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DIVISION OF HEALTHCARE QUALITY PROMOTION

2024 National Healthcare Safety Network Antimicrobial Use Option Report

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Table of Contents

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ANTIMICROBIAL USE OPTION

Executive Summary

Monitoring antimicrobial use (AU) is an important component of antimicrobial stewardship programs (ASPs). AU data delivered to ASPs allow stewards to develop, implement, and assess interventions aimed at optimizing antimicrobial prescribing.[1] These interventions, in turn, serve to improve the effectiveness of antimicrobial treatment, protect patients from harms caused by unnecessary antimicrobial exposure, and curb antimicrobial resistance associated with excessive antibiotic use.[2-4]

Since its launch in 2011, the Centers for Disease Control and Prevention's (CDC) National Healthcare Safety Network (NHSN) AU Option has become a central resource for monitoring AU among US hospitals. Data from the NHSN AU Option have been used by individual hospitals, health systems, and health departments to inform and support efforts to improve antibiotic use.[5-9]

To enable comparisons across hospitals, NHSN developed a risk-adjusted benchmarking metric, the Standardized Antimicrobial Administration Ratio (SAAR). The SAAR is a ratio of observed antimicrobial days to predicted antimicrobial days. The first baseline was created using 2014 data. NHSN then updated the AU SAAR baseline using data submitted for 2017 (adult and pediatric SAARs) and 2018 (neonatal SAARs). The NHSN AU Option Data Reports for 2019–2023 were based on 2017/2018 baselines. With expanded data from additional hospitals and diverse patient care locations, NHSN created new SAAR prediction models using the data submitted for year 2023 (2023 baseline). This report highlighting the 2024 NHSN AU Option data is the first data report generated using the 2023 baseline.

The 2024 AU Option Data Report summarizes the distributions of SAARs and antimicrobial use across each SAAR agent category for adult, pediatric, and neonatal patient care locations, as detailed in **Table 1**. The distributions of SAARs allow hospitals and group users to compare their SAARs with the national and state (if sufficient sample size) averages. Hospital antibiotic stewardship teams can use these distributions to establish hospital-specific targets within the NHSN Targeted Assessment for Antimicrobial Stewardship (TAS) Strategy. The percentage of antimicrobial use by class and drug within each SAAR category offers insights into prescribing practices across various types of patient care locations. Hospital stewardship staff can assess usage patterns in relation to local treatment guidelines, penicillin allergy protocols, antimicrobial resistance patterns and rates, and formulary options. For additional information and resources on TAS, please refer to the TAS Guide.[10]

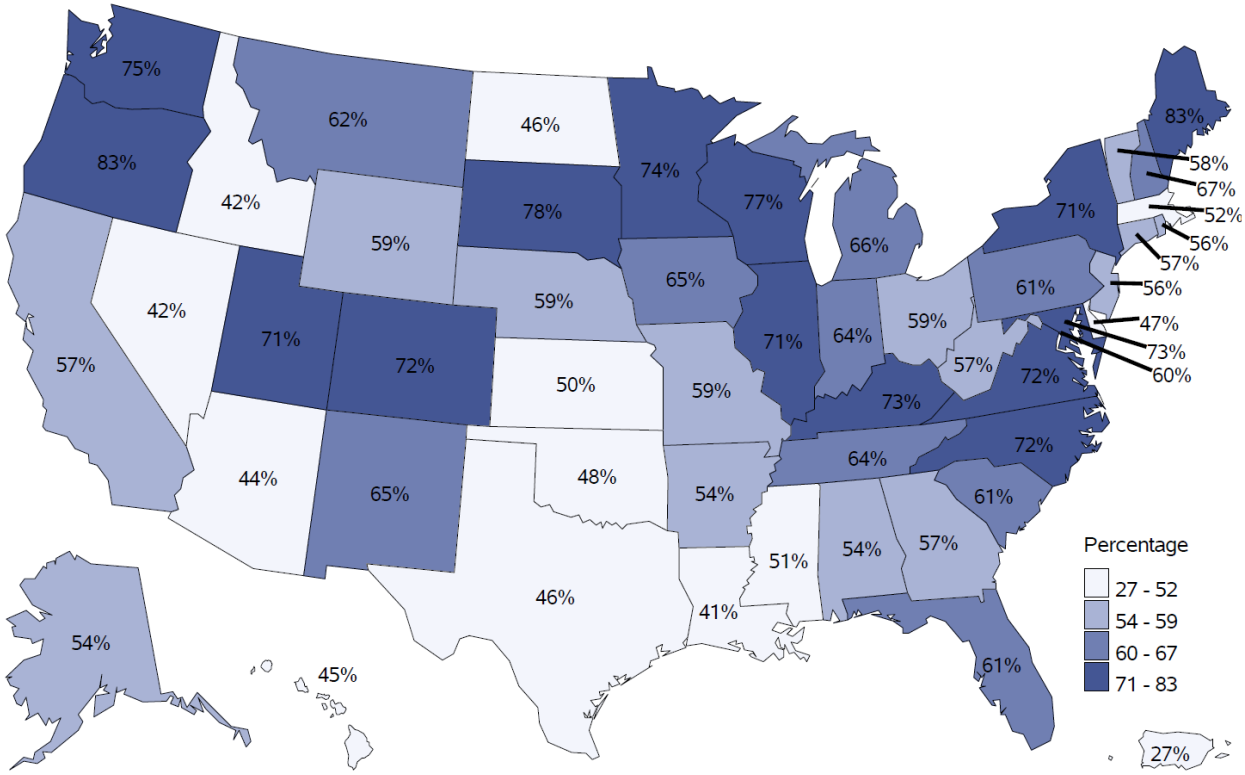
Background

The NHSN AU Option requires hospitals to report data completely electronically. Hospitals must have an electronic medication administration record (eMAR) or barcode medication administration (BCMA) system to pull antimicrobial administration data. Similarly, denominator data are electronically pulled from the hospital's Admission Discharge Transfer (ADT) system.

All inpatient hospitals that are enrolled in NHSN, reporting to the Patient Safety Component, and able to electronically access numerator and denominator data can participate in the AU Option. Hospital types that are eligible for AU Option reporting are general acute care hospitals, critical access hospitals, children's hospitals, long term acute care hospitals, pediatric long term acute care hospitals, military and veterans' hospitals, oncology hospitals, orthopedic hospitals, psychiatric hospitals, rehabilitation hospitals, surgical hospitals, women's hospitals, women's and children's hospitals, and government and non-government hospitals for public health emergencies. For the remainder of this report, this group of participants will be referred to as hospitals.

