Editorial

Best Practice Proposal to Enhance Application of the Standardized Antimicrobial Administration Ratio (SAAR)

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Abstract

Description

A core element of hospital antibiotic stewardship programs is the tracking of outcomes. It is recommended that hospitals do this by reporting to the National Healthcare Safety Network (NHSN) Antimicrobial Use (AU) Option. With this, hospitals can access the Standardized Antimicrobial Administration Ratio (SAAR) for various antibiotic groupings and locations. While there are benefits to the SAAR, several limitations reduce the interpretation and utility of SAAR values. In particular, the SAAR cannot inform users of antimicrobial appropriateness. This article describes an antimicrobial days of therapy (DOT) report that was developed by a tele-stewardship infectious diseases pharmacist. This article proposes that a DOT report, such as the one described, is used in combination with SAAR values to better assess where improvements in antimicrobial prescribing are needed and track the progress of interventions. If not reporting to the NHSN AU Option, this type of report can help meet antimicrobial stewardship standards from The Joint Commission.

Keywords

Standardized Antimicrobial Administration Ratio; SAAR; antimicrobial agent; anti-microbial agents; antimicrobial; days of therapy (DOT)

Introduction

The 2019 Centers for Disease Control and Prevention (CDC) Core Elements of Hospital Antibiotic Stewardship Programs includes 7 recommended elements that aim to help hospitals implement an antibiotic stewardship program (ASP). One of these core elements is the tracking of outcomes. Various outcomes are important to evaluate and monitor, but 1 outcome that is integral to any ASP is antibiotic use measures. Measuring and evaluating antibiotic use is critical for improving antimicrobial prescribing with the ultimate goal of treating infections effectively, decreasing unnecessary antimicrobial use, and preventing or slowing the development of antimicrobial resistance. It is recommended that hospitals in the United States (US) do this through electronic reporting to the National Healthcare Safety Network (NHSN) Antimicrobial Use (AU) Option.[1] With this, ASPs can access the Standardized Antimicrobial Administration Ratio (SAAR) for various groupings of antibiotics and patient care locations. Because the SAAR compares observed to predicted use, ASPs can benchmark their antimicrobial use to facilities that are similar to them.[2]

While there are many benefits to utilizing the SAAR, 1 limitation is the inability of the SAAR to inform users of the appropriateness of antimicrobial use. A high SAAR may indicate excessive use, but a low SAAR may indicate antimicrobial underuse. Antimicrobials are life-saving medications and are necessary for many inpatients, thus, any SAAR value may require further investigation. The SAAR value may not be meaningful without knowledge of other antimicrobial use or process outcomes. In particular, trends and comparisons of antimicrobial

Figure 1. The antimicrobial DOT report includes a main dashboard.

use over time, indications for antimicrobial use, de-escalation strategies, durations of therapy, new service lines, emerging infectious diseases, and incidence of resistant or susceptible organisms are examples of important considerations when interpreting any SAAR value.

The HCA Healthcare system consists of 182 affiliated acute care hospitals plus approximately 3200 other sites of care across 20 US States and the United Kingdom. Within the US, facilities have an established ASP, but workflow and strategies may vary based on each facility's unique services and needs. Most facilities submit their AU data to the NHSN and have access to their site's SAAR data. Due to the aforementioned limitations with the SAAR, an antimicrobial days of therapy (DOT) report was created using spreadsheet software by a tele-stewardship infectious diseases (ID) pharmacist for 40 acute care hospitals to better visualize potential antimicrobial opportunities. This article describes the utility of each section of the antimicrobial DOT report and provides 4 real-world examples of how it was applied to improve antimicrobial use.

Methods and Results

The antimicrobial DOT report was created using pivot tables, graphs, and tables with various filter functions in a spreadsheet software program (Microsoft Excel, Microsoft, Redmond WA). Antimicrobial DOT data are imported into the spreadsheet software each month using data from the pharmacovigilance software program.[3] After importing the data, the report displays DOT per adjusted patient day (APD) in a user-friendly format to help identify opportunities for improvement and areas of success. It includes various data points and trending graphs for both inter- and intra-facility comparisons.

