of Outpatient Stewardship](#)
- [The Core Elements of Antibiotic Stewardship for Nursing Homes](#)
- [Implementation of Antibiotic Stewardship Core Elements for Small and Critical Access Hospitals](#)





CDC sepsis surveillance toolkit helps healthcare facilities track sepsis and improve antibiotic treatment in sepsis.

In 2018, CDC released the **Hospital Toolkit for Adult Sepsis Surveillance**, which provides healthcare facilities with tools to assess adult sepsis incidence and monitor progress in their facilities. The toolkit enables healthcare professionals to track facility-level sepsis incidence and outcomes using surveillance methodology from “**Incidence and Trends of Sepsis in U.S.**

Hospitals Using Clinical vs. Claims Data, 2009–2014,” published in the *Journal of the American Medical Association* in October 2017. Data are useful for understanding the effectiveness of local sepsis prevention, early recognition, and treatment programs.

Antibiotic stewardship programs and sepsis care programs in facilities should be coordinated because prompt use of antibiotics is a critical component of sepsis care. Antibiotics should be started as soon as sepsis is suspected. A critical step in treatment is to review antibiotic therapy 48 to 72 hours after it is started to stop, change, or continue therapy based on the patient’s clinical condition and microbiology culture results. This toolkit can be used in hospital quality-improvement efforts, particularly in identifying antibiotics used in sepsis, so hospitals can facilitate both rapid administration and appropriate de-escalation of antibiotics in sepsis to improve patient care.

Antibiotic Stewardship in Action

CDC collaborates with partners to implement activities to improve antibiotic use at a local level. Healthcare facilities and organizations across the country are implementing targeted antibiotic stewardship improvements in outpatient, inpatient, and long-term care settings.

Partner Outpatient Antibiotic Stewardship Efforts

The American Academy of Pediatrics (AAP) implements antibiotic stewardship through a chapter Quality Network Project.

AAP worked with 14 pediatric practices in Virginia, through a chapter Quality Network project, on the Judicious Use of Antibiotics Pilot Project. They utilized **CDC’s Core Elements of Outpatient Antibiotic Stewardship** and quality improvement methods to decrease antibiotic prescriptions for children with viral upper respiratory infections (URIs), and prescribe more appropriately for bacterial ear infections, sinusitis, and pharyngitis. Activities also focused on educating parents, caregivers, and families about antibiotics.



Teams used quality improvement methods to integrate best practices gradually into their workflows and policies, and to change physician behaviors and beliefs about antibiotic use. Participants held in-person meetings and monthly webinars to share what they learned and review practice-level data to facilitate cross-practice learning and accelerate adoption of best practices. Here are the activities the practices implemented, with their results:

- Increased first-line antibiotic prescribing.
 - Prescriptions for first-line antibiotics increased from 63.5% to 79.3% by the end of the project. This was excellent performance, given that roughly 10% of children have a reported history of penicillin allergy and another 10% likely had taken a penicillin-based antibiotic in the previous four to six weeks.
- Decreased prescription fill rates for acute otitis media (AOM) through use of delayed prescribing, or safety-net antibiotic prescriptions (SNAPs).
 - The proportion of AOM prescriptions written as SNAPs increased from 4.5% at baseline to 24.5% after six months.
- Increased education provided to families about antibiotics and symptom management.
 - At the start of this project, only about half of all practices documented regular AOM and URI education.
 - Education for URI during visits increased from 66.1% to 86.7%.
 - Education for AOM symptom management during visits and/or delayed prescribing increased from 19.7% to 86.3%.



Although 10% of the U.S. population reports a penicillin allergy, fewer than 1% are truly penicillin allergic. **Correctly identifying if patients are penicillin-allergic** can decrease the unnecessary use of broad-spectrum antibiotics.



The Quality Innovation Network-Quality Improvement Organizations successfully implements CDC's Core Elements of Outpatient Antibiotic Stewardship.

The Quality Innovation Network-Quality Improvement Organizations (QIN-QIOs), funded by the Centers for Medicare & Medicaid Services (CMS), are working with 7,629 outpatient facilities across the country to implement CDC's [Core Elements of Outpatient Antibiotic Stewardship](#). The QIN-QIOs targeted the following outpatient facilities:

- physician offices
- outpatient pharmacies and clinics
- EDs
- urgent care clinics
- Federally Qualified Health Centers (FQHCs)

As of August 5, 2018, over 5,100 outpatient facilities across the country were implementing all four Core Elements. Additionally, a [Field Guide to Outpatient Antibiotic Stewardship](#) provides a collection of concrete implementation strategies, suggestions, and tools designed, tested, and applied by QIN-QIOs.

