



Implementing Interventions Based on NHSN AU Data

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Disclosures / Conflicts of Interest

- None



Objectives

- Identify key SAAR metrics available in NHSN antimicrobial utilization data
- Interpret NHSN antimicrobial utilization data to draw a conclusion about that data set
- Apply NHSN antimicrobial utilization data to design an antimicrobial stewardship initiative



National Healthcare Safety Network (NHSN)



NHSN

- The National Healthcare Safety Network (NHSN) is the nation's most widely used healthcare-associated infection (HAI) tracking system
- NHSN provides facilities, states, regions, and the nation with data needed to:
 - Identify problem areas
 - Measure progress of prevention efforts
 - Eliminate healthcare-associated infections

NHSN

- Covers a variety of facility types including:
 - Acute Care Hospitals (ACHs)
 - Inpatient Rehabilitation Facilities (IRFs)
 - Long-Term Acute Care Hospitals (LCTACHs)
- Primary focus of data set for ACHs is HAIs
 - CLABSI, CAUTI, VAE, SSI, C. difficile, and MRSA bacteremia
- Today's focus will be on the antimicrobial utilization (AU) module



NHSN Antimicrobial Utilization (AU) Module





AU Module

- Objectives:
 - Primary objective of the Antimicrobial Use (AU) Option is to facilitate risk-adjusted inter- and intra-facility antimicrobial use benchmarking
 - Secondary objective is to evaluate antimicrobial use trends over time at the facility and national levels



AU Module

- Participation in the AU module is optional
- Requires pre-specified data format and integration into electronic health record (EHR)
 - Software solution generally available through EHR platform, or third-party platform

AU Module

Components:

- Days of Therapy (DOT) / 1000 Days Present
- Standardized Antimicrobial Administration Ratio (SAAR)



Days of Therapy (DOT) / 1000 Days Present



DOT / 1000 Days Present

- Primary metric: antimicrobial days per 1000 days present
- Antimicrobial days:
 - 1 antimicrobial day = any amount of specific antibiotic administered in a calendar day to a particular patient
 - 1 antimicrobial day = 1 day of therapy
- Days present: total number of patients in a location or facility anytime each day during a calendar month

DOT / 1000 Days Present

Each component is calculated as an aggregate per month

Data obtained from medication administration record



DOT / 1000 Days Present

$$\frac{\text{Drug specific antimicrobial days per patient care location per month}}{\text{Days present per patient care location per month}} \times 1000$$

DOT / 1000 Days Present

- Example calculation for piperacillin/tazobactam:

Patient	Piperacillin/tazobactam Duration
Patient 1	4.5g q8h x 3 days
Patient 2	4.5g q12h x 7 days
Patient 3	4.5g q8h x 6 days

- Total of 175 patients days this month
- Piperacillin/tazobactam $\frac{16}{175} \times 1000 = 91$ DOT per 1000 patients days



Standardized Antimicrobial Administration Ratio (SAAR)



SAAR

- Standardized Antimicrobial Administration Ratio (SAAR) compares observed antimicrobial days to predicted antimicrobial days for groups of antimicrobial agents used in specified patient care locations

$$SAAR = \frac{\textit{Observed antimicrobial days of therapy}}{\textit{Predicted antimicrobial days of therapy}}$$

SAAR

- NHSN calculates predicted antimicrobial days by risk-adjusting for location- and facility-level factors found to be statistically significantly associated with differences in AU rates among the SAAR referent population

SAAR

SAAR >1.0 indicates more antimicrobial days were observed than predicted

SAAR = 1.0 indicates the number of antimicrobial days observed was equal to the number predicted

SAAR <1.0 indicates fewer antimicrobial days were observed than predicted

SAAR – Locations Available

- 2017 baseline adult SAAR-eligible patient care locations:
 - Adult medical intensive care units (ICUs) and wards
 - Adult medical-surgical ICUs and wards
 - Adult surgical ICUs and wards
 - Adult step down units
 - Adult general hematology-oncology wards