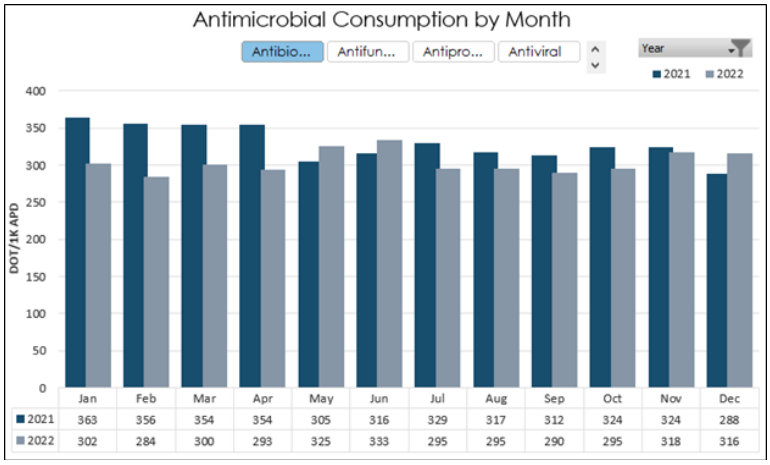

Figure 2. The antimicrobial DOT report main dashboard includes a graph that shows antimicrobial consumption by month and year.

Figure 3. The antimicrobial DOT report's main dashboard includes a list of the top 10 antibiotics.

The main dashboard for the antimicrobial DOT report is shown in **Figure 1**. Month, year, and facility can be selected at the top. Antimicrobial DOT per 1000 APD by month and year over year is shown in **Figure 2**. This can be filtered by antibiotics, antifungals, or antivirals. The top 10 antibiotics used for the month are shown in **Figure 3**. This helps to identify opportunities to reduce the usage of targeted antimicrobials in the facility. The pie chart in **Figure 4** shows antimicrobial use by unit, and this can be filtered by 1 or more antimicrobials. The right-hand section focuses on intravenous (IV) to oral opportunities. In **Figure 5**, a graph shows the percentage of oral and IV dosage forms by antimicrobial agent. In **Figure 6**, percentages of IV and oral dosage forms of total antimicrobials are displayed month-over-month. This graph can also be filtered by 1 or more antimicrobials.

The next section of the antimicrobial DOT report is shown in **Figure 7**. This breaks down antimicrobial DOT per 1000 APD by each agent and compares selected months' data to previous years selected. This is an important inter-facility comparison of antimicrobial use to reduce bias from usual seasonality trends. A red circle automatically appears for a 50% or greater increase from the previous year. This section can also inform users of non-formulary or restricted antimicrobial use.

A pie chart from the antimicrobial DOT report is shown in **Figure 8**. This shows the percentage use of each antimicrobial group for the time period selected. The data can be filtered by facility, month, year, and antimicrobial type and can be selected to display 1 or more of these variables. The pie chart can help to identify whether a specific antimicrobial group is being used more often, which could raise concerns for resistance development.

The next section of the antimicrobial DOT report (**Figure 9**) is a comparison of antimicrobial use across facilities, as well as a comparison of year-over-year use for each facility. This data can be displayed for 1 or more months to high-

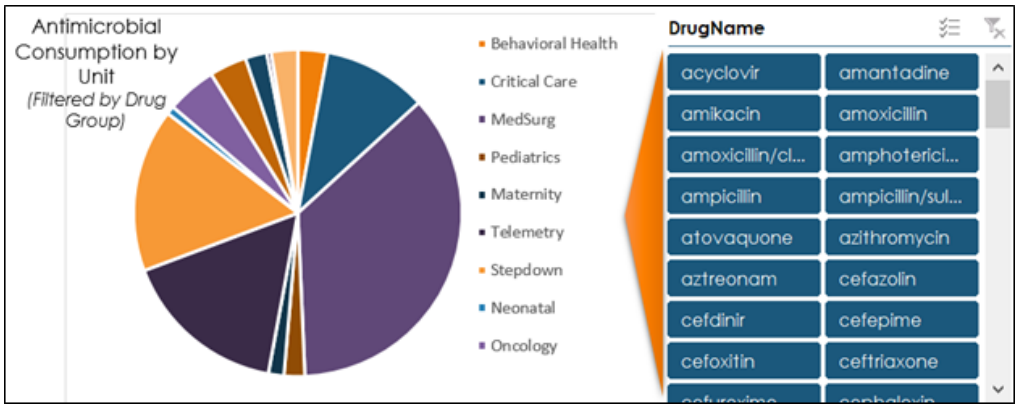

Figure 4. The antimicrobial DOT report main dashboard includes a pie chart that shows antimicrobial consumption by unit.

