Technical Assistance Tool | 2023

Measurement and Evaluation Approaches to Improve Outpatient Antibiotic Prescribing in Health Systems

Contents

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

> Health systems, clinic networks, and healthcare facilities can use this resource to evaluate and target opportunities to improve outpatient antibiotic prescribing practices and evaluate efforts focused on improving antibiotic stewardship. This resource is an adaptation and update to the "Measurement and Evaluation Approaches to Improve Outpatient Antibiotic Prescribing" (https://www.chcs.org/media/Improving-Antibiotic-Use-Measurement-071320.pdf) technical assistance tool developed in July 2020.

A key consideration for health systems seeking to improve outpatient antibiotic prescribing is how to identify targets for antibiotic stewardship implementation and how to measure and evaluate baseline performance and progress over time. This document describes metrics that can be used to accomplish these aims along with pros, cons, and operational considerations of each approach. Health systems' antibiotic stewardship program leaders are a primary audience for this tool, however, other partners involved in improving antibiotic use (e.g., clinic networks, health plans, and individual healthcare facilities) may find the information included here to be helpful. Table 1 at the end of this document provides a summary of the pros, cons, and operational considerations of the measure types. Table 2 provides information about the numerators, denominators, and exclusions for specific measures that are referenced. Finally, Table 3 provides a list of helpful supplemental resources which may be valuable when using metrics to benchmark and improve antibiotic use.

Data Sources

Health systems, clinic networks, and healthcare facilities can consider leveraging a range of data sources to report on antibiotic use and antibiotic appropriateness. Electronic health record (EHR) data generally allows for more precise mapping of antibiotic prescription to a specific diagnosis than is possible using claims data. Additional clinical information about visits from chart review may be captured in these data and can be useful for assessing antibiotic appropriateness, as needed. Though less comprehensive compared to EHR data, administrative claims data can sometimes be used in addition to EHR data to provide a broad view of patient healthcare encounters, including prescription fills, testing performed, and or services provided. Healthcare Effectiveness Data and Information Set (HEDIS®) measures related to antibiotic use can be adapted and applied to EHR and claims data. In addition, data on HEDIS® measure performance reported by healthcare insurance organizations can be used to evaluate progress and identify opportunities for improvement. In situations where data challenges preclude using electronic data pulls and/or a deeper dive into prescribing decisions is desired, chart review to assess antibiotic appropriateness may be useful.

Metrics to Measure and Evaluate Antibiotic Use and Appropriateness

Selecting a measurement strategy is the first step in using data to improve antibiotic use in health systems. An initial, high-level analysis or broad overview of antibiotic prescribing can be helpful to prioritize antibiotic stewardship improvement targets and inform measurement strategies. For example, a total antibiotic prescribing rate or the prescribing rate for acute respiratory infections can be calculated and or disaggregated into common conditions for which antibiotics are prescribed to provide insight into facility- or system-level trends of antibiotic prescribing. Using this information, health systems can identify and prioritize antibiotic stewardship improvement targets and metrics based on the prescribing patterns observed.

Different metrics may serve different purposes – such as identifying targets for improvement or tracking progress over time. It may be helpful to use one or multiple approaches to accomplish antibiotic stewardship goals depending on data availability; alignment with other facilities, clinic networks, or health systems; provider or other stakeholder buy-in; data analysis capacity; or other resource constraints.

Measurement approaches discussed below can be applied to EHR and/or claims data. Several require access to either EHR data, claims data, or pharmacy data linked via a common patient identifier, but others can be operationalized with pharmacy data alone.

