



Health Experts Establish National Targets to Improve Outpatient Antibiotic Selection

Antibiotic stewardship is key to addressing inappropriate use

Overview

Ensuring the appropriate use of antibiotics is critical to improving patient care and minimizing the development of antibiotic resistance. Antibiotic use in outpatient health care settings, such as primary care clinics and emergency rooms, represents the majority of dollars spent on antibiotics for human health in the United States and should be a focus for efforts to ensure that antibiotics are prescribed only when necessary and that the appropriate antibiotic is selected.¹ In 2015, The Pew Charitable Trusts partnered with the Centers for Disease Control and Prevention and other public health and medical experts to determine how much U.S. outpatient antibiotic use is inappropriate and to set national targets for improving antibiotic prescribing.

The first objective from this partnership was to quantify unnecessary antibiotic prescribing in outpatient physician offices, hospital-based clinics, and emergency departments. The resulting study revealed that at least 30 percent of antibiotic prescriptions (47 million prescriptions each year) in these outpatient settings are unnecessary²—such as prescribing an antibiotic for a viral illness like the common cold. Unnecessary antibiotic use is only one example of inappropriate antibiotic prescribing.

The second objective, presented in this issue brief, addressed another aspect of inappropriate antibiotic prescribing—the choice of drug, that is, antibiotic selection. Even when an antibiotic is necessary to treat an infection, it is important that the most appropriate drug be prescribed at the optimal dose and duration of therapy, thus minimizing the potential for adverse patient outcomes from ineffective treatment or side effects (such as *Clostridium difficile* infections) and reducing the development of antibiotic resistance.

In order to better understand the appropriateness of antibiotic selection, Pew convened a panel of experts to analyze U.S. prescribing data from 2010 and 2011. Using these data, the panel set national targets for improving the selection of antibiotics for three common conditions in outpatient settings: sinus infections, middle ear infections, and pharyngitis.

Key findings from this analysis show that:

- Sinus infections, middle ear infections, and pharyngitis (inflammation of the throat often reported by patients as a sore throat) account for over 44 million antibiotic prescriptions each year.³ However, only 52 percent of patients with these infections who were treated with antibiotics received recommended first-line drugs based on established practice guidelines.
- Approximately 80 percent of patients treated for these three infections should receive recommended first-line antibiotics, according to the expert panel’s estimates. Select circumstances exist in which second-line antibiotics are appropriate, such as when a patient is allergic to the first-line drug or when a patient’s infection fails to respond to initial treatment.
- Children are more likely than adults to receive recommended first-line antibiotics for these infections.
- The most commonly prescribed non-first-line antibiotics for sinus infections, middle ear infections, and pharyngitis were macrolides (such as azithromycin), a class of broad-spectrum antibiotics (which target a wide range of bacterial pathogens) frequently prescribed in outpatient settings. However, macrolides are not recommended for sinus or middle ear infections and are recommended for pharyngitis only for patients with an allergy to the penicillin class of antibiotics.

About this series

This publication is the second in a series evaluating current antibiotic use in the United States and establishing national targets for improved prescribing practices in different health care settings. The initial report, *Antibiotic Use in Outpatient Settings: Health Experts Create National Targets to Reduce Unnecessary Antibiotic Prescriptions*, identified the amount of unnecessary antibiotic prescribing in outpatient settings.

Establishing national targets for improving antibiotic selection

Condition-specific practice guidelines published by medical societies identify which antibiotics should be used as first-line treatments based on a number of factors, including treatment effectiveness and the potential for adverse drug effects in patients.

The expert panel focused on three key outpatient conditions—sinus infections, middle ear infections, and pharyngitis—which have clear practice guidelines for when to prescribe antibiotics and what types should be used as first-line therapies. (See methodology.) Together, these three diagnoses account for nearly 30 percent of the antibiotics prescribed in outpatient settings.⁴

Antibiotic Selection and Antibiotic Resistance

Antibiotic resistance and the types of antibiotics recommended for various infections are connected in two ways. First, practice guidelines must take resistance patterns into account when identifying appropriate first-line treatments. For example, macrolides are not recommended first-line drugs for sinus or middle ear infections in part due to high rates of resistance among *Streptococcus pneumoniae*, the most common bacterial cause of these infections, in the United States.*

Additionally, practice guidelines sometimes, though not always, take public health concerns such as antibiotic resistance into consideration when determining the most appropriate first-line treatments. For example, guidelines sometimes recommend antibiotics with a narrower spectrum of activity (those that target fewer types of bacterial pathogens) over more broad-spectrum antibiotics as long as the drugs are considered equally effective. Prescribing antibiotics that target fewer types of bacteria can help to minimize the impact that antibiotic use has on the development of resistance.

