Antibiotic Stewardship in Small and Critical Access Hospitals

Shaina Bernard, PharmD, BCPS
Antimicrobial Resistance Coordinator

Healthcare Associated Infections/Antimicrobial Resistance (HAI/AR) Team

Seth Levine, MPH	Epidemiology Program Manager
Sarah Lineberger, MPH	HAI/AR Program Manager
Shaina Bernard, PharmD	AR Coordinator
Carol Jamerson, RN, CIC	HAI/AR Nurse Investigator
Rehab Abdelfattah, MD, MPH, CIC	HAI/AR Clinical Investigations Consultant
Virgie Fields, MPH	HAI Epidemiologist
Emily Valencia, MPH	AR Epidemiologist
Christina Martone, MPH	HAI/AR Policy and Prevention Specialist
Tisha Mitsunaga, DrPH, ScM	CDC/CSTE Applied Epidemiology Fellow

Objectives

1. Report NHSN survey results related to antimicrobial stewardship for small and critical access hospitals
2. Define the CDC Core Elements for small and critical access hospitals
3. Compare evidence-based stewardship strategies to increase optimal antimicrobial use
4. List antimicrobial stewardship resources available from state agencies and partners

Background

- CDC published a comprehensive analysis outlining the top 18 antibiotic-resistant threats in the U.S. in 2013
  - Update planned for fall 2019
- Combating Antibiotic-Resistant Bacteria (CARB) National Action Plan, 2014
  - By 2020 reduce inappropriate antimicrobial use by 20% in inpatient settings
  - Emphasis on antimicrobial stewardship

https://www.cdc.gov/drugresistance/pdf/report-to-the-president-on-combating-antibiotic-resistance.pdf

Decreasing Antimicrobial Resistant Infections

Antimicrobial Stewardship

Infection Prevention

Tracking

Developing New Drugs and Diagnostics

Association between antibiotic use and resistance

- Changes in antimicrobial use are paralleled by changes in resistance
- Antimicrobial resistance is more prevalent in healthcare-associated bacterial infections
- Patients with healthcare-associated infections caused by resistant strains are more likely than control patients to have received prior antimicrobials
- Increasing duration of patient exposure to antimicrobials increases the likelihood of colonization with resistant organisms

Clinical Infectious Diseases. 2016. 62;10:e51–e77

Impact of Antimicrobial Stewardship

Multidisciplinary antimicrobial stewardship programs have been associated with:

- Decreased antimicrobial use (22%–36% reductions)
- Reduced rates of antimicrobial resistance among health care–associated pathogens (e.g., *Pseudomonas*, *S. aureus*)
- Reduced incidence of adverse outcomes associated with antibiotic use (e.g., C. difficile infection)
- Significant reductions in pharmacy expenditures ($200K–$900K per year)

Dellit T.H., et al. Clinical Infectious Diseases (2007) 44:159-77 Davey P., et al. Cochrane Database Systematic Review (2005) 19(4):CD003543

Stewardship Goals

OPTIMIZING antibiotics as part of the medical TEAM

1. Appropriate use of antibiotics
2. Improve patient outcomes
3. Minimize adverse effects
4. Reduce antimicrobial resistance
5. Decrease health care cost

Clinical Infectious Diseases. 2016. 62;10:e51–e77

CDC Core Elements for Antimicrobial Stewardship

https://www.cdc.gov/antibiotic-use/healthcare/implementation/core-elements.html

Barriers to Implementing Antimicrobial Stewardship

- Resources
- Lack of leadership support
- Infrastructure
- Patient population
- Lack of understanding by providers

Clinical Infectious Diseases. 2016. 62;10:e51–e77

Small and Critical Access Hospital Core Elements

1. Leadership commitment from administration
2. Single leader responsible for outcomes
3. Single pharmacy leader
4. Specific improvement interventions
5. Antibiotic use tracking
6. Regular reporting on antimicrobial use and resistance
7. Education to providers on use and resistance

https://www.cdc.gov/antibiotic-use/healthcare/implementation/core-elements-small-critical.html

Small and Critical Access Hospitals in Virginia

23/24 hospitals answered the 2017 NHSN Annual Survey

Non- ICU bed size
Average: 51
Range: 15 - 118

Infection Preventionists FTEs
Average: 0.88
Range: 0.4 - 1

Hospital Epidemiologist FTEs
Average: 0.2
Range: 0 - 1

Small and Critical Access Hospital Core Elements: Results from NHSN Annual Survey

1. Leadership commitment from administration
   - *Written statement of support: 21/23 hospitals*
   - *Salary support: 8/23*
2. Single leader responsible for outcomes
   - *Leader assigned for stewardship: 22/23 hospitals*
3. Single pharmacy leader
   - *Pharmacist assigned for stewardship: 23/23 hospitals*
4. Specific improvement interventions
   - *At least one improvement intervention: 23/23 hospitals*
   - *Indication for therapy: 16/23 hospitals*
   - *Prospective antimicrobial review: 19/23 hospitals*
   - *Procedure for clinicians to review appropriateness: 16/23 hospitals*
   - *Antibiotic approval process: 15/23 hospitals*

