Thank you

Virginia HAI Advisory Group;

Antimicrobial Stewardship Workgroup

HAI Advisory Group - HAIAR (virginia.gov)

Logistics – Zoom Meeting

To ask questions, click on the **Chat** icon. At the end of the presentation, you will also be able to unmute to ask a question verbally.

You may adjust your audio by clicking the caret next to the **Mute** icon.

Resources from today's session will be shared after the call.

Health Quality Innovation Network

Today's Presenter

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Antimicrobial Resistance Coordinator
 Healthcare-Associated Infections (HAI) and

Antimicrobial Resistance (AR) Program
 Division of Clinical Epidemiology (DCE)

Office of Epidemiology (OEPI)

Virginia Department of Health

Antimicrobial Stewardship Data

July 29, 2022

Agenda

1 Outline key metrics to assess the impact of an antibiotic stewardship program

2 Discuss current antibiotic use measuring and reporting via CDC-NHSN's AU module

3 Review example case studies using data to improve AS interventions

Why are data important to Antimicrobial Stewardship (AS)?

Establish baseline

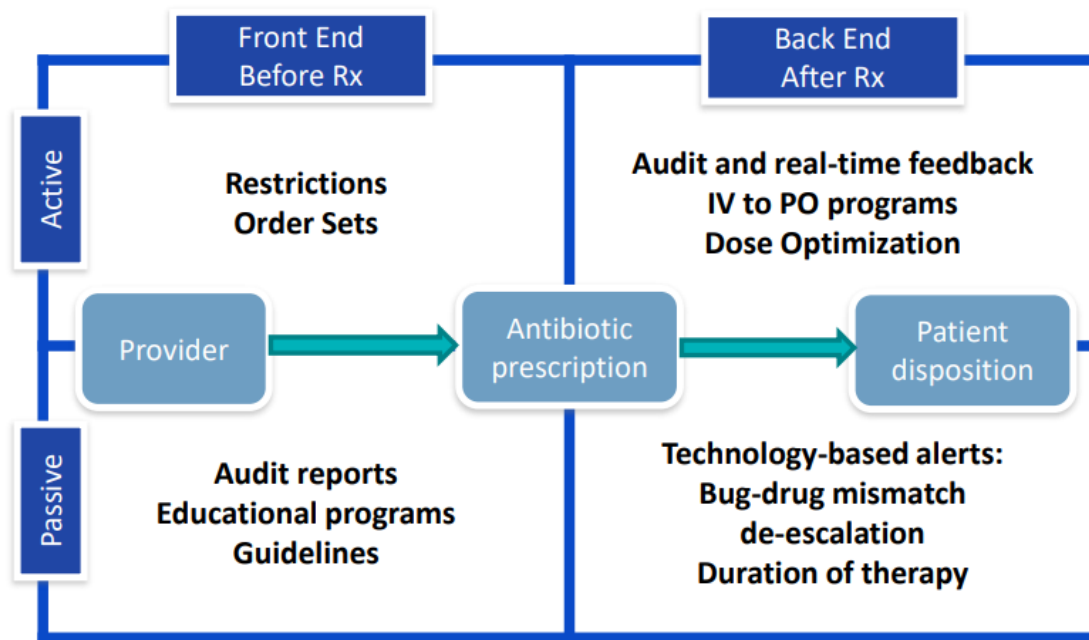Measure change overtime and benchmark against others

Inform guideline development and policy making

Identify intervention opportunities

Define determinants of practice

Allocate resources

Types of AS Measures

Metrics Category	Examples
Outcomes (vs. 'Balance' measure)	Mortality (inpatient), length of stay, rate of readmission
Unintended consequences (microbial outcomes)	Resistance, HAIs
Process measures	Proportion of: ASP recommendations followed; guideline adherence; number of ASP alerts acted on
Appropriateness	Right drug, dose, route, schedule and duration
Antibiotic Cost	$$ spent on purchasing, dispensing or administered antibiotics (normalized per patient days or admission)
Antibiotic utilization (AU)	Days of Therapy (DOT)

All metrics categories are included in the CDC Core Elements

Successful implementation of the CDC Core Elements requires data

- Leadership commitment/accountability
  - Quality improvement projects
  - Reporting structure with facility leadership
- Action
  - Antimicrobial targets for intervention
- Tracking
  - Antimicrobial use
  - Process measures
  - Outcome measures
- Reporting
  - Aligns with tracking element
- Education
  - Academic detailing

Types of interventions should guide metrics

Adapted from Moerhing RW Anderson DJ, Curr Infect Dis Rep 2012; 14(6):592-600

11

AS Data Sources

Metrics Category	Data Sources	Example Professional Collaboration
Outcomes (vs. 'Balance' measure)	- CMS tracking	- Quality Improvement/Safety Officer - Information Technology
Unintended consequences (microbial outcomes)	- NHSN HAI data - Micro data (antibiograms)	- Infection Prevention - Microbiology
Process measures	- Medication Use Evaluation - EHR - ASP Internal Tracking System	- Students/learners - Information Technology
Antibiotic utilization (AU)	- EHR/Pharmacy system	- Information Technology

