ORASN NHSN AU Option Report

LAST UPDATE: March 3, 2026

Table of Contents

Overview

Confidentiality Statement:

This report contains de-identified, facility-level National Healthcare Safety Network (NHSN) Antimicrobial Use (AU) data for Oregon hospitals and is intended to provide a state-level snapshot of antimicrobial use patterns among Oregon hospitals. Per the Data Use Agreement between Oregon Antimicrobial Stewardship Network (ORASN) and participating facilities, ORASN cannot publish identifiable facility-level data.

Purpose: The purpose of this report is to support antimicrobial stewardship (AS) programs by summarizing National Healthcare Safety Network (NHSN) AU Option data and providing comparisons across facilities participating in the ORASN NHSN data-sharing group. These data are intended to help identify potential areas for targeted review and stewardship intervention. These results are not intended for regulatory, performance evaluation, or public reporting.

Data included: This report summarizes NHSN AU Option data submitted by Oregon acute care hospitals (ACHs) and critical access hospitals (CAHs) that participate in the ORASN NHSN data-sharing group. The report includes data from 2021 through 2024**.**

Analyses focus on adult inpatient ward and ICU locations and include the following NHSN Standardized Antimicrobial Administration Ratio (SAAR) type categories:

- All antibacterial agents
- Broad-spectrum agents for hospital-onset infections (BSHO)
- Agents posing the highest risk for *Clostridioides difficile* infection (CDI-risk agents)
- Agents used to treat resistant Gram-positive infections (Gram-positive agents)
- Narrow-spectrum beta-lactam agents (NSBL)

For facilities that have NHSN-mapped pediatric locations, SAARs for all antibacterial agents in those locations are also included.

Executive Summary

ORASN is a statewide, voluntary collaborative of healthcare professionals, public health leaders, and academic researchers working to improve the safety and quality of AU. Established in 2018 in partnership with the Oregon Health Authority (OHA), ORASN fosters peer learning, quality improvement (QI), and cross-institution benchmarking across 37 diverse hospitals, including both ACHs and CAHs.

This report summarizes statewide AU patterns from 2021 through 2024 using AU data submitted to the NHSN Antimicrobial Use and Resistance (AUR) Module by hospitals participating in the ORASN NHSN data-sharing group. Analyses use the 2017 NHSN baseline models to compare observed versus predicted antimicrobial use for all SAAR calculations.

For detailed descriptions of the parameters assessed in the NHSN adult and pediatric 2017 baseline SAAR risk models (by antimicrobial agent category), see pages 30–40 of the *NHSN Standardized Antimicrobial Administration Ratio (SAAR) Guide* [1]. A complete list of antibacterial agents included in each SAAR agent category is provided in Table A.1 of Appendix A.

Key Statewide Findings from 2021-2024:

1. **Facility-Level Variation in Antimicrobial Use**
   Across adult ward locations, caterpillar plot analyses showed moderate variation in AU across all evaluated categories, including all antibacterials, BSHO, CDI-risk agents, Gram-positive agents, and NSBL. For most categories, facility-level SAAR values among ACHs were not significantly higher than predicted based on national risk-adjusted benchmarks. While most facilities exhibited AU at or below expected levels, some NHSN-mapped locations showed higher-than-predicted use, indicating potential opportunities for local AS review. It is important to note that SAAR metrics compare observed to predicted AU and are not a direct measure of prescribing appropriateness; therefore, values above 1 are best interpreted as signals for further investigation by local AS programs rather than indictors of inappropriate prescribing.
2. **Upward Trend in Antimicrobial Use (2021–2024)**
   We observed a gradual increase in overall AU between 2021 and 2024. This pattern may reflect clinical practice changes following the COVID-19 public health emergency, variation in patient acuity, changes in case mix, or recovery in healthcare utilization during this period. Additional assessment may help determine the extent to which these factors contributed to the observed increases.
3. **Seasonal Patterns and Between-Facility Differences in Quarterly Trends**
   Quarterly AU trends from 2021 through 2024 displayed expected seasonal

fluctuations; however, consistent differences across facilities persist throughout the time series. These findings highlight sustained variation in prescribing practices and underscore the value of facility-specific feedback to support stewardship optimization.

4. **Regional Variation in Antimicrobial Use**
   Facilities in southern Oregon demonstrated higher overall AU in unadjusted analyses compared with those in other regions in the state. Because these comparisons are not risk adjusted, observed differences may reflect variation in facility type, patient populations, case mix, or acuity rather than prescribing practices alone. Differences in denominator size, reporting completeness, or other data factors may also contribute to the variation. Future analyses using risk-adjusted metrics will be needed to help determine whether these patterns reflect true regional differences in antimicrobial use.
5. **Antimicrobial Classes Driving Overall Use**
   Annual AU stratified by antimicrobial class indicates that cephalosporins remain a major contributor to inpatient prescribing across facilities. This pattern is consistent with national trends, where beta-lactam/beta-lactamase inhibitor combinations and third- and fourth-generation cephalosporins account for a substantial proportion of inpatient AU [2]. While elevated SAAR values typically warrant review, higher-than-predicted use of NSBL agents may reflect more targeted empiric or step-down therapy. When clinically appropriate, increased reliance on these agents can support stewardship goals by promoting spectrum narrowing and reducing unnecessary exposure to broad-spectrum antibiotics.
6. **Statistically Significant SAAR Findings**
   Across reporting facilities, the SAAR category representing antibacterial agents posing the highest risk for CDI accounted for the greatest number of elevated SAAR values, indicating higher use relative to predicted levels. Because this category includes fluoroquinolones, clindamycin, and other high-risk agents, these findings highlight an important opportunity for stewardship teams to review local prescribing patterns and implement targeted interventions where warranted. Potential approaches include focused audit and feedback, refinement of treatment guidance, or reassessment of empiric therapy pathways in units with persistently elevated values. In future analyses, integrating NHSN laboratory-identified (LabID) *Clostridioides difficile* infection data could help determine whether elevated CDI incidence corresponds with higher use of CDI-risk agents and further inform prioritization of stewardship efforts.

Recognition and Collaboration

ORASN works closely with the Oregon Health Authority (OHA) to advance AS statewide, including supporting initiatives such as the Antimicrobial Stewardship Honor Roll which recognizes hospitals that demonstrate sustained leadership in stewardship. ORASN also

partners with the Oregon Office of Rural Health (ORH) to strengthen stewardship engagement and capacity among critical access and rural hospitals across Oregon.

Implications

Theses analyses underscore the importance of reliable NHSN reporting for stewardship planning. At the statewide level, the findings help identify areas for targeted review and intervention to support appropriate AU and reduce risks associated with antimicrobial resistance across diverse hospital settings.

List of Figures

Table of Acronyms/Abbreviations

- **ACH** – Acute Care Hospital(s)
- **AU** – Antimicrobial Use
- **AS** – Antimicrobial Stewardship
- **AUR** – Antimicrobial Use and Resistance Module
- **BSHO** – Broad-spectrum antibacterial agents predominantly used for hospital-onset infections
- **CAH** – Critical Access Hospital(s)
- **CDC** – Centers for Disease Control and Prevention
- **CDI–Risk Agents** – Antibacterial agents posing the highest risk for *C. difficile* infection
- **CI** – Confidence Interval
- **DOT** – Days of Therapy
- **DP** – Days Present
- **DUA** – Data Use Agreement
- **Gram-Positive Agents**– Antibacterial agents predominantly used for resistant Gram-positive infections
- **HAI** – Healthcare-Associated Infection
- **ICU** – Intensive Care Unit
- **IDSA** – Infectious Diseases Society of America
- **MRSA** – Methicillin-Resistant *Staphylococcus aureus*
- **NHSN** – National Healthcare Safety Network
- **NSBL** – Narrow-Spectrum Beta-Lactam Agents
- **OHA** – Oregon Health Authority
- **ORASN** – Oregon Antimicrobial Stewardship Network
- **QGIS** – Quantum Geographic Information System
- **QI** – Quality Improvement
- **SAAR** – Standardized Antimicrobial Administration Ratio

Background and Overview

The Oregon Antimicrobial Stewardship Network (ORASN) is a voluntary, nonprofit collaborative of healthcare professionals, public health partners, and academic researchers working to improve the safety and quality of antimicrobial use (AU) and infectious disease management across Oregon. Established in 2018, ORASN supports stewardship practice through education, collaborative learning, QI initiatives, and research. The network currently includes 37 hospitals statewide, representing more than half of Oregon's hospitals.

Mission and Vision

ORASN's mission is to support antimicrobial stewardship implementation across Oregon by fostering interdisciplinary collaboration, peer learning, and QI. Its vision is to promote consistent adoption of evidence-based stewardship practices statewide to improve patient outcomes and antimicrobial use.

ORASN Membership and Participation

ORASN Membership Overview

ORASN includes 37 hospitals across Oregon, representing rural and urban settings, community and tertiary care facilities, and both teaching and non-teaching institutions. All member hospitals participate in ORASN's collaborative learning activities; however, participation in the NHSN AU data-sharing group varies.

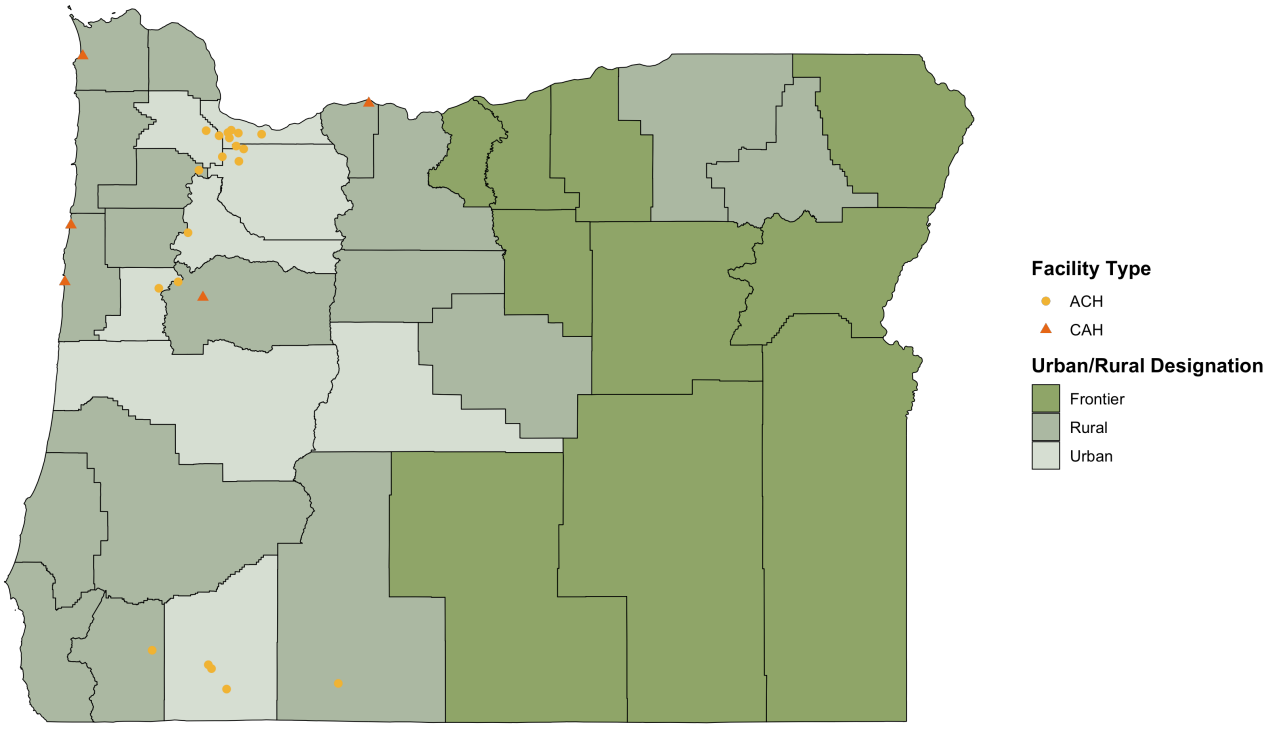
Twenty-seven facilities contribute AU data to this report through the NHSN AU Option, including five critical access hospitals (CAHs) and 22 acute care hospitals (ACHs). Hospitals that join the NHSN data-sharing group authorize ORASN to access their submitted data for statewide analysis and stewardship support. Other member hospitals participate in ORASN activities but do not contribute AU data to this report. Appendix A.2 provides a summary of characteristics for facilities participating in the data-sharing group.

Participation Status

- **Current Data Sharing Sites:** Hospitals that have executed a Data Use Agreement (DUA) allowing ORASN to securely access their NHSN-submitted AU data. These hospitals have contributed data to the current report (n=27; 22 ACHs and 5 CAHs).

- **Non-Data Sharing Member Sites** Hospitals that participate in ORASN activities but have not executed a DUA. These facilities may submit AU data to NHSN independently, but their data are not included in this report (n = 10).

Figure 1. Geographic distribution of ORASN facilities contributing AU data to this report, Oregon, April 2025.



This map displays facilities participating in ORASN's NHSN data-sharing group. Facilities are differentiated by hospital type (22 acute care hospitals [ACHs] and 5 critical access hospitals [CAHs]). County boundaries are shown and shaded by urban, rural, or frontier designation as defined by the Oregon Office of Rural Health [3]. The map illustrates the geographic distribution of participating facilities across the state and the representation of both hospital types within Oregon's healthcare system. Mapping methods are described in Appendix B.1.

Activities and Strategic Contributions

ORASN hosts quarterly web-based meetings that provide a forum for peer learning and exchange of AS strategies. Member hospitals are invited to participate in QI initiatives and collaborative research projects. In partnership with the Oregon Office of Rural Health (ORH), ORASN also supports stewardship engagement among CAHs and rural hospitals statewide.

Oregon AMS Honor Roll

The Oregon Health Authority (OHA) Healthcare-Associated Infections (HAI) Program established the Antimicrobial Stewardship (AMS) Honor Roll to recognize hospitals across the state that demonstrate a strong commitment to AS. The Honor Roll highlights hospitals that meet the CDC's Core Elements of Hospital Antibiotic Stewardship Programs and are actively advancing stewardship practices within their institutions.

The Honor Roll criteria were developed jointly by ORASN and OHA to reflect national CDC Core Elements while incorporating Oregon-specific priorities and input from local stewardship leaders. This collaborative process ensured that recognition standards were both meaningful and feasible across diverse hospital types, including CAHs.

Hospitals achieving Gold status have demonstrated sustained leadership in stewardship implementation and QI activities. A complete list of Oregon AMS Honor Roll facilities is provided in Appendix A.3. To learn more about the honor roll or to apply please visit https://www.oregon.gov/oha/PH/DISEASESCONDITIONS/COMMUNICABLEDISEASE/ANTIBIOTICRESISTANCE/Pages/Oregon-Antimicrobial-Stewardship-Honor-Roll.aspx.

NHSN Data Overview and Data Quality Trends

NHSN Overview

ORASN analyzes data submitted to the AUR Module within the Patient Safety Component of the NHSN. NHSN, operated by the Centers for Disease Control and Prevention (CDC), is the nation's most widely used healthcare-associated infection (HAI) surveillance system and provides standardized methods for monitoring and comparing patient safety data across U.S. healthcare facilities [4].

Hospital submit aggregate, unit-level AU data to NHSN monthly, including:

- Days of Therapy (DOT): the number of days a patient receives a specific antimicrobial agent
- Days Present (DP): the number of days patients are present in a specific given unit
- Patient care location, drug name, route of administration and dose

Using these inputs, NHSN produces standardized AU outputs, including the SAAR.

Hospitals that participate in ORASN's NHSN data-sharing group authorize access through DUAs, enabling ORASN to analyze participating facilities' NHSN-submitted AUR data for statewide reporting and stewardship support.

Historically, participation in NHSN antimicrobial use (AU) reporting was voluntary, which has influenced both data completeness and the ability to compare trends consistently across facilities over time. Beginning in 2024, eligible hospitals and CAHs were required to submit AU data to the NHSN AUR Module as part of the CMS Promoting Interoperability Program. This policy is intended to strengthen AS efforts by leveraging Certified Electronic Health Record Technology (CEHRT) to support systematic monitoring of AU and resistance patterns.

Despite this shift toward broader participation, variation in reporting start dates, data completeness, and local data validation practices may continue to affect trend stability and cross-facility comparability. Accordingly, the completeness and consistency of NHSN AU submissions should be considered when interpreting statewide AU patterns, as SAAR estimates and AU trends rely on sustained monthly, unit-level reporting.

Missingness and Data Quality Trends:

Reporting completeness was assessed using the NHSN Linelist: All Submitted AU Data report, which compiles all AU submissions from participating facilities. These data were reviewed to identify periods of consistent reporting, intermittent submissions, or cessation of reporting.

From 2021 through 2024, NHSN AU data submissions among ORASN active data contributors showed substantial variability in AU reporting patterns. Some facilities maintained uninterrupted reporting across all years, while others experienced gaps associated with internal capacity constraints, mapping challenges, or workflow disruptions—particularly during and following the COVID-19 public health emergency.

Because reporting completeness declined in late 2024, fourth-quarter data were excluded from quarterly AU analyses. This approach allowed quarterly analyses to focus on stable reporting periods. Annual SAAR values, however, were reported as generated by NHSN, which incorporates all submitted data within the reporting year.

Key patterns included:

- Facilities with substantial gaps in reporting: Facility D (intermittent submissions from May 2020 through 2023); and Facilities E, U, X, and M (intermittent submissions from October 2022 through 2023).
- Facilities with consistent reporting: Facilities Y, G, and W submitted complete and uninterrupted AU data from 2017 through 2024.

These differences in reporting completeness should be considered when interpreting statewide AU patterns. Facilities with intermittent submissions may exhibit apparent fluctuations in annual or multi-year trends that reflect reporting gaps rather than true changes in AU. Reporting variability is therefore an important contextual factor for understanding the statewide results presented in the following sections.

What is the SAAR?

The Standardized Antimicrobial Administration Ratio (SAAR) is a risk-adjusted metric developed by CDC/NHSN to facilitate benchmarking of inpatient antimicrobial days [1]. It is calculated as the ratio of observed antimicrobial days of therapy (DOT) to predicted DOT, where predicted values are derived from national risk-adjustment models that account for patient-care location, facility type, and hospital characteristics [1].

- A SAAR of 1.0 indicates observed AU is equal to the predicted value for similar hospitals/units nationwide.
- A SAAR greater than 1.0 indicates observed AU was greater than the predicted value for similar hospitals/units nationwide.
- A SAAR less than 1.0 indicates observed AU was less than the predicted value for similar hospitals/units nationwide.

Note that SAAR values of 0 occur when a location reports non-zero days present (denominator) but zero AU days (numerator). In these instances, the SAAR reflects that no antimicrobial agents within the specified category were administered during the reporting period.

SAAR values are considered missing when no days present are reported. In these cases, the SAAR cannot be calculated and is not reported by NHSN. These observations were excluded from the analysis due to incomplete denominator data.

By providing a standardized benchmark, the SAAR enables hospitals to evaluate AU patterns, identify opportunities for stewardship interventions, and track changes over time. The SAAR alone does not indicate AU appropriateness, and values above or below 1.0 should be interpreted in the context of local patient populations, clinical practices, and case mix.

Data Limitations:

The NHSN's AU Option contains only aggregated data and does not include patient-level detail, limiting the ability to directly evaluate appropriateness of prescribing or clinical outcomes. Despite this limitation, AU data provide a valuable framework for population-level stewardship surveillance and identifying system-level opportunities for improvement.

Statewide Antimicrobial Utilization Analyses (2021-2024):

To support statewide assessment of AU patterns, we created a series of visualizations examining AU rates and SAAR values across Oregon ACHs and CAHs. These analyses use NHSN AU Option data submitted by participating facilities. The years 2021–2024 were selected because they represent the most complete and consistent period of reporting across active data-sharing Oregon hospitals. All SAAR values were calculated by NHSN using the 2017 baseline risk-adjustment models, which provide standardized predictions of AU for comparison across facilities and over time.

Caterpillar Plots for SAAR Values in Adult Wards

Adult ward locations were selected for SAAR analyses because they are the most consistently mapped and reported across ACHs and CAHs, which supports consistent cross-facility comparisons [5]. Wards also account for a large proportion of inpatient days and AU, providing more stable denominators and improving the ability to detect meaningful variation [5]. In addition, ward-level SAARs align with how NHSN builds the SAAR metric: predicted antimicrobial days are generated from risk-adjustment models that are specified for patient-care locations. Using ward-level SAARs therefore preserves that location-specific risk adjustment and avoids masking differences through facility-wide aggregation [1,4,6]. Finally, unit- or service-level interventions recommended in stewardship guidance (e.g., order-set design, IV-to-PO policies, duration defaults) are typically implemented on specific wards, so ward-level displays are operationally actionable [7,8].

Caterpillar plots were generated for the following SAAR antimicrobial categories in adult ward locations:

- All antibacterial agents (Figures 2–3)
- BSHO (Figures 4–5)
- CDI-risk agents (Figures 6 –7)
- Gram-positive agents (Figures 8–9)
- NSBL (Figure 10–11)

For each antimicrobial category, separate caterpillar plots were produced for ACHs and CAHs. Figures display annual SAAR values from 2021–2024, shown side-by-side by reporting year. Facilities are de-identified using stable labels and ordered by their 2021 SAAR to support visual comparison over time. Data points represent NHSN-derived SAAR estimates, with vertical bars representing the corresponding 95% CIs. The horizontal dashed line at SAAR = 1.0 marks the null value where observed antimicrobial use equals predicted use. Values above the line indicate higher-than-predicted use, and values below the line indicate lower-than-predicted use. Additional details regarding methods used to generate caterpillar plots are provided in Appendix B.2.

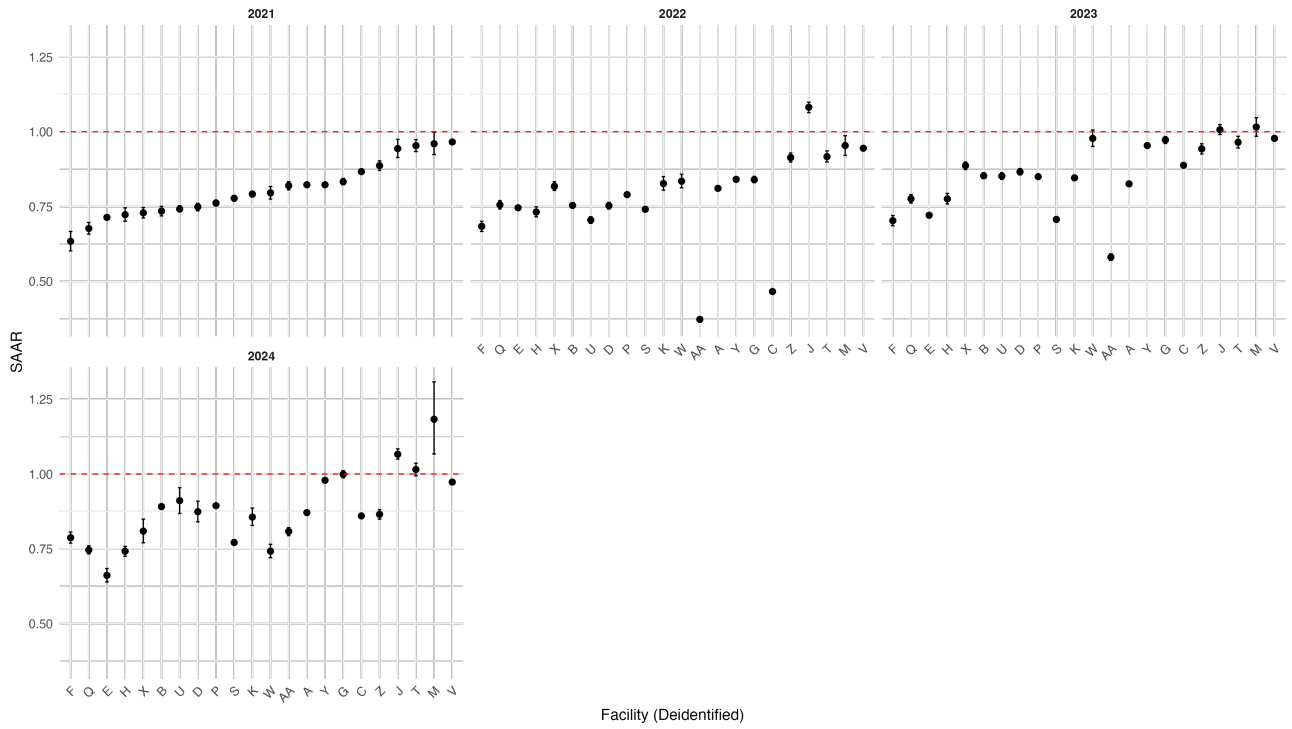


Figure 2. Annual SAAR values for all antibacterial agents used in adult wards among ACHs from 2021-2024. Points represent each facility's annual SAAR, and vertical bars indicate 95% confidence intervals. The dashed red reference line at SAAR = 1.0 denotes where observed AU equals predicted use; values above 1.0 indicate higher-than-predicted use, and values below 1.0 indicate lower-than-predicted use. Facilities on the x-axis are deidentified with stable labels and are ordered by their 2021 SAAR, with this ordering held constant across years.

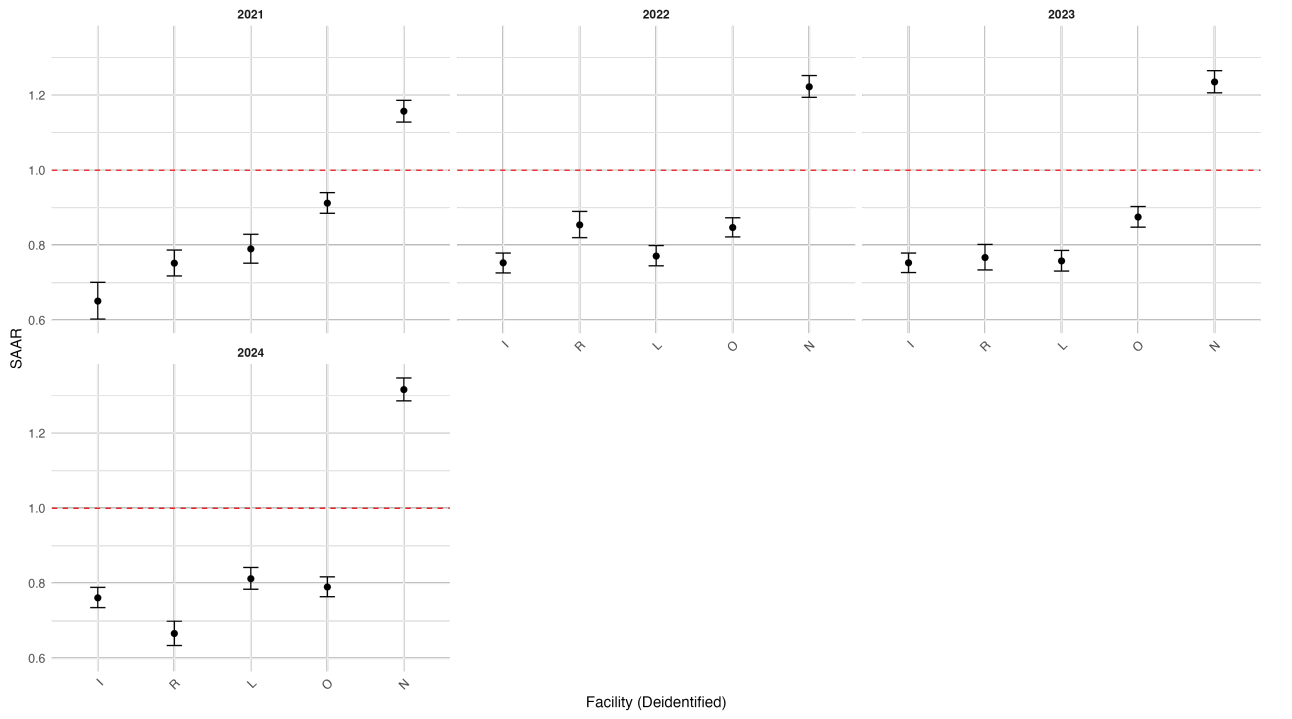


Figure 3. Annual SAAR values for all antibacterial agents used in adult wards among CAHs from 2021-2024. Points represent each facility's annual SAAR, and vertical bars indicate 95% confidence intervals. The dashed red reference line at SAAR = 1.0 denotes where observed AU equals predicted use; values above 1.0 indicate higher-than-predicted use, and values below 1.0 indicate lower-than-predicted use. Facilities on the x-axis are deidentified with stable labels and are ordered by their 2021 SAAR, with this ordering held constant across years.