Small and Critical Access Hospital Core Elements: Results from NHSN Annual Survey

5. Antibiotic use tracking
    - *Days of therapy: 20/23 hospitals*
    - *Purchasing data: 9/23 hospitals*
6. Regular reporting on antimicrobial use and resistance
    - *Report shared with prescribers: 18/22 hospitals*
7. Education to providers on use and resistance
    - *Education provided: 22/23 hospitals*

Core Elements for Long Term Care

Leadership

Accountability

Drug Expertise

Action

Tracking

Reporting

Education

Demonstrate Leadership Support

1. Written statement of leadership support to improve antibiotic use
2. Support training for hospital stewardship leaders
3. Antibiotic use and resistance data is reviewed with facility leadership and the hospital board

Core Elements for Hospitals

Leadership

Accountability

Drug Expertise

Action

Tracking

Reporting

Education

Example Letter

The (Insert Hospital Name) commits to creating a culture that promotes antimicrobial stewardship through the implementation of initiatives to optimize patient care and safety throughout the health system. Leadership is committed to ensuring the implementation of the Center for Disease Control and Prevention (CDC) Core Elements for Antimicrobial Stewardship Programs (ASP). The seven core elements for ASP include leadership commitment, accountability, drug expertise, action, tracking, reporting, and education.

Core Elements for Long Term Care

Leadership

Accountability

Drug Expertise

Action

Tracking

Reporting

Education

Identify lead(s) for antibiotic stewardship activities

1. Physician in the C-suite or individual that reports to the C-suite
2. Funding remote consultation or telemedicine with experts in antibiotic stewardship
3. Placing stewardship requirements into the contractual responsibilities of any external pharmacy services and requiring pharmacy contractors have formal stewardship training

Stewardship Interest Group of Virginia (SIGoVA)

- Group created by stewardship pharmacists to connect healthcare professionals dedicated to increasing optimal antibiotic use
- VDH has recently become involved to re-energize the group
  - Engaging members to join a communication platform to network and share ideas/policies
  - Arranging in-person meeting opportunities

Core Elements for Long Term Care

Leadership

Accountability

Drug Expertise

Action

Tracking

Reporting

Education

Policies to Improve Antibiotic Prescribing

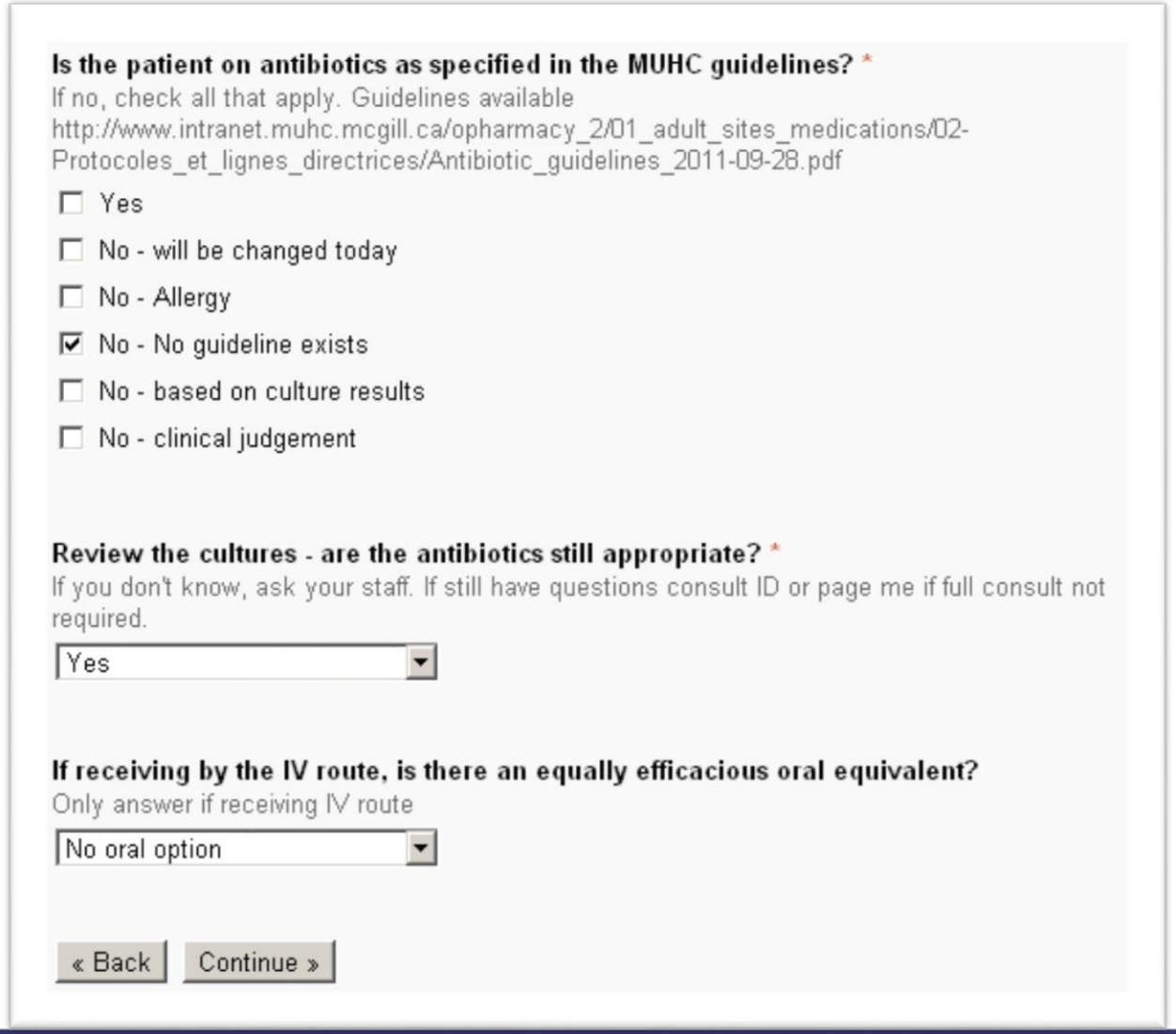
1. Develop facility specific treatment recommendations for infections
   - Community-acquired pneumonia
   - Urinary tract infections
   - Skin and soft tissue infections
2. Prospectively review antibiotic therapy for safety and indication
3. Utilize nurses for antibiotic time-outs