Antibiotic Prescribing Across Composite Measures of High-Priority Conditions

Health system antibiotic prescribing can be assessed using composite measures of antibiotic prescribing for high-priority conditions or overall volume or rates of antibiotic prescriptions. Each of these can be stratified by provider, facility, department, and/or region, and can be used to further inform strategic, data-driven approaches to identifying and targeting high-priority conditions for improvement. Visit-based rates of antibiotic prescriptions (i.e., antibiotics prescribed divided by the total number of medical visits) can be calculated with EHR or claims data and can inform further measurement approaches and complement condition-specific metrics, as needed. An example of a broad-based composite measure to assess outpatient antibiotic prescribing is the (HEDIS® measure Antibiotic Utilization for Respiratory Conditions [AXR]), which includes antibiotic-inappropriate acute respiratory conditions (e.g., viral upper respiratory infection (URI)) as well as conditions for which antibiotics are sometimes appropriate (antibiotics-sometimes appropriate conditions), such as sinusitis. The measure allows comparison of prescribing behaviors for respiratory conditions across facilities or individual clinicians. The "goal" for this measure is not zero antibiotic prescribing. Rather, facilities or clinicians who achieve improvements in antibiotic prescribing might be performing well.

Data Requirements

Access to either EHR or medical claims can help establish a total number of visits involving one or multiple high-priority conditions, which can be used as a denominator for calculating visit-based rates. Calculating numbers of antibiotic prescriptions with pharmacy data only can be leveraged if the data contain information about the prescribing physician, facility, region, or other desired level of analysis.

Pros:

- By including a spectrum of highly related respiratory conditions, use of composite metrics such as AXR de-emphasizes the importance of diagnosis codes and instead focuses broadly on antibiotic prescribing. For example, many viral URIs are misdiagnosed as sinusitis. A metric that assesses antibiotic prescribing for both viral URIs and sinusitis encourages prescribers to improve antibiotic prescribing for both conditions and discourages diagnosis shifting from viral URI (antibiotic never indicated) to sinusitis (antibiotic sometimes indicated).
- By focusing on a broader set of respiratory conditions, these measures may have a larger impact on unnecessary use than measures that only target individual conditions for which antibiotics are almost never appropriate (antibiotic-inappropriate conditions).
- Measuring total antibiotic prescriptions can be accomplished using pharmacy-only data and does not require linking pharmacy and claims data or access to EHR data.
- There is little potential for diagnosis shifting with this approach.

Cons:

- There is no clear goal or benchmark for performance for this type of measure. As a result, clinicians may need additional direction regarding how to use these data to improve practice, and benchmarking improvements in antibiotic prescribing may be contingent upon setting organization-specific improvement goals.
- These metrics do not control for case-mix of patients seen by clinicians, and clinicians taking care of higher acuity patients may prescribe higher rates of antibiotics per visits. As a result, it is preferable to compare prescribers practicing in the same specialty and or type of setting to one another.
- When using pharmacy-only data, antibiotic appropriateness, meaning whether the antibiotics were prescribed in accordance with clinical practice guidelines, cannot be assessed without information about the diagnosis associated with the prescription, which would require linking to claims or EHR data.
- Be aware when using raw numbers of antibiotic prescriptions without denominators, rather than visit-based rates, does not control for volume of patients seen by clinicians. As such, result may be influenced by clinicians who see more patients writing a high volume of antibiotic prescriptions.

Antibiotic Prescribing for Antibiotic-Inappropriate Conditions

For antibiotic-inappropriate conditions, such as acute bronchitis, influenza, and viral upper respiratory infections (URI), the desired prescribing rate for encounters with these diagnoses should be as low as possible. Metrics for these conditions are usually reported as a percent of visits for the diagnosis of interest (e.g., viral URIs) that received antibiotics. Health systems may choose to target unnecessary prescribing for one of these conditions or use a single metric to target multiple antibiotic-inappropriate conditions.

Targeting antibiotic-inappropriate conditions is an effective approach to identify inappropriate prescribing. The HEDIS® measures Avoidance of Antibiotic Treatment for Acute Bronchitis/Bronchiolitis (AAB) and Appropriate Treatment for Upper Respiratory Infection (URI) are examples of measures targeting antibiotic inappropriate conditions. A detailed summary of the measures can be found on the NCQA website (https://www.ncqa.org/hedis/).