AS Measurement Issues

Resistance measurement
- Changes in resistance may take time and may not be reflected in antibiogram
- Community bacterial isolates influence

Outcomes
- Many confounding factors for mortality, LOS

Antimicrobial Use
- Squeezing the balloon
- "Zero" is not the goal
- Needs to be adjusted by census

Cost
- Economic endpoints should be used to complement other stewardship goals
- Drug costs can vary
- Expect a plateau

Appropriateness
- Historically difficult to define
- Increase in research/publications

The ultimate key is to have a measure that is useful for stewardship activities, meaningful to providers and that can be tracked over time to assess improvements

Process Measures

Poll Question

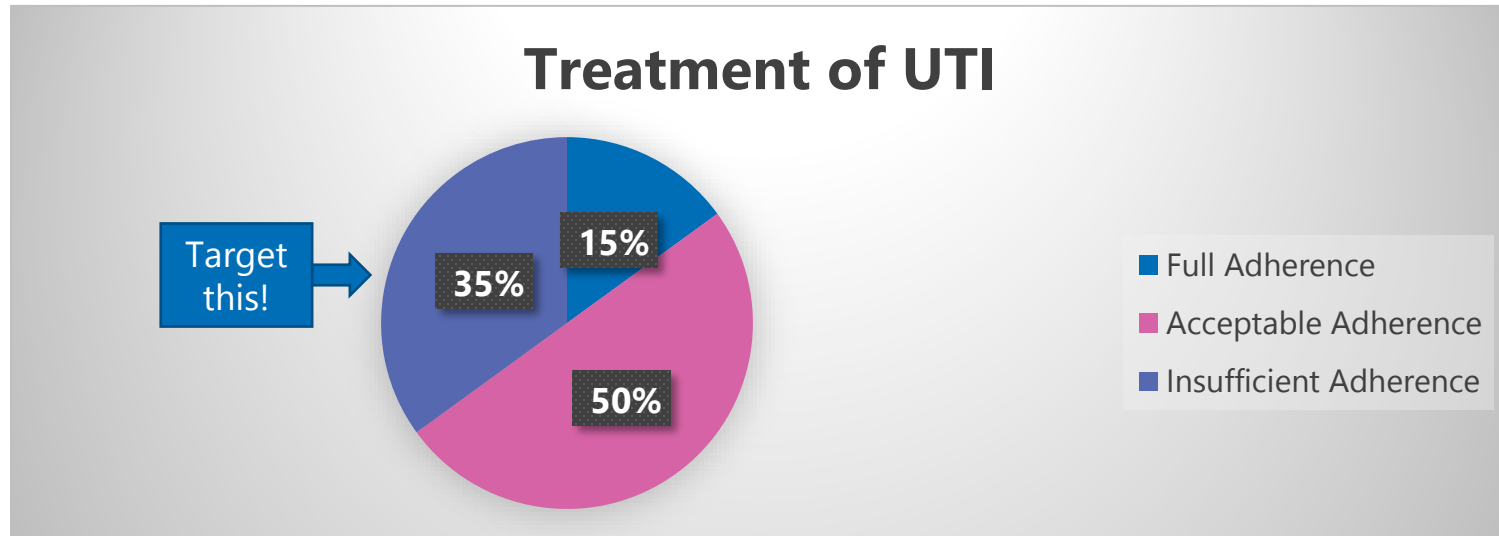How often do you report ASP process measures to hospital leadership?
A. Monthly
B. Quarterly
C. Annually
D. Other
E. Do not report process measures to hospital leadership
F. Don't know

Process Measures by AS Intervention

Action Element	What to Measure	Considerations
Prospective audit and feedback	- Number of charts reviewed or alerts reviewed - Number by type of intervention recommended	- Computer decision support options for tracking - Can stratify by categories (bug-drug mismatch, antibiotics for >72 hours)
Antimicrobial restriction	- Number of calls/requests - Number of approvals or denials - Categorize denials	- Who all has authority to "approve/deny"
Facility-specific guidance	- Number of guidance documents created and reviewed annually - Percent adherence to guidance	- Embedded in order sets or standalone documents - Indications for use

Example: Adherence to Facility-specific treatment guidance

Treatment of UTI

Target this! →

- 15% Full Adherence
- 50% Acceptable Adherence
- 35% Insufficient Adherence

Example AS Intervention Categories

- ❑ Recommended discontinuing antibiotics
- ❑ Recommended broadening antibiotic coverage
- ❑ Recommended de-escalating antibiotics
- ❑ Recommended no change
- ❑ Recommended switch to different antibiotic (similar spectrum of activity)
- ❑ Recommended dose optimization
- ❑ Recommended ID consult

