North Carolina SPICE
Statewide Program for Infection Control & Epidemiology

North Carolina Clinical Antibiotic Stewardship Partners

PICK OUT A NEW TOOL: ENHANCING ANTIMICROBIAL STEWARDSHIP IN THE HOSPITAL THROUGH SMART AIMS AND IMPROVED INTERVENTIONS

September 13, 2023

NC CLASP Hospital Stewardship
Year 2, Session 1

NORTH CAROLINA CLINICAL ANTIBIOTIC STEWARDSHIP PARTNERS (NC CLASP)

- NC CLASP is a new initiative created to support acute care, outpatient, and nursing home settings to improve antibiotic stewardship and the health of patients throughout North Carolina
- NC CLASP is funded by NC DHHS and administered through the NC Statewide Program for Infection Prevention and Epidemiology (NC SPICE)
- There is no cost to participate

INTRODUCTIONS

Please put your name, hospital, and location in the chat!

CONFLICT OF INTEREST DISCLOSURES

- The views and opinions expressed in this series are those of the speakers and do not reflect the official policy or position of any agency of the US or NC government or UNC.
- Our speakers have the following financial relationships with the manufacturer(s) and/or provider(s) of commercial services discussed in this activity:
  - Dr. Kistler served as a consultant for Base10, Inc on their UTI embedded clinical support tool and received funding from Pfizer to study pneumococcal carriage.
  - Dr. Willis has performed contracted research with: Pfizer (pediatric nirmatrelvir-ritonavir and maternal RSV vaccine), Novavax (pediatric COVID-19 vaccine), and Merck (monoclonal antibody for RSV prevention)
  - Ms. Doughman owns individual Gilead stock.
- The speakers do not intend to discuss an unapproved/investigative use of a commercial product/device in this series, and all COI have been mitigated.
- These slides contain materials from a variety of colleagues, as well as the CDC, WHO, AHRQ, etc.

CME AND CE CREDIT

- CME & CE for participants
  - Attendance and active participation per learning session
  - Click the link in the chat during the session to document your attendance
  - Complete surveys as requested

OUTLINE OF TODAY'S SESSION

- ✓ Welcome & Housekeeping
- ❑ Building on the background: Core Elements of Hospital Stewardship
- ❑ CLASP Year 2 Overview
- ❑ Planned Improvement: Using Smart Aims
- ❑ Breakout session: discussion
- ❑ Tools to improve antibiotic use in individual patients
  - ❑ Focus on some strategies that can help discontinue antibiotics
- ❑ Homework and Wrap-Up

DEFINITION: ANTIMICROBIAL STEWARDSHIP

Stewardship describes the careful and responsible management of something entrusted to one's care.

In 1996, John McGowan and Dale Gerding first applied the term antimicrobial stewardship, where they suggested a causal association between antimicrobial agent use and resistance. …

Antimicrobial Stewardship (AMS) refers to the optimal selection, dosing, and duration of antimicrobial treatment resulting in the best clinical outcome with minimal side effects to the patients and minimal impact on subsequent resistance.

Shrestha J, Zahra F, Cannady P. Antimicrobial Stewardship In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan. PMID: 34283434

NC CLASP: YEAR TWO

6 hour-long learning sessions

September 2023-May/June 2024

CE included: CME, RN, Pharmacist (ACPE)