In 2017, Centers for Medicare & Medicaid Services (CMS) and the Assistant Secretary for Technology Policy/Office of the National Coordinator for Health Information Technology (ASTP/ONC) identified NHSN Antimicrobial Use and Resistance (AUR) Module reporting as one option to meet the Public Health Registry reporting element within the CMS Medicare Promoting Interoperability Program (formerly the Meaningful Use Program) for eligible hospitals and critical access hospitals (CAHs). In August 2022, CMS published the 2023 Final Rule for the Medicare Promoting Interoperability Program for eligible hospitals and CAHs that required the AUR Surveillance measure under the Public Health and Clinical Data Exchange Objective.[11] In 2024, hospitals in the program were required to start a two-year transition toward active engagement in reporting AUR Module data. As defined by CMS, this includes registration, testing, and submitting at least 180 continuous days of production data. The majority of hospitals successfully moved to submitting production data over the course of 2024. As of January 1, 2025, 4,362 hospitals (59.1% of eligible hospitals) reported at least one month of data to the AU Option since the launch of the Option. Participation, by jurisdiction among hospitals eligible to report, ranged from 27% in Puerto Rico to 83% in Maine **(Figure 1)**.

Figure 1. Percentage of hospitals ever reporting to the Antimicrobial Use Option among National Healthcare Safety Network acute care hospitals* by state/jurisdiction as of January 1, 2025



*Acute care hospitals include critical access, children's, general acute care, long-term acute care, military, oncology, orthopedic, psychiatric, inpatient rehabilitation, surgical, Veterans Affairs, women's, and women's and children's.

Methodology

Data Submission

Data for the NHSN Antimicrobial Use (AU) Option were submitted electronically in accordance with the Health Level 7 (HL7) Clinical Document Architecture (CDA) Implementation Guide. Manual entry is not supported. Each participating hospital submitted monthly AU summary files containing antimicrobial days of therapy (numerator), as well as days present and admissions (denominator data) from a combined facility-wide inpatient (FacWideIN) file along with additional location-level files for each eligible inpatient and outpatient acute care location (emergency department [ED], pediatric ED, and 24-hour observation).

Numerator data consisted of antimicrobial days (days of therapy, DOT), defined as the number of calendar days on which a patient received any amount of a given antimicrobial agent, recorded from the hospital's eMAR or BCMA system. DOTs were stratified by route of administration (i.e., intravenous, intramuscular, digestive, and respiratory).

Denominator data included days present (the total number of patients present for any portion of

a day in a given location) and admissions (aggregate count of patients admitted to inpatient locations during the month). Days present denominators are submitted for each individual location as well as FacWideIN. Admissions are reported for FacWideIN only.

Inclusion and Exclusion Criteria

Inclusion Criteria

Hospitals and locations were included in analyses if they met the following requirements:

- Reported ≥ 9 months of AU data in 2024.
- Belonged to an NHSN SAAR-eligible location type as defined in the 2023 baseline predictive models.
- Submitted AU summary files containing antimicrobial days and denominators (days present and admissions for FacWideIN) in accordance with NHSN protocol.
- Had 2024 NHSN Annual Hospital Survey data available; if unavailable, 2023 survey data were used for risk adjustment.
- For neonatal locations, satisfied additional criteria outlined in the NHSN SAAR Guide.

Exclusion Criteria

Records were excluded from analyses under the following conditions:

- Hospital had withdrawn from NHSN prior to July 1, 2025.
- Location/month reported 0 days present.
- Location/month reported DOT greater than days present for any antimicrobial agent.

Standardized Antimicrobial Administration Ratio (SAAR)

The SAAR is a ratio of observed antimicrobial days to predicted antimicrobial days. A SAAR greater than 1.0 indicates more antimicrobial days were observed than predicted; conversely, a SAAR less than 1.0 indicates fewer antimicrobial days were observed than predicted. This report is the first publication of AU data using new 2023 SAAR models. Previous years of AU Data Reports used the 2017 adult/pediatric and 2018 neonatal SAAR models. NHSN developed each new SAAR predictive model included in this report by assessing how rates of antimicrobial use for a specific antimicrobial category (e.g., narrow spectrum beta-lactam agents) were associated with select location- and facility-level factors collected by NHSN. AU data from eligible adult, pediatric, and neonatal locations reporting data in 2023 (the “baseline year”) were used to create final risk-adjusted negative binomial regression models, which can later be applied to predict AU for that antimicrobial category for any subsequent year. Eligible locations were determined based on availability of data in the baseline year and clinical relevance. The

SAAR categories and agents within those categories were defined by CDC based on published and presented reports on stewardship efforts (see Appendix E in the AUR Module Protocol). Additionally, CDC sought independent individual feedback from experts in antimicrobial stewardship. In this report, we include location-level SAAR distributions, and we calculate pooled mean SAAR values by pooling observed and predicted antimicrobial days across SAAR eligible location types. All predicted antimicrobial days were calculated using the 2023 adult, pediatric, and neonatal SAAR baseline models. Table 1 and Table 2 list SAAR patient care locations and antimicrobial agent categories, respectively.

$$SAAR = \frac{\textbf{Observed}\ antimicrobial\ days\ of\ therapy}{\textbf{Predicted}\ antimicrobial\ days\ of\ therapy}$$

- Observed AU: antimicrobial days reported within the AU Option by a hospital for a SAAR antimicrobial agent category used in a specified patient care location or group of locations (SAAR-eligible locations).
- Predicted AU: antimicrobial days predicted for that same antimicrobial agent category used in the same location or group of locations. NHSN calculates predicted antimicrobial days using risk-adjusted SAAR predictive models.

Table 1. Patient care locations eligible for generating SAARs in 2023 adult, pediatric, and neonatal baseline

Adult SAAR Locations	Pediatric SAAR Locations	Neonatal SAAR Locations
• Select intensive care units (ICUs): burn, medical, medical cardiac, medical-surgical, neurologic, neurosurgical, surgical, surgical cardiothoracic, trauma • Select wards: burn; labor and delivery; labor, delivery, recovery, postpartum suite; medical; medical-surgical; neurology; neurosurgical; postpartum; pulmonary; surgical • Mixed acuity units • Orthopedic and orthopedic trauma wards • Solid organ transplant specialty care areas • Step down units • General hematology-oncology and oncology hematopoietic stem cell transplant wards	• Select intensive care units (ICUs): medical, medical-surgical, surgical cardiothoracic • Select wards: medical, medical-surgical, surgical • General hematology-oncology and oncology hematopoietic stem cell transplant wards • Step down units	• Level II special care nurseries • Level II/III critical care units • Level III critical care units • Level IV critical care units

The CDC Locations and Descriptions and Instructions for Mapping Patient Care Locations document contains the NHSN patient care location definitions.
Abbreviations: Standardized Antimicrobial Administration Ratio (SAAR).