Can easily and systematically show value by tracking these categories and reporting to leadership

Example: Implementing Antibiotic Time-outs

Setting

- Self-Stewardship Time-out Project for Broad- Spectrum Antibiotics (SSTOP Broad-Spectrum Antibiotics) project was implemented at a tertiary care teaching hospital within a large Southern California Veterans Affairs (VA) health care system

Implementation

- Targeted vancomycin and piperacillin-tazobactam
- Antibiotic time-outs were introduced stepwise to new services on an approximately monthly basis, starting with vancomycin time-outs on the general medicine services

Intervention

- Electronic Antimicrobial Dashboard
- Antibiotic Time-out Templates
- Social Marketing and Educational Program

Outcome Measurement

- Electronic Chart Review for Time-out Outcomes and Guideline Concordance
- Usability Survey

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4750836/

Usability Survey

- Adaption of the System Usability Scale (SUS) to evaluate the usability and usefulness of the dashboard reports
  - The SUS is a publically available 10-item usability scale known for its broad applicability and easy administration and interpretation

2. I found that using the *templates* for self-approval [from disagree strongly (1) to agree strongly (7)]:

Made ordering renewals more difficult than calling someone for approval. ___
Increased my feelings of autonomy. ___
Increased my workload. ___
Decreased my confidence about decisions regarding antibiotics. ___
Improved discussions about antibiotic use during rounds. ___
Decreased conflict with pharmacist. ___
Increased the likelihood of making a good antibiotic ordering decision. ___
I intend to use the templates for self-approval frequently. ___
Comments _____
_____

I found the Antibiotic Informational Online *educational content* to be [from disagree strongly (1) to agree strongly (7)]:

Easy to use. ___
Easy to access. ___
Unnecessarily complex. ___
Useful in everyday practice. ___
Comments _____

Overall, based on your experience, the entire Antibiotic Renewal Program is:

Undesirable	1	2	3	4	5	6	7	Desirable
Negative	1	2	3	4	5	6	7	Positive
Not at all helpful	1	2	3	4	5	6	7	Very helpful

Key Message: Tailor your measurement!

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4750836/

Antimicrobial Usage

AU Measurement Approaches

- Antimicrobial use (AU) data
    - Total use measure
    - Appropriateness of use
    - Cost
- Stratification categories
    - Drug class
    - Provider type
    - Syndrome/diagnosis
    - Hospital unit
- Approaches to measurement
    - NHSN Antimicrobial Use Module
    - "Home-grown" tracking method
    - Point prevalence survey

IDSA and CDC both recommend using Days of Therapy as the preferred AU measure

Stratification can help target areas for improvement and make interventions more manageable

CDC recommends using the NHSN Antimicrobial Use Module

Poll Question

What is your facility's approach to tracking antimicrobial use
a. Use NHSN AU Module
b. Use "Homegrown System"
c. Use EHR reports or other electronic system
d. Use Point Prevalence Survey
e. Other tracking method
f. Don't know
g. No tracking exists

NHSN AU Option

National Healthcare Safety Network (NHSN) is CDC's system for tracking and reporting healthcare-associated infections

- Objectives
    - Monitor and improve antimicrobial prescribing
    - Identify, understand, and respond to antimicrobial resistance patterns or trends
    - Requires barcode medication administration data or electronic medication administration records to be extracted
    - Cost and time commitment involved
- Key features
    - Data usable by submitting hospitals, CDC, state public health agencies
    - Single set of technical specifications and standard definitions
- Electronic data
    - Medication administration data
    - Admission and transfer data
    - No personal identifiers

Flow of Antibiotic Use Data AUR Module

Medication administration record data

Health IT Vendor Services/Software

Extracted along with admission and discharge data

Clinical Document Architecture CDA

Formatted and submitted electronically

Stored on NHSN Servers

Hospital staff can access and analyze using NHSN-platform tools, and/or download data for further analysis

NHSN AU Measurement

Based on Days of Therapy (administered) per 1000 patient days present

- Days of therapy
  - Barcode medication administration
- Days Present
  - Time period during which a given patient is at risk for antimicrobial exposure in a given patient location
    - Census data by facility and wards/units

https://www.cdc.gov/nhsn/psc/aur/index.html

Example Days of Therapy Calculation

Table 1. *Example eMAR for patient housed in Medical Ward*

Medical Ward	Monday December 28	Tuesday December 29	Wednesday December 30
Meropenem 1g intravenously every 8 hours	Given: 2300	Given: 0700 Given: 1500 Given: 2300	Given: 0700
Amikacin 1000mg intravenously every 24 hours	Given: 2300	Given: 2300	

Table 2. *Example of calculation of antimicrobial days*

Calculation	Monday December 28	Tuesday December 29	Wednesday December 30
Drug-specific Antimicrobial Days (total)	Meropenem Days = 1 Amikacin Days = 1	Meropenem Days = 1 Amikacin Days = 1	Meropenem Days = 1 Amikacin Days = 0
Drug-specific Antimicrobial Days Stratified by Route of Administration	Meropenem Days (IV) = 1 Amikacin Days (IV) = 1	Meropenem Days[a] (IV) = 1 Amikacin Days (IV) = 1	Meropenem Days (IV) = 1 Amikacin Days (IV) = 0

[a] Please note, despite receiving three administrations of Meropenem on December 29, the patient only contributed one total Meropenem antimicrobial day per calendar day.

