2021 National Healthcare Safety Network (NHSN) Antimicrobial Use (AU) Option Report

Centers for Disease Control and Prevention

National Center for Emerging and Zoonotic Infectious Diseases

Division of Healthcare Quality Promotion

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NATIONAL HEALTHCARE SAFETY NETWORK
ANTIMICROBIAL USE OPTION

Executive Summary

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

The benefits of monitoring AU for patient care and public health are most likely to be achieved when collection and analysis of data are systematic and standardized. Leveraging electronic medication administration records and automating data submission regarding AU from hospitals reduces burden of reporting burden and facilitates the reuse of AU data. These AU surveillance principles and practices are fundamental to CDC's National Healthcare Safety Network (NHSN) AU Option. Hospitals submit AU data electronically to NHSN, where the data are aggregated, analyzed, and used to produce inpatient AU benchmarks. The Standardized Antimicrobial Administration Ratio (SAAR) is NHSN's risk-adjusted AU metric, available to hospitals reporting to NHSN's AU Option from select patient care locations.

The 2021 NHSN AU Option Report (2021 AU Report) provides a summary of SAAR distributions and of antibiotic use within each SAAR antimicrobial agent category among adult, pediatric, and neonatal patient care locations (specified below). The report includes data from acute care hospitals that reported at least 9 months of data in 2021 from SAAR locations:1,773 hospitals reporting eligible adult SAAR locations, 341 reporting pediatric SAAR locations, and 649 reporting neonatal SAAR locations. The distributions of SAARs can help inform stewardship efforts by enabling hospitals to see how their SAARs compare with the national distribution. For 2021, distributions of SAARs calculated at the state level were added to the 2021 AU Report data tables. Facilities can use the distributions as one of the considerations to set facility-specific targets when using the NHSN Targeted Assessment for Antimicrobial Stewardship (TAS) Strategy. The percentage of AU by class and drug within a SAAR antimicrobial agent category provides insight into prescribing practices across differing patient locations such as medical critical care units (ICUs) compared to medical wards. Facilities may evaluate these usage patterns in context of their local treatment guidelines, antimicrobial resistance rates, and formulary. For more information and resources related to TAS, refer to the TAS guide[5].

The Coronavirus Disease 2019 (COVID-19) Pandemic

Coronavirus Disease 2019 (COVID-19) has presented unprecedented challenges for US hospitals, including for antibiotic stewardship. AU in hospitals fluctuated with COVID-19 incidence. CDC published an analysis exploring COVID-19 hospital incidence on AU from the Premier Healthcare dataset[6] and presented data on unadjusted pooled antibiotic use and resistance at The Presidential Advisory Council on Combating Antibiotic-Resistant Bacteria (PACCARB) meetings. These presentations can be found in the "Past Meetings" section of the PACCARB webpage[7]. These analyses found that inpatient azithromycin and ceftriaxone use increased during the pandemic. Ceftriaxone is included in the broad-spectrum antibiotics predominantly used for community-acquired infections (BSCA) SAAR agent category in adult and pediatric

populations. Readers may notice increases in BSCA SAARs for most adult location types between 2019 and 2020. These increases may appear less dramatic than expected, however, given the sharp rise in ceftriaxone use in 2020. Because SAAR agent categories include many antibiotics, changes in the use of a single agent do not necessarily result in changes to SAAR values. Changes in rates of one antimicrobial may be muted by changes in rates of other antimicrobials within the same SAAR agent category. For example, since 2017, adult inpatient fluoroquinolone use has decreased nationally. Fluoroquinolones are also included in the adult BSCA SAAR. If fluoroquinolone use is decreasing and ceftriaxone use is increasing, overall BSCA SAARs may appear not to change markedly from year to year. To assess changes in a specific antimicrobial over time (e.g., trend analyses), we suggest using unadjusted rates for the individual antimicrobial, rather than SAARs. For more information on how to assess AU data over time, please refer to the SAAR Guide[8].