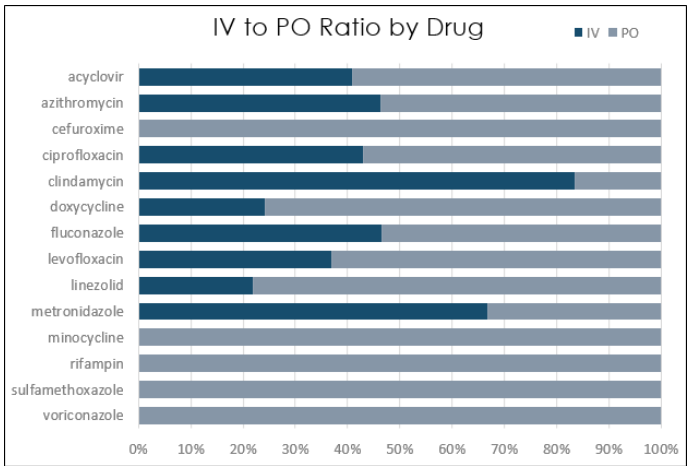

Figure 5. The antimicrobial DOT report main dashboard includes a graph that shows the percentage of oral and IV dosage forms by antimicrobial.

light increased or decreased use for a specific month, quarter, or year. It can also be filtered for ≥ 1 antimicrobial. This may be useful to compare the use of 1 specific agent or groups of agents, such as antipseudomonal beta-lactams or vancomycin. The comparison across facilities can be particularly helpful to show the ASP team and other stakeholders the areas in which their facility is an outlier.

Within the next section of the antimicrobial DOT report (**Figure 10**), there are 5 rows of month-to-month trending graphs for agents with methicillin-resistant *Staphylococcus aureus* (MRSA) activity, anti-pseudomonal agents, multi-drug resistant (MDR) organism therapy, antifungal agents, and remdesivir. Year-over-year comparisons for each group are shown in the first column, and to the right of each group, there are individual trending graphs for each antimicrobial within those groups. For example, anti-MRSA therapy DOT per 1000 APD by month and year-over-year is shown in the top left-hand corner. To the right of this graph, DOT per 1000 APD month-to-month trending graphs are shown for clindamycin, daptomycin, linezolid, trimethoprim/sulfamethoxazole, and vancomycin. These graphs can help identify where there are increasing, or decreasing, trends with broad-spectrum or restricted agents.

In the last section of the antimicrobial DOT report (**Figure 11**), the graphs can be filtered by several different variables to stratify antimicrobial DOT per 1000 APD by year, facility, unit type, and antimicrobial type, route, group, class, and specific agent. The utility and flexibility within this section allow the user to identify various opportunity areas. What is unique to this section is the ability to display data by unit, which can highlight where there may be increased use in specific areas of the facility.

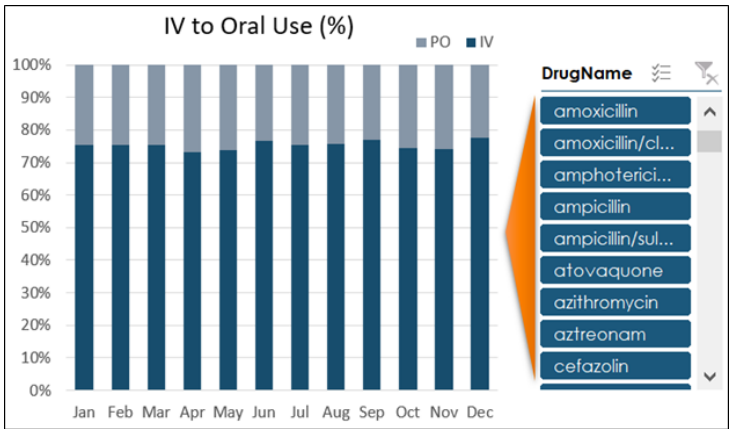

Figure 6. The antimicrobial DOT report main dashboard includes a graph that shows the percentage of oral and IV dosage forms by month.

