



Methods for R-SAARs Hospital-specific Report, Part 1

Overall Aim: Evaluate your hospital's aggregated antimicrobial use (AU) data using existing standard methods for external comparisons of 1) unadjusted or "raw" AU rates and 2) existing risk-adjustment models used by National Healthcare Safety Network (NHSN) called the Standardized Antimicrobial Administration Ratio (SAAR). The SAAR models use facility-level risk-adjustment variables obtained from the NHSN annual facility survey and were built on unit-aggregated AU data reported to NHSN from 2017 (Reference: <https://doi.org/10.1093/cid/ciaa326>).

Inclusion/Exclusion Criteria

Setting: Acute care hospital study sites with complete data

Time: Calendar year 2022, based on date/time in bed flow information (ie. presence in an inpatient unit during the calendar days January 1, 2022 through December 31, 2022). For admissions that crossed over the dates, only information for calendar days in 2022 were included in estimates.

Encounters and locations: Inpatient encounters with at least 1-day present in an inpatient location. Patients cared for in non-inpatient areas such as the emergency department, procedural areas, or observation wards were excluded.

Age: Neonates less than 1 year at the time of hospital admission were excluded

Agents: Antimicrobial agents included were limited to those identified and collected in the NHSN AU Option (Reference: <https://www.cdc.gov/nhsn/PDFs/pscManual/11pscAURcurrent.pdf> Appendix B).

Routes: Routes were limited to those identified in the NHSN AU module given by digestive, intravenous, inhaled, or intramuscular.

Definitions

Antimicrobial use rates: Days of therapy per 1,000 days present using the same definitions as NHSN AU Option reporting. Days of therapy (DOT) is defined as the number of calendar days of antibacterial agent exposure.

- A DOT is counted for any amount of antimicrobial given on that calendar day. For example, administration of cefazolin as a single dose or as 3 doses given 8 hours apart but within the same 24-hour period both represent 1 DOT.
- Single agents are counted separately and then summed. For example, administration of vancomycin plus ceftazidime on the same calendar day would represent 2 DOT for the same calendar day.
- Days present is defined as the count of calendar days when a patient is present on an inpatient unit for any portion of a calendar day. The administrative status is irrelevant (e.g. "outpatient" housed on an inpatient ward still counts as a day present and is eligible to receive antimicrobials).



Age groups: Adult was defined as age greater than or equal to 18 years. Pediatric was defined age 1 up to 18 years.

Antimicrobial agents and Agent groups were defined using NHSN AU Option SAAR Categories (Table 1). Included route categories for each antimicrobial age outcome group were assumed to be the 4 listed in inclusion criteria, EXCEPT for those specified in the SAAR outcome groups as “IV only,” which means “intravenous” route only and EXCLUDES digestive, inhaled, and intramuscular administrations.

Table 1. Age and Antimicrobial Agent Groups	
Age Group	Agent Groups
Adult	Adult + All antibacterials Adult + Anti-fungal Adult + <i>C. difficile</i> agents Adult + Community-onset Adult + Hospital-onset Adult + Narrow spectrum beta lactam Adult + Resistant Gram-positive
Pediatric	Pediatric + All antibacterials Pediatric + Anti-fungal Pediatric + Azithromycin Pediatric + <i>C. difficile</i> agents Pediatric + Broad Community-onset Pediatric + Narrow Community-onset Pediatric + Hospital-onset Pediatric + Resistant Gram-positive
Agent lists for the above groups are in Appendix E of the NHSN AU Option: https://www.cdc.gov/nhsn/PDFs/pscManual/11pscAURcurrent.pdf	

Unit Type: Defined by study hospitals’ unit mapping in NHSN. Unit type is categorized by each hospital’s local infection prevention team using NHSN guidance. Data from unmapped units were excluded.

Facility-wide: Inpatient units will be defined as those unit-types included in the NHSN definition of FACWIDEIN with the following exceptions of unit types that were excluded: maternal (e.g. Labor and Delivery), Neonatal (e.g. Well Baby Nursery), Behavioral Health.

Observed to Expected (O:E) Ratio: Expected DOT values were calculated using 2017 model parameters provided by the NHSN (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7879497/bin/NIHMS1666875-supplement-Supplement.docx>), answers to the 2022 NHSN annual survey, and days present during 2022. The O:E is the ratio of observed DOT (described above) to the calculated, expected DOT values, which replicates 2017 SAAR calculations using 1-year of 2022 data for that hospital unit.

Statistical Methods for Results in Part 1 Report

Section 1: Aims to provide descriptive information on study hospitals and your hospital to inform comparisons.

Table 1 provides information about the study hospitals and specific characteristics of your hospital using descriptive statistics. These data were extracted from hospitals’ responses to the NHSN Annual Survey and



information on NHSN unit types. This table was modeled after public information available from NHSN (<https://www.cdc.gov/nhsn/datastat/aur-reports.html>).

Section 2: Aims to provide unadjusted comparisons of AU rates among All Study Hospitals as compared with your hospital.

Figure 1 includes histogram plots with a density overlay. The green line shows the density or shape of the distribution of facility-wide AU rates for all hospitals. The X axis indicates the AU rate in DOT/1,000 days present. The Y axis and bars indicate the number of study hospitals with that rate. Indicators for 10th, 25th, 50th, 75th, and 90th percentiles of the distribution are provided as well as a large yellow bar showing your hospital's rate. Text includes the values of the AU rate and percentile for your hospital, as well as the range of AU rates observed among all study hospitals. Data are presented for Adult Antimicrobial Groups (Table 1) on the facility-wide level.

Table 2 includes information on the most frequently used individual agents at your hospital, with a comparison to AU rates for that agent among all study hospitals including a percentile among 50 study hospitals.

Section 3: Aims to provide comparisons to NHSN 2017 SAAR risk-adjustment models' calculated expected AU for eligible units and their O:E ratios (2017 SAARs).

Figure 2A includes data and comparisons for Adult hospital units that were eligible for 2017 SAAR model estimates, had at least 20 days present in 2022, and reported a minimum of 6 months of data. Note, that the 2017 SAAR models only included certain unit types for Adults (Medical Ward, Surgical Ward, Medical/Surgical Ward, Medical Critical Care, Surgical Critical Care, Medical/Surgical Critical Care, Hematology-Oncology Ward, Adult Step Down). Your hospital may have other units that are not eligible for application of 2017 SAAR methods.

Plots of each hospital unit and unit type include both the observed AU rates (as DOT/1,000 days present) and expected AU rates produced from 2017 SAAR model parameters. Units are sorted by unit-type. The light blue dot indicates the expected AU value calculated from the NHSN SAAR 2017 models for that unit, and the dark blue dot indicates the observed AU value for that unit. On the right sidebar, the O:E ratio for that particular unit is provided as well as the percentile of O:E ratios among units of that same type in the study. Plots are provided by antimicrobial group.

Percentiles for a specific unit represents the percentile score for that unit's O:E Ratio (or 2017 SAAR) among the same units of that type in all study hospitals. Percentiles were only calculated among unit types with at least 10 units of that type among study hospitals. In parentheses next to the unit type description is the number of those types of units in study hospitals.

Figure 2B includes the same information but for Pediatric units eligible for 2017 SAAR model estimates. If your hospital does not have a pediatric unit, then this section was left blank.

Appendix: Aims to provide values for comparisons provided in Part 1 Report.

This CSV file includes Your Hospital's calculated AU rates on the unit-level, and values for the comparisons presented in plots. Individual cells are left blank if they were not calculated based on the criteria listed above.