



# Trends in Antibiotic Prescribing and the Importance of Antibiotic Stewardship

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Division of Healthcare Quality Promotion



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## Speaker Disclosures

- The speaker has no financial relationships or disclosures.

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## Objectives

1. Describe CDC's Office of Antibiotic Stewardship mission, goals and ongoing activities
2. Review changes in antibiotic prescribing during the COVID-19 Pandemic
3. Identify resources for antibiotic stewardship implementation

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**The Threat of Antibiotic Resistance in the United States**

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

**New National Estimate\***

Antibiotic-resistant bacteria and fungi cause at least an estimated:

	<b>2,868,700</b>		<b>35,900</b>
	infections		deaths

**+**

*Clostridioides difficile* is related to antibiotic use and antibiotic resistance: \*

	<b>223,900</b>		<b>12,800</b>
	cases		deaths

**New Threats List**  
Updated urgent, serious, and concerning threats—totaling 18

**5** urgent threats

**2** new threats

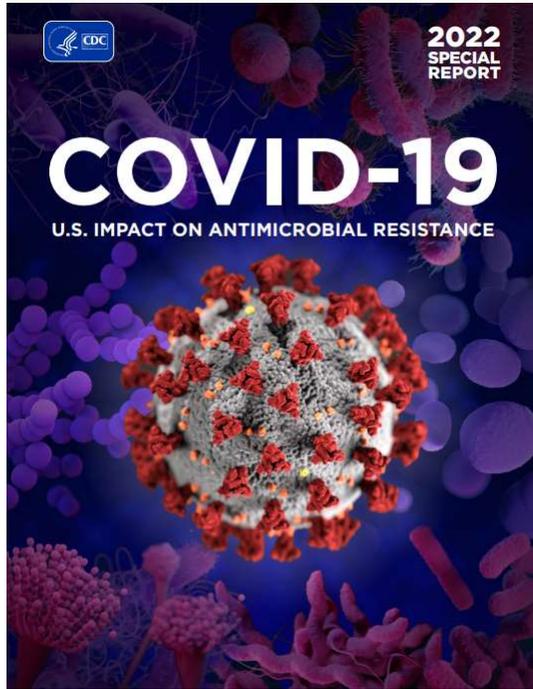
NEW:  
Watch List with **3** threats

 Antibiotic resistance remains a significant One Health problem, affecting humans, animals, and the environment.

\* *C. diff* cases from hospitalized patients in 2017

<https://www.cdc.gov/drugresistance/biggest-threats.html>

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<https://www.cdc.gov/drugresistance/covid19.html>

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## Five core strategies to combat the threat of antibiotic resistant infections



**Antibiotic use and access:** ensure **appropriate** use and reduce **unnecessary** use of antibiotics, and ensure improved access to antibiotics



**Infection prevention and control:** Prevent infections and reduce the spread of germs



**Tracking and data:** Share data and improve data collection



**Environment and sanitation:** Keep antibiotics and antibiotic-resistant threats from entering the environment through actions like improving sanitation and improving access to safe water



**Vaccines, therapeutics, and diagnostics:** Invest in development and improved access to vaccines, therapeutics, and diagnostics for better prevention, treatment, and detection

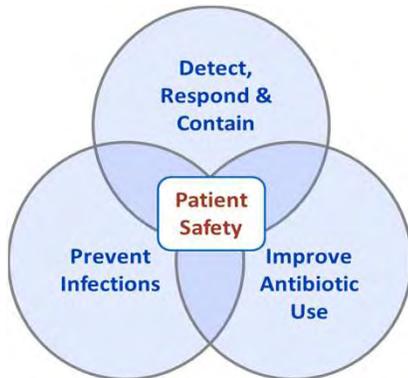
<https://www.cdc.gov/drugresistance/pdf/threats-report/2019-ar-threats-report-508.pdf>

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## CDC's Office of Antibiotic Stewardship

### Mission:

Improve antibiotic use in human healthcare to ensure equitable access to high quality healthcare, optimize the evaluation and treatment of infections and patient safety, and slow the development of antimicrobial resistance.



### Goals:

1. Leverage **antibiotic use data** to identify where improvements in antibiotic use are needed.
2. Advance the assessment of **appropriateness** of antibiotic use.
3. Assess, support, and improve antibiotic stewardship **implementation**.
4. Enhance healthcare professional and general public **knowledge** of appropriate antibiotic use and antibiotic stewardship.

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Leverage **antibiotic use data** to identify where improvements in antibiotic use are needed

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## Leverage antibiotic use data to identify where improvements in antibiotic use are needed: Hospitals

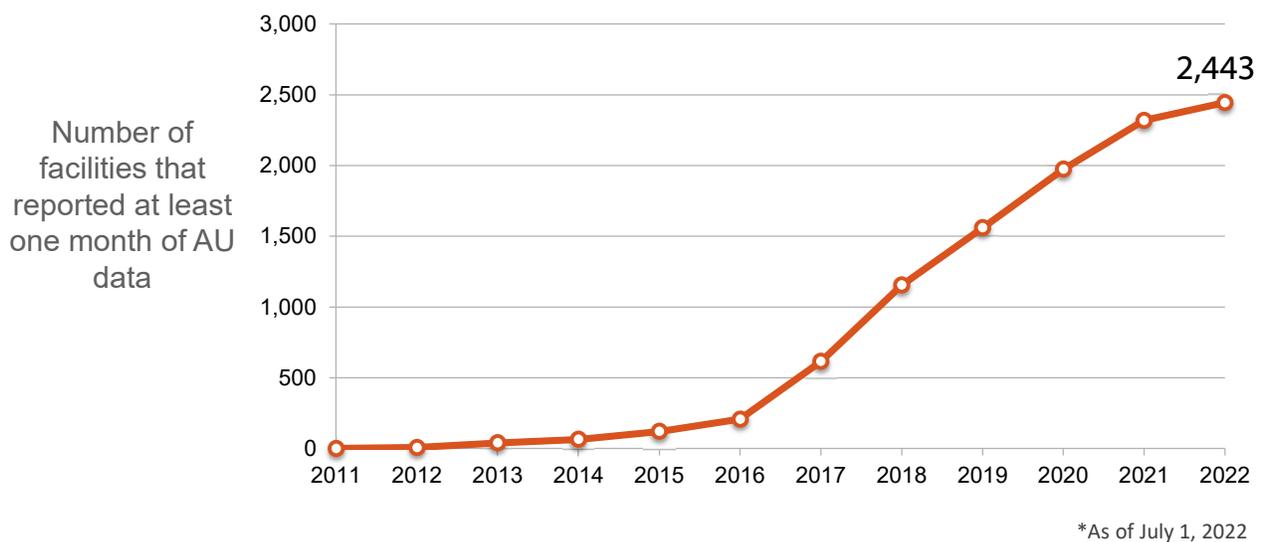


### Antibiotic use surveillance:

- National Healthcare Safety Network (NHSN)
  - Most widely used healthcare-associated infection tracking system
  - Antimicrobial Use (AU) Option, main objective to facilitate risk adjusted antimicrobial use benchmarking and evaluate trends over time
- Other data sources for antibiotic use surveillance (Premier, Marketscan, others)

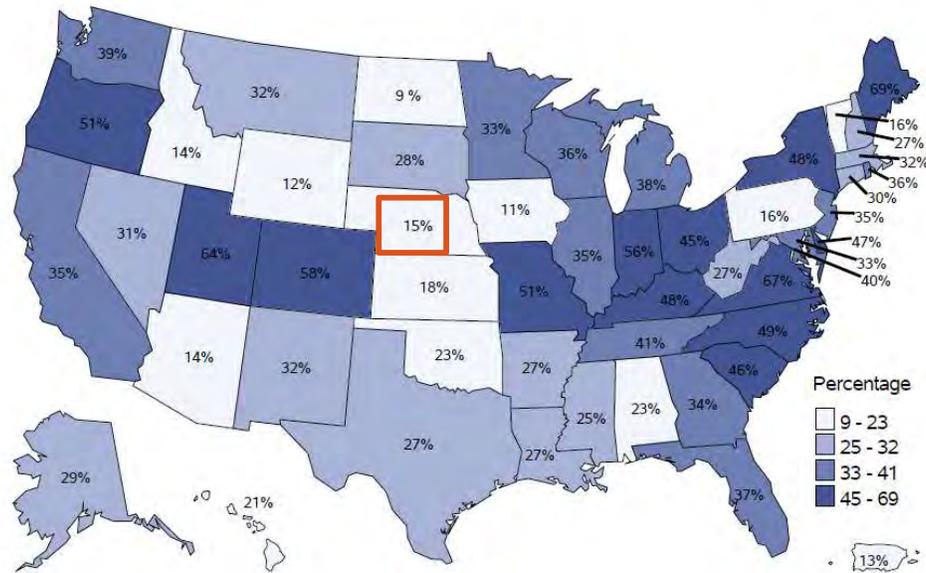
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## Yearly Submission into the AU Option\*



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Percentage of facilities reporting at least one month of data to NHSN's AU Option\*



\*As of July 1, 2022

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## Leverage antibiotic use data to identify where improvements in antibiotic use are needed: Hospitals



- The Standardized Antimicrobial Administration Ratio (SAAR) is a summary measure of AU available to hospitals participating in the AU Option



- Summary of SAAR distributions and percentages of use within SAAR antimicrobial agent categories in adult, pediatric, and neonatal patient care locations
  - Enables hospitals to compare SAARs to the national distribution and see where to improve

AU Data Reports and data tables: <https://www.cdc.gov/nhsn/datastat/aur-reports.html>

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## Leverage antibiotic use data to identify where improvements in antibiotic use are needed: Nursing Homes



### Antibiotic use surveillance:

- Nursing home cross-sectional survey characterized antibiotic use in 161 nursing homes
- Evaluation and description of long term-care pharmacy and electronic health record order data showing variability in antibiotic prescribing and opportunities to improve prescribing practices

JAMA | Original Investigation

#### Antimicrobial Use in a Cohort of US Nursing Homes, 2017

Nicola D. Thompson, MS, PhD; Nimalie D. Stone, MD; Cedric J. Brown, MS; Austin R. Penna, MPH; Taniece R. Euro, MPH; Wendy M. Bamberg, MD; Grant R. Barney, MPH; Devra Barter, MS; Paula Clogher, MPH; Malini B. DeSilva, MD, MPH; Ghinwa Dumyati, MD; Linda Frank, RN, BSN, PHN; Christina B. Felsen, MPH; Deborah Godine, RN; Lourdes Inzarary, MD; Marlon A. Kainer, MBBS, MPH; Linda Li, MPH; Ruth Lynfield, MD; J. P. Mahoethney, RN, MPH; Meghan Maloney, MPH; Joelle Nadle, MPH; Valerie L. S. Ocampo, RN, MPH; Rebecca Pierce, PhD, MS; Susan M. Ray, MD; Sarah Srinum Davis, MPH; Maria Sievers, MPH; Krithika Srinivasan, MD, MPH; Lucy E. Wilson, MD, ScM; Alexia Y. Zhang, MPH; Shelley S. Magill, MD, PhD