NSHN does not have facility-level data on COVID-19 incidence and, thus, the analyses presented in the 2021 AU Report are not adjusted for COVID-19 rates. It is also possible that NHSN patient care locations changed function during the COVID-19 pandemic (e.g., surgical wards changing to medical wards). These changes may not be reflected in the 2021 AU Report since facilities may not have remapped their patient care locations within NHSN.

NHSN AU Option Standardized Antimicrobial Administration Ratio (SAAR)

The SAAR is a ratio of observed antimicrobial days to predicted antimicrobial days. Each SAAR predictive model included in this report was developed using negative binomial regression applied to AU data from eligible adult and pediatric locations (2017 data) and eligible neonatal locations (2018 data). SAAR patient care locations and antimicrobial agent categories are listed in Tables 1 and 2, respectively.

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

The SAAR can be used to track AU changes over time at individual healthcare facilities and as a benchmarking metric for comparison of AU in similar patient care locations nationally. While the SAAR is not a measure of appropriateness of AU, it enables ASPs to compare their AU to a national baseline. These types of analyses enable facilities to assess whether they are using antimicrobials at higher rates than predicted (i.e., SAAR values >1), which can prompt facilities to further evaluate prescribing practices and ultimately intervene, if necessary, to optimize AU. More information on the SAAR can be found in the SAAR Guide[8] and AUR Module Protocol[9].

Table 1. Eligible SAAR patient care locations (2017 adult and pediatric baseline, 2018 neonatal baseline)

Adult SAAR Locations	Pediatric SAAR Locations	Neonatal SAAR Locations
- Medical critical care units - Medical-surgical critical care units - Surgical critical care units - Medical wards - Medical-surgical wards - Surgical wards - Step down units - General hematology-oncology wards	- Medical critical care units - Medical-surgical critical care units - Medical wards - Medical-surgical wards - Surgical wards	- Level II special care nurseries - Level II/III critical care units - Level III critical care units - Level IV critical care units

NHSN patient care location definitions can be found in the CDC Locations and Descriptions and Instructions for Mapping Patient Care Locations document[10].

Table 2. SAAR antimicrobial agent categories (2017 adult and pediatric baseline, 2018 neonatal baseline)

Adult SAAR Categories	Pediatric SAAR Categories	Neonatal SAAR Categories
All antibacterial agents	All antibacterial agents	All antibacterial agents
Broad spectrum antibacterial agents predominantly used for hospital-onset infections (BSHO)	Broad spectrum antibacterial agents predominantly used for hospital-onset infections (BSHO)	Vancomycin predominantly used for treatment of late-onset sepsis (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 antibacterial agents predominantly used for hospital-onset infections (BSHO)
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 (3rd gen Cephs)
Narrow spectrum beta-lactam agents (NSBL)	Narrow spectrum beta-lactam agents (NSBL)	Ampicillin predominantly used for treatment of early-onset sepsis (Amp)
Antibacterial agents posing the highest risk for CDI (CDI)	Antibacterial agents posing the highest risk for CDI (CDI)	Aminoglycosides predominantly used for treatment of early-onset and late-onset sepsis (Amino)
Antifungal agents predominantly used for invasive candidiasis (Antifungal)	Antifungal agents predominantly used for invasive candidiasis (Antifungal)	Fluconazole predominantly used for candidiasis (Fluco)
	Azithromycin	

For the list of specific agents included in each SAAR category, refer to Appendix E of the AUR Module protocol[7].

Submissions of data to the NHSN AU Option are voluntary. No federal AU reporting requirements were in effect during the period covered by this report. However, the SAAR is the statistical centerpiece of the NHSN AU measure endorsed by the National Quality Forum in 2015 (NQF #2720) and re-endorsed by NQF in 2019 for surveillance and quality improvement purposes[11]. This endorsement, coupled with NHSN's collaboration with ASPs and other partners, has prompted an increase in voluntary AU reporting to NHSN. As of December 1, 2021, 2,318 facilities had reported at least one month of data to the AU Option. Participation by state among facilities eligible to report ranges from 9% in North Dakota and Wyoming to 71% in Maine (Figure 1).