Another approach to reducing prescribing for antibiotic-inappropriate conditions is to use a composite metric which combines multiple antibiotic-inappropriate conditions. For example, the MITIGATE metric, which targets antibiotic-inappropriate acute respiratory infections (ARIs) has been used previously to improve antibiotic use; a detailed description of the metric and relevant ICD-10 codes is included in the MITIGATE toolkit.[1] Other studies have validated this metric as a reliable indicator of inappropriate antibiotic prescribing.[2]

Data Requirements

This type of measure requires access to either EHR data or both medical and pharmacy claims. Health systems can link the visit where the antibiotic was prescribed to the prescription record and identify relevant diagnosis codes; typically, by searching for antibiotic prescriptions within a specified timeframe (e.g., three days) of the visit. This type of measure requires examining all diagnosis codes for a visit to exclude visits with antibiotic-appropriate diagnoses. Comorbidity data may also be useful to exclude patients with comorbidities that impact antibiotic prescribing decisions (e.g., chronic obstructive pulmonary disease [COPD]). The MITIGATE metric and HEDIS® metrics referenced above exclude patients with relevant co-infections and comorbidities that might warrant antibiotics.

Pros:

- One of the key advantages of this type of metric is its clarity---it focuses on antibiotic-inappropriate respiratory conditions, so the goal is to decrease unnecessary antibiotic prescribing. This is the case for the MITIGATE metric, or composite metrics involving antibiotic-inappropriate conditions. For the HEDIS® measures Avoidance of Antibiotics for Bronchitis (AAB) and Appropriate Treatment for Upper Respiratory Infection (URI), the goals are 100%, in other words that 100% of patients received appropriate treatment (were not prescribed antibiotics) for these conditions.
- Another advantage of this type of metric is that it can be structured to exclude patients with comorbidities where antibiotics may be warranted. As a result, it may be more acceptable to clinicians than other measures that include conditions where the decision about prescribing antibiotics is less clear, such as conditions for which antibiotics are sometimes indicated (e.g., acute otitis media or acute sinusitis).

Cons:

- This type of measure is sensitive to diagnosis shifting (i.e., when clinicians change the diagnosis code to one that is more antibiotic appropriate to justify the antibiotic) because the range of antibiotic-inappropriate conditions excludes conditions with similar symptoms where an antibiotic may be warranted, such as acute sinusitis. As a result, incentives exist to code a patient as having an antibiotic-appropriate condition to justify a prescription for antibiotics, even when the patient has a condition where antibiotics are not needed, such as a cold or acute bronchitis.

Antibiotic Prescribing for Antibiotics-Sometimes Appropriate Conditions

Conditions for which antibiotics are sometimes indicated include sinusitis, pharyngitis, and acute otitis media, which are major drivers of antibiotic use in outpatient settings. For these conditions, antibiotics are sometimes beneficial for patients, however, antibiotics are often over-prescribed.[3-5] Antibiotic prescribing guidelines are important to follow because they include criteria for antibiotic use and improve health care quality by establishing standards of care, focusing quality improvement efforts, and improving patient outcomes. Delayed prescribing of antibiotics for sinusitis and acute otitis media are guideline-recommended management strategies for select patients[4] and help reduce overuse of antibiotics.

Data Requirements

Measures that assess antibiotic prescribing usually require access to EHR data or medical and pharmacy claims. Sometimes visits must be linked to prescriptions, typically by searching for antibiotic prescriptions within three days of the relevant visit. These measures require examining all diagnosis codes for a visit to exclude visits with antibiotic-appropriate diagnoses. Comorbidity data may also be useful in excluding patients with comorbidities that impact antibiotic prescribing decisions (e.g., Chronic Obstructive Pulmonary Disease).