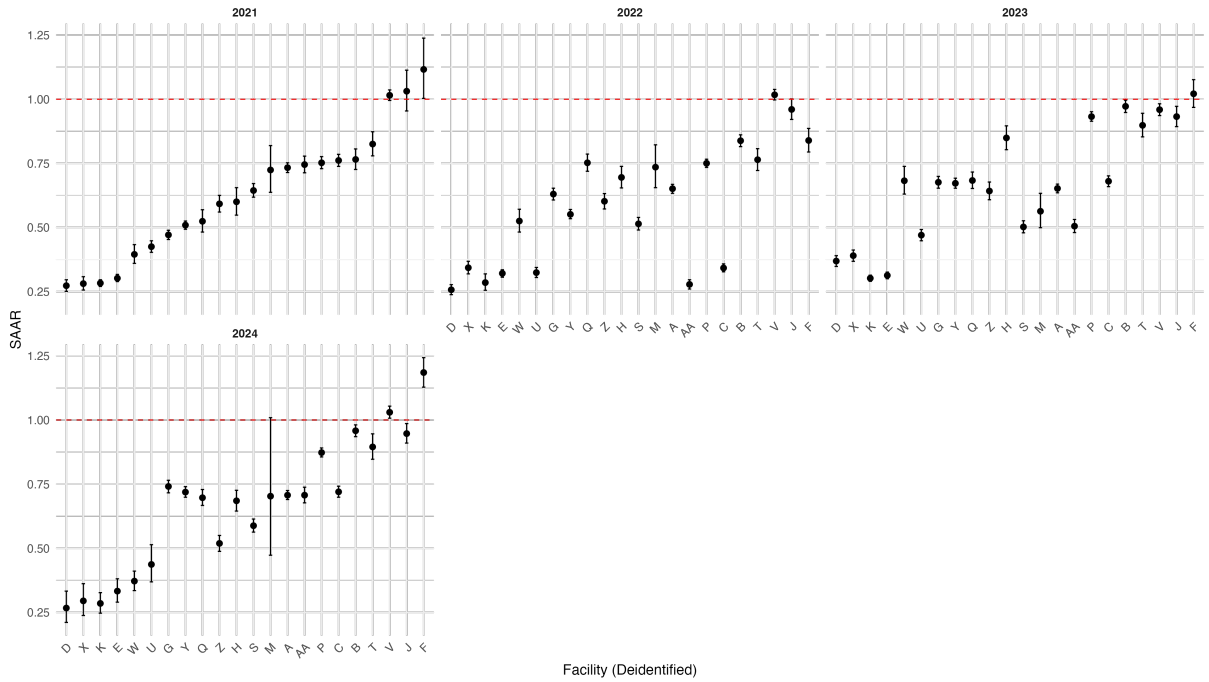


Figure 4. Annual SAAR values for BSHO in adult wards among ACHs from 2021-2024. Points represent each facility's annual SAAR, and vertical bars indicate 95% confidence intervals. The dashed red reference line at SAAR = 1.0 denotes where observed AU equals predicted use; values above 1.0 indicate higher-than-predicted use, and values below 1.0 indicate lower-than-predicted use. Facilities on the x-axis are deidentified with stable labels and are ordered by their 2021 SAAR, with this ordering held constant across years.

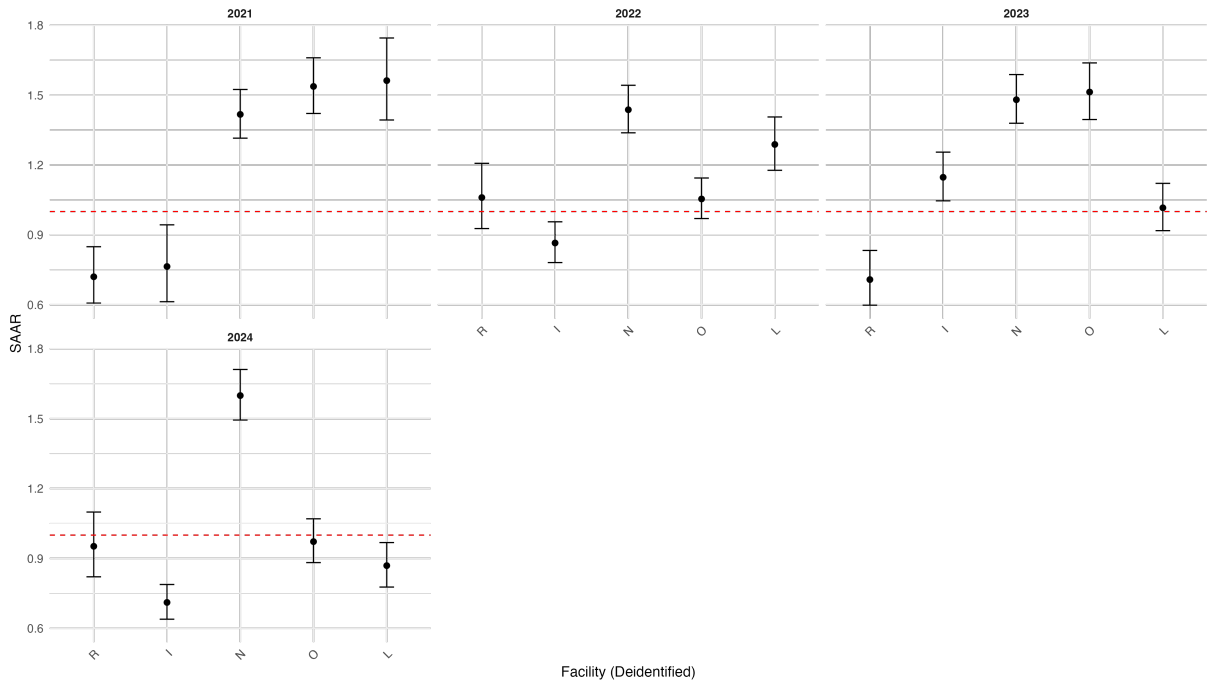


Figure 5. Annual SAAR values for BSHO in adult wards among CAHs from 2021-2024. Points represent each facility's annual SAAR, and vertical bars indicate 95% confidence intervals. The dashed red reference line at SAAR = 1.0 denotes where observed AU equals predicted use; values above 1.0 indicate higher-than-predicted use, and values below 1.0 indicate lower-than-predicted use. Facilities on the x-axis are deidentified with stable labels and are ordered by their 2021 SAAR, with this ordering held constant across years.

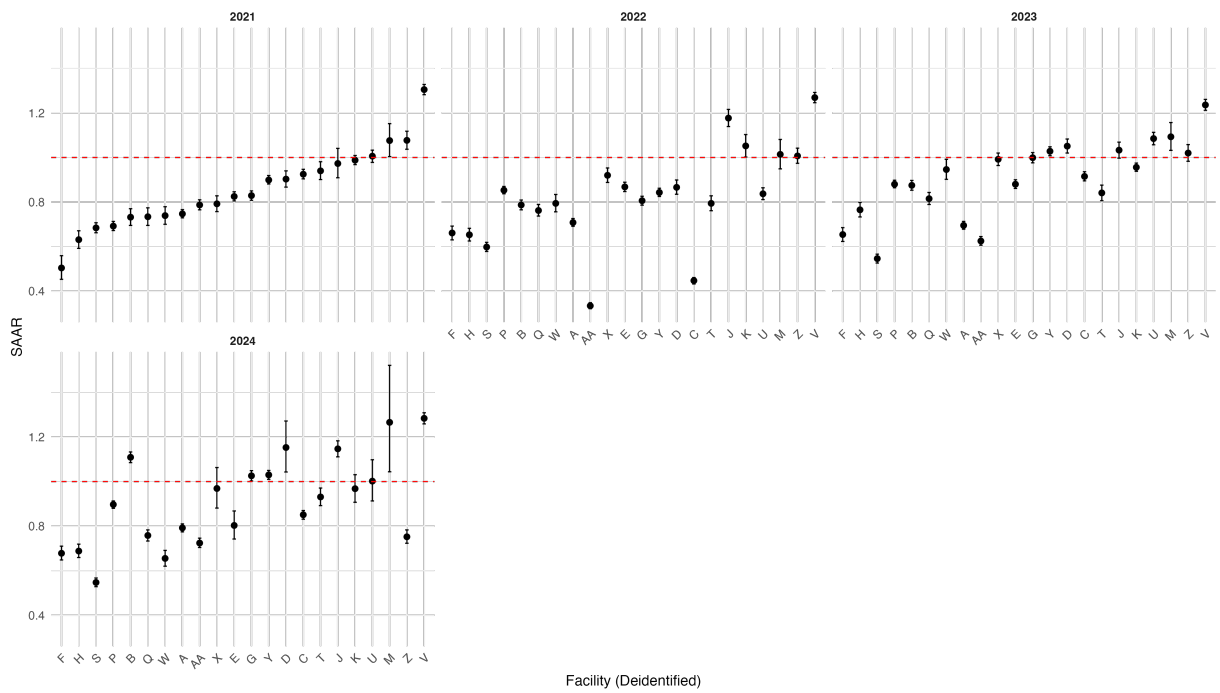


Figure 6. Annual SAAR values for CDI-risk agents in adult wards among ACHs from 2021-2024. Points represent each facility's annual SAAR, and vertical bars indicate 95% confidence intervals. The dashed red reference line at SAAR = 1.0 denotes where observed AU equals predicted use; values above 1.0 indicate higher-than-predicted use, and values below 1.0 indicate lower-than-predicted use. Facilities on the x-axis are deidentified with stable labels and are ordered by their 2021 SAAR, with this ordering held constant across years.

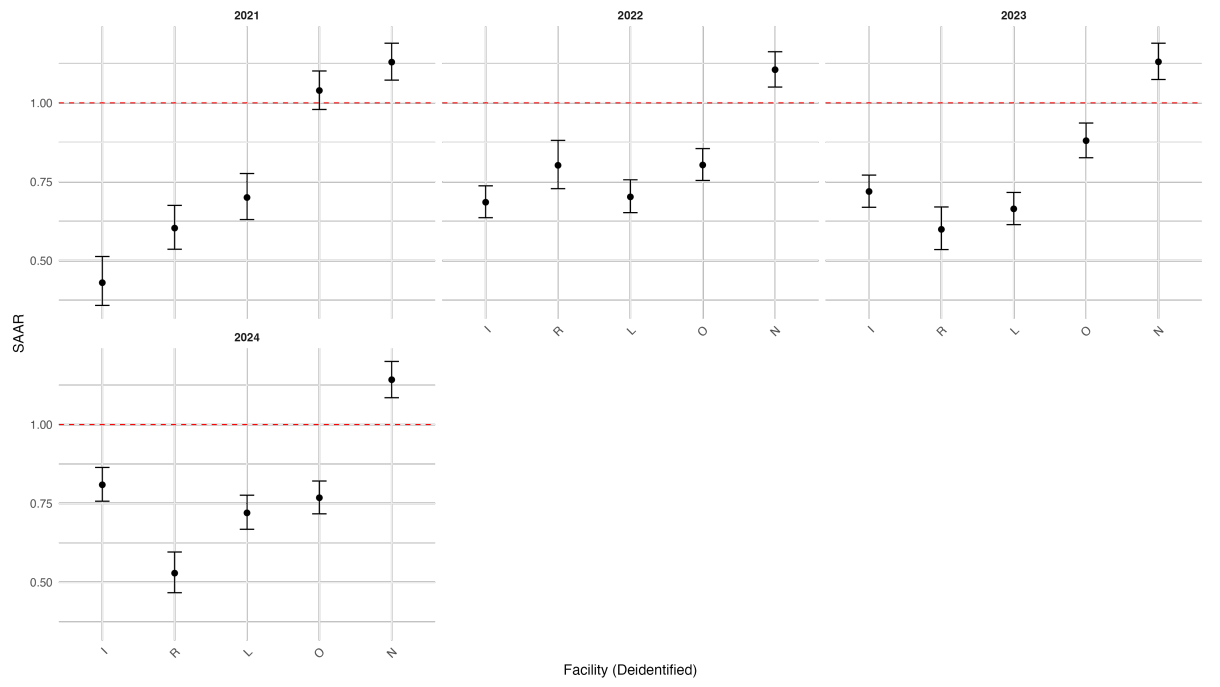


Figure 7. Annual SAAR values for CDI-risk agents in adult wards among CAHs from 2021-2024. Points represent each facility's annual SAAR, and vertical bars indicate 95% confidence intervals. The dashed red reference line at SAAR = 1.0 denotes where observed AU equals predicted use; values above 1.0 indicate higher-than-predicted use, and values below 1.0 indicate lower-than-predicted use. Facilities on the x-axis are deidentified with stable labels and are ordered by their 2021 SAAR, with this ordering held constant across years.

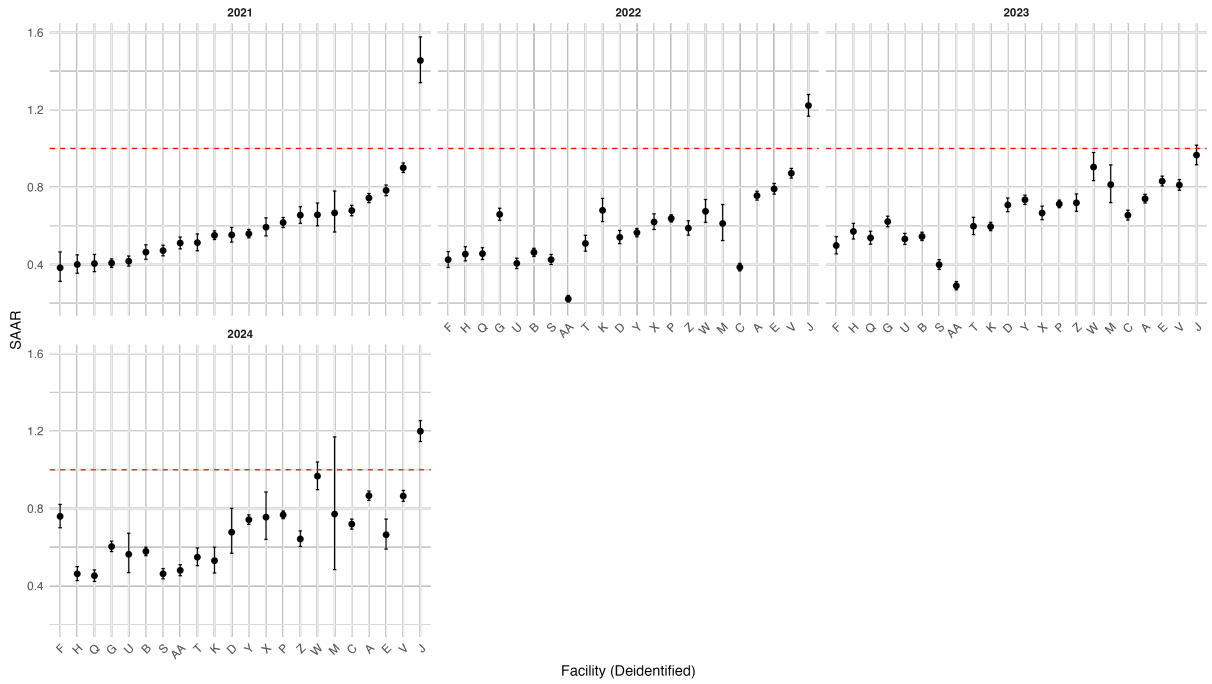


Figure 8. Annual SAAR values for gram-positive agents in adult wards among ACHs from 2021-2024. Points represent each facility's annual SAAR, and vertical bars indicate 95% confidence intervals. The dashed red reference line at SAAR = 1.0 denotes where observed AU equals predicted use; values above 1.0 indicate higher-than-predicted use, and values below 1.0 indicate lower-than-predicted use. Facilities on the x-axis are deidentified with stable labels and are ordered by their 2021 SAAR, with this ordering held constant across years.

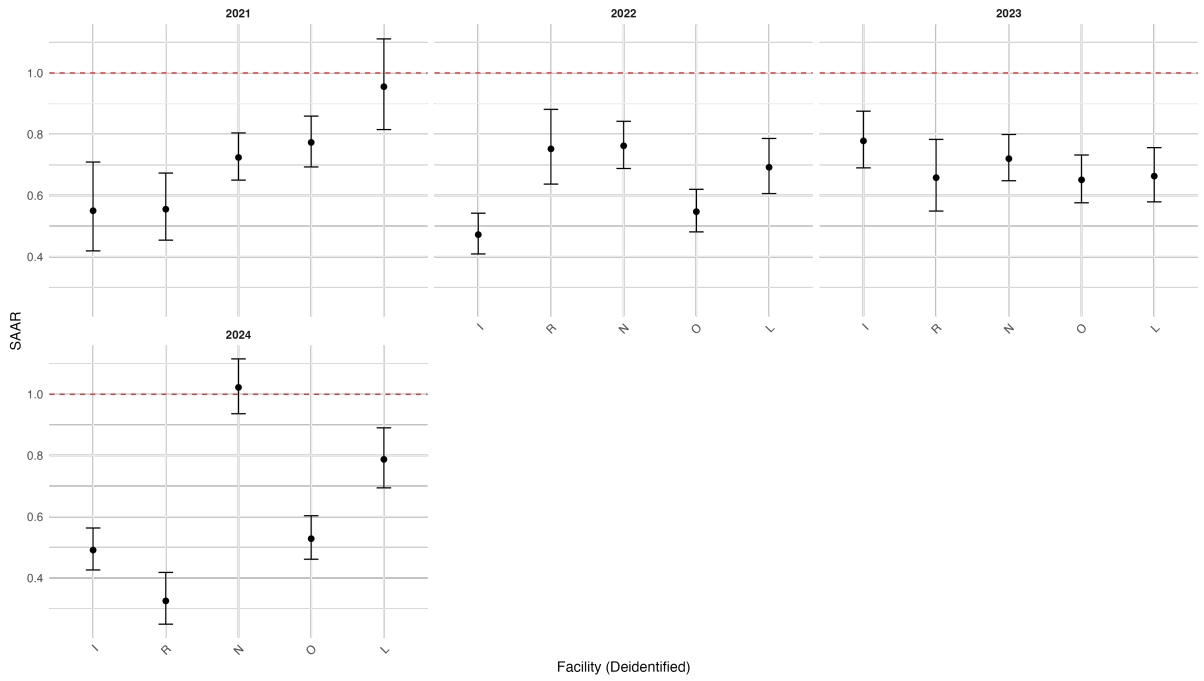


Figure 9. Annual SAAR values for gram-positive agents in adult wards among CAHs from 2021-2024. Points represent each facility's annual SAAR, and vertical bars indicate 95% confidence intervals. The dashed red reference line at SAAR = 1.0 denotes where observed AU equals predicted use; values above 1.0 indicate higher-than-predicted use, and values below 1.0 indicate lower-than-predicted use. Facilities on the x-axis are deidentified with stable labels and are ordered by their 2021 SAAR, with this ordering held constant across years.

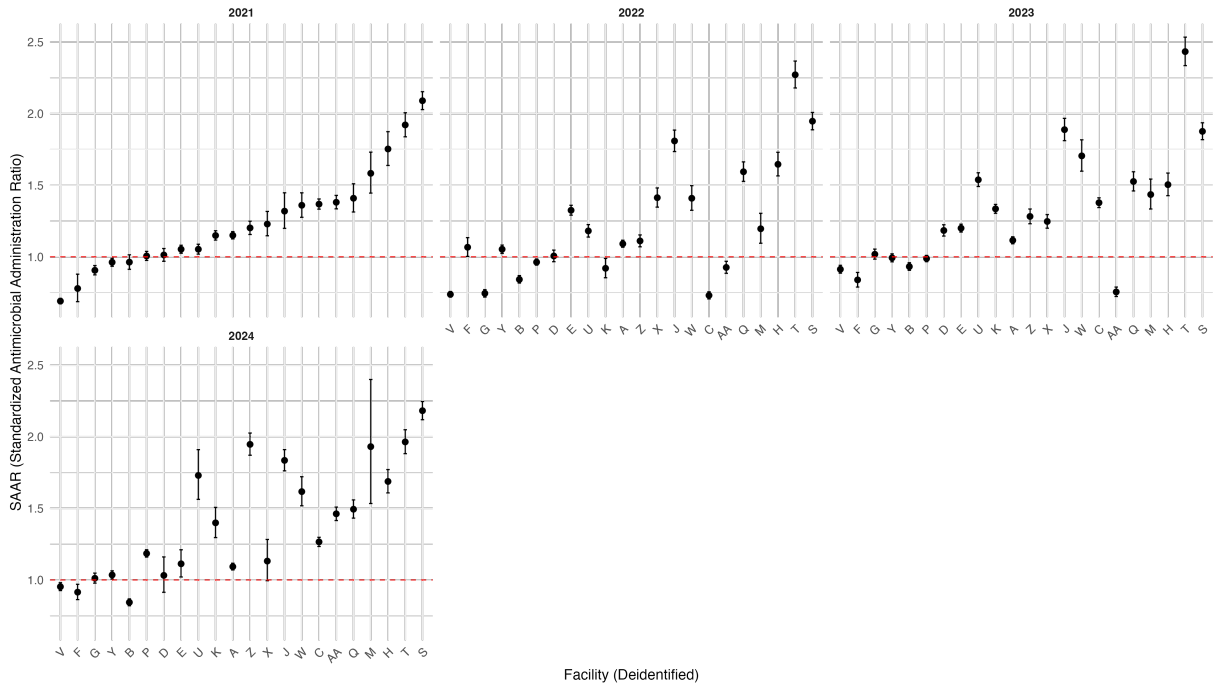


Figure 10. Annual SAAR values for NSBL used in adult wards among ACHs from 2021-2024. Points represent each facility's annual SAAR, and vertical bars indicate 95% confidence intervals. The dashed red reference line at SAAR = 1.0 denotes where observed AU equals predicted use; values above 1.0 indicate higher-than-predicted use, and values below 1.0 indicate lower-than-predicted use. Facilities on the x-axis are deidentified with stable labels and are ordered by their 2021 SAAR, with this ordering held constant across years.

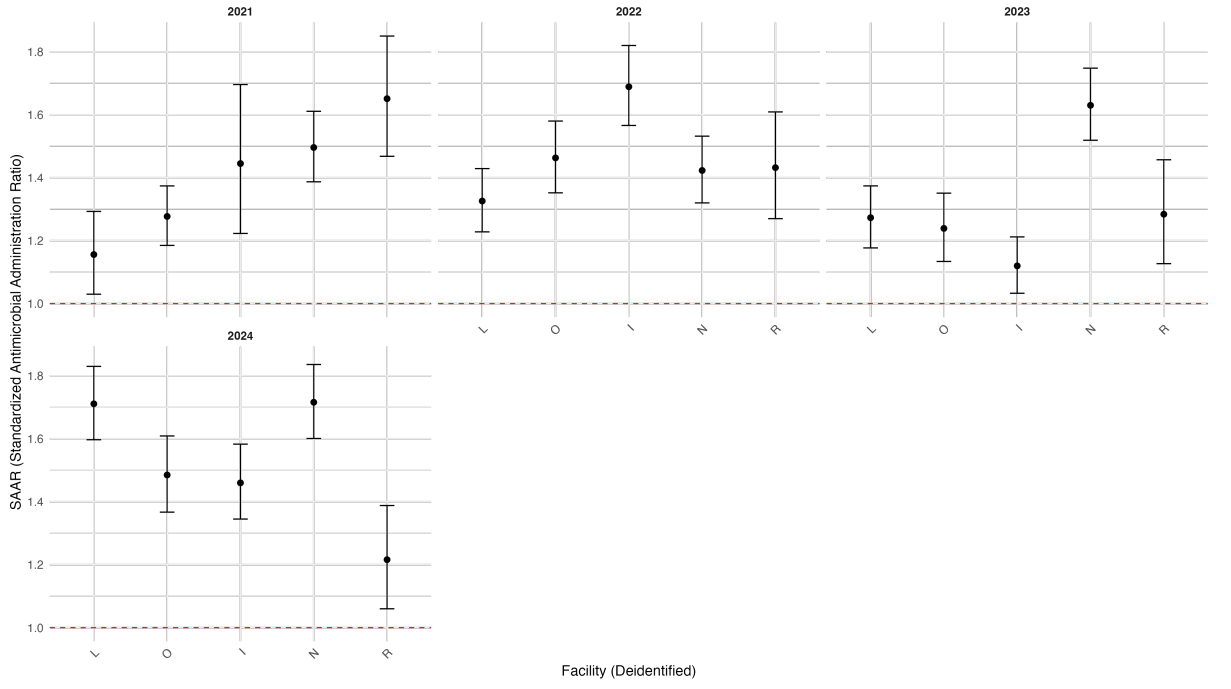


Figure 11. Annual SAAR values for NSBL used in adult wards among CAHs from 2021-2024. Points represent each facility's annual SAAR, and vertical bars indicate 95% confidence intervals. The dashed red reference line at SAAR = 1.0 denotes where observed AU equals predicted use; values above 1.0 indicate higher-than-predicted use, and values below 1.0 indicate lower-than-predicted use. Facilities on the x-axis are deidentified with stable labels and are ordered by their 2021 SAAR, with this ordering held constant across years.

Lines Plots for Quarterly Antimicrobial Use Trends

Figure 12 displays quarterly AU per 1,000 days present (DP) for all antibacterial agents used facility-wide from 2021 Q1 through 2024 Q3. Each colored line represents a single facility's quarterly AU rate (DOT per 1,000 DP). The gray ribbon shows the unadjusted cross-facility mean ±1 standard deviation within each hospital type. Reported zeros—reflecting periods of non-reporting were coded as missing. No smoothing or interpolation was applied.

Figure 13 presents a simplified version of these data, showing unadjusted quarterly mean AU per 1,000 DP for all adult antibacterial agents over the same time period.

Figure 14 displays quarterly AU for all antibacterial agents used facility-wide among ACHs, stratified by region. CAHs were excluded from these regional analyses due to small numbers and the potential for facility identifiability. Each line represents the unweighted regional mean of AU (DOT per 1,000 DP). Detailed methods for line-plot generation, missing-data handling, and regional assignment are provided in Appendix B.3. Analyses were truncated at 2024 Q3 because later quarters were incomplete at the time of data extraction.

Together, these plots illustrate temporal patterns, seasonal variability, and persistent differences in AU across Oregon hospitals.

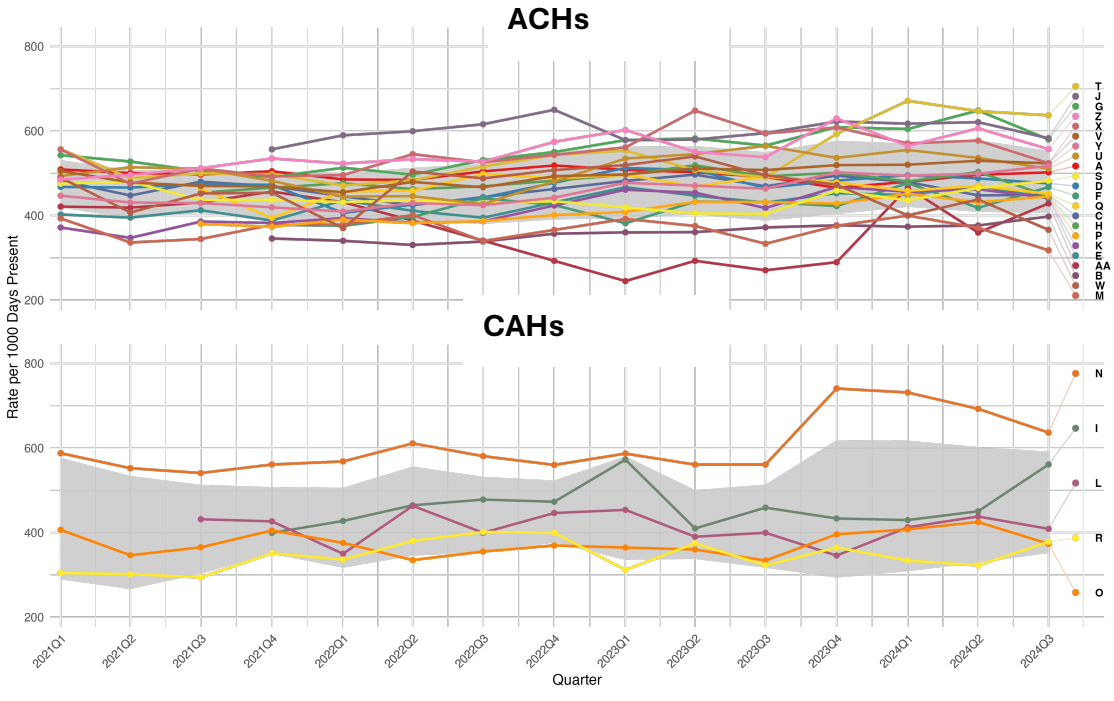


Figure 12. Quarterly AU per 1,000 DP for all antibacterial agents used facility-wide from Q1 2021 through Q3 2024. Each colored line traces a single facility's quarterly AU rate; panels separate ACHs (top) and CAHs (bottom). The gray ribbon shows the mean ± 1 SD within each hospital type.