Antimicrobial Stewardship & Healthcare Epidemiology (2021), 1, e56, 1–7  
doi:10.1017/ajh.2021.207

#### Original Article

#### Description of antibiotic use variability among US nursing homes using electronic health record data

Sarah Kabbani MD, MSc<sup>1</sup>, Stanley W. Wang MA, MS<sup>2</sup>, Laura L. Ditz RN<sup>3</sup>, Katryna A. Gouin MPH<sup>1</sup>, Danielle Palms MPH<sup>1</sup>, Theresa A. Rowe DO, MS<sup>2,3</sup>, David Y. Hyun MD<sup>4</sup>, Nancy W. Chi MHA<sup>2</sup>, Nimalie D. Stone MD, MS<sup>1</sup> and Lauri A. Hicks DO<sup>1</sup>



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## Leverage antibiotic use data to identify where improvements in antibiotic use are needed: Outpatient Settings

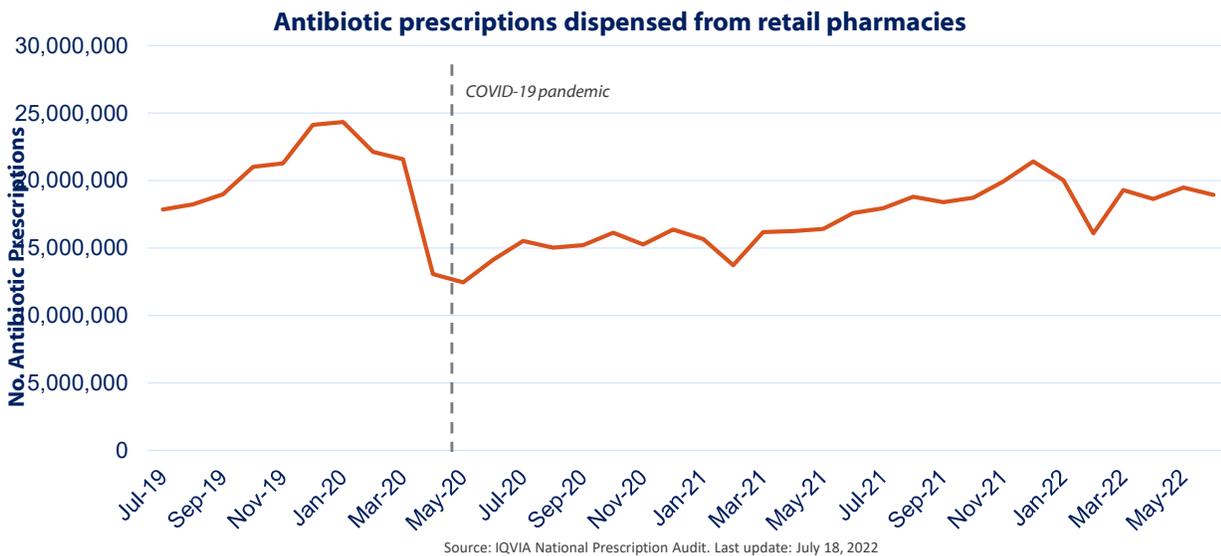


- Antibiotic use surveillance:
  - IQVIA Xponent and other data sources (MarketScan, Medicare)



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## National monthly outpatient antibiotic prescription trends, 2019-2022



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## Leverage antibiotic use data to identify where improvements in antibiotic use are needed: Outpatient Settings

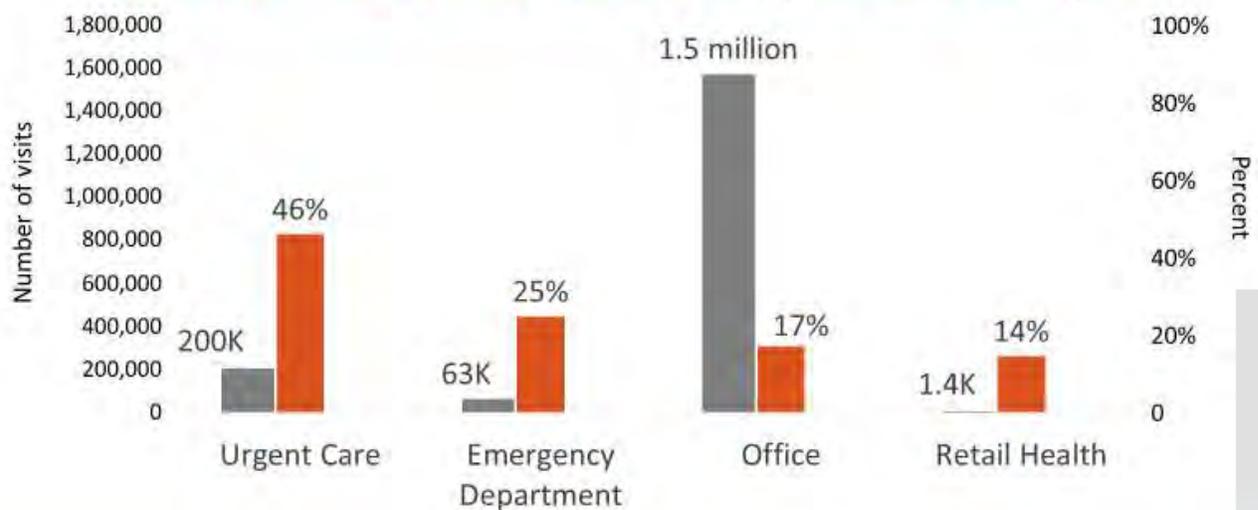


- High prescribing settings
  - Geographic variability (South)
  - Urgent care settings
  - Prescriber Specialty

King et al. Infect Control Hosp Epidemiol. 2022 Jan 10;1-5.

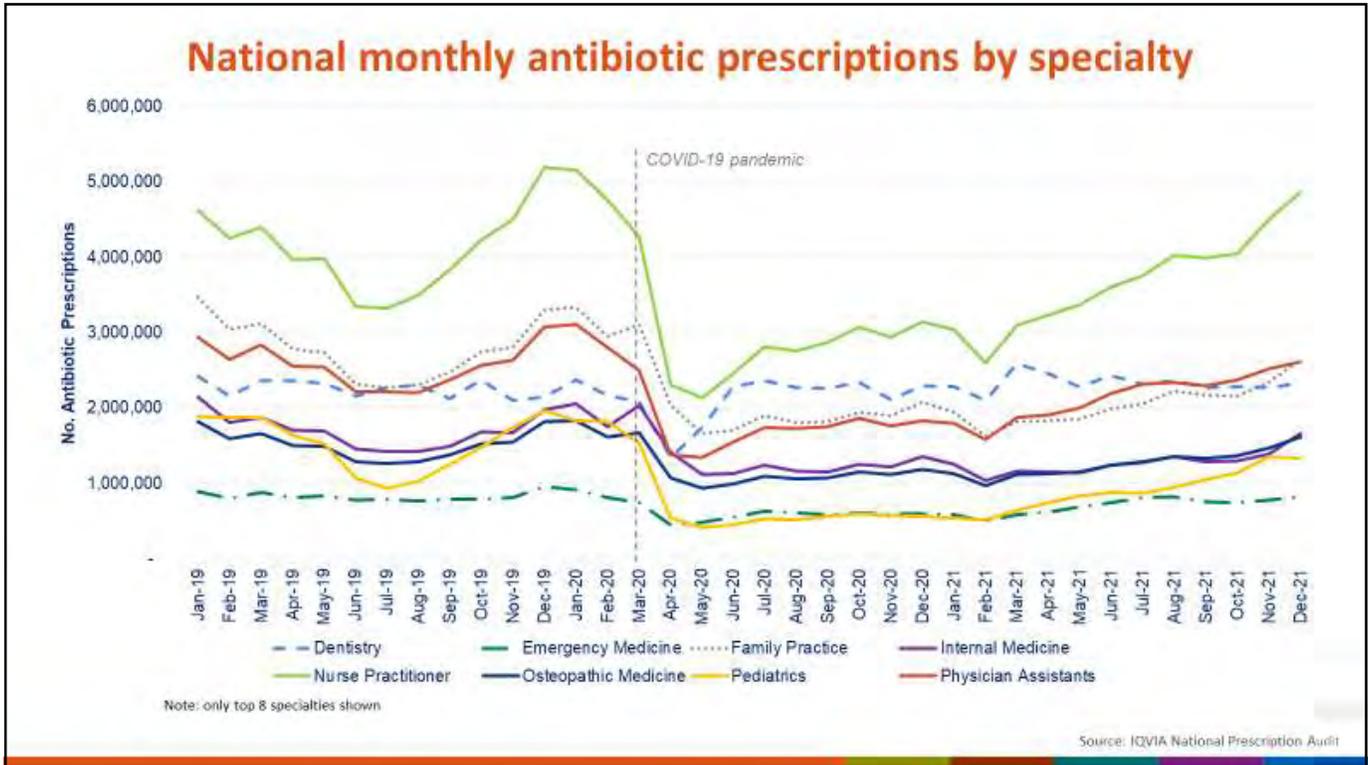
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## Inappropriate antibiotic prescribing for viral respiratory infections is common across outpatient settings