Pros:

- Conditions for which antibiotics are sometimes indicated represent the most common conditions for which antibiotics are prescribed.
- Improving antibiotic prescribing for antibiotics-sometimes appropriate conditions can involve one or several elements of appropriate antibiotic use such as improving the drug selection, duration of therapy, or the decision to prescribe antibiotics at all. As such, improvement targets are flexible and readily adaptable to match organizational needs, provider acceptance, and desired complexity regarding antibiotic stewardship interventions and benchmarking.
- This type of metric is less susceptible to diagnostic shifting than metrics that focus only on antibiotic-inappropriate diagnoses.

Cons:

- Unlike antibiotic-inappropriate conditions, the antibiotic prescribing goal should not be zero. As a result, providing actionable prescribing feedback for improving prescribing practices can be more complex compared to providing prescribing feedback for antibiotic-inappropriate conditions.
- The use of watchful waiting or delayed antibiotic prescribing strategies can be challenging to capture in data.

Antibiotic Selection for Specific Antibiotic Classes

Some antibiotic classes and agents are rarely indicated as first-line therapy and are associated with adverse events (e.g., fluoroquinolones) or are often used inappropriately (e.g., azithromycin). For example, the inappropriate use of azithromycin for acute respiratory conditions is well-documented and has been used as an improvement target in prior implementation studies.[6] Similarly, the proportion of antibiotic prescriptions involving first-line agents, such as amoxicillin, compared to alternative agents is commonly used as an improvement target, especially in pediatric settings.[7]

Data Requirements

This measure can be implemented using EHR or pharmacy data if the data contain information about the prescriber, facility, region, or other desired level of analysis. Calculating visit-based rates requires EHR data or the ability to link pharmacy data to medical claims. Data should be able to capture the number of visits involving prescriptions of the target antibiotic class out of all antibiotic prescriptions. Alternatively, if using pharmacy data alone, the total volume of antibiotic prescriptions for a specific antibiotic class can be monitored over time.

Pros:

- Focusing on specific antibiotic classes for targeted improvements may be more actionable for clinicians than reducing overall antibiotic use and may enable improvements in antibiotic prescribing across many conditions.
- Tracking the total number of antibiotics in a specific class can be done with pharmacy data alone.
- There is less potential for diagnosis shifting with this approach.

Cons:

- Antibiotic appropriateness cannot be fully assessed without additional clinical information about the visit (e.g., drug allergy documentation, recent antibiotic exposures, or medical history involving multidrug-resistant organisms) or information about the diagnosis associated with the prescription, both of which would typically require EHR data or linking to claims.
- Clinicians may increase prescribing of other antibiotics as they decrease prescribing of targeted classes, therefore this measure may not reduce unnecessary prescribing.

Excess Duration of Antibiotic Prescriptions

Antibiotic duration metrics track the duration of antibiotic therapy to assess the frequency with which the shortest effective duration is being prescribed. This can be accomplished by evaluating antibiotic prescription duration for conditions for which longer durations are frequently used. For example, antibiotic prescriptions for acute sinusitis are frequently longer than the guideline-recommended 5-7 days,[5] making this condition an ideal candidate for improving prescription duration.

Data Requirements

Data describing duration of antibiotic prescriptions are often captured in EHR or pharmacy data. One approach to monitoring duration is to establish a threshold beyond which duration is inappropriately long for a particular condition (e.g., antibiotic prescriptions for sinusitis longer than 7 days), and then using that metric to describe the proportion of visits with a longer duration of antibiotic prescriptions while encouraging use of shorter, guideline-concordant durations.

Pros:

- Promoting appropriate antibiotic duration can be augmented, systematized, or automated by using clinical decision support systems such as pre-set prescription durations and accountable justification alerts when excess duration is about to be prescribed.
- Optimizing antibiotic duration as an improvement goal is generally well-accepted by clinicians.

Cons:

- The impact of this metric is limited to excess antibiotic prescription durations. As such, the decision to prescribe antibiotics, improvement of antibiotic selection, or optimizing guideline concordance beyond antibiotic prescription duration is unaffected.
- Improvement targets for excess duration are limited by available medical literature, clinical practice guidelines, and organizational policies.