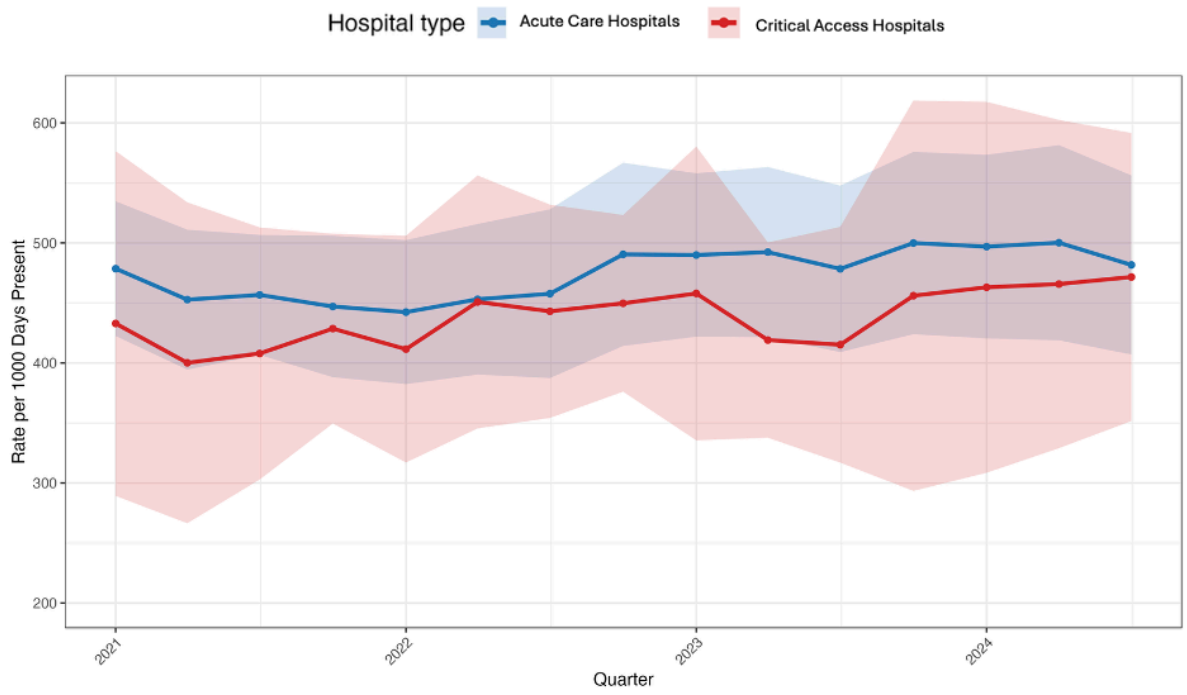


Figure 13. Quarterly AU mean with ± 1 SD bands, 2021 Q1–2024 Q3. Lines show the **mean AU per 1,000 DP** for ACHs (blue) and CAHs (red) by quarter. Shaded bands depict **±1** standard deviation around each mean.

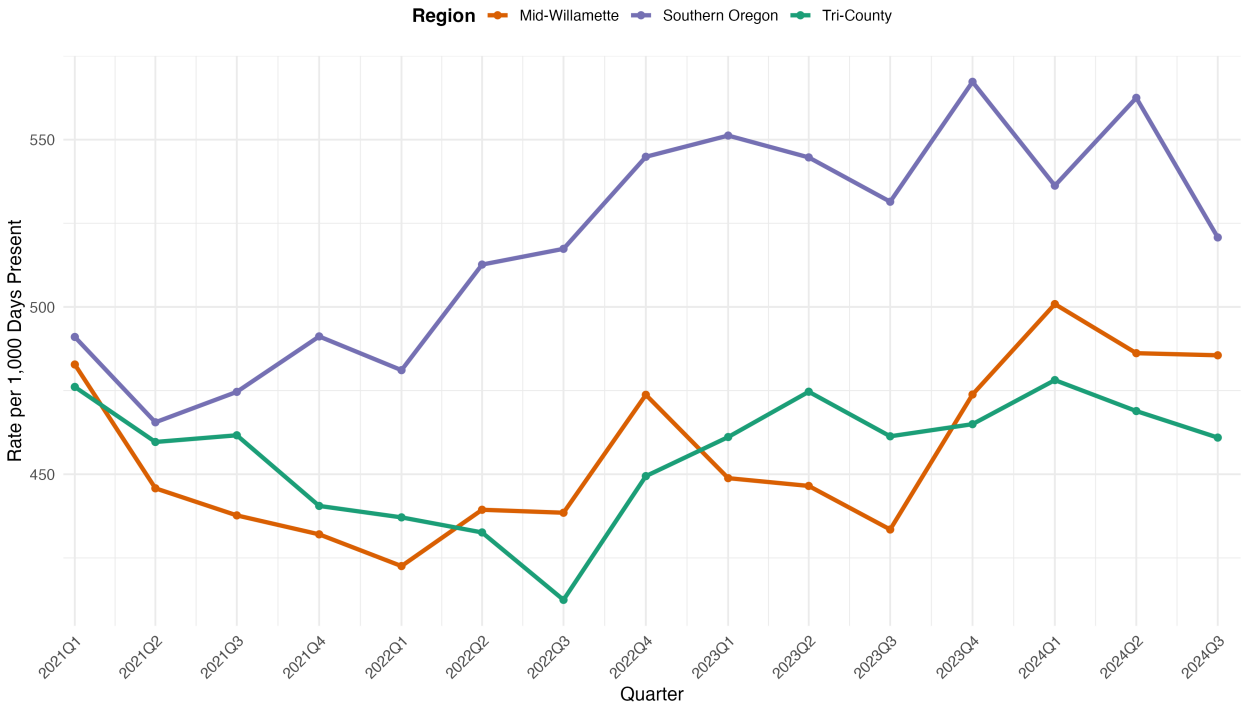


Figure 14. Quarterly AU used facility-wide among ACHs from 2021 Q1–2024 Q3 stratified by region. Lines show the unweighted regional mean of facility-level AU, expressed as DOT/1,000 days present.

Stacked Bar Plots for Annual Antimicrobial Use by Drug Class

Stacked bar plots illustrate annual AU by drug class for each participating facility, with separate figures for ACHs and CAHs. AU is expressed as DOT per 1,000 DP on the y-axis, with de-identified facility labels on the x-axis. Each bar shows the relative contribution of antimicrobial classes to overall AU for that year.

To improve interpretation, several classes with low utilization or limited relevance to inpatient stewardship interventions—including folate pathway inhibitors, fosfomycins, glycylcyclines, nitrofurans, phenicols, pleuromutilins, polymyxins, and rifampins—were grouped into an "Other" category. Lipopeptides, glycopeptides, and oxazolidinones were grouped as "Anti-MRSA Agents." Detailed methods for figure generation are described in Appendix B.4.

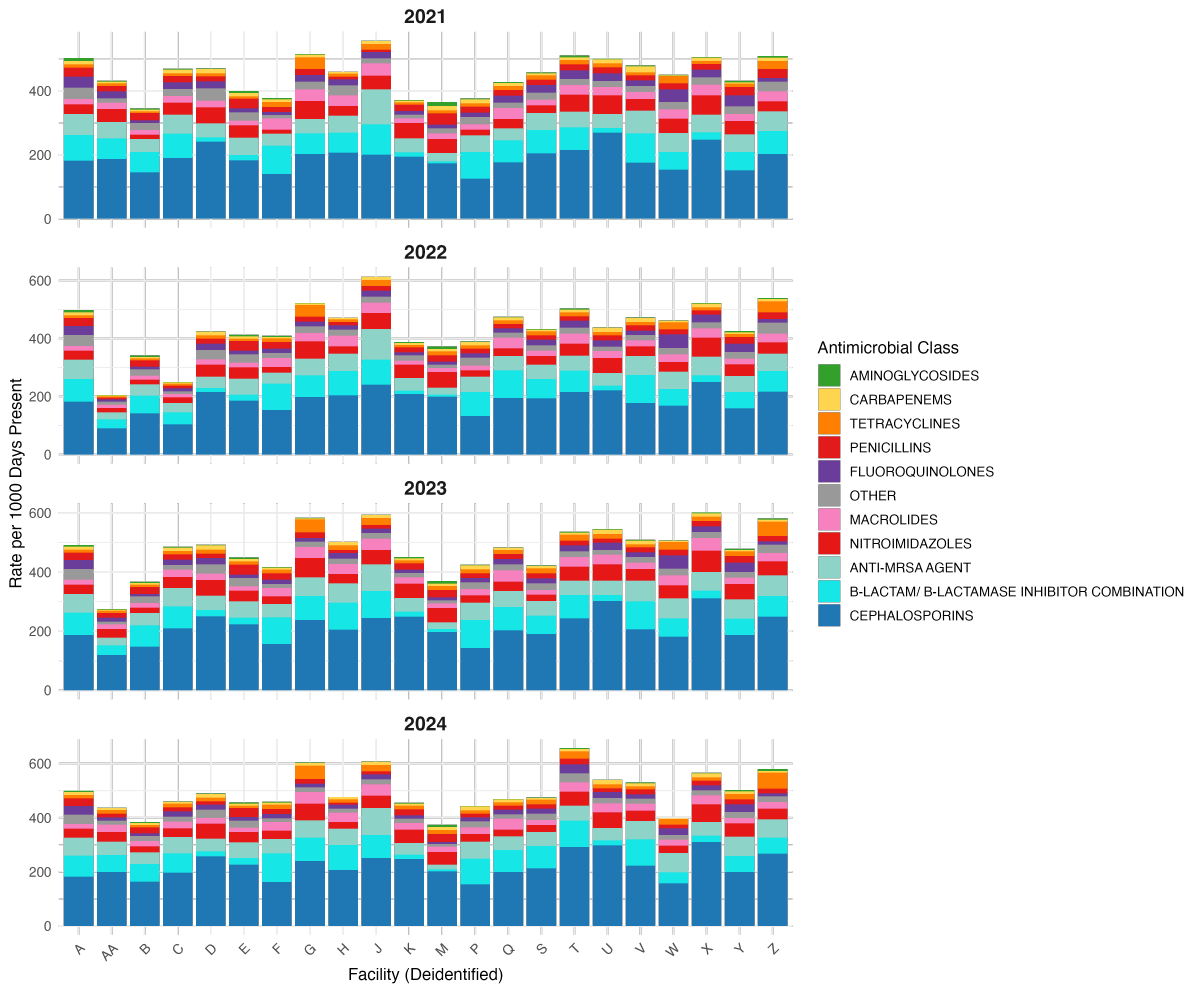


Figure 15. Annual AU rate per 1,000 days present by drug class among ACHs from 2021-2024. Stacked bars show annual AU per 1,000 days present by facility; stacks represent relative contribution of antimicrobial class to overall AU.

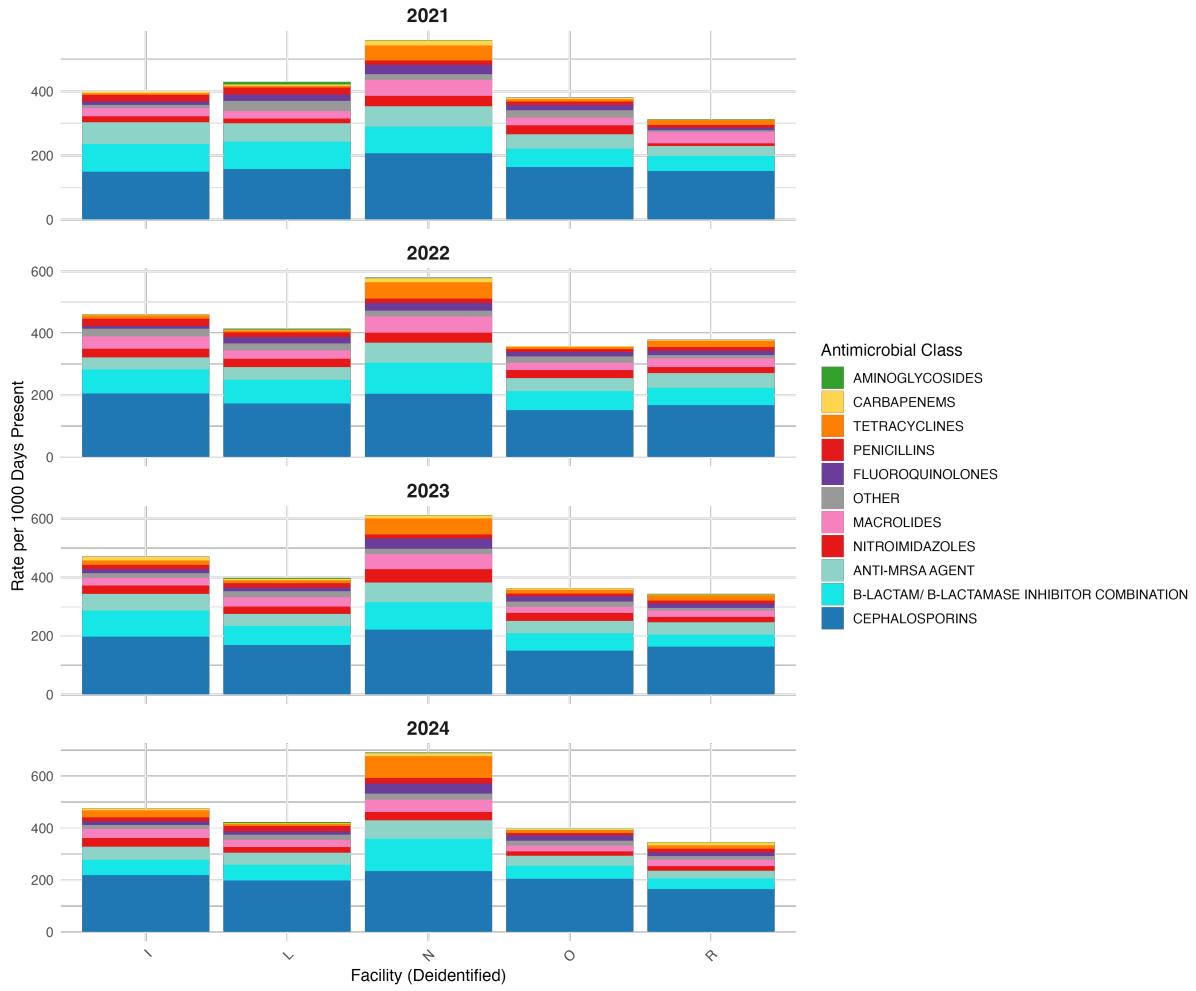


Figure 16. Annual antimicrobial use by class among CAHs from 2021-2024. Stacked bars show annual AU per 1,000 days present by facility; stacks represent relative contribution of antimicrobial class to overall AU.

Point Plots for Facility-Level Variation in SAARs with Statistical Significance

Point plots were generated to display annual facility-level SAAR values, stratified by antimicrobial agent category—BSHO, CDI-risk agents, Gram-positive agents, and NSBL and patient-care location (ICUs and wards).

In each figure, each data point represents a facility's SAAR for a specific NHSN-defined patient-care location in the selected year. A horizontal dashed reference line at SAAR = 1.0 denotes where observed AU equals predicted use. Data points are color-coded based on the NHSN SAAR significance test ($p < 0.05$): red indicates significantly greater-than-predicted use, blue indicates significantly lower-than-predicted use, and gray indicates no statistically significant difference.

Because multiple NHSN patient-care locations may be mapped within a single facility, confidence intervals were omitted to reduce visual overlap and improve interpretability. To maintain confidentiality, finer sub-location distinctions (e.g., medical versus surgical wards) are not displayed.

The main report presents 2024 results for ACHs, including ICU and ward locations for BSHO, CDI-risk agents, and Gram-positive agents, and ward locations only for NSBL. Point plots for ACHs for 2021–2023 and for CAHs across all years are included in Appendix A. Detailed figure-generation methods are provided in Appendix B.5.

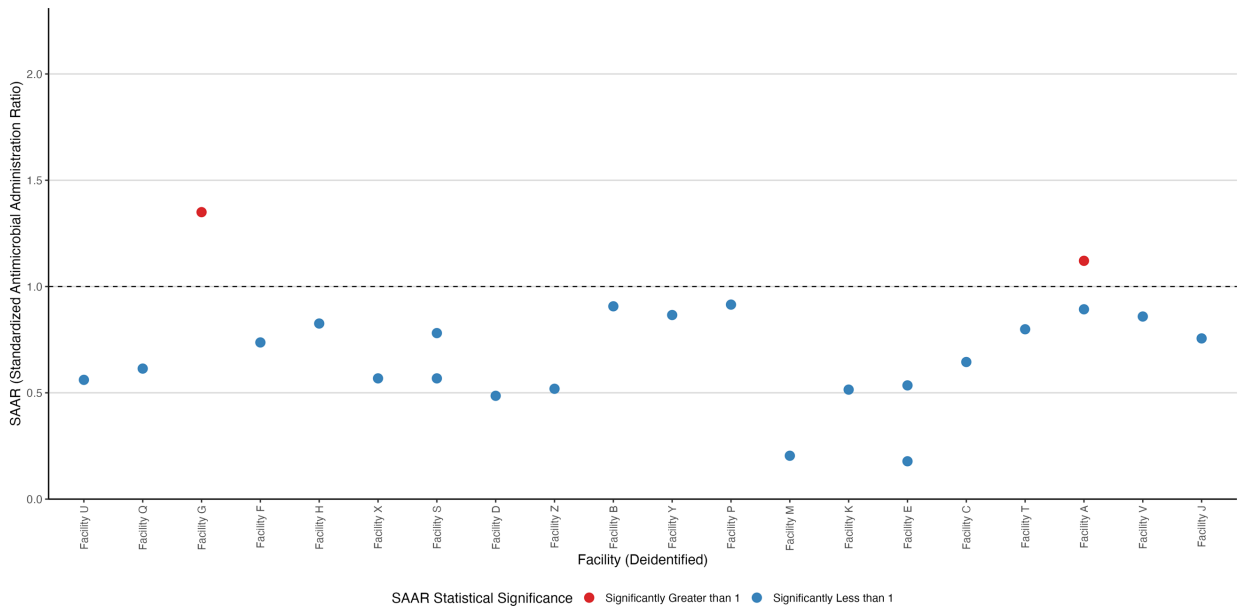


Figure 17. BSHO SAARs from Adult ICUs in ACHs during 2024. Each point represents an NHSN-mapped ICU location within a facility; facilities with multiple eligible units contribute multiple points. The dashed line at 1 denotes where observed AU equals predicted use. Points are colored by statistical significance vs 1 using the NHSN-reported SAAR p-value ($p < 0.05$)**:** red = significantly > 1**,** blue = significantly < 1**,** gray = not significantly different.

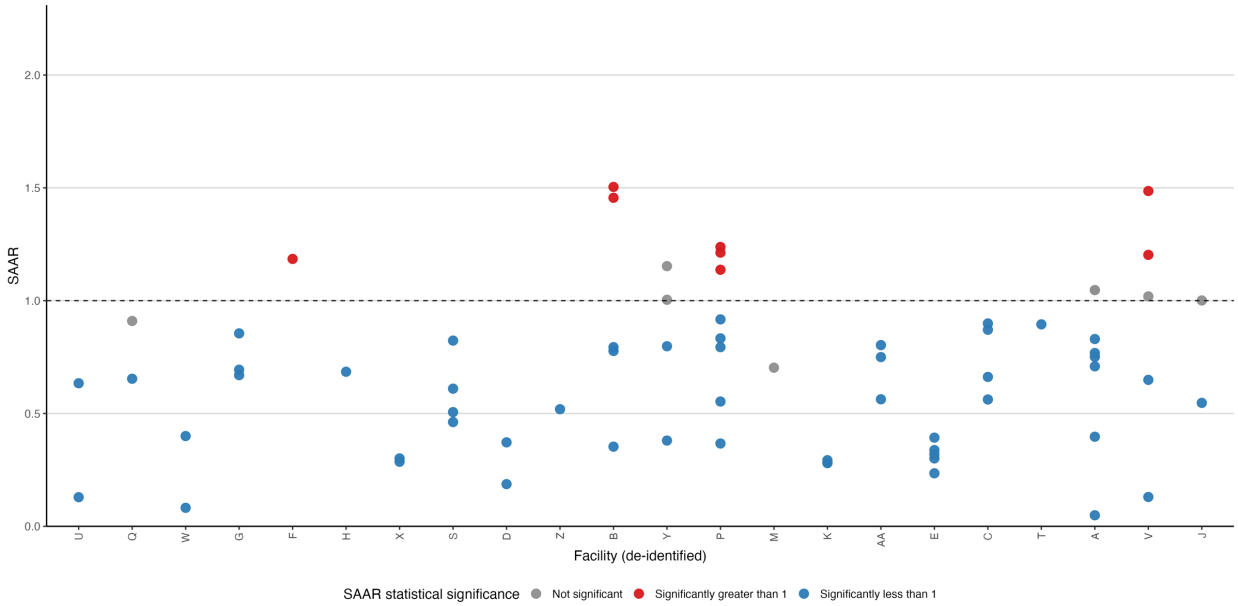


Figure 18. BSHO SAARs from Adult Wards in ACHs during 2024. Each point represents an NHSN-mapped ward location within a facility; facilities with multiple eligible units contribute multiple points. The dashed line at 1 denotes where observed AU equals predicted use. Points are colored by statistical significance vs 1 using the NHSN-reported SAAR p-value ($p < 0.05$)**:** red = significantly > 1**,** blue = significantly < 1**,** gray = not significantly different.

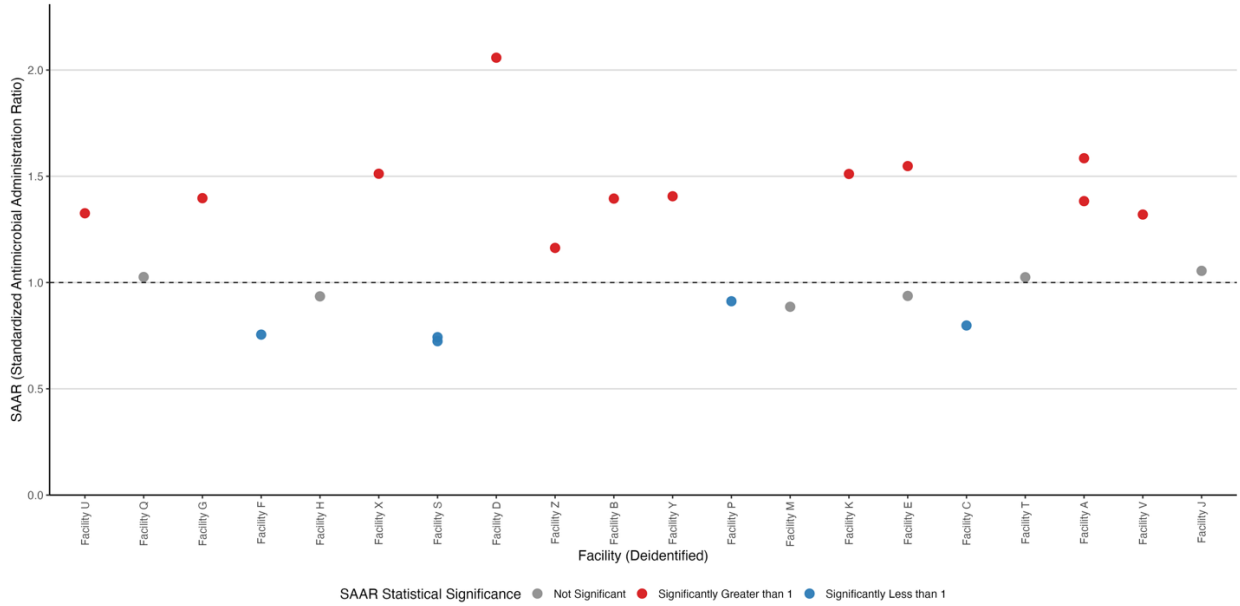


Figure 19. Antibacterial agents posing the highest risk for CDI SAARs from Adult ICUs in ACHs during 2024. Each point represents an NHSN-mapped ICU location within a facility; facilities with multiple eligible units contribute multiple points. The dashed line at 1 denotes where observed AU equals predicted use. Points are colored by statistical significance vs 1 using the NHSN-reported SAAR p-value ($p < 0.05$)**:** red = significantly > 1**,** blue = significantly < 1**,** gray = not significantly different.

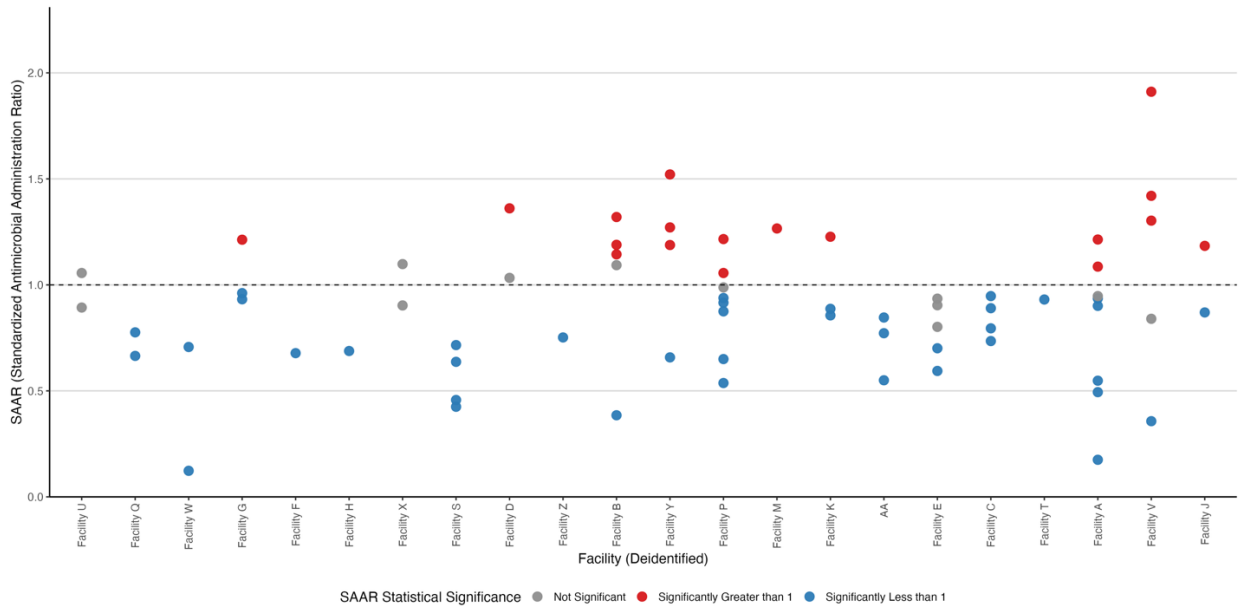


Figure 20. Antibacterial agents posing the highest risk for CDI SAARs from Adult Wards in ACHs during 2024. Each point represents a NHSN-mapped ward location within a facility; facilities with multiple eligible units contribute multiple points. The dashed line at 1 denotes where observed AU equals predicted use. Points are colored by statistical significance vs 1 using the NHSN-reported SAAR p-value ($p < 0.05$)**:** red = significantly > 1**,** blue = significantly < 1**,** gray = not significantly different.

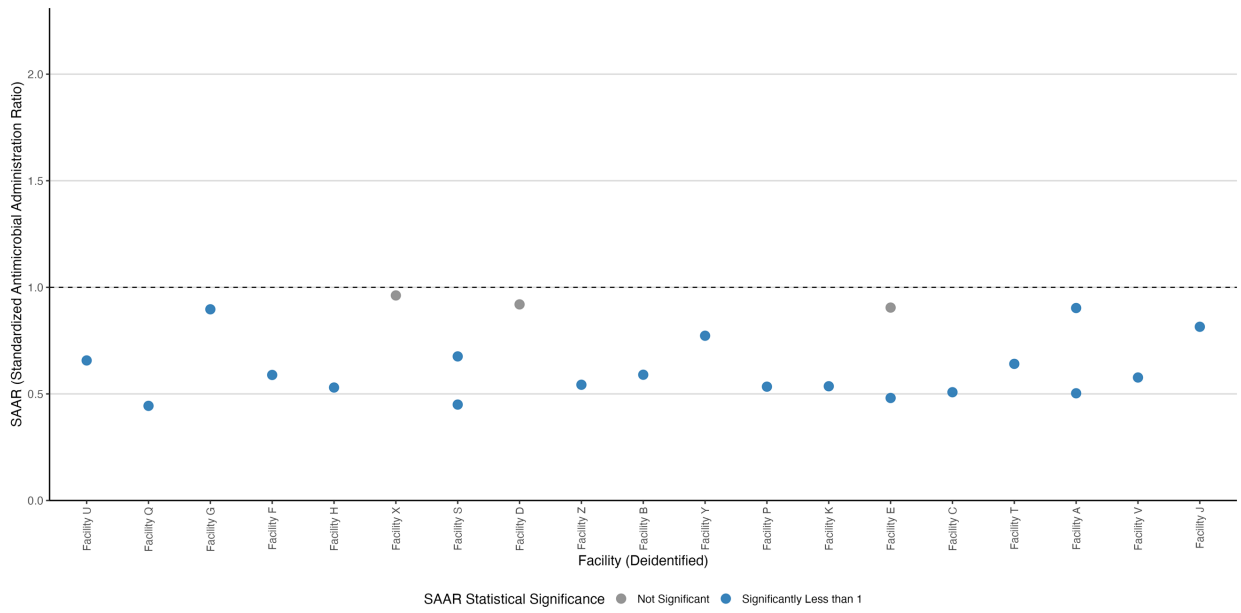


Figure 21. Antibacterial agents predominately used for Gram-Positive infections SAARs in Adult ICUs in ACHs during 2024. Each point represents an NHSN-mapped ICU location within a facility; facilities with multiple eligible units contribute multiple points. The dashed line at 1 denotes where observed AU equals predicted use. Points are colored by statistical significance vs 1 using the NHSN-reported SAAR p-value ($p < 0.05$)**:** red = significantly > 1**,** blue = significantly < 1**,** gray = not significantly different.