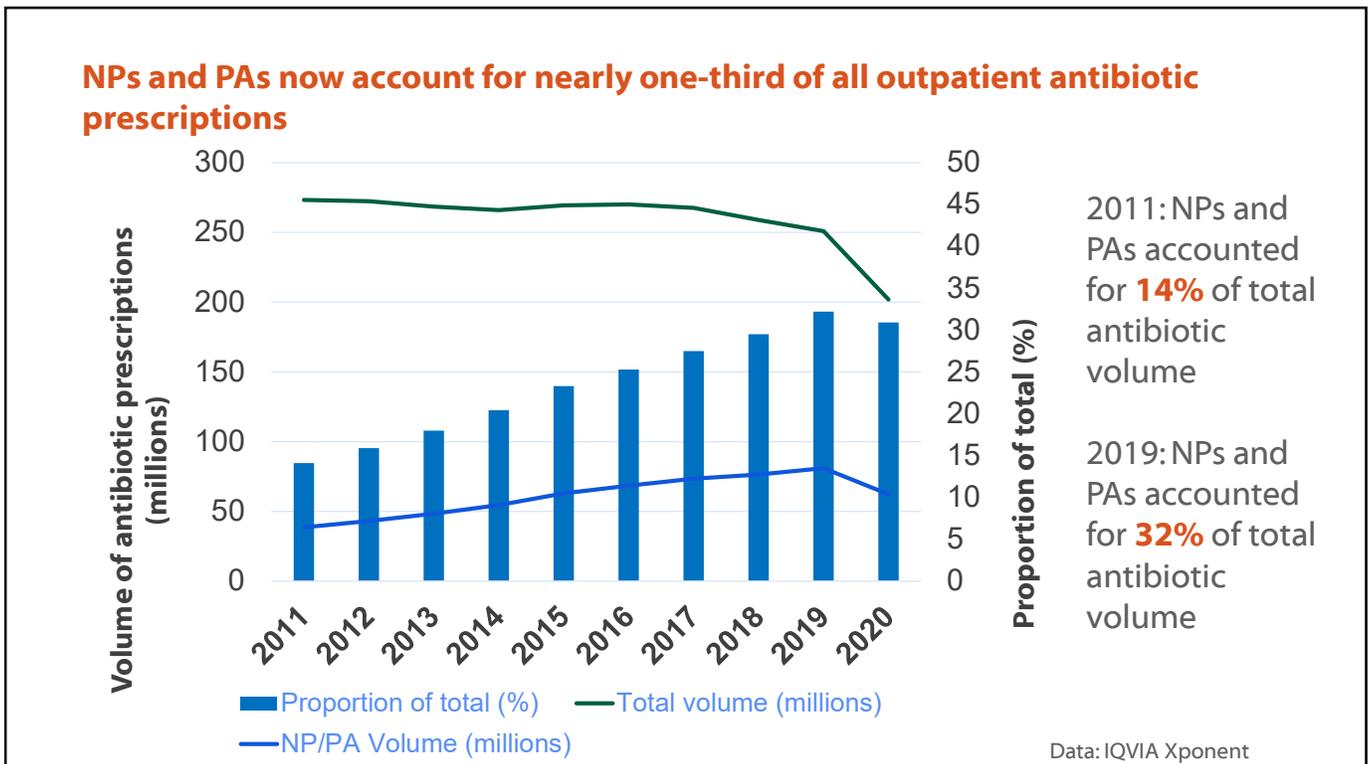


Palms et al. 2018. *JAMA Intern Med* 178(9):1267-1269.

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# Leverage antibiotic use data to identify where improvements in antibiotic use are needed: Outpatient Settings



- Identifying higher volume prescribers for public health interventions

**Improving antibiotic prescribing practices is important to slow antibiotic resistance**

Higher-volume prescribers\* write 41% of antibiotic prescriptions in the U.S.

Providing feedback on individual prescribing practices to clinicians, especially compared with peers, can improve antibiotic prescribing

**CDC** **MMWR**

Supplement 5, 2019, Vol. 68, No. 10  
<http://dx.doi.org/10.1182/mmwr7106a3>

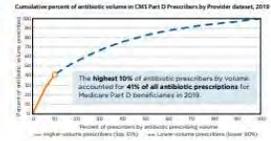
## Guide to Using Outpatient Antibiotic Prescription Data for Peer Comparison Audit & Feedback

### DATA FOR ACTION

Audit and feedback for clinicians on individual antibiotic prescribing practices, especially when including comparison with peers, has been shown to be effective at improving antibiotic prescribing.<sup>1,2</sup>

Centers for Medicare & Medicaid Services (CMS) provides publicly available Part D prescription data files with counts of drug claims aggregated at different levels. The Prescribers by Provider data file can be used by public health organizations and health systems to assess antibiotic prescribing among adults >65 years of age and identify prescribers for peer comparison audit and feedback interventions.<sup>3,4</sup>

CMS PART D PRESCRIBER FILES*	DATA ELEMENTS
NATIONAL BY GEOGRAPHY AND DRUG	antibiotic class and agent
STATE BY GEOGRAPHY AND DRUG	antibiotic class and agent, state, and geographic region
BY PROVIDER	antibiotic total count, prescriber characteristics (National Provider Identifier, specialty, ZIP code)
BY PROVIDER AND DRUG	antibiotic class and agent, prescriber characteristics



\*Limitations: Counts of drug claims (CI) are aggregated in the CMS Part D Prescriber Public Use File, which has a larger threshold for the prescriber level compared to the national level. Information is not available, therefore, appropriateness cannot be assessed.

<https://www.cdc.gov/mmwr/volumes/71/wr/mm7106a3.htm>  
<https://www.cdc.gov/antibiotic-use/pdfs/Outpatient-Rx-Analytic-Guide-508.pdf>

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# COVID-19 and Antibiotic Prescribing

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# COVID-19 and antibiotic prescribing

During the COVID-19 pandemic, antibiotic use varied across settings, with azithromycin prescribing higher than expected in all settings



While antibiotic use throughout the pandemic varied across healthcare settings, antibiotics were commonly prescribed to patients for COVID-19—even though antibiotics are not effective against viruses.

### COVID-19 Impacts on Antibiotic Use:

Improve the use of antibiotics wherever they are used and improve access

When a patient (human or animal) receives an antibiotic they do not need, not only does the patient get no benefit, but they are also put at risk for side effects (e.g., allergic reactions, toxicity that affects organ function, C. diff). Evidence suggests that 1 in 5 hospitalized patients who receive an antibiotic has an adverse drug event.<sup>24</sup>

Antibiotics and antifungals can save lives, but any time they are used—for people, animals, or plants—they can contribute to resistance.

When COVID-19 cases increased in hospitals, so did antibiotic use. Antibiotics were frequently started upon admission, but several studies have shown that patients who had COVID-19 were rarely also infected with bacteria when admitted.<sup>15-17</sup>

### Antibiotic Use Varied During the COVID-19 Pandemic

#### Hospitals

- From March 2020 to October 2020, almost 80% of patients hospitalized with COVID-19 received an antibiotic.<sup>18</sup>
- Antibiotic use was lower overall as of August 2021 compared to 2019 but increased for some antibiotics like azithromycin and ceftriaxone. Approximately half of hospitalized patients received ceftriaxone, which was commonly prescribed with azithromycin.
- This likely reflects difficulties in distinguishing COVID-19 from community-acquired pneumonia when patients first arrive at a hospital for assessment.

#### Outpatient Settings

- Antibiotic use significantly dropped in 2020 compared to 2019 due to less use of outpatient health care and less spread of other respiratory illnesses that often lead to antibiotic prescribing.
- However, in 2021 outpatient antibiotic use rebounded. While antibiotic use was lower overall in 2021 compared with 2019, in August 2021, antibiotic use exceeded prescribing in 2019 by 3%.
- From 2020 through December 2021, most antibiotic prescriptions for adults were for azithromycin and increases in azithromycin prescribing corresponded to peaks in cases of COVID-19. After an initial peak in azithromycin prescribing in March 2020, azithromycin use decreased during the pandemic.
- By August 2021, there was still more azithromycin prescribing than in August 2019.

#### Nursing Homes

- Antibiotic use in nursing homes spiked alongside surges of COVID-19 cases but remains lower overall.
- However, azithromycin use was 150% higher in April 2020 and 82% higher in December 2020 than the same months in 2019. Azithromycin prescribing remained elevated through October 2020.
- In 2021, antibiotic use overall was, on average, 5% lower than 2019. This decrease might be due to fewer nursing home residents during this time.

COVID-19: U.S. Impact on Antimicrobial Resistance. Special Report 2022

### Trends in US Outpatient Antibiotic Prescriptions During the Coronavirus Disease 2019 Pandemic

Laura M King, Maribeth C Lovegrove, Nadine Shehab, Sharon Tsay, Daniel S Bushnell, Andrew I Geller, Jennifer N Lind, Rebecca M Roberts, Lauri A Hicks, Sarah Kabbani  
Clinical Infectious Diseases, Volume 73, Issue 3, 1 August 2021, Pages e652–e660, <https://doi.org/10.1093/cid/ciaa1896>  
Published: 29 December 2020 Article history

### Trends in Prescribing of Antibiotics and Drugs Investigated for Coronavirus Disease 2019 (COVID-19) Treatment in US Nursing Home Residents During the COVID-19 Pandemic

Katryna A Gosun, Stephen Creasy, Mary Beckerson, Martha Wlowski, Esaul A Hicks, Jennifer N Lind, Andrew I Geller, Daniel S Bushnell, Sarah Kabbani  
Clinical Infectious Diseases, Volume 74, Issue 1, 1 January 2022, Pages 74–82,

Open Forum Infectious Diseases

SHORT REPORT

### Trends in Antibiotic Use in United States Hospitals During the Coronavirus Disease 2019 Pandemic

Ashley R. Ross, James Briggs, Hannah Wulford, Melinda M. Neuhaus, Arjun Srivastava, Ad V. Gandipati, Sujan Reddy, Lyndyale Kompaniets, Audrey F. Pennington, Chae Goh, and Sarah Kabbani

Research Letter

April 6, 2022

### Antibiotic Prescriptions Associated With COVID-19 Outpatient Visits Among Medicare Beneficiaries, April 2020 to April 2021

Sharon F. Tsay, MD, Emma Brennan, PhD, Katherine Johnson, PhD, Sarah Kabbani, MD, Laura M. King, MD  
JAMA Infectious Diseases  
<https://doi.org/10.1001/jama.2022.1422>

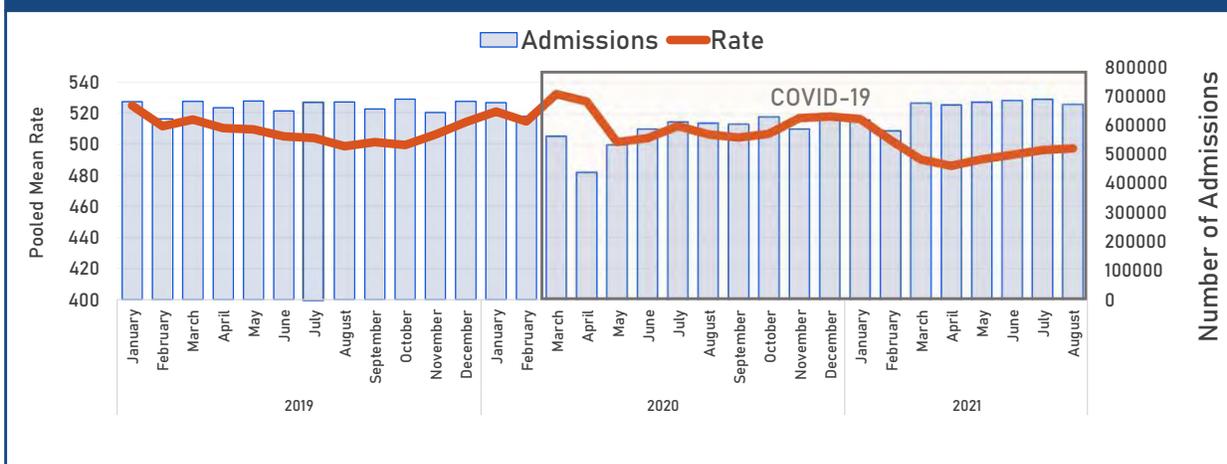
© 2022 by American Medical Association

<https://www.cdc.gov/drugresistance/covid19.html>

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## Hospitals: Early in the COVID-19 pandemic, overall antibiotic use increased, but was lower in 2021 compared to 2019.