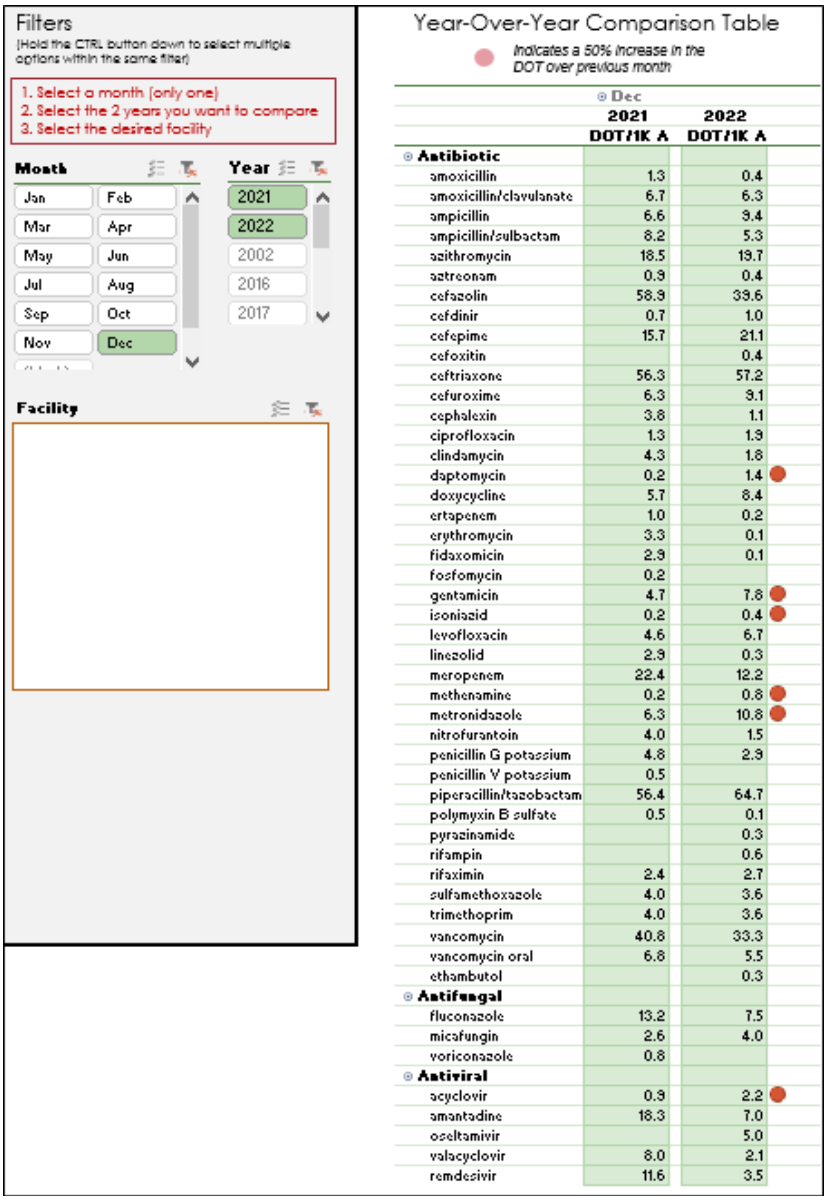

Figure 7. The antimicrobial DOT report includes a section that displays a year over year comparison of DOT by antimicrobial.

After importing DOT data for each facility from the prior month, the tele-stewardship ID pharmacist then distributes the report to each facility's ASP pharmacy champion and pharmacy leadership. Each facility's ASP pharmacy champion is then responsible for summarizing that month's utilization data and reporting their assessment to the tele-stewardship ID pharmacist, pharmacy leadership, and the facility's ASP or pharmacy and therapeutics committee. The tele-stewardship ID pharmacist is available for feedback and questions if more information is needed.

Examples of Antimicrobial DOT Report Application

By evaluating each month's antimicrobial utilization data, facilities are more apt to identify where there are opportunities for improvement and where more detailed evaluation may be needed. The following section provides examples of how ASP efforts were enhanced through the application of the antimicrobial DOT report.