SAAR – Locations Available

- 2017 baseline pediatric SAAR-eligible patient care locations:
 - Pediatric medical ICUs and wards
 - Pediatric medical-surgical ICUs and wards
 - Pediatric surgical wards
- 2018 baseline neonatal SAAR-eligible patient care locations:
 - Level II neonatal step down nurseries
 - Level II/III neonatal intensive care units (NICUs)
 - Level III NICUs
 - Level IV NICUs

SAAR – Antimicrobial Groupings

Broad spectrum antibacterial agents predominantly used for hospital-onset infections (BHSO_ICU/Ward_2017)			
Amikacin	Ceftazidime/Avibactam	Doripenem	Meropenem
Aztreonam	Ceftolozane/tazobactam	Gentamicin	Piperacillin/tazobactam
Cefepime	Colistimethate	Imipenem/Cilastatin	Tobramycin
Ceftazidime			
Broad spectrum antibacterial agents predominantly used for community-acquired infections (BSCA_ICU/Ward_2017)			
Cefaclor	Cefpodoxime	Cefuroxime	Gemifloxacin
Cefdinir	Cefprozil	Ciprofloxacin	Levofloxacin
Cefixime	Ceftriaxone	Ertapenem	Moxifloxacin
Cefotaxime			
Antibacterial agents predominantly used for resistant Gram-positive infections (e.g. MRSA- GramPos_ICU/Ward_2017)			
Ceftaroline	Linezolid	Quinupristin/Dalfopristin	Televancin
Dalbavancin	Oritavancin	Tedizolid	Vancomycin
Daptomycin			
Narrow spectrum beta-lactam agents (NSBL_ICU/Ward_2017)			
Amoxicillin	Cefadroxil	Cephalexin	Penicillin G
Amoxicillin/Clavulanate	Cefazolin	Dicloxacillin	Penicillin V
Ampicillin	Cefotetan	Nafcillin	
Ampicillin/Sulbactam	Cefoxitin	Oxacillin	
Antibacterial agents posing the highest risk for CDI (CDI_ICU/Ward_2017)			
Cefdinir	Cefotaxime	Ceftriaxone	Gemifloxacin
Cefepime	Cefpodoxime	Ciprofloxacin	Levofloxacin
Cefixime	Ceftazidime	Clindamycin	Moxifloxacin
Antifungal agents predominantly used for invasive candidiasis (Antifungal_ICU/Ward_2017)			
Anidulafungin	Caspofungin	Fluconazole	Micafungin

Question #1

- Which of the following is an available SAAR antimicrobial grouping?
 - A. Respiratory antimicrobials used for pneumonia
 - B. Broad spectrum agents predominately used for hospital-onset infections
 - C. Fluoroquinolone antimicrobials
 - D. Novel broad spectrum restricted antimicrobials for MDR pathogens

Question #1 - Answer

- Which of the following is an available SAAR antimicrobial grouping?
 - A. Respiratory antimicrobials used for pneumonia
 - B. Broad spectrum agents predominately used for hospital-onset infections**
 - C. Fluoroquinolone antimicrobials
 - D. Novel broad spectrum restricted antimicrobials for MDR pathogens



Considerations and Limitations of SAAR



SAAR – Dynamic vs. Static

- SAAR metrics are a static measure, currently benchmarking against the 2017 national data set
- Periodically the benchmark data is updated but changes in other hospital's prescribing patterns will NOT effect your local institutions SAAR in real time

SAAR - Seasonality

- Avedissian et al. 2019
- Evaluated impact of seasonality on SAAR data
- Demonstrated at the study site of practice (Northwestern Memorial Hospital) that seasonal variation of antibiotic use had the potential to impact SAAR

SAAR – Antimicrobial Appropriateness

- SAAR > 1 does not necessarily equal inappropriate use
 - For example, narrow spectrum beta-lactam agents SAAR being > 1 might indicate a strategic choice and show that the institution is on average using a more narrow spectrum than would be expected
- SAAR < 1 does not necessarily equal appropriate use
 - For example, broad spectrum hospital onset SAAR being < 1 may be inappropriate if patients are routinely receiving ineffective spectrum of coverage based on the institution's resistance pattern