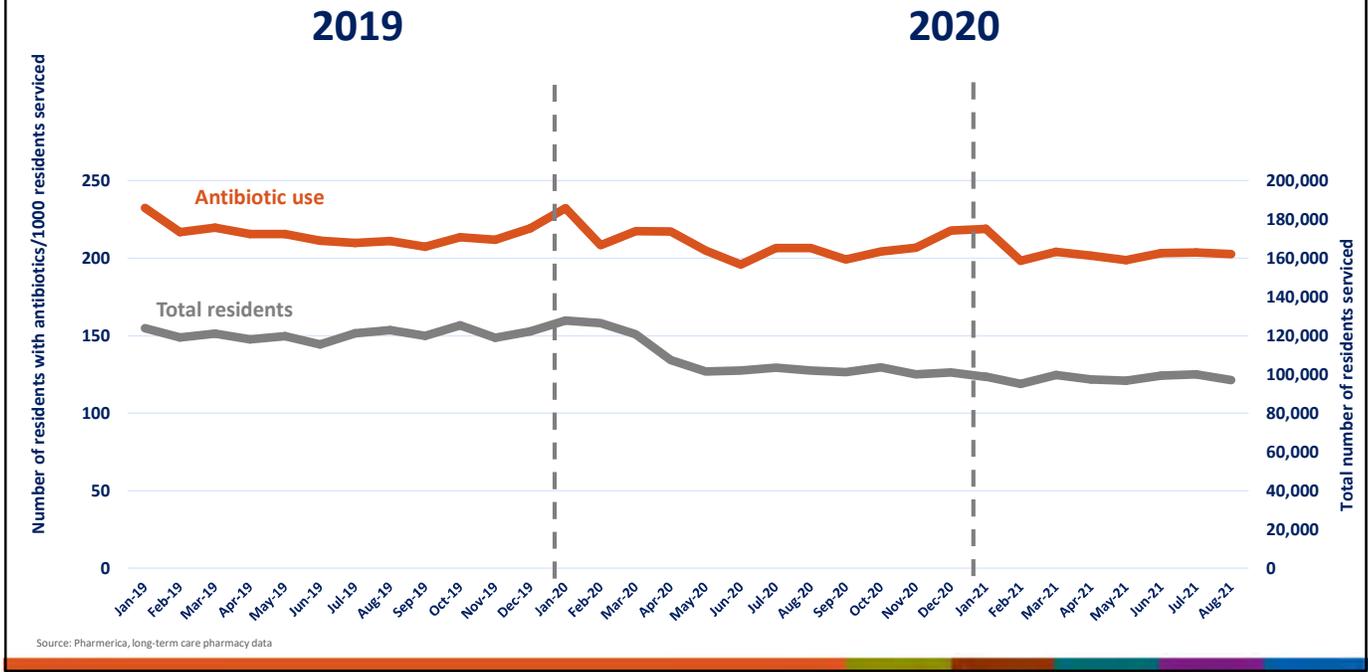
National Healthcare Safety Network (526 hospitals)  
Days of Therapy per 1,000 Days Present – All antibacterial agents



Source: National Healthcare Safety Network Antimicrobial Use Option

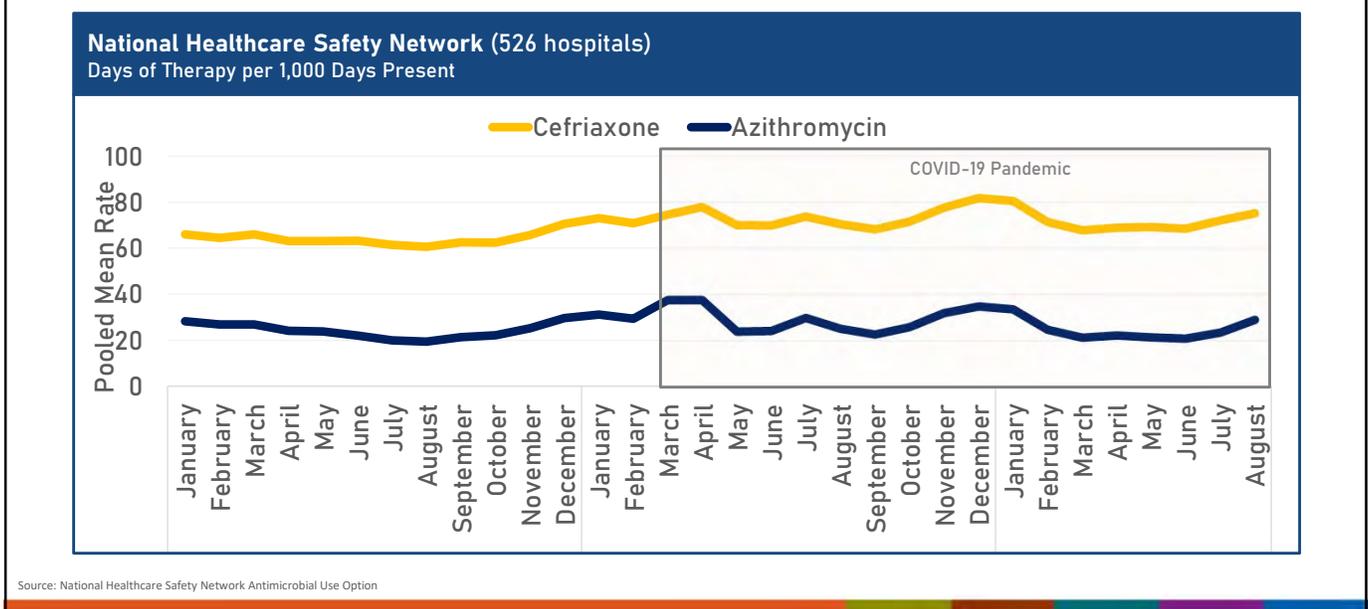
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### Nursing Homes: Overall antibiotic prescribing decreased, 2019-2021.



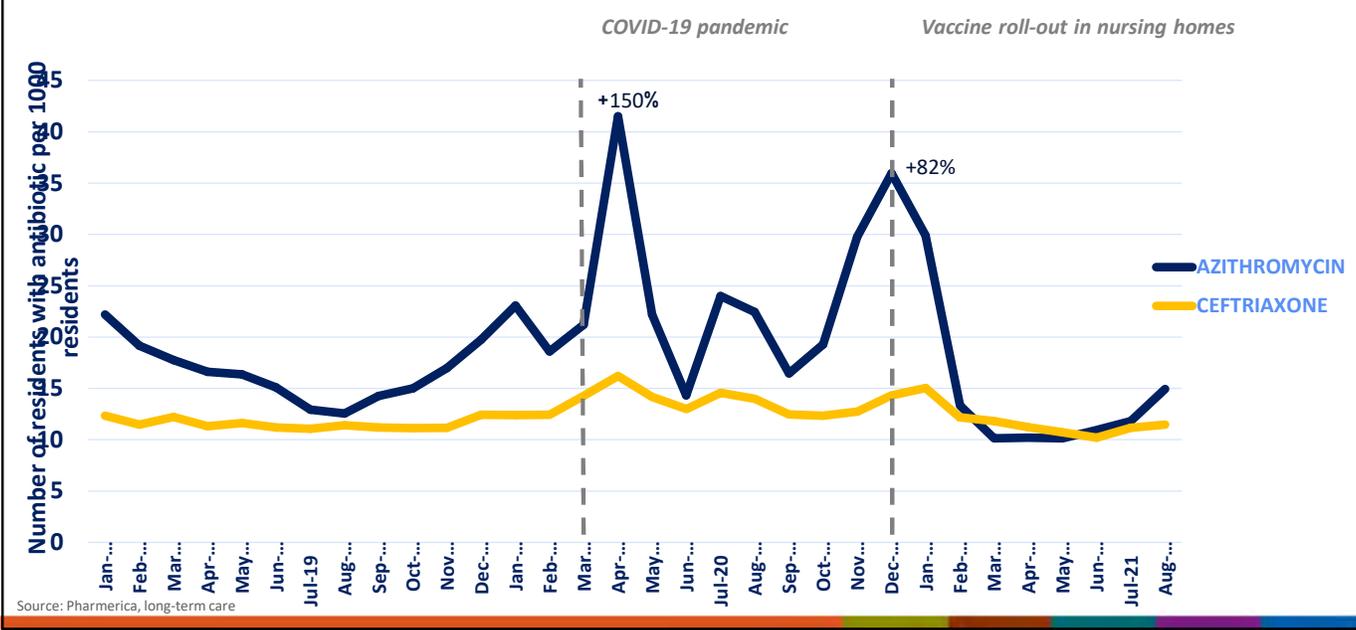
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### Hospitals: Azithromycin and ceftriaxone use fluctuated – with multiple peaks in 2020 and 2021.



