Tracking Antibiotic Spectrum Using A Novel Metric, Days of Antibiotic Spectrum Coverage (DASC)

Hiroyuki Suzuki MD MSCI[1,2], Brett Heintz PharmD BCPS AQ-ID[3], Daniel J Livorsi MD MS[1,2], Eli N Perencevich MD MS[1,2], Michihiko Goto MD MSCI[1,2]

1) Center for Access & Delivery Research & Evaluation (CADRE), Iowa City VA Health Care System;
2) Department of Internal Medicine, University of Iowa Carver College of Medicine, Iowa City, IA; 3) Department of Pharmacy, Iowa City VA Health Care System

Introduction

- In the United States, days of therapy (DOT) is the currently preferred method for measuring antibiotic consumption
- A major disadvantage of DOT is that it does not account for the antibiotic's spectrum.
- Antibiotic stewardship (ASP) activity to avoid unnecessarily broad-spectrum antibiotics is not well-captured by DOT
- We compared the performance of DOT and Days of Antibiotic Spectrum Coverage (DASC), a novel metric to capture the spectrum using antibiotic consumption data at Iowa City VA Health care System (ICVAHCS)

Materials and Methods

Study Design and data collection

- We analyzed the retrospective data of inpatient antibiotic use at ICVAHCS from 2017 to 2021
- Antibiotic DOT for each antibiotic type was obtained from Veterans Integrated Service Network (VISN) 23 Antimicrobial stewardship dashboard

Days of Antibiotic Spectrum Coverage

- DASC is calculated by multiplying DOT and the antibiotic spectrum coverage (ASC) score
- ASC score was assigned based on the activities of each antibiotic agent for 11 wild type bacteria and 5 acquired resistance patterns DASC for each antibiotic was calculated by multiplying ASC score for each antibiotic to DOT
- Total monthly DOT was the aggregation of monthly DOT for each antibiotic
- Total monthly DASC was the aggregation of monthly DASC for each antibiotic
- DASC/DOT was obtained to evaluate the mean ASC for the month

Metrics	Antibiotics	D1	D2	D3	D4	D5	D6	D7	Total
DOT	Piperacillin/tazobactam	1	1	1					7
	Cefazolin				1	1	1	1	
DASC	Piperacillin/tazobactam	11	11	11					45
	Cefazolin				3	3	3	3	

De-escalation

Metrics	Antibiotics	D1	D2	D3	D4	D5	D6	D7	Total
DOT	Meropenem	1	1	1					11
	Ceftriaxone+metronidazole				2	2	2	2	
DASC	Meropenem	12	12	12					68
	Ceftriaxone+metronidazole				8	8	8	8	

Antimicrobial stewardship activity at ICVAHCS

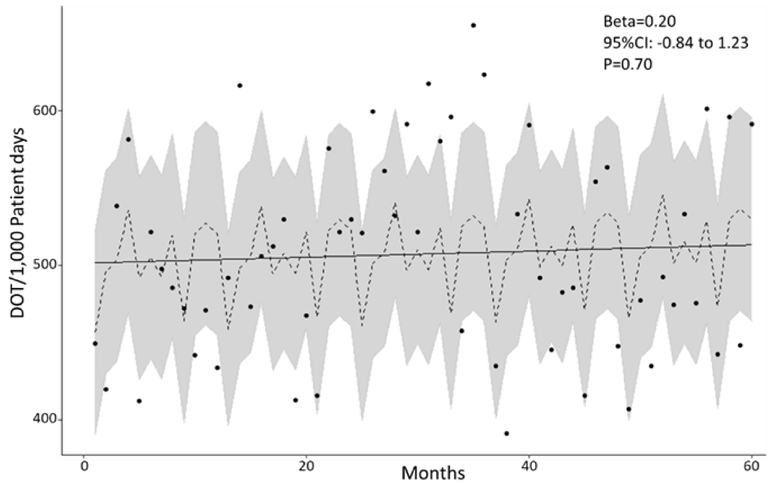
- Consists of two Infectious Diseases (ID) providers and one ID pharmacist
- Overseeing all patients on inpatient antibiotic therapy through daily prospective audit and feedback (PAF) on weekdays (9.7 recommendations/week during the study period)
- Additional ASP activities included a monthly educational lecture to medical residents/students; promotion of a local antibiotic-prescribing guide available online and by a free smartphone app; and routine assignment of a clinical pharmacist to each inpatient physician team for assistance with ordering medications, including antibiotics