SAAR – Clinical Context

- SAAR metrics as a whole cannot provide clinical context of the prescribing culture at an institution
- SAAR highlights areas of variance / deviation from the expected
- SAAR needs to be combined with onsite clinical context to effectively design interventions



Published Applications



SAAR as a Motivational Tool

- Shealy et al. 2021
- Prospective cohort study
- Purpose: examine the utility of SAAR reporting and inter-facility comparisons as a motivational tool to improve overall and broad-spectrum AU

SAAR as a Motivational Tool

SAAR Category	Hospital A			Hospital B			Hospital C		
	Pre	Post	p-Value	Pre	Post	p-Value	Pre	Post	p-Value
All agents, all locations	0.69	0.62	0.06	1.09	0.83	<0.001	0.60	0.64	0.69
Broad-spectrum agents used for hospital-onset infections, ICU	0.67	0.52	0.01	1.36	0.81	<0.001	0.83	0.54	0.007
Agents used for resistant gram-positive infections, ICU	0.59	0.64	0.37	1.27	0.72	<0.001	0.68	0.60	0.31

SAAR as a Motivational Tool

- Using SAAR as a motivational tool led to overall decreases in SAAR and reduced variations between different hospitals in the same health system

Prospective Audit and Feedback – Impact on SAAR

- Livorsi et al. 2017
- Single center retrospective cohort study
- Purpose: evaluate the impact of prospective audit and feedback (PAF) on SAAR

Prospective Audit and Feedback – Impact on SAAR

- Prospective audit and feedback led to persistent reductions in the SAAR categories:
 - Broad spectrum agents predominately used for hospital-onset infections
 - Broad spectrum agents predominately used for community-acquired infections
 - Anti-MRSA agents

Prospective Audit and Feedback – Impact on SAAR

- Griebel et al. 2018
- Single center retrospective cohort study
- Purpose: evaluate the impact of prospective audit and feedback (PAF) on SAAR

Prospective Audit and Feedback – Impact on SAAR

- Prospective audit and feedback led to persistent reductions in the SAAR while antimicrobial-prescribing outcomes and patient safety outcomes remained stable OR improved
- Key takeaway, SAAR values substantially < 1 can be safely achieved



Case Examples



Case #1

- You are the antimicrobial stewardship pharmacist for a 250 bed hospital
- Your facility starts to participate in NHSN AU module and you now have access to DOT and SAAR data
- Goal: utilize the NHSN AU data to decide on the next targeted intervention your antimicrobial stewardship program (ASP) will implement

Case #1 – SAAR Data

SAAR Metric	Q1 2021	Q2 2021	Q3 2021	Q4 2021
Adult_All-Antibacterial_2017	1.13	1.15	1.16	1.13
Adult_Antifungal_ICU_2017	0.92	0.98	1.01	1.34
Adult_Antifungal_Ward_2017	1.23	0.82	0.67	0.73
Adult_BSHO_ICU_2017	1.15	1.24	1.07	1.04
Adult_BSHO_Ward_2017	1.17	1.09	1.08	1.13
Adult_GramPos_ICU_2017	1.22	1.09	1.31	1.06
Adult_GramPos_Ward_2017	1.47	1.36	1.21	1.56
Adult_NSBL_ICU_2017	0.89	0.91	0.90	1.01
Adult_NSBL_Ward_2017	1.08	0.97	0.99	1.22

Question #2

- Based on the available SAAR data, what would be a reasonable initiative to implement?
 - A. Carbapenem restriction criteria
 - B. Mandatory ID consult for *Staphylococcus aureus* bacteremia
 - C. Pharmacy-driven MRSA nares PCR screening for patients on empiric anti-MRSA therapy
 - D. Prospective audit and feedback targeting fluconazole

Question #2

- Based on the available SAAR data, what would be a reasonable initiative to implement?
 - A. Carbapenem restriction criteria
 - B. Mandatory ID consult for *Staphylococcus aureus* bacteremia
 - C. Pharmacy-driven protocol for MRSA nares PCR screening for patients on empiric anti-MRSA therapy
 - D. Prospective audit and feedback targeting fluconazole