Use of Diagnostic Testing

Improper use of diagnostic testing can increase risk of misdiagnosis and inappropriate antibiotic management. Improving diagnosis, such as following guideline-recommended diagnostic criteria, and using guideline-recommended treatment strategies can improve antibiotic prescribing for these conditions. These metrics focus on conditions for which diagnostic stewardship offers clear opportunities for improving antibiotic use, such as the use of antigen detection testing (RADT) for group A streptococcal pharyngitis or avoidance of the use of urinalysis and culture in patients without signs and symptoms of a urinary tract infection.

Data Requirements

The use of procedural or diagnostic testing data needs to be available and may also need to be linked to clinical visit information. The HEDIS® metric Appropriate Testing for Pharyngitis (CWP) is an example of a measure that assesses antibiotic prescribing practices. This measure evaluates the appropriate diagnosis of pharyngitis by the presence of a group A *Streptococcus* test for patients prescribed antibiotics, which reduces inappropriate antibiotic use for non-streptococcal pharyngitis.

Pros:

- Improving diagnostic testing can have a broader impact on patient safety and quality of care beyond antibiotic prescriptions. For instance, if a urinary tract infection can be ruled out during clinical decision-making, the patient will be more likely to obtain necessary care, receive an accurate diagnosis, and be less likely to receive unnecessary treatment which could cause unintentional harm.

Cons:

- A limitation of diagnostic stewardship metrics is that acquiring reliable data describing which patients are appropriate candidates for diagnostic testing can be difficult without having to review clinical documentation.
- Antibiotic stewardship programs may need to consider whether patients tested for group A *Streptococcus* meet criteria for testing and the potential for detection of colonization when establishing improvement goals and interpreting metrics.
- The addition of procedural codes to capture diagnostic testing can add a layer of complexity to some data analyses.

Conclusion

This document provides a broad overview of common antibiotic prescribing metrics to track and report antibiotic use in outpatient settings to optimize prescribing practices. Selection of antibiotic use metrics that best align with institutional priorities and planned stewardship interventions are important for tracking process measures and outcomes. Health system leadership support to ensure resource commitment is necessary for effective antibiotic stewardship quality improvement initiatives. Antibiotic stewardship goals can be achieved using a thoughtfully developed and complementary suite of metrics to evaluate, benchmark, and monitor prescribing changes over time.

Table 1: Outpatient Antibiotic Prescribing Measurement Strategies, Key Considerations, and Examples