Figure 1. Percentage of active NHSN acute care facilities* reporting at least one month of data to the AU Option as of December 1, 2021.
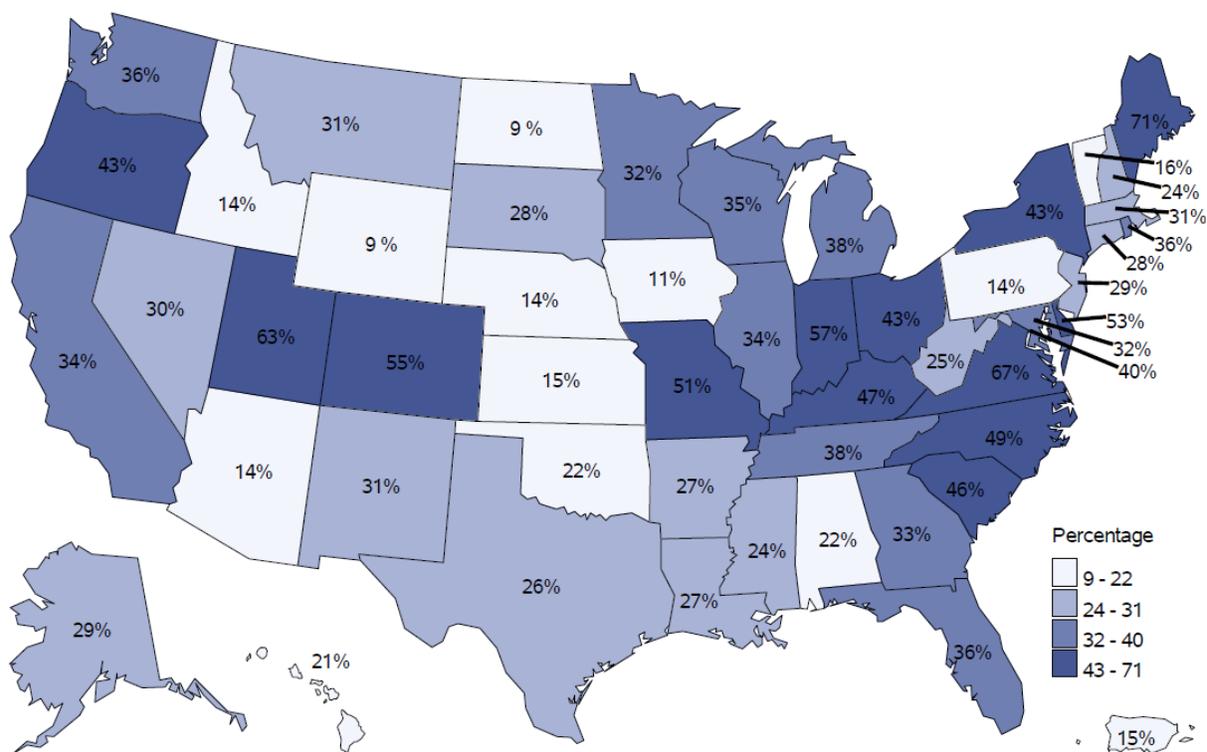
Facility types that have reported at least one month of data to the AU Option as of December 1, 2021, include: critical access, children's, general acute care, long-term acute care, military, oncology, orthopedic, psychiatric, inpatient rehabilitation, surgical, Veterans Affairs, women's, and women's and children's hospitals.

High-level SAAR comparison, 2019 vs. 2020 vs. 2021

When looking at adult pooled mean SAARs for All, BSHO, and BSCA categories (Figure 2a), we see minimal change in SAAR values when comparing the same quarter across years (e.g., comparing Quarter 2 [Q2] in 2019 to Q2 in 2020 and Q2 in 2021) for most SAAR categories and adult location types, but there is quite a bit of within-year variation from quarter to quarter. When comparing the same four-quarter periods across years, we see an increase in BSHO SAARs for adult ICUs from 2019 to 2021. While there is variation by quarter, the year-to-year shift in SAAR values for All and BSCA categories for ICUs is more difficult to visually discern. In adult wards, we see little change in the BSHO and BSCA category SAARs in 2019, but there was a decrease in the All SAAR values across the three years.