Table 2. SAAR antimicrobial agent categories used in 2023 adult, pediatric, and neonatal baseline

Adult SAAR Categories	Pediatric SAAR Categories	Neonatal SAAR Categories
• All antibacterial agents (All)	• All antibacterial agents (All)	• All antibacterial agents (All)
• Broad spectrum antibacterial agents predominantly used for hospital-onset infections (BSHO)	• Broad spectrum antibacterial agents predominantly used for hospital-onset infections (BSHO)	• Vancomycin (Vanc)
• Broad spectrum antibacterial agents predominantly used for community-acquired infections (BSCA)	• Broad spectrum antibacterial agents predominantly used for community-acquired infections (BSCA)	• Broad spectrum gram-negative coverage (BSGN)
• Antibacterial agents predominantly used for resistant gram-positive infections (e.g., MRSA) (GramPos)	• Antibacterial agents predominantly used for resistant gram-positive infections (e.g., MRSA) (GramPos)	• Third generation cephalosporins (Cephs)
• Narrow spectrum beta-lactam agents (NSBL)	• Narrow spectrum beta-lactam agents (NSBL)	• Ampicillin (Amp)
• Antibacterial agents posing the highest risk for CDI (CDI)	• Antibacterial agents posing the highest risk for CDI (CDI)	• Aminoglycosides (Amino)
• Antifungal agents predominantly used for invasive candidiasis (Antifungal)	• Antifungal agents predominantly used for invasive candidiasis (Antifungal)	• Fluconazole (Fluco)
	• Azithromycin (Azith)	

For the list of specific agents included in each SAAR category, refer to Appendix E of the AUR Module protocol.[13]
Abbreviations: Standardized Antimicrobial Administration Ratio (SAAR).

Results

2024 Antimicrobial Use Data

The 2024 AU Data Report provides a summary of median and pooled mean SAARs and percentages of use within SAAR antimicrobial agent categories for adult, pediatric, and neonatal locations in the following sections. The 2024 AU Report data tables provide more detailed information about SAAR distributions and the percentage of AU by class and drug within a SAAR antimicrobial agent category. The 2024 AU Report Excel data tables include the following:

- Scope of Report and Table of Contents

- Characteristics of NHSN acute care hospitals reporting for adult, pediatric, and neonatal SAAR locations for ≥9 months in 2024
- Percentage of NHSN locations reporting to the AU Option in 2024 among all active NHSN locations
- SAAR distributions for adult, pediatric, and neonatal SAAR antimicrobial category, by location type
- Percentage of antimicrobial use by class and drug for each SAAR antimicrobial agent category, by location type
- SAAR distributions for adult, pediatric, and neonatal SAAR antimicrobial agent categories, by state

Adult SAAR Antimicrobial Agent Categories

In 2024, 3,288 hospitals reported ≥9 months of AU data from 18,824 adult SAAR-eligible patient care locations (AU Report Excel Data Table 1a, 2a). The national pooled mean SAAR values differ across location type, reflecting different levels of antimicrobial use (relative to baseline year) for that SAAR category across locations, and SAAR category, reflecting distinct predictive models contributing to the SAAR as well as different compositions of antimicrobials (Table 3). Table 3 contains nationally aggregated data, with pooled mean SAARs ranging from 0.682 (Antifungal SAAR in orthopedic trauma wards) to 1.171 (Antifungal SAAR in burn wards). Data presented in Table 3 below can be found in more detail, including sample size and numerator/denominator information, in AU Report Excel Data Tables 3a1 – 3g1.

Table 3. Pooled mean SAAR values with 95% confidence limits by adult location type and SAAR antimicrobial agent category—National Healthcare Safety Network Antimicrobial Use Option, 2024. Location types sorted alphabetically.

	Adult SAAR Antimicrobial Agent Categories						
Adult SAAR Location Type	All antibacterial agents	Broad spectrum antibacterial agents predominantly used for hospital-onset infections	Broad spectrum antibacterial agents predominantly used for community-acquired infections	Antibacterial agents predominantly used for resistant gram-positive infections	Narrow spectrum beta-lactam agents	Antibacterial agents posing the highest risk for Clostridioides difficile infection	Antifungal agents predominantly used for invasive candidiasis
Burn ICUs	0.903 (0.897, 0.908)	0.860 (0.851, 0.870)	0.768 (0.753, 0.784)	0.900 (0.888, 0.912)	0.934 (0.917, 0.950)	0.901 (0.891, 0.911)	0.919 (0.898, 0.941)
Burn Wards	1.077 (1.071, 1.084)	1.121 (1.109, 1.133)	1.105 (1.086, 1.125)	1.146 (1.132, 1.160)	0.960 (0.947, 0.974)	1.132 (1.120, 1.143)	1.171 (1.137, 1.205)
Labor and Delivery Wards	1.027 (1.025, 1.028)	1.146 (1.138, 1.154)	0.915 (0.905, 0.926)	0.847 (0.835, 0.860)	1.011 (1.009, 1.013)	1.002 (0.996, 1.009)	0.954 (0.934, 0.975)
Labor, Delivery, Recovery, Postpartum Suites	1.017 (1.015, 1.019)	0.985 (0.977, 0.993)	1.081 (1.069, 1.092)	0.905 (0.890, 0.920)	1.011 (1.008, 1.014)	0.988 (0.981, 0.994)	0.983 (0.960, 1.006)