Antibiotic Time Out

- Stewardship is not something done “to you” or “for you”
- Ownership is on the primary team to ensure appropriate antibiotic use
- Centralized approaches to stewardship may fail to affect the many episodes of antimicrobial use not subject to scrutiny by the stewardship team
- Lessons learned from Infection Prevention

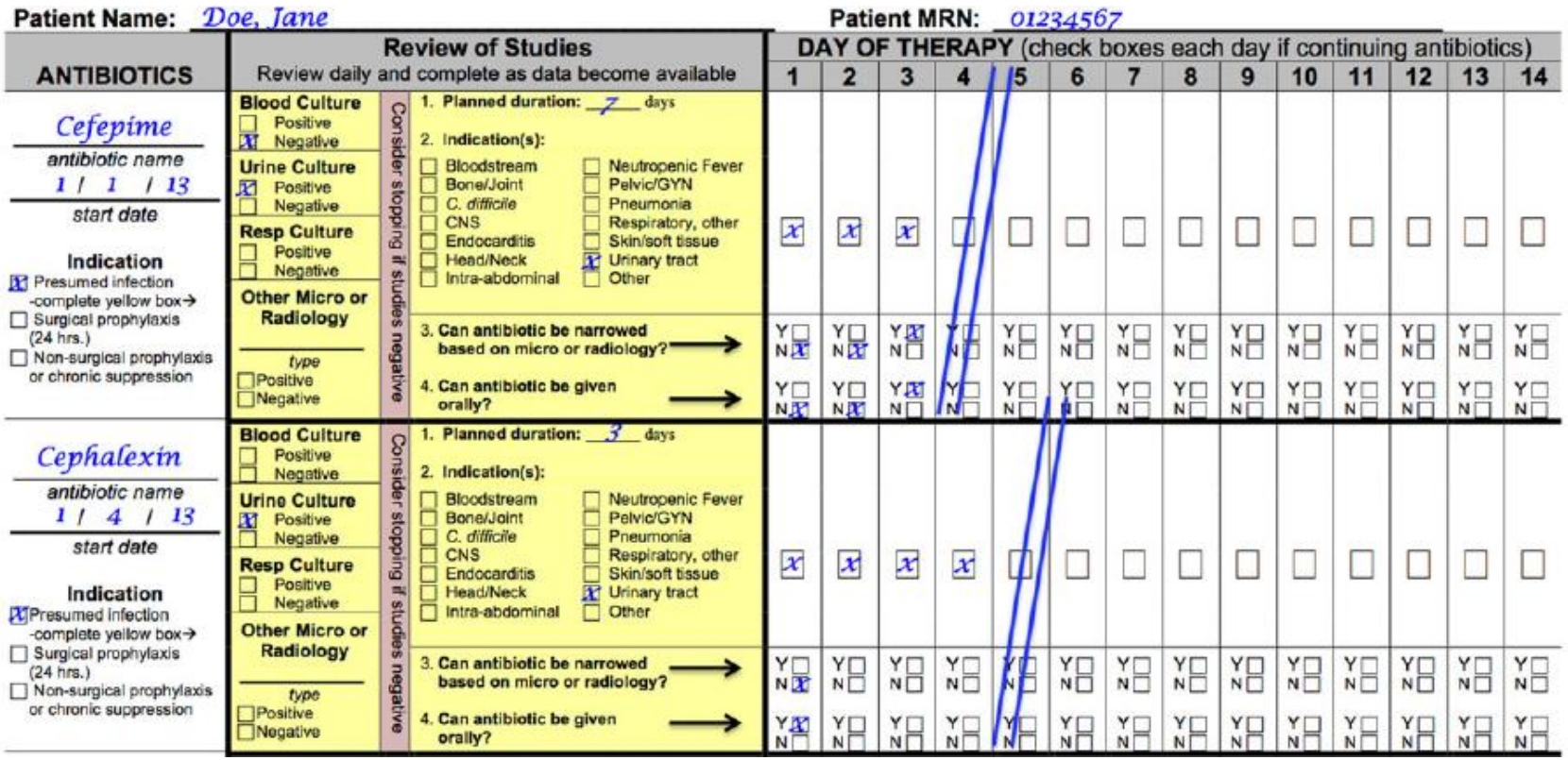
Lee TC et al. Ann Intern Med. 2014;18;161

