

# Antibiotic Use in Outpatient Settings

Health experts create national targets to reduce unnecessary antibiotic prescriptions

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## Overview

The use and misuse of antibiotics is a major contributor to the development of antibiotic-resistant bacteria. These drugs should be used only to treat bacterial infections and, when needed, the right antibiotic should be prescribed at the most appropriate dose and duration. Yet antibiotics are often prescribed inappropriately across health care settings in the United States. Antibiotic stewardship efforts, which aim to ensure that these drugs are prescribed appropriately, are critical for combating the public health threat posed by antibiotic-resistant pathogens. To effectively implement and evaluate stewardship efforts, it is essential to first understand current antibiotic prescribing patterns.

Antibiotic use in outpatient health care settings, such as primary care offices and emergency rooms, represents the majority of dollars spent on antibiotics for human health care in the United States.<sup>1</sup> Beginning in 2015, The Pew Charitable Trusts convened a panel of experts, including representatives from the Centers for Disease Control and Prevention (CDC) and other public health and medical experts to analyze current outpatient antibiotic prescribing habits in the United States, determine targets for reducing inappropriate prescribing, and identify steps needed to reach these targets.

Key findings from this analysis are:

- Antibiotics should be prescribed only when a bacterial infection is known or suspected. Approximately 13 percent of all outpatient office visits in the United States, or about 154 million visits annually, result in an antibiotic prescription; about 30 percent of these, or some 47 million prescriptions, are unnecessary.
- 44 percent of outpatient antibiotic prescriptions are written to treat patients with acute respiratory conditions, such as sinus infections, middle ear infections, pharyngitis, viral upper respiratory infections (i.e., the “common cold”), bronchitis, bronchiolitis, asthma, allergies, influenza, and pneumonia. Half of these prescriptions are unnecessary, since many are viral illnesses or other conditions that do not respond to antibiotics.
- In 2015, the White House released a national action plan for combating antibiotic resistance that included the goal of reducing inappropriate outpatient antibiotic use by 50 percent by 2020.<sup>2</sup> Based on the panel’s estimate of unnecessary prescribing, this goal would be reached by reducing outpatient antibiotic use by 15 percent overall, which would result in approximately 23 million fewer antibiotics prescribed annually by 2020.

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**This report is the first in a series evaluating current antibiotic use in the United States and establishing national targets for improved prescribing practices in different health care settings.**

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In addition to these findings, the expert panel discussed the importance of increased stewardship activities to ensure that the United States reaches the goal laid out in the 2015 national action plan. There is no one-size-fits-all stewardship program that practitioners can implement in their facilities. However, a number of interventions have been shown to be effective at improving prescribing habits, such as providing clinicians with individualized antibiotic prescribing feedback.

Since no single agency or organization oversees antibiotic use in outpatient facilities across the country, implementing stewardship programs nationwide will be a complex undertaking. A diverse group of stakeholders will need to take coordinated and sustained action to provide the resources and expertise necessary to expand stewardship efforts. Below is a sampling of roles that stakeholders could play in reducing inappropriate outpatient antibiotic use:

- Individual outpatient health care providers can evaluate their own prescribing habits as well as implement stewardship activities in their practices.
- Health systems can provide expertise and resources to offices within their network to aid in stewardship implementation.
- Health plans can assist in data collection and analysis—evaluating the antibiotic prescribing habits of their providers and providing feedback highlighting potential areas for improvement.
- State and local health agencies can help provide outpatient facilities with information on best practices for implementing antibiotic stewardship programs, and help develop regional partnerships between various health care stakeholders, such as providers, health plans, and health systems, to better coordinate stewardship activities.
- Federal agencies can track antibiotic prescribing at the national level, identifying areas for further improvement and providing technical assistance to stakeholders interested in implementing stewardship efforts of their own.
- Organizations that develop standards to assess the quality of health care services can develop metrics to assess the antibiotic prescribing habits of health care providers.
- Health care professional societies can provide expert guidance to their members on appropriate antibiotic prescribing and incorporating diagnostics to aid in prescribing decision-making.

## Background

Antibiotics are essential to the practice of modern medicine—from treating common infections to enabling lifesaving procedures such as organ transplantation. However, the emergence and spread of antibiotic-resistant bacteria threaten the effectiveness of these critical therapies. According to the World Health Organization, high rates of resistance in common bacteria are being seen worldwide.<sup>3</sup> In the United States, drug-resistant bacteria are responsible for at least 2 million infections each year, resulting in an estimated 23,000 deaths.<sup>4</sup>

Infections caused by multidrug-resistant bacteria are becoming increasingly common. A 2011 survey of U.S. infectious disease physicians found that over 60 percent of respondents had treated a patient with an infection resistant to all available antibiotics.<sup>5</sup> Of particular concern is the spread of carbapenem-resistant Enterobacteriaceae (CRE), due to its resistance to many, if not all, available therapies and its high mortality rate once infecting the bloodstream.<sup>6</sup> In 2001, only one state reported a case of CRE; as of early 2015, only two states had not reported one.<sup>7</sup>

## Importance of improved antibiotic stewardship

All antibiotic use, whether appropriate or not, carries a risk of contributing to the development of antibiotic resistance. To minimize this threat and preserve the effectiveness of these important drugs, antibiotics should be used judiciously and prescribed only when recommended. However, much antibiotic use is unnecessary or inappropriate.<sup>8</sup> Over 60 percent of antibiotic expenditures in the United States occur in outpatient settings where patients are seen for many conditions that do not warrant antibiotic use, such as acute bronchitis.<sup>9</sup> Antibiotic stewardship efforts aim to ensure that these drugs are used only when indicated (i.e., for a known or suspected bacterial infection) and prescribed at the right dose and duration of therapy. Such programs are critical to limiting the development of antibiotic resistance.

In addition to the importance of antibiotic stewardship in minimizing the threat of resistance, reducing inappropriate antibiotic use can also improve patient safety. Exposure to antibiotics increases a patient's risk

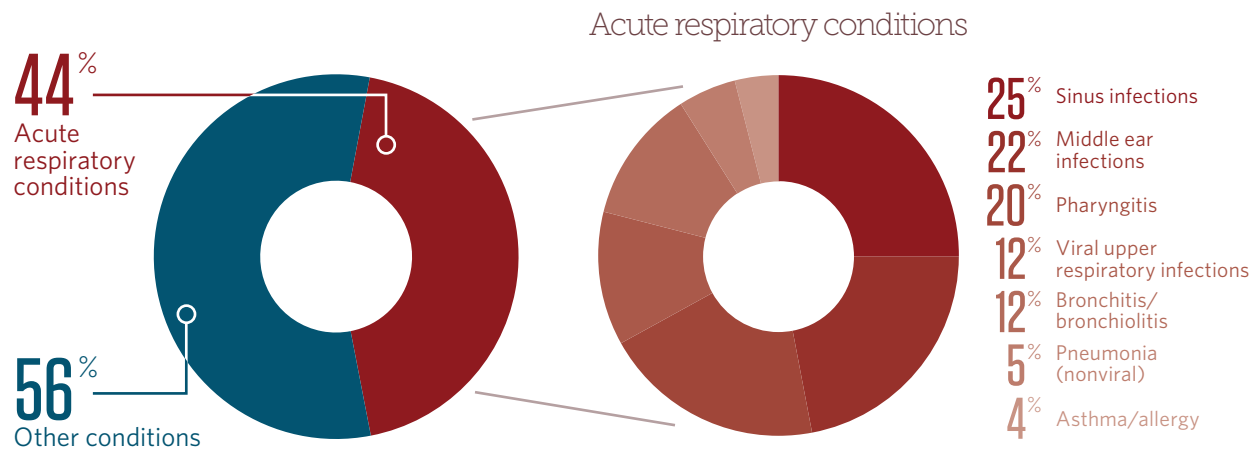
of an infection caused by *Clostridium difficile*, which can cause sometimes life-threatening diarrhea. There were nearly 500,000 estimated cases of *C. difficile* infection in the United States in 2011, which resulted in approximately 15,000 deaths.<sup>10</sup> Antibiotics also carry the risk of adverse drug events, including drug interactions, allergic reactions ranging from minor rashes to life-threatening responses, and other side effects. It is estimated that antibiotic-related adverse events result in more than 140,000 emergency room visits a year.<sup>11</sup>

