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1822. Veterans Are Special: Clinical Decision Tree Misses ESBL Status in Bacteremic Veterans

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Background. Severe bacterial infections require appropriate empiric antibiotic choices. The Johns Hopkins Hospital clinical decision tree (JHH-CDT) to detect bacteremia with ESBL+ Enterobacteriaceae performed well at the developer's institution, but its external validity is not known. We sought to determine the performance of the JHH-CDT to predict bacteremia with ESBL+ Enterobacteriaceae in a VA population and compare the JHH-CDT with standard of care (empiric antibiotics prescribed to the patient, without using the CDT).

Methods. Electronic medical records were examined for clinical and microbiological data. The first episodes of mono-microbial bacteremia in patients at the Houston VA with positive blood cultures that grew either *E. coli* or *Klebsiella* species during 2016 were included. The JHH-CDT was used to predict whether or not the isolate would be ESBL+. Empiric initial antibiotic selection was also collected.

Results. Eighty-seven cases occurred during the study period; 95% were in men. In veterans at the VA in Houston compared with patients at JHH, respectively, the JHH-CDT demonstrated lower sensitivity (35.7% vs. 51%), positive predictive value (83.3% vs. 90.8%), negative predictive value (88.8% vs. 91.9%) but similar specificity (98.6% vs. 99.1%). Of note, of the five questions in the JHH-CDT, only one was applicable to the Veteran population: history of ESBL colonization or infection in the prior 6 months. Two other CDT questions did not apply to the VA population (no Veterans had these conditions): hospitalization for ≥1 day in an ESBL high-burden in the prior 6 months and age <43 years old. Standard of care led to carbapenems being empirically prescribed for 4/14 (28.6%) ESBL+ bloodstream infections and for 3/73 (4.1%) of non-ESBL bloodstream infections.

Conclusion. In this VA population, the JHH-CDT had low sensitivity because two decision nodes did not apply to our older population with little international travel. Standard of care empiric choice of antibiotics also had low sensitivity, covering only 28.6% of ESBL infections appropriately. These findings highlight the importance of developing and validating population-specific predictive stewardship tools.

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1823. Signal or Noise? A Comparison of Methods to Identify Outliers in Antimicrobial Use (AU)

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Background. Antimicrobial Stewardship Programs (ASPs) use AU benchmarking data to help identify areas in need of investigation. The high frequency and wide variation in AU make statistical tests frequently significant.

Methods. We compared four statistical methods of analyzing AU data to quantify how often statistically significant outliers occur. We analyzed days of therapy (DOT) per 1,000 days present (dp) from 2017 in medical and surgical adult wards and three NHSN AU antibiotic groups: anti-MRSA agents (anti-MRSA), broad agents for community-onset infections (CO), and broad agents for hospital-onset multidrug-resistant organisms (HO/MDRO). Outliers were defined as follows: (1) Units ≥90th or ≤10th percentiles. (2) Units with Standardized Antimicrobial Administration Ratios (SAARs) outside 95% confidence intervals (CI). (3) Units with observed rates outside 95% CI predicted by a generalized estimating equation (GEE) negative binomial regression model. (4) Units with observed rate outside 95% CI predicted by mixed effects negative binomial regression model with hospital as a random effect. Adjustment in method 2 included hospital teaching status and location type. Methods 3 and 4 included adjustment for teaching status, location type, average age, average

hospital length of stay, surgical volume, percent sepsis admissions, and average DRG weight.

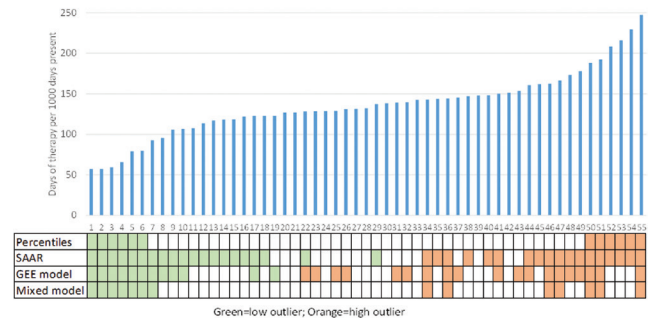
Results. Fifty-five units and 628,358 dp were included in the 1-year sample. Each method identified both positive and negative outliers. SAAR and GEE methods identified the largest number of outliers; percentiles identified the least (table). The four methods identified different individual units as outliers (figure).