Antibiotic Timeout Electronic Prompts



Lee TC et al. Ann Intern Med. 2014;18;161

Antibiotic Timeout Rounding Sheet



Patient Name: Doe, Jane **Patient MRN:** 01234567

ANTIBIOTICS	Review of Studies (Review daily and complete as data become available)	DAY OF THERAPY (check boxes each day if continuing antibiotics) 1 2 3 4 5 6 7 8 9 10 11 12 13 14
Cefepime antibiotic name 1 / 1 / 13 start date **Indication** ☒ Presumed infection -complete yellow box→ ☐ Surgical prophylaxis (24 hrs.) ☐ Non-surgical prophylaxis or chronic suppression	**Blood Culture** ☐ Positive ☒ Negative **Urine Culture** ☒ Positive ☐ Negative **Resp Culture** ☐ Positive ☐ Negative **Other Micro or Radiology** ____ type ☐ Positive ☐ Negative Consider stopping if studies negative 1. **Planned duration:** 7 days 2. **Indication(s):** ☐ Bloodstream ☐ Bone/Joint ☐ *C. difficile* ☐ CNS ☐ Endocarditis ☐ Head/Neck ☐ Intra-abdominal ☐ Neutropenic Fever ☐ Pelvic/GYN ☐ Pneumonia ☐ Respiratory, other ☐ Skin/soft tissue ☒ Urinary tract ☐ Other 3. **Can antibiotic be narrowed based on micro or radiology?** → 4. **Can antibiotic be given orally?** →	1 ☒ 2 ☒ 3 ☒ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 3. N ☒ N ☒ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ 4. N ☒ N ☒ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐
Cephalexin antibiotic name 1 / 4 / 13 start date **Indication** ☒ Presumed infection -complete yellow box→ ☐ Surgical prophylaxis (24 hrs.) ☐ Non-surgical prophylaxis or chronic suppression	**Blood Culture** ☐ Positive ☐ Negative **Urine Culture** ☒ Positive ☐ Negative **Resp Culture** ☐ Positive ☐ Negative **Other Micro or Radiology** ____ type ☐ Positive ☐ Negative Consider stopping if studies negative 1. **Planned duration:** 3 days 2. **Indication(s):** ☐ Bloodstream ☐ Bone/Joint ☐ *C. difficile* ☐ CNS ☐ Endocarditis ☐ Head/Neck ☐ Intra-abdominal ☐ Neutropenic Fever ☐ Pelvic/GYN ☐ Pneumonia ☐ Respiratory, other ☐ Skin/soft tissue ☒ Urinary tract ☐ Other 3. **Can antibiotic be narrowed based on micro or radiology?** → 4. **Can antibiotic be given orally?** →	1 ☒ 2 ☒ 3 ☒ 4 ☒ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 3. N ☒ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ 4. N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐ N ☐

Hamilton K. et al. Clin Infect Dis. 2015;60(8):1252-8.

Antibiotic Self Stewardship

Audit time frame	Total audits, n	Audits with change, n (%)	Type of change made, n(%)	
			Dose or duration	Other
First	1062	154 (14.5)	85 (55)	69 (45)
Second	271	24 (8.9)	15 (63)	9 (38)
Subsequent	180	11 (6.1)	7 (64)	4 (36)
Total	1513	189 (12.5)	107 (57)	82 (43)

Lee TC et al. Ann Intern Med. 2014;18;161

Antibiotic Self Stewardship

Drug or Class	Total audits, n	Audits with change, n (%)	Type of change made, n (%)	
			Dose, duration, or route	To another drug
Pipercillin/tazobactam	285	58 (20.3)	19 (33)	39 (67)
Fluoroquinolone	200	37 (18.5)	22 (60)	15 (40)
Vancomycin	93	13 (14)	6 (46)	7 (54)
Carbapenems	55	4 (7)	2 (50)	2 (50)