Currently, the IV formulations of doxycycline, linezolid, and minocycline are substantially costlier than the oral formulations. Some ASPs may limit or restrict the use of the IV formula-

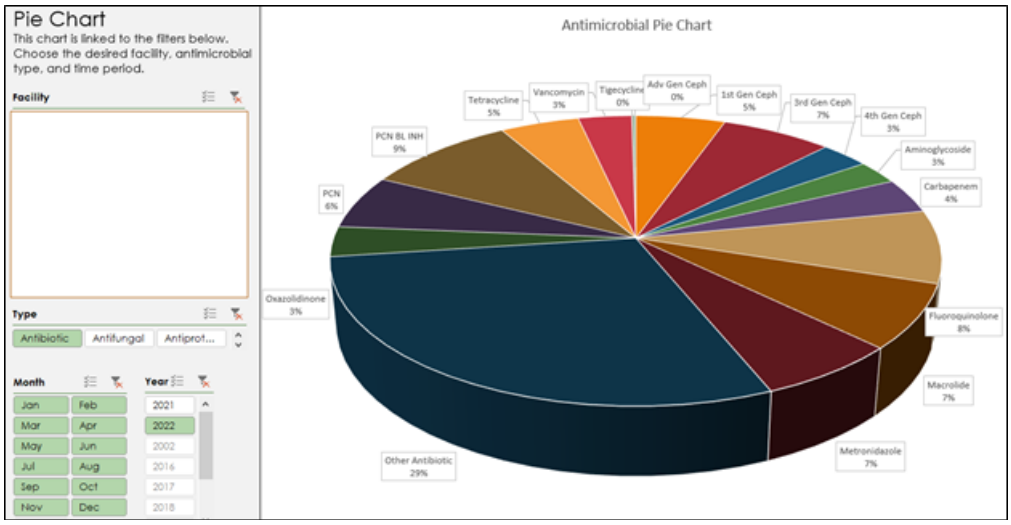

Figure 8. The antimicrobial DOT report includes a section with a pie chart of antimicrobial groups.

tion as a cost savings strategy. This is particularly true for minocycline, for which the average wholesale price is up to 200 times the cost of the oral formulation.[4] By evaluating the percentage of DOT of the IV and oral formulations in **Figure 5**, facilities have been able to quickly address opportunities to improve the use of resources. While doxycycline and minocycline are included in the AUR protocol, they are not included in any of the antimicrobial groupings. The SAAR also does not stratify results based on IV versus oral formulations. These data gaps may make it more difficult to identify these opportunities if a facility is focusing solely on SAAR antimicrobial groupings that have higher than predicted use.

Using the section of the report that shows antimicrobial DOT per 1000 APD by each agent (**Figure 7**), 1 facility observed a recent increase in the use of fosfomycin. Fosfomycin has been a restricted medication since it is not as effective as other antibiotics used for cystitis and is not considered a first-line option for cystitis caused by MDR organisms.[5,6] A detailed review of reasons for fosfomycin use revealed that it was prescribed for cystitis caused by MDR gram-negative organisms at risk for intrinsic resistance due to the *fosA* resistance gene.[4,5] Opportunities to optimize the use of this specific, restricted antibiotic would not have been identified from SAAR values alone. Observing a trend of increased use of fosfomycin led to a collegial discussion on recent treatment guide-

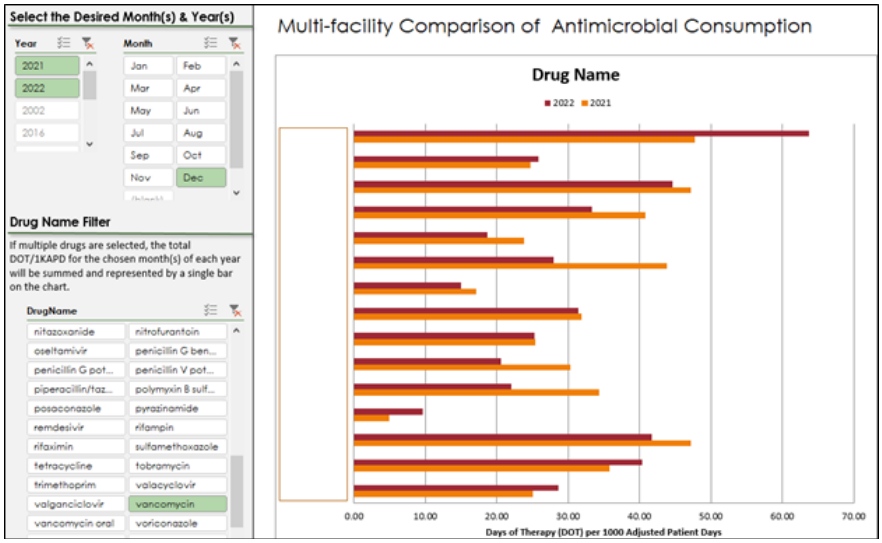

Figure 9. The antimicrobial DOT report includes a section that shows a comparison of antimicrobial DOT across facilities.

lines and the elimination of inappropriate use of fosfomycin for an indication where it is not a preferred treatment, thus reducing the risk of treatment failure.