Conclusion. Overly sensitive statistical methods may produce more signals than are clinically meaningful. Investments of ASP resources to investigate such signals may vary widely depending on statistical method used. Additional research is required to develop AU analysis methods with high positive predictive value.

Table: Number (%) of Outlier Units Identified Using Four Statistical Methods

Group	AU in DOT/1,000 dp median (IQR)	1. Percentile	2. SAAR	3. GEE model	4. Mixed model
Anti-MRSA	84 (73–103)	10 (18%)	42 (76%)	30 (55%)	14 (26%)
CO	132 (106–184)	10 (18%)	50 (91%)	22 (40%)	14 (26%)
HO/MDRO	132 (118–151)	12 (22%)	38 (69%)	31 (56%)	14 (26%)

Figure. HO/MDRO AU outliers among 55 adult wards using four statistical methods



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1824. Care Transformation in Infectious Diseases: Using a Novel Approach for Tracking Antimicrobial Stewardship Metrics

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Background. A key component of antimicrobial stewardship (AS) programs is the use of adequate metrics to monitor antimicrobial utilization. Limitations have been described in the literature for traditional metrics such as Defined Daily Doses (DDD) and Days of Therapy (DOT), including practitioner's unfamiliarity with the terminology in relation to their meaning. This abstract describes an innovative approach developed by our organization that resulted in improved utilization of high-cost antimicrobials and increased the engagement of practitioners based on real-time (RT) analytics using a novel metric: Defined Daily Goal (DDG).

Methods. A RT medication utilization dashboard (DB) for daptomycin (DAP) was created in October 2017 by clinical analysts and pharmacists. The DB provides a list of patients with active orders for DAP and compares the sum of active orders to the sum of available orders to meet the DDG. At Florida Hospital Orlando (FHO), the DAP goal based on national benchmark data were 6.8 days of therapy (DOT)/1,000 patient days (PDs) or a total of 240 orders/month. The average PDs/month was calculated to be 35, 380, thus the DAP DDG for FHO was determined to be 8 orders/day to meet a goal of 6.8 DOT/month. This goal of 8 DAP orders/day was built into the DB for daily AS team review. This calculation allowed for a conversion of our monthly DOT goal to a DDG equivalent.

Results. From October to December 2017, the DB identified an average of 230.7 orders/month at FHO, which was below the goal of 240 orders/month. Visualizing the daily goals for the number of allotted orders for DAP using a DDG format, this allowed the AS team to effectively meet the DOT/1,000 PDs goal. Focusing on the DDG combined with standard AS activities, resulted in a significant reduction of DAP utilization. When discussing utilization goals with ID specialists and general practitioners, the use of the DDG concept proved to be intuitive and facilitated understanding around specific metrics.

Conclusion. Implementation of a medication utilization RT DB, combined with the introduction of the DDG concept, allowed for an actionable measure to trend daily and facilitated the goals of our AS program. Based on this valuable information provided by the DB, this initiative has now been expanded to include other high-cost agents across all campuses.

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1825. Electronic Measure of Unnecessary Antimicrobial Use in US Veterans Affairs Medical Centers

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Background. Antimicrobial inappropriateness is highly contextual and dynamic, depending not only on the patient's disease condition but also the information available at the time. To estimate the extent to which antimicrobials could theoretically be decreased with antimicrobial stewardship, we sought to capture unnecessary inpatient antimicrobial use in context over time as manifested in the electronic health record in Veterans Affairs (VA).

Methods. We extracted antimicrobial use, administrative, admission, and laboratory data from all acute care VA medical centers between 2010 and 2016. Information present during Choice (hospital day [HD] 1–3), Change (HD 4–5), Completion (HD 6–7), and Post-completion (thereafter) was used to determine context. All antimicrobial use without any documented infection was considered unnecessary (admission, discharge, or otherwise). Choice Anti-MRSA agents were considered unnecessary in cellulitis without history of or current positive culture for MRSA. Choice HOMDR agents were unnecessary in cellulitis without history of positive culture for ceftriaxone-resistant Gram-negative rods. Also unnecessary were broad-spectrum antimicrobials (anti-methicillin-resistant *Staphylococcus aureus* [MRSA] and hospital-onset multidrug-resistant [HOMDR] organisms antimicrobials as defined by the National Healthcare Safety Network) administered without evidence of multidrug-resistant organisms existed during Change and Completion time frames.

Results. Figure 1 demonstrates the distribution of facility proportions of unnecessary antimicrobials of different classes over time. Table 1 illustrates the percentage of unnecessary antimicrobials administered during choice, change, completion, and post-completion time-frames.

