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
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
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.
NC CLASP: YEAR TWO

In-depth discussion topics include:

- 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

6 hour-long learning sessions
September 2023-May/June 2024

CE included: CME, RN, Pharmacist (ACPE)

Two in-person conferences

Is there another topic you’d like to learn about or discuss in these sessions?
Core Elements of Hospital Antimicrobial Stewardship Programs

Hospital Leadership Commitment
Dedicate necessary human, financial, and information technology resources.

Accountability
Appoint a leader or co-leaders, such as a physician and pharmacist, responsible for program management and outcomes.

Pharmacy Expertise (previously “Drug Expertise”):
Appoint a pharmacist, ideally as the co-leader of the stewardship program, to help lead implementation efforts to improve antibiotic use.

Action
Implement interventions, such as prospective audit and feedback or preauthorization, to improve antibiotic use.

Tracking
Monitor antibiotic prescribing, impact of interventions, and other important outcomes, like C. difficile infections and resistance patterns.

Reporting
Regularly report information on antibiotic use and resistance to prescribers, pharmacists, nurses, and hospital leadership.

Education
Educate prescribers, pharmacists, nurses, and patients about adverse reactions from antibiotics, antibiotic resistance, and optimal prescribing.

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?
## CORE ELEMENT #4: ACTION

“IMPLEMENT INTERVENTIONS…. TO IMPROVE ANTIBIOTIC USE”

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

* CDC “priority” interventions, TJC Elements of Performance, 2023→

Examples, list not all-inclusive
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
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)?*
Impact of a Prescriber-driven Antibiotic Time-out on Antibiotic Use in Hospitalized Patients

Kerri A. Thom,1 Pranita D. Tamma,1 Anthony D. Harris,1 Kathryn Dzintars,3 Daniel J. Morgan,14 Shanshan Li,1 Lisa Pinedes,1 Arjun Srinivasan,4 Edina Avdic,3 and Sara E. Cosgrove7

- 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)

Clin Infect Dis 2019; 68:1581-4

"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".
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

Van Schooneveld, et al. Infection Control & Hospital Epidemiology 2020; 41:1266–1271
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?”
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

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

26 eligible trials, 12 countries

<table>
<thead>
<tr>
<th></th>
<th>Control (n=3372)</th>
<th>Procalcitonin group (n=3336)</th>
<th>Adjusted OR (95% CI)*, p value</th>
<th>Pmeta-analysis</th>
</tr>
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<tbody>
<tr>
<td>Overall</td>
<td></td>
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<tr>
<td>30-day mortality</td>
<td>336 (10%)</td>
<td>286 (9%)</td>
<td>0.83 (0.7 to 0.99), p=0.037</td>
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<tr>
<td>Treatment failure</td>
<td>841 (25%)</td>
<td>768 (23%)</td>
<td>0.80 (0.80 to 1.01), p=0.068</td>
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<tr>
<td>Length of ICU stay, days</td>
<td>13.3 (16.0)</td>
<td>13.7 (17.2)</td>
<td>0.39 (-0.81 to 1.58), p=0.524</td>
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<tr>
<td>Length of hospital stay, days</td>
<td>13.7 (20.6)</td>
<td>13.4 (18.4)</td>
<td>-0.19 (-0.96 to 0.68), p=0.626</td>
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<tr>
<td>Antibiotic-related side-effects</td>
<td>336/1521 (22%)</td>
<td>247/1513 (16%)</td>
<td>0.68 (0.57 to 0.82), p&lt;0.0001</td>
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Lancet Infect Dis 2018;18:95-107
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 (e.g., 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.
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
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?
Antibiotic Stewardship Conference

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

More information at spice.unc.edu/ncclasp/
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
- Liwandi, et al. Critical Care Medicine 2023

S. aureus bacteremia
- Smith J, et al Diagn Microbiol Infect Dis 2018;90:50-54
- Buehrle, et al. AJIC 2017;45:713-6

Clinical Stewardship interventions
- Sadeq et al. Antibiotics 2022;11:1306
- https://www.cdc.gov/antibiotic-use/core-elements/hospital/implementation.html