Locations

Adult Locations
- All adult locations
- Medical Ward
- Med-Surgical Ward
- Surgical Ward
- Medical ICU
- Med-Surgical ICU
- Surgical ICU
- Step Down Units
- General Heme-Onc Ward

Pediatric Locations
- All pediatric locations
- Medical Ward
- Med-Surgical Ward
- Surgical Ward
- Medical ICU
- Med-Surgical ICU

Neonatal Locations
- Step down Neonatal Nursery
- Neonatal Critical Care (Level II/III)
- Neonatal Critical Care (Level III)
- Neonatal Critical Care (Level IV)

NHSN AU:Location-specific and Facility-wide Inpatient Metrics

Patient Care Location-Specific Analyses

Rate of Antimicrobial Days per 1,000 Days Present

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

Notes:

- One patient can contribute only one day present per calendar day for each specific location.
- Summed total may be higher when compared to facility-wide count (reflecting transfers between locations).

Facility-wide Inpatient Analyses

Rate of Antimicrobial Days per 1,000 Days Present

$$\frac{Drug\ specific\ antimicrobial\ days\ for\ all\ inpatient\ units\ in\ a\ facility\ per\ month}{Days\ present\ per\ facility\ wide\ inpatient\ per\ month} \times 1000$$

Notes:

- One patient can contribute only one day present per calendar day for a facility. Thus, one denominator is obtained for all inpatient locations in an entire facility.
- The day present measure for facility-wide inpatient should be lower when compared to sum total from location-specific comparison.
- Only include inpatient units where both the antimicrobial days (numerator) and the days present (denominator) can be accurately electronically captured.
- Exclude outpatient locations.

Rate of Antimicrobial Days per 100 Admissions

$$\frac{Drug\ specific\ antimicrobial\ days\ for\ inpatient\ units\ in\ a\ facility\ per\ month}{Admissions\ per\ facility\ wide\ inpatient\ per\ month} \times 100$$

Notes:

- Only calculated for facility-wide inpatient for the AU Option.
- Only include inpatient units where both the antimicrobial days (numerator) and the days present and admissions (denominators) can be accurately electronically captured.
- Exclude outpatient locations.

Can download graphs from NHSN for different time periods, antimicrobial agents, and patient locations

NHSN AU Module

Main advantage of submitting data to NHSN AU Module (compared to other AU tracking methods) is the ability to benchmark!

- Benchmarking
  - Comparison of AU measures to internal or external standards
  - Recommended as a key part of hospital ASP
  - Helps identify AU outliers, target interventions, track over time
  - Makes comparison of hospitals more meaningful by controlling for inter-hospital differences

NHSN uses the Standardized Antibiotic Administration Ratio (SAAR) for benchmarking

Standardized Antimicrobial Administration Ratio (SAAR)

SAAR is an Observed-to-Predicted ratio

Days of therapy reported by a healthcare facility for a specified category of antimicrobial agents in a specified patient care location or group of locations

Days of therapy predicted on the basis of nationally aggregated AU data for a healthcare facility's use of a specified category of antimicrobial agents in a specified patient care location or group of locations

SAAR Predictive Model

Factors assessed in 2017 baseline adult and pediatric SAAR predictive models:
- Patient care location type
- Facility type
- Hospital teaching status
- Hospital bed-size
- Number of ICU beds
- Percentage of ICU beds, calculated as (ICU beds/total hospital beds) x 100
- Average facility length of stay (LOS), calculated as (annual patient days/annual admissions)

https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/aur/au-saar-guide-508.pdf

SAAR Reports

Total of 47 possible SAARs

- 22 antimicrobial agent categories
  - 7 adult, 8 pediatric, and 7 neonatal
- 17 specific NHSN location types
  - 8 adult, 5 pediatric, and 4 neonatal

SAARs can be produced by month, quarter, half year, or year or cumulative time periods.

