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Campylobacter jejuni bacteria cause serious gastroenteritis and are increasingly resistant to commonly used antibiotics.

Trends in U.S. Antibiotic Use, 2018

Despite some progress in data collection and availability, more information is needed to improve prescribing, combat the threat of resistant bacteria

Overview

Antibiotic resistance remains a pressing global public health problem. This second report on antibiotic use in the United States highlights encouraging progress made over the past year in the collection and availability of data for both human health care and animal agriculture settings. Despite these gains, more comprehensive data are needed to enable policymakers to track trends, refine priorities, and target interventions to reduce unnecessary antibiotic use and slow the emergence of resistance.

Antibiotic use in health care

The U.S. has a relatively high antibiotic prescribing rate. For example, an analysis of 2004 outpatient data from the U.S. and 27 European countries showed the U.S. had the fourth-highest prescribing rate.¹ Although data are incomplete, existing evidence suggests that a significant portion of antibiotic use across U.S. health care settings is inappropriate—from primary care offices and emergency rooms to hospitals and long-term care facilities. Policy options and incentives will vary depending on the setting, but enhanced data are needed across all settings in order to design targeted and effective stewardship interventions that will improve the use and preserve the effectiveness of this valuable resource.

Antibiotic use in outpatient care

Volume of use

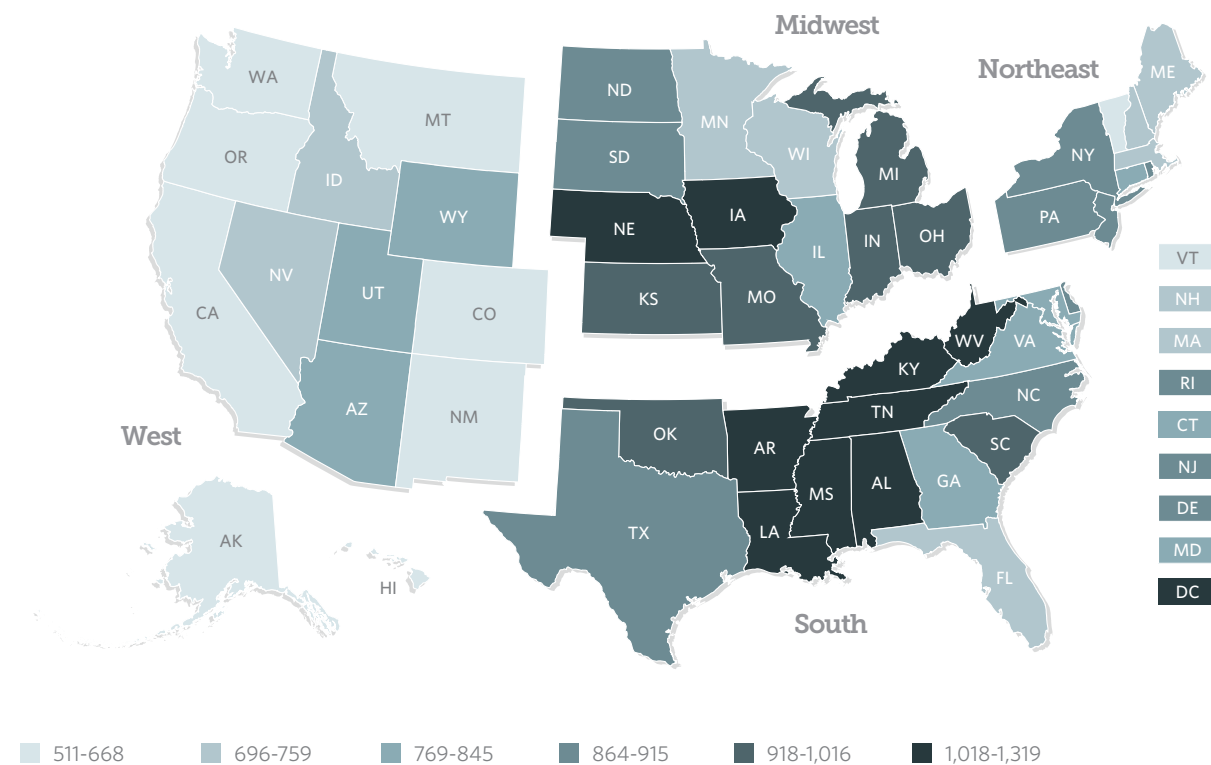
Providers in doctors' offices, emergency departments, and other outpatient settings in the U.S. wrote nearly 270 million antibiotic prescriptions in 2015, amounting to 838 antibiotic prescriptions for every 1,000 people.² Although this was essentially unchanged from 2014, data going back to 2011 indicate a slow downward trend in outpatient prescribing.³ Nonetheless, U.S. rates remain high by international standards. In 2015, for example, U.S. outpatient prescribing was more than 2½ times Sweden's rate that year.⁴