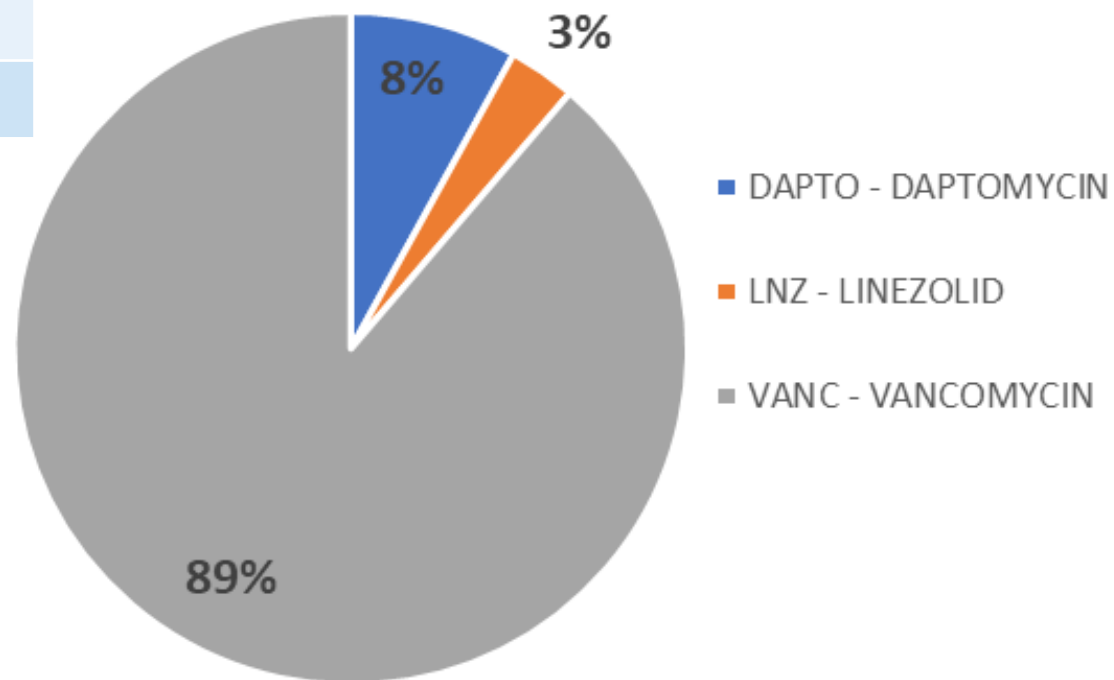
Case #1 - Continued

- DOT / 1000 Patient Days can be useful to determine which antimicrobial is driving the bulk of the elevation in SAAR
- It can also be used to track changes over time in specific antimicrobial prescribing

Case #1 - Continued

Antimicrobial	Q1 2021	Q2 2021	Q3 2021	Q4 2021
Vancomycin	108.5	106.4	115.5	101.2
Daptomycin	10.3	9.3	8.7	10.1
Linezolid	4.9	3.2	2.3	4.8

Anti-MRSA Agents



Question #3

- Based on the available DOT data, which anti-MRSA agent would you focus PAF efforts on?
 - A. Vancomycin
 - B. Daptomycin
 - C. Linezolid