Two in-person conferences

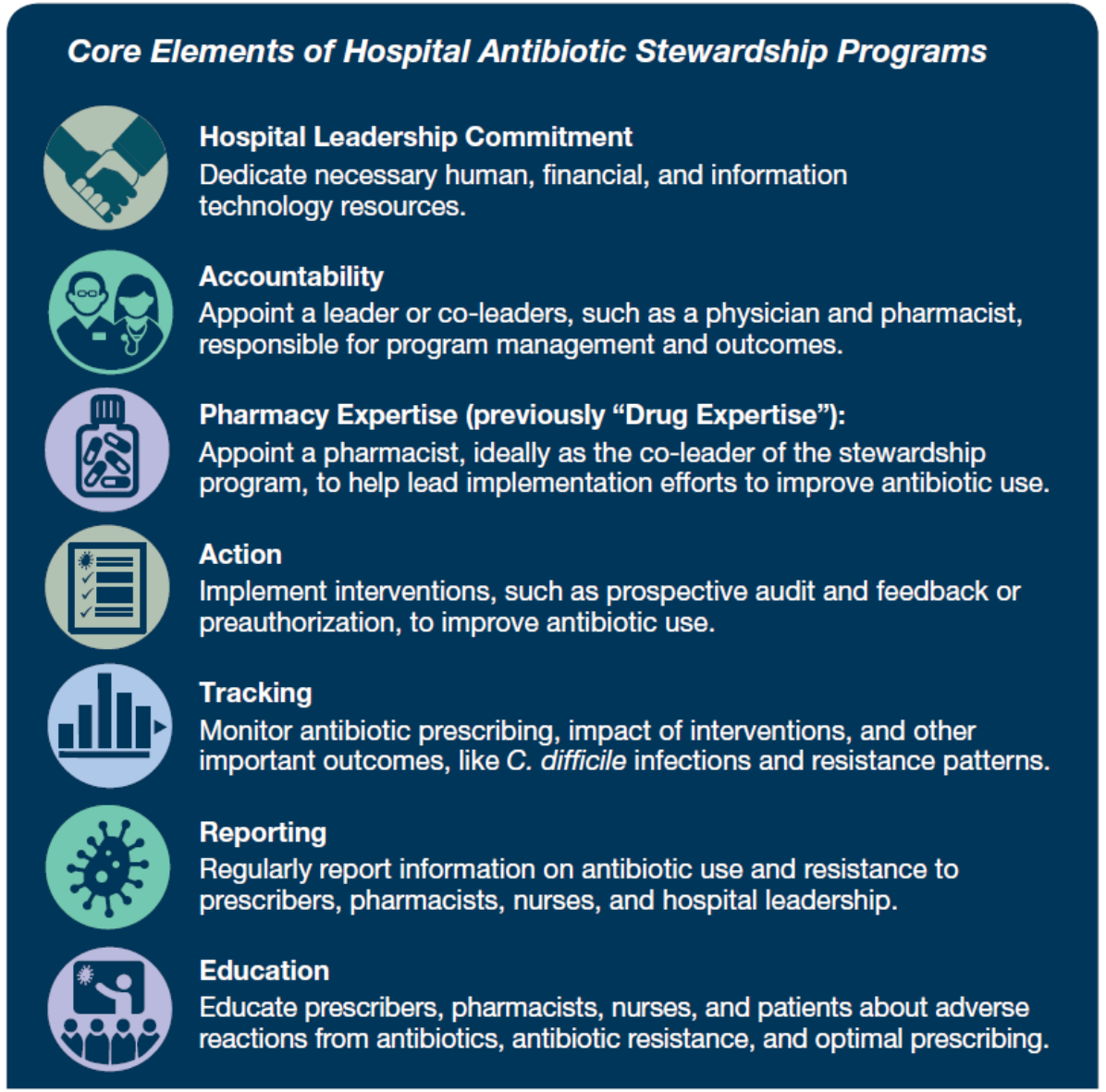
- **<u>In-depth discussion topics include:</u>**

- De-escalation skills
- NHSN reporting
- Handling antibiotic allergies
- Diagnostic stewardship/ collaborating with the Clinical Microbiology lab
- Resistance reporting/ antibiograms
- Optimizing duration of therapy
- Stewardship in skin/skin structure infections
- Stewardship in transitions of care to and from the Emergency Department

? Is there another topic you'd like to learn about or discuss in these sessions?

CDC 2019

Core Elements of Hospital Antimicrobial Stewardship Programs



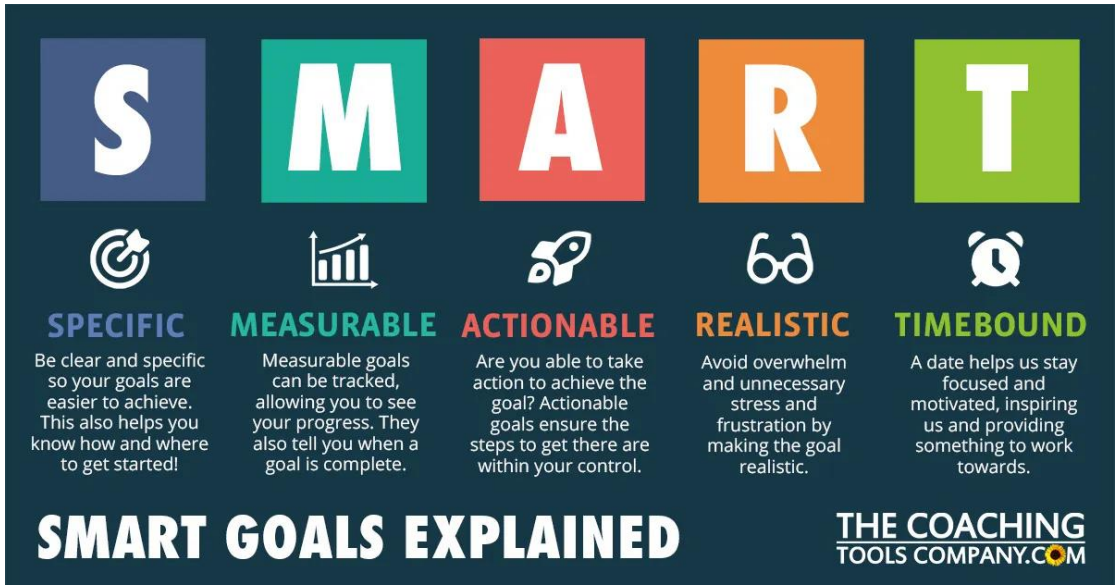
CDC. Core Elements of Hospital Antibiotic Stewardship Programs. Available at https://www.cdc.gov/antibiotic-use/core-elements/hospital.html.