Antimicrobial Categories

Adult Categories

- All antibacterial agents

- Broad spectrum antibacterial agents predominantly used for hospital-onset infections (BSHO)

- Broad spectrum antibacterial agents predominantly used for community-acquired infections (BSCA)

- Antibacterial agents predominantly used for resistant Gram-positive infections (e.g., MRSA)

- Narrow spectrum beta-lactam agents (NSBL)

- Antibacterial agents posing the highest risk for CDI (not mutually exclusive, agents may overlap with other categories)

- Antifungal agents predominantly used for invasive candidiasis

Pediatric Categories

- All antibacterial agents

- Broad spectrum antibacterial agents predominantly used for hospital-onset infections

- Broad spectrum antibacterial agents predominantly used for community-acquired infections

- Antibacterial agents predominantly used for resistant Gram-positive infections (e.g., MRSA)

- Narrow spectrum beta-lactam agents

- Azithromycin

- Antibacterial agents posing the highest risk for CDI (not mutually exclusive, agents may overlap with other categories)

- Antifungal agents predominantly used for invasive candidiasis

Neonatal Categories

- All neonatal antibacterial agents

- Vancomycin predominantly used for treatment of late-onset sepsis

- Broad spectrum antibacterial agents predominantly used for hospital-onset infections

- Third generation Cephalosporins

- Ampicillin predominantly used for treatment of early-onset sepsis

- Aminoglycosides predominantly used for treatment of early-onset and late-onset sepsis

- Fluconazole predominantly used for candidiasis

Adult Antibiotic Groupings by SAAR

Adult Broad spectrum antibacterial agents predominantly used for hospital-onset infections (BSHO)

- Amikacin (IV only)

- Aztreonam (IV only)

- Cefepime

- Ceftazidime

- Doripenem

- Gentamicin (IV Only)

- Imipenem/cilastatin

- Meropenem

- Piperacillin/tazobactam

- Tobramycin (IV only)

Adult Broad spectrum antibacterial agents predominantly used for community-acquired infections (BSCA)

- Cefaclor

- Cefdinir

- Cefixime

- Cefotaxime

- Cefpodoxime

- Cefprozil

- Ceftriaxone

- Cefuroxime

- Ciprofloxacin

- Ertapenem

- Gemifloxacin

- Levofloxacin

- Moxifloxacin

Full list of antimicrobials included in each category can be found on page 27 of the NHSN AUR Protocol

Interpreting SAAR

- A SAAR > 1.0 indicates greater antimicrobial than predicted
- A SAAR = 1.0 indicates antimicrobial use equivalent to predicted use
- A SAAR < 1.0 indicates less antimicrobial use than predicted

Note: A SAAR is not a definitive measure of appropriateness of antimicrobial use; any SAAR value may warrant additional investigation

Example SAAR Graph

NSBL and BSCA SAARs for Medical Wards, 2017-2019*
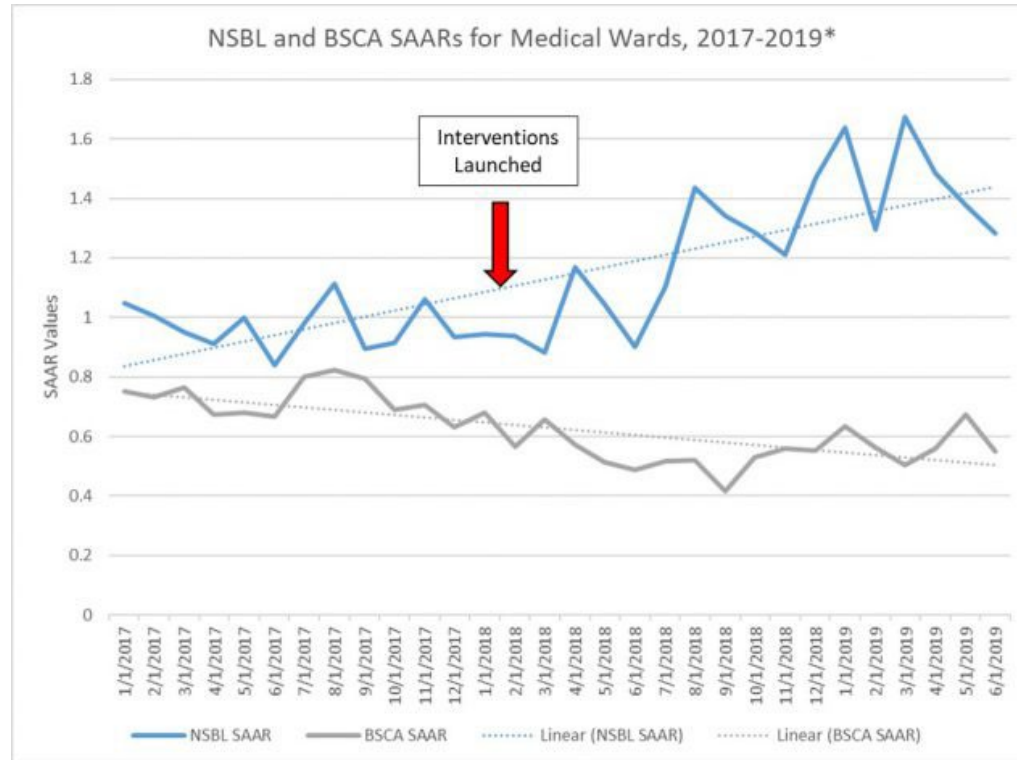
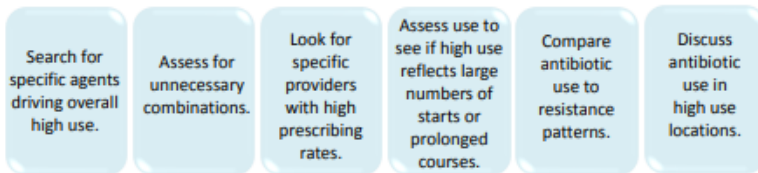# CDC guidance for AS on using data