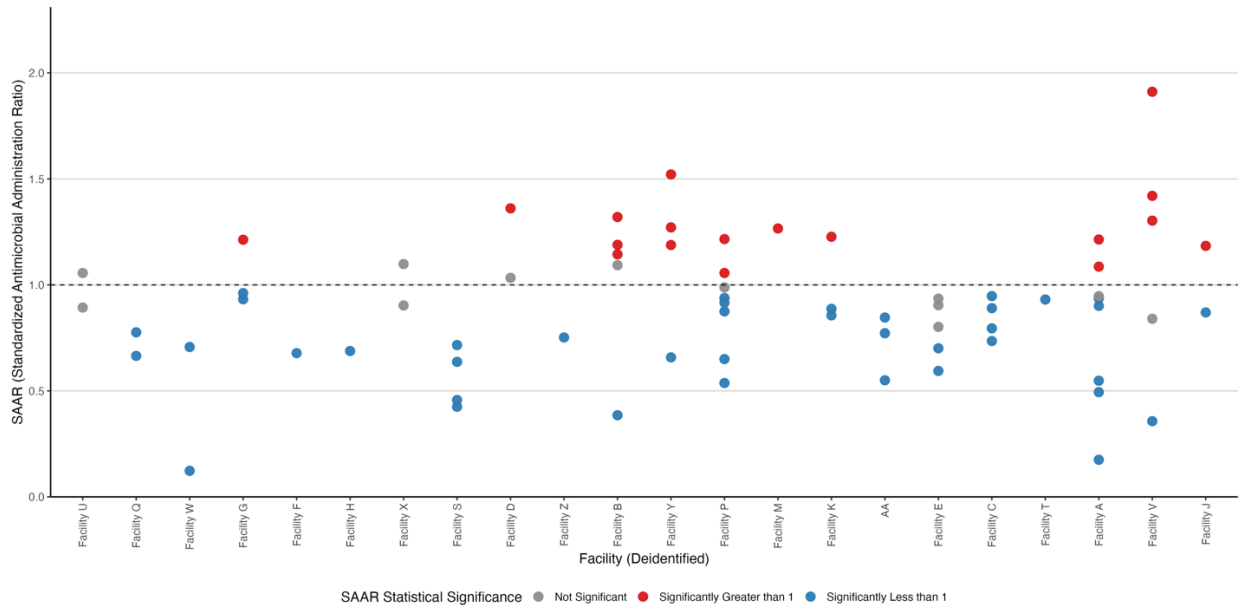


Figure 22. Antibacterial agents predominately used for Gram-Positive infections SAARs in Adult Wards in ACHs during 2024. Each point represents a NHSN-mapped ward location within a facility; facilities with multiple eligible units contribute multiple points. The dashed line at 1 denotes where observed AU equals predicted use. Points are colored by statistical significance vs 1 using the NHSN-reported SAAR p-value ($p < 0.05$)**:** red = significantly > 1**,** blue = significantly < 1**,** gray = not significantly different.

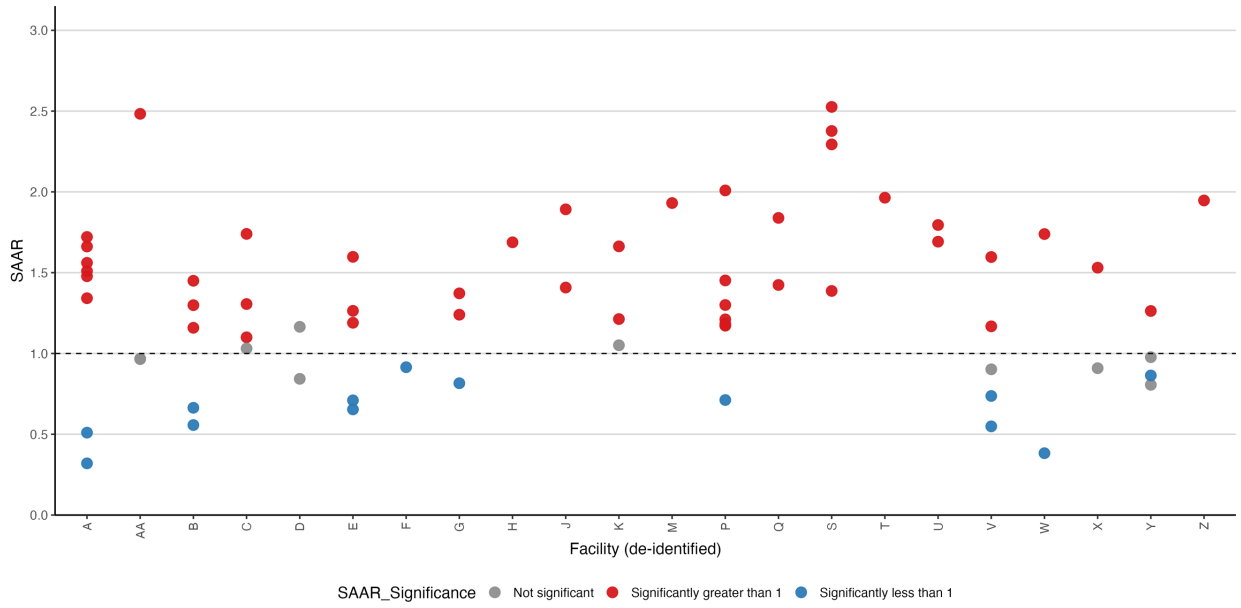


Figure 23. NSBL agents SAARs in Adult Wards in ACHs during 2024. Each point represents a NHSN-mapped ward location within a facility; facilities with multiple eligible units contribute multiple points. The dashed line at 1 denotes where observed AU equals predicted use. Points are colored by statistical significance vs 1 using the NHSN-reported SAAR p-value ($p < 0.05$)**:** red = significantly > 1**,** blue = significantly < 1**,** gray = not significantly different.

Caterpillar Plots for Annual SAARs for Pediatric Units

Caterpillar plots were generated to display annual SAAR values for all antibacterial agents in inpatient pediatric ward locations from 2021–2024. To preserve anonymity, SAARs are shown at the unit level rather than the facility level. The x-axis therefore presents de-identified unit labels (e.g., Unit A, Unit B), each corresponding to a distinct CDC-mapped pediatric location. Facilities with more than one NHSN-mapped pediatric ward will have each unit displayed separately, with its own label and plotted point.

Each data point represents a unit's SAAR for a given year, with vertical bars indicating the NHSN-reported 95% CI. A horizontal dashed line at SAAR = 1.0 denotes where observed and predicted AU are equal. Data points are colored according to the NHSN SAAR significance test ($p < 0.05$): red indicates significantly greater-than-predicted use, blue indicates significantly lower-than-predicted use, and gray indicates no statistically significant difference. Within each year, units are ordered by their SAAR value.

To minimize re-identification risk, the number of pediatric units per facility is not reported, and pediatric sub-location types (e.g., medical ward vs surgical ICU) are not displayed. The main report presents 2024 results; plots for 2021–2023 are provided in Appendix B.6.

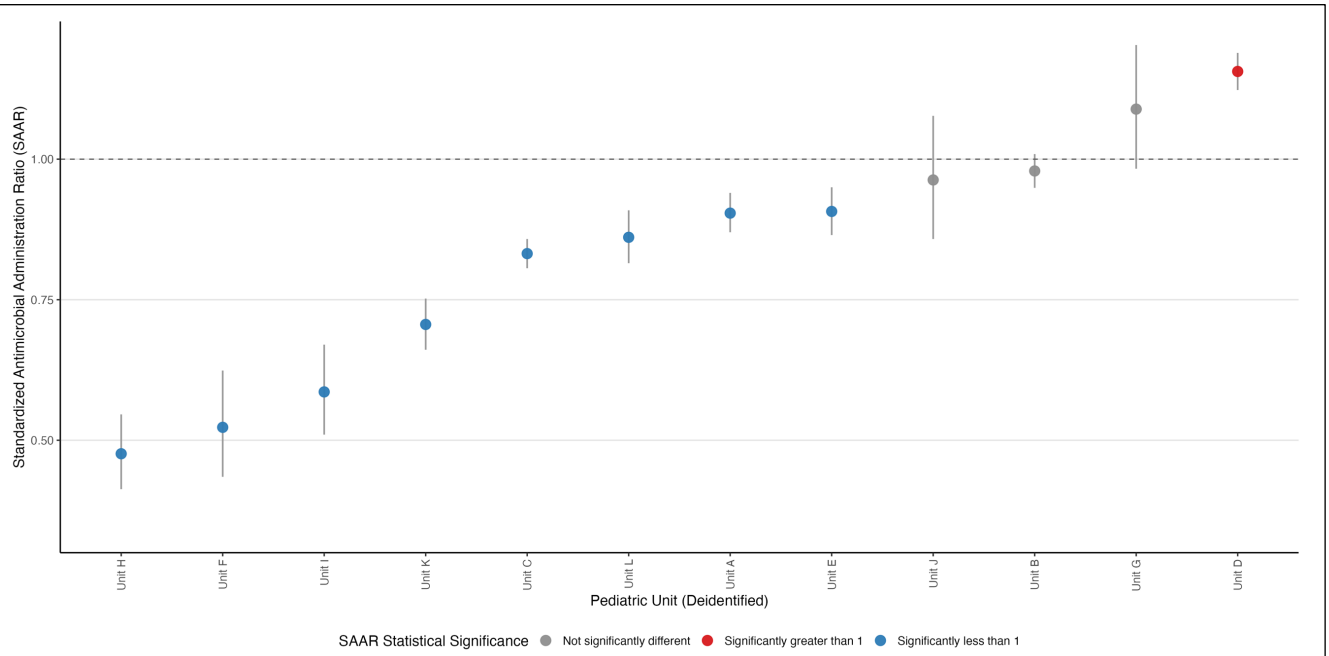


Figure 24. Pediatric SAARs for All Antibacterial Agents, 2024, unit level. Each point represents a distinct pediatric unit; error bars show 95% CIs. The dashed line at SAAR = 1 denotes where observed AU equals predicted use. Points are color-coded by the NHSN SAAR p-value ($p < 0.05$): red indicates significantly greater than 1, blue indicates significantly less than 1, and gray indicates not significantly different.

References

1. Centers for Disease Control and Prevention. The NHSN standardized antimicrobial administration ratio (SAAR): A guide to the SAAR. Version 1.2. July 28, 2025. Accessed September 2, 2025. https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/aur/au-saar-guide-508.pdf
2. Centers for Disease Control and Prevention. *National Healthcare Safety Network (NHSN) Antimicrobial Use Option Report: 2023 Data Summary*. Centers for Disease Control and Prevention; 2024. Accessed Month Day, Year.
3. Oregon Office of Rural Health (ORH). *About rural and frontier data*. Oregon Health & Science University. Accessed April 2026. https://www.ohsu.edu/oregon-office-of-rural-health/about-rural-and-frontier-data
4. Centers for Disease Control and Prevention. NHSN Patient Safety Component Manual: Antimicrobial Use and Resistance (AUR) Module. January 2024.
5. Centers for Disease Control and Prevention. CDC locations and descriptions and instructions for mapping patient care locations. In: NHSN Patient Safety Component Manual. Chapter 15. January 2025. Accessed September 2, 2025. https://www.cdc.gov/nhsn/pdfs/pscmanual/15locationsdescriptions_current.pdf
6. Centers for Disease Control and Prevention. Keys to success with the SAAR. March 30, 2023. Accessed September 2, 2025. https://www.cdc.gov/nhsn/ps-analysis-resources/keys-to-success-saar.html
7. Barlam TF, Cosgrove SE, Abbo LM, et al. Implementing an antibiotic stewardship program: Guidelines by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America. Clin Infect Dis. 2016;62(10):e51-e77. doi:10.1093/cid/ciw118
8. Centers for Disease Control and Prevention. Core elements of hospital antibiotic stewardship programs. December 5, 2024. Accessed September 2, 2025. https://www.cdc.gov/antibiotic-use/hcp/core-elements/hospital.html

Appendix A. Supplementary Tables and Figures

Table A.1 Antimicrobial Agent Categories for SAAR Calculations

Antibacterial Groupings for SAAR Calculations			
BSHO	**CDI-risk agents**	**Gram-positive agents**	**NSBL**
Amikacin (IV only) Aztreonam (IV only) Cefepime Ceftazidime Doripenem Gentamicin (IV only) Imipenem/Cilastatin Meropenem Piperacillin/Tazobactam Tobramycin (IV only)	Cefdinir Cefepime Cefixime Cefotaxime Cefpodoxime Ceftazidime Ceftriaxone Ciprofloxacin Clindamycin Gemifloxacin Levofloxacin Moxifloxacin	Ceftaroline Dalbavancin Daptomycin Linezolid Oritavancin Quinupristin/Dalfopristin Tedizolid Telavancin Vancomycin (IV only)	Amoxicillin Amoxicillin/Clavulanate Ampicillin Ampicillin/Sulbactam Cefadroxil Cefazolin Cefotetan Cefoxitin Cephalexin Dicloxacillin Nafcillin Oxacillin Penicillin G Penicillin V

Antimicrobial agent categories are defined by the NHSN AUR Module [1].

Table A.2 Characteristics of Oregon facilities contributing data to this report

Facility Characteristic	n /27 (%)
Bed Size	
<50	8 (29.6)
51-100	2 (7.4)
101-200	8 (29.6)
201-499	6 (22.2)
>500	3 (11.1)
Urban and Rural Classification	
Urban	13 (48.1)
Rural	14 (51.9)
Teaching designation	
Graduate	8 (29.6)
Major	8 (29.6)
Undergraduate	4 (14.8)
None	7 (25.9)

Table A.3 AMS Honor Roll Facilities

Facility	City	Honor Roll Status
Asante Rogue Regional Medical Center	Medford	Gold
Good Samaritan Regional Medical Center	Corvallis	Gold
Providence Hood River Memorial Hospital	Hood River	Gold
Providence Milwaukie Hospital	Milwaukie	Gold
Providence Portland Medical Center	Portland	Gold
Providence Willamette Falls Medical Center	Oregon City	Gold
Providence St. Vincent	West Haven-Sylvan	Gold
Providence Newburg	Newburg	Gold
Providence Seaside	Seaside	Gold
Salem West Valley	Dallas	Bronze
Salem Hospital	Salem	Gold
Samaritan Albany General Hospital	Albany	Gold
Samaritan Lebanon Community Hospital	Lebanon	Gold
Samaritan North Lincoln Hospital	Lincoln City	Gold
Samaritan Pacific Community Hospital	Newport	Gold
St. Charles Bend	Bend	Gold

*Last updated: December 2025

The following hospitals have achieved Gold or Bronze Status recognition by the Oregon Health Authority's Healthcare-Associated Infections (HAI) Program in recognition of their sustained leadership and excellence in AS. These facilities meet or exceed the CDC's Core Elements for Hospital Antibiotic Stewardship Programs and have demonstrated commitment to stewardship implementation.

The following hospitals have received Antimicrobial Stewardship Center of Excellence designation from the Infectious Diseases Society of America (IDSA). This designation recognizes hospitals that have established stewardship programs led by infectious diseases (ID) physicians and ID-trained pharmacists and that meet national standards for excellence based on evidence-based guidelines.

Facility	City
Oregon Health & Science University	Portland
Kaiser Permanente Sunnyside Medical Center	Clackamas
Kaiser Permanente Westside Medical Center	Hillsboro

Figures A.4–A.21 SAAR Point Plots for ACHs, 2021-2023

Annual facility-level SAAR values are displayed by antimicrobial agent category (BSHO, CDI-risk, Gram-positive, NSBL) and patient-care location (ICUs and wards). Each data point represents a facility–location–year SAAR. Data points are colored based on NHSN SAAR significance ($p < 0.05$): red indicates greater-than-predicted use, blue indicates lower-than-predicted use, and gray indicates no statistically significant difference. To maintain confidentiality, finer sub-location distinctions (e.g., medical vs surgical wards) are not displayed. A horizontal reference line at SAAR = 1.0 indicates observed antimicrobial use equal to predicted use for similar hospitals and units nationwide.

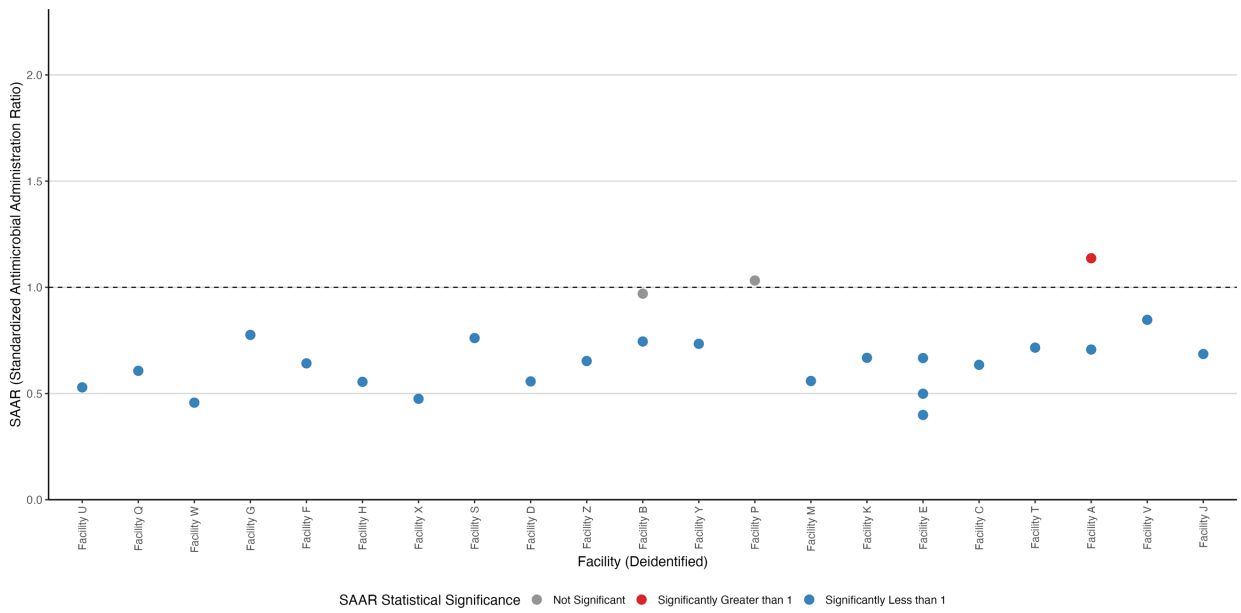


Figure A.4 SAARs for BSHO in Adult ICUs among ACHs during 2021.

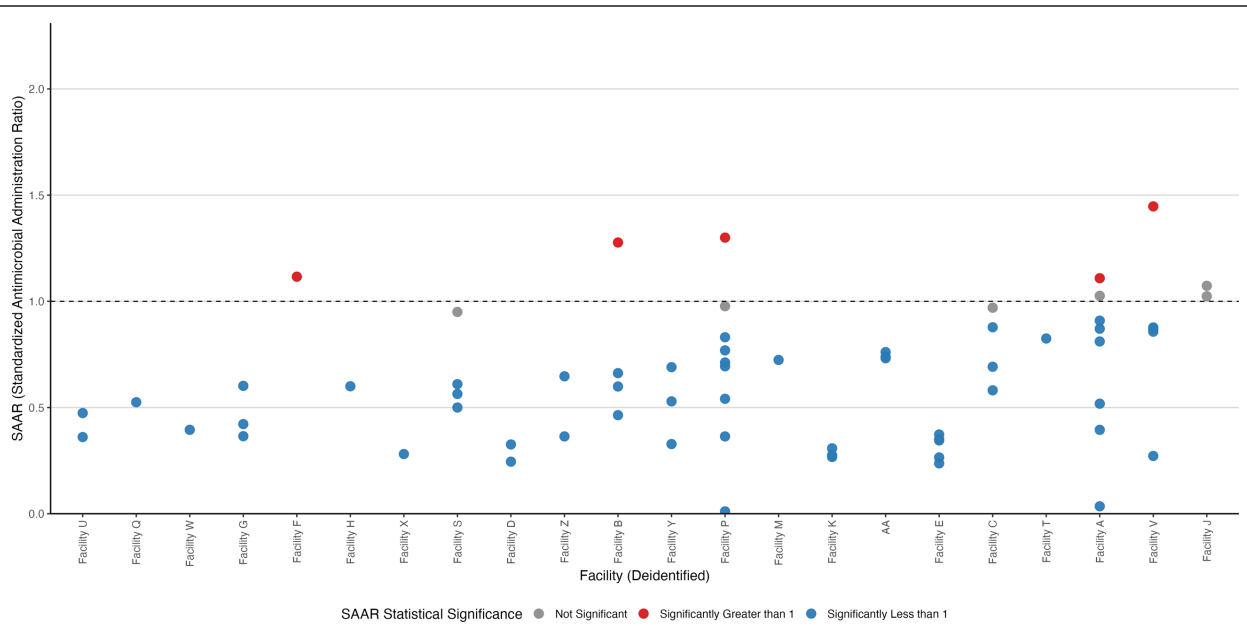


Figure A.5 SAARs for BSHO in Adult Wards among ACHs during 2021.

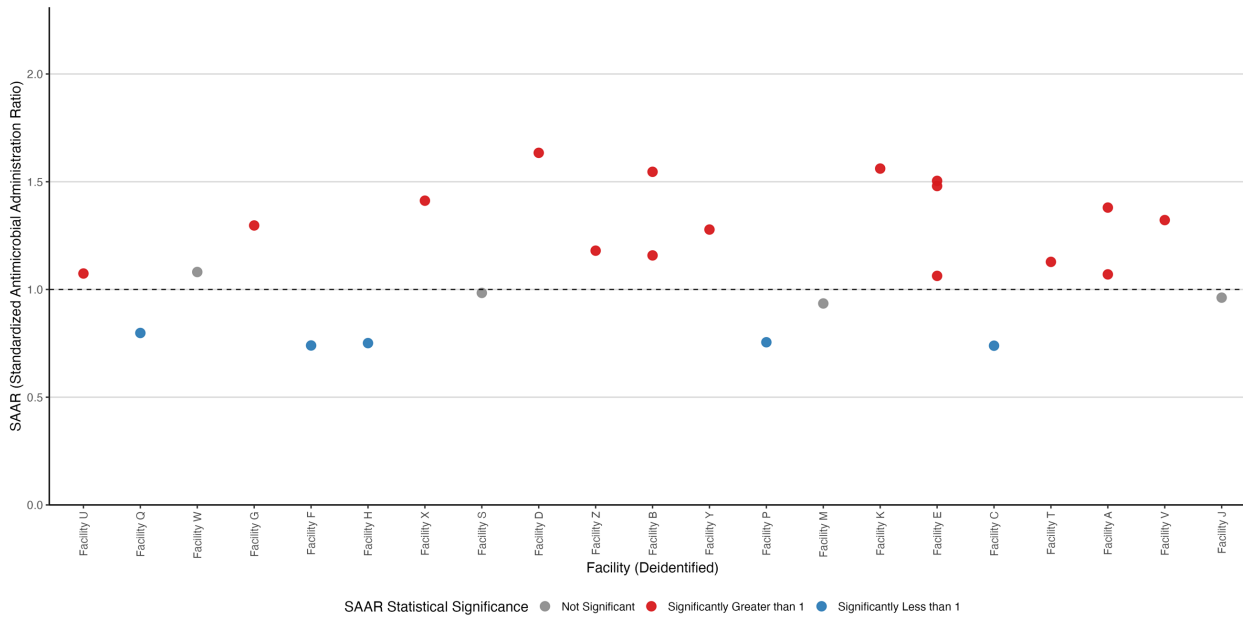


Figure A.6 SAARs for antibacterial agents posing highest risk of CDI in Adult ICUs among ACHs for 2021.

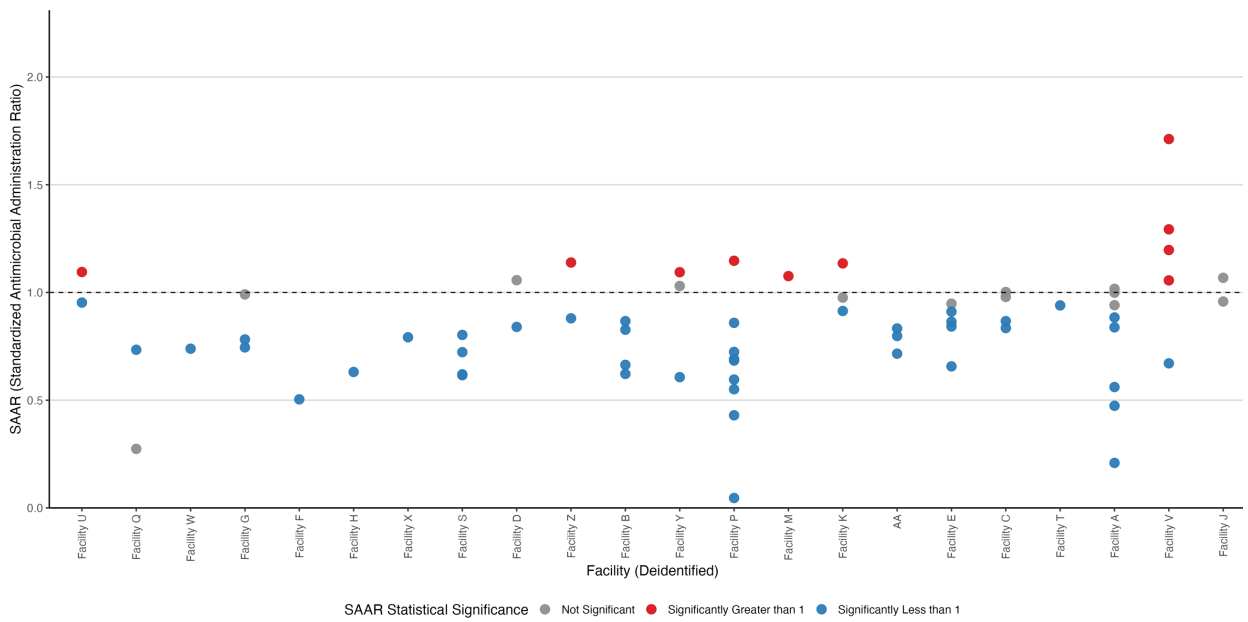


Figure A.7 SAARs for antibacterial agents posing highest risk of CDI in Adult Wards among ACHs for 2021.

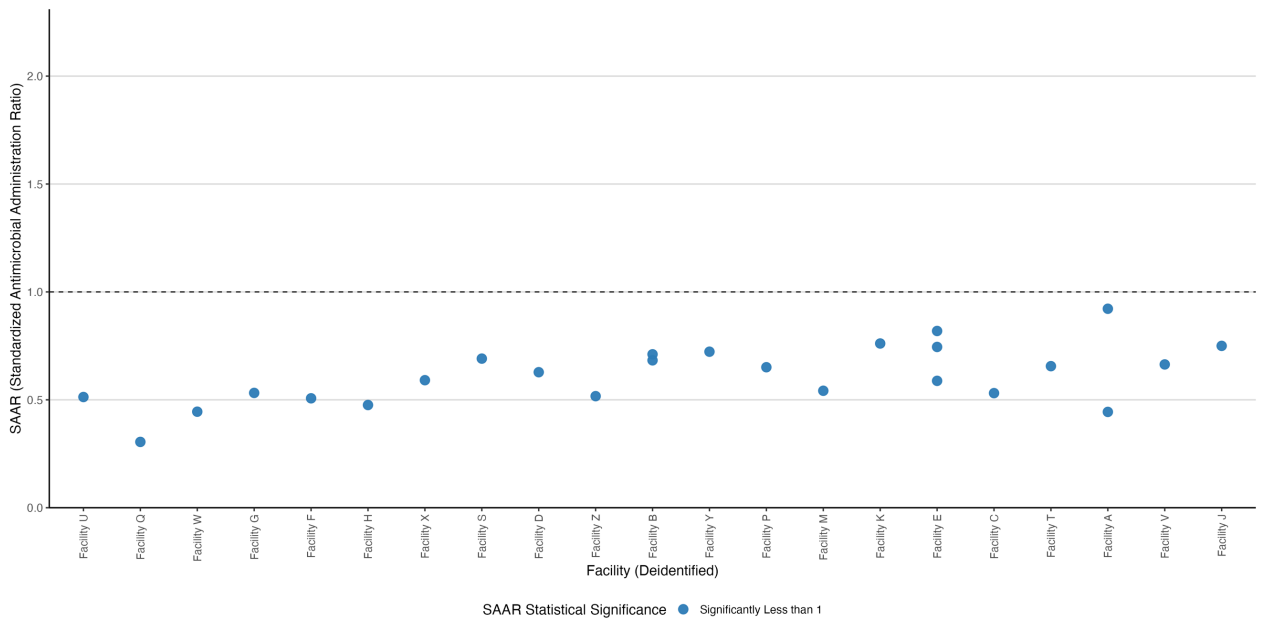


Figure A.8 SAARs for antibacterial agents predominately used to treat Gram-positive infections in Adult ICUs among ACHs during 2021.