Approach	Key Operational Considerations	Pros	Cons	Example Measures
Antibiotic Prescribing Across Composite Measures of High-Priority Conditions	■ Overall numbers and rates per population can be produced with pharmacy claims only ■ Rates per visit require information from EHR or medical claims to calculate denominator	■ Relative simplicity of data analysis ■ Not vulnerable to diagnosis shifting	■ Antibiotic appropriateness cannot be assessed, may be less actionable than other measures as a result ■ Does not adjust for patient acuity or volume	■ Overall rates by provider, facility or region ■ Overall rates by visit ■ Practice-level or clinician-level antibiotic prescribing rate across all patient visits[8]
Antibiotic Prescribing for Antibiotic-Inappropriate Conditions	■ Requires linkage of prescription to a visit to identify diagnosis associated with prescription ■ Requires examining all diagnosis codes for a visit to exclude visits with antibiotic-appropriate diagnoses	■ Clarity-focuses on "never events" and goal is zero ■ Excludes patients with comorbidities where antibiotics may be warranted; may be more palatable to clinicians as a result	■ Vulnerable to diagnosis shifting, e.g., coding diagnoses to avoid classification of an antibiotic prescription as inappropriate ■ Does not capture common conditions where antibiotics are sometimes warranted but frequently overprescribed (e.g., sinusitis)	■ MITIGATE metric ■ HEDIS® measures Avoidance of Antibiotics for Bronchitis (AAB)[9] or Appropriate Treatment for Upper Respiratory Infections (URI)[10] ■ Antibiotics prescribed during visits for acute bronchitis[11] ■ Antibiotic prescribing rate among visits for conditions for which antibiotics are not appropriate (e.g., acute bronchitis and viral URIs)[12]
Antibiotic Prescribing for Antibiotic-Sometimes Appropriate Conditions	■ May require linkage of a prescription to a visit to identify the diagnosis associated with prescription ■ Requires examining all diagnosis codes to exclude visits with antibiotic-appropriate diagnoses	■ Less susceptible to diagnostic shifting ■ May help improve diagnostic accuracy ■ Focuses on conditions that are major drivers of antibiotic use	■ Prescribing goals are less clear than measures focusing on antibiotic inappropriate conditions where antibiotics are almost never warranted	■ Antibiotic prescribing rate for ARTIs (e.g., sinusitis, pharyngitis, acute otitis media, viral URIs, and bronchitis combined)[6,13] ■ HEDIS® measure Antibiotic Utilization for Respiratory Conditions (AXR)[14]
Antibiotic Selection for Specific Antibiotic Classes	■ Does not require linkage to an outpatient visit as long as information about prescribing provider, facility, and/or region is available	■ Relative simplicity of data analysis ■ Not vulnerable to diagnostic shifting ■ Focusing on specific classes makes information more actionable	■ Antibiotic appropriateness cannot be assessed, may decrease provider buy-in ■ Potential for clinicians to shift to other antibiotics not targeted	■ Rates of fluoroquinolones by provider, facility, or region ■ Rates of fluoroquinolones by visit ■ Rates of macrolide prescribing for specific conditions (e.g., acute sinusitis) ■ Frequency of amoxicillin or amoxicillin-clavulanate treatment (first-line recommended therapy) for acute sinusitis in adults[3,15] ■ Frequency of ciprofloxacin prescribing for the treatment of acute cystitis in adult women[16,17]

Table 1: Outpatient Antibiotic Prescribing Measurement Strategies, Key Considerations, and Examples (continued)

Approach	Key Operational Considerations	Pros	Cons	Example Measures
Excess Duration of Antibiotic Prescriptions	■ Establish a threshold beyond which duration is inappropriately long for a particular condition ■ Adult sinusitis is a condition for which therapy duration remains problematic	■ Relative simplicity of data analysis ■ Well-defined, actionable target which is generally palatable for prescribers and amenable to stewardship interventions	■ Reducing antibiotic duration may have a lower overall impact compared to reducing unnecessary antibiotic use	■ Acute sinusitis visits resulting in antibiotic prescriptions with a duration longer than 7 days
Use of Diagnostic Testing	■ Consider calculating numbers and rates of diagnostic testing for conditions which require a test to warrant antibiotic use (e.g., group A streptococcal pharyngitis) ■ A review of clinical documentation may be necessary to ascertain appropriate diagnostic testing	■ Broader impact on patient safety and quality of care beyond antibiotic prescriptions ■ Can be more complex to analyze compared to other metrics	■ Fewer conditions provide easy targets for outpatient diagnostic stewardship	■ Pharyngitis visits resulting in antibiotics without RADT testing (e.g., HEDIS® measure, Appropriate Testing for Pharyngitis [CWP])[18] ■ Rates of urinalysis or culture orders for patients without urinary tract infection symptoms ■ Antibiotics prescribed during visits for acute bronchitis[11] or asymptomatic bacteriuria[19]