SMART AIMS

- Specific
  - Have a clear goal in mind.
  - NOT: “Use fewer fluoroquinolones.”
  - “Reduce X by 25%.” “Increase Y by 50%.” “Achieve 90% compliance.”
- Measurable
  - Can’t be specific if you can’t measure it
- Attainable
  - Is there a strategy that’s likely to work?
  - Don’t set your goal too high
- Relevant/Realistic
  - “If we achieve our aim, will our patients be safer/have better outcomes?”
  - Make sure your aim affects a lot of patients (or makes a big difference for a small number)
- Time-bound
  - Set a deadline
  - Work backward from there

IMPLEMENTING AIMS

- Develop your target into a SMART Aim
- Example:
  - By [6/30/24], we will [reduce] [use of antibiotics for X] by [X%], compared to [baseline].
  - How will you measure progress toward your goal?
  - What will be the primary action you will take to achieve this goal?



The Coaching Tools Company, available at www.thecoachingtoolscompany.com/smart-goals-complete-guide-for-coaches-with-pdf/

CORE ELEMENT #4: **ACTION**

"IMPLEMENT INTERVENTIONS…. TO IMPROVE ANTIBIOTIC USE"

Patient-specific	System wide
Prospective audit and feedback*	**Facility-specific treatment guidelines***
-Bug-drug mismatch/de-escalation	Promote routine individual antibiotic process review i.e. "time out"
-Drug specific monitoring	Clinical decision support systems
-Disease-specific monitoring	Cumulative susceptibility report (antibiogram)
-Optimize route of administration	Drug / Disease state treatment review
-Duration of therapy	Formulary Management, shortage management
Optimize antimicrobials for next level of care	Antimicrobial dosing recs
Preauthorization of certain drugs/classes*	Micro lab output optimization strategies, diagnostic stewardship

* CDC "priority" interventions,
TJC Elements of Performance, 2023→

Examples, list not all-inclusive

SPICE

BREAKOUT SESSION

- How does your institutional stewardship team decide what to work on next?
- Have you used SMART aims? What has worked for you?

- What tools for improving the antimicrobial therapy of individual patients are most effective in your institution? Which have worked less well?
- Is there a tool you've wanted to use but have yet to develop?

STEWARDSHIP STRATEGIES FOR IDENTIFYING OPPORTUNITIES TO DISCONTINUE ANTIMICROBIALS

- Mid-course “time-out” to re-evaluate therapy
- Procalcitonin or other host marker(s) of infection
- Negative bacterial culture report
- Resistant pathogen (eg MRSA, *P aeruginosa*, resistant Enterobacterales) NOT identified on rapid diagnostic tool (eg: multiplex PCR)
- Pathogen-specific marker of infection (eg: influenza A/B, SARS CoV2)
- Nasal *S aureus* colonization status
- Automatic stop protocol for antibiotics
- Citing updated literature on duration of therapy for certain infections

ANTIBIOTIC TIME-OUTS

ANTIMICROBIAL THERAPY TIME-OUT

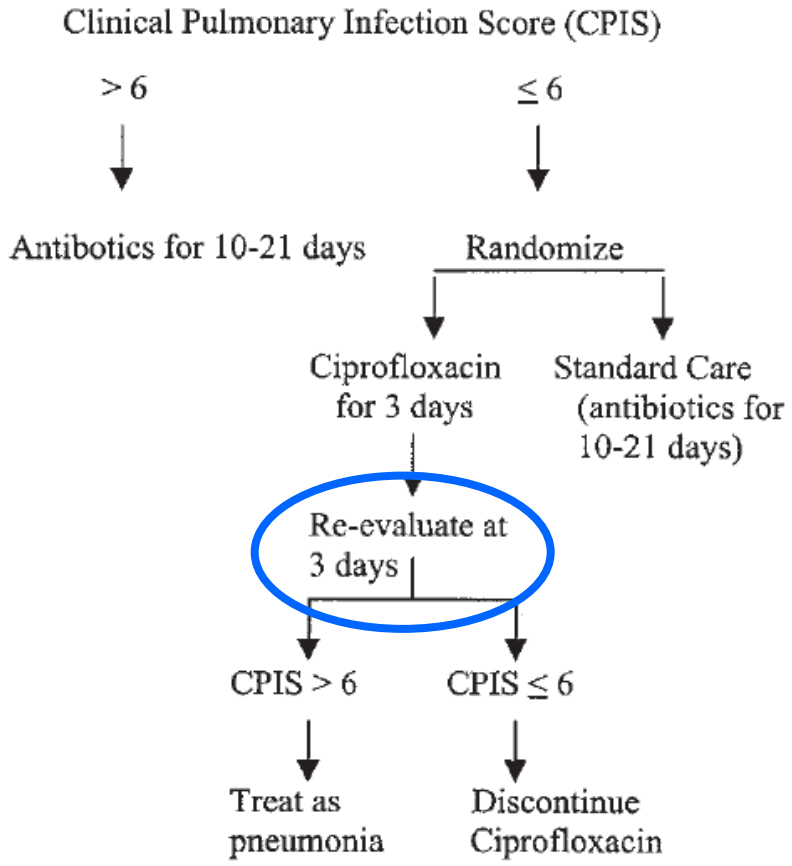
CDC 2019 Core Elements Assessment tool asks:
Does your facility have a formal procedure for all prescribers to conduct daily reviews of antibiotic selection until a definitive diagnosis and treatment duration are established (i.e. time out)?