Below are some examples of individual QIN-QIOs successfully implementing the Core Elements:

HealthCentric Advisors QIN (Maine QIN-QIO) is hosting webinars throughout the region.

One webinar highlighted how a physician and pharmacist worked with their team to reduce antibiotic prescribing for acute bronchitis in outpatient offices from 35% to 0% in one year. In another webinar, Dr. Elizabeth Dennis shared how her initiative was able to reduce antibiotic prescribing from 84% to 8% in the outpatient setting and 67% to 54% in the ED by giving “goody bags” with self-care items, such as tissues and cough drops, and information about bronchitis to patients with acute bronchitis.

Health Services Advisory Group (HSAG) QIN (Ohio QIN-QIO) is sharing antibiotic use data and treatment recommendations with providers to improve antibiotic prescribing.

HSAG created a custom high-performer and low-performer accountability document based on a provider-level antibiotic prescribing report and shared with target providers. Letters were sent to each department medical director outlining the growing threat of antibiotic resistance and high antibiotic prescribing rates in their county (based on Medicare Part D claims information). The letter provided an overall antibiotic-use metric for the providers in the health system, an acceptable rate based on National Quality Forum (NQF)'s 0058 *Avoidance of Antibiotic Treatment in Adults with Acute Bronchitis*, and a timeframe for correction.

Following the letter, the system infectious disease physician and chief clinical pharmacist performed site visits that included question-and-answer sessions with providers. During these meetings, they showed providers their specific antibiotic prescribing information (privately) and gave them time to ask questions. Providers were also given an opportunity to review the method behind the data abstraction. Each provider was given the system-wide outpatient antibiogram (antibiotic susceptibility profiles for specific bacteria), contact information for patient treatment questions/concerns, and facility-specific treatment recommendations for common outpatient diagnoses, based on national standards and local resistance patterns.



Site visits and outreach are ongoing, but the initial provider and facility feedback has been extremely positive. To ensure sustainability of this project, HSAG is providing technical support to staff in participating health systems so they can generate their own antibiotic prescribing reports going forward.

Great Plains QIN (South Dakota QIN-QIO) is providing facilities with additional support for antibiotic stewardship. Great Plains connected facilities with Johns Hopkins University stewardship experts to provide additional support for antibiotic stewardship activities. Interested facilities submitted 10 patient cases for the experts to review and recommend changes in care or treatment.

Atlantic Quality QIN (New York QIN-QIO) creates a duration-of-therapy pocket guide to reduce lengthy antibiotic therapy. These pocket guides were created after site-specific reports demonstrated lengthy durations of therapy of targeted antibiotics (i.e., fluoroquinolones, amoxicillin-clavulanate, cephalosporins). They distributed a county-level antibiogram of isolates from urine specimens tested at Quest Diagnostics to recruited sites to inform providers about local resistance patterns to assist in the selection of empiric antibiotic therapy for cystitis.

HSAG QIN (Arizona QIN-QIO) is raising awareness about improving antibiotic prescribing and use among Hispanic populations. HSAG developed a relationship with the Arizona chapter of the National Hispanic Nurses Association. The chapter president is collaborating with a physician to discuss antibiotic use on Spanish-language radio to increase awareness, understand barriers, and reach a broader audience.

Partner Inpatient Antibiotic Stewardship Efforts

A Colorado Hospital Association collaborative is improving diagnosis and management of urinary tract infections and skin and soft tissue infections.

In partnership with the Colorado Hospital Association, Colorado hospitals were invited to participate in the **Acute Care Antimicrobial Stewardship Collaborative** to improve the diagnosis and management of inpatient urinary tract infections (UTIs) and skin and soft tissue infections. Twenty-six hospitals, including nine critical access hospitals, participated in the collaborative. Significant reductions were observed in the use of fluoroquinolones for UTIs, use of broad-spectrum antibiotics for skin infections, and treatment durations for skin infections.

A number of hospitals achieved significant improvements from the collaborative, particularly the critical access hospitals. This project demonstrates that the collaborative model is a feasible approach to engage a large number of diverse hospitals in a common antibiotic stewardship intervention.