## Establishing a baseline of outpatient antibiotic use

Antibiotics are some of the most frequently prescribed medicines in the United States.<sup>12</sup> To understand current prescribing patterns and identify areas for improvement, the CDC and other experts analyzed U.S. antibiotic prescribing data from 2010 to 2011 (see Appendix B for additional information on data sources). This analysis showed that about 13 percent of all outpatient health care visits—154 million visits annually—resulted in an antibiotic prescription, a large number of which were for visits related to acute respiratory conditions, such as sinus and middle ear infections, asthma and allergy, and bronchitis. These diagnoses collectively accounted for 44 percent of all outpatient antibiotics, representing 68 million prescriptions per year. Many of these respiratory syndromes are caused by viruses or may resolve without an antibiotic. Acute respiratory conditions are clearly in need of additional stewardship activities.

Figure 1

### Outpatient Antibiotic Prescriptions by Diagnosis



Note: Not pictured are influenza and viral pneumonia. There are not enough visits with an antibiotic prescribed in the data set to calculate reliable estimates for these diagnoses individually. Both diagnoses do contribute to the total number of antibiotics prescribed for acute respiratory conditions.

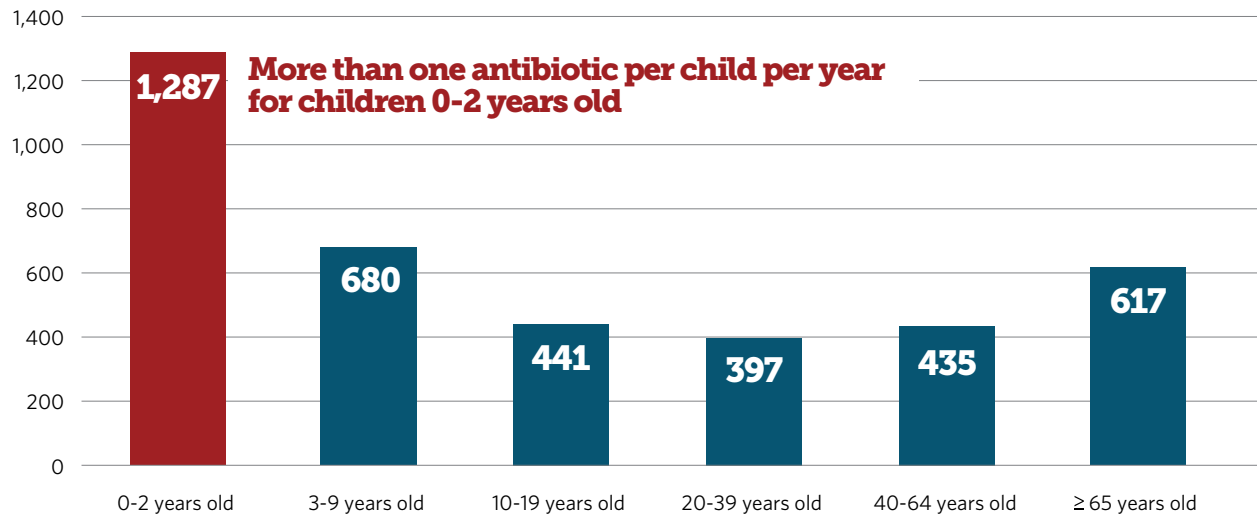
Source: Analysis of NAMCS and NHAMCS data on U.S. antibiotic prescribing, 2010-2011

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Prescribing patterns also show distinct variations by age of the recipient and geographic region. Children younger than 2 receive the most antibiotics, averaging just over one prescription per child per year. Among U.S. regions, the West has the lowest rate of antibiotic prescribing overall, while individuals in the South are prescribed about 30 percent more antibiotics, on average. Although these variations do not necessarily indicate inappropriate antibiotic prescribing, they highlight populations for which targeted stewardship efforts may have the greatest effect.

Figure 2

## Outpatient Antibiotic Prescriptions (per 1,000 People) by Age

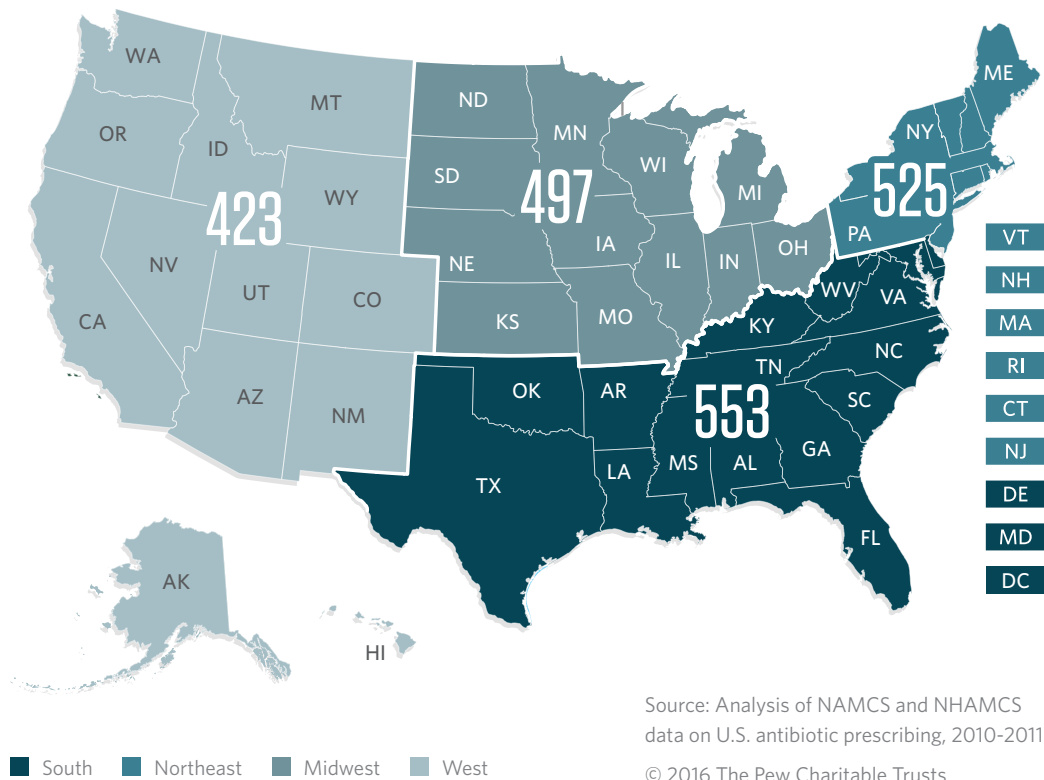


Source: Analysis of NAMCS and NHAMCS data on U.S. antibiotic prescribing, 2010-2011

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Figure 3

## Outpatient Antibiotic Prescriptions (per 1,000 People) by Region



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

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## Establishing national targets for reducing unnecessary antibiotic use in outpatient settings

In early 2015, Pew convened a panel of experts to quantify how much of outpatient antibiotic use in the United States is inappropriate and set targets for reducing outpatient prescribing. Participants were chosen based on their expertise in appropriate outpatient antibiotic use and represented a wide range of specialties, such as primary care, infectious diseases, pediatrics, emergency medicine, pharmacy, nursing, and public health.