Am J Respir Crit Care Med Vol 162. pp 505–511, 2000

Short-course Empiric Antibiotic Therapy for Patients with Pulmonary Infiltrates in the Intensive Care Unit

A Proposed Solution for Indiscriminate Antibiotic Prescription

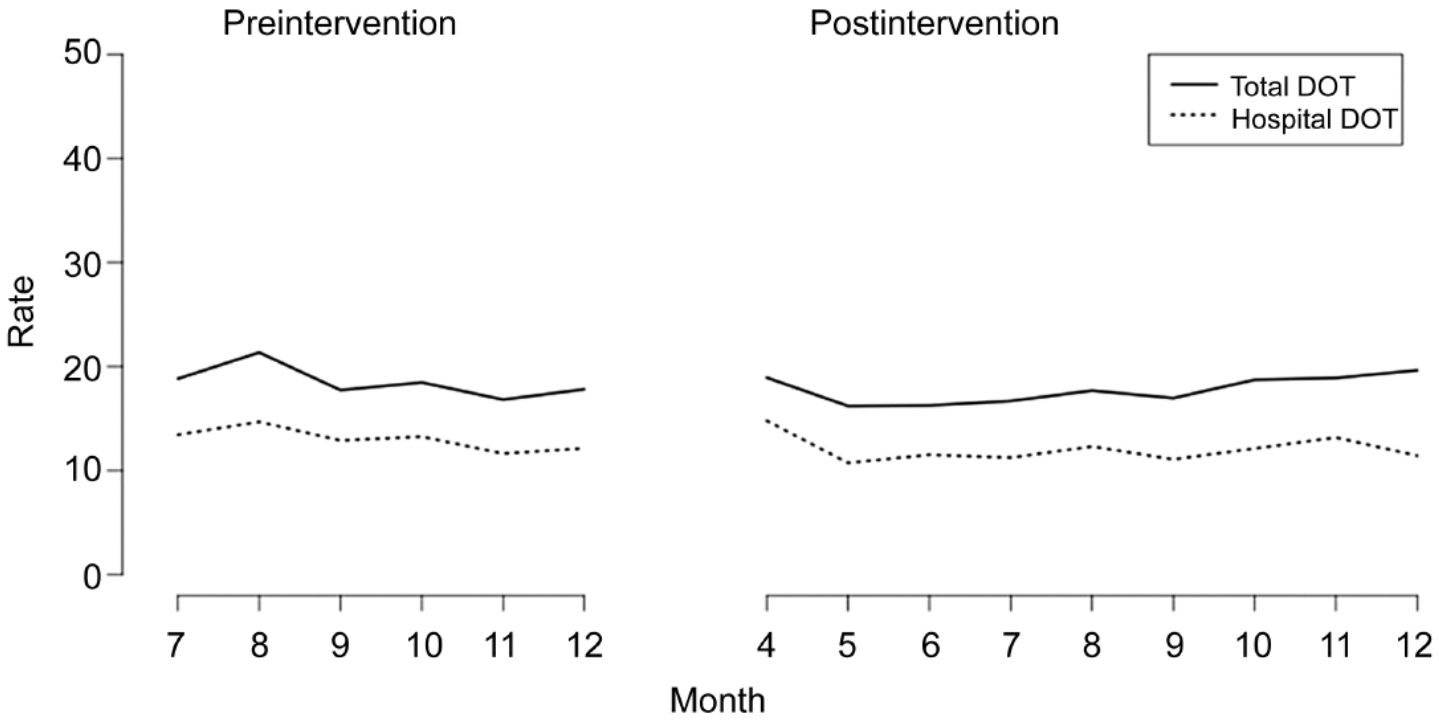
NINA SINGH, PAUL ROGERS, CHARLES W. ATWOOD, MARILYN M. WAGENER, and VICTOR L. YU



Impact of a Prescriber-driven Antibiotic Time-out on Antibiotic Use in Hospitalized Patients

Kerri A. Thom,[1] Pranita D. Tamma,[2] Anthony D. Harris,[1] Kathryn Dzintars,[3] Daniel J. Morgan,[1,4] Shanshan Li,[5] Lisa Pineles,[1] Arjun Srinivasan,[6] Edina Avdic,[3] and Sara E. Cosgrove[7]

- Pre- & Post evaluation of antibiotic use following implementation of a single antibiotic time-out at day 3-5 of therapy
- 11 care units in 6 acute care hospitals
- ATO discussion prompted by study team and standardized using a paper form
- Pre- cohort: 1541 courses (50% modified)
- Post cohort: 1929 courses (56% modified)



'Inappropriate' Antibiotics
Pre-cohort: 45%
Post cohort 31% (*p<0.05*)

"Single time-outs without input from antibiotic stewardship teams are insufficient to optimize prescribing".

Clin Infect Dis 2019; 68:1581-4

WHAT PROMPTS THE TIME-OUT EVENT?