Question #3 - Answer

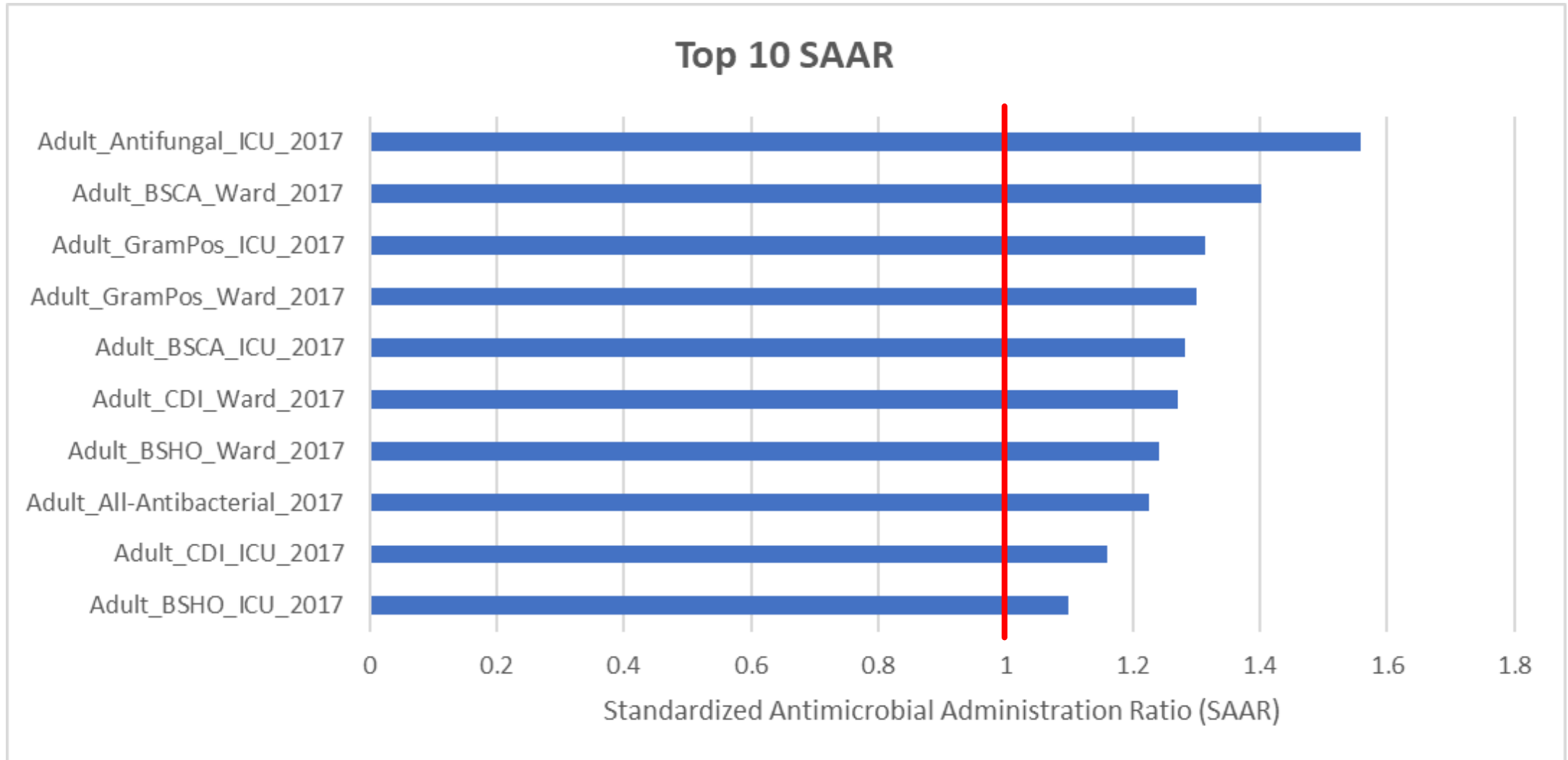
- Based on the available DOT data, which anti-MRSA agent would you focus PAF efforts on?