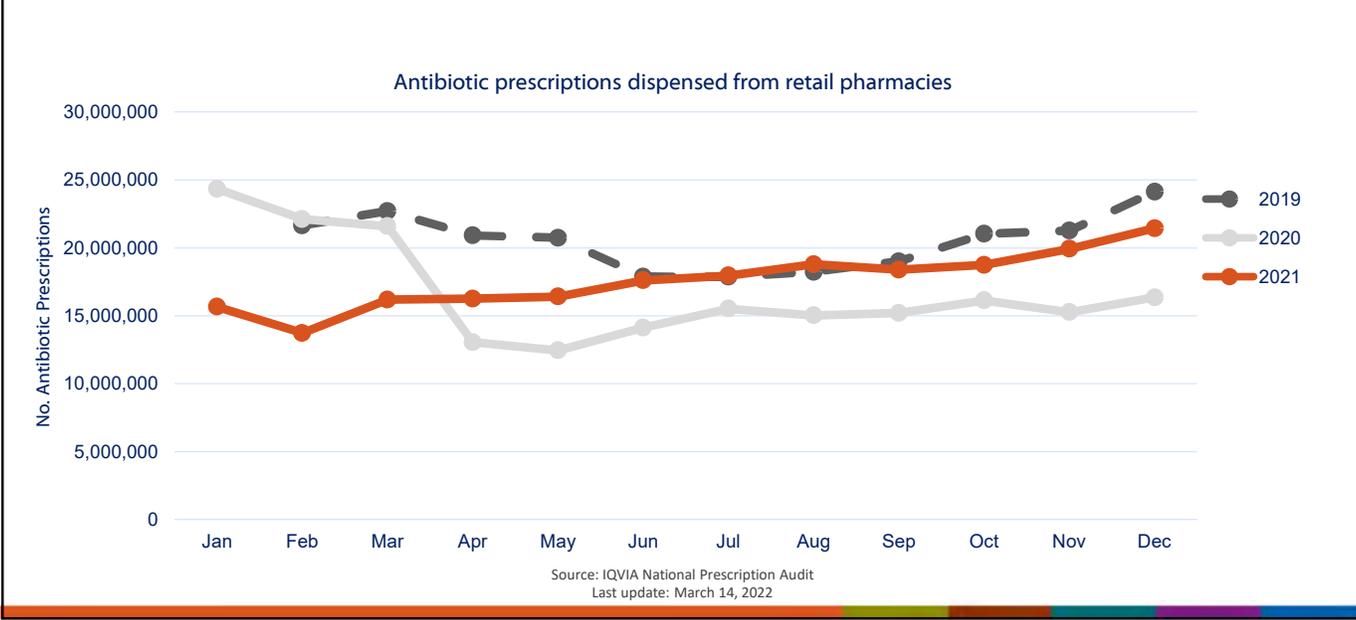
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### Nursing homes: Azithromycin and ceftriaxone prescribing increased in 2020 and 2021 compared to 2019.



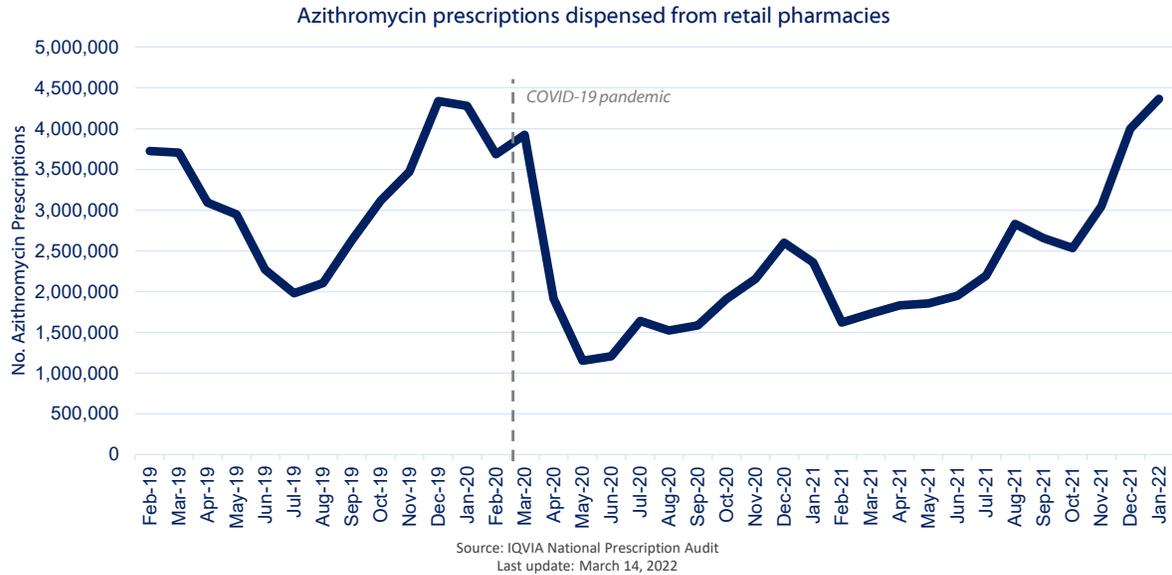
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### Outpatient Settings: Antibiotic prescribing decreased, but it's approaching pre-pandemic levels.



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## Outpatient Settings: Monthly outpatient azithromycin prescription trends similar to the pandemic epi curve.



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## Most hospitalized patients with COVID-19 receive antibiotics.

Trends in Antibiotic Use in United States Hospitals During the Coronavirus Disease 2019 Pandemic

*Open Forum Infectious Diseases*

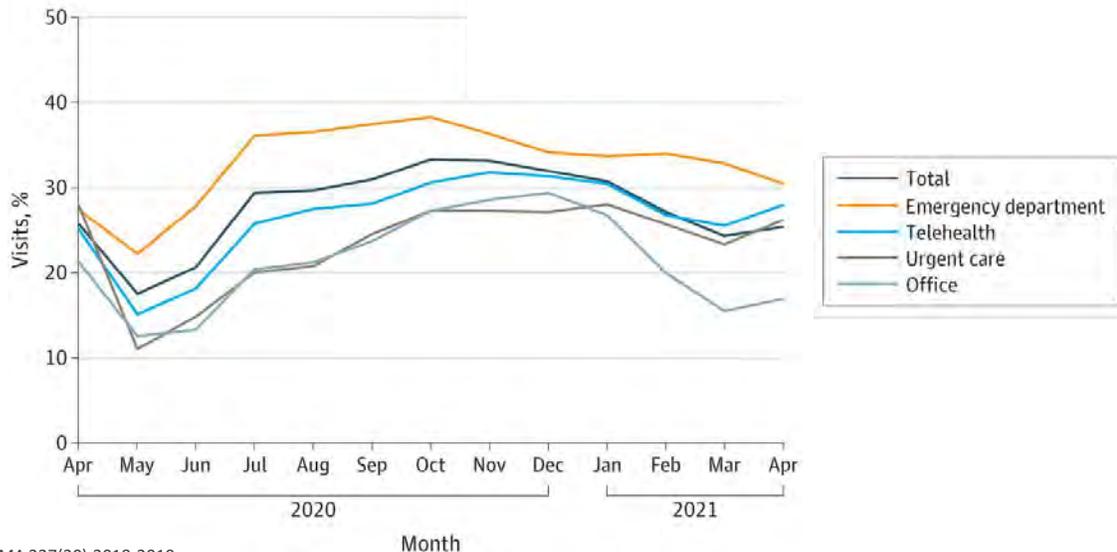
**BRIEF REPORT**

- Most patients (77.3%) hospitalized with COVID-19 received antibiotics.<sup>1</sup>
  - Over 80% of antibiotics were started on admission.
  - Almost half of patients received ceftriaxone, frequently in combination with azithromycin.

1. Rose et al, OFID, June 3 2021, <https://academic.oup.com/ofid/article/8/6/ofab236/6291836>

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## Antibiotic prescribing to older adults with COVID-19 was common across outpatient settings



Tsay et al. 2022. JAMA 327(20):2018-2019.

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## There is a low frequency of secondary bacterial infections in patients with COVID-19.

- Bacterial co-infections are uncommon.
  - Bacterial co-infection (estimated on presentation) identified in **3.5%** of hospitalized patients (95% CI 0.4-6.7%)<sup>1</sup>
  - Multicenter study found that bacterial respiratory co-infections were uncommon (**1.2%**) at the time of hospital admission<sup>2</sup>
- Healthcare-associated infections are more common and associated with antibiotic exposure.
  - Retrospective cohort of hospitalized patients with COVID-19, **7%** had a proven or possible hospital-acquired infection 48 hours after admission<sup>3</sup>
  - Risk factors: ICU admission, dexamethasone use, severe COVID-19, heart failure, and antibiotic exposure on admission<sup>3</sup>



1. Langford et al. Clin Microbiol Infect. 2020 Dec;26(12):1622-1629.  
 2. Karaba et al. Open Forum Infect Dis. 2020 Dec 21;8(1).  
 3. Smith et al. Infect Control Hosp Epidemiol. 2021 Apr 13 : 1-4.

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## Antibiotic Stewardship Programs and COVID-19 Lessons Learned

- Antibiotic stewardship programs expertise, skills and structure were critical for health systems' COVID-19 response
  - Diagnostic testing, treatment, and vaccination
- Increase in telehealth services
  - Challenges and opportunities for antibiotic stewardship
- Opportunities for improvement
  - Low quality studies led to rampant use of azithromycin
  - Stewardship staff repurposed for pandemic roles, down-sizing, limited program resilience

Pierce J et al. Int J Infect Dis. 2021 Dec;113:103-108.  
Mazdeyasna H et al. Curr Infect Dis Rep. 2020;22(9):23.

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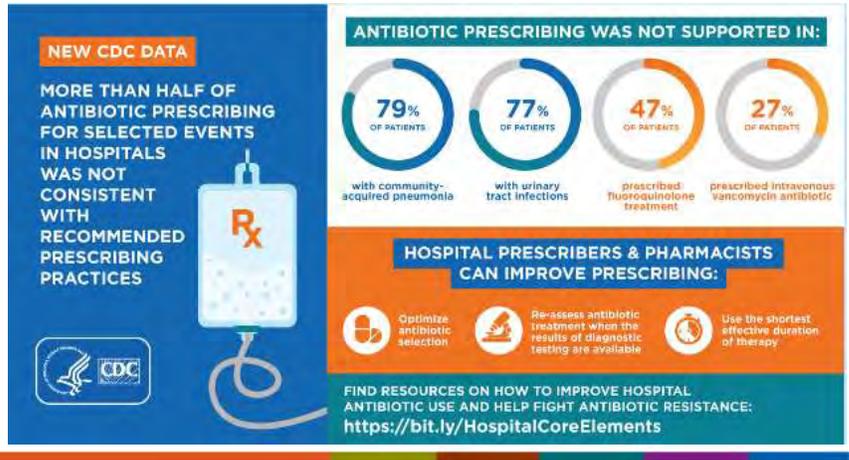
**Advance the assessment of  
appropriateness of antibiotic use**

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## Advance the assessment of appropriateness of antibiotic use: Hospitals



- Emerging Infections Program HAI/AU point prevalence survey, AQUA
  - Planned follow-up in 2023



Magill et al, JAMA Netw Open. 2021;4(3):e212007.