Using the baseline antibiotic-use data presented above, the experts reviewed the prescribing rates and current practice guidelines for each diagnosis to determine how much antibiotic use could be eliminated for each (see Appendix C for additional information on methodology for setting reduction targets and Appendix D for recommended reduction targets). This condition-specific approach allowed the panel to factor in variations in antibiotic prescribing guidelines between each illness when setting reduction targets. The panel also set specific targets by age group—0 to 19 years, 20-64, and 65 and older—for each condition.

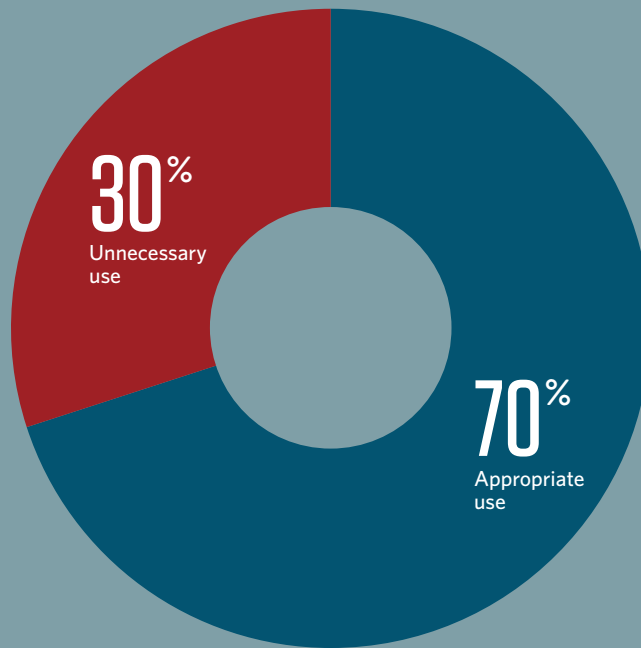
Table 1  
Expert Panel Members

Name	Affiliation	Specialty
Monina Bartoces	Centers for Disease Control and Prevention	Public health, biostatistics
Eva Enns	University of Minnesota	Mathematical modeling
Thomas File	Summa Health System	Infectious diseases
Jonathan Finkelstein	Boston Children's Hospital	General pediatrics
Katherine Fleming-Dutra	Centers for Disease Control and Prevention	Public health, pediatric emergency medicine
Jeffrey Gerber	The Children's Hospital of Philadelphia	Pediatric infectious diseases
Adam Hersh	University of Utah, Primary Children's Hospital	Pediatric infectious diseases
Lauri Hicks	Centers for Disease Control and Prevention	Public health, infectious diseases
David Hyun	The Pew Charitable Trusts	Pediatric infectious diseases
Jeffrey A. Linder	Brigham and Women's Hospital, Harvard Medical School	General internal medicine, primary care
Ruth Lynfield	Minnesota Department of Health	Public health, infectious diseases
David J. Margolis	University of Pennsylvania	Dermatology
Larissa May	University of California, Davis	Emergency medicine
Daniel Merenstein	Georgetown University	Family medicine
Joshua Metlay	Massachusetts General Hospital	Internal medicine, epidemiology
Jason Newland	St. Louis Children's Hospital, Washington University in St. Louis School of Medicine	Pediatric infectious diseases
Jay F. Piccirillo	Washington University in St. Louis School of Medicine	Otolaryngology
Rebecca Roberts	Centers for Disease Control and Prevention	Public health
Guillermo Sanchez	Centers for Disease Control and Prevention	Public health, physician assistant
Daniel Shapiro	University of California, San Francisco	Biostatistics
Katie Suda	University of Illinois at Chicago	Pharmacy, infectious diseases
Ann Thomas	Oregon Health Authority	Public health, pediatrics
Teri Moser Woo	Pacific Lutheran University	Pediatric nursing, nurse practitioner prescribing
Rachel Zetts	The Pew Charitable Trusts	Public health, epidemiology

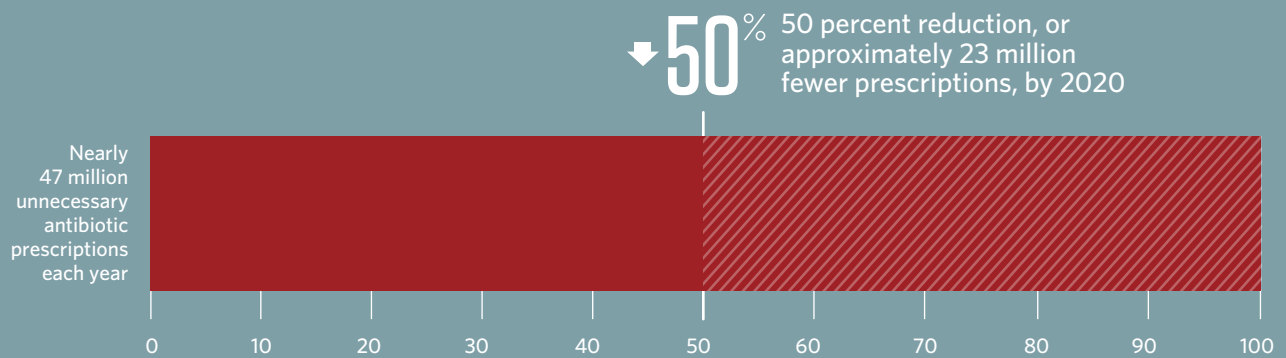


Figure 4  
Expert Panel Recommendations for Improving  
Outpatient Antibiotic Use

Proportion of unnecessary antibiotic use: All conditions



National goal for reducing inappropriate antibiotic use by 2020



## Unnecessary vs. Appropriate Use, by Health Condition

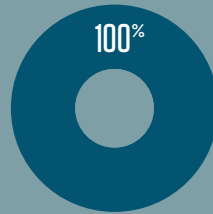
Miscellaneous bacterial infections\*



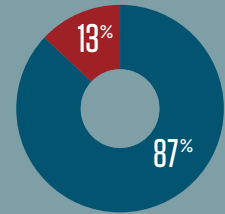
Nonviral pneumonia



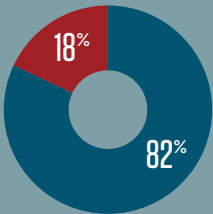
Urinary tract infections



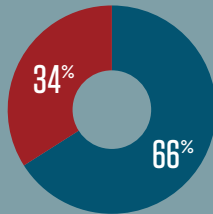
Middle ear infections (suppurative)



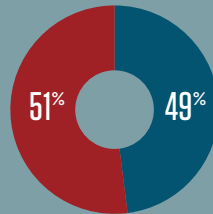
Remaining conditions\*\*



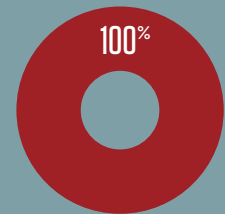
Sinus infections



Pharyngitis



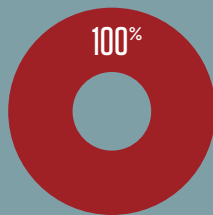
Asthma/allergy



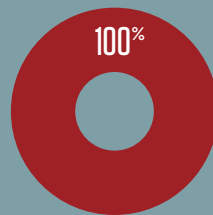
Bronchitis/bronchiolitis



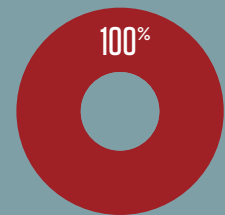
Middle ear infections (nonsuppurative)



