LACDPH Antibiotic Stewardship Program

Basics about the National Healthcare Safety Network (NHSN) Standardized Antimicrobial Administration Ratio (SAAR)

What is the standardized antimicrobial administration ratio (SAAR)?

The SAAR is a risk adjusted measure of antibiotic use. The SAAR provides a national benchmark for a facility's reported antibiotic use (AU) in a defined time-period (i.e., month, quarter or year).

Why is the SAAR valuable?

Tracking AU patterns within a facility provides an internal facility benchmark. When AU tracking is compared to an external benchmark, antimicrobial stewardship programs have an additional opportunity to identify areas of improvement that can inform antibiotic stewardship actions.

How is the SAAR calculated?

NHSN calculates the SAAR by dividing the number of observed antimicrobial days, also called antimicrobial days of therapy (DOT), reported to NHSN by the number of predicted antimicrobial days of therapy calculated by NHSN.

SAAR = Observed antimicrobial DOTs/Predicted antimicrobial DOTs, where:

- **A SAAR value < 1 indicates observed AU was less than predicted AU**
- **A SAAR value = 1 indicates observed AU was equivalent to predicted AU**
- **A SAAR value >1 indicates observed AU was greater than predicted AU**

What is the predicted AU (Predicted antimicrobial DOTs)?

The predicted AU is a calculated DOT estimate (during a defined period of time) based on specific hospital features and length of stay data reported by a facility to NHSN.

Through negative binomial regression analysis, a model was created for each SAAR antibiotic category (see SAAR antimicrobial categories below). Factors known to significantly affect the predicted AU result include facility type (i.e., critical access, VA, military, etc.), facility teaching status, hospital location type (i.e., ICU, wards, oncology, etc.), hospital beds, ICU beds, and average hospital stay. These factors serve as a proxy for severity of illness and case-mix which is currently not reported by facilities to NHSN.

NHSN develops new models or revised models for adult, pediatric and neonatal populations every few years. The current adult SAAR AU models were generated in 2017 from 449 acute-care hospitals spanning 49 states/districts/territories. Pediatric SAAR AU models were developed in 2017 using data from 106 acute-care hospitals across 29 states. The models will be updated using 2023 national reporting data.

What is a SAAR antimicrobial category?

The SAAR antimicrobial categories are groupings of antibiotics (or antifungals) that share common clinical uses. The antimicrobial categories were chosen to inform actionable stewardship interventions. Antimicrobial categories are periodically revised based on changing clinical relevance of newer or older antimicrobial agents. There are seven adult SAAR antimicrobial categories, eight pediatric SAAR antimicrobial categories and seven neonatal antimicrobial categories:

Table1: Adult SAAR Antimicrobial Categories

All Antibiotics (Excludes below)	BSHO	BSCA	NSBL	Anti-MRSA	High CDI Risk	Antifungal
Amikacin lipo Cefideracol Colistin Delafloxacin Eravacycline Imipenem/rele Lefamulin Meropenem/vabo Omadacycline Piperacillin Plazomicin Sulbactam/durl Ticarcillin/clav	Amikacin Aztreonam Cefepime Ceftazidime Doripenem Gentamicin Imipenem Meropenem Piperacillin/tazo tobramycin	Cefaclor Cefdinir Cifixime Cefotaxime Cefpodoxime Cefprozil Ceftriaxone Cefuroxime Ciprofloxacin Ertapenem Gemifloxacin Levofloxacin moxifloxacin	Amoxicillin Amoxicillin/clav Ampicillin Ampicillin/sulb Cefadroxil Cefazolin Cefotetan Cefoxitin Cephalexin Dicloxacillin Nafcillin Oxacillin Penicillin G Penicillin V	Ceftaroline Dalbavancin Daptomycin Linezolid Oritavancin Quinupristin/dalf Tedizolid Telavancin Vancomycin	Cefdinir Cefepime Cefotaxime Cefpodoxime Ceftazidime Ceftriaxone Ciprofloxacin Clindamycin Gemifloxacin Levofloxacin Moxifloxacin	Anidulafungin Caspofungin Fluconazole Micafungin

BSHO: Broad spectrum antibacterial agents predominantly used for hospital-onset infections; **BSCA**: Broad spectrum antibacterial agents predominantly used for community-acquired infections; **NSBL**: Narrow spectrum beta-lactam agents; **GramPos**: Antibacterial agents predominantly used for resistant Gram-positive infections (e.g., MRSA); **CDI**: Antibacterial agents posing the highest risk for *C.difficile* infection; **Antifungal**: Antifungal agents predominantly used for invasive candidiasis