U.S. prescribing rates vary by state, with numbers generally higher in Southern states and lowest in the West. (See Figure 1.) For instance, based on the most recent data, West Virginia's rate was over twice that of Alaska's. Although geographic variation alone does not clearly indicate differences in the appropriateness of prescribing, this information can help inform targeted stewardship efforts. Research indicates that effective antibiotic stewardship interventions have the potential to reduce outpatient rates of antibiotic use in the U.S. when they also account for the clinical, socio-behavioral, and other unique factors that drive inappropriate use in a given setting.⁵

Figure 1

Outpatient Antibiotic Prescriptions by State, 2015

Antibiotic prescriptions per 1,000 people



Source: Centers for Disease Control and Prevention, "Outpatient Antibiotic Prescriptions—United States, 2015," accessed Jan. 25, 2018, <https://www.cdc.gov/antibiotic-use/community/pdfs/Annual-Report-2015.pdf>

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Antibiotic prescribing trends vary widely by provider type. For example, prescribing rates for primary care doctors fell by 18 percent from 2011 to 2015, while those for nurse practitioners and physician assistants rose 64 percent.⁶ The latter figure does not take into account possible changes over time in patient caseloads—for instance, whether providers are seeing more patients with bacterial infections. However, such trend differences highlight the importance of implementing comprehensive stewardship initiatives that involve all provider types.

Appropriateness of use

At least 30 percent of oral antibiotics prescribed in physicians' offices, emergency departments, and hospital-based clinics are unnecessary.⁷ Of the total excess prescriptions, nearly three-quarters are for acute respiratory conditions, including asthma, allergies, colds, and other infections not caused by bacteria, which therefore do not respond to antibiotics.



In cases where an antibiotic is necessary to treat an infection, it is important to prescribe the appropriate drug. An examination of antibiotic prescribing for three common respiratory conditions found that in about a third of cases, providers selected the wrong drug.⁸ Choosing an antibiotic that targets only the bacteria most likely to cause a given illness could substantially reduce the development of resistance.⁹

The three respiratory conditions included in the above study accounted for nearly 30 percent of all antibiotic prescriptions in outpatient settings. Additional data are needed to assess the appropriateness of antibiotic selection for other common conditions managed in such settings.

Improving data

There are many areas where adequate data on outpatient antibiotic prescribing are lacking. For example, data capturing appropriateness of prescribing in dental offices or via telemedicine are not publicly available. Encouragingly, new data were recently published for retail and urgent care clinics—facilities that play a large role in the provision of U.S. outpatient care.¹⁰ Although not nationally representative, the data suggest there is significant room for improving prescribing practices in these settings.¹¹ Better data and qualitative research on the drivers of antibiotic use would enable public health agencies, the health care industry, professional societies, and other stakeholders to implement interventions that could improve the appropriateness of prescribing.

Outpatient Data Summary

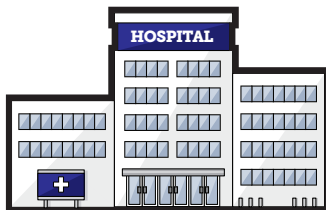
Volume of antibiotic use	Appropriateness of use	Next steps
Nationally representative data are available on number of prescriptions.	Nationally representative data are available but do not cover prescribing in certain settings.	<ul style="list-style-type: none">• Collect enhanced appropriateness data.• Evaluate impact of policy interventions.

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Antibiotic use in inpatient care

Volume of use

Over half of all hospital patients receive antibiotics during their stay—a figure unchanged in recent years. However, while the overall rate of hospital antibiotic use has remained steady, the mix of drugs being used has changed. Between 2006 and 2012 specifically, the use of many broad-spectrum antibiotics increased, with a commensurate decrease in use of many narrow-spectrum antibiotics that target a limited group of bacteria.¹² As broad-spectrum antibiotics have been shown to significantly increase the risk of drug-resistant infections, this trend is concerning.¹³



Over **50%** of all hospital patients receive antibiotics.