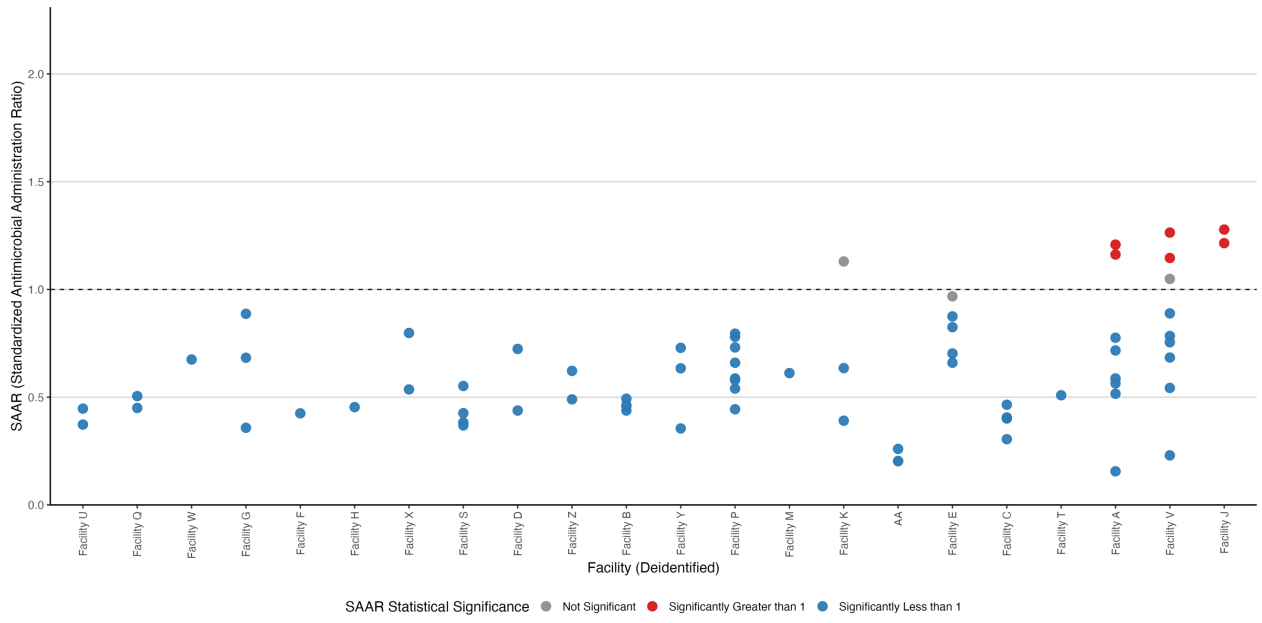


Figure A.9 SAARs for antibacterial agents predominately used to treat Gram-positive infections in Adult Wards among ACHs during 2021.

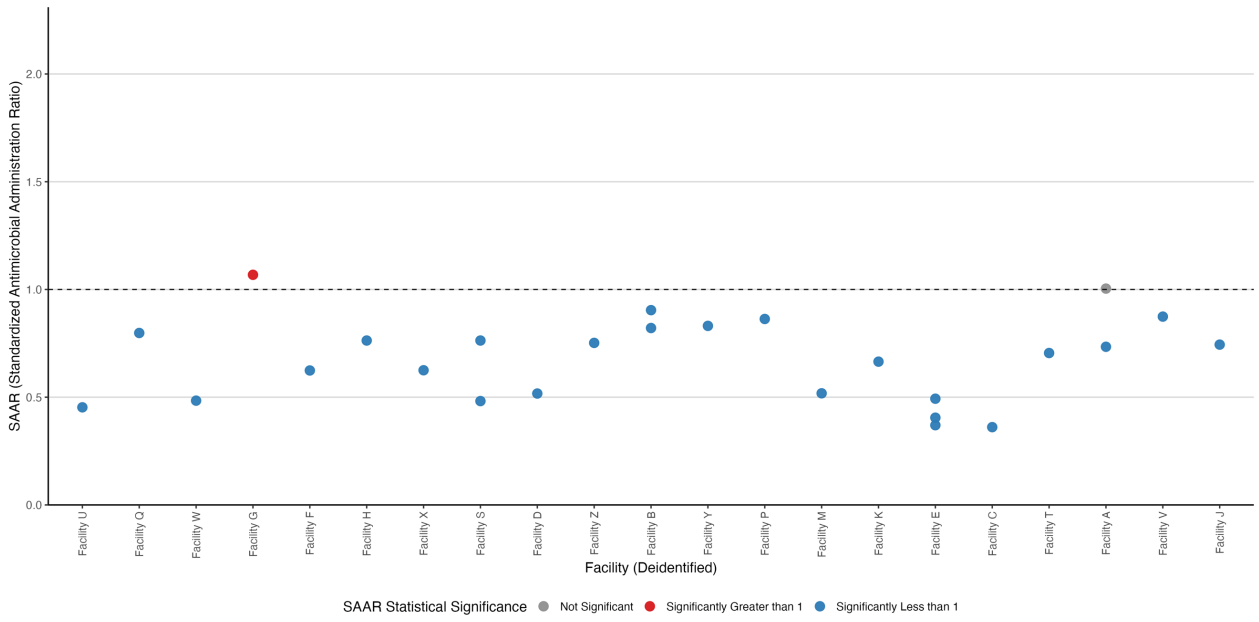


Figure A.10. SAARs for BSHO in Adult ICUs among ACHs during 2022.

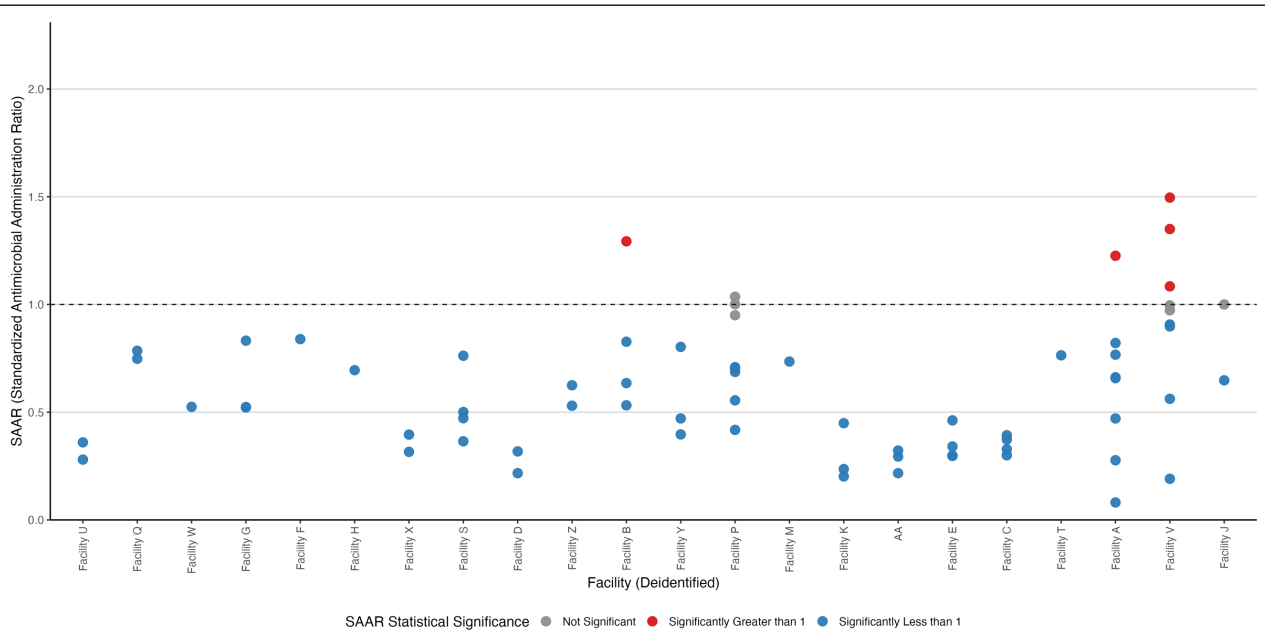


Figure A.11 SAARs for BSHO in Adult Wards among ACHs during 2022.

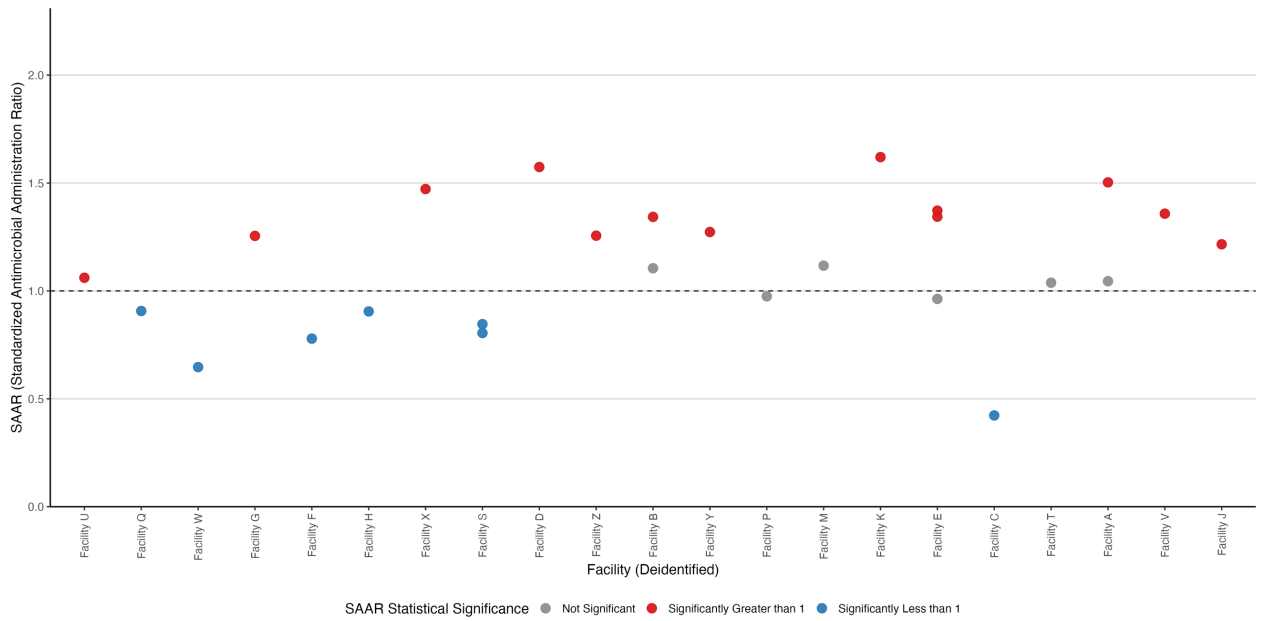


Figure A.12 SAARs for antibacterial agents posing highest risk for CDI among Adult ICUs in ACHs during 2022.

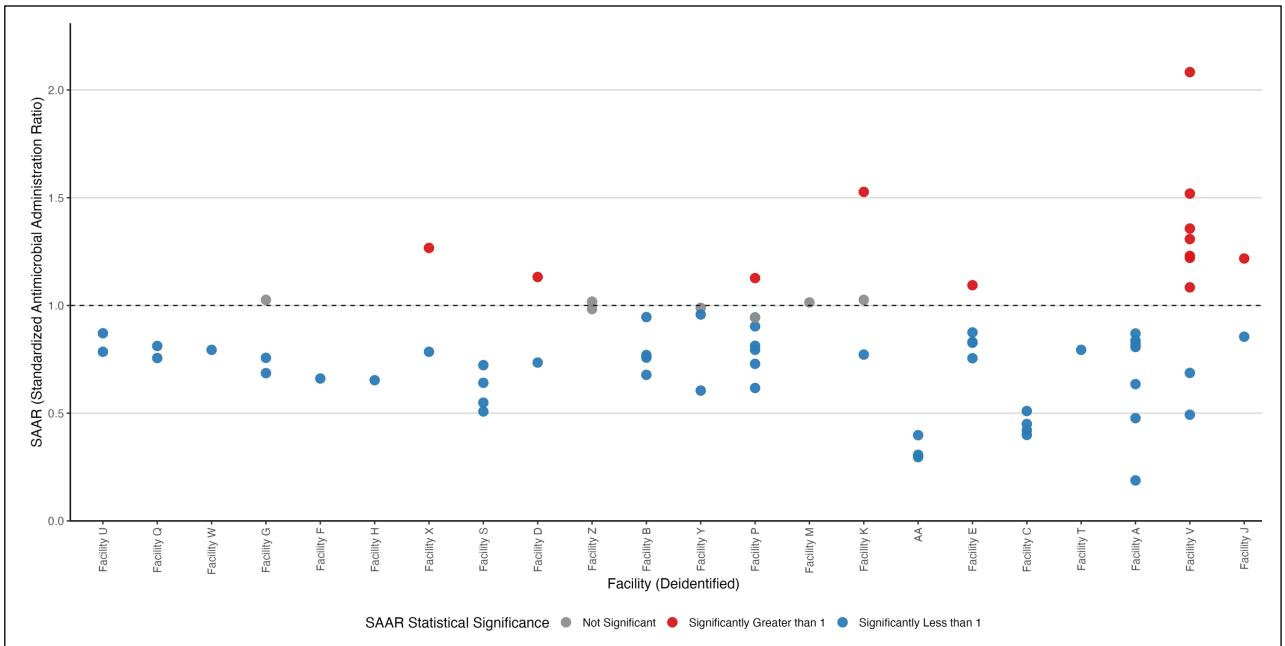


Figure A.13 SAARs for antibacterial agents posing highest risk for CDI among Adult Wards in ACHs during 2022.

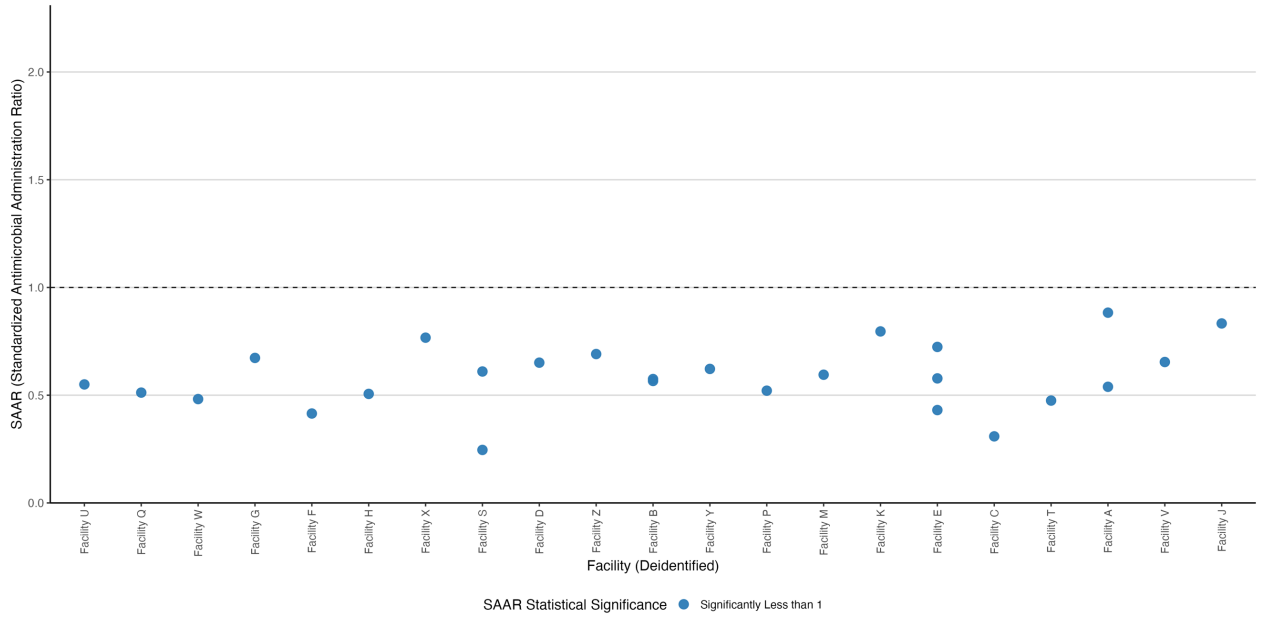


Figure A.14 SAARs for antibacterial agents predominately used to treat Gram-positive infections in Adult ICUs among ACHs during 2022.

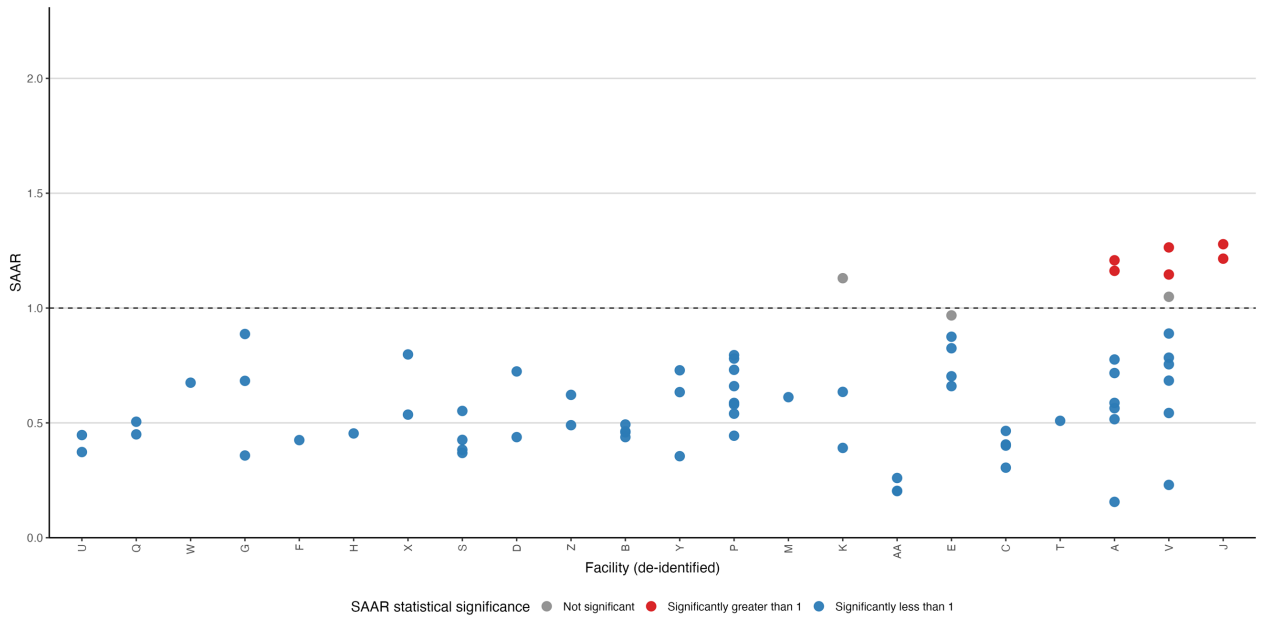


Figure A.15. SAARs for antibacterial agents predominately used to treat Gram-positive infections in Adult Wards among ACHs during 2022.

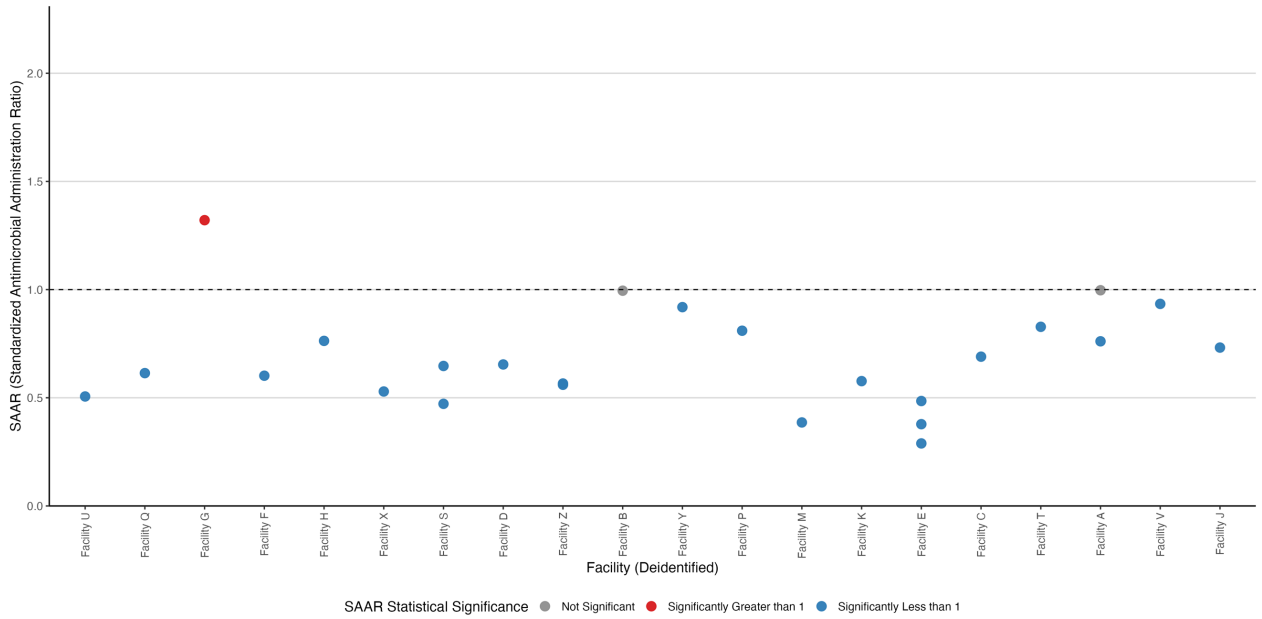


Figure A.16 SAARs for BSHO in Adult ICUs among ACHs during 2023.

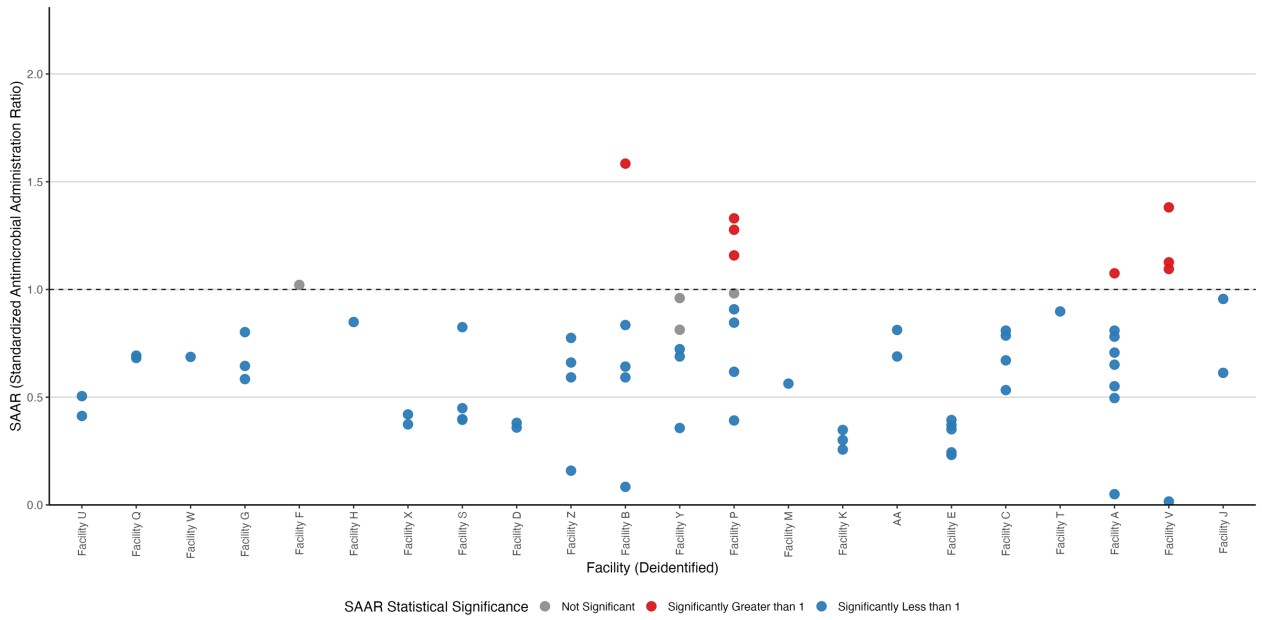


Figure A.17 SAARs for BSHO in Adult Wards among ACHs during 2023.

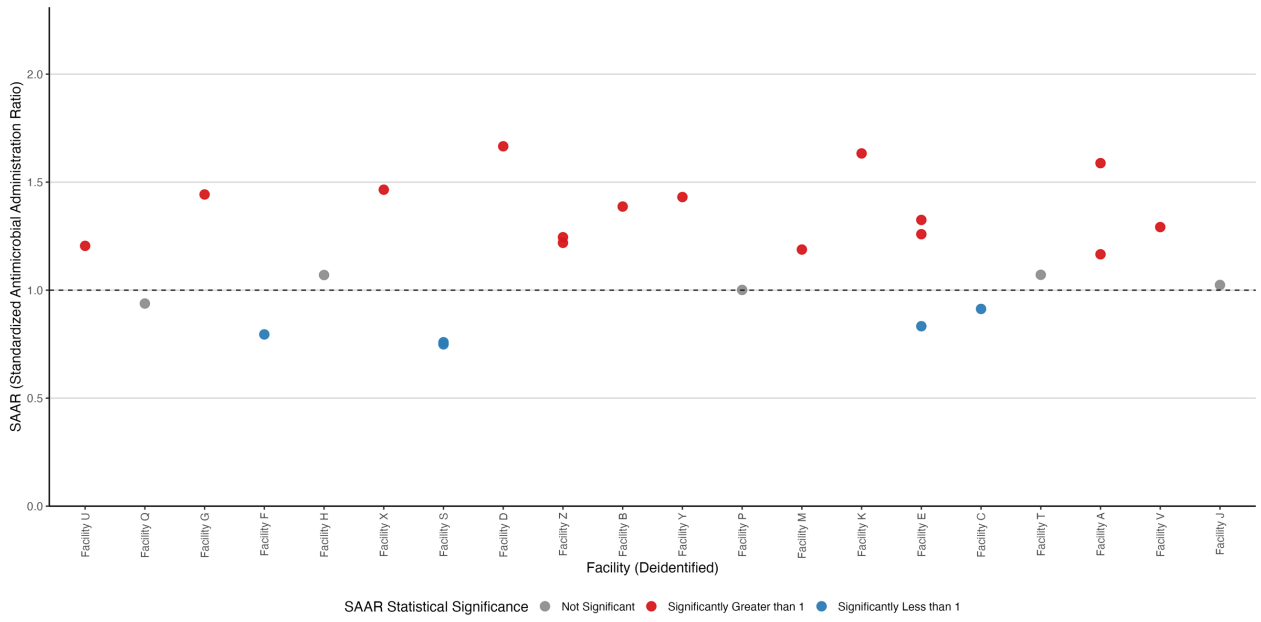


Figure A.18 SAARs for antibacterial agents posing highest risk of CDI in Adult ICUs among ACHs for 2023.

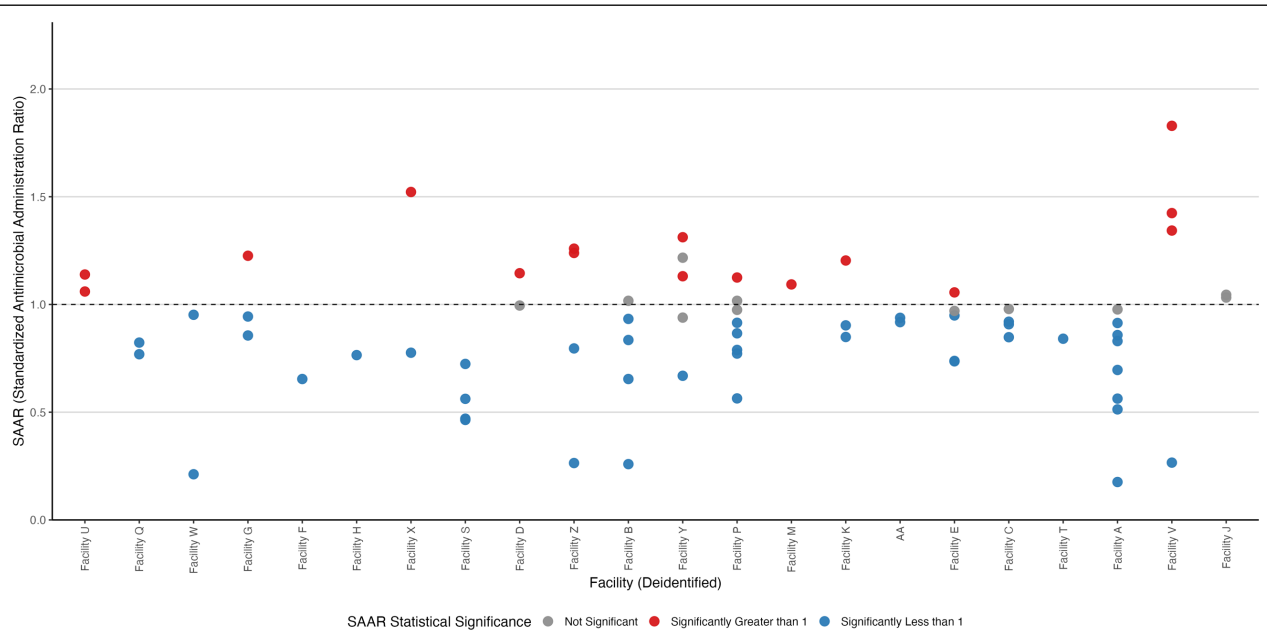


Figure A.19 SAARs for antibacterial agents posing highest risk of CDI in Adult Wards among ACHs for 2023.