* Anthony W. Chow et al., "IDSA Clinical Practice Guideline for Acute Bacterial Rhinosinusitis in Children and Adults," *Clinical Infectious Diseases* 54, no. 8 (2012): e72–e112, <http://dx.doi.org/10.1093/cid/cir1043>; Richard M. Rosenfeld et al., "Clinical Practice Guideline (Update): Adult Sinusitis," *Otolaryngology—Head and Neck Surgery* 152, suppl. 2 (2015): S1–S39, <http://dx.doi.org/10.1177/0194599815572097>; Ellen R. Wald et al., "Clinical Practice Guideline for the Diagnosis and Management of Acute Bacterial Sinusitis in Children Aged 1 to 18 Years," *Pediatrics* 132, no. 1 (2013): e262–e280, <http://dx.doi.org/10.1542/peds.2013-1071>; and Allan S. Lieberthal et al., "The Diagnosis and Management of Acute Otitis Media," *Pediatrics* 131, no. 3 (2013): e964–e999, <http://dx.doi.org/10.1542/peds.2012-3488>.

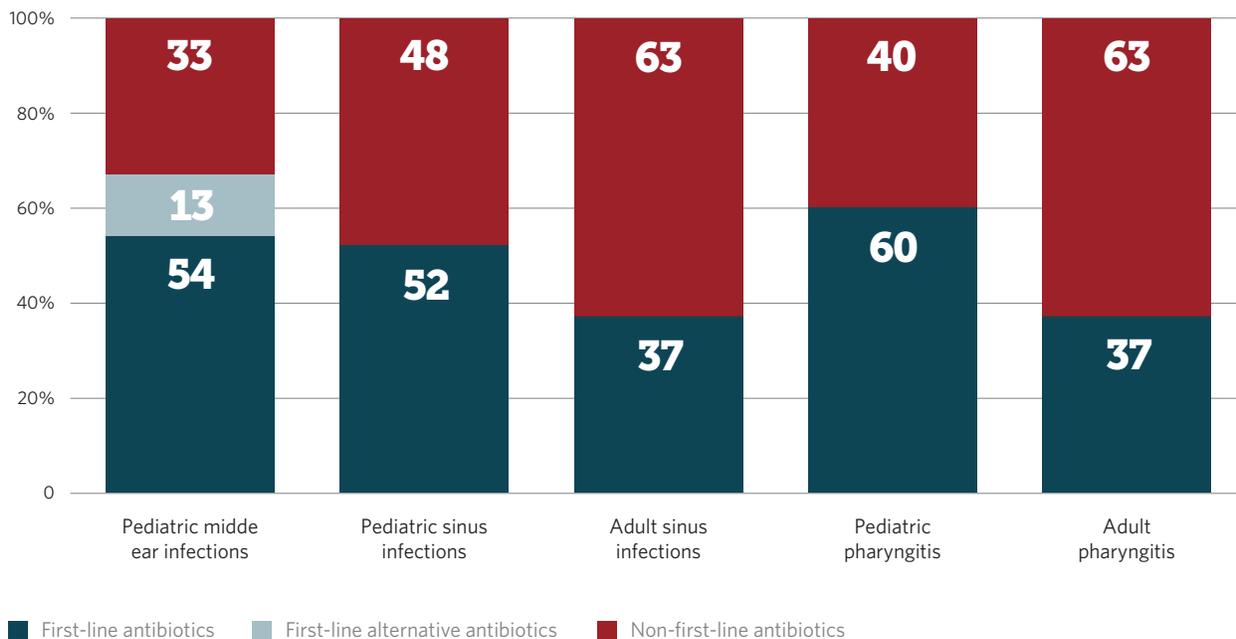
Overarching targets for improving antibiotic selection

To set targets for improving antibiotic selection, the panel identified how much of the population should be receiving first-line therapies. Although first-line antibiotics are the most appropriate treatments for the majority of patients, the use of non-first-line antibiotics is warranted in certain circumstances, including when a patient is allergic to first-line antibiotics or when an infection does not respond to the initial first-line therapy prescribed.