Conclusion: CDC's antibiotic time-outs can aid in reducing both costs and optimizing antimicrobial use

Lee TC et al. Ann Intern Med. 2014;18;161

Pharmacist stewardship activity

Core Elements for Long Term Care

Leadership

Accountability

Drug Expertise

Action

Tracking

Reporting

Education

1. Reviews antibiotic courses for appropriateness of administration and/or indication
2. Establishes standards for clinical/laboratory monitoring for adverse drug events from antibiotic use
3. Reviews microbiology culture data to assess and guide antibiotic selection

Prospective Audit With Intervention and Feedback

- Stewardship personnel reviews alerts generated by a computer decision support program
  - Example alerts: bug-drug mismatch, antibiotics/antifungals for > 3 days without positive cultures, duplicate antibiotic therapy with similar spectrum
- Stewardship personnel contacts team to recommend changes
  - Method of communication varies
- Interventions are more focused on targeted therapy/treatment duration
  - Patient has already been on antibiotics for >3 days by the time you are reviewing the alert

Clinical Infectious Diseases. 2016. 62;10:e51–e77

Antibiotic Restriction

Requires

- Process and **personnel** to restrict dispensing
- Requires education to staff about restriction policies
- Requires escalation pathway
- Requires documentation and audits

Limitations can vary based on resources

- Certain indications
- Specific prescribers (e.g., by infectious diseases specialists)
- Specific services or wards (e.g., critical care units)
- Specific patient populations (e.g., patients with immunosuppression or cystic fibrosis)

Criteria for use can be helpful to providers

- Explains rationale for restriction
- Gives education on when to use antibiotic

Clinical Infectious Diseases. 2016. 62;10:e51–e77

Criteria For Use Example

Caspofungin

- Empiric in patients with risk factors for resistant *Candida* spp. infections; Any ICU patient growing yeast in a blood culture; Targeted therapy for patients with resistant Candida

Linezolid

- Empiric in patients with risk factors for VRE; Targeted therapy for patients growing VRE in sites other than urine

Meropenem

- Patients with confirmed or expected multi-drug resistant gram-negatives; Patients not improving on cefepime or pipercillin/tazobactam

Facility Guidelines for the Treatment of Common Infections

Community-acquired pneumonia

- Uncomplicated pneumonia can be treated for 5-7 days in the setting of a timely clinical response

Urinary tract infections

- Criteria to distinguish between asymptomatic and symptomatic bacteriuria
- Fluroquinolones are not optimal empiric therapy

Skin and soft tissue infections

- Criteria to distinguish purulent and non-purulent infections

Monitor measures of antibiotic use

Core Elements for Long Term Care

Leadership

Accountability

Drug Expertise

Action

Tracking

Reporting

Education

1. Adherence to facility-specific treatment recommendations
2. Performs medication use evaluation
3. Monitors antibiotic days of therapy
   - Submit through CDC NHSN AU and Resistance Module

What Do Clinicians Want to Measure?

- 55-question online survey was e-mailed to 94 physicians or pharmacists in acute care hospitals in the United States
- Distribution list was developed based on those institutions that had contact with the Medical Affairs department at Cubist Pharmaceuticals and were known to have existing ASPs or thought to be developing ASPs
- The outcomes or metrics available in the survey for selection by respondents were based on the IDSA/SHEA ASP guidelines

What Do Clinicians Want to Measure?

- Respondents were from 48 institutions (51% response rate) in 29 states
- Academic/university hospital accounted for 52% of respondents
- 76% of respondents were ID pharmacists

Table 3. Respondents' Opinion of Most Important Antimicrobial Stewardship Program Outcomes Based on Audience and Those Collected as Metrics (n = 41)

Outcome[a]	Collected by Respondents as ASP Metric	Most Important	Hospital Administrator Perceived Most Important[b]	Pharmacy Director Perceived Most Important[b]	P&T Committee Perceived Most Important[b]	ID Physician Perceived Most Important[b]
Antimicrobial use	30 (73)	6 (15)	1 (2)	9 (22)	13 (32)	1 (2)
Antimicrobial cost	30 (73)	4 (10)	17 (41.5)	23 (56)	6 (15)	0 (0)
Appropriateness of antimicrobial use	21 (51)	23 (56)	2 (4.9)	2 (5)	6 (15)	11 (27)
Infection-related mortality rate	3 (7)	14 (34)	1 (2)	2 (5)	1 (2)	15 (37)
Infection or antibiotic-associated length of stay	5 (12)	9 (22)	2 (4.9)	0 (0)	1 (2)	3 (7)