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## Advance the assessment of appropriateness of antibiotic use: Outpatient Settings



- Appropriateness of treatment for acute respiratory illnesses
  - CDC funded development of new NCQA HEDIS quality measure (released 2022)



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# Assess, support, and improve antibiotic stewardship implementation

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The Core Elements of  
Hospital Antibiotic Stewardship  
Programs: 2019

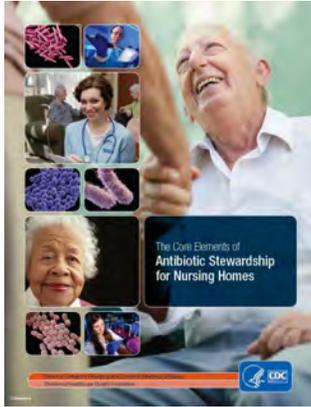
Centers for Disease  
Control and Prevention  
National Center for Emerging and  
Zoonotic Infectious Diseases  
Division of Healthcare Quality Promotion

### Core Elements of Hospital Antibiotic Stewardship Programs

- Hospital Leadership Commitment**  
Dedicate necessary human, financial, and information technology resources.
- Accountability**  
Appoint a leader or co-leaders, such as a physician and pharmacist, responsible for program management and outcomes.
- Pharmacy Expertise (previously "Drug Expertise"):**  
Appoint a pharmacist, ideally as the co-leader of the stewardship program, to help lead implementation efforts to improve antibiotic use.
- Action**  
Implement interventions, such as prospective audit and feedback or preauthorization, to improve antibiotic use.
- Tracking**  
Monitor antibiotic prescribing, impact of interventions, and other important outcomes, like *C. difficile* infections and resistance patterns.
- Reporting**  
Regularly report information on antibiotic use and resistance to prescribers, pharmacists, nurses, and hospital leadership.
- Education**  
Educate prescribers, pharmacists, nurses, and patients about adverse reactions from antibiotics, antibiotic resistance, and optimal prescribing.

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## CDC's Core Elements of Antibiotic Stewardship Across Settings



Nursing Homes



Outpatient



Small and Critical Access Hospitals



Resource-Limited Setting

<https://www.cdc.gov/antibiotic-use/core-elements/index.html>

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## CDC's Core Elements of Antibiotic Stewardship play an important role in regulatory and accreditation stewardship standards:

### Hospitals

- 2019, The Centers for Medicare and Medicaid Services (CMS) published final rule requiring hospitals to have antibiotic stewardship programs
  - July 2022, Interpretive Guidance include stewardship best practices and follow nationally recognized standards including the Core Elements
- January 2023, new and revised antibiotic stewardship requirements will apply to all Joint Commission–accredited hospitals and critical access hospitals



<https://www.jointcommission.org/standards/prepublication-standards/new-and-revised-requirements-addressing-antibiotic-stewardship-for-hospital/>

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## CDC's Core Elements of Antibiotic stewardship play an important role in regulatory and accreditation stewardship standards:

### Nursing Homes

- 2016, CMS issued a final rule requiring nursing homes to have antibiotic stewardship integrated within pharmacy and infection prevention and control programs
  - September 2019, Interpretive Guidance is based on CDC's core elements and the rule emphasizes that nursing homes should have antibiotic use protocols and a system to monitor antibiotic use



<https://www.federalregister.gov/documents/2019/09/30/2019-20736/medicare-and-medicaid-programs-regulatory-provisions-to-promote-program-efficiency-transparency-and>

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## Assess, support, and improve antibiotic stewardship implementation: Hospitals



CDC Centers for Disease Control and Prevention  
CDC 24/7 Saving Lives. Protecting People™

Antibiotic Resistance & Patient Safety Portal

Home | Antibiotic Use & Stewardship

### Antibiotic Use & Stewardship

Outpatient Antibiotic Use      Hospital Antibiotic Stewardship

Hospital antibiotic stewardship is an initiative that aims to improve patient safety by promoting programs, protocols, and best practices that improve the way we manage and use antibiotics. Hospital antibiotic stewardship promotes using the right antibiotic, at the right time, at the right dose and for the right duration. Hospital antibiotic stewardship has a number of proven benefits that include: protecting patients from unintended consequences of antibiotics, improving treatment of infections, and helping combat antibiotic resistance. These data reflect programs exclusively for inpatient hospital settings.

Hospital Antibiotic Stewardship

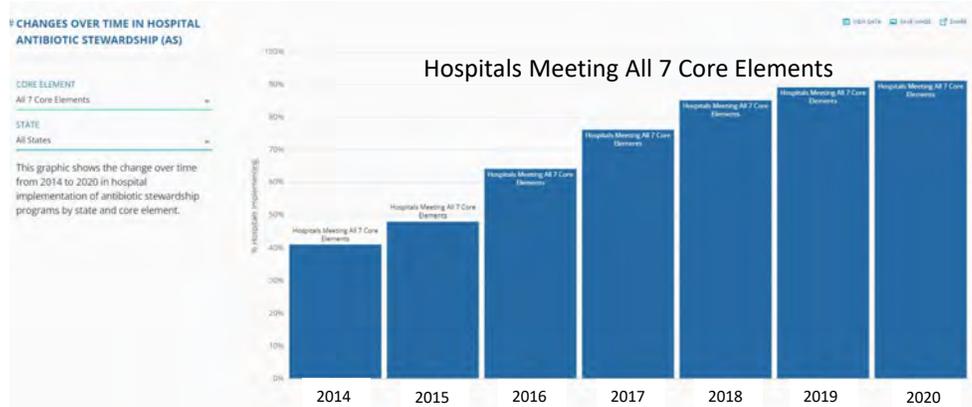
<https://arpsp.cdc.gov/profile/antibiotic-use?tab=hospital-stewardship>

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## Assess, support, and improve antibiotic stewardship implementation: Hospitals



- More than 90% of US hospitals report implementing all 7 Core Elements



<https://arpsp.cdc.gov/profile/antibiotic-use?tab=hospital-stewardship>

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## Assess, support, and improve antibiotic stewardship implementation: Hospitals



- Priorities for Hospital Core Elements Implementation
  - Incorporating into the AR & Patient Safety Portal-Fall 2022

### Examples of Priorities of Hospital Core Elements Implementation

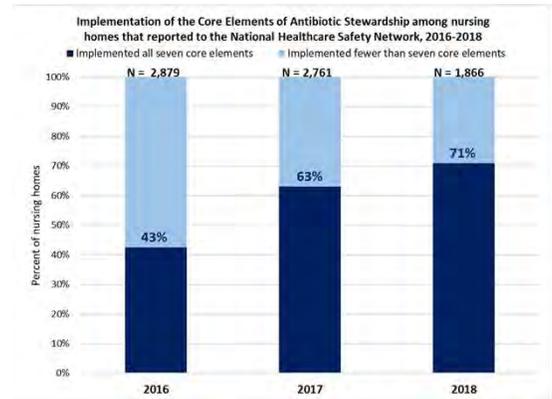
 <b>Hospital Leadership Commitment</b> Dedicate necessary human, financial, and information technology resources.	}	Dedicated stewardship staffing and resources
 <b>Accountability</b> Appoint a leader or co-leaders, such as a physician and pharmacist, responsible for program management and outcomes.	}	Co-leadership model with physician and pharmacist
 <b>Action</b> Implement interventions, such as prospective audit and feedback or preauthorization, to improve antibiotic use.	}	Prospective Audit & Feedback, Preauthorization, and Facility-Specific Treatment Guidelines
 <b>Tracking</b> Monitor antibiotic prescribing, impact of interventions, and other important outcomes, like <i>C. difficile</i> infections and resistance patterns.	}	Submission to NHSN AU Option

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## Assess, support, and improve antibiotic stewardship implementation: Nursing Homes



- Similar to hospitals, characterize nursing home Core Elements implementation using NHSN's LTCF annual survey
  - Incorporate into AR & Patient Safety Portal



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## Assess, support, and improve antibiotic stewardship implementation: Nursing Homes



- Qualitative review of CMS antibiotic stewardship citations issued during nursing home facility inspections and categorized under Core Elements
  - Identify gaps and where support is needed

Action was most commonly cited in nursing homes in the 318 citations reviewed.



Note: These categories are not mutually exclusive; citations could be classified into one or more categories.

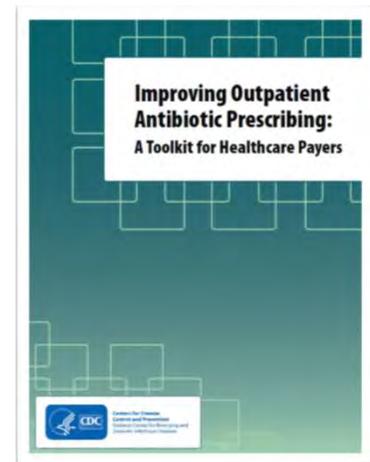
Preliminary data presented during ID Week 2021, please do not reproduce without permission  
[https://academic.oup.com/ofid/article/8/Supplement\\_1/S55/6449518?login=true](https://academic.oup.com/ofid/article/8/Supplement_1/S55/6449518?login=true)

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## Assess, support, and improve antibiotic stewardship implementation: Outpatient Settings



- Engagement with healthcare payers to support stewardship implementation
- Funding partners and professional organizations for stewardship interventions



<https://www.cdc.gov/antibiotic-use/core-elements/pdfs/AU-Outpatient-Payer-Toolkit-508.pdf>

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## Strategies to Improve Antibiotic Prescribing in Outpatient Dialysis Settings

### Improving Antibiotic Use in Outpatient Hemodialysis Facilities

#### Antibiotic Use in Outpatient Hemodialysis

Over 450,000 people across the United States utilize roughly 6,800 facilities to receive hemodialysis treatment on a regular basis. Patients on maintenance hemodialysis have an increased risk of infection due to an impaired immune system and frequent use of catheters or insertion of needles to access the blood stream. Infections are the second leading cause of death among patients on hemodialysis and many of those deaths are caused by sepsis.