Adult SAAR Location Type	Adult SAAR Antimicrobial Agent Categories						
	All antibacterial agents	Broad spectrum antibacterial agents predominantly used for hospital-onset infections	Broad spectrum antibacterial agents predominantly used for community-acquired infections	Antibacterial agents predominantly used for resistant gram-positive infections	Narrow spectrum beta-lactam agents	Antibacterial agents posing the highest risk for Clostridioides difficile infection	Antifungal agents predominantly used for invasive candidiasis
Medical Cardiac ICUs	1.023 (1.020, 1.025)	1.005 (1.001, 1.009)	1.031 (1.025, 1.037)	1.049 (1.044, 1.054)	0.998 (0.992, 1.005)	0.939 (0.935, 0.942)	1.036 (1.024, 1.048)
Medical ICUs	1.026 (1.025, 1.027)	1.028 (1.026, 1.030)	1.070 (1.067, 1.073)	1.007 (1.004, 1.009)	1.041 (1.037, 1.045)	0.986 (0.984, 0.988)	1.018 (1.013, 1.023)
Medical Wards	1.012 (1.011, 1.012)	1.011 (1.010, 1.012)	1.044 (1.043, 1.045)	0.971 (0.969, 0.972)	1.000 (0.998, 1.001)	1.023 (1.023, 1.024)	0.946 (0.944, 0.949)
Medical-Surgical ICUs	1.005 (1.004, 1.005)	1.021 (1.020, 1.022)	0.959 (0.957, 0.961)	0.997 (0.995, 0.998)	1.075 (1.072, 1.077)	0.986 (0.985, 0.987)	0.985 (0.981, 0.988)
Medical-Surgical Wards	0.981 (0.980, 0.981)	0.993 (0.992, 0.993)	0.974 (0.973, 0.975)	0.985 (0.983, 0.986)	0.962 (0.961, 0.963)	0.991 (0.990, 0.991)	0.994 (0.991, 0.996)
Mixed Acuity Units	0.981 (0.980, 0.983)	0.959 (0.957, 0.961)	1.001 (0.999, 1.003)	0.972 (0.969, 0.974)	0.999 (0.997, 1.002)	0.963 (0.961, 0.964)	0.964 (0.959, 0.970)
Neurologic ICUs	0.935 (0.932, 0.939)	0.929 (0.923, 0.936)	1.101 (1.091, 1.111)	0.898 (0.890, 0.905)	0.874 (0.867, 0.882)	0.950 (0.944, 0.956)	0.910 (0.889, 0.931)
Neurology Wards	0.999 (0.997, 1.001)	0.975 (0.969, 0.980)	1.078 (1.073, 1.084)	0.992 (0.986, 0.999)	0.972 (0.968, 0.977)	0.926 (0.922, 0.930)	0.894 (0.881, 0.907)
Neurosurgical ICUs	0.981 (0.978, 0.983)	0.942 (0.938, 0.946)	1.051 (1.045, 1.058)	0.957 (0.952, 0.962)	0.982 (0.977, 0.987)	0.976 (0.971, 0.980)	0.936 (0.923, 0.950)
Neurosurgical Wards	0.972 (0.969, 0.974)	1.029 (1.023, 1.036)	1.080 (1.073, 1.087)	0.853 (0.847, 0.859)	0.905 (0.900, 0.909)	1.002 (0.998, 1.007)	0.916 (0.900, 0.933)
Oncology General Hematology-Oncology Wards	1.018 (1.017, 1.020)	0.988 (0.986, 0.990)	1.128 (1.125, 1.131)	0.936 (0.932, 0.939)	1.010 (1.006, 1.014)	0.977 (0.975, 0.979)	0.969 (0.965, 0.973)

Adult SAAR Location Type	Adult SAAR Antimicrobial Agent Categories						
	All antibacterial agents	Broad spectrum antibacterial agents predominantly used for hospital-onset infections	Broad spectrum antibacterial agents predominantly used for community-acquired infections	Antibacterial agents predominantly used for resistant gram-positive infections	Narrow spectrum beta-lactam agents	Antibacterial agents posing the highest risk for Clostridioides difficile infection	Antifungal agents predominantly used for invasive candidiasis
Oncology Hematopoietic Stem Cell Transplant Wards	0.956 (0.954, 0.958)	0.970 (0.966, 0.974)	0.999 (0.994, 1.003)	0.998 (0.990, 1.006)	1.121 (1.108, 1.134)	0.964 (0.961, 0.967)	0.950 (0.946, 0.954)
Orthopedic Trauma Wards	0.924 (0.920, 0.928)	1.069 (1.058, 1.079)	0.975 (0.964, 0.986)	0.924 (0.914, 0.934)	0.804 (0.798, 0.810)	1.065 (1.056, 1.074)	0.682 (0.665, 0.701)
Orthopedic Wards	0.975 (0.973, 0.976)	1.075 (1.072, 1.078)	1.076 (1.073, 1.079)	1.037 (1.033, 1.040)	0.888 (0.887, 0.890)	1.104 (1.101, 1.107)	1.114 (1.103, 1.124)
Postpartum Wards	0.918 (0.916, 0.920)	1.000 (0.994, 1.006)	0.909 (0.900, 0.918)	0.816 (0.803, 0.830)	0.879 (0.875, 0.882)	0.898 (0.893, 0.903)	0.983 (0.958, 1.009)
Pulmonary Wards	1.006 (1.003, 1.008)	1.008 (1.002, 1.013)	1.165 (1.159, 1.172)	0.965 (0.957, 0.972)	1.078 (1.068, 1.088)	0.955 (0.951, 0.959)	0.944 (0.930, 0.959)
Solid Organ Transplant Special Care Areas	1.027 (1.024, 1.030)	1.004 (0.998, 1.010)	1.081 (1.072, 1.089)	1.074 (1.065, 1.084)	1.017 (1.007, 1.027)	1.084 (1.077, 1.090)	0.958 (0.951, 0.966)
Step-down Units	0.999 (0.999, 1.000)	0.998 (0.996, 0.999)	1.027 (1.026, 1.029)	0.962 (0.961, 0.964)	0.977 (0.975, 0.979)	1.009 (1.008, 1.011)	0.994 (0.991, 0.998)
Surgical Cardiothoracic ICUs	1.024 (1.022, 1.026)	1.085 (1.082, 1.088)	1.048 (1.043, 1.053)	1.014 (1.011, 1.018)	0.944 (0.941, 0.947)	1.033 (1.030, 1.036)	1.058 (1.051, 1.065)
Surgical ICUs	0.993 (0.992, 0.995)	0.993 (0.991, 0.996)	1.002 (0.997, 1.007)	0.978 (0.974, 0.982)	1.009 (1.005, 1.013)	1.027 (1.024, 1.030)	1.109 (1.103, 1.114)
Surgical Wards	0.996 (0.996, 0.997)	1.006 (1.005, 1.008)	1.049 (1.047, 1.051)	0.996 (0.994, 0.998)	0.935 (0.934, 0.937)	1.011 (1.010, 1.013)	1.062 (1.057, 1.066)

Adult SAAR Location Type	Adult SAAR Antimicrobial Agent Categories						
	All antibacterial agents	Broad spectrum antibacterial agents predominantly used for hospital-onset infections	Broad spectrum antibacterial agents predominantly used for community-acquired infections	Antibacterial agents predominantly used for resistant gram-positive infections	Narrow spectrum beta-lactam agents	Antibacterial agents posing the highest risk for Clostridioides difficile infection	Antifungal agents predominantly used for invasive candidiasis
Trauma ICUs	0.989 (0.986, 0.992)	0.999 (0.994, 1.004)	1.057 (1.049, 1.065)	0.946 (0.940, 0.952)	1.018 (1.012, 1.025)	0.954 (0.949, 0.958)	0.868 (0.858, 0.878)

Abbreviations: Standardized Antimicrobial Administration Ratio (SAAR), intensive care unit (ICU).