Table 2: HEDIS® Measures for Outpatient Antibiotic Prescribing*

Measure	Description	Numerator	Denominator
Antibiotic Utilization for Respiratory Conditions (AXR)	Percentage of episodes for members 3 months of age and older with a diagnosis of a respiratory condition that resulted in an antibiotic dispensing event	Episodes involving patients aged 3 months or older with a diagnosis of a respiratory illness receiving an antibiotic	Episodes involving patients aged 3 months or older with a diagnosis involving respiratory illness
Avoidance of Antibiotic Treatment for Acute Bronchitis/Bronchiolitis (AAB)	Percentage of episodes for members 3 months of age and older with a diagnosis of acute bronchitis/bronchiolitis that did not result in an antibiotic dispensing event	Episodes involving patients aged 3 months or older with a diagnosis of acute bronchitis or bronchiolitis in the measurement period who were not prescribed an antibiotic	Episodes involving patients aged 3 months or older with a diagnosis of acute bronchitis or bronchiolitis in the measurement period
Appropriate treatment for upper respiratory infection (URI)	Percentage of episodes for members 3 months of age and older with a diagnosis of upper respiratory infection (URI) that did not result in an antibiotic dispensing event	Episodes involving patients aged 3 months or older with a diagnosis of upper respiratory infection (URI) during the measurement period and were not prescribed an antibiotic within 3 days of relevant visit	Episodes involving patients aged 3 months or older with a diagnosis of upper respiratory infection (URI) during the measurement period
Appropriate Testing for Pharyngitis (CWP)	Percentage of episodes for members 3 years of age and older with a diagnosis of pharyngitis, dispensed an antibiotic and received a group A *Streptococcus* test for the episode	Episodes involving patients aged 3 months or older with pharyngitis, ordered an antibiotic and received a group A *Streptococcus* (strep) test	Episodes involving patients aged 3 months or older with a diagnosis of pharyngitis during the measurement period and an antibiotic ordered on or three days after the visit

* Antibiotic-related HEDIS measures are used by most U.S. health plans and allow for comparison of quality metrics across providers, health plans, and health systems. They are highly relevant, feasible, and useful as they are created using a process of evidence review, testing, and stakeholder input. For additional information and technical resources on HEDIS measures, including exclusion criteria information for numerators and denominators, visit the NCQA website (https://www.ncqa.org/hedis/measures/).

Table 3: Technical Resources for Tracking Outpatient Antibiotic Use Metrics*

Resource (Organization)	Description
CDC Outpatient Treatment Recommendations (https://www.cdc.gov/antibiotic-use/clinicians.html) (CDC)	• Summary of clinical practice guideline recommendations for common outpatient conditions.
HEDIS® Measures website (https://www.ncqa.org/hedis/measures/) (NCQA)	• HEDIS® measures compare antibiotic prescribing quality across health plans and healthcare settings. • Specifications and resources to use these measures are provided, however, access is limited by institution-specific licensing agreements.
MITIGATE Antimicrobial Stewardship Toolkit (https://stacks.cdc.gov/view/cdc/80653) (CDC, CMS, and UC Davis)	• Toolkit for antibiotic stewardship and quality improvement programs for improving antibiotic use in emergency department and urgent care settings. • Provides a guide for data extraction of ICD-10-CM codes to calculate prescribing rates and a composite antibiotic use measure for acute respiratory infections.
Implementation Guide for Ambulatory Care Antibiotic Stewardship (https://www.ahrq.gov/antibiotic-use/ambulatory-care/improve/index.html) (AHRQ)	• AHRQ has developed an ambulatory care toolkit (https://www.ahrq.gov/antibiotic-use/ambulatory-care/index.html) and toolkit and implementation guide (https://www.ahrq.gov/sites/default/files/wysiwyg/antibiotic-use/ambulatory-care/antibiotic-stewardship.pdf) for improving antibiotic use in outpatient settings. • Includes a data collection form to share with information technology staff for building a system to track antibiotic prescriptions and clinic visits.

*Abbreviations: CDC, Centers for Disease Control and Prevention; CHCS, Center for Health Care Strategy; CMS, Centers for Medicare & Medicaid Services; UC Davis, University of California, Davis; ABIM, American Board of Internal Medicine; NCQA, National Center for Quality Assurance; HEDIS®, Healthcare Effectiveness Data and Information Set; AHRQ, Agency for Healthcare Research and Quality.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention (CDC). CDC does not endorse any particular product, service, or enterprise.

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