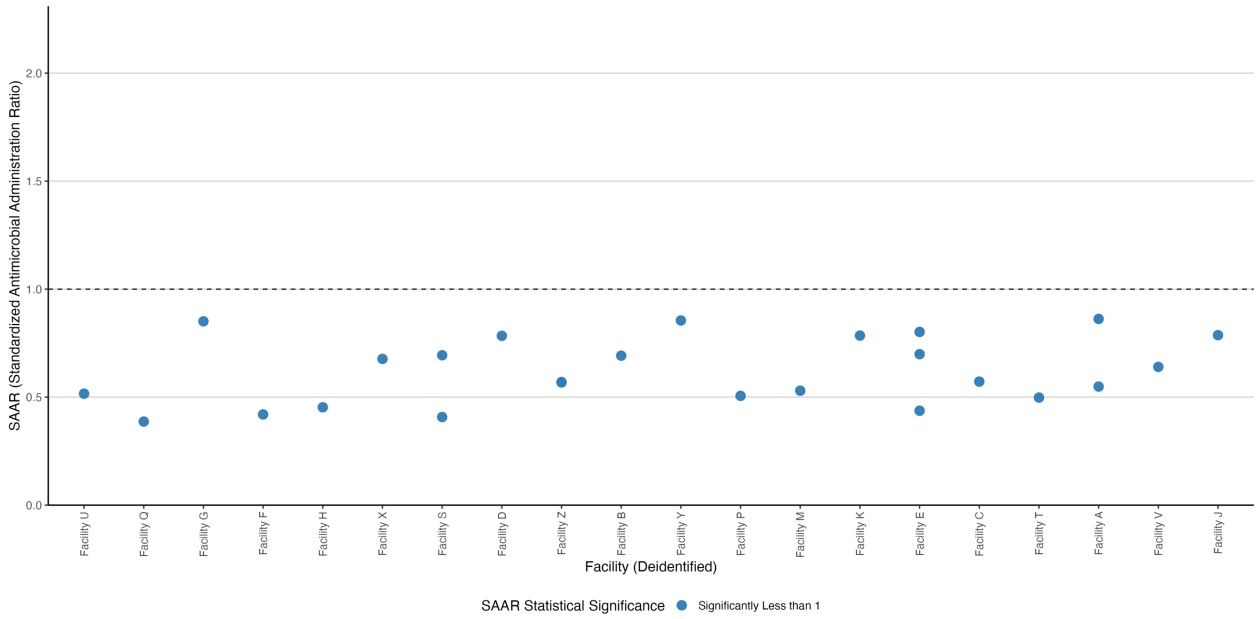


Figure A.20 SAARs for antibacterial agents predominately used to treat Gram-positive infections in Adult ICUs among ACHs during 2023.

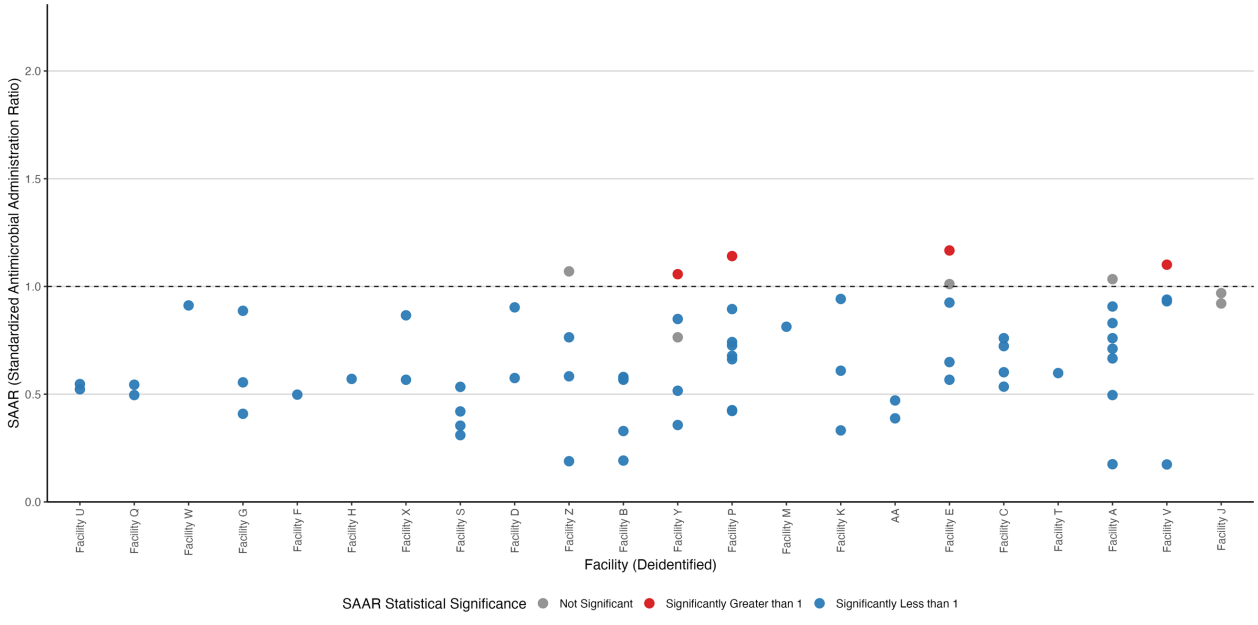


Figure A.21 SAARs for antibacterial agents predominately used to treat Gram-positive infections in Adult Wards among ACHs during 2023.

Figures A.22–47 SAAR Point Plots for CAHs, 2021-2024

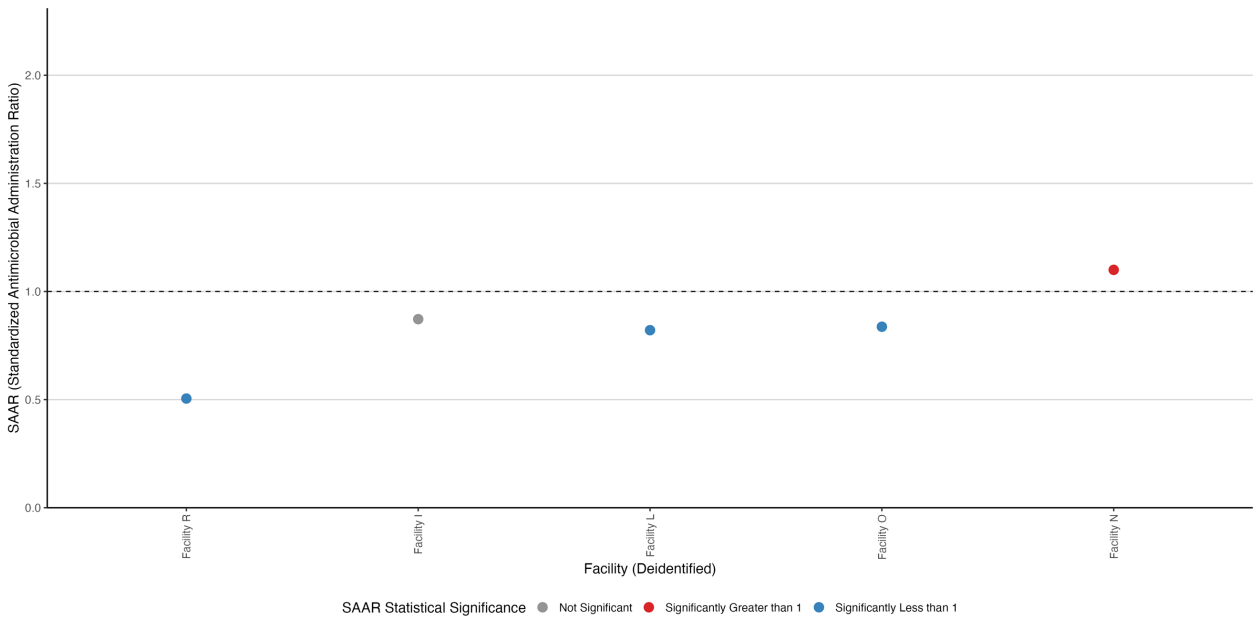


Figure A.22 SAARs for BSHO in Adult ICUs among CAHs during 2021.

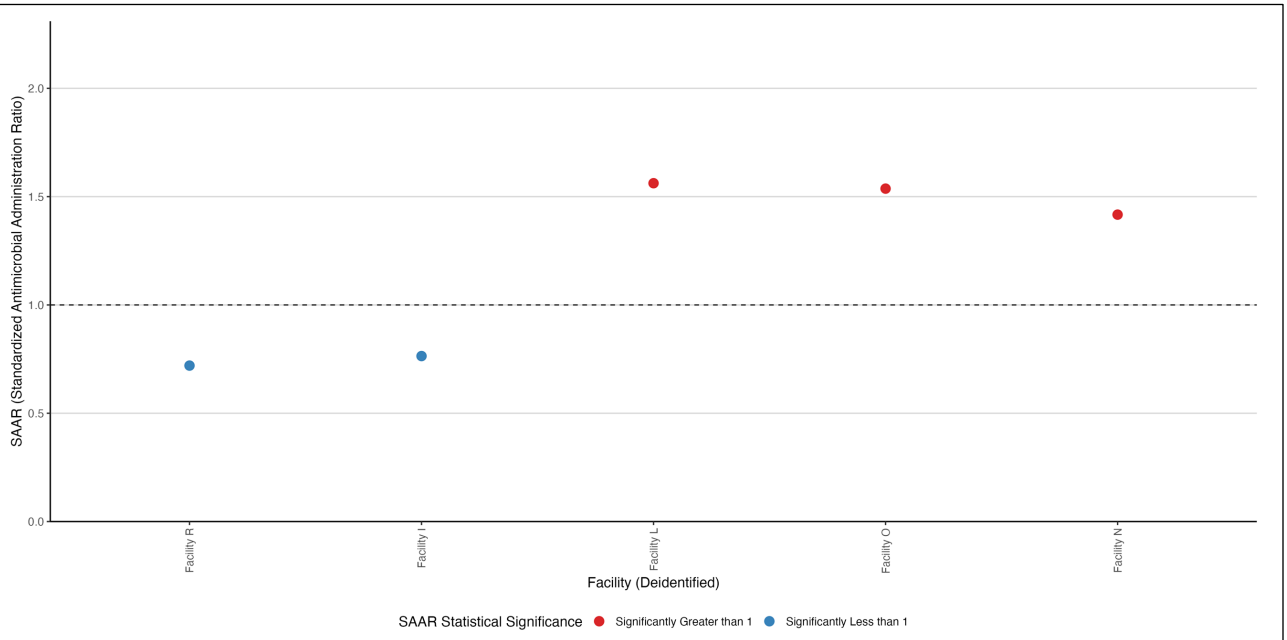


Figure A.23 SAARs for BSHO in Adult Wards among CAHs during 2021.

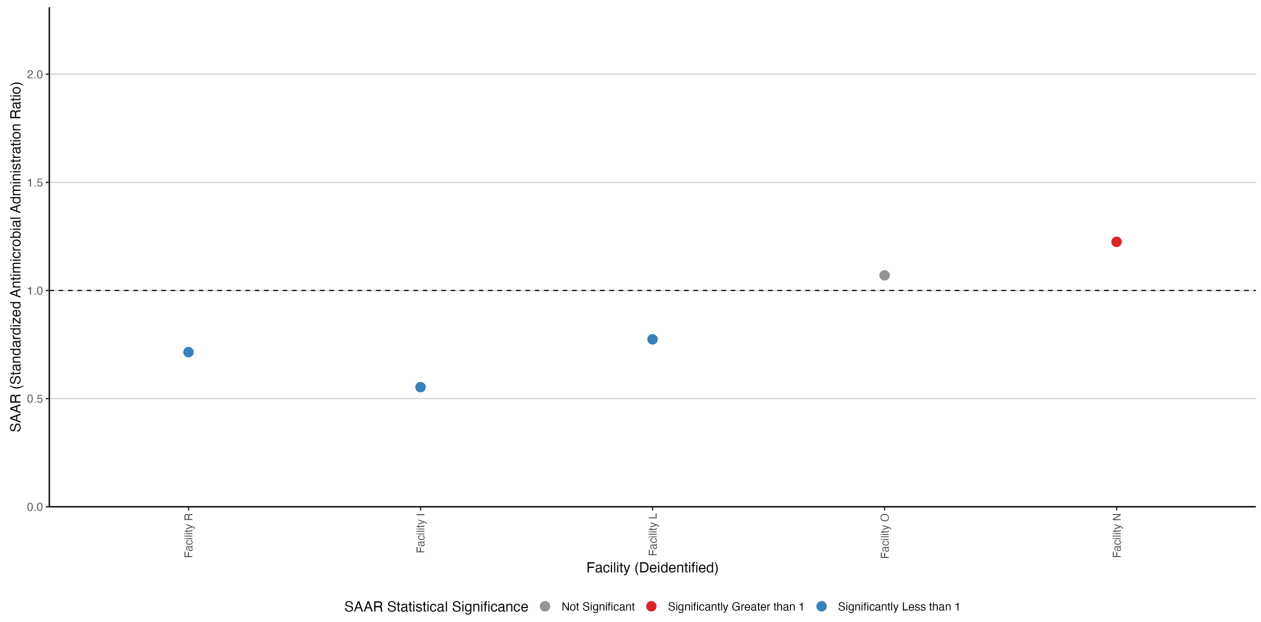


Figure A.24 SAARs for antibacterial agents posing highest risk of CDI in Adult ICUs among CAHs for 2021.

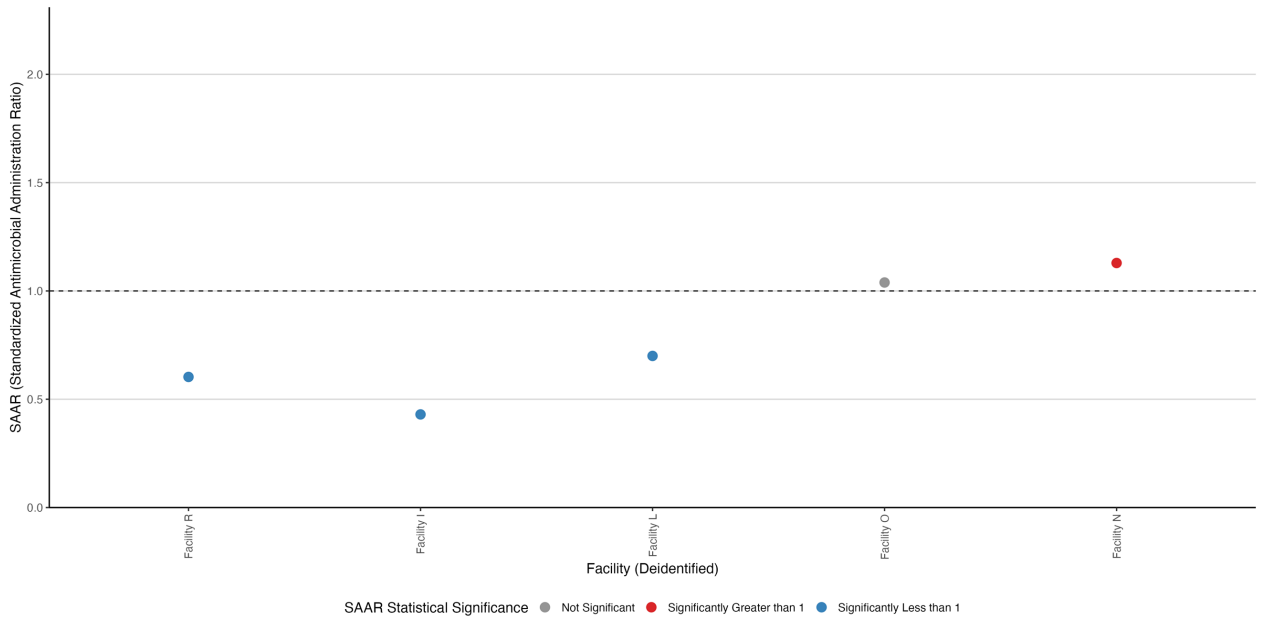


Figure A.25 SAARs for antibacterial agents posing highest risk of CDI in Adult Wards among CAHs for 2021.

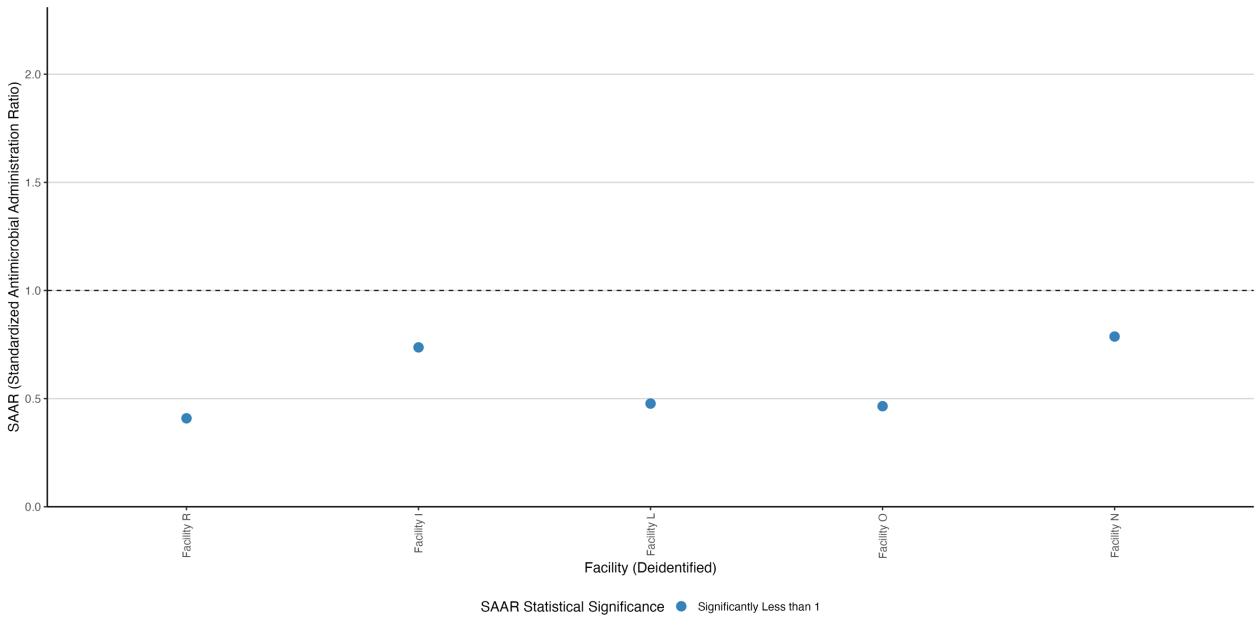


Figure A.26 SAARs for antibacterial agents predominately used to treat Gram-positive infections in Adult ICUs among CAHs during 2021.

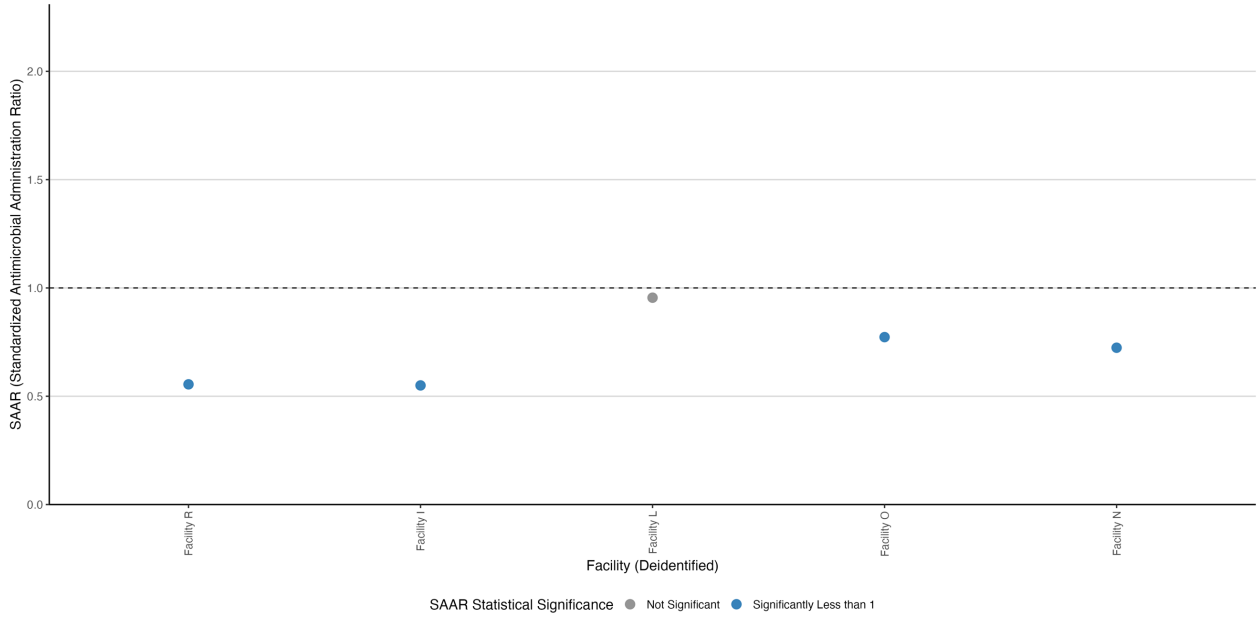


Figure A.27 SAARs for antibacterial agents predominately used to treat Gram-positive infections in Adult Wards among CAHs during 2021.

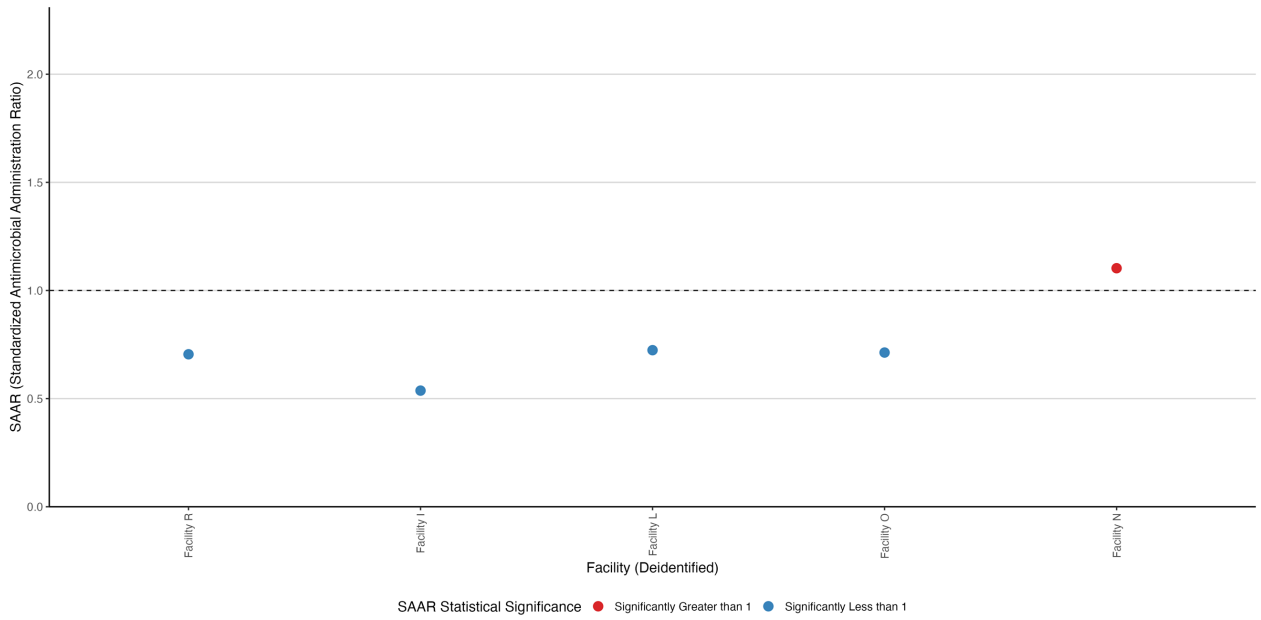


Figure A.28 SAARs for BSHO in Adult ICUs among CAHs during 2022.

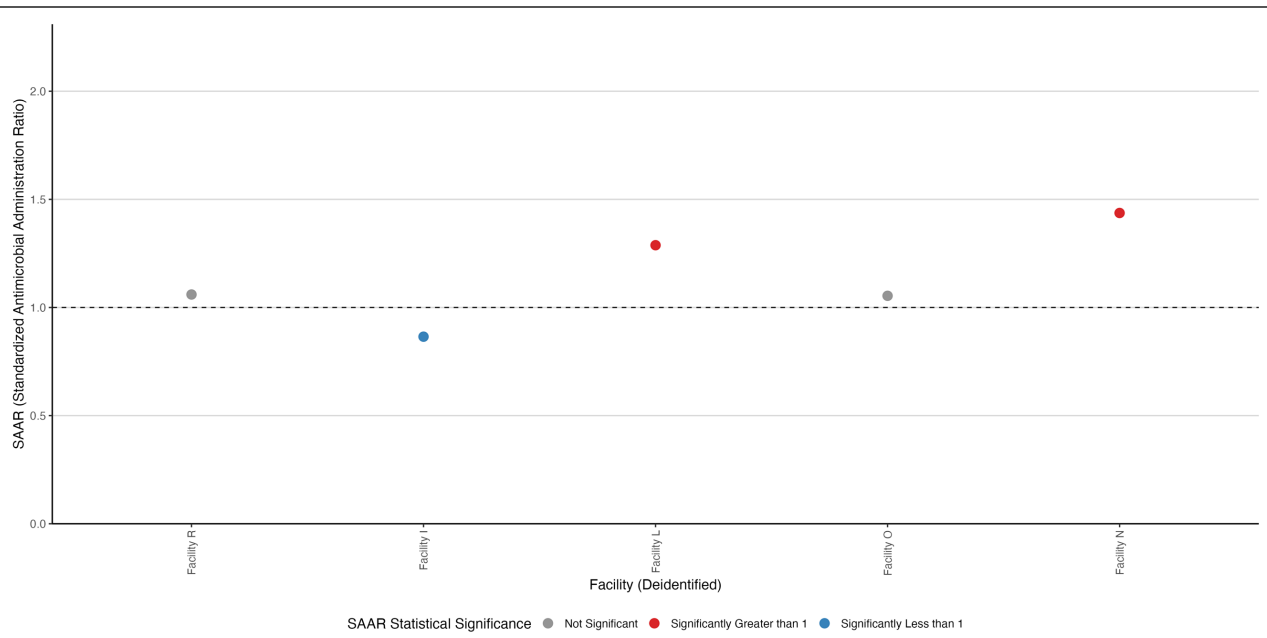


Figure A.29 SAARs for BSHO in Adult Wards among CAHs during 2022.

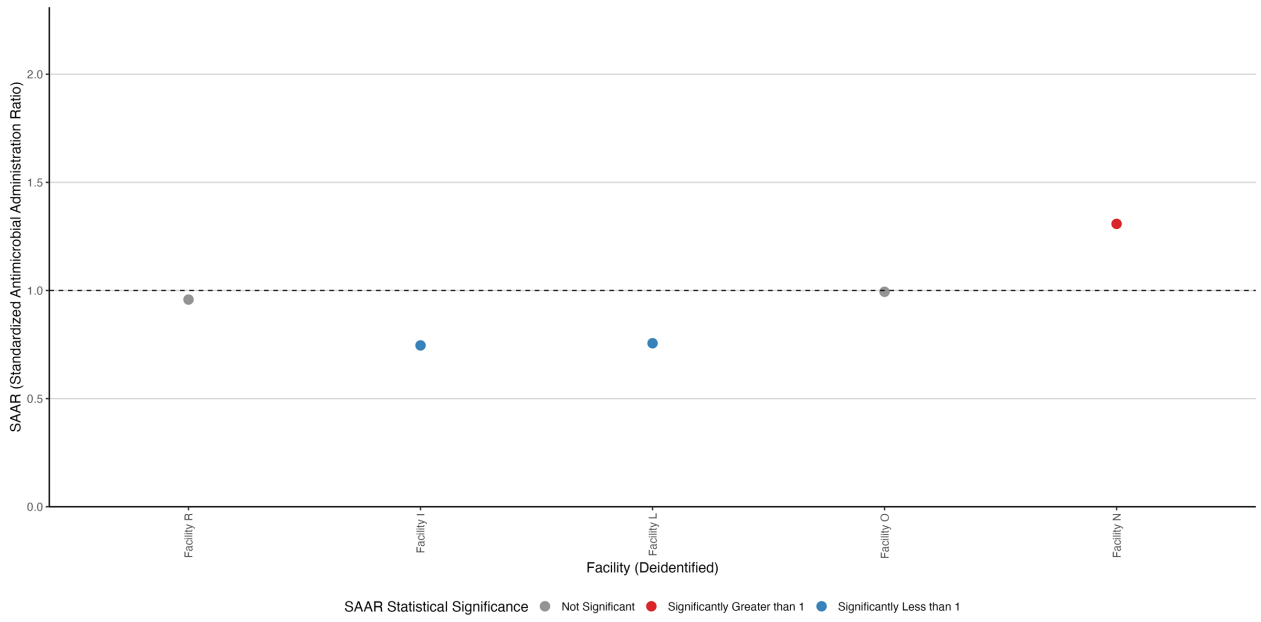


Figure A.30 SAARs for antibacterial agents posing highest risk of CDI in Adult ICUs among CAHs for 2022.