The following bullets highlight percentage of AU by class and drug for each adult SAAR antimicrobial agent category (AU Report Excel Data Tables 3a2 – 3g2):

- Within the **All antibacterial SAAR** category, the top 10 antibacterial agents represented 74.1%–93.9% of use, depending on the SAAR location. Vancomycin, cefepime, piperacillin/tazobactam, and ceftriaxone were consistently among the most frequently used agents across many location types. Within surgical ICUs, surgical cardiothoracic ICUs, neurosurgical ICUs, orthopedic and orthopedic trauma wards, neurology, neurosurgical and surgical wards, cefazolin was among the top three agents. In labor and delivery wards and labor, delivery, recovery, and postpartum suites, antimicrobial days were predominantly attributable to cefazolin, penicillin G, and ampicillin. However, in postpartum wards, the top three agents were cefazolin, metronidazole, and ampicillin. The most commonly used agent in oncology hematopoietic stem cell transplant wards was levofloxacin, while in solid organ transplant special care areas, it was sulfamethoxazole/trimethoprim. (AU Report Excel Data Table 3a2)

- Within the Broad spectrum antibacterial agents predominantly used for hospital-onset infections **(BSHO) SAAR** category, the most commonly used agent was piperacillin/tazobactam in most ICUs, non-oncology wards, and step-down units, followed by cefepime and meropenem. Cefepime was the most often used agent in oncology hematopoietic stem cell transplant wards, orthopedic trauma wards, neurosurgical wards, as well as burn ICUs and wards, followed by piperacillin/tazobactam and meropenem. Alternatively, gentamicin (IV) was the most used agent within this category in labor and delivery wards; labor, delivery, recovery and postpartum suites; and postpartum wards. Depending on location types, piperacillin/tazobactam represented 13.0%–61.6% of antimicrobial use, and carbapenems (meropenem and imipenem/cilastatin) represented 1.2%–21.9% of use. (AU Report Excel Data Table 3b2)

- Within the Broad spectrum antibacterial agents predominantly used for community-acquired infections **(BSCA) SAAR** category, ceftriaxone had the highest use across most location types (except for Oncology hematopoietic stem cell transplant wards where levofloxacin was the most commonly used agent), ranging from 48.4% in hematology-oncology wards to 87.6% in neurologic ICUs. The next most used agents were levofloxacin, ciprofloxacin, and ertapenem in varying order across location types. Solid organ transplant, surgical ICUs and wards, and pulmonary wards had a higher proportion of ertapenem use (range of 6.4%–12.6%) compared to other SAAR locations (range of 1.4%–5.8%). (AU Report Excel Data Table 3c2)

- Within the Antibacterial agents predominantly used for resistant gram-positive infections **(GramPos) SAAR** category, intravenous vancomycin was the predominant agent used in all SAAR location types, representing 57.1%–98.2% of use across location types, followed by linezolid and daptomycin. (AU Report Excel Data Table 3d2)

- Within the Narrow spectrum beta-lactam agents **(NSBL) SAAR** category, cefazolin had the highest use across all SAAR location types, except within oncology hematopoietic stem cell transplant wards where penicillin V had the highest use. (AU Report Excel Data Table 3e2)

- Within the Antibacterial agents posing the highest risk for *Clostridioides difficile* infection

(CDI) SAAR category, third and fourth generation cephalosporins had the highest use across most SAAR location types. Oncology hematopoietic stem cell transplant wards had a higher proportion of fluoroquinolone use among antimicrobials in this category (46.7%) compared to other SAAR location types (range of 0.9%-24.1%). Clindamycin represented a high percentage of antimicrobial use in labor, delivery, recovery, postpartum suites (44.2%), postpartum wards (50%), and labor and delivery wards (51.9%) when compared to the percentage of its use among other SAAR locations (range of 0.3%–6.0%). (AU Report Excel Data Table 3f2)

- Within the Antifungal agents predominantly used for invasive candidiasis **(Antifungal) SAAR** category, echinocandins represented approximately half (range of 40.4%–60.4%) of use in ICUs and one-third (32.7%) of use in step down units. Mixed acuity units and wards had a higher proportion of fluconazole use (range of 55.6%–99.7%) than echinocandin use (range of 0.4%–44.5%). (AU Report Excel Data Table 3g2)

Pediatric SAAR Antimicrobial Agent Categories

In 2024, 523 hospitals reported ≥9 months of AU data from 1,182 pediatric patient care locations (AU Report Excel Data Tables 1b, 2b). The national pooled mean SAAR values varied by location type and SAAR category (Table 4). Table 4 contains nationally aggregated data, with pooled mean SAARs ranging from 0.648 (Antifungal SAAR in pediatric oncology hematopoietic stem cell transplant wards) to 2.099 (Antifungal SAAR in pediatric step-down units). Pooled mean SAARs in 2023, the baseline year, are around 1.0, and changes in 2024 could be due to changes in disease burden, rates of antimicrobial resistance, or other factors. For example, we observed that 2024 pooled mean Azithromycin SAARs across all location types were above 1.0. An ad-hoc analysis showed the pooled mean Azithromycin SAARs in medical-surgical wards increased from 0.903 in 2023 to 1.889 in 2024. It is possible that these changes reflected shifts in the burden of infections that required azithromycin in this population.[14] Data presented in Table 4 below can be found in more detail, including sample size and numerator/denominator information, in AU Report Excel Data Tables 4a1 – 4h1.