Pooled mean SAARs in pediatric units are more variable over time (Figure 2b). In both pediatric wards and ICUs, we see the pooled mean All antibiotic SAAR decrease over the three years. For the BSHO SAAR agent category, for both ICUs and wards, we see a sharp decrease in SAARs in Q4 of 2019 and Q1 of 2020, a large rise in Q2 of 2020, and a decrease across the final six quarters. For the BSCA SAAR agent category, we see large fluctuations in pooled mean SAARs from quarter to quarter for 2019 and early 2020, especially in ICUs. BSCA SAARs increase across 2021 in ICUs and show a less consistent pattern in wards.

We cannot say how much variation in SAARs between years and across quarters is related to COVID-19 versus normal seasonal variation or changes to prescribing practices due to antibiotic stewardship efforts. We anticipate that pooled means and distributions displayed in data tables will help ASPs assess how their facility's AU compares to others.

Figure 2. Select 2019, 2020, and 2021 pooled mean SAARs, by antimicrobial agent category and quarter for **A)** adult ICUs and wards and **B)** pediatric ICUs and wards.
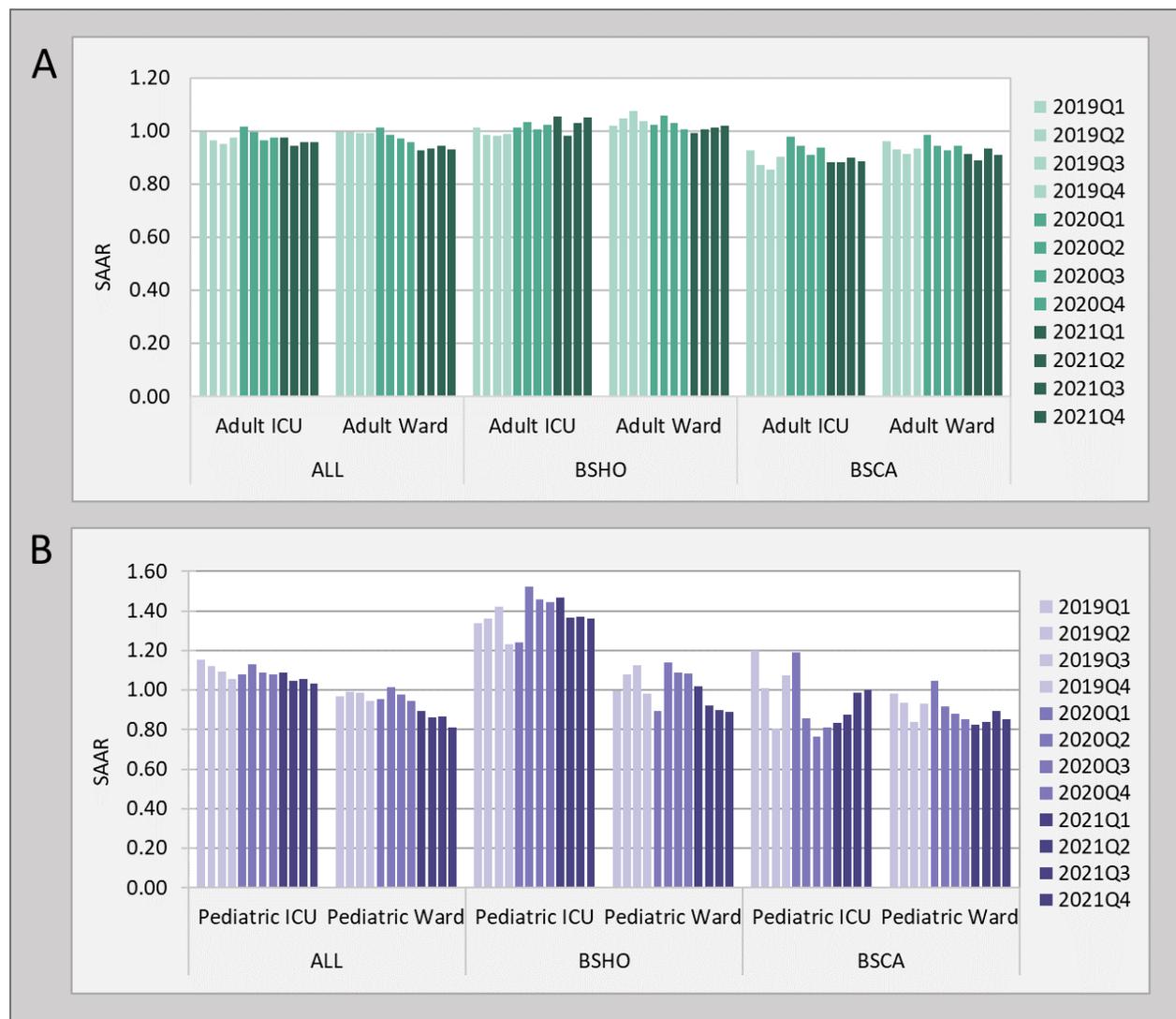
Adult ICUs include medical critical care units, medical-surgical critical care units, and surgical critical care units. Adult wards include medical wards, medical-surgical wards, and surgical wards. Step-down units and adult general hematology-oncology units are not included in pooled means.