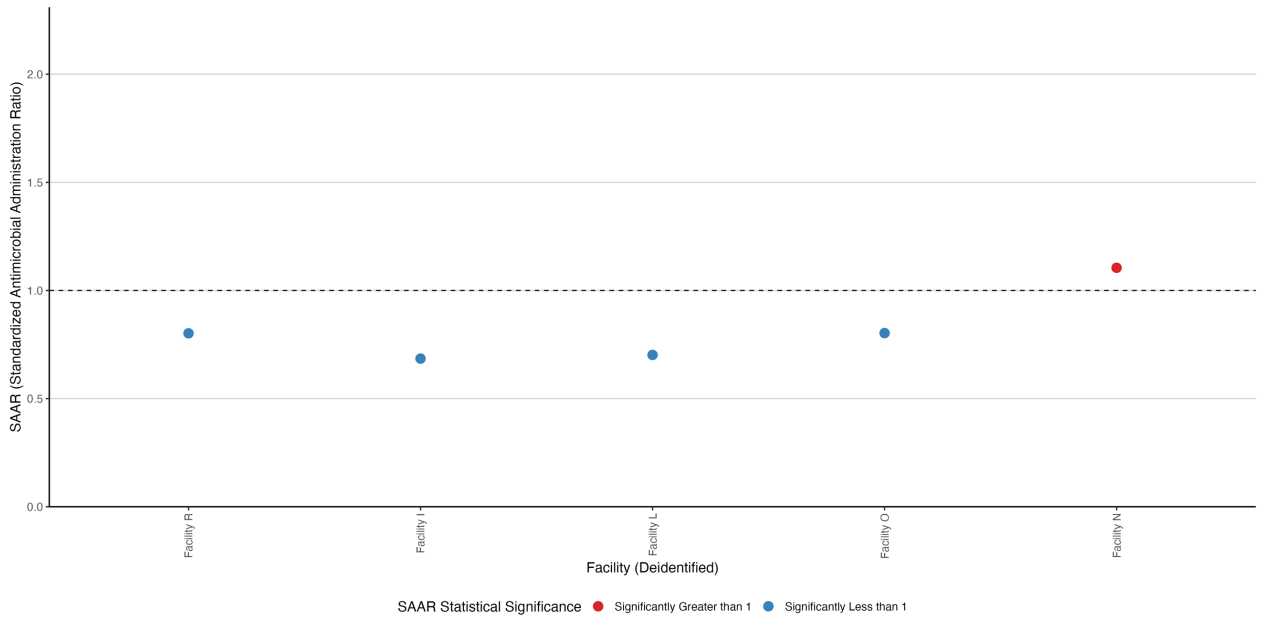


Figure A.31 SAARs for antibacterial agents posing highest risk of CDI in Adult Wards among CAHs for 2022.

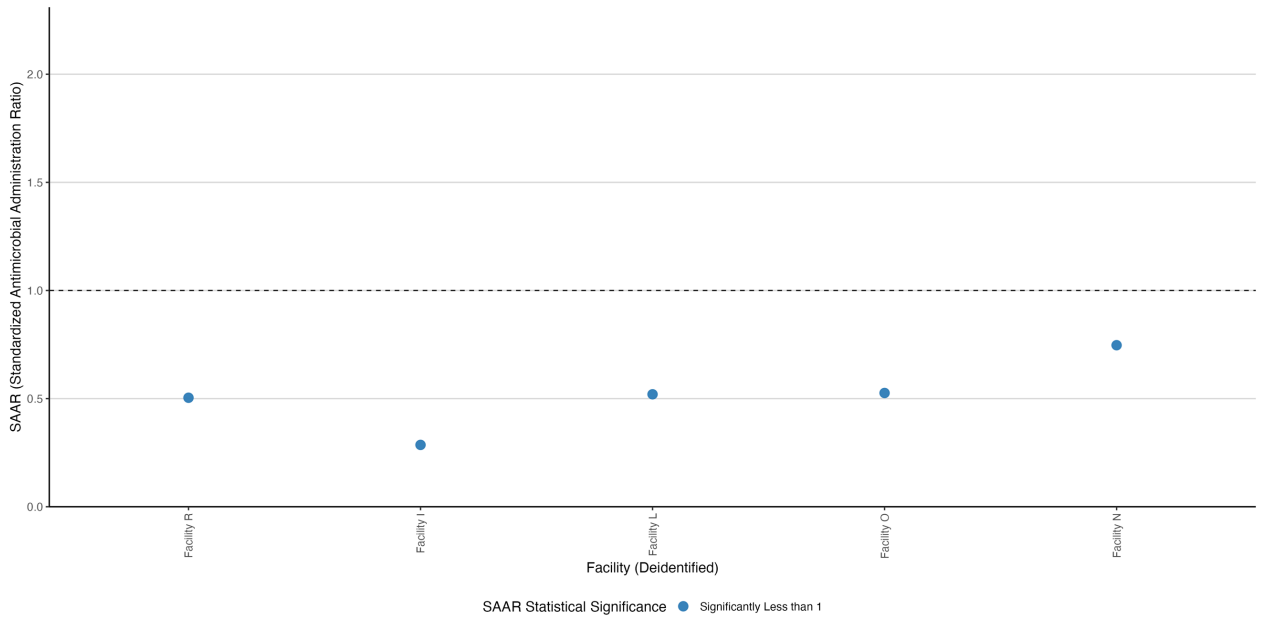


Figure A.33 SAARs for antibacterial agents predominately used to treat Gram-positive infections in Adult ICUs among CAHs during 2022.

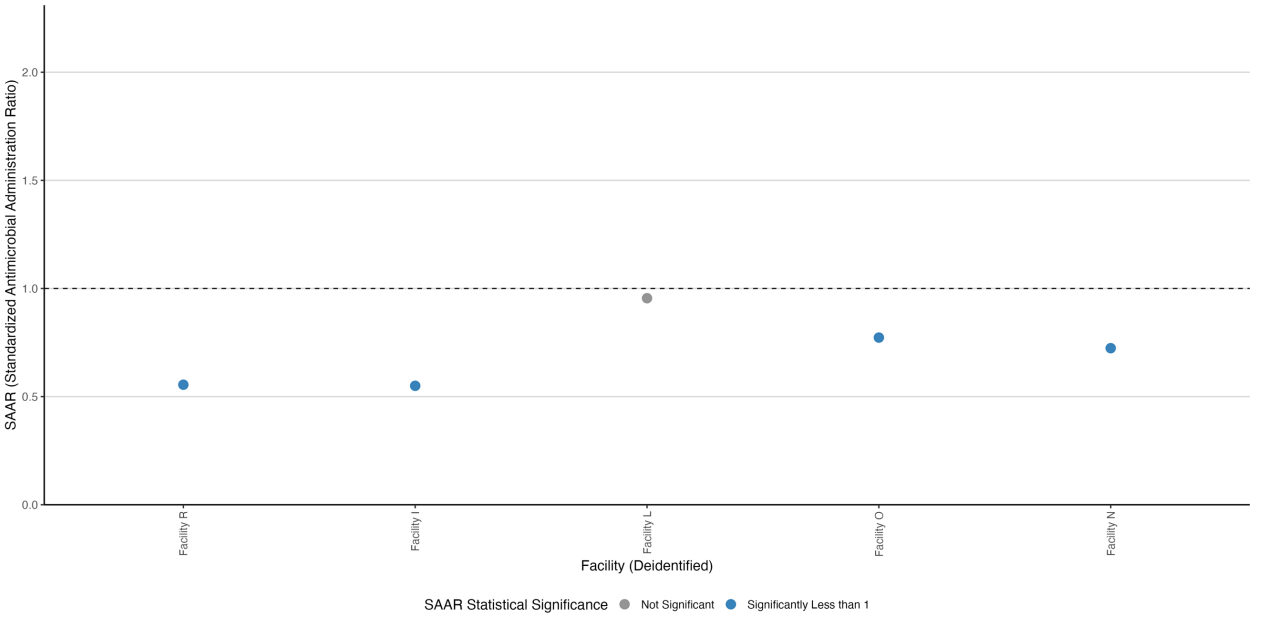


Figure A.34 SAARs for antibacterial agents predominately used to treat Gram-positive infections in Adult Wards among CAHs during 2022.

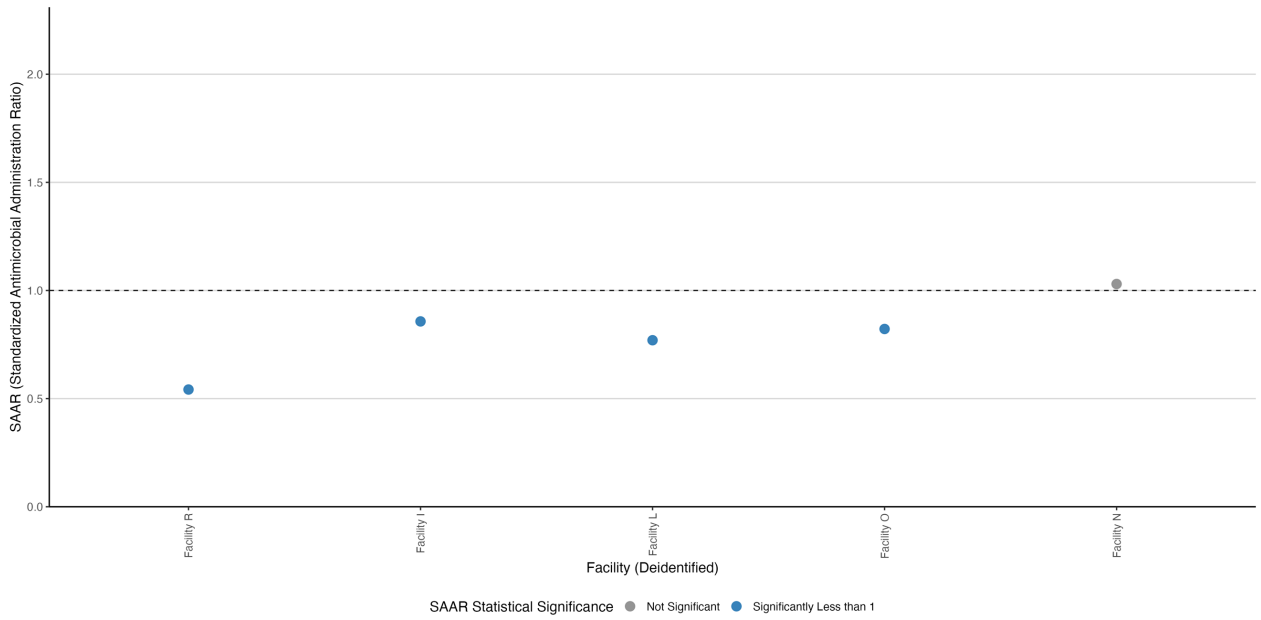


Figure A.35 SAARs for BSHO in Adult ICUs among CAHs during 2023.

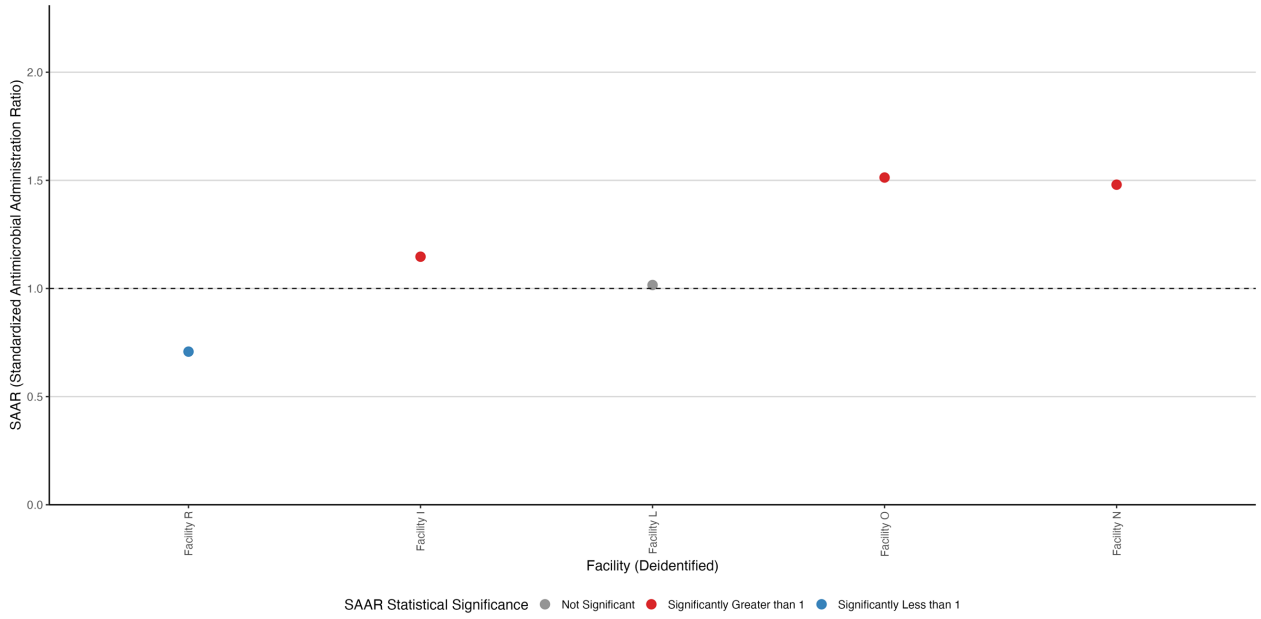


Figure A.36 SAARs for BSHO infections in Adult Wards among CAHs during 2023.

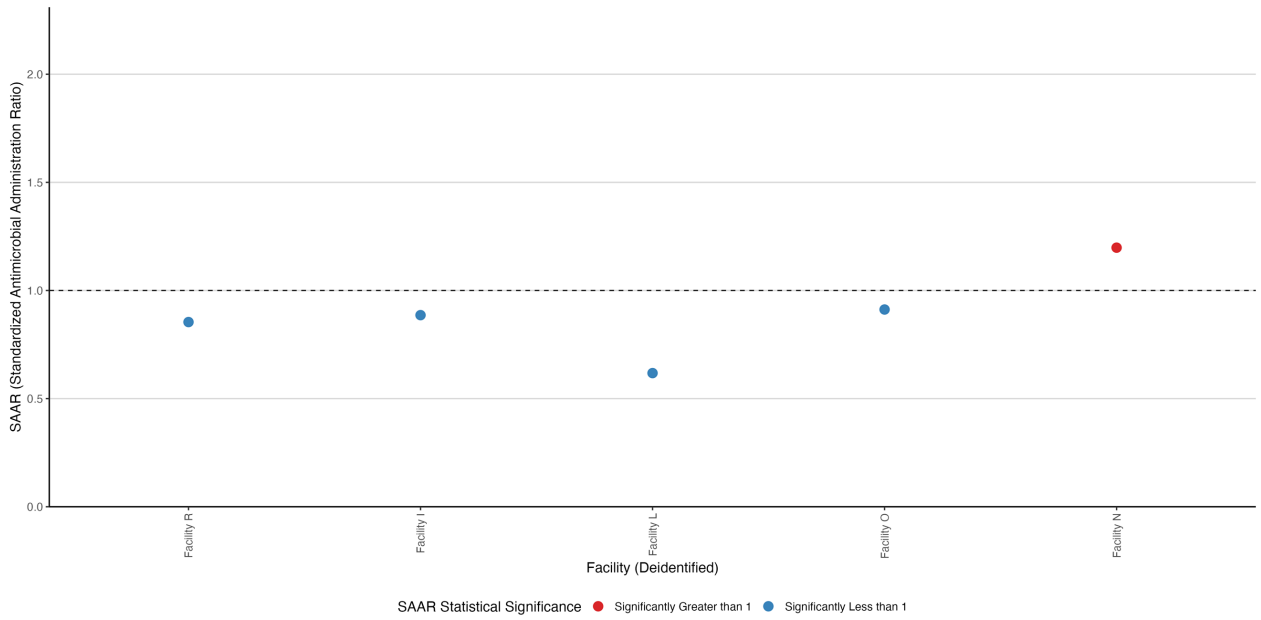


Figure A37 SAARs for antimicrobial agents posing the highest risk for CDI in Adult ICUs among CAHs during 2023.

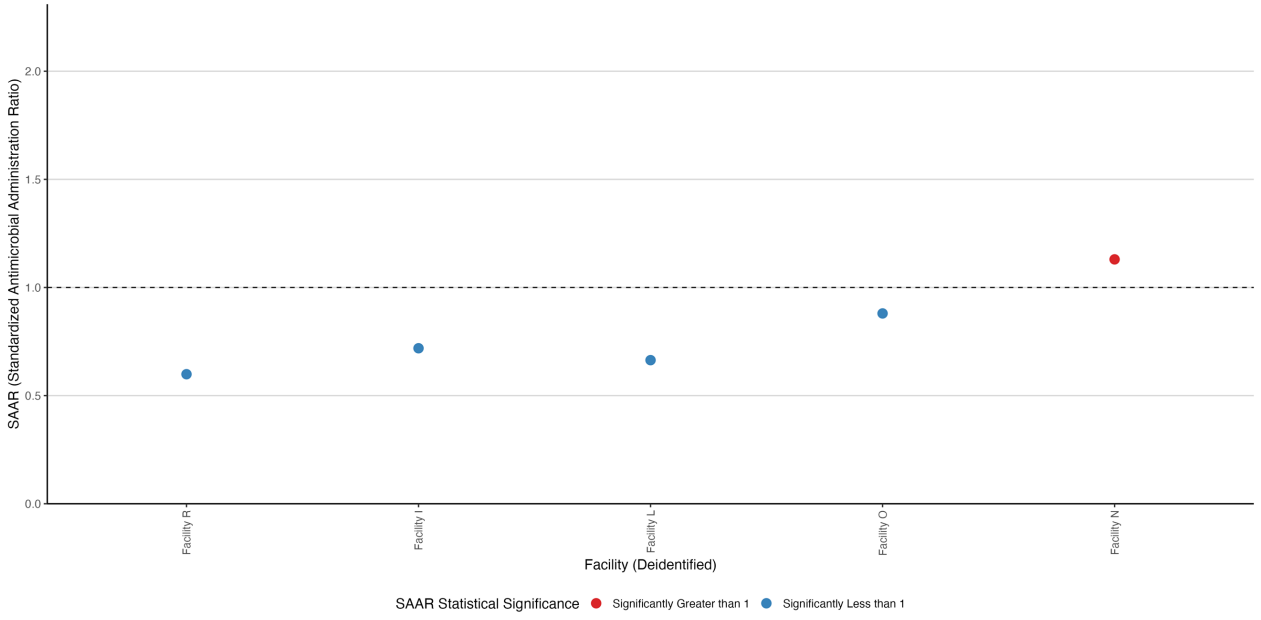


Figure A.38 SAARs for antimicrobial agents posing the highest risk for CDI in Adult Wards among CAHs during 2023.

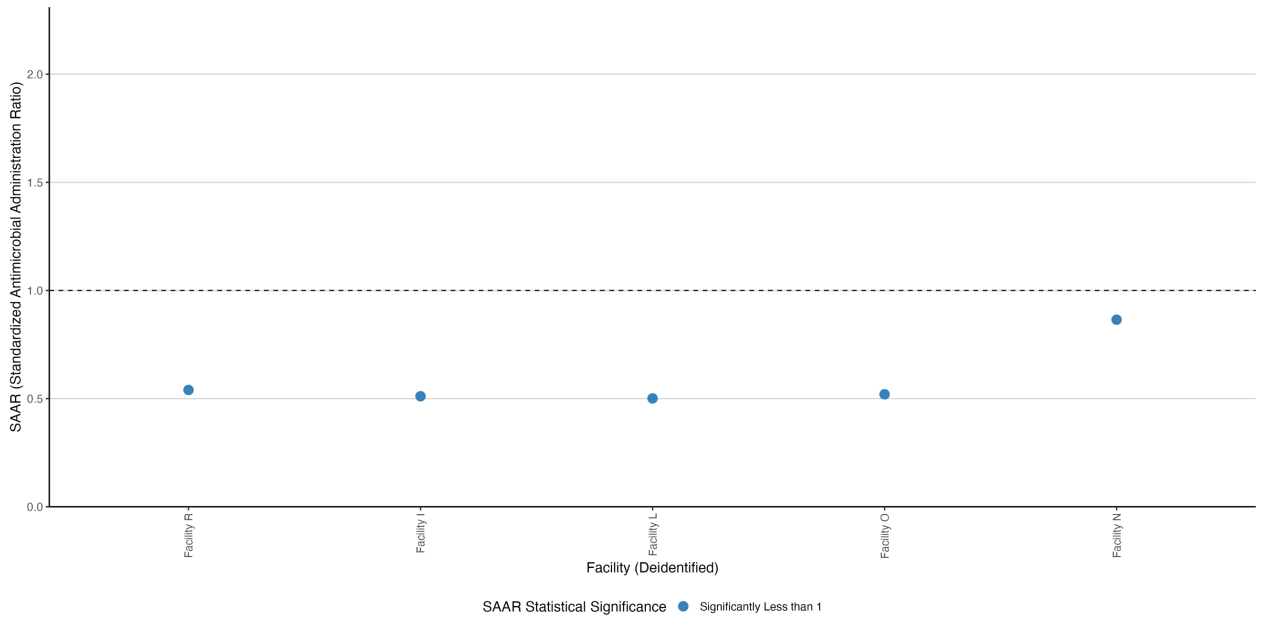


Figure A.39 SAARs for antibacterial agents predominately used for resistant Gram-positive infections in Adult ICUs among CAHs during 2023.

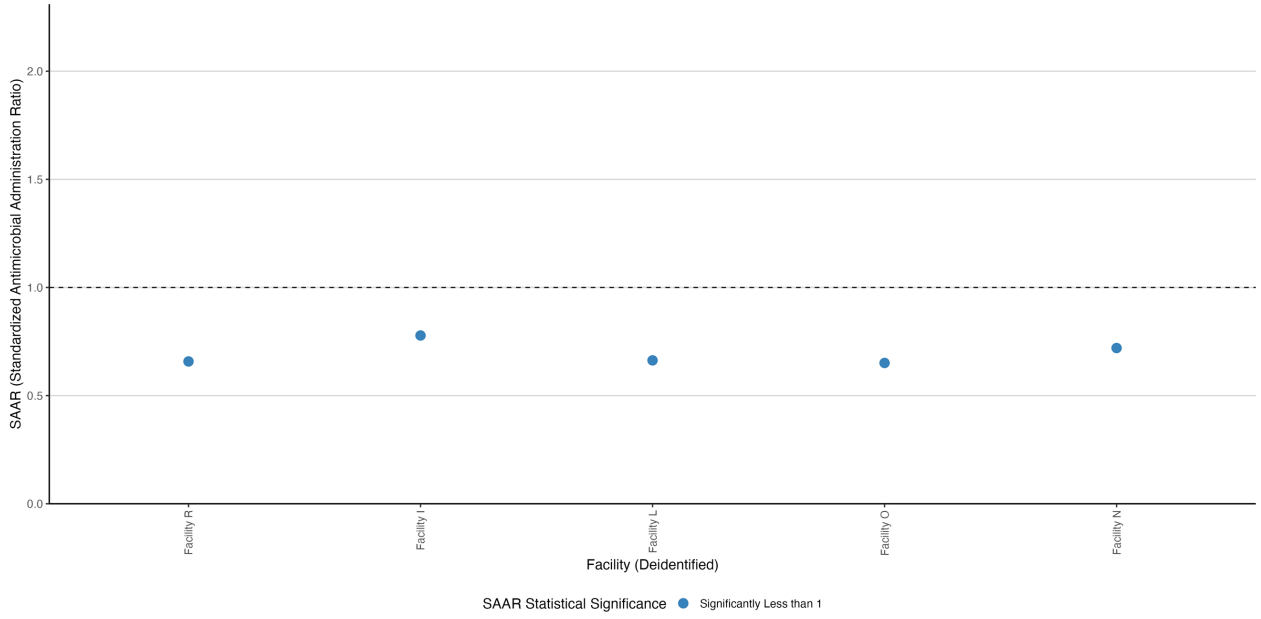


Figure A.40 SAARs for antibacterial agents predominately used for resistant Gram-positive infections in Adult Wards among CAHs during 2023.

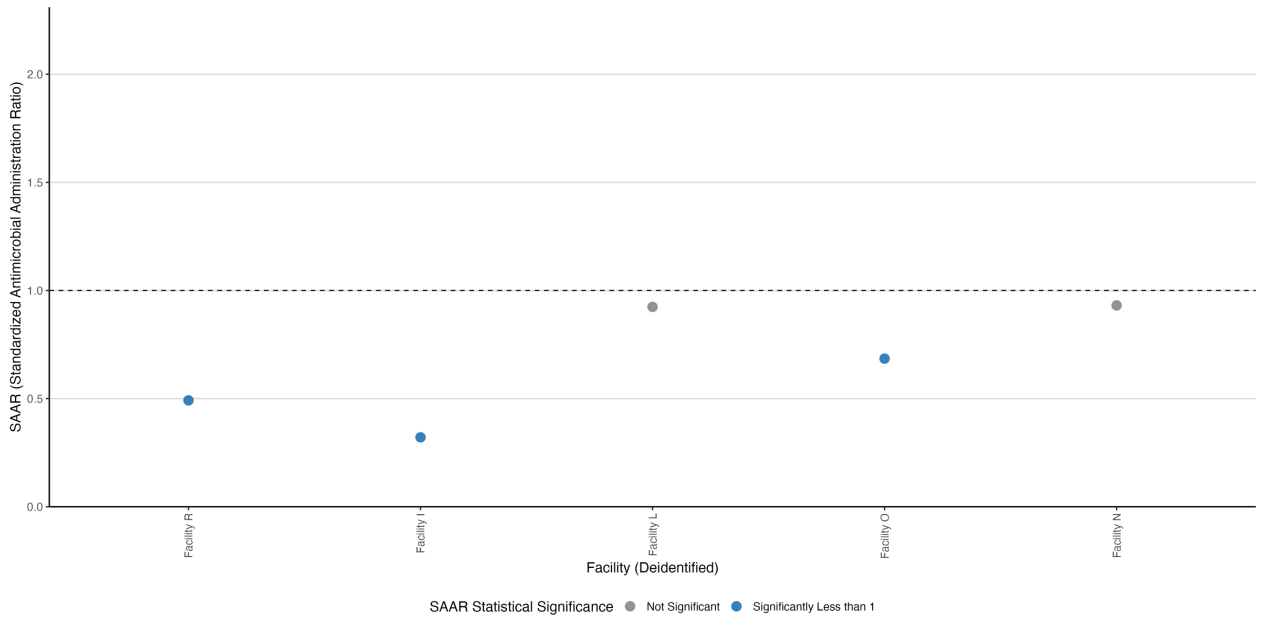


Figure A.41 SAARs for BSHO in Adult ICUs among CAHs during 2024.

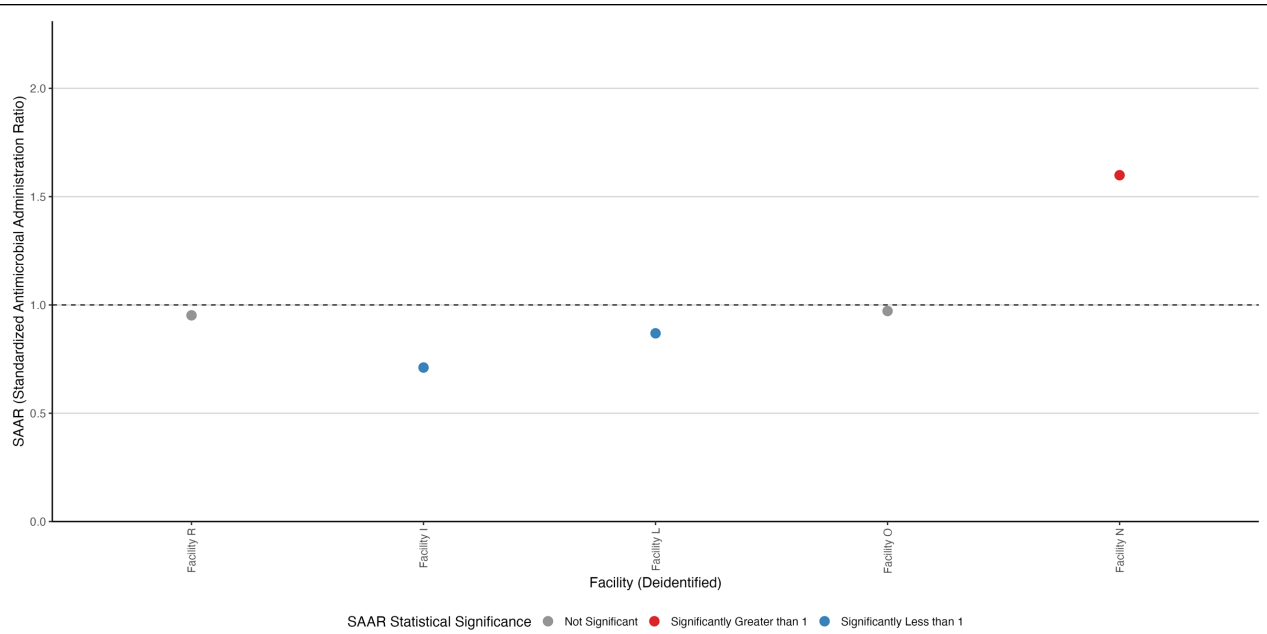


Figure A.42 SAARs for BSHO in Adult Wards among CAHs during 2024.