- Use guidance in conjunction with the SAAR to target assessments in areas where use is unexpectedly high
- Could still find this tool useful to assess higher than expected levels of antibiotic use even if your facility is NOT submitting to NHSN
- This tool might also help antibiotic stewardship programs find opportunities for improvement, even in locations where antibiotic use is within expected levels
- Guidance intended to identify areas where the potential for improvement is high based on previous studies and experience
- Ideally, these assessments will be driven by local data on antibiotic use

https://www.cdc.gov/antibiotic-use/healthcare/pdfs/Strategies-to-assess-antibiotic-use-in-hospitals-508.pdf

SAAR or other indicators of antibiotic use show higher than expected values
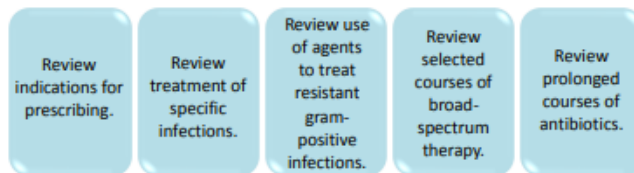
↓

General Assessments

Search for specific agents driving overall high use.	Assess for unnecessary combinations.	Look for specific providers with high prescribing rates.	Assess use to see if high use reflects large numbers of starts or prolonged courses.	Compare antibiotic use to resistance patterns.	Discuss antibiotic use in high use locations.

Narrow investigation targets → Medication use evaluations

Detailed Reviews

Review indications for prescribing.	Review treatment of specific infections.	Review use of agents to treat resistant gram-positive infections.	Review selected courses of broad-spectrum therapy.	Review prolonged courses of antibiotics.