Table 4. Pooled mean SAAR values with 95% confidence limits by pediatric location type and SAAR antimicrobial agent category—National Healthcare Safety Network Antimicrobial Use Option, 2024. Location types sorted alphabetically.

	Pediatric SAAR Antimicrobial Agent Categories							
Pediatric SAAR Location Type	All antibacterial agents	Broad spectrum antibacterial agents predominantly used for hospital-onset infections	Broad spectrum antibacterial agents predominantly used for community-acquired infections	Antibacterial agents predominantly used for resistant gram-positive infections	Narrow spectrum beta-lactam agents	Azithromycin	Antibacterial agents posing the highest risk for Clostridioides difficile infection	Antifungal agents predominantly used for invasive candidiasis
Medical ICUs	0.940 (0.932, 0.949)	0.938 (0.921, 0.955)	0.825 (0.810, 0.841)	0.766 (0.748, 0.784)	1.023 (1.002, 1.045)	1.391 (1.343, 1.440)	0.859 (0.847, 0.872)	0.828 (0.794, 0.864)
Medical Wards	0.992 (0.989, 0.995)	0.911 (0.904, 0.917)	1.046 (1.040, 1.051)	0.888 (0.881, 0.895)	0.948 (0.943, 0.954)	1.642 (1.625, 1.659)	0.986 (0.981, 0.991)	0.842 (0.827, 0.856)
Medical-Surgical ICUs	1.123 (1.120, 1.125)	1.198 (1.193, 1.204)	1.010 (1.005, 1.014)	1.075 (1.069, 1.081)	1.056 (1.050, 1.062)	1.413 (1.400, 1.427)	1.082 (1.079, 1.086)	1.214 (1.204, 1.225)

Pediatric SAAR Location Type	Pediatric SAAR Antimicrobial Agent Categories							
	All antibacterial agents	Broad spectrum antibacterial agents predominantly used for hospital-onset infections	Broad spectrum antibacterial agents predominantly used for community-acquired infections	Antibacterial agents predominantly used for resistant gram-positive infections	Narrow spectrum beta-lactam agents	Azithromycin	Antibacterial agents posing the highest risk for Clostridioides difficile infection	Antifungal agents predominantly used for invasive candidiasis
Medical-Surgical Wards	1.050 (1.048, 1.052)	0.984 (0.980, 0.988)	1.056 (1.052, 1.060)	0.938 (0.933, 0.943)	1.060 (1.056, 1.064)	1.889 (1.875, 1.903)	0.990 (0.987, 0.993)	1.050 (1.039, 1.061)
Oncology General Hematology-Oncology Wards	0.957 (0.954, 0.960)	0.926 (0.922, 0.930)	1.097 (1.087, 1.106)	0.936 (0.927, 0.945)	1.129 (1.118, 1.141)	1.378 (1.355, 1.401)	0.968 (0.964, 0.972)	0.876 (0.870, 0.882)
Oncology Hematopoietic Stem Cell Transplant Wards	0.954 (0.947, 0.961)	1.011 (1.000, 1.022)	1.374 (1.340, 1.409)	0.929 (0.908, 0.951)	0.892 (0.873, 0.911)	1.303 (1.248, 1.359)	1.017 (1.007, 1.028)	0.648 (0.639, 0.656)
Step-down Units	1.047 (1.040, 1.053)	1.162 (1.145, 1.178)	1.172 (1.154, 1.190)	0.950 (0.932, 0.969)	0.957 (0.944, 0.970)	1.412 (1.372, 1.454)	1.129 (1.116, 1.142)	2.099 (2.048, 2.152)
Surgical Cardiothoracic ICUs	1.014 (1.010, 1.018)	0.993 (0.986, 1.001)	1.069 (1.053, 1.086)	1.035 (1.024, 1.045)	0.952 (0.945, 0.960)	1.667 (1.625, 1.710)	0.994 (0.987, 1.001)	0.900 (0.887, 0.913)
Surgical Wards	1.108 (1.102, 1.115)	1.148 (1.133, 1.163)	1.105 (1.092, 1.118)	0.829 (0.813, 0.844)	1.077 (1.066, 1.089)	1.743 (1.657, 1.832)	0.868 (0.859, 0.878)	0.841 (0.812, 0.870)

Abbreviations: Standardized Antimicrobial Administration Ratio (SAAR), intensive care unit (ICU).

The following bullets highlight percentage of AU by class and drug for each pediatric SAAR antimicrobial agent category (for categories with more than one agent) (AU Report Excel Data Tables 4a2, 4b2, 4c2, 4d2, 4e2, 4g2 and 4h2):

- Within the **All antibacterial SAAR** category, the top ten antibacterial agents accounted for 64.4%–80.8% of total use, depending on the SAAR location type. In most locations, ceftriaxone was the most frequently used agent. However, there were exceptions: in surgical wards and surgical cardiothoracic ICUs, cefazolin was used most often, while in general hematology-oncology wards and oncology hematopoietic stem cell transplant wards, cefepime had the highest use. (AU Report Excel Data Table 4a2)

- Within the Broad spectrum antibacterial agents predominantly used for hospital-onset infections **(BSHO) SAAR** category, cefepime and piperacillin/tazobactam were the leading agents used (in varying order) in most pediatric SAAR location types. In general hematology-oncology wards and oncology hematopoietic stem cell transplant wards, levofloxacin ranked second after cefepime, while in surgical cardiothoracic ICUs, meropenem was the second most used agent. Carbapenems (meropenem, ertapenem, and imipenem/cilastatin) accounted for 7.3%–15.3% of use for different SAAR location types. Medical wards had a higher proportion of aminoglycoside use (5.4%) compared with other location types (range of 0.5%–2.2%). (AU Report Excel Data Table 4b2)

- Within the Broad spectrum antibacterial agents predominantly used for community-acquired infections **(BSCA) SAAR** category, ceftriaxone was the agent used most frequently across all SAAR location types, ranging from 52.5% in surgical wards to 70.6% in medical ICUs. Ampicillin-sulbactam and amoxicillin-clavulanate use were the second highest (combined range of 22.2%–45.7%, depending on location type). (AU Report Excel Data Table 4c2)

- Within the Antibacterial agents predominantly used for resistant gram-positive infections **(GramPos) SAAR** category, the most used antimicrobial was IV vancomycin (range of 44.5%–76.7% in varying locations). This was followed by clindamycin (range of 8.6%–43.9%) and linezolid (range of 5.6%–9.3%) in varying order depending on location type. (AU Report Excel Data Table 4d2)