- Add time-out to physician rounding checklist
- EMR electronic or other prompt
- Stewardship practitioner prompt (eg pharmacist) on multidisciplinary rounds
- Physician trainees tasked to prompt team
- Education on value of a time-out
- Electronic or paper checklist of treatment aspects to re-evaluate
- Progress note from stewardship team

Mohayya, et al Antibiotics **2021**, 10, 1078.
Taylor, et al. Hospital Pharmacy 2021;56:343–346
Van Schooneveld, et al. Infection Control & Hospital Epidemiology 2020; 41:1266–1271
Lee, at al *Ann Intern Med.* 2014;161:S53-S58.
Paulson, et al. J Pharmacy Practice 2022;35:388

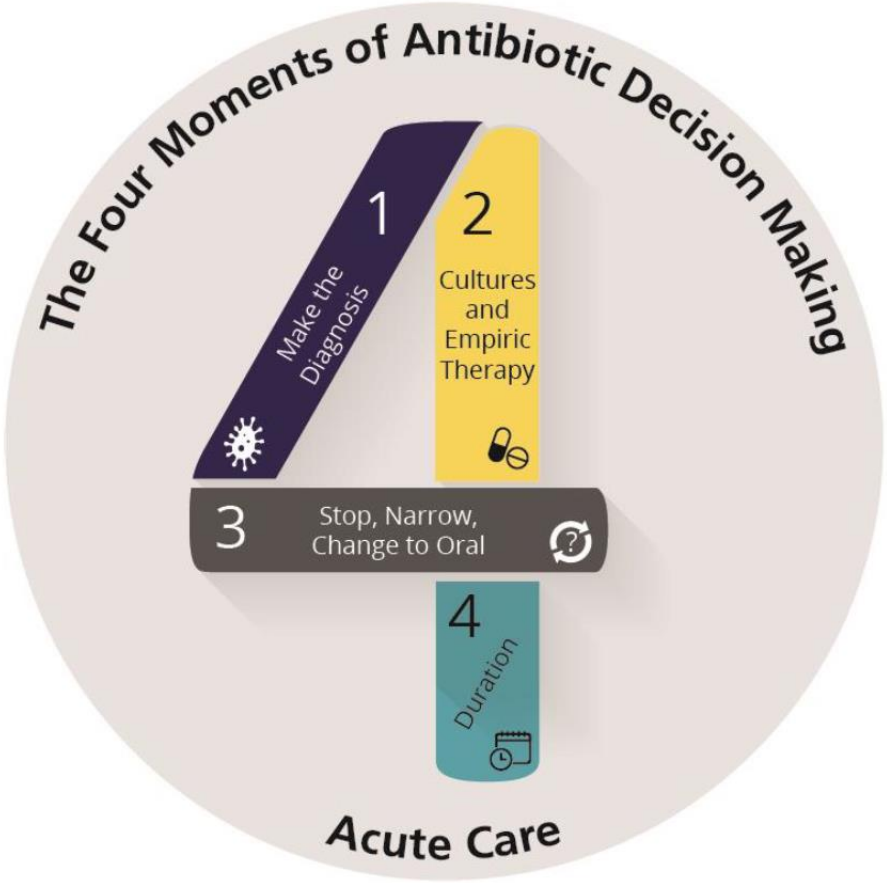
DAY BY DAY ASSESSMENT OF THE PROCESS

Moment 1 occurs at the time initiation of antibiotic therapy is considered:
Ask, "Does my patient have an infection that requires antibiotics?"

Moment 2 occurs when the decision is made to start antibiotics:
Ask 2 questions, "Have I ordered appropriate cultures before starting antibiotics? What empiric therapy should I initiate?"

Moment 3 occurs every day of antibiotic therapy:
Ask 3 questions, "Can I stop antibiotics? Can I narrow therapy? Can I change from IV to oral therapy?"

Moment 4 occurs when the infectious process is clear and the patient responds to therapy:
Ask, "What duration of antibiotic therapy is needed for my patient's diagnosis?"



Iamma PD, et al. JAMA. 2019 Jan 15;321(2):139-40.

BIOMARKERS IN ANTIMICROBIAL STEWARDSHIP

MARKERS OF INFECTION THAT MAY IMPACT STEWARDSHIP

- Pathogen-specific markers
  - Influenza A/B antigen
  - SARS CoV-2 antigen
  - *Streptococcus pneumoniae* urinary antigen
  - Legionella Urinary antigen
  - β-D glucan, galactomannan, Cryptococcal antigen
- Host-response biomarkers
  - C-reactive protein
  - Serum procalcitonin