#### On This Page

Antibiotic Use in Outpatient Hemodialysis

[Antibiotic Stewardship in Dialysis](#)

Strategies to Improve Antibiotic Prescribing in Outpatient Dialysis Settings



American Journal of Kidney Diseases  
Volume 77, Issue 5, May 2021, Pages 757-768

Special Report

Opportunities to Improve Antibiotic Prescribing in Outpatient Hemodialysis Facilities: A Report From the American Society of Nephrology and Centers for Disease Control and Prevention Antibiotic Stewardship White Paper Writing Group

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<https://www.cdc.gov/antibiotic-use/stewardship/dialysis.html>  
Apata IW et al. AJKD 2020. May 2021, Pages 757-768

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## Diagnostic stewardship

- Ordering the right test, for the right patient, at the right time to optimize clinical care
- The 2019 Hospital Core Elements highlighted key diagnostic stewardship activities and roles for microbiology staff and antibiotic stewardship programs.

Available from: <https://www.cdc.gov/antibiotic-use/core-elements/implementation.html>



### Key Activities and Roles for Microbiology Laboratory Staff in Antibiotic Stewardship Programs

Updated: August 2020

#### Purpose

To outline the ways in which microbiology laboratory staff can impact antibiotic stewardship programs.

In the CDC's [Core Elements of Hospital Antibiotic Stewardship Programs, 2019](https://www.cdc.gov/antibiotic-use/core-elements/hospital.html) (<https://www.cdc.gov/antibiotic-use/core-elements/hospital.html>) there are several areas where the activities of microbiology laboratory staff, as part of the antibiotic stewardship program team, have been further expanded and highlighted. This document outlines these activities. It is important for the members of the antibiotic stewardship program to regularly communicate and collaborate. This can be challenging in instances where laboratory services are provided offsite from clinical care settings and there is not daily interaction between clinical infectious diseases, stewardship program, and microbiology personnel. The following areas are highlighted in the Core Elements of Hospital Antibiotic Stewardship where microbiology staff should provide input.

Curren et al, Clin Infect Dis. 2022 Mar 1;74(4):723-728.

Diekema et al, JAMA. 2017;318(7):607-608.

<https://www.cdc.gov/antibiotic-use/pdfs/Key-Activities-Laboratory-Stewardship-508.pdf>

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Proven prevention efforts should be expanded and sustained.

Over the next 5 years, CDC will invest **\$2.1 billion** through the American Rescue Plan to enhance infection prevention and control and antibiotic stewardship across U.S. public health and health care.

This funding will allow the U.S. to strengthen and equip U.S. health departments and other partner organizations:

- Expand support to healthcare facilities to improve the quality of health care
- Assist healthcare workers in preventing infections, support rapid response to detect and contain infectious organisms and engage in innovations to combat infectious disease threats
- Address the rise of healthcare associated infections and antibiotic resistance threats

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## Health Equity in Antibiotic Prescribing and Stewardship

- Exploring antibiotic prescribing data sources (existing and new)
- Narrative review of the literature to characterize inequities in antibiotic prescribing to inform research priorities and stewardship interventions
- A portion of American Rescue Plan funds (\$120 million) dedicated to antibiotic stewardship
  - Provide **access to stewardship expertise** and support for stewardship implementation across different healthcare settings



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Enhance healthcare professional and general public **knowledge** of appropriate antibiotic use.

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**Antibiotic Use**

- About Antibiotic Use +
- Patient Resources and Education +
- Healthcare Professional Resources and Training +
- Health Department Resources
- Improving Antibiotic Use +
- Core Elements of Antibiotic Stewardship** -
- Hospital -
  - Implementation Resources for Hospitals
- Outpatient -
  - Implementation Resources for Outpatient Facilities
- Nursing Home -
  - Implementation Resources for Nursing Homes
- Small and Critical Access Hospitals
- Resource-Limited Settings

## Core Elements of Antibiotic Stewardship

Antibiotic stewardship is the effort to measure and improve how antibiotics are prescribed by clinicians and used by patients. Improving antibiotic prescribing and use is critical to effectively treat infections, protect patients from harms caused by unnecessary antibiotic use, and combat antibiotic resistance.

CDC's Core Elements of Antibiotic Stewardship offer providers and facilities a set of key principles to guide efforts to improve antibiotic use and, therefore, advance patient safety and improve outcomes. These frameworks complement existing guidelines and standards from key healthcare partner organizations, including the Infectious Diseases Society of America, Society for Healthcare Epidemiology of America, American Society of Health System Pharmacists, Society of Infectious Diseases Pharmacists, and The Joint Commission.

CDC recognizes that there is no "one size fits all" approach to optimize antibiotic use for all settings. The complexity of medical decision-making surrounding antibiotic use and the variability in facility size and types of care in U.S. healthcare settings require flexible programs and activities.

- Core Elements of Hospital Antibiotic Stewardship Programs
- Core Elements of Outpatient Antibiotic Stewardship
- Core Elements of Antibiotic Stewardship for Nursing Homes
- Implementation of Antibiotic Stewardship Core Elements at Small and Critical Access Hospitals
- Core Elements of Human Antibiotic Stewardship Programs in Resource-Limited Settings

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# 5 Ways Pharmacists Can Be Antibiotics Aware Across Healthcare Settings



**Nursing Homes**



**Hospitals**



**Community Pharmacies**  
*Coming Soon!*

**For antibiotic stewardship resources for each setting, visit [cdc.gov/antibiotic-use/training/materials.html](https://cdc.gov/antibiotic-use/training/materials.html).**



[www.cdc.gov/antibiotic-use](https://www.cdc.gov/antibiotic-use)



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# Improving antibiotic use at hospital discharge

<https://www.cdc.gov/antibiotic-use/pdfs/BAA-Hospital-Discharge-Flowchart-P.pdf>

**HEALTHCARE PROFESSIONALS: BE ANTIBIOTICS AWARE At Hospital Discharge**

- 1 Use the most targeted and safe antibiotic<sup>1,2</sup>**
  - If a penicillin allergy is listed in the medical record, determine whether the patient is truly allergic.
  - If the patient is to be discharged on a fluoroquinolone, consider a safer alternative when appropriate.
  - If planning outpatient parenteral antibiotic therapy, consider review by the antibiotic stewardship program or infectious disease consultation service.
- 2 Use the shortest effective antibiotic duration<sup>3,4</sup>**
  - Account for inpatient antibiotic days when considering the duration of a post-discharge prescription.
  - Examples of total treatment duration for common infections:
    - Community-acquired pneumonia: 5 days<sup>5</sup>
    - Hospital-acquired pneumonia: 7 days<sup>6</sup>
    - Non-pulmonary cellulitis: 5 days<sup>7</sup>
- 3 Document and communicate a structured and timely discharge summary<sup>8</sup>**
  - Information communicated across transitions of care may include:
    - Diagnosis and treatment plan
    - Antibiotic therapy
      - List inpatient antibiotic(s) and total number of days received in the hospital.
      - Specify if antibiotic therapy was completed in the hospital or if continued therapy post-discharge is needed.
    - For a post-discharge prescription, list the planned antibiotic, dose, and end date.
    - Results of relevant diagnostic tests (including pending tests)
    - Instructions for follow-up medical care, including contact information for additional questions
- 4 Educate patients and caregivers<sup>9</sup>**
  - Indication and planned antibiotic course
  - Instructions for follow-up medical care
  - Signs and symptoms of worsening infection, and sepsis.
  - Signs and symptoms of antibiotic-associated adverse events, including Clostridium difficile infection

The document is meant to provide general guidance and does not apply to all circumstances. Always consult the antibiotic stewardship program or your clinical pharmacist, antibiotic stewardship pharmacist, or infectious disease specialist.

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www.cdc.gov/antibiotic-use

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# Adapting communication principles to nursing homes

**NURSING HOME HEALTHCARE PROFESSIONALS: BE ANTIBIOTICS AWARE Effective Communication with Residents and Families**

50-70% of nursing home residents are prescribed an antibiotic each year.<sup>1</sup>

25-75% of antibiotic prescriptions in nursing homes are inappropriate.<sup>2</sup>

Effective communication with residents and their families helps to address treatment expectations and places the resident at the center of care. Nursing home healthcare professionals can help reduce inappropriate antibiotic use by utilizing the 4-part communication strategy shown below. Communication skills training has been shown to significantly reduce inappropriate antibiotic prescribing in outpatient settings.<sup>3</sup>

Two scenarios using the communication strategy to decrease unnecessary prescribing for asymptomatic bacteriuria and respiratory infections are described on the pages that follow.

Healthcare professionals can use the 4-part Communication Strategy<sup>4</sup> to discuss appropriate antibiotic use when there is a change in the resident's condition.

- 1. Review findings:** Review relevant information such as symptoms or physical examination findings that support the decision about appropriate testing and antibiotic use.
- 2. Deliver a clear diagnosis:** Deliver a clear diagnosis that explains the change in the resident's condition.
- 3. Provide a FIRST negative, THEN positive treatment recommendation:** When an antibiotic is not needed, FIRST provide a negative treatment recommendation that "rules out" the need for antibiotics. THEN provide a positive recommendation for further evaluation, management, and monitoring.
- 4. Discuss a contingency plan:** Outline a contingency plan that details what actions will be taken if the resident does not improve, or if their condition worsens.

The scenarios are examples that apply the communication strategy discussed above and are not meant to guide the diagnosis and treatment of residents in nursing home residents. Always assess the individual resident, use your clinical judgment, and follow your facility's treatment guidelines and protocols when necessary.

**SCENARIO 1**

Mr. Smith's daughter is concerned because her mother did not sound like herself on the phone. She is worried that her mother may have a urinary tract infection and needs an antibiotic.

Asymptomatic bacteriuria refers to the presence of bacteria in a urine culture from a resident without signs or symptoms of a urinary tract infection. Urinary tract infections should **not** be treated with antibiotics in most cases.<sup>1</sup>

Healthcare professionals can use the 4-part Communication Strategy<sup>2</sup> discussed above to avoid unnecessary testing and antibiotic treatment for residents with asymptomatic bacteriuria.

- 1. Review findings:** Ms. Smith is less talkative than usual today. She is not complaining of pain or urgency when she urinates and she has no other symptoms to suggest an infection. Otherwise, she does not have any fever, her lungs sound clear, and her abdomen is not tender.
- 2. Deliver a clear diagnosis:** Her urine is darker than usual, which seems more consistent with fluid deficit than a urinary tract infection.
- 3. Provide a FIRST negative, THEN positive treatment recommendation:** Since the clinical findings do not indicate a urinary tract infection, an antibiotic will not help and may cause side effects, such as diarrhea (which we will give her fluids and monitor her over the next 24 hours).
- 4. Discuss a contingency plan:** If Ms. Smith does not improve, develop a fever or any new symptoms consistent with an infection, we will perform further testing and start antibiotics if needed.

The scenario are examples that apply the communication strategy discussed above and are not meant to guide the diagnosis and treatment of residents in nursing home residents. Always assess the individual resident, use your clinical judgment, and follow your facility's treatment guidelines and protocols when necessary.