Conclusion. By this measure, unnecessary anti-MRSA and HOMDR use has been decreasing in VA over time. The bulk of unnecessary use is empiric but there is a substantial proportion that is used for longer stays, during which time more information was likely present. More research is necessary to determine how well these simple rules correlate with clinical determinations of appropriateness. Also ICD-10-CM was implemented in October 2015, which may have introduced an ascertainment bias.

Figure 1. Violin plots for the facility proportion of unnecessary anti-MRSA and hospital-onset multidrug-resistant antimicrobials out of their respective totals is shown over time.



Table 1. HOMDR and MRSA columns show the number of antimicrobial days apportioned across Choice, Change, Completion, and Post-completion time frames. The % unnecessary for both is also illustrated.

Decision context	HOMDR %unnecessary	MRSA %unnecessary
Choice	1039224 37.0%	915501 38.0%
Change	478971 93.2%	83813 91.2%
Completion	328075 91.8%	257638 89.4%
Post-completion	924105 90.3%	756510 87.8%

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1826. Interventions to Enhance Clinical Nurse Partnership in Acute Care and Nursing Home (NH) Antibiotic Stewardship Efforts: A Scoping Review

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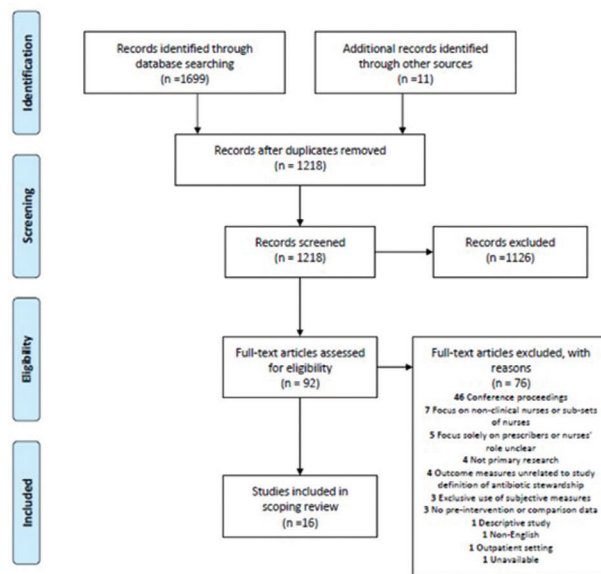
Background. Nurses are called upon to partner in antibiotic stewardship programs (ASPs). Yet, the nurses' role in ASPs and measures of nurses' contributions to ASPs are poorly defined.

Methods. Scoping review to explore (1) interventions to enhance nurses' role in optimizing antibiotic use in the inpatient and nursing home (NH) settings and (2) measures to quantify intervention impact. We searched the PubMed, CINAHL, Embase, and Cochrane Library databases for articles published between 2005 and October 2017. We included studies that targeted clinical nurses to improve the appropriateness, timing, and duration of antibiotics. Two researchers reviewed titles, abstracts and extracted data from eligible full-texts.

Results. Sixteen studies met inclusion criteria (figure). Among studies, 10, 5, and 1 were conducted in the NH, inpatient or several settings, respectively. Nearly all studies (N = 15) incorporated nurses into interprofessional efforts to improve antibiotic use. Thirteen studies aimed to improve antibiotic appropriateness. Of these, six educated nurses in culturing technique and/or appropriateness; five educated nurses in antibiotic treatment guidelines; and two incorporated nurses into audit and feedback mechanisms. Six studies aimed to improve the timeliness of antibiotic administration. Of these, all included education on the importance of prompt antibiotic administration; two improved antibiotic availability and one enabled nurses to administer antibiotics before a provider's evaluation. Two studies, both conducted in the NH, aimed to improve the duration of antibiotics by having nurses track the days of antibiotic therapy or remind prescribers to use treatment guidelines. Nonprescribing outcomes (e.g., timeliness of culture specimens and antibiotic administration, etc.) were evaluated in seven studies and significant improvements were consistently found. Prescribing outcomes (e.g., antibiotic use, appropriate antibiotic use, etc.) were evaluated in 12 studies and eight studies identified significant improvements.

Conclusion. Nurses may successfully contribute to improved antibiotic use. Further research is needed to clarify the nurses' role in ASPs and to develop validated measures of nurses' contributions.

Figure. Study Flow Diagram



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1827. Clinical Staff Retention and Leadership Stability and Antibiotic Utilization in Nursing Homes

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