2016 IDSA Antimicrobial Stewardship Guidelines

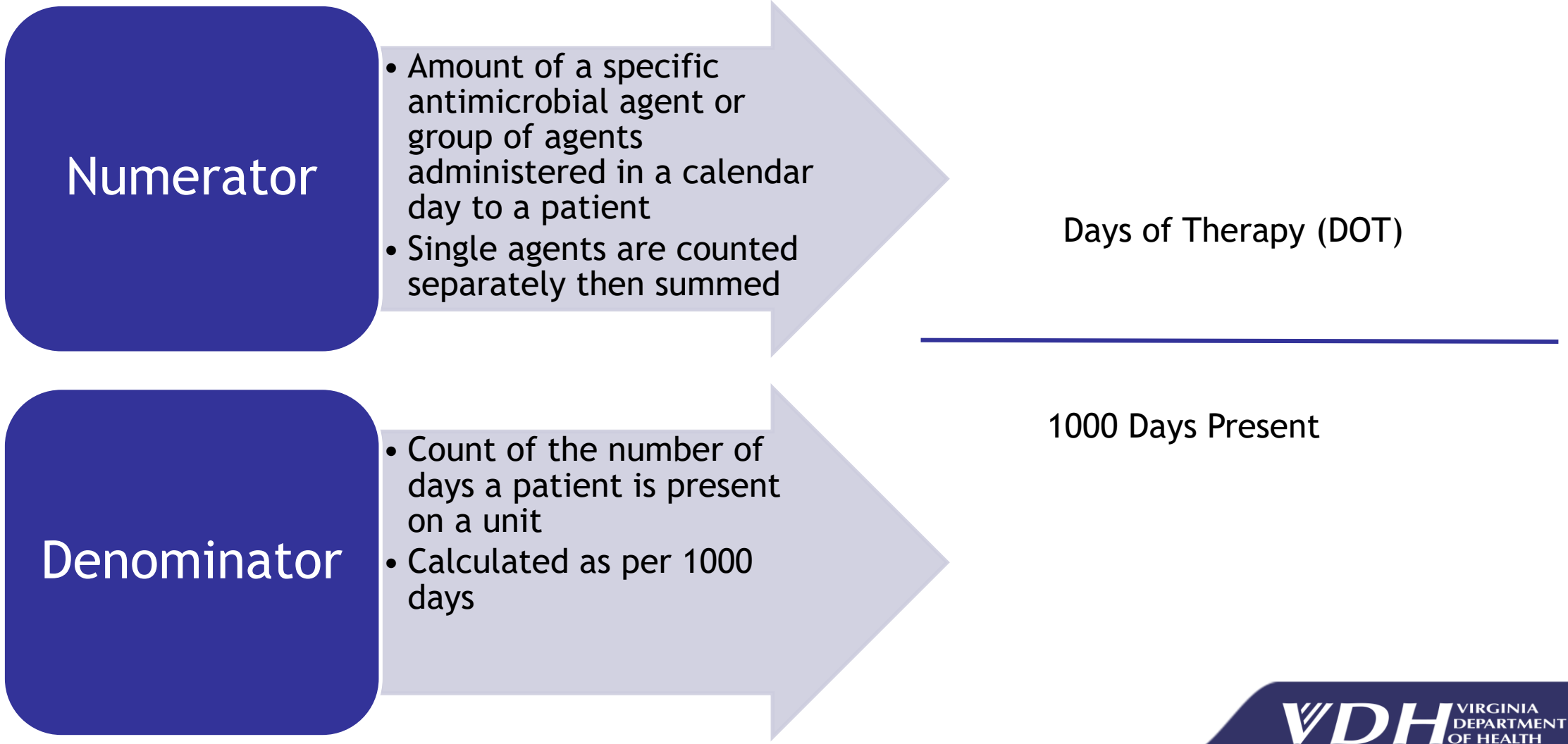
Which overall measures best reflect the impact of ASPs and their interventions?

- We suggest monitoring antibiotic use as measured by days of therapy (DOT) in preference to defined daily dose (DDD)
- ASPs should consider measurement of appropriate antibiotic use within their own institution by examining compliance with local or national guidelines and share that data with clinicians to help inform their practice
- Although rates of CDI or antibiotic resistance may not reflect ASP impact (because those outcomes are affected by patient population, infection control, and other factors) those measurements can also be used for targeted interventions

Antimicrobial Utilization Measures

- Understand the volume of antimicrobial use, patterns of use, and evaluate the impact of stewardship interventions
- Can be used for benchmarking
- Feasibility concerns
  - Full capture of targeted antimicrobial agents including non-formulary agents
  - Mapping of agents to a standard agent list
  - Mapping of hospital units with the appropriate unit type category

Antimicrobial Utilization Measures



Monitor outcomes of antibiotic use

Core Elements for Long Term Care

Leadership

Accountability

Drug Expertise

Action

Tracking

Reporting

Education

1. Monitors rates of *C. difficile* infection
2. Monitors rates of antibiotic-resistant organisms
3. Monitors rates of adverse drug events due to antibiotics