- Within the Narrow spectrum beta-lactam agents **(NSBL) SAAR** category, cefazolin, ampicillin, and amoxicillin (in varying order) were the top agents used in most SAAR location types. Surgical cardiothoracic ICUs, surgical wards, oncology general hematology and oncology hematopoietic stem transplant wards were an exception, where the top agents were cefazolin, amoxicillin, penicillin V, or cephalexin. (AU Report Excel Data Table 4e2)

- Within the Antibacterial agents posing the highest risk for *Clostridioides difficile* infection **(CDI) SAAR** category, ceftriaxone, cefepime, and clindamycin (in varying order) were the most commonly used agents in medical wards, medical-surgical wards, and surgical wards. Medical ICUs, medical-surgical ICUs, general hematology-oncology wards, hematopoietic stem cell transplant wards, step down units and surgical cardiothoracic ICUs had either meropenem or levofloxacin within the top three most commonly used agents. Among antimicrobial agents in this category, surgical cardiothoracic, medical, and medical-surgical ICUs had a higher proportion of third and fourth generation

cephalosporins use (77.9%, 75.9%, and 75.2%, respectively) than other SAAR location types (range of 59.3%–71.8%). (AU Report Excel Data Table 4g2)

- Within the Antifungal agents for invasive candidiasis **(Antifungal) SAAR** category, fluconazole was the most frequently used agent in non-oncology units, with use ranging from 51.0% to 81.8%. In contrast, in general hematology-oncology and hematopoietic stem cell transplant wards, echinocandins (such as micafungin) were the predominant agents, accounting for 64.9%–68.4% of use. (AU Report Excel Data Table 4h2)

Neonatal SAAR Antimicrobial Agent Categories

In 2024, 1,078 hospitals reported ≥9 months of AU data from 1,179 neonatal patient care locations (AU Report Excel Data Table 1c, 2c). The national pooled mean SAAR values varied by location type and SAAR category (Table 5), ranging from 0.578 (Third generation cephalosporin SAAR in Level II special care nurseries) to 1.354 (Third generation cephalosporin SAAR in Level II/III NICUs). Data presented in Table 5 below can be found in more detail, including sample size and numerator/denominator information, in AU Report Excel Data Tables 5a1 – 5g1.

Table 5. Pooled mean SAAR values with 95% confidence limits by neonatal location type and SAAR antimicrobial agent category—National Healthcare Safety Network Antimicrobial Use Option, 2024

	Neonatal SAAR Antimicrobial Agent Categories						
Neonatal SAAR location type	All antibacterial agents	Neonatal Vancomycin	Neonatal broad spectrum gram-negative coverage	Neonatal third generation cephalosporins	Neonatal Ampicillin	Neonatal Aminoglycosides	Neonatal Fluconazole
Special Care Nursery (Level II)	0.880 (0.874, 0.885)	1.222 (1.152, 1.296)	1.153 (1.097, 1.211)	0.578 (0.549, 0.607)	0.916 (0.907, 0.925)	0.950 (0.939, 0.961)	0.722 (0.662, 0.787)
Level II/III NICU	1.004 (1.001, 1.007)	0.989 (0.977, 1.000)	1.090 (1.079, 1.101)	1.354 (1.335, 1.374)	0.961 (0.957, 0.965)	0.925 (0.920, 0.930)	1.018 (1.004, 1.032)
Level III NICU	1.049 (1.046, 1.052)	0.867 (0.858, 0.875)	0.859 (0.851, 0.866)	1.025 (1.013, 1.038)	1.008 (1.004, 1.013)	1.080 (1.075, 1.086)	0.941 (0.930, 0.952)
Level IV NICU	0.974 (0.972, 0.977)	1.101 (1.091, 1.111)	0.997 (0.990, 1.005)	1.257 (1.244, 1.271)	0.909 (0.904, 0.915)	0.979 (0.972, 0.986)	1.072 (1.060, 1.085)

Abbreviations: Standardized Antimicrobial Administration Ratio (SAAR), intensive care unit (ICU).

The following bullets highlight percentage of AU by class and drug for each neonatal SAAR antimicrobial agent category (for categories with more than one agent) (AU Report Excel Data Tables 5a2, 5c2, 5d2, and 5f2).

- Within the **All antibacterial SAAR** category, the top two antibacterial agents, ampicillin and gentamicin, represented the largest portion (combined range of 40.2%–85.3%) of antibacterial use in all SAAR location types. Vancomycin was the third most commonly used antibacterial in all SAAR locations except Level II special care nurseries, where penicillin G was used more often. (AU Report Excel Data Table 5a2)

- Within the Neonatal broad-spectrum gram-negative coverage **(BSGN) SAAR** category, cefepime accounted for the largest share of use across all neonatal location types (range of 51.2%–60.5%), followed by piperacillin/tazobactam (range of 26.0%–33.5%). Meropenem use was less frequent, representing 13.4%–16.7% of use depending on level of care, while ertapenem and imipenem/cilastatin use was minimal. (AU Report Excel Data Table 5c2)

- Within the Neonatal 3rd generation cephalosporins **(Cephs) SAAR** category, intravenous ceftazidime accounted for most of the use (82.5%–94.0%) in all SAAR location types. (AU Report Excel Data Table 5d2)

- Within the Neonatal aminoglycosides **(Amino) SAAR** category, intravenous and intramuscular gentamicin accounted for almost all use in each SAAR location type (range of 93.7%–97.5%). (AU Report Excel Data Table 5f2)

Conclusion and Recommendations

The 2024 NHSN AU Option Data Report summarizes the SAARs for adult, pediatric, and neonatal locations across 3,288, 523, and 1,078 hospitals, respectively, using the updated 2023 SAAR baseline. Additionally, this report provides a detailed breakdown of the use of individual antimicrobials within each SAAR category. In contrast to the previous 2017/2018 SAAR baselines, the 2023 baseline reflects a more recent and larger cohort of US hospitals and patient care locations. Furthermore, the 2023 SAAR baseline includes SAARs for additional location types which were not available in the previous baseline. Depending on location types, data included in this report represent approximately 55%–89% of patient care locations actively engaged in NHSN reporting.

One surveillance vendor that prepared AU data submission for 154 hospitals—representing approximately 5% of hospitals submitting AU data to NHSN in 2024—retrospectively notified NHSN of a data attribution error. A small portion of antimicrobial days and days present that occurred in ED or 24-hour observation units were mistakenly attributed to inpatient locations during a transition window when patients had been admitted in the electronic health records but had not yet physically arrived in an inpatient bed. The data were not excluded from this report, as the volume affected and the impact on the overall AU rate was minimal.