Using the month-to-month trending graphs for anti-MRSA agents and anti-pseudomonal agents (**Figure 10**), 1 facility observed a consistently increasing trend in the use of these broad-spectrum antibiotics in 2022 compared to 2021. While SAAR values are available for these antibiotic groups and can identify higher use than predicted, they cannot inform the user about why there has been higher use and

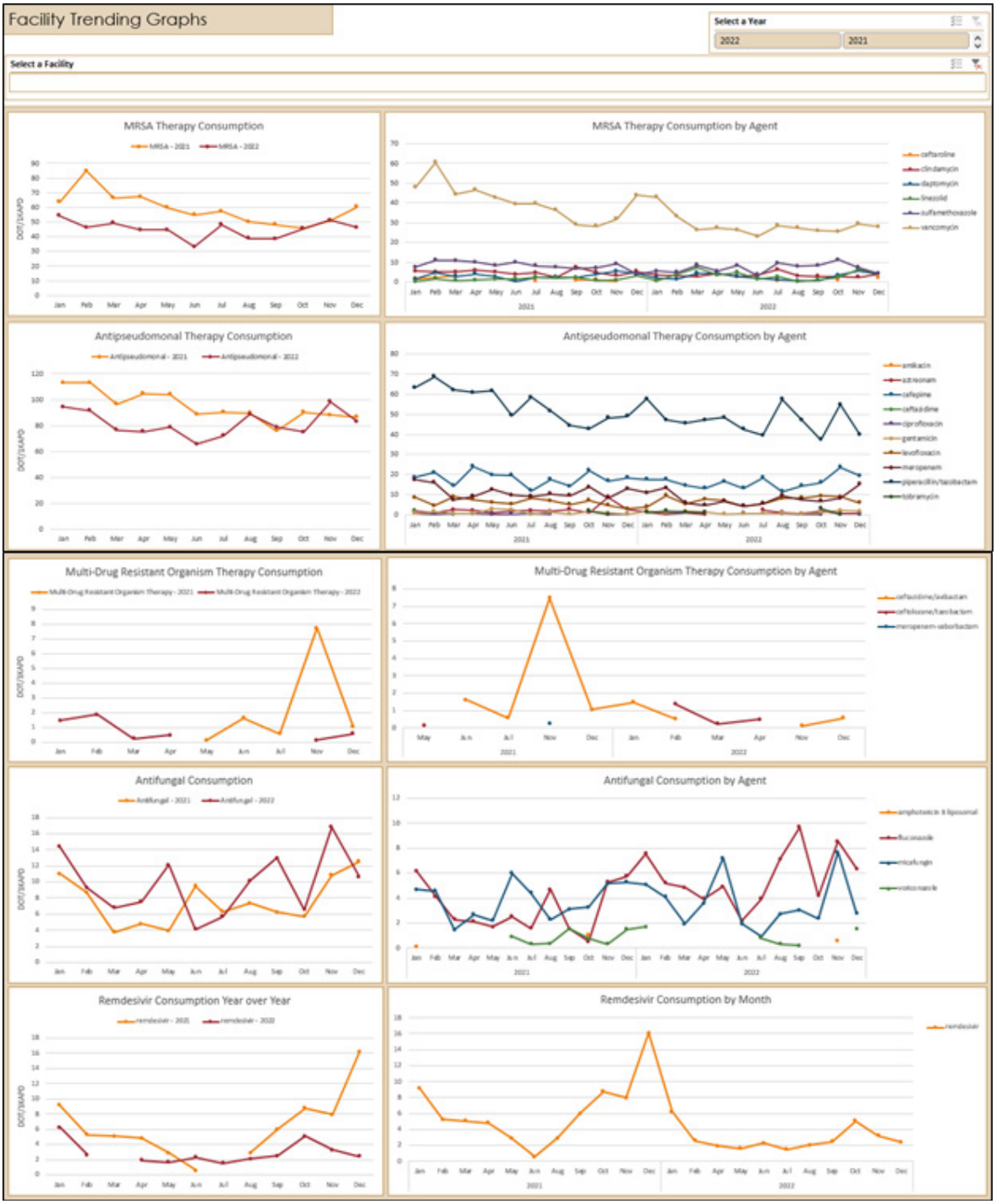

Figure 10. The antimicrobial DOT report includes a section with month-to-month trending graphs of targeted antimicrobials.