Influenza



Viral pneumonia



Viral upper respiratory infections



■ Unnecessary use ■ Appropriate use

\* Includes bacterial infections—excluding those categorized as acute respiratory conditions—that almost always warrant antibiotic use

\*\* Includes all other conditions for which antibiotics were prescribed in the data set not captured in other diagnosis categories

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

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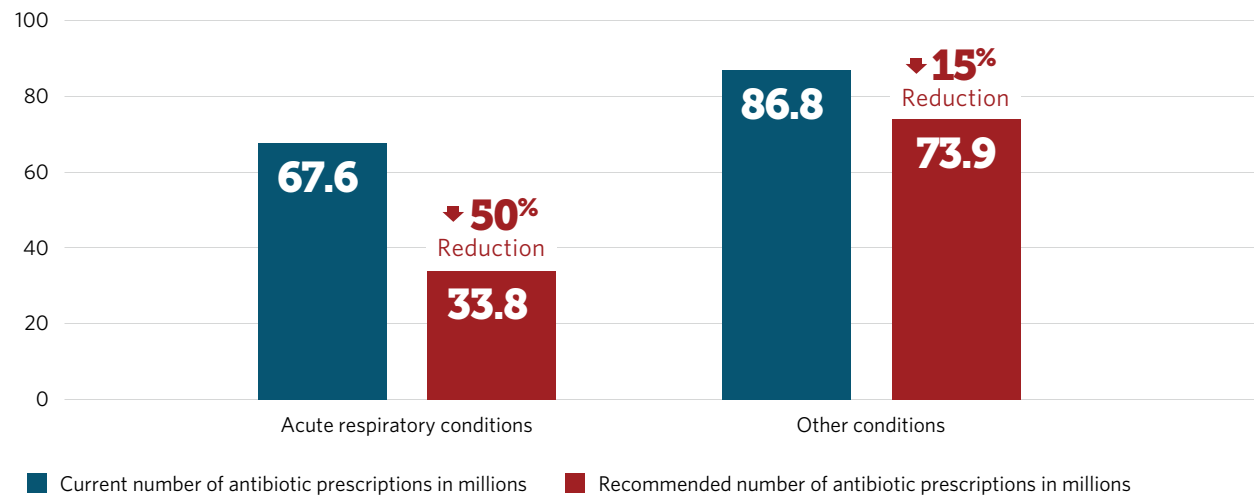
## Overarching recommendations for reduction

The panel determined that at least 30 percent of the outpatient antibiotic prescriptions written in the United States are unnecessary—nearly 47 million excess prescriptions each year. The president’s national action plan for combating antibiotic resistance calls for a 50 percent reduction of this inappropriate use by 2020, which would require decreasing outpatient antibiotic prescribing by 15 percent overall.

The majority of this reduction would come from eliminating unnecessary antibiotic prescribing for acute respiratory conditions. The panel determined that half of all antibiotics prescribed for these conditions are unnecessary, leading to about 34 million excess prescriptions annually. Acute respiratory conditions should clearly be a target of antibiotic stewardship efforts in outpatient settings. Additionally, improving prescribing practices for other conditions, such as skin infections and acne, could reduce antibiotic use by about 13 million prescriptions annually.

Figure 5

### Outpatient Antibiotic Prescribing Reduction Targets



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

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### Acute respiratory conditions

Acute respiratory conditions include a wide range of common infections and other syndromes treated in outpatient facilities:

- Sinus infections.
- Middle ear infections.
- Pharyngitis.
- Viral upper respiratory infections (“common cold”).
- Bronchitis and bronchiolitis.

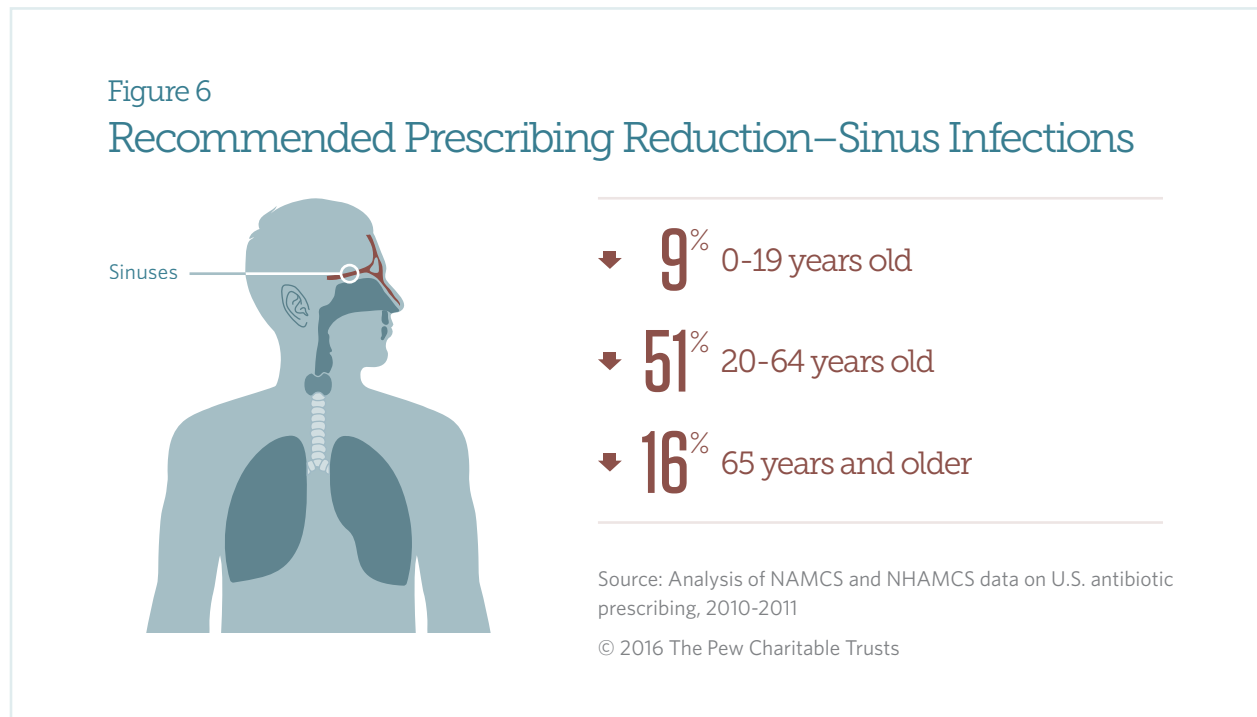
- Asthma and allergy.
- Influenza.
- Pneumonia.

Antibiotics are not recommended for many of these conditions.

### Sinus infections

Sinus infections are the most common reason that antibiotics are prescribed in outpatient settings in the United States, accounting for more than 17 million prescriptions annually. The majority of these prescriptions are written for adults ages 20-64. Although sinus infections can be caused by a number of pathogens, both bacterial and viral, treatment guidelines recommend antibiotic use only when the infection is suspected to be caused by bacteria.<sup>13</sup> Diagnostic tests are rarely used because doctors would have to perform a surgical procedure to obtain a mucus sample from a patient’s sinuses,<sup>14</sup> which is considered impractical and too invasive for most outpatient settings.<sup>15</sup> Thus doctors often diagnose a sinus infection based on clinical criteria—such as whether the patient has experienced related symptoms for 10 days or more without improvement.