After reviewing available literature, the panel estimated that these two situations combined occur in about 20 percent of patient visits. (See methodology.)

Based on this estimate, the panel recommended that at least 80 percent of patients receiving treatment for sinus infections, middle ear infections, and pharyngitis should be treated with first-line or first-line alternative antibiotics. However, U.S. antibiotic prescribing data show that only 52 percent of patients treated with antibiotics received recommended first-line or first-line alternative drugs, while the rest received other types of antibiotics.

Figure 1
Outpatient Antibiotic Prescriptions, 2010-11



Note: The recommended first-line antibiotic for middle ear infections is amoxicillin. An alternative first-line therapy in select circumstances is amoxicillin with clavulanate, which is recommended as initial therapy only in select circumstances (for example, concurrent ear and eye infections). Recommended first-line antibiotics for sinus infections include amoxicillin or amoxicillin with clavulanate. Recommended first-line antibiotics for pharyngitis include amoxicillin or penicillin.

Sources: Analysis of NAMCS and NHAMCS data on U.S. antibiotic prescribing, 2010-2011.

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Middle ear infections

Suppurative middle ear infections (those with pus) result in 14.4 million antibiotic prescriptions each year, mostly for patients 19 years old or younger (12.8 million antibiotic prescriptions).⁵ Current pediatric prescribing guidelines recommend treating patients diagnosed with these infections either with antibiotics or, for certain children, waiting 48 to 72 hours to see whether symptoms improve without antibiotic treatment.⁶

The recommended first-line therapy for suppurative middle ear infections in children is amoxicillin. Amoxicillin with clavulanate is recommended as an alternative first-line treatment only in specific circumstances, such as when children have ear and eye infections concurrently.⁷ Sixty-seven percent of children with suppurative middle ear infections were treated using either amoxicillin (54 percent) or amoxicillin with clavulanate (13 percent). The panel did not evaluate antibiotic selection for the treatment of middle ear infections in adults, because these infections do not typically occur in older patients and no prescribing guidelines exist for the adult population. The panel also did not evaluate antibiotic selection for the treatment of nonsuppurative middle ear infections (those without pus) because antibiotics are not a recommended treatment.⁸

Sinus infections

More than 17 million outpatient antibiotic prescriptions are written for sinus infections each year.⁹ Antibiotics are recommended to treat these infections only when a bacterial cause is suspected.¹⁰ This diagnosis is often based on clinical criteria—such as whether a patient has experienced related symptoms for 10 or more days without improvement.

Recommended first-line therapies for sinus infections include amoxicillin or amoxicillin with clavulanate.¹¹ In 2010 and 2011, only 52 percent of children with sinus infections and 37 percent of adults were treated using these antibiotics.

Pharyngitis

Pharyngitis is inflammation of the throat, which patients typically report as a sore throat. Over 13 million outpatient antibiotic prescriptions are written for this diagnosis each year.¹² Pharyngitis should be treated with antibiotics only when it is caused by group A *Streptococcus* (i.e., “strep throat”).¹³

When diagnostic tests confirm strep throat, recommended first-line therapies include penicillin or amoxicillin.¹⁴ Sixty percent of children with pharyngitis and only 37 percent of adults received either of these two therapies.

Conclusions

Overall, only 52 percent of patients treated with antibiotics for sinus infections, middle ear infections, and pharyngitis received the first-line treatments recommended by prescribing guidelines. This is far below the 80 percent target set by the expert panel. Macrolides were the most common non-first-line antibiotics prescribed. Antibiotic selection for the treatment of adult patients (ages 20 and older) is in need of the greatest improvement, with only 37 percent of patients receiving first-line therapies for both pharyngitis and sinus infections.

Increased antibiotic stewardship efforts are needed to reach the 80 percent target for use of first-line antibiotics. These efforts aim to ensure that antibiotics are reserved for treating bacterial infections and, when indicated, that the most appropriate antibiotic is prescribed at the right dose and duration of therapy. A number of stewardship activities can help improve prescribing. For example, audit and feedback interventions—which provide health care practitioners with their antibiotic prescribing rates, often as compared with those of their peers or an expected rate—can help highlight areas in need of improvement.¹⁵ Clinical decision support tools, such as clinical guidelines and decision flowcharts, can help clinicians make the most appropriate treatment decisions for individual patients.¹⁶ Beyond these interventions, broader strategies include updating practice guidelines to take key stewardship principles into account when recommending first-line treatments to physicians.