Statistical analysis

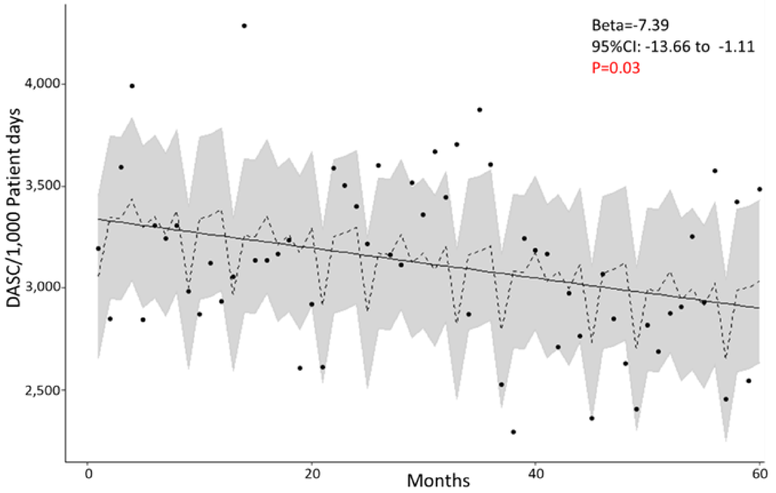
- Trends of total monthly DOT, DASC and DASC/DOT were analyzed by one-way linear regression accounting for the month in a year to address seasonality

Results

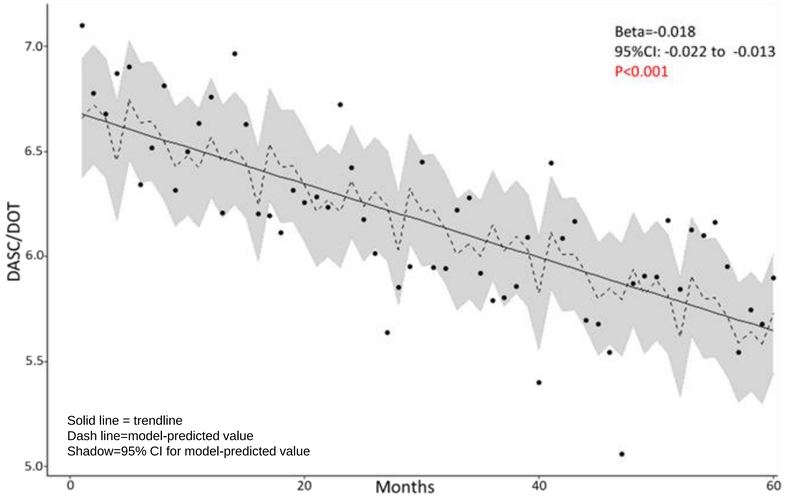
1. DOT/1,000 patient days: **Antibiotic consumption**



2. DASC/1,000 patient days : **Antibiotic consumption + spectrum**



3. DASC/DOT: **Antibiotic spectrum**



- Changes in DOT for several classes of antibiotics

Antibiotic class	DOT/1000 Patient-days in 2017	DOT/1000 Patient-days in 2021	% Change
Anti-pseudomonal agents	87.9	77.2	-12%
Fluoroquinolones	38.5	17.7	-54%
Anti-MRSA agents	65.7	53.2	-19%
Ceftriaxone	45.3	62.0	37%
Ampicillin/sulbactam or amoxicillin/clavulanate	34.5	38.6	12%

Discussion

- While a significant downward trend was seen when using DASC/1,000 present-days and DASC/DOT, no trend was observed when using DOT/1,000 days-present as a metric
- In contrast to DOT, which captures antibiotic consumption without considering the spectrum, DASC captures both antibiotic consumption and spectrum
- DASC/DOT captures average spectrum of antibiotics
- Metrics that don't capture antibiotic spectrum may not be able detect improvements in avoiding unnecessary use of broad-spectrum antibiotics, an important target of ASPs
- Future studies are needed to evaluate how DASC will predict clinical outcomes related to antibiotic use such as *Clostridioides difficile* infection or development of infection with resistant organisms
- DASC is a promising metric that should be considered for wider adoption if future studies confirm its responsiveness to stewardship processes and its association with relevant clinical outcomes

Reference

Kakiuchi S, Livorsi DJ, Perencevich EN, et al. Days of Antibiotic Spectrum Coverage (DASC): A Novel Metric for Inpatient Antibiotic Consumption. Clin Infect Dis. 2021 Dec 15;ciab1034. doi: 10.1093/cid/ciab1034.

Acknowledgement: We thank Mr. Erik Stensgard for allowing us to use the antibiotic consumption data through VISN 23 ASP dashboard.

Correspondence: Hiroyuki Suzuki MD (hiroyuki-suzuki@uiowa.edu)