Provide facility-specific reports

Core Elements for Long Term Care

Leadership

Accountability

Drug Expertise

Action

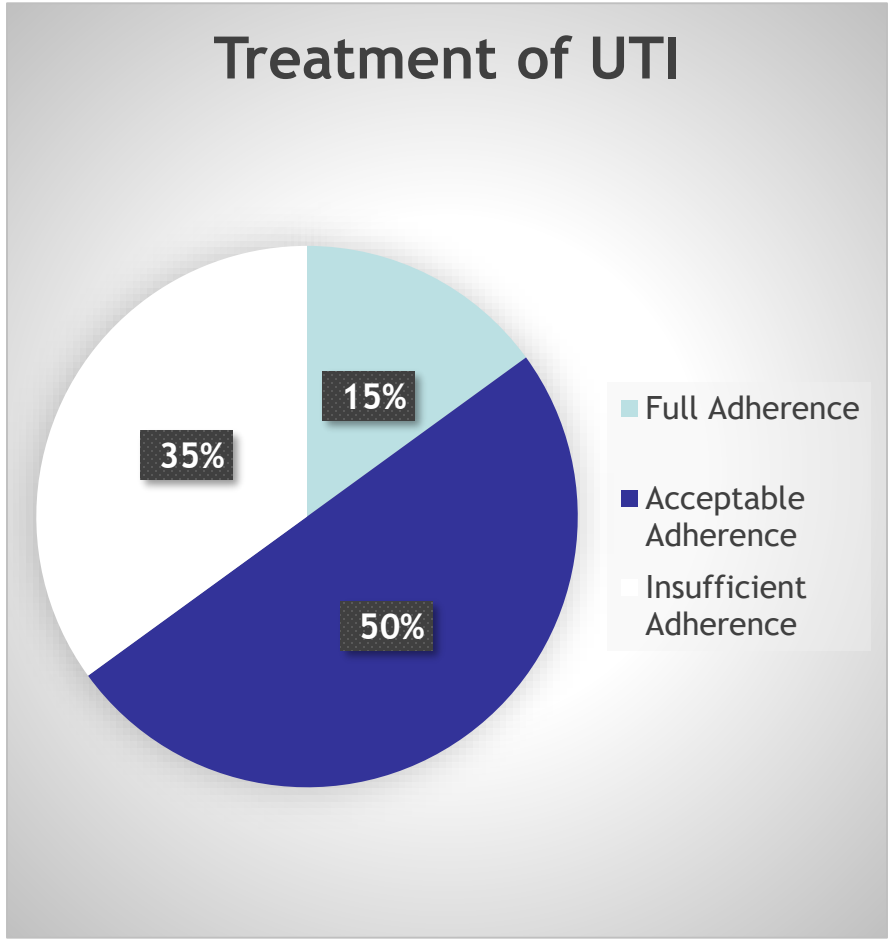
Tracking

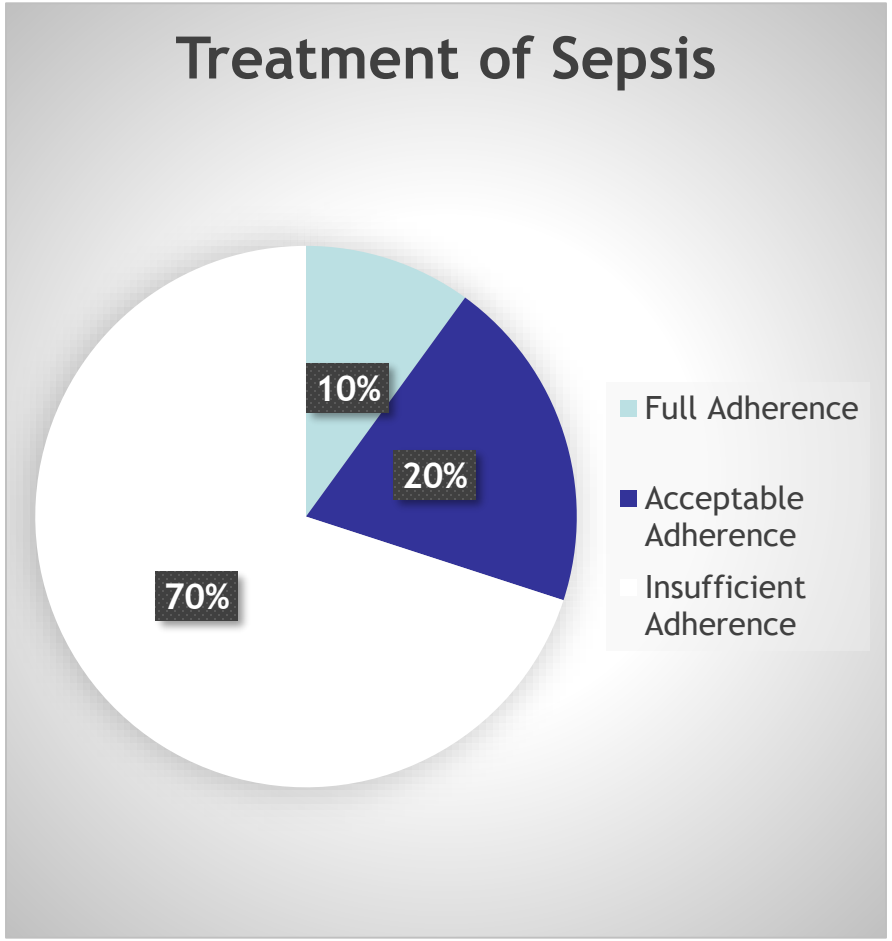
Reporting

Education

1. Measures of antibiotic use at the facility
   a) Personalized feedback on antibiotic use
2. Measures of outcomes related to antibiotic use
3. Report of facility antibiotic susceptibility patterns