Source: James Baggs et al., "Estimating National Trends in Inpatient Antibiotic Use Among US Hospitals From 2006 to 2012," *JAMA Internal Medicine* 176, no. 11 (2016): 1639–48, <http://dx.doi.org/10.1001/jamainternmed.2016.5651>

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Appropriateness of use

Unfortunately, the U.S. lacks comprehensive data on the appropriateness of inpatient antibiotic use.¹⁴ Existing research suggests that improvement is needed. For example, one study examining the treatment of a common bacterial condition (urinary tract infection) and use of a commonly prescribed antibiotic (vancomycin) in a sample of hospitals across the country found that 37 percent of prescriptions were potentially unnecessary or inappropriate (written for the wrong duration or antibiotic).¹⁵ In order to have a more complete assessment of the appropriateness of antibiotic use in U.S. hospitals, additional data that capture more conditions and drugs are needed.

Improving data

The Centers for Disease Control and Prevention has the capacity to track hospital antibiotic use through its National Healthcare Safety Network (NHSN), but current data are voluntary and limited. As of July 2017, only a small fraction of hospitals report their antibiotic use;¹⁶ mandatory reporting would provide the data needed to establish a more accurate baseline of current use, identify where and what types of stewardship interventions would be most effective, and measure progress toward reducing inappropriate prescribing.

Inpatient Data Summary

Volume of antibiotic use	Appropriateness of use	Next steps
Data are not systematically reported at the national level; estimates of use come from voluntary survey data.	Nationally representative data are limited to one health condition and one antibiotic.	<ul style="list-style-type: none">• Collect use data from all hospitals through NHSN.• Collect enhanced appropriateness data.• Evaluate impact of policy interventions.

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Antibiotic use in animal agriculture

Antibiotics are used in animal agriculture to treat, control, and prevent disease. Currently, little information is publicly available on how those antibiotics are actually used on the farm or the appropriateness of that use in the U.S. Experiences in other countries—for instance, through the Monitoring of Antimicrobial Resistance and Antibiotic Usage in Animals in the Netherlands (MARAN) or the European Surveillance of Veterinary Antimicrobial Consumption projects—demonstrate the feasibility and value of collecting data to better understand antibiotic use on farms.¹⁷ Collecting such data in the U.S. will be key to establishing a current baseline of use; identifying opportunities to responsibly reduce antibiotic use; setting evidence-based reduction goals; and measuring progress over time.

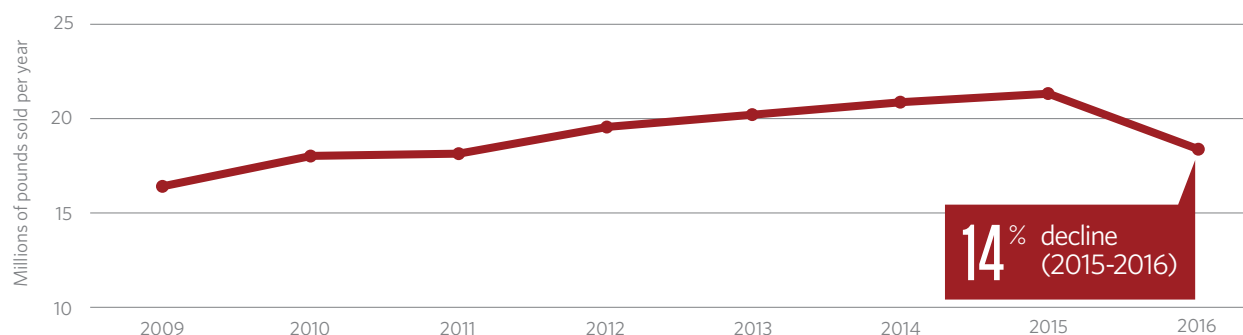
Collecting nationally representative use data is complicated by the diversity of how industries are structured. For example, the poultry industry is highly integrated whereas the cattle industry is more fragmented, resulting in differences across species in the use of centralized data collection systems.¹⁸ Nonetheless, as other countries have demonstrated, enhanced data collection is possible.

Volume of use

Currently the only national estimates of total antibiotic use in U.S. food animal production come from sales data, which can provide insights into trends in use. In 2016, the most recent year for which data are available, approximately 18.4 million pounds (8.4 million kilograms) of antibiotics considered important for human use were sold for use in animal agriculture. This represents a 14 percent drop from the previous year and marks the first decrease since these data were initially reported in 2009. (See Figure 2.) The exact reason for the 2016 decrease cannot be determined from available data because sales information does not capture how the drugs were used. The trend reversal is encouraging, however, and is expected to continue given full implementation in January 2017 of federal guidance requiring veterinary oversight of antibiotics and limiting the use of these drugs for growth promotion.