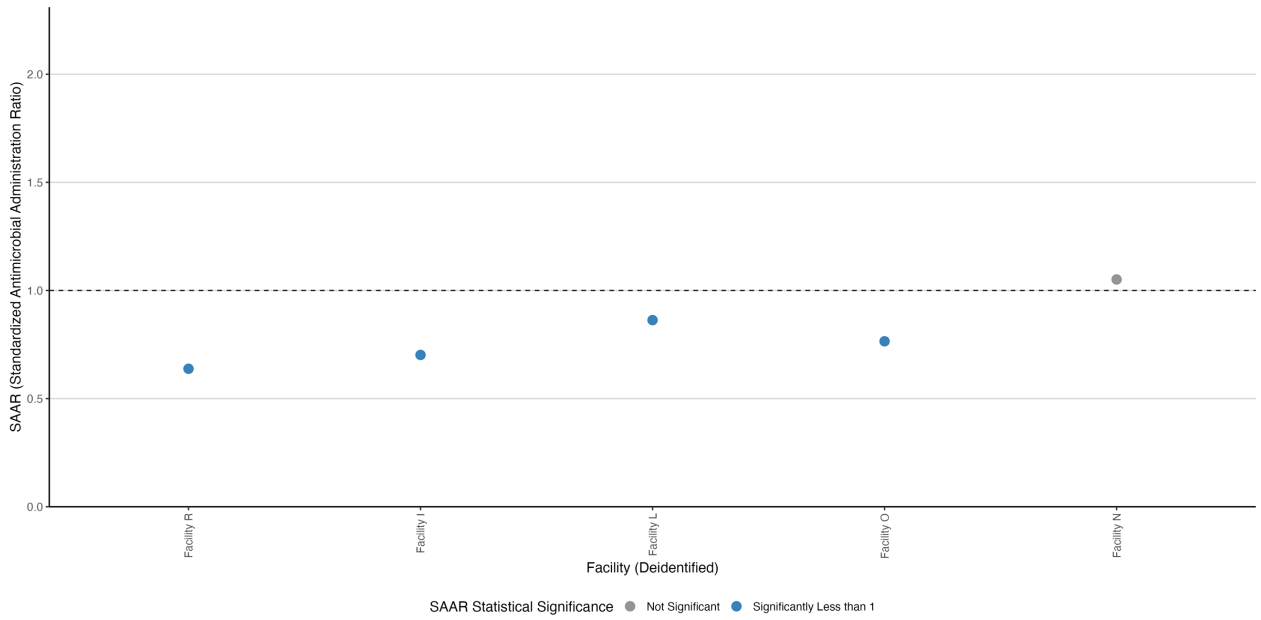


Figure A.43 SAARs for antibacterial agents posing highest risk for CDI in Adult ICUs among CAHs during 2024.

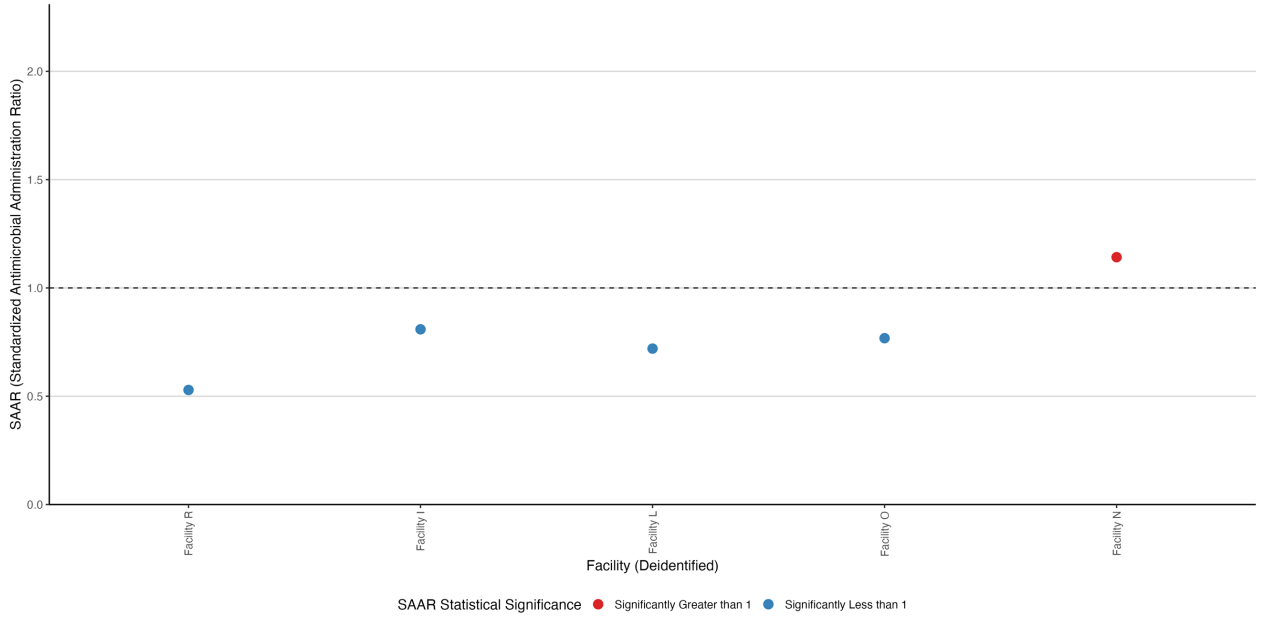


Figure A.44 SAARs for antibacterial agents posing highest risk for CDI in Adult Ward among CAHs during 2024.

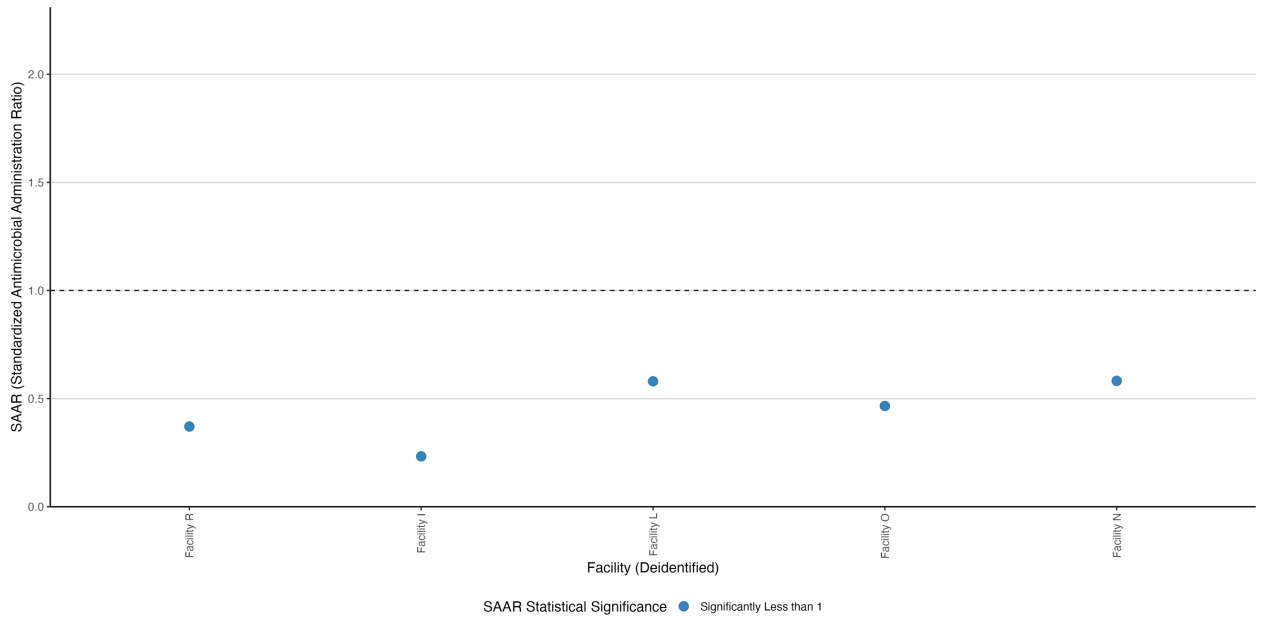


Figure A.45 SAARs for antibacterial agents predominately used for resistant Gram-positive infections in Adult ICUs among CAHs during 2024.

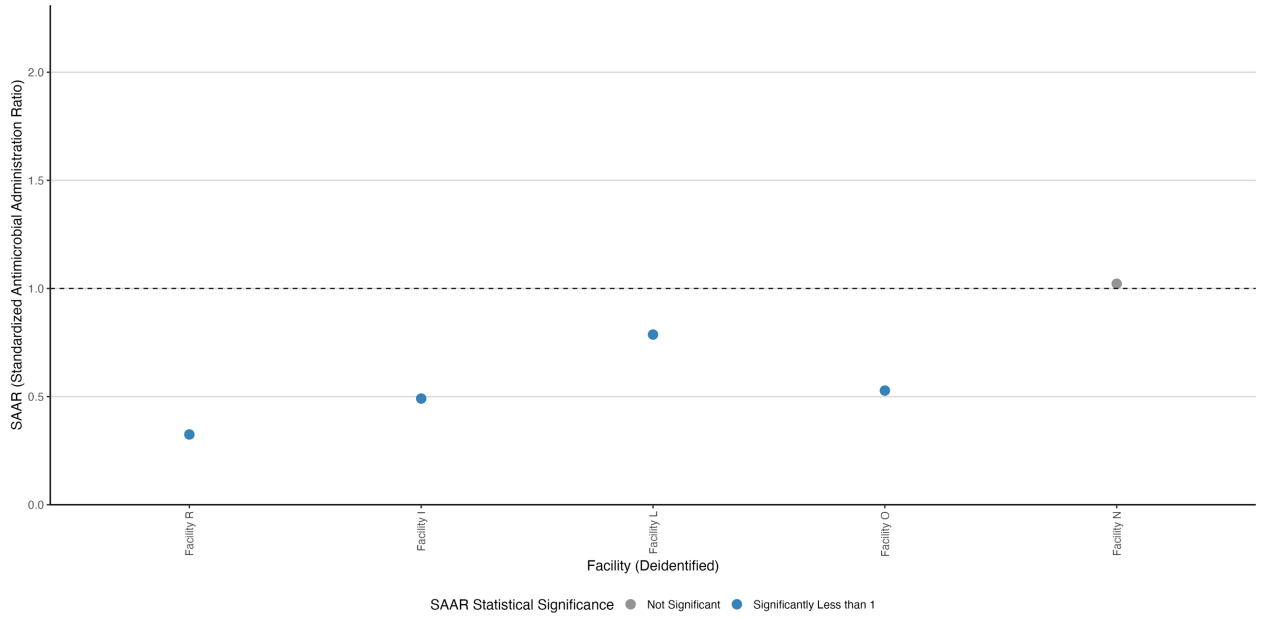


Figure A.46 SAARs for antibacterial agents predominately used for resistant Gram-positive infections in Adult Wards among CAHs during 2024.

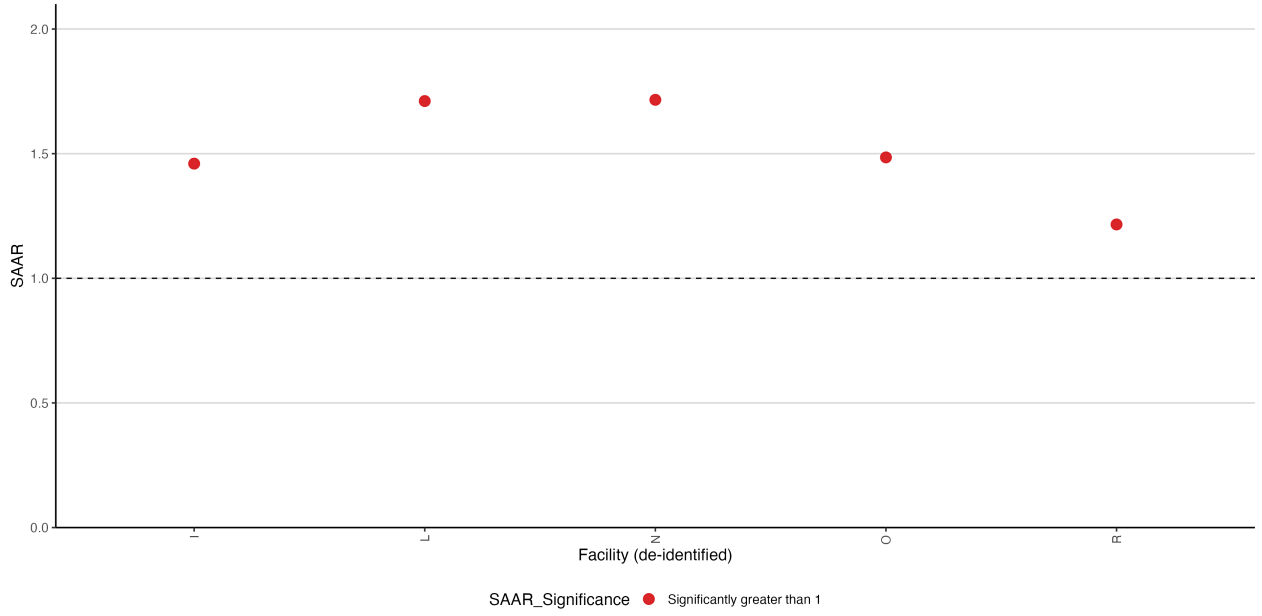


Figure A.47 SAARs for narrow-spectrum beta-lactam agents in Adult Wards among CAHs during 2024.

Figures A.48-50 Caterpillar Plots for Annual SAAR Values for Pediatric Units, 2021-2024

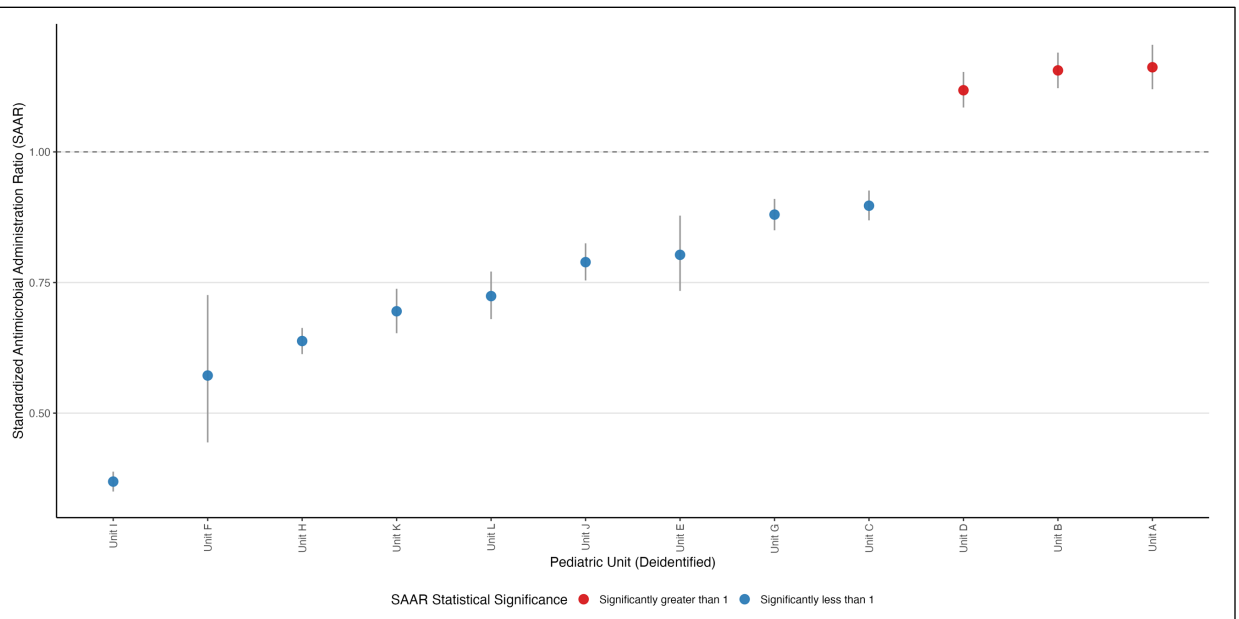


Figure A.48 Pediatric SAARs for all antibacterial agents by unit, 2021.

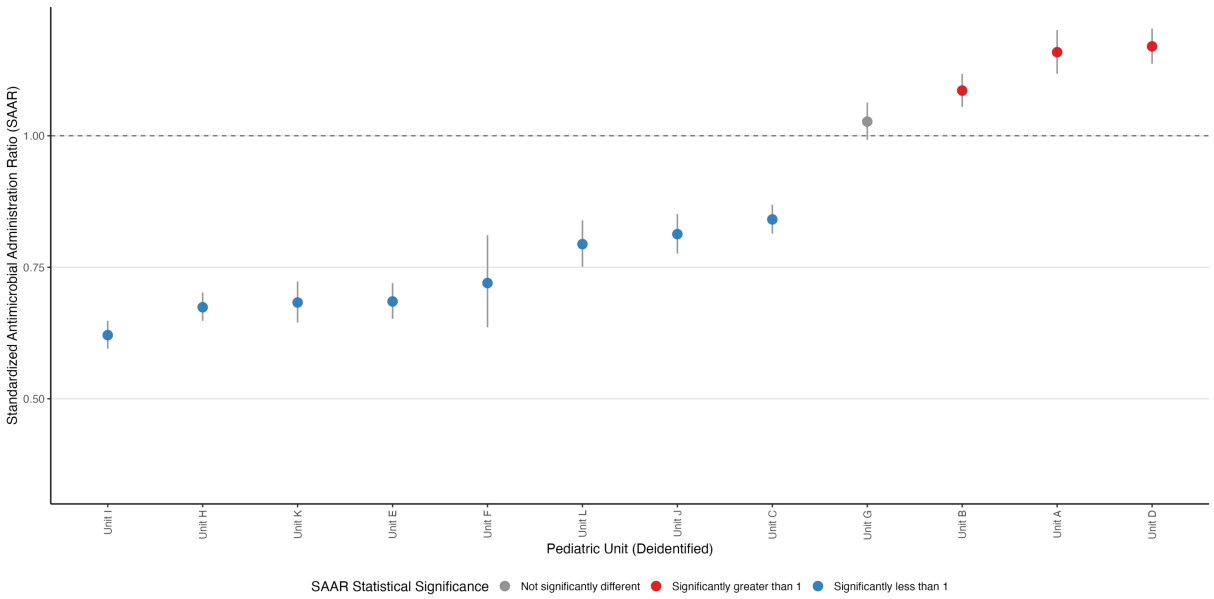


Figure A.49 Pediatric SAARs for all antibacterial agents by unit, 2022.

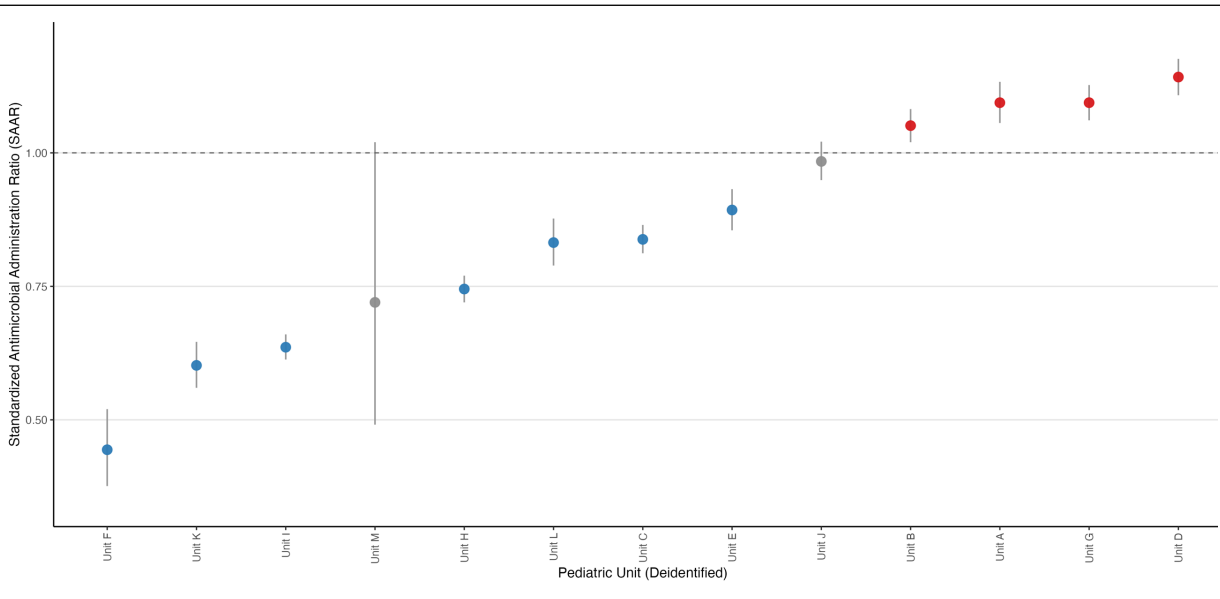


Figure A.50 Pediatric SAARs for all antibacterial agents by unit, 2023.

Appendix B. Supplemental Methods

B.1 Map Generation

The map in Figure 1 was generated in R (version 4.4.0) using the sf, ggplot2, dplyr, and tibble packages. County boundary geometries were obtained from the U.S. Census Bureau TIGER/Line generalized county shapefile (2022 release) and filtered to include counties within Oregon (STATEFP = 41). Spatial geometries were transformed to the WGS84 coordinate reference system (EPSG:4326) to align with facility latitude and longitude coordinates.

County polygons were classified as urban, rural, or frontier based on designations from the Oregon Office of Rural Health. Counties classified as frontier included Baker, Gilliam, Grant, Harney, Lake, Malheur, Morrow, Sherman, Wallowa, and Wheeler. Counties classified as urban included Multnomah, Washington, Clackamas, Lane, Marion, Deschutes, Benton, and Jackson. All remaining counties were categorized as rural. These classifications were applied to county polygons and displayed using distinct fill colors to illustrate geographic variation in population density and healthcare access across the state.

Locations of ORASN hospitals contributing AU data were plotted as spatial point features using facility latitude and longitude coordinates. Hospitals were categorized as ACHs or CAHs using facility classification lists obtained from the Oregon Health Authority and the Oregon Office of Rural Health. Point symbols were encoded by hospital type, with circular markers representing ACHs and triangular markers representing CAHs.

County boundaries were displayed with thin outlines to provide geographic context, and facility locations were overlaid on county polygons using color and shape to distinguish hospital type.

B.2 Caterpillar Plots for Adult Ward SAAR Values

Annual SAAR values and corresponding 95% confidence intervals (CIs) for adult ward locations were extracted from the NHSN Antimicrobial Use and Resistance (AUR) Module SAAR Report (All Adult and Pediatric SAARs, 2017 Baseline) for reporting years 2021–2024. Caterpillar plots were generated separately for each SAAR antimicrobial agent category–all antibacterial agents, BSHO, CDI-risk agents, Gram-positive agents, and NSBL.

Plots were created separately for ACHs and CAHs. Facility OrgIDs were de-identified and mapped to stable facility labels that were used consistently across all figures. Within each

antimicrobial agent category, facilities were ordered by their 2021 SAAR value, and this ordering was maintained for all subsequent years to support visual comparison over time.

Figures display annual SAAR values using faceted panels by year. All data processing and figure generation were performed in R (version 4.4.0) using the tidyverse, forcats, and ggplot2 packages.

B.3 Line Plots for Quarterly AU Trends

Facility-level antimicrobial use (AU) data were obtained from the NHSN Antimicrobial Use Option. Analyses were restricted to the "–All–" antimicrobial class, representing total inpatient antimicrobial exposure expressed as days of therapy per 1,000 days present (DOT per 1,000 DP).

Quarterly AU values were extracted for each de-identified facility from 2021 Q1 through 2024 Q3. Reporting periods were parsed from NHSN export files, and reported zero values, which reflect periods of non-reporting rather than true zero antimicrobial use, were coded as missing. No imputation or smoothing was applied across these gaps.

Quarterly AU trajectories were plotted for each facility across the study period using fixed y-axis limits to facilitate comparison across hospitals. Facilities were classified as acute care hospitals (ACHs) or critical access hospitals (CAHs) using lists provided by the Oregon Health Authority and the Oregon Office of Rural Health. For each hospital type, quarterly mean AU values across reporting facilities were calculated, and mean ±1 standard deviation ribbons were displayed to illustrate variation across facilities within each hospital type. Summary lines representing the average AU trajectory for each hospital type were overlaid.

For regional trend analyses, ACHs were assigned to one of three regions based on county location. Quarterly regional mean AU values were calculated for each region. CAHs were excluded from regional analyses because of heterogeneous geographic distribution and smaller denominators. All data processing and figure generation were conducted in R (version 4.4.0) using the tidyverse, ggplot2, and lubridate packages. A persistent de-identification key was used to maintain consistent facility labels across figures.

Regional Groupings by County:

Region	Counties Included
Tri-County	Multnomah, Washington, Clackamas
Mid-Willamette	Yamhill, Marion, Linn, Benton
Southern Oregon	Josephine, Jackson, Klamath

B.4 Stacked Bar Plots for Annual Antimicrobial Use by Class

Facility-level antimicrobial use data were obtained from NHSN Quarterly AU Class Summary Reports for reporting years 2021–2024. For each facility and year, antimicrobial use was summarized as days of therapy per 1,000 days present by antimicrobial class, excluding the "–All–" grouped roll-up category.

Facilities were de-identified using stable letter labels that were applied consistently across all figures. Separate plots were generated for ACHs and CAHs. To improve interpretability, two grouping strategies were applied to antimicrobial classes. First, an "Anti-MRSA" category was created by combining lipopeptides, glycopeptides, and oxazolidinones. Second, low-frequency or heterogeneous antimicrobial classes were combined into a single "Other" category. This category included monobactams, streptogramins, macrocyclics, folate pathway inhibitors, fosfomycins, glycylcyclines, lincosamides, nitrofurans, phenicols, pleuromutilins, polymyxins, and rifampin. All remaining NHSN antimicrobial classes were displayed as individual strata.

Stacked bar plots display, for each facility and year, the proportional contribution of antimicrobial classes to total inpatient AU within each facility–year. Facilities were presented in a fixed order across all years to support cross-year comparison. Data processing and figure generation were conducted in R (version 4.4.0) using the tidyverse and ggplot2 packages.

B.5. Point Plots for Facility-Level Variation in SAAR by Location and Antimicrobial Agent Category

Annual SAAR values by location were extracted from the NHSN AUR Module SAAR Report by Location for reporting years 2021–2024. SAAR values were grouped by antimicrobial agent category (BSHO, CDI-risk agents, Gram-positive agents, and NSBL) and by CDC location category (ICU and ward). Facilities were de-identified and categorized according to hospital type.

Statistical significance was assessed using NHSN-reported p-values and 95% confidence intervals for each facility–location–year combination. SAAR values were classified AU as significantly higher than predicted when the 95% CI was entirely above 1.0 ($p < 0.05$), significantly lower than predicted when the 95% CI was entirely below 1.0 ($p < 0.05$), or not significantly different from predicted when the CI included 1.0 ($p \geq 0.05$).

For each year, antimicrobial agent category, and CDC location category, one data point was plotted per facility to represent its annual SAAR value. Data points were colored

according to statistical significance category, and a dashed horizontal reference line at SAAR = 1.0 indicated the value at which observed AU equals predicted use.

To protect confidentiality, finer NHSN location mappings (for example medical vs surgical wards) were not displayed and individual facility units were not labeled. All figures were generated in R (version 4.4.0) using the tidyverse and ggplot2 packages.

SAAR values of 0 (reflecting locations with non-zero days present and zero antimicrobial use days) were observed infrequently, occurring once in CDI ICU data, five times in BSHO ward data, seven times in Gram-positive ward data, and four times in CDI ward data. Missing SAAR values due to incomplete reporting (no days present reported) were also infrequent and occurred three times in BSHO ward data, once in BSHO ICU data, once in Gram-positive ICU data, three times in Gram-positive ward data, four times in CDI ward data, and once in CDI ICU data.

B.6 Caterpillar Plots for Annual SAAR Values for Pediatric Units

Annual SAAR values for all antibacterial agents were extracted from the NHSN Antimicrobial Use Option SAAR Report for pediatric inpatient ward locations for reporting years 2021–2024.

To protect confidentiality, unit identifiers were replaced with a persistent de-identification key so that each pediatric location received a stable label across years. No additional stratification by CDC pediatric location subtype (for example IN:ACUTE:WARD:M_PED) was applied to reduce the risk of re-identification.

For each year, one data point was plotted per pediatric unit to represent its annual SAAR value for all antibacterial agents. Data points were displayed with NHSN-reported 95% confidence intervals, and a dashed horizontal reference line at SAAR = 1.0 indicates where observed and predicted antimicrobial use are equal. Within each year, units were ordered by increasing SAAR value to support visual comparison across facilities.

All data processing and figure generation were conducted in R (version 4.4.0) using the tidyverse and ggplot2 packages.