The panel recommended a geographic approach to setting reduction targets for prescribing antibiotics to treat sinus infections. Using this method, the ideal antibiotic prescribing rate for sinus infections was set to match the U.S. region with the lowest prescribing rates for each age group. The panel estimated that nearly 6 million unnecessary antibiotic prescriptions are written for sinus infections each year. Adult patients account for an overwhelming majority of these and should be the primary population targeted by stewardship efforts for this diagnosis.



The reduction targets for sinus infections are a conservative estimate because inappropriate antibiotic prescribing occurs across the U.S., even in the lowest-prescribing region. It will be important to evaluate progress made toward these targets and to assess whether further reduction goals are warranted.

## Middle ear infections

Middle ear infections are another condition for which antibiotics are commonly prescribed in outpatient health care settings. About 15 million antibiotic prescriptions are written for this diagnosis each year, with 87 percent of them for patients 19 and younger. As with sinus infections, antibiotics are only sometimes recommended for treating this diagnosis.

The symptoms associated with middle ear infection may be caused by a true infection (suppurative otitis media, identified by the presence of pus) or by the presence of noninfected fluid in the middle ear (nonsuppurative otitis media). Antibiotics are not recommended for the latter condition.<sup>16</sup> For suppurative otitis media, current pediatric prescribing guidelines recommend either treating the patient with antibiotics or, for certain children, waiting 48 to 72 hours to see whether symptoms improve without antibiotic treatment.<sup>17</sup>

The expert panel recommended two approaches for setting reduction targets for middle ear infections. Based on current practice guidelines, the panel recommended eliminating all antibiotic prescribing for nonsuppurative cases of middle ear infections. For a suppurative diagnosis, the panel used the same approach as with sinus infections, setting the target prescribing rate to match that of the lowest prescribing region. Based on this method, the panel estimated that there are nearly 2 million unnecessary prescriptions written for suppurative middle ear infections each year.<sup>18</sup> Improved antibiotic prescribing for both types of middle ear infections could lead to 2.5 million fewer antibiotic prescriptions each year. Antibiotic stewardship activities should focus on improving prescribing for middle ear infections in children and adolescents, as this population accounts for such a large proportion of antibiotics prescribed for this diagnosis. Additionally, stewardship efforts should focus on helping providers to accurately diagnose suppurative middle ear infections, because these are the only cases for which antibiotics may be needed and overdiagnosis of suppurative cases may contribute to overprescribing.

Figure 7

### Recommended Prescribing Reduction—Middle Ear Infections (Nonsuppurative)

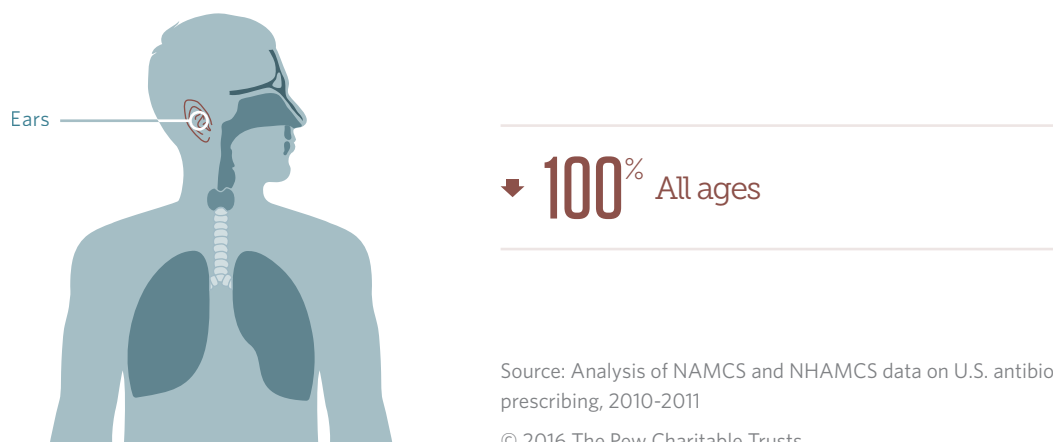
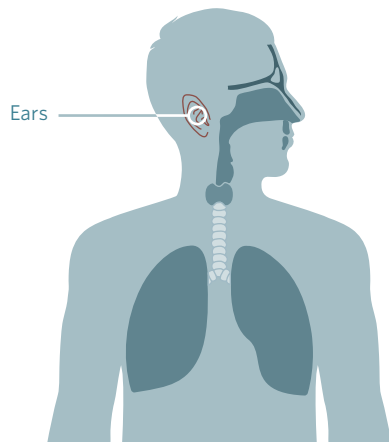


Figure 8

## Recommended Prescribing Reduction—Middle Ear Infections (Suppurative)



↓ **10%** 0-19 years old

↓ **33%** 20-64 years old

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

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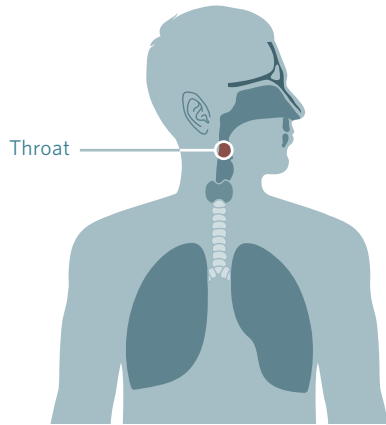
### Pharyngitis

Pharyngitis is a diagnosis of inflammation of the throat, which patients typically report as a sore throat. This condition accounts for over 13 million outpatient antibiotic prescriptions a year in the United States. Pharyngitis can be caused by a number of pathogens, with group A *Streptococcus* (“strep throat”) being the primary bacterial cause.<sup>19</sup> This pathogen can be accurately identified with a diagnostic test, and current guidelines recommend antibiotics for its treatment.<sup>20</sup>

To set a reduction target for this diagnosis, the expert panel reviewed the literature and found that about 37 percent of children and 18 percent of adults presenting with sore throats have strep.<sup>21</sup> Using these data, the panel determined that there are about 7 million excess antibiotic prescriptions written for pharyngitis each year,<sup>22</sup> with 4 million written for patients 20-64 years old. Ensuring appropriate diagnostic testing for strep throat is critical to improving antibiotic use for this diagnosis.

Figure 9

## Recommended Prescribing Reduction—Pharyngitis



↓ **34%** 0-19 years old

↓ **75%** 20-64 years old

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

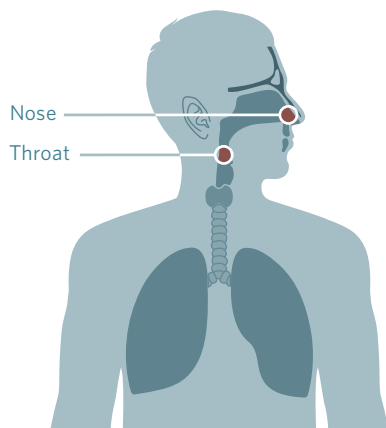
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### Viral upper respiratory infections

Viral upper respiratory infection (URI) is also known as the “common cold” and is associated with symptoms such as cough, congestion, and sore throat.<sup>23</sup> Because these infections are caused by viruses and not bacteria, antibiotic therapy is not recommended.<sup>24</sup> Eliminating unnecessary use for this diagnosis could result in 8 million fewer antibiotic prescriptions each year.