 - A. Vancomycin**
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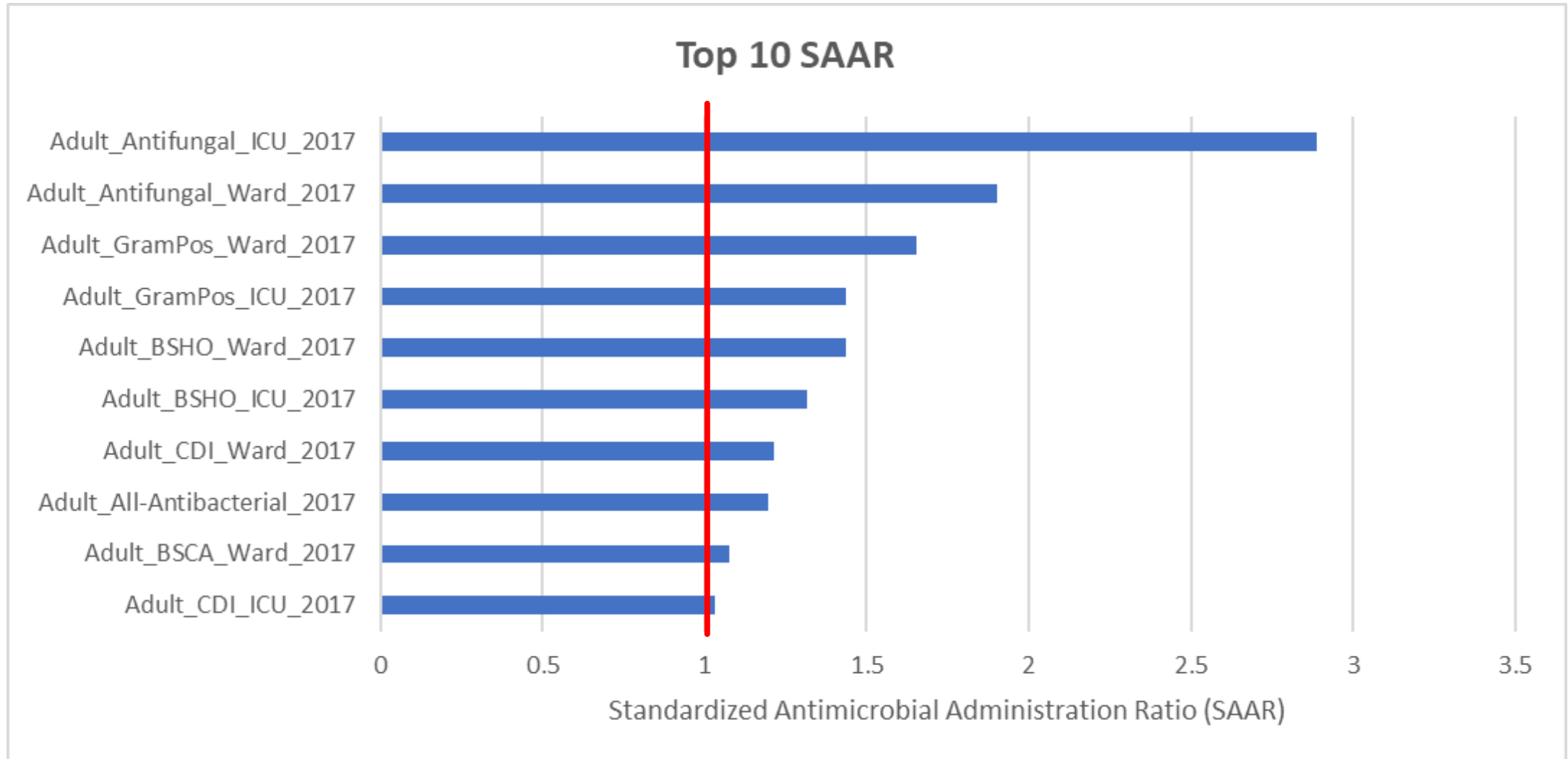
Case #2