Physicians and pharmacists at Atrium Health partner across a large footprint to establish an antibiotic stewardship program.

Atrium Health, a Charlotte, NC-based integrated healthcare system with more than 40 hospitals and 12.5 million annual patient encounters, established a formalized antibiotic stewardship program in 2013 with the launch of its Antibiotic Support Network (ASN).



The ASN is a network of pharmacists and physicians who advise medical and pharmacy staff on the optimal selection, dosage, and duration of antibiotic therapy.

Building on the success of the ASN, Atrium Health formed a collaborative in 2016 to expand stewardship beyond the Charlotte area and encompass 28 acute care hospitals of varying size and scope across the Carolinas (i.e., critical access to tertiary care). The collaborative succeeds with a pharmacist and physician-led quality advisory team, who combine their expertise with the efforts of local champions (administrative staff, physicians, and pharmacists) that facilitate each location's customized, daily stewardship activities.

Antibiotic stewardship efforts across the system's acute care hospitals yielded aggregate reductions of 15% to 20% in broad-spectrum antibiotic use. Working across the care continuum, Atrium Health has also formed an outpatient antibiotic stewardship program and launched a marketing and communications campaign, [Got Germs?](#), with educational resources for patients, consumers, and providers about appropriate use of antibiotics in outpatient settings.

Partner Long-term Care Antibiotic Stewardship Efforts

The Rochester Nursing Home Collaborative implements antibiotic stewardship programs to reduce the use of fluoroquinolones.

The [Rochester Nursing Home Collaborative](#) is a collaboration between the University of Rochester Medical Center antibiotic stewardship team and 10 nursing homes in Monroe County, NY. CDC's [Core Elements of Antibiotic Stewardship for Nursing Homes](#) served as a framework for implementing antibiotic stewardship programs at participating nursing homes. The collaborative succeeded in reducing the use of fluoroquinolones over a five-year period across several nursing homes. This success is attributed to the following activities:

- **Developing and disseminating local treatment guidelines to healthcare providers.** An advisory group of nursing home medical directors developed and disseminated local treatment guidelines for common infections to nursing home staff and prescribers.
- **Tracking antibiotic use data to identify improvement opportunities.** The stewardship teams at the nursing homes were provided with quarterly antibiotic use reports to identify targets for improving use and track the progress of stewardship interventions (e.g., percentage of antibiotic orders with documented indications, proportion of residents on prophylaxis for UTI, proportion of fluoroquinolones prescribed for specific conditions).
- **Providing antibiotic stewardship education to healthcare providers, patients, and their families.** Medical and nursing staff were provided in-person antibiotic stewardship education. Also, informational pamphlets about the principals of antibiotic stewardship and appropriate treatment for UTIs were distributed to residents and families.



The Minnesota Department of Health (MDH) provides tools, education, and recognition to nursing homes.

In 2017 and 2018, MDH-supported antibiotic stewardship in nursing homes with new tools, educational opportunities, and statewide recognition. In many nursing homes, competing priorities make stewardship education and implementation difficult, so MDH developed the **Minnesota Sample Antibiotic Stewardship Policy for Long-Term Care Facilities** and **companion guide**. Facilities use these documents to identify and document how CDC's Core Elements of Antibiotic Stewardship for Nursing Homes will be implemented in their setting.

MDH has also used an Antibiotic Stewardship Policy Writing Workshop to provide both education on the Core Elements and dedicated time for stewardship leaders to draft a stewardship policy for their nursing homes. **Online long-term care stewardship education** is also available.

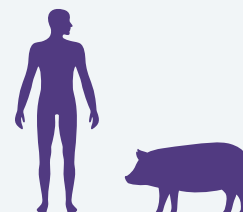
The Minnesota Antibiotic Stewardship Honor Roll for Long-Term Care, hosted by MDH, recognizes antibiotic stewardship commitment, action, and collaboration in Minnesota nursing homes and shares facility approaches on a website.

Minnesota's **One Health Antibiotic Stewardship Collaborative** provides an environment to promote judicious use of antibiotics and combat antibiotic resistance in humans, animals, and the environment.

Its goals are to:



Promote understanding of the One Health approach across disciplines



Improve human and animal antibiotic stewardship efforts



Communicate the impact of antibiotic use in the environment