**SCENARIO 2**

Mr. Jones woke up with a cough. He is concerned and asks for an antibiotic because in the past, antibiotics have helped him feel better when he is sick.

Antibiotics should not be prescribed for residents with upper respiratory infections or acute uncomplicated bronchitis unless pneumonia is suspected, or they meet criteria for antibiotic initiation.<sup>3</sup>

Healthcare professionals can use the 4-part Communication Strategy<sup>4</sup> discussed above to avoid unnecessary antibiotic treatment for residents with respiratory tract infections.

- 1. Review findings:** Mr. Jones I am sorry you are not feeling well today. When I examined you, your temperature and respiratory were normal, you have no chest tenderness or clear lung sounds.
- 2. Deliver a clear diagnosis:** The doctor used to discuss your symptoms. If seems that you have acute bronchitis, also known as a chest cold, which is most commonly caused by a virus.
- 3. Provide a FIRST negative, THEN positive treatment recommendation:** An antibiotic will not work against a viral infection, and may cause side effects, such as diarrhea. Instead, we will treat you for respiratory viruses, including flu. We will provide treatment to help you feel better and closely monitor your symptoms.
- 4. Discuss a contingency plan:** If you become short of breath, develop a fever or any other concerning symptoms, we will perform more testing, a chest X-ray, and start antibiotics if needed.

The scenario are examples that apply the communication strategy discussed above and are not meant to guide the diagnosis and treatment of residents in nursing home residents. Always assess the individual resident, use your clinical judgment, and follow your facility's treatment guidelines and protocols when necessary.

<https://www.cdc.gov/antibiotic-use/pdfs/NursingHome-Toolkit-508.pdf>

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### Blood Culture Contamination: An Overview for Infection Control and Antibiotic Stewardship Programs Working with the Clinical Laboratory

#### Purpose

Blood culture contamination can compromise quality of care and lead to unnecessary antibiotic exposure and prolonged length of hospitalization. Microbiology laboratories typically track blood culture contamination rates and can provide data to assist in reducing contamination rates. Infection control programs and microbiology laboratories might participate in designing and implementing interventions to decrease contamination rates, and antibiotic stewardship programs could also be engaged to optimize multidisciplinary quality improvement efforts to decrease blood culture contamination and improve the collection of blood culture specimens.

#### Background

Blood cultures are important diagnostic tools for identifying the pathogen(s) responsible for a patient's infection. This is especially true of patients with suspected sepsis or septic shock and for patients with suspected infective endocarditis<sup>1,2</sup>. When indicated, blood cultures should be obtained prior to starting antimicrobial therapy<sup>3,4</sup>. A conventional blood culture set consists of an aerobic and an anaerobic bottle. For adults, 20–30 mL of blood per vial (depending on the instrument manufacturer) is recommended and may require >2 bottles depending on the system<sup>5</sup>. At least two blood culture sets should be obtained within a few hours of each other via peripheral venipuncture when obtaining blood cultures for a total volume of 40–60 mL of blood to optimize detection of pathogens<sup>6</sup>. The College of American Pathologists laboratory accreditation program states that clinical laboratories have a written policy and procedure for monitoring blood cultures from adults for adequate volume and provide feedback on the results to the collectors<sup>6</sup>. Moreover, the monitoring and reporting of blood culture contamination rates is a laboratory quality best practice<sup>7</sup>.



Example of a blood culture set consisting of an aerobic and an anaerobic bottle, with the same size (10 mL) in an instrument volume of blood.

Because blood is a normally sterile body site, positive blood cultures with a known pathogen have a generally overall high positive predictive value for infection. However, blood culture contamination is a significant problem. In the era of modern blood culturing techniques, virtually all blood culture contamination occurs during collection; the source of contamination is usually the patient's skin or the hub or canula of an indwelling catheter (i.e., when an existing catheter is used to obtain the specimen). Frequent causes include poor collection technique and insufficient skin disinfection. Typical organisms include coagulase-negative staphylococci, *Corynebacterium* spp., *Facillus* spp., other than *Facillus anthracis*, *Mycobacterium* spp., and *Cutibacterium* across among others. Consequences include unnecessary antibiotic exposure with the potential for downstream untoward consequences (e.g., possible allergic reactions and *Clostridiaceae* difficile infections)<sup>8</sup>. Other possible consequences include the unnecessary removal of intravenous catheters or other devices, an increased length of stay, and increased costs<sup>9</sup>. One study found that the average length of stay was 2 days longer in patients with contaminated blood cultures compared to patients with negative cultures<sup>9</sup>. That same study found that direct and indirect hospital costs of a contaminated blood culture were \$12,824 compared to \$8,246 for a negative blood culture (savings of \$4,578 for preventing a contaminated blood culture<sup>9</sup>).



18/11/2018

<https://www.cdc.gov/antibiotic-use/core-elements/pdfs/FS-BloodCulture-508.pdf>

#### Tracking and Reporting

It can be useful to track the blood culture contamination rate to ensure high quality blood culture collection techniques are in place and to evaluate the effectiveness of the program. The College of American Pathologists recommends that the laboratory director should regularly review blood culture contamination rates as tracking the contamination rate and providing feedback to units and persons drawing blood cultures is one method that has been shown to reduce contamination rates<sup>6</sup>. Regularly reporting the rate to facility committees and leaders (e.g., infection prevention and control committee or an antimicrobial stewardship committee) can help ensure broad engagement. The American Society for Microbiology (ASM) and the Clinical Laboratory Standards Institute (CLSI) have recommended that an overall blood culture contamination rate should not exceed 3%<sup>6</sup>. However, many facilities have been able to drive this to less than 1%. Therefore, it should be possible to achieve blood culture contamination rates substantially lower than 3% even if 0% is not reached; when best practices are followed, a target contamination rate of 1% is achievable. Such thresholds can provide a method to benchmark within or between facilities<sup>6</sup>.

#### Tracking the Blood Culture Contamination Rate

Blood culture contamination rates should be monitored by the laboratory. A contaminated blood culture is generally defined by one set out of multiple sets being positive for a commensal organism. A list of skin commensals can be found [10]. An example of calculating a blood culture contamination rate involves dividing the total number of contaminated blood culture sets by the total number of blood culture sets collected during the evaluation period.

Number of blood culture sets with growth of skin commensals within the same organism in one set collected within 24 hours

Total number of all eligible blood culture sets collected

Exclusion criteria could include a lack of two blood culture sets drawn within a 24-hour period. As an example of the above calculation, if an institution has 200 blood culture sets drawn on 100 patients (each patient has 2 sets drawn within 8 minutes of each other) in one month, and one set grows, Staphylococcus epidermidis and the patient's other set drawn within 24 hours of the positive one is negative, then the institution's contamination rate is 0.5%.

#### Using Blood Culture Contamination Rate for Quality Improvement

Many clinical laboratories routinely calculate and report the blood culture contamination rate as a quality metric at the beginning of the month to evaluate the previous month's rate. In addition to reporting infection prevention and antibiotic stewardship specialists, reporting of rates identifies care locations and collection staff (in phlebotomy teams), can be undertaken to improve efforts.

#### Prevention/Actions<sup>6</sup>

An in-depth discussion of the ways a problem of the blood culture contamination found in the review article by Doorn <sup>1</sup> of the article follows.

Full article link: [https://doi.org/10.1093/cid/ciaa111](#)

- 1. Diagnostic Stewardship**  
Clinicians should strive to obtain the right patients, in the right set right time. Blood cultures can be not obtained for a patient with sub-therapeutic antibiotic therapy. Without a blood culture collect antibiotics, it can be more difficult to de-escalate antibiotic therapy if causative organisms are more likely unknown. Also, blood cultures of an indeterminate volume is less (i.e., two to three 20 mL volume initial evaluation of the patient to see this can decrease the overall blood culture contamination rate. These devices divert the initial 10 mL of potentially contaminated blood and then collect blood for the blood culture<sup>6</sup>.
- 2. Proper Skin Antisepsis**  
Impregnated skin antiseptics can be in blood culture contamination recommended that the skin be alcohol swabbed (disinfected) prior to drawing blood cultures<sup>6</sup>.
- 3. Blood Culture Bottle Disinfection**  
It is standard blood culture sets the blood culture bottle tops prior

#### 4. Blood Culture Collection Site

Peripheral venipuncture has consistently been associated with lower rates of blood culture contamination than draws collected through existing central venous catheters<sup>6</sup>. Thus, peripherally drawn blood cultures are preferred over catheter drawn cultures except when the degree of catheter-associated bloodstream infection is suspected<sup>6</sup>. In these cases, both peripheral and catheter draws are indicated.

#### 5. Hand Hygiene

Hand hygiene is recommended prior to interacting with patients and forming gloves prior to drawing blood cultures<sup>6</sup>.

#### 6. Phlebotomy Teams and Education on Proper Technique

Blood cultures drawn by phlebotomy teams are less likely to be contaminated compared with blood cultures collected by non-phlebotomy staff in hospital settings<sup>6</sup>.

#### 7. Surveillance and Feedback

Studies have demonstrated that providing feedback to those performing blood cultures regarding their contamination rates can decrease blood culture contamination rates<sup>6</sup>. Antibiotic stewardship programs can also consider tracking and evaluating the impact of contamination rates on antimicrobial vancomycin use.

#### 8. Serial Specimen Drawn Devices

There are devices that are commercially available that have shown promise in further reducing blood culture contamination rates. These devices divert the initial 10 mL of potentially contaminated blood and then collect blood for the blood culture<sup>6</sup>.

#### Next Step Considerations for Tracking and Preventing Blood Culture Contamination Events

- Antibiotic stewardship and infection prevention personnel should meet with laboratory personnel to learn how tracking and reporting of blood culture contamination events is being performed at their facility.
- Underlines locations in the facility where blood culture contamination events occur most commonly, the type of staff who collect blood cultures, and how the collector is identified in the laboratory information system.

#### • Review with the laboratory staff the blood culture collection procedures used at the facility and the training modules by system responsibility for collecting blood cultures.

• Explore with laboratory staff how the site where blood cultures are collected is labeled (e.g., venipuncture or central venous catheter) and consider how to encourage collecting blood cultures from preferred sites.

• Think about future tracking and facility benchmarking of blood culture utilization (e.g., blood cultures per admissions and patient days) as further data and guidance becomes available.

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10. [https://www.cdc.gov/antibiotic-use/core-elements/pdfs/FS-BloodCulture-508.pdf](#). Accessed on 1/4/2022.

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