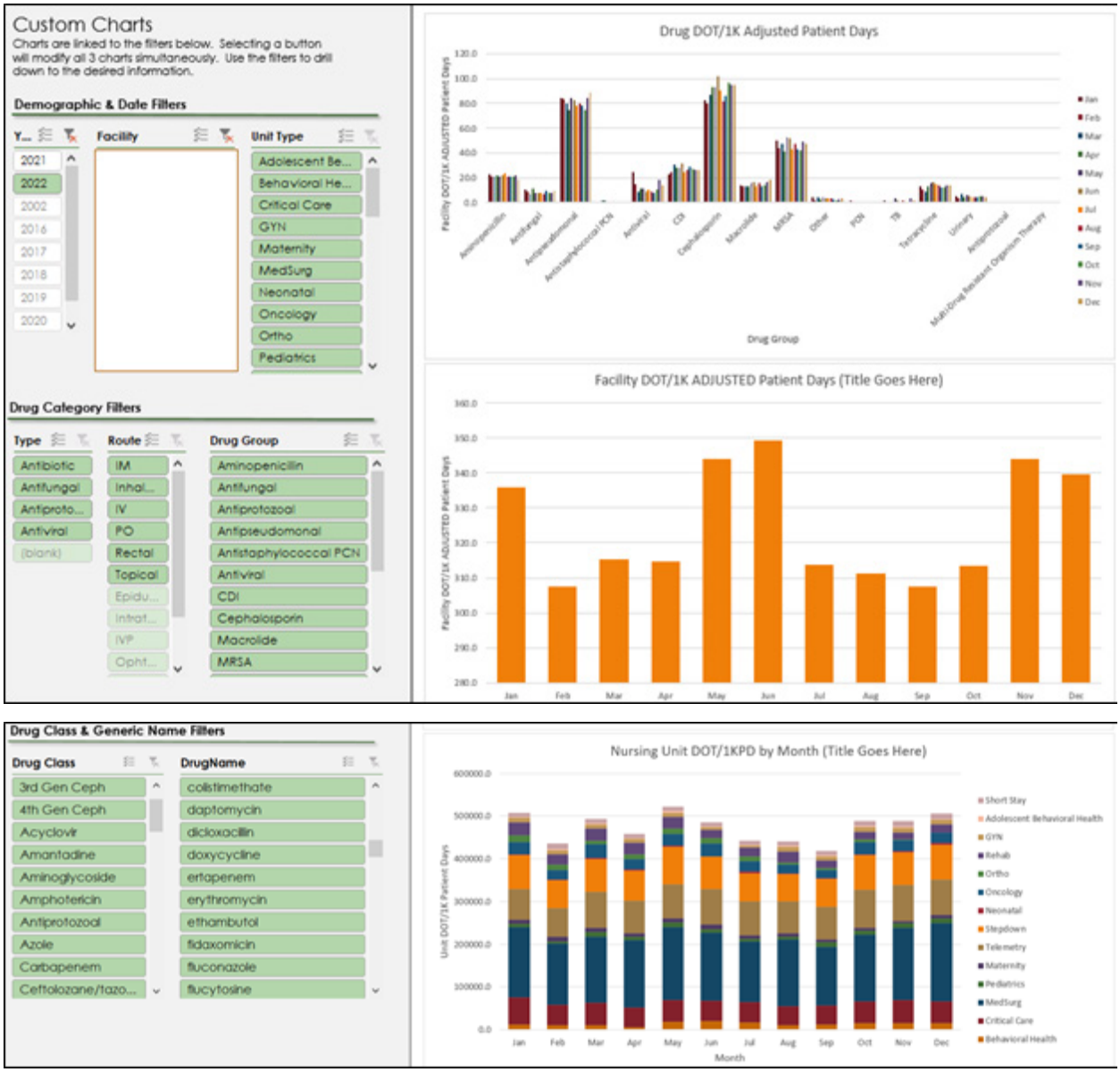

Figure 11. The antimicrobial DOT report includes a section with month-to-month trending graphs that can be filtered by several variables.

whether it was appropriate. After superimposing DOT data with the incidence of resistant organisms by month, the facility was able to explain the increased use of broad-spectrum antibiotics. Specifically, the incidence of MRSA and gram-negative organisms producing an extended-spectrum beta-lactamase (ESBL) increased in 2022. This also reinforced the importance for the ASP to focus on strategies to use more narrow-spectrum antibiotics to slow the development of resistance at their facility.