Figure 10

## Recommended Prescribing Reduction—Viral Upper Respiratory Infections



↓ **100%** All ages

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

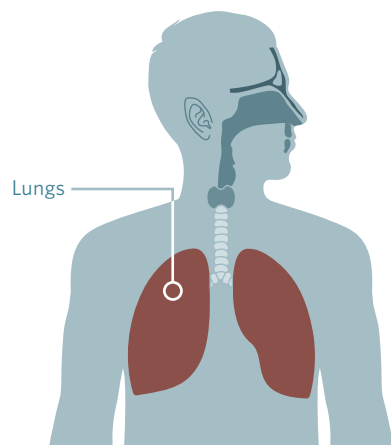
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## Bronchitis and bronchiolitis

Bronchitis and bronchiolitis are types of infections that result in inflammation of the airways of the lungs.<sup>25</sup> Bronchiolitis occurs in children younger than 24 months. These infections are caused primarily by viral pathogens, and current guidelines recommend against prescribing antibiotics.<sup>26</sup> Adherence to these guidelines could eliminate 7.8 million prescriptions annually. Over half of this unnecessary prescribing occurs in adult patients ages 20-64. This population is a key target for antibiotic stewardship efforts for acute bronchitis.

Figure 11

### Recommended Prescribing Reduction—Bronchitis and Bronchiolitis



↓ 100% All ages

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

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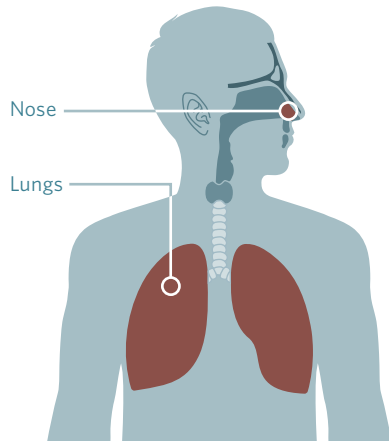
## Asthma and allergy

Asthma and allergies are commonly diagnosed conditions in outpatient health care settings. They are not caused by an infection, although symptoms sometimes associated with these diagnoses—such as cough and runny nose—can mimic an infection.<sup>27</sup> Antibiotics are not recommended for treating these conditions;<sup>28</sup> however, they account for nearly 3 million outpatient antibiotic prescriptions annually.



Figure 12

## Recommended Prescribing Reduction—Asthma and Allergy



↓ 100% All ages

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

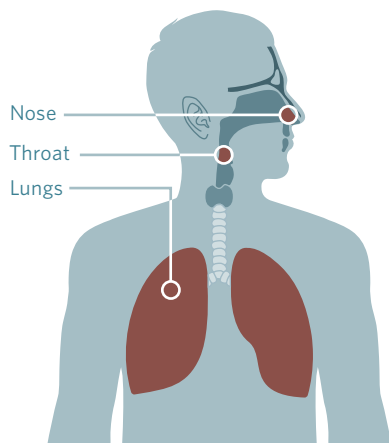
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## Influenza

Influenza (the “flu”) is caused by the influenza virus and is associated with symptoms such as cough and fever.<sup>29</sup> Patients with the flu should not be treated using antibiotics.<sup>30</sup> Although the panel recommended that no patient should receive antibiotics for this viral illness, an individual estimate of the potential reduction in antibiotic prescriptions could not be calculated because of data limitations.

Figure 13

## Recommended Prescribing Reduction—Influenza



↓ 100% All ages

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

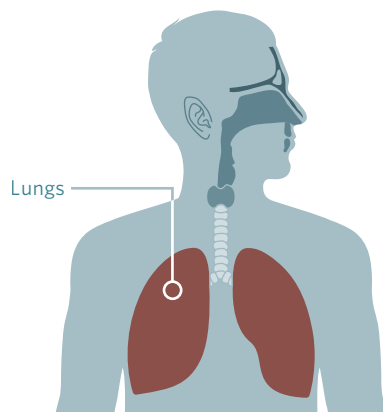
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## Pneumonia

Pneumonia is an infection often characterized by shortness of breath, fever, and cough.<sup>31</sup> This disease can be caused by a number of pathogens, including bacteria and viruses.<sup>32</sup> Antibiotics should not be prescribed in cases of known or suspected viral pneumonia. As with influenza, an individual estimate of this reduction in millions of antibiotic prescriptions could not be calculated because of data limitations. For nonviral pneumonia, the panel did not recommend any reduction target because antibiotic therapy is recommended for this diagnosis.

Figure 14

### Recommended Prescribing Reduction—Viral Pneumonia



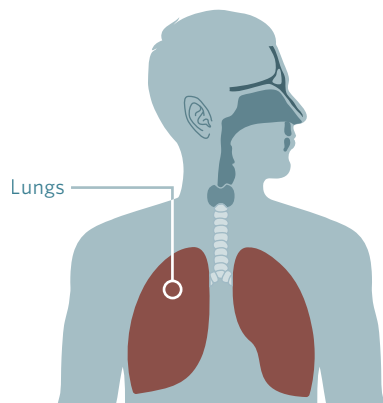
↓ 100% All ages

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

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Figure 15

### Recommended Prescribing Reduction—Nonviral Pneumonia



0% All ages

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

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## Other conditions

Beyond respiratory conditions, a number of other conditions are commonly treated with antibiotics in outpatient settings, including urinary tract infections (UTIs), skin infections, and acne. Some of these, such as UTIs, are usually bacterial infections for which antibiotics are an appropriate treatment.<sup>33</sup> No reduction targets were set for UTIs or other miscellaneous bacterial infections (such as syphilis or whooping cough). Others, such as acne and skin infections, only sometimes warrant antibiotic treatment. For these conditions, the panel again recommended using a regional approach to set reduction targets. Overall, it was estimated that these remaining conditions account for over 13 million unnecessary antibiotic prescriptions each year.

Figure 16  
**Recommended Prescribing Reduction—Urinary Tract Infections and Miscellaneous Bacterial Infections\***

**0%** All ages

\* Includes bacterial infections—excluding those categorized as acute respiratory conditions—that almost always warrant antibiotic use.

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

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Figure 17  
**Recommended Prescribing Reduction—Remaining Conditions\***

- ↓ **25%** 0-19 years old
- ↓ **19%** 20-64 years old
- ↓ **10%** 65 years and older

\* Includes all other conditions for which antibiotics were prescribed in the data set not captured in other diagnosis categories.

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

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## Reaching national targets for improved antibiotic use: The role of antibiotic stewardship

Understanding how much of current antibiotic prescribing is unnecessary is only the first step to meeting the national goal of reducing inappropriate outpatient antibiotic use 50 percent by 2020. The targets set forth in this report clearly highlight conditions for which increased antibiotic stewardship is necessary. However, coordinated and sustained stakeholder action will be critical to the scale-up of current stewardship efforts.

In October 2015, Pew brought together the original panel of experts, as well as additional individuals representing diverse stakeholders, including behavioral scientists, health systems, health plans, and state health departments. This expanded group discussed interventions shown to be effective in changing outpatient prescribing habits, barriers to outpatient stewardship implementation, and the roles of stakeholders in addressing these barriers and promoting increased implementation of stewardship interventions.