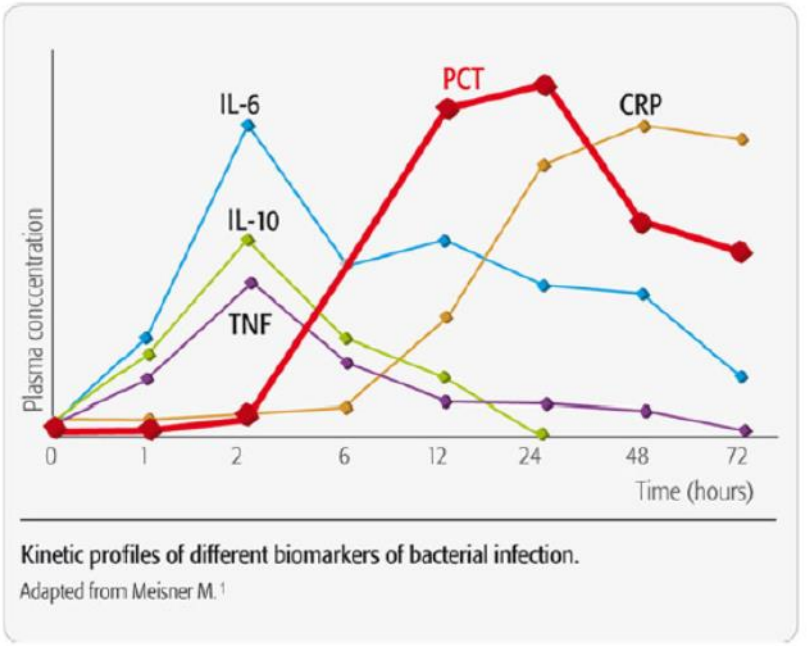


Figure 1. Procalcitonin (PCT) kinetics. CRP = C-reactive protein; IL = interleukin; TNF = tumor necrosis factor.

Povoa, et al. Intensive Care Med (2023) 49:142–153

Covington, et al. Pharmacotherapy 2018;38:569–581

Effect of procalcitonin-guided antibiotic treatment on mortality in acute respiratory infections: a patient level meta-analysis

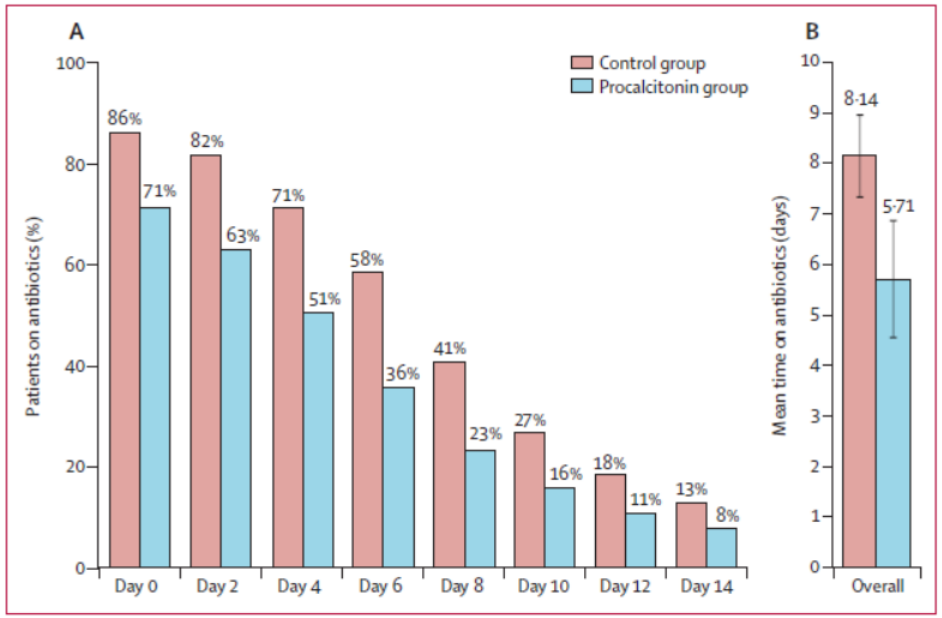


Figure 3: **Antibiotic use**
(A) Proportions of patients on antibiotics. (B) Mean duration of antibiotic use.

26 eligible trials, 12 countries

	Control (n=3372)	Procalcitonin group (n=3336)	Adjusted OR (95% CI)*, p value	$p_{interaction}$
Overall				
30-day mortality	336 (10%)	286 (9%)	0·83 (0·7 to 0·99), p=0·037	..
Treatment failure	841 (25%)	768 (23%)	0·90 (0·80 to 1·01), p=0·068	..
Length of ICU stay, days	13·3 (16·0)	13·7 (17·2)	0·39 (−0·81 to 1·58), p=0·524	..
Length of hospital stay, days	13·7 (20·6)	13·4 (18·4)	−0·19 (−0·96 to 0·58), p=0·626	..
Antibiotic-related side-effects	336/1521 (22%)	247/1513 (16%)	0·68 (0·57 to 0·82), p<0·0001	..