Pediatric ICUs (intensive care units) include medical critical care units and medical-surgical critical care units. Pediatric wards include medical wards, medical-surgical wards, and surgical wards.

SAAR agent category abbreviations are defined in Table 2 above.

Additional notes:
- *Only facilities reporting >9 months of data in 2021 were included in analyses.*
- *Predicted use (the SAAR denominator) is based on antimicrobial use rates in 2017 among adult and pediatric SAAR referent populations.*
- *A SAAR <1.0 does not necessarily mean antimicrobial use and prescribing is clinically appropriate and a SAAR >1.0 does not necessarily mean antimicrobial use and prescribing is clinically inappropriate.*

2021 Antimicrobial Use Data

The 2021 AU Report data tables include the following:
- Overview and Table of Contents
- Characteristics of NHSN acute care hospitals reporting for adult, pediatric, and neonatal SAAR locations for ≥9 months in 2021
- SAAR distributions for adult, pediatric, and neonatal SAAR agent category by location type
- Percentage of AU by antimicrobial class and drug for each SAAR agent category by location type
- SAAR distributions for adult, pediatric, and neonatal SAAR agent category by state

Adult SAAR antimicrobial agent categories

Over 1,700 facilities had adult SAAR patient care locations reporting ≥9 months of AU data in 2021. The pooled mean SAAR values differ across location type and SAAR category (Table 3). The SAAR values in this report were derived using pooled observed antimicrobial days from 2021 divided by pooled predicted days calculated using the 2017 baseline SAAR model.

Table 3. Pooled mean SAAR values by adult location type and SAAR antimicrobial agent category.

Adult SAAR Location Type	Adult SAAR Antimicrobial Agent Categories						
	All Antibacterial	BSHO	BSCA	GramPos	NSBL	CDI	Antifungal
Medical ICUs	0.975	1.022	0.902	0.992	0.948	1.231	1.000
Medical-Surgical ICUs	0.944	1.025	0.867	0.867	0.868	1.040	0.986
Surgical ICUs	0.990	1.050	1.000	0.925	0.759	1.248	1.124
Medical Wards	0.910	0.920	0.901	0.822	0.975	0.948	0.799
Medical-Surgical Wards	0.938	1.036	0.897	0.840	0.978	0.958	0.858
Surgical Wards	0.957	1.096	1.010	0.941	0.778	1.068	0.996
Step Down Units	0.919	0.938	0.896	0.845	0.917	0.975	0.846
General Hematology-Oncology Wards	0.938	0.934	0.957	0.842	0.980	1.020	0.781