Figure 2

After Steady Increases, Sales of Medically Important Antibiotics for Use in U.S. Food-Producing Animals Fell for the First Time in 2016



Source: Food and Drug Administration, “2016 Summary Report on Antimicrobials Sold or Distributed for Use in Food-Producing Animals” (2017), <https://www.fda.gov/downloads/ForIndustry/UserFees/AnimalDrugUserFeeActADUFA/UCM588085.pdf>

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Notably, the most recent data break down sales estimates by the major types of food animals—cows, chickens, pigs, and turkeys—setting a baseline to analyze future species-specific sales information. Understanding which drugs are prescribed primarily for which species can provide insight into use patterns and help identify areas for targeted interventions and prioritized research funding.

Like overall sales estimates, species-level data estimates do not allow researchers to determine why antibiotics were used. Differences in the animal population, such as their physical size and quantity, make current species data difficult to interpret and compare. A recent Food and Drug Administration proposal to establish a standardized method for adjusting sales estimates by the size of the animal populations could help address this challenge. However, more data are needed to better understand actual use in food animal production.

Appropriateness of use

National data to evaluate the appropriateness of antibiotic use in animal agriculture are limited. The U.S. Department of Agriculture collects nationally representative survey data on animal health, management practices, and productivity. Traditionally, these data have been collected infrequently (about every five years), and surveys differ widely across species.¹⁹ Additional limitations include insufficient quantitative information on reasons for use, and specific drugs, dosages, and duration.²⁰ Last year, USDA expanded its efforts to collect information on how antibiotics are used in cattle feedlots and swine operations. The data are expected to be released in late 2018, and the agency has indicated it plans to repeat the survey every two years. This expansion will provide some important insight into why antibiotics are used in U.S. animal production, but additional and more detailed data—for example, on specific diagnoses, dosages, and durations of use—are needed to determine the extent of appropriate and inappropriate antibiotic use in animal agriculture and where alternatives might be used.

Improving data

Expanding the USDA’s existing survey to include more detailed questions about the volume of actual use and the dosages, duration, and conditions for which antibiotics are being used would provide the missing information about antibiotic use on farms. This would enable stakeholders to evaluate the impact of recent policy changes, monitor trends, and identify opportunities to improve antibiotic use.

Animal Agriculture Data Summary

Volume of antibiotic use	Appropriateness of use	Next steps
Nationally representative data are available on sales but not on actual use.	No nationally representative data exist to evaluate appropriateness.	<ul style="list-style-type: none"> • Collect use data. • Collect appropriateness data. • Research drivers of on-farm use. • Evaluate research priorities and impact of policy interventions.

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Conclusion

Currently available data on antibiotic use in the U.S. are insufficient. Key stakeholders from the public, private, and nonprofit sectors must work together to improve the quality and availability of data in order to expand antibiotic stewardship in human health care and promote the responsible use of these drugs in food animals.

To improve antibiotic use data:

- The Centers for Medicare & Medicaid Services should require mandatory reporting of hospital antibiotic use to the National Healthcare Safety Network.
- FDA should finalize its proposed method to adjust species-level use data and ensure that the method is transparent, understandable, and consistent with related international efforts.
- Congress should support the USDA and FDA’s capacity to implement currently underfunded data collection plans through an increase in appropriations.
- Livestock producers, retailers, and researchers should collaborate to determine how best to enhance data collection on the farm.

The Pew Charitable Trusts will continue to work with various partners to improve the quality and quantity of antibiotic use data on all fronts, and will periodically evaluate progress and remaining gaps.

Endnotes

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- 20 U.S. Department of Agriculture, "Proposed Initiatives From the USDA Antimicrobial Resistance Action Plan" (2015), https://www.aphis.usda.gov/animal_health/nahms/amr/downloads/ProposedInitiatives.pdf. USDA's Agricultural and Resource Management Survey also includes questions on antibiotic use, but the data provide no information on the drivers or details of such use. Selected National Antimicrobial Resistance Monitoring System (NARMS) studies have collected information on antibiotic use and resistance on study farms. NARMS is operated jointly by the USDA, CDC, and FDA to monitor trends in antimicrobial resistance. However, NARMS surveys have relatively small samples and other limitations that impede the system's ability to provide information that can be used to evaluate the appropriateness of antibiotic use in animal agriculture.

This issue brief was updated Aug. 29, 2018, to clarify the conclusions.

For further information, please visit:
pewtrusts.org/antibiotic-resistance-project

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