Lancet Infect Dis 2018;18:95-107

CLINICAL USE OF BIOMARKERS

PRINCIPLES OF USE

- Use biomarkers together with other clinical parameters, never as a stand-alone
- Use serial values to follow change over time (2-3 days)
- With host-response markers, use a validated diagnostic cut-off value for that disease state
- Be cognizant of interfering co-morbid conditions (eg PCT: renal dysfunction, heart failure, immunosuppression)
- Arguably better used to discontinue antibiotics than to diagnose infection/ initiate antibiotics

CHALLENGES TO CLINICAL UTILITY

- Widely studied in many populations sepsis, bacteremia, HAP/VAP, CAP, ruling out secondary bacterial infection in primary viral infection: Overall positive but varied results
- Optimal diagnostic thresholds are not fully clear
- Much study = much “noise” in beliefs about the test(s). Protocol and education required for local implementation

See Resources slide

BACTEREMIA WITH STAPHYLOCOCCUS SPECIES

STAPHYLOCOCCI REQUIRE UNIQUE TREATMENT STRATEGIES

- *S aureus* (including MRSA) grows well in most culture systems. Cultures (or rapid diagnostic assays) negative for this pathogen suggest it is not etiologic in the infection. Often it is appropriate to discontinue MRSA therapy
- MRSA nasal colonization status can be used to determine need for antibiotics against this pathogen[Mergenhagen 2020, Parente 2018]
- In the case of positive cultures, esp blood cultures, close follow-up is indicated to define the extent of the infection and duration of treatment (see next slide)
- Care bundles of diagnosis and treatment have been designed and implemented by AS teams[Brock 2019, Smith 2018]
- Some institutions mandate or strongly recommend formal Infectious Disease consultation for *S aureus* bacteremia. Improved outcomes have been documented in comparative trials[Paulsen 2016]

STAPHYLOCOCCUS AUREUS BACTEREMIA

COMPLICATED (LONGER TREATMENT)

- Endovascular involvement *OR*
- Persistently positive blood cultures *OR*
- Persistent fevers *OR*
- Dissemination *OR*
- Hardware

UNCOMPLICATED (SHORTER TREATMENT)

- Defervesce within 72h of antibiotics ***AND***
- Blood cultures 2-4 days after antibiotics → No Growth ***AND***
- No dissemination or metastatic sites ***AND***
- No implanted prostheses ***AND***
- No endovascular involvement

IDSA MRSA Guidelines 2011

BLOOD CULTURES

DIAGNOSING CONTAMINATION

IN APPROXIMATE DESCENDING ORDER OF IMPORTANCE

- **Clinical suspicion** (Are the signs and symptoms consistent with bacteremia?)
- **Organism** common contaminants:
  - Coag neg Staphylococci [exception: *S lugdunensis*]
  - diphtheroids [Corynebacteria/Propionibacteria]
  - alpha hemolytic streptococci-[careful!]
- **Number of positive cultures** (a single positive culture out of several drawn at same time suggests contamination)
- **Non-duplicate organisms** where multiple organisms isolated
- **Site of blood draw** (e.g. a single positive culture drawn through a catheter is more likely a colonizer or contaminant)
- **Time to positivity** (more rapid = higher inoculum, long time to positivity suggests an event other than actual presence of germ in blood when drawn)
- **Number of bottles or plates** positive

- Synthesize these factors into a decision…..

SURVEY: WHICH OF THESE TOOLS DOES YOUR INSTITUTION EMPLOY TO IMPROVE ANTIMICROBIAL USE? (SELECT ALL THAT APPLY)

- ❑ Antibiotic “time out”
- ❑ Nasal *S aureus* colonization status
- ❑ Procalcitonin or other marker(s) of infection
- ❑ Negative bacterial culture reports
- ❑ Resistant pathogen (eg MRSA, *P aeruginosa*, resistant Enterobacterales) NOT identified on rapid diagnostic tool (eg multiplex PCR)
- ❑ Pathogen-specific marker of infection (eg: influenza A/B, SARS CoV2)
- ❑ Automatic stop protocol for antibiotics
- ❑ Citing updated literature on duration of therapy for certain infections
- ❑ Routine prospective audit and feedback

SURVEY: WHAT HAS BEEN YOUR MOST SUCCESSFUL STRATEGY TO DISCONTINUE EMPIRIC ANTIMICROBIALS? (SELECT ONE)

- ❑ Antibiotic “time out”
- ❑ Nasal *S aureus* colonization status
- ❑ Procalcitonin or other marker(s) of infection
- ❑ Negative bacterial culture reports
- ❑ Resistant pathogen (eg MRSA, *P aeruginosa*, resistant Enterobacterales) NOT identified on rapid diagnostic tool (eg multiplex PCR)
- ❑ Pathogen-specific marker of infection (eg: influenza A/B, SARS CoV2)
- ❑ Automatic stop protocol for antibiotics
- ❑ Citing updated literature on duration of therapy for certain infections
- ❑ Routine prospective audit and feedback

END OF SESSION ASSIGNMENT

- We'll stop for 1 minute
- If you haven't done so yet, please type into the chat a topic you'd like to see discussed in future sessions.

HOMEWORK

- Identify a SMART aim or objective for a patient-specific tool you'd like to implement to improve antimicrobial stewardship at your institution
  - An alternative aim could involve upgrading or improving an existing patient care modality.
  - Weigh time, personnel, IT resources, etc
  - Weigh the potential benefit of such a program against what is already in place
  - Is a "before" and "after" data collection indicated to document the effects of the program?
  - Other considerations?