Another facility also utilized the month-to-month trending graphs (**Figure 10**) and observed a large increase in broad-spectrum antibiotics compared to the prior month and prior year. Their general assessment included an evaluation of use by agent, provider, location, and duration, and showed that meropenem, cefepime, and vancomycin were driving the increase. A more detailed review showed that there were opportunities for using narrower spectrum agents empirically for skin and soft tissue infections (SSTIs) and intra-abdominal infections (IAIs). Based on their findings, they were able to target their stewardship interventions to improve the use of these specific broad-spectrum antibiotics. They developed

educational one-pagers on uncomplicated SSTIs and IAIs to disseminate to their prescribers, which included facility-specific data and treatment recommendations. While the SAAR can inform users of higher than predicted use of broad-spectrum antibiotics, this facility used the antimicrobial DOT report to identify the specific agents driving high use and conducted a detailed review of those select antibiotics to better target their stewardship efforts.

Discussion

Standardizing antimicrobial use measures continues to be an evolving area of research. The SAAR has improved attempts to compare observed antimicrobial use to predicted use based on CDC predictive models using a referent, or baseline, population. Facilities now have the ability to compare antimicrobial use within their own facility and to other facilities that may be similar in location type, facility type, hospital teaching status, hospital bed size, number of ICU beds, percentage of ICU beds, and average facility length of stay.[7] Neonatal SAAR predictive models include other factors that may affect a facility's use of antimicrobials in neonates. Along with SAAR values, the SAAR reports generated by NHSN also include statistical measures that indicate whether a facility's observed difference in antimicrobial use is statistically significant from what is predicted. Although there may be a statistical difference, NHSN acknowledges that this may not be meaningful. Two of the main limitations with the AU Option are that predicted use is calculated using AU data from a previous year, and it is currently unable to collect patient-level information. As a result, a facility's SAAR value does not indicate whether antimicrobial use is appropriate, and it does not account for a facility's current patient population and acuity level. Other challenges with NHSN's AU Option are that the SAAR has not been an antimicrobial-use measure that is easy to understand, NHSN reports may not be user-friendly, up-to-date data cannot be obtained in real-time, and SAARs cannot be meaningfully tracked over time.[7] These limitations underscore the need to develop and standardize additional tools and resources to help support ASPs when applying SAAR values to their facility's antimicrobial use.

As of January 1, 2023, The Joint Commission-accredited hospitals are required to monitor and analyze their antibiotic use through 1 of 2 methods: 1) reporting to the NHSN AU Option; or 2) DOT per 1000 days present or 1000 patient days.[8] To address some of the limitations of the SAAR, facilities that report to the NHSN AU Option should use a combination of antibiotic use measures to better assess where improvements in antimicrobial prescribing are needed and track the progress of interventions. If a hospital is not reporting to the NHSN AU Option, tracking their antibiotic use with the DOT adjusted for a hospital occupancy measure will meet this requirement. For facilities that report to the NHSN AU Option, a combination of antibiotic use measures should be used to better assess where improvements in antimicrobial prescribing are needed and track the progress of interventions.

Conclusion

A report, such as the one described here, could supplement the SAAR by identifying specific antimicrobials that are driving elevated SAAR values and where there may be opportunities. The examples summarized in this article describe how ASPs have applied these data to target their stewardship efforts and drive change as recommended by the CDC.[9] This antimicrobial DOT report could be analyzed and shared by a member of the ASP team on a regular and timely cadence with facility prescribers, pharmacists, nurses, and leadership and help to address opportunities for improvements in antimicrobial use that may not be directly evident through theuse of the SAAR alone.

Conflicts of Interest

The author declares that she has no conflicts of interest.

Dr Butterfield-Cowper is an employee of HealthTrust Supply Chain, an organization affiliated with the journal's publisher.

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