Action is needed from multiple stakeholders to help provide the expertise and resources required to implement robust stewardship activities in outpatient settings. Key stakeholders include:

- Individual providers and practices.
- Patients.
- Health systems.
- Health plans.
- Local, state, and federal governments.
- Health care quality organizations.
- Professional societies.

Together, these individuals and organizations can help to expand antibiotic stewardship efforts into outpatient health care facilities nationwide, resulting in improved patient care and combating the growing threat of antibiotic resistance.

Methodology

The data used to analyze outpatient antibiotic prescribing habits came from two surveys conducted annually in the United States, the National Ambulatory Medical Care Survey (NAMCS) and the National Hospital Ambulatory Medical Care Survey (NHAMCS). Together, these nationally representative surveys provide a picture of outpatient health care visits to doctors' offices, emergency departments, and hospital specialty clinics. Specific to antibiotic prescribing, NAMCS and NHAMCS collect information on a clinician's diagnosis or diagnoses and any drugs that a patient is provided, newly prescribed, or that the patient is taking at the time of the office visit.

The expert panel analyzed these data for three conditions—sinus infections, middle ear infections, and pharyngitis—according to the types of antibiotics a patient was prescribed. For each of these infections, the panel utilized current prescribing guidelines to identify appropriate first-line and alternative first-line antibiotics.

To identify how much of the population should receive these first-line therapies, the panel reviewed available literature on the prevalence of allergies and incidence of visits for treatment failures related to these conditions.

- **Allergies:** An estimated 10 percent of the U.S. population reports an allergy to penicillin, a class of antibiotics that includes first-line therapies for these three conditions. This is likely to be an overestimate of the true prevalence of penicillin allergy.¹⁷
- **Treatment failures:** There is limited research on the frequency of treatment failure among U.S. patients with sinus infections, middle ear infections, and pharyngitis. One study found that only about 10 percent of patients treated with first-line antibiotics for uncomplicated sinus infections (where the infection had not spread to surrounding areas and the patient was not immunocompromised) experienced treatment failure.¹⁸ Similarly, another study found that only 11 percent of visits by patients with middle ear infections were for relapses after the initial antibiotic treatment.¹⁹

Based on these studies, the panel estimated that the combined prevalence of allergies and incidence of visits for treatment failures was approximately 20 percent. However, this is a conservative estimate. The true prevalence of

penicillin allergy, for example, is thought to be lower than the reported 10 percent. Additional research is needed to better understand the frequency of allergies and treatment failures among U.S. patients with these conditions. Additionally, for strep throat, treatment failures due to bacterial resistance to first-line drugs is not a concern, because penicillin resistance among group A *Streptococcus* has never been documented.²⁰ Use of non-first-line agents is sometimes warranted, though only in limited circumstances.²¹

Because of the conservative nature of the target set by the panel—that 80 percent of patients should receive first-line antibiotics—it will be important to evaluate progress made toward this goal and to assess whether further improvement is needed. Additionally, because the panel focused on only three conditions, further evaluation of antibiotic selection for other conditions (such as urinary tract infections and skin infections) in outpatient settings could help to identify additional areas in need of improvement.

Finally, it is important to note that antibiotics are not always recommended for the treatment of sinus infections, middle ear infections, and pharyngitis. A previous study by this expert panel identified how much of current antibiotic prescribing for these conditions is unnecessary and set condition- and age-specific targets for reducing this use. The target set forth in this issue brief, to improve antibiotic selection, did not take into account whether the prescription was necessary, just whether the patient received the recommended first-line therapies. This analysis assessed the proportion of first-line vs. non-first-line drugs, and did not estimate the overall improvement in terms of millions of prescriptions. Therefore, even if the overall number of antibiotics prescribed is reduced, any improvement in antibiotic selection for these conditions can be monitored simultaneously.

External reviewers

This brief benefited from the insights and expertise of external reviewers Adam Hersh, associate professor of pediatric infectious diseases at the University of Utah, and Edward Stenehjem, medical director, Antimicrobial Stewardship and TeleHealth ID Program, Intermountain Medical Center. Although they have reviewed the issue brief, neither they nor their organizations necessarily endorse its findings or conclusions.

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Endnotes

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