SAVE THE DATE

Antibiotic Stewardship Conference

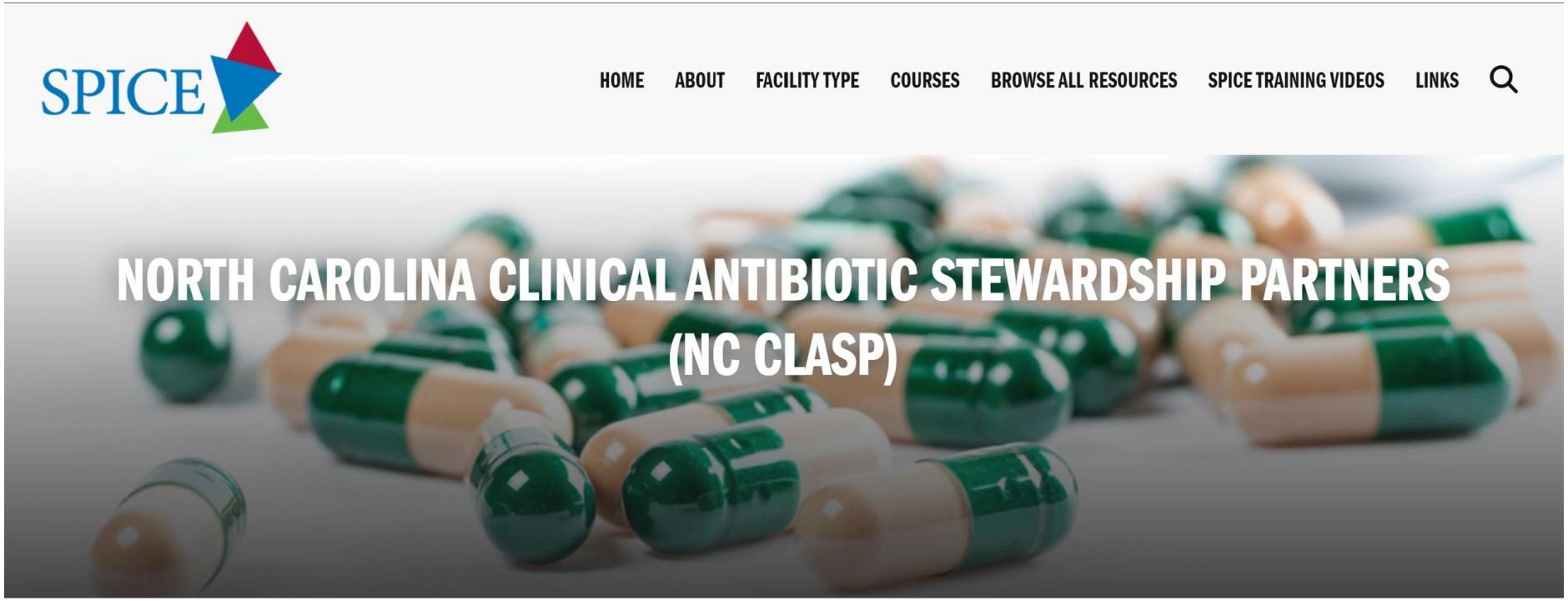
11.15.23 | 9 am - 4 pm
The Friday Conference Center
Chapel Hill, NC

North Carolina Clinical Antibiotic Stewardship Partners

More information at spice.unc.edu/ncclasp/

THE NORTH CAROLINA CLINICAL ANTIBIOTIC STEWARDSHIP PARTNERS (NC CLASP)

- All the information from today's session will be on our website https://spice.unc.edu/ncclasp/



RESOURCES

SMART Aims

- CDC Guide with template

Biomarkers of infection and AS

- Povoa, et al. Intensive Care Med (2023) 49:142–153
- Covington, et al. Pharmacotherapy 2018;38:569–581
- Shuetz, et al. Lancet Infect Dis 2018;18:95-107
- Liwandi, et al. Critical Care Medicine 2023
- Voirot, et al. BMJ Open 2021;11:e0848187
- Fugit, et al. Am J Health-Syst Pharm 2023;80(suppl 2):S49
- Wirz, et al. Crit Care 2018;22:19
- DeJong, et al. Lancet 2016;16;819-27

S. aureus bacteremia

- Mergenhagen, et al. Clin Infect Dis 2020;71:1142-8
- Parente, et al. Clin Infect Dis 2018;67:1-7
- Brock, et al. J Healthc Qual 2019;41:e83-89
- Smith J, et al Diagn Microbiol Infect Dis 2018;90:50-54
- Paulsen J, et al. Open Forum Infect Dis. 2016 Mar 1;3(2):ofw048.
- Buehrle, et al. AJIC 2017;45:713-6
- Al Sidairi, et al. Microbiology Spectrum 2023: 2
- Carr, et al. Pharmacotherapy 2018;38:1216-28

Clinical Stewardship interventions

- Davey, et al. Cochrane Database of Systematic Reviews 2017, Issue 2. Art. No.: CD003543
- Sadeq et al. Antibiotics 2022;11:1306
- https://www.cdc.gov/antibiotic-use/core-elements/hospital/implementation.html