Tracking


Treatment of UTI
15%
35%
50%
Full Adherence
Acceptable Adherence
Insufficient Adherence

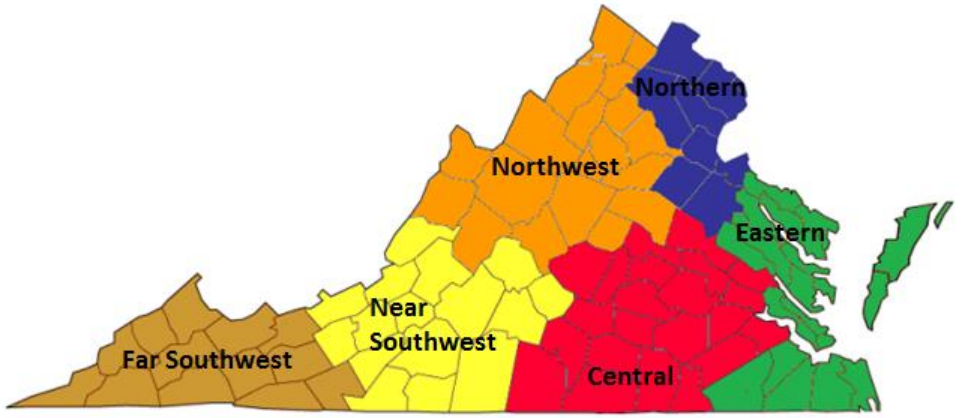

Treatment of Sepsis
10%
20%
70%
Full Adherence
Acceptable Adherence
Insufficient Adherence

State and Regional Cumulative Antibiogram

- The Virginia Healthcare-Associated Infections Advisory Group analyzed data from facility-level antibiograms to develop an understanding of antimicrobial susceptibility and resistance among bacteria recovered from clinical specimens across Virginia
  - Led by the Virginia Department of Health, Health Quality Innovators, and the Virginia Hospital and Healthcare Association
- June 2018 antimicrobial stewardship pharmacists were contacted to participate
- Seventy-six of eighty-five (89%) Virginia hospitals voluntarily submitted facility-level antibiograms for years 2016-2017
- Data included in the state and regional cumulative antibiogram were based on compilation of data from submitted antibiograms

State and Regional Cumulative Antibiogram

Region	Number of hospitals asked to participate	Number of hospitals participating, n (%)
Central	17	16 (94)
Eastern	18	16 (89)
Northern	15	12 (80)
Northwest	9	7 (78)
Far Southwest	11	11 (100)
Near Southwest	15	14 (93)
Total	85	76 (89)



State and Regional Cumulative Antibiogram

- Statewide data suggest similar trends in resistance to national data
  - For *Pseudomonas aeruginosa*, meropenem was resistant in 10% of isolates
  - For *E. coli*, 27% of isolates were resistant to levofloxacin compared to only 8% of isolates resistant to third generation cephalosporins
  - For *Staphylococcus aureus*, 47% of isolates were resistant to nafcillin
  - For *Enterococcus faecium*, 80% of isolates were resistant to ampicillin and 62% were resistant to vancomycin
- Full report can be found on the VDH HAI/AR website

Core Elements for Long Term Care

Leadership

Accountability

Drug Expertise

Action

Tracking

Reporting

Education

Provide educational resources about antibiotic resistance and opportunity for improving antibiotic use

1. Clinical providers
2. Nursing staff
3. Patients and families

Where to begin

1. Evaluate current practices
   a) Use core elements as guide
2. Start by implementing or adding one initiative
3. Use available resources
   a) CDC website
   b) VDH HAI/AR website
   c) Stewardship Interest Group of Virginia (registration form)

Summary

- Antibiotic resistance is a major public threat
- Antimicrobial stewardship programs are necessary to improve antibiotic use
- Successful stewardship programs require collaboration between administration, physicians, pharmacists, microbiologists, IP, nursing, and IT
- Small and critical access hospitals should consider which stewardship interventions will be the most successful in their unique facility
- Resources are available through VDH and CDC

Questions?

hai@vdh.virginia.gov

NHSN VDH Group

- HAI

Group ID: 12813

Password: health

- AUR

Group ID: 55773

Password: vdh_stewardship