While most pooled mean SAARs are centered around 1.0, there are small differences by location type and across SAAR antimicrobial agent categories. For example, on average, in 2021, surgical ICUs used only 0.759 NSBL antimicrobial days for each 1.000 antimicrobial day predicted. Highlights of percentage of AU by class and/or drug for each adult SAAR antimicrobial agent category are below:

- Within the **All antibacterial SAAR** category, the top 10 antibacterial agents represented 78.4% - 86.8% of use, depending on the SAAR location. In most SAAR locations, the three most commonly used agents included vancomycin, piperacillin-tazobactam and either ceftriaxone or cefepime. An exception to this is surgical wards, where cefazolin instead of ceftriaxone or cefepime was included in the top three. (AU Report Data Table 2a2)

- Within the **BSHO SAAR** category, piperacillin-tazobactam was the most commonly used agent in ICUs, non-oncology wards, and step down units, followed by cefepime. Anti-pseudomonal carbapenems had higher percentages of use in ICUs compared to wards. The percentage of piperacillin-tazobactam (40.4%) and anti-pseudomonal cephalosporins (44.1%) were similar in hematology-oncology wards. (AU Report Data Table 2b2)

- Within the **BSCA SAAR** category, ceftriaxone had the highest use across all location types, followed by levofloxacin and ciprofloxacin. For general hematology-oncology wards, the percentage of ceftriaxone and flurofloxacin were comparable. In surgical units, ertapenem was used more frequently than it was in other SAAR locations. (AU Report Data Table 2c2)

- Within the **GramPos SAAR** category, vancomycin was the predominant agent used in all SAAR locations followed by linezolid and daptomycin. In ICUs and step down units, linezolid had slightly higher use than other SAAR locations. (AU Report Data Table 2d2)

- Within the **NSBL SAAR** category, cefazolin had the highest use across all SAAR locations with the highest percentage of use in surgical units. Use of β-lactam/β-lactamase inhibitor combination drugs was higher in medical and hematology-oncology units compared to med-surg and surgical units. (AU Report Data Table 2e2)

- Within the **CDI SAAR** category, the 3rd and 4th generation cephalosporins had the highest use across all SAAR locations. Fluoroquinolones, the next most commonly used agents, contributed to higher percentages in wards and general hematology-oncology units compared to ICUs and step down units. Clindamycin accounted for 6.6% for surgical ICUs and 8.2% for surgical wards compared to lower percentages in other locations (range: 2.5%-5.3%). (AU Report Data Table 2f2)

- Within the **Antifungal SAAR** category, echinocandins contributed over half (51.0%-58.6%) of use in ICUs. Fluconazole use was higher than echinocandins in other location types (70.8%-80.9%). (AU Report Data Table 2g2)

Pediatric SAAR antimicrobial agent categories

Fewer facilities (n=341) contributed data for pediatric SAAR locations compared to adult SAAR locations. The pooled mean SAAR values differ across location type and SAAR category (Table 4).

Table 4. Pooled mean SAAR values by pediatric location type and SAAR antimicrobial agent category.

Pediatric SAAR Location Type	Pediatric SAAR Antimicrobial Agent Categories							
	All Antibacterial	BSHO	BSCA	GramPos	NSBL	Azithro-mycin	CDI	Anti-fungal
Medical ICUs	0.945	2.021	0.805	0.704	0.897	0.572	0.822	0.964
Medical-Surgical ICUs	1.040	1.329	0.924	1.015	0.813	0.590	1.124	1.605
Medical Wards	0.856	0.881	0.891	0.698	0.773	0.702	0.897	2.220
Medical-Surgical Wards	0.842	0.900	0.824	0.708	0.922	0.486	0.821	1.871
Surgical Wards	0.999	1.722	1.011	0.799	0.781	1.039	0.865	1.198

There is greater variability in SAARs in pediatric locations compared to adult locations, which may relate to both the smaller pediatric sample sizes and possibly greater variability in pediatric AU overall. In 2021, on average, pediatric BSHO use in medical ICUs and surgical wards was 2.021 and 1.722 times higher, respectively, than predicted by the 2017 national baseline. However, sample sizes for these two location types were quite low, with just 17 medical ICUs and 18 surgical wards contributing data to 2021 SAAR distributions. With small sample sizes, even one location with a high number of days present can greatly impact the overall pooled mean SAAR.