↓

Stewardship Actions

FEEDBACK   EDUCATION   INTERVENTION

Using The Data: Examples

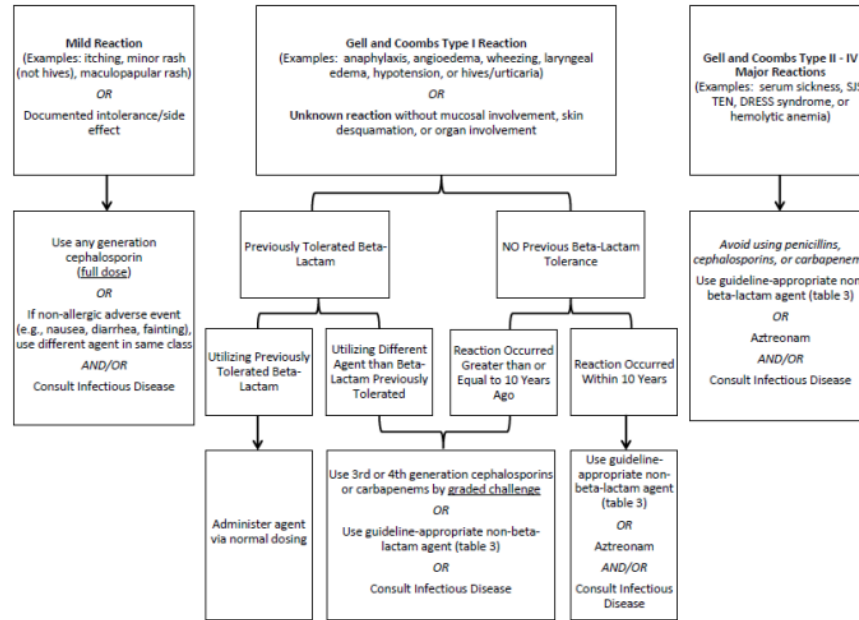# Using Cost to Evaluate an Intervention

The Problem
ASP Pharmacist notices a high percentage of patients on aztreonam while conducting prospective audit and feedback
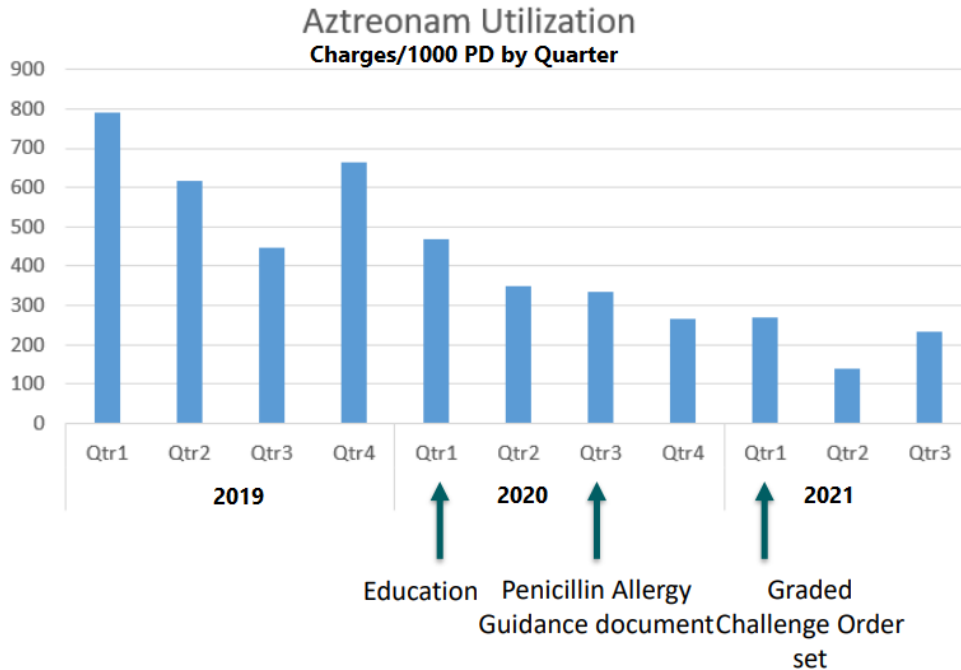
The Intervention

1. ASP Pharmacist reviews guidance/best practice for beta-lactam allergy
2. Phase 1 – conduct in-service
3. Phase 2 – create guidelines and get buy-in from QI/Nursing/P&T
4. Phase 3 – use guidelines to create order set

Allergy Assessment & Graded Challenge

https://www.unmc.edu/intmed/divisions/id/asp/clinical-pathways/index.html

Using Cost to Evaluate an Intervention

Aztreonam Utilization
Charges/1000 PD by Quarter

Using SAAR to Decrease FQ Use

The Problem

Wilson Medical Center, a 145 bed facility located in Eastern North Carolina noted the highest SAAR values were for the BSCA category in both the ICUs and wards

- SAARs of nearly 2.0 or greater for adult ICUs and wards
- This category, specifically fluoroquionolone (FQ) use, was an area of high use that was previously suspected

The Intervention

Empiric FQ therapy and long treatment durations were identified as key targets
Stewardship team prepared empiric treatment guidelines that were intentionally quinolone sparing

- Providers were educated and order sets were updated to reflect the new recommendations during the summer of 2016.