### Outpatient antibiotic stewardship: What does it look like?

Antibiotic stewardship programs aim to ensure that these drugs are reserved for treating bacterial infections and, when they are indicated, that the most appropriate antibiotic is prescribed at the right dose and duration of therapy. There is no one-size-fits-all stewardship program, as needs and resources vary across health care settings. However, a number of stewardship strategies can improve prescribing. Examples include:

- **Audit and feedback:** This strategy aims to supply health care providers with their individual antibiotic prescribing rates for a specific condition or conditions, often compared against peer rates or an expected rate based on practice guidelines. A 2013 study showed that combining physician education with audit and feedback on individual prescribing habits significantly improved antibiotic use in a handful of outpatient practices.<sup>34</sup> Other studies have found mixed results.<sup>35</sup>
- **Decision support:** Clinical decision support provides clinicians with information to help them determine the most appropriate diagnosis and treatment plan for individual patients. Decision support tools range from clinical guidelines to flowcharts to electronic alerts. Studies have shown that implementing paper or electronic decision tools in outpatient facilities can improve antibiotic prescribing habits.<sup>36</sup>
- **Communication training:** Health care providers often prescribe unnecessary antibiotics because they believe their patient or a patient's parents expect them.<sup>37</sup> Training on how to effectively discuss treatment options with a patient can help to overcome this barrier. For example, training a provider to make "positive" treatment recommendations—recommending nonantibiotic remedies to alleviate symptoms, rather than just telling a patient that antibiotics are not needed—can decrease antibiotic prescribing.<sup>38</sup>

Overall, the group agreed that no single stewardship intervention will alone significantly improve antibiotic prescribing in all outpatient facilities. Rather, a combination of the above tactics, as well as others, will be required. Research into the effectiveness of these and other types of stewardship interventions across various practice settings is needed. These evaluations should take into account not only the effect these efforts will have on inappropriate prescribing, but also their impact on patient outcomes and cost.

### Role of health care stakeholders in expanding outpatient antibiotic stewardship programs

Outpatient antibiotic stewardship efforts are complicated by a number of barriers to widespread implementation. First, these offices may not have access to personnel with expertise in critical areas such as infectious diseases,

pharmacology, and information technology. Second, outpatient offices often lack adequate data systems that allow for the easy collection and dissemination of data on antibiotic use. This information can aid in stewardship implementation by highlighting prescribing habits in need of improvement. Finally, time constraints limit both the window a provider has to spend with a patient discussing alternate treatment options, as well as a small practice's ability to implement stewardship interventions in general.

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## A Patient's Role in Improving Antibiotic Stewardship

Providers often report feeling pressured by patients to prescribe antibiotics. Patients can help alleviate this concern by talking to their clinician about when an antibiotic is, and is not, needed to treat a particular infection. Questions such as "Do I really need an antibiotic to treat my infection?" can help patients ensure that they receive appropriate treatment.

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Multiple stakeholders must contribute to antibiotic stewardship efforts in order to help overcome these barriers:

- **Individual providers and practices:** Clinicians and other health care providers will play a critical role in helping the U.S. reach the national targets outlined in this report. Given time and resource constraints, outpatient practices might start by targeting key conditions or populations where overprescribing is a known issue.
- **Health systems:** Health systems coordinate and manage patient care within a geographic area. These organizations can help provide their outpatient offices with access to additional expertise—such as infectious disease specialists and resources that can aid in stewardship implementation. For example, health systems can leverage shared electronic health records to help build the data systems needed for interventions such as audit and feedback.
- **Health plans:** Public and private health plans can play a critical role in analyzing and disseminating prescribing data for their health care providers. Plans can use these data to identify high prescribers within their networks and target them for stewardship activities, such as providing educational materials to these individuals.
- **State and local health agencies:** Health departments can provide outpatient facilities with information on how to implement antibiotic stewardship. These agencies can also develop local and regional networks of inpatient and outpatient facilities to work together to improve antibiotic use.
- **Federal agencies:** Government agencies can also aid stewardship efforts at the national level. For example, the Centers for Disease Control and Prevention can continue to track data on antibiotic prescribing, identifying potential areas for improvement and offering guidance to individual providers and other health care stakeholders on how to implement stewardship programs across various settings.
- **Health care quality organizations:** Organizations that develop standards to assess the quality of health care services can develop metrics to measure the success of outpatient stewardship efforts. For example, the National Committee for Quality Assurance (NCQA) develops a collection of measures known as the Healthcare Effectiveness Data and Information Set (HEDIS) to help assess the quality of health care in the United States. HEDIS currently includes specific measures related to antibiotic prescribing.<sup>39</sup> Outpatient stewardship efforts can be bolstered by further developing metrics for evaluating the appropriateness of antibiotic prescribing by outpatient health care providers. NCQA and other quality organizations can lead these efforts and obtain input from other health care stakeholders.

- **Professional societies:** Medical, nursing, and pharmacy professional organizations can offer their members expert guidance on current prescribing and practice guidelines most relevant to their patients. These organizations can also highlight new technologies that can aid in stewardship efforts, such as the latest diagnostic tools.

The overarching national goal and the targets outlined in this report are ambitious but achievable if stakeholders at all levels commit to comprehensive and sustained action to expand current outpatient stewardship efforts nationwide. By prioritizing antibiotic stewardship and reducing unnecessary antibiotic exposure in outpatients, these groups can minimize the threat of antibiotic resistance.

## Appendix A: Glossary

**Acute respiratory conditions:** Key outpatient conditions that affect various parts of the respiratory tract, specifically allergies, asthma, bronchitis, bronchiolitis, influenza, sinus infections, middle ear infections, pharyngitis, pneumonia, and viral upper respiratory infections.

**Allergy:** An immune response to foreign substances often found in the environment; allergic reactions can range from harmless responses to life-threatening ones.<sup>40</sup>

**Asthma:** Inflammatory disorder of the airway characterized by recurring episodes of wheezing, shortness of breath, and/or cough.<sup>41</sup>

**Bronchiolitis:** Inflammation of the smallest branches of the air passage of the lungs (bronchioles) caused by an infection; occurs in infants less than 24 months old.<sup>42</sup>

**Bronchitis:** Inflammation of the mucous membrane of the major branches of the air passages of the lungs (bronchi).<sup>43</sup>

**Influenza (“flu”):** A contagious infection of the respiratory pathway caused by the influenza virus.<sup>44</sup>

**Middle ear infections:** Inflammation of the middle ear that frequently occurs in early childhood; also known as otitis media; can present as suppurative (presence of pus) or nonsuppurative (fluid without pus).<sup>45</sup>

**Outpatient health care settings:** Health care services where patients are treated without being hospitalized, such as primary care facilities, emergency rooms, and other hospital-based specialty clinics.

**Pharyngitis:** Inflammation of the passage at the back of the throat (pharynx).<sup>46</sup>

**Pneumonia:** Acute inflammation of the lung tissue usually due to an infection.<sup>47</sup>

**Sinus infections (sinusitis):** Inflammation of one or more of the sinuses that surround the nasal cavity (paranasal sinuses).<sup>48</sup>

**Upper respiratory infections:** Infection of the nasal passages, sinuses, voice box (larynx), or passage at the back of the throat (pharynx);<sup>49</sup> in this report, viral upper respiratory infection specifically refers to diagnoses of a common cold or unspecified upper respiratory infection.

**Urinary tract infections:** Infection of the kidneys, bladder, urethra, or ureter.<sup>50</sup>

## Appendix B: Data sources for assessing outpatient antibiotic use

The data used to identify current patterns in outpatient antibiotic prescribing and inform the process for setting national reduction targets come from two surveys conducted in the United States annually, 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 services in the United States, including visits to doctors' offices, emergency departments, and hospital specialty clinics. Specific to antibiotic prescribing, NAMCS and NHAMCS collect information on the diagnosis or diagnoses made by the clinician and any drugs that a patient is newly prescribed or is taking at the time of that office visit. These data provide a snapshot of why antibiotics are being prescribed in outpatient facilities.