Highlights of percentage of AU by class and/or drug for each pediatric SAAR antimicrobial agent category (if more than one agent is included) are outlined below:

- Within the **All antibacterial SAAR** category, the top ten antibacterial agents represented 63.0%-77.2% of use in pediatric SAAR locations, depending on the location type. In medical wards and medical-surgical ICUs, vancomycin, ceftriaxone, and cefepime were the three most frequently used antibacterial agents. In medical ICUs, ceftriaxone, vancomycin, and cefazolin were included in the top three. In medical-surgical and surgical wards, ceftriaxone, piperacillin-tazobactam, and cefazolin (in varying order) were the top three. (AU Report Data Table 3a2)

- Within the **BSHO SAAR** category, cefepime and piperacillin-tazobactam were the top agents used (in varying order) in all SAAR locations. Antipseudomonal cephalosporins (cefepime and ceftazidime) had the highest percentage of use in medical ICUs, medical-surgical ICUs, and medical wards while piperacillin-tazobactam had higher use in medical-surgical and surgical wards. (AU Report Data Table 3b2)

- Within the **BSCA SAAR** category, ceftriaxone was the predominant agent used across all SAAR locations. Ampicillin-sulbactam and amoxicillin-clavulanate were the next most commonly used agents. (AU Report Data Table 3c2)

- Within the **GramPos SAAR** category, vancomycin and clindamycin combined represented 89.0%-94.1% of use, depending on the SAAR location. Vancomycin had higher use compared to clindamycin in all location types except for surgical wards. (AU Report Data Table 3d2)

- Within the **NSBL SAAR** category, cefazolin, ampicillin, and amoxicillin were the top agents used in all SAAR locations except surgical wards. Cefazolin, cefoxitin, and ampicillin were the top agents used in surgical wards. (AU Report Data Table 3e2)

- Within the **CDI SAAR** category, the 3rd and 4th generation cephalosporins had the highest use for all SAAR locations. Clindamycin, the next most commonly used agent, contributed higher percentages in wards compared to ICUs. Fluoroquinolones accounted for the lowest usage across all SAAR locations. (AU Report Data Table 3g2)

- Within the **Antifungal SAAR** category, fluconazole was the most commonly used agent for all SAAR locations, with highest percentage of use in medical, surgical, and medical-surgical wards. (AU Report Data Table 3h2)

Neonatal SAAR antimicrobial agent categories

There were 649 facilities that reported data from eligible neonatal SAAR locations. The pooled mean SAAR values differ across location type and SAAR category (Table 5).

Table 5. Pooled mean SAAR values by neonatal location type and SAAR antimicrobial agent category.

Neonatal SAAR Location Type	Neonatal SAAR Antimicrobial Agent Categories						
	All Antibacterial	VANC	BSHO	3rd gen CEPHS	AMP	Amino-glycosides	FLUCO[a]
Step Down Neonatal Nursery (Level II)	0.646	1.250	2.616	0.321	0.644	0.605	--
Level II/III Neonatal ICU	0.877	0.767	1.477	0.860	0.841	0.811	0.988
Level III Neonatal ICU	0.972	1.048	1.083	1.073	0.927	0.893	1.234
Level IV Neonatal ICU	1.170	1.003	1.207	1.010	0.872	0.762	1.487

[a]*Neonatal fluconazole SAARs are not available for Level II neonatal step down nurseries.*

Highlights of percentage of AU by class and/or drug for each neonatal SAAR antimicrobial agent category (if more than one agent is included) are outlined below.