Table 2: Pediatric SAAR Antimicrobial Categories

All Antibiotics (Excludes below)	BSHO	BSCA	NSBL	Anti-MRSA	High CDI Risk	Antifungal	Azithromycin
Amikacin lipo Cefideracol Colistin Delafloxacin Eravacycline Imipenem/rele Lefamulin Meropenem/vabo Omadacycline Piperacillin Sulbactam/durl Ticarcillin/clav	Amikacin Aztreonam Cefepime Ceftazidime Doripenem Ertapenem Gemifloxacin Imipenem Levofloxacin Meropenem Piperacillin/tazo tobramycin	Amoxicillin/clav Ampicillin/sulb Cefaclor Cefdinir Cefixime Cefotaxime Cefpodoxime Cefprozil Ceftriaxone Cefuroxime	Amoxicillin Ampicillin Cefadroxil Cefazolin Cefotetan Cefoxitin Cephalexin Dicloxacillin Nafcillin Oxacillin Penicillin G Penicillin V	Ceftaroline Clindamycin Dalbavancin Daptomycin Linezolid Oritavancin Quinupristin/dalf Tedizolid Vancomycin IV	Cefdinir Cefepime Cefixime Cefotaxime Cefpodoxime Ceftazidime Ceftriaxone Ciprofloxacin Clindamycin Gemifloxacin Levofloxacin Moxifloxacin	Anidulafungin Caspofungin Fluconazole Micafungin	Azithromycin

BSHO: Broad spectrum antibacterial agents predominantly used for hospital-onset infections; **BSCA**: Broad spectrum antibacterial agents predominantly used for community-acquired infections; **NSBL**: Narrow spectrum beta-lactam agents; **GramPos**: Antibacterial agents predominantly used for resistant Gram-positive infections (e.g., MRSA); **CDI**: Antibacterial agents posing the highest risk for *C.difficile* infection; **Antifungal**: Antifungal agents predominantly used for invasive candidiasis

Table 3: Neonatal SAAR Antimicrobial Categories

All Antibiotics (Excludes below)	BSHO	Third Generation Cephalosporins	Ampicillin for early-onset sepsis	Vancomycin for late-onset sepsis	Aminoglycosides for early-onset and late-onset sepsis	Fluconazole predominantly used for candidiasis
Amikacin lipo Cefideracol Choramphenicol Colistin Dapbavancin Delafloxacin Doripenem Doxycycline Eravacycline Erythromycin/sulfisoxa Gemifloxacin Imipenem/rele Meropenem/vabo Minocylcline Omadacycline Oridavancin Piperacillin Plazomicin Sulbactam/durlo Tetracyline Tigecycline	Cefepime Ertapenem Imipenem Meropenem Piperacillin/tazo	Cefotaxime Ceftazidime Ceftriaxone	Ampicillin IV	Vancomycin IV	Amikacin IV Gentamicin IV Tobramycin IV	Fluconazole IV

BSHO: Broad spectrum antibacterial agents predominantly used for hospital-onset infections

What is a SAAR location?

SAAR locations represent areas of high antimicrobial category use that are important to hospital antimicrobial stewardship programs. The SAAR locations help pinpoint where antibiotic use is high within a facility.

SAAR inpatient locations include:

- **Adult**: medical and/or surgical ICU, medical and/or surgical wards, step-down units and oncology
- **Pediatric**: medical and/or surgical ICU and medical and/or surgical wards
- **Neonate**: step-down nursery and critical care

SAAR outpatient locations include:

- Emergency department
- 24-hour observation
- Pediatric emergency department

What is a SAAR Type

A SAAR type is an antimicrobial category – hospital location combination reported for a time-period (month, quarter or year). SAARs are calculated for each antimicrobial category in each hospital location.

SAARs are not generated in the following circumstances:

- If there are no patient days or antibiotic use reported for a hospital location during the selected time-period.
- If the predicted AU is 1.0 or less as the risk of statistical error is greater. This would typically occur in small hospitals and can be addressed by aggregating data over a longer time-period.

What does the SAAR tell you about your facility?

The SAAR provides a national benchmark for the QUANTITY of antibiotics used within a facility. SAAR values can be tracked over time to assess progress toward meeting specific antibiotic stewardship goals or identify other areas of high AU previously not known.

What does the SAAR NOT tell you about your facility's antibiotic use?

The SAAR does not provide information about the appropriateness of antibiotic use within a facility. Antibiotic use indications, case-mix index, infectious disease burden, or seasonality are not reported by facilities to NHSN. These data were determined to be too onerous for hospitals to report and require very large sample sizes to create the predictive AU models.

How can the SAAR be used in my facility by the antimicrobial stewardship program?

Actions: Identify specific targeted areas of the hospital where antimicrobial category use or use of individual antimicrobials of interest is high to direct new or additional AS efforts through prospective audit and feedback, preauthorization, medication use evaluation, treatment guideline adherence, etc.

Tracking: Track SAARs over time by month, quarter or year to identify increases in AU or assess outcomes from interventions. NHSN can provide statistical analysis between time points.

Reporting and physician feedback: Include SAARs in routine antibiotic stewardship benchmark reports presented to hospital committees. Provide feedback to physicians who prescribe antibiotics in specific facility locations.

Education: Use SAARs to target prescriber education.

Resources:

- CDC Antimicrobial Use (AU) and Antimicrobial Resistance (AR) Comprehensive Resources
- Leveraging National Health Safety Network (NHSN) AU Data to Inform, Implement and Assess Antibiotic Stewardship Activities
- Strategies to assess antibiotic use to drive improvements
- DASON Clinical Stewardship scenarios
- NHSN AU and AR module
- NHSN AU and AR training videos
- NHSN AU Case Examples
- NHSN Guide to the SAAR
- NHSN Targeted Assessment for Antimicrobial Stewardship (TAS) Guide
- NHSN FAQs: Antimicrobial use option