Although NAMCS and NHAMCS offer the best data currently available to assess the appropriateness of antibiotic prescribing in the United States, it is important to recognize that they represent only a portion of total outpatient services. For example, these data do not include information on antibiotic prescribing that occurs independent of an office visit, such as prescribing via telemedicine or in retail and urgent care clinics. These are also important settings for outpatient services in the United States. Additionally, NAMCS and NHAMCS do not survey dental offices. Dentists are one of the highest prescribing specialties in the United States, representing 9 percent of all outpatient antibiotic prescriptions.<sup>51</sup> These surveys may also underrepresent prescribing by physician assistants and nurse practitioners.

Thus, in part because NAMCS and NHAMCS represent only a subset of outpatient prescribing facilities, the national goal outlined in this report should be considered a minimum estimate of how much antibiotic use should be reduced in this country. Additional work must be conducted to identify opportunities for improved prescribing by outpatient providers not currently included in this goal.



## Appendix C: Methodology for setting national reduction targets

To identify how much of outpatient antibiotic use is unnecessary, the expert panel took a condition-specific approach to analyzing the baseline data provided by NAMCS and NHAMCS.

As a first step, the panel recommended an analytic approach that took any documented secondary and tertiary diagnoses into account for individual patients. Patients were categorized according to the most antibiotic-appropriate diagnosis. For example, in NAMCS or NHAMCS, a patient may have bronchitis listed as the primary diagnosis but have bacterial pneumonia as his or her second or third diagnosis. Although an antibiotic is not recommended for the treatment of bronchitis, it is recommended for cases of bacterial pneumonia. Using the panel's recommended approach, this patient's antibiotic prescription would be counted as appropriate due to the pneumonia diagnosis. This antibiotic prescription would not be included in the total number of antibiotics prescribed for bronchitis.

The panel then recommended two primary methods for setting condition-specific targets. For many of the acute respiratory conditions, current prescribing guidelines provided clear recommendations for or against antibiotic therapy within defined circumstances. In those cases, the panel set reduction targets based solely on these published, consensus documents. This method was used for the following diagnoses:

- Nonsuppurative middle ear infections.
- Pharyngitis.
- Viral upper respiratory infections.
- Bronchitis and bronchiolitis.
- Asthma and allergies.
- Influenza.
- Pneumonia.
- Urinary tract infections.
- Miscellaneous bacterial infections.

For pharyngitis, the panel also utilized literature to determine what percentage of patients with pharyngitis have strep throat—i.e., meet criteria for antibiotic prescribing according to current guidelines.

For conditions where an optimal prescribing rate was unclear—illnesses for which antibiotics are sometimes but not always appropriate—the panel recommended a geographic approach for determining an “ideal” prescribing rate. Using this method, the target prescribing rate was set as the rate of the lowest prescribing region for each condition and age group. This method was used for the following diagnoses:

- Sinus infections.
- Suppurative middle ear infections.
- Remaining conditions.

The panel was not aware of data suggesting that low-prescribing regions had worse outcomes. Research to evaluate patient outcomes associated with these conditions would be useful moving forward.

The reductions targets set forth in this report focus on just a single aspect of inappropriate antibiotic prescribing: unnecessary antibiotic use. However, inappropriate prescribing also includes other situations, such as the choice of a therapeutically inappropriate drug or duration of treatment. The panel also evaluated the appropriateness of current outpatient prescribing according to antibiotic choice, with results to be presented in a future report.

## Appendix D: Reduction tables

Table D.1

### Acute Respiratory Conditions

Diagnosis	Number of antibiotic prescriptions (millions)	Recommended number of antibiotic prescriptions (millions)	Antibiotic prescription rate per 1,000 people	Recommended antibiotic prescription rate per 1,000 people	Reduction target
<b>Goals: 0-19 years old</b>					
Asthma/allergy, bronchitis/ bronchiolitis, influenza, middle ear infections (nonsuppurative), viral upper respiratory infections, viral pneumonia	7.4	0	90	0	-100%
Sinus infections	5.4	4.9	65	59	-9%
Middle ear infections (suppurative)	12.8	11.4	154	138	-10%
Pharyngitis	7.5	5	91	60	-34%
Pneumonia (nonviral)	1.8	1.8	22	22	0%
<b>Total</b>	<b>34.8</b>	<b>23</b>	<b>421</b>	<b>278</b>	<b>-34%</b>
<b>Goals: 20-64 years old</b>					
Asthma/allergy, bronchitis/ bronchiolitis, influenza, middle ear infections (nonsuppurative), viral upper respiratory infections, viral pneumonia	9.5	0	52	0	-100%
Sinus infections	10	4.9	55	27	-51%
Middle ear infections (suppurative)	1.6	1.1	9	6	-33%
Pharyngitis	5.3	1.3	29	7	-75%
Pneumonia (nonviral)	1	1	5	5	0%
<b>Total</b>	<b>27.3</b>	<b>8.3</b>	<b>150</b>	<b>45</b>	<b>-70%</b>
<b>Goals: 65 and older</b>					
Asthma/allergy, bronchitis/ bronchiolitis, influenza, middle ear infections (nonsuppurative), viral upper respiratory infections, viral pneumonia	2.6	0	66	0	-100%
Sinus infections	1.7	1.5	44	37	-16%
Middle ear infections (suppurative)	N/A	N/A	N/A	N/A	N/A
Pharyngitis	N/A	N/A	N/A	N/A	N/A
Pneumonia (nonviral)	0.5	0.5	12	12	0%
<b>Total</b>	<b>5.4</b>	<b>2.5</b>	<b>136</b>	<b>63</b>	<b>-54%</b>

Table D.2  
Other Conditions

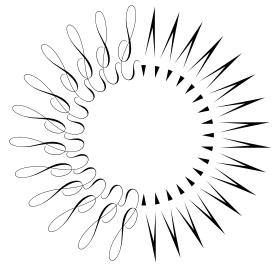
Diagnosis	Number of antibiotic prescriptions in millions	Recommended number of antibiotic prescriptions in millions	Antibiotic prescription rate per 1,000 people	Recommended antibiotic prescription rate per 1,000 people	Reduction target
<b>Goals: 0-19 years old</b>					
Urinary tract infections	1.9	1.9	23	23	0%
Miscellaneous bacterial infections	1.6	1.6	20	20	0%
Remaining conditions	15.1	11.3	182	137	-25%
<b>Total</b>	<b>18.6</b>	<b>14.9</b>	<b>225</b>	<b>180</b>	<b>-20%</b>
<b>Goals: 20-64 years old</b>					
Urinary tract infections	6.4	6.4	35	35	0%
Miscellaneous bacterial infections	2	2	11	11	0%
Remaining conditions	40.7	32.9	222	180	-19%
<b>Total</b>	<b>49.2</b>	<b>41.5</b>	<b>269</b>	<b>227</b>	<b>-16%</b>
<b>Goals: 65 and older</b>					
Urinary tract infections	2.5	2.5	64	64	0%
Miscellaneous bacterial infections	N/A	N/A	N/A	N/A	N/A
Remaining conditions	15.9	14.3	401	362	-10%
<b>Total</b>	<b>19</b>	<b>17.5</b>	<b>480</b>	<b>441</b>	<b>-8%</b>

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