The SAAR can be used to track AU changes over time for individual hospitals and as a benchmarking metric for comparing AU among similar patient care locations. While the SAAR is not a measure of appropriateness of AU, it allows ASPs to compare their AU to a national

benchmark. These analyses allow hospitals to assess whether they are using antimicrobials at higher rates than predicted (specifically, SAAR values >1), which can prompt them to further evaluate prescribing practices and intervene, if necessary, to optimize AU. The SAAR Guide[12] and NHSN Antimicrobial Use and Resistance (AUR) Module Protocol[13] contain more information on the SAAR and the new baseline.

It is important to note that SAARs generated using different baseline years (2014, 2017, 2018, or 2023) should NOT be compared with one another. Each baseline year was developed from distinct patient populations, risk adjustments, and antimicrobial agent categories. As a result, comparisons across baseline years may lead to misleading conclusions. Instead, hospitals and stewardship teams should focus on interpreting SAARs relative to the specific baseline model on which they are built.

To maximize the utility of the NHSN AU Option and this report, we recommend considering the following actions:

- Submit monthly hospital AU data to the NHSN AU Option to guide tracking and reporting for ASPs.
- To ensure the accuracy of the AU data, run the AU Option data quality line list available in the NHSN application quarterly. Beyond the data quality line list, using the NHSN AUR data validation protocol annually or during implementation of a new EHR system or surveillance software allows for more extensive data quality checks.
- Although not a definitive indicator for appropriateness of use, SAAR is a tool for antimicrobial stewards to understand how their SAARs compare with others. We recommend stewards review antibiotic use for the locations with SAARs that are significantly higher or lower than 1.0, trending higher over time (using the 2023 SAAR baseline), or are higher when compared to national, state, or local distributions.
- Generate and review your hospital's AU data at least every quarter, and track SAAR and AU data over time:
  - Know where your hospital's SAAR values are located among the SAAR distributions provided in this report. Examine the SAAR values by location or location types and in the context of past SAARs.
  - For the locations with potential stewardship opportunities, examine the percentage of antimicrobials by class and individual drug. Doing so can help stewards understand prescribing practices at your hospital. To identify potential overuse or underuse, stewards must understand common indications for antimicrobial use, organisms associated with the infection diagnoses commonly seen in different patient care locations and their respective appropriate antimicrobial treatment.
- Report SAAR and AU data on a regular basis to senior leadership, hospital board, hospital committees (for example, antimicrobial stewardship, infection control, Pharmacy & Therapeutics), and healthcare providers.
- Establish target SAAR goals for your hospital. Then, use Antimicrobial Use cumulative attributable difference (AU-CAD) available in the TAS reports and dashboards to determine how many antimicrobial days need to be reduced or adjusted to meet your

hospital's goal. Reassess your SAAR target annually. The national- and state-level distribution of SAARs provided in this report can assist you in setting informed goals. For additional recommendations on AU-CAD and goal setting, please refer to the NHSN TAS Strategy.

- Health departments, healthcare systems, or collaboratives can use the NHSN AU Option Group Function and generate SAARs for the hospitals in your jurisdictions or network, identify hospitals with significantly higher SAARs and investigate possible causes. Through the NHSN Group Function, users can also track the uptake of the core elements of antibiotic stewardship among the hospitals in their jurisdiction or network.

- Healthcare systems and health departments should compare their AU to national and/or state-specific SAAR distributions. Stewards can also explore and visualize state-level SAAR distributions on the Antimicrobial Resistance & Patient Safety Portal.

- Released in 2022, CDC's Priorities for Hospital Core Element Implementation highlight a subset of implementation approaches that are highly effective or prioritized by stewardship experts **(Figure 2)**. The NHSN AU Option can serve as a tool for ASP monitoring and benchmarking antimicrobial use in their hospitals.

Figure 2. The Core Elements of Hospital Antibiotic Stewardship Programs and the Priorities for Hospital Core Element Implementation

Hospitals that have implemented the Hospital Core Elements of Antibiotic Stewardship can implement the Priorities for Hospital Core Element Implementation to further enhance their stewardship program.

Hospital Core Elements	Priorities for Hospital Core Element Implementation
Hospital Leadership Commitment	
Dedicate necessary human, financial, and information technology resources.	Antibiotic stewardship physician and/or pharmacist leader(s) have antibiotic stewardship responsibilities in their contract, job description, or performance review.
Accountability	
Appoint a leader or co-leaders, such as a physician and pharmacist, responsible for program management and outcomes.	Antibiotic stewardship program is co-led by a physician and pharmacist.*
Pharmacy/Stewardship Expertise	
Appoint a pharmacist, ideally as the co-leader of the stewardship program, to help lead implementation efforts to improve antibiotic use.	Antibiotic stewardship physician and/or pharmacist leader(s) have completed infectious diseases specialty training, a certificate program, or other training on antibiotic stewardship.
Action	
Implement interventions, such as prospective audit and feedback or preauthorization, to improve antibiotic use.	Antibiotic stewardship program has facility-specific treatment recommendations for common clinical condition(s) and performs prospective audit/feedback or preauthorization.
Tracking	
Monitor antibiotic prescribing, impact of interventions, and other important outcomes, like *C. difficile* infections and resistance patterns.	Hospital submits antibiotic use data to the NHSN Antimicrobial Use Option.
Reporting	
Regularly report information on antibiotic use and resistance to prescribers, pharmacists, nurses, and hospital leadership.	Antibiotic use reports are provided at least annually to target feedback to prescribers. In addition, the antibiotic stewardship program monitors adherence to facility-specific treatment recommendations for at least one common clinical condition.
Education	
Educate prescribers, pharmacists, nurses, and patients about adverse reactions from antibiotics, antibiotic resistance, and optimal prescribing.	No implementation priority identified.

* For critical access hospitals (CAHs), this criterion can be met if the hospital has a physician leader with a pharmacist involved in stewardship (recognizing that some CAHs do not have pharmacists on staff, so co-leadership is not possible).

CS 335529-B

An accessible version of "The Core Elements of Hospital Antibiotic Stewardship Programs and the Priorities for Hospital Core Element Implementation" is available at this webpage.
Abbreviations: Clostridioides difficile (C. difficile), National Healthcare Safety Network (NHSN), critical access hospital (CAH).

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