- Within the **All antibacterial SAAR** category, the top two antibacterial agents, ampicillin and gentamicin, represented a large portion of antibacterial use in all SAAR locations (78.1% in Level II nurseries, 69.4% in Level II/III NICUs, 56.0% in Level III NICUs, and 45.2% in Level IV NICUs). (AU Report Data Table 4a2)

- Within the **BSHO SAAR** category, similar usage patterns were seen in Level II/III and Level IV locations with cefepime contributing approximately 51%, followed by piperacillin-tazobactam and meropenem. In Level III locations, cefepime had slightly less usage at around 46%, and

meropenem had slightly greater usage at 16%. Level II locations had the highest use of cefepime at 68% and lowest use of meropenem at 6.6%. (AU Report Data Table 4c2)

- Within the **3rd generation cephalosporins SAAR** category, ceftazidime represented the majority of use (approximately 71.6%-89.3% in all SAAR locations) followed by cefotaxime and ceftriaxone, in varying order. (AU Report Data Table 4d2)

- Within the **Aminoglycosides SAAR** category, gentamicin accounted for almost all use in each SAAR location, ranging from 93.0% to 99.7% across the four location types. (AU Report Data Table 4f2)

Conclusion

NHSN serves as a source system for risk-adjusted AU benchmarks and other AU summary statistics that hospital ASPs can use in their efforts to monitor and improve antimicrobial prescribing. The 2019 and 2020 NHSN AU Reports provided national summaries of SAAR distributions and AU within each SAAR antimicrobial agent category by location, and this 2021 AU Report provides an update on those data. It is likely that the COVID-19 pandemic heavily influenced antibiotic use in 2020. This impact was likely less in 2021. However, NHSN does not have facility-level COVID-19 data that would enable adjustment for the impact of COVID-19. The data on AU provide quantitative indicators of differential use of antimicrobial agents across facilities for common clinical scenarios, including treatment of hospital-onset and community-acquired infections. Facilities can compare their AU to national SAAR distributions and state-specific SAAR distributions, which can help inform stewardship efforts, including goal setting for the NHSN TAS Strategy. The AU cumulative attributable difference (AU-CAD), the metric used in TAS reports and dashboards, translates a SAAR target into a numeric antimicrobial day reduction (or addition) goal, providing a concrete goal to drive action.

Many facilities integrated monitoring and benchmarking from the NHSN AU Option into the 7 Core Elements of Hospital Antibiotic Stewardship Programs to optimize antibiotic use at their facility and/or healthcare system[1]. In addition, CDC recently released the Priorities for Hospital Core Element Implementation to highlight a subset of implementation approaches that are highly effective and/or were prioritized by stewardship experts (Figure 3). The goal of the Priorities is to enhance the quality and impact of antibiotic stewardship programs.

Discussions with AU Option users suggest the following best practices for using AU data for action:
1) Submit monthly hospital AU data to the NHSN AU Option to guide tracking and reporting for ASPs.
2) Review NHSN AU data at least quarterly and track SAAR/AU data over time to both inform and assess stewardship interventions. Use SAAR distributions by location and percentage of antimicrobials by class and/or drug for additional context of prescribing practices at your facility.
3) Report SAAR/AU data on a regular basis to senior leadership, hospital board, hospital committees (e.g., antibiotic stewardship, infection control, Pharmacy & Therapeutics) and providers.
4) Establish facility-specific SAAR target goals for quality improvement using AU-CAD in the TAS reports and dashboards.
5) Create and/or participate in the NHSN AU Option Group Function as part of a healthcare system, health department and/or collaborative.

Figure 3. The Core Elements of Hospital Antibiotic Stewardship Programs and the Priorities for Hospital Core Element Implementation

Table. 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).

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Accessible version of "The Core Elements of Hospital Antibiotic Stewardship Programs and the Priorities for Hospital Core Element Implementation" available here: https://www.cdc.gov/antibiotic-use/core-elements/hospital/priorities.html

Acknowledgements

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