- You are the system-level antimicrobial stewardship pharmacist for a health system with three hospitals
- You are tasked with reviewing last year's NHSN AU data to determine system goals for the stewardship program for the coming year

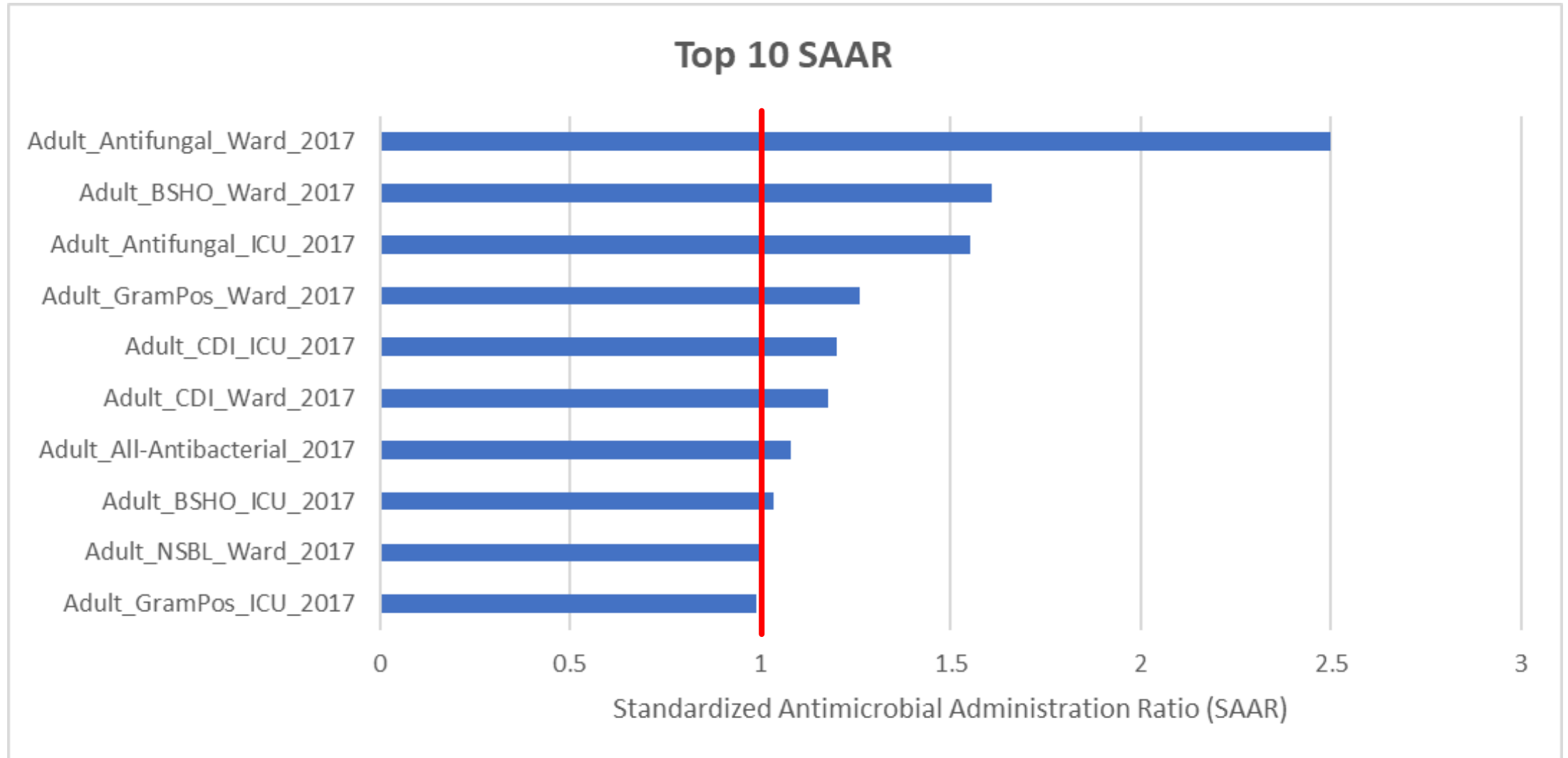
Case #2 – SAAR Data for 2021 - Hospital A



Case #2 – SAAR Data for 2021 - Hospital B



Case #2 – SAAR Data for 2021 - Hospital C



Question #4

- What conclusion can you draw from the SAAR about all three facilities?
 - A. Anti-MRSA agent use on the general medical wards is inappropriate
 - B. All three hospitals use too many antibiotics overall
 - C. All three hospitals prescribe excessive antifungal therapy in their ICUs
 - D. Antifungal use in the ICUs is greater than would be expected for each hospitals specific factors

Question #4 - Answer

- What conclusion can you draw from the SAAR about all three facilities?
 - A. Anti-MRSA agent use on the general medical wards is inappropriate
 - B. All three hospitals use too many antibiotics overall
 - C. All three hospitals prescribe excessive antifungal therapy in their ICUs
 - D. **Antifungal use in the ICUs is greater than would be expected for each hospitals specific factors**



Summary

- Several preset groupings of antimicrobial are available for SAAR data
- SAAR data can highlight areas of variance / deviations from expected use
- Clinical context is crucial when evaluating any antimicrobial utilization data
- DOT data can aid efforts to identify which antimicrobials are driving elevations in SAAR data

Questions?



References

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