Using SAAR to Decrease FQ Use

BSCA SAAR Values for Wards & ICU, 2016-2018
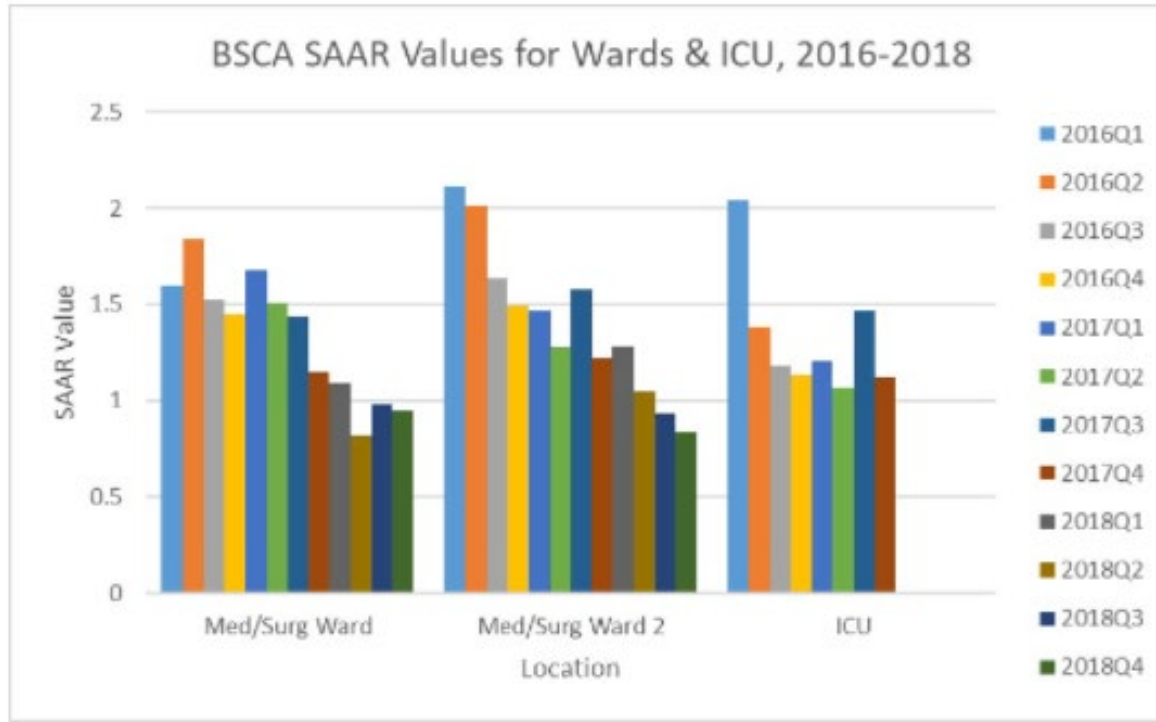
Getting Fancy: AS Dashboard
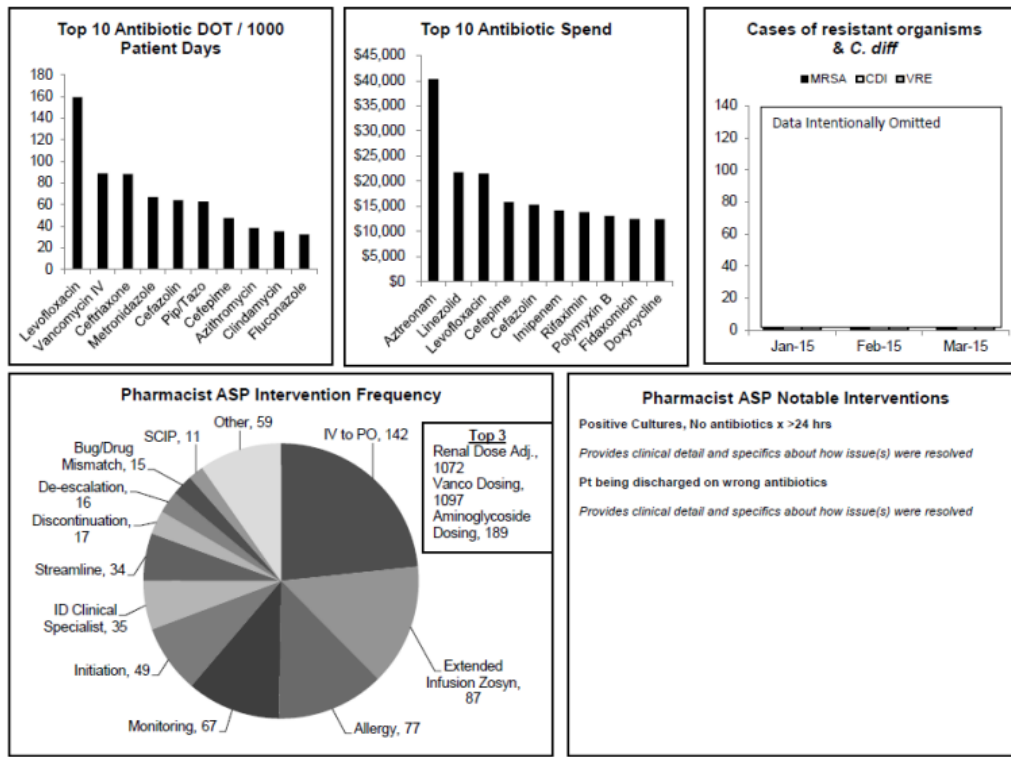
Putting it all together

Summary: Measure Something!

- Process
  - Antimicrobial use
  - Compliance with policy

- Outcomes
  - Resistance
  - Safety
  - Mortality
  - LOS

- Comparative
  - Over time
  - Benchmark with like institutions

- Compelling
  - Demonstrate value
  - Reduce variation
  - Know your audience

Key Tips

- Leverage existing resources (IT, IP, QI)

- Conduct environment scan for existing data sources relevant to ASP

- Make sure the juice is worth the squeeze

- Not a "one-size" fits all approach – think about what outcomes you want to demonstrate

Upcoming Events

Join Us for the next session of
Antimicrobial Stewardship Summer Camp

Wednesday, August 31 from noon to 1 p.m. ET
Reducing Hospital Onset CDI Through Diagnostic Stewardship: The University of Virginia Experience

Registration Link:
https://hqin-org.zoom.us/meeting/register/tZEvdOCpqTwuGNbDlx-CVQjIG9_emOcSQfQ1

August Office Hours
Zero Tolerance for Workplace Violence
Date: August 11
Time: 12:00 PM
Registration Link:
https://hqin-org.zoom.us/meeting/register/tJMqdO6sqj0sH9Gqv-umYdfPUQbxD1vyVT6N

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