CDC/IHI Antibiotic Stewardship Pilot Testing

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Objectives

- Describe the current state and opportunities for improving antibiotic use.
- Discuss the results of pilot testing the CDC/IHI framework for reducing inappropriate antibiotic utilization.
- Discuss progress toward developing effective models of hospitalist-led antimicrobial stewardship initiatives.
Framing

- Making the case for Antibiotic Stewardship
- Developing and Testing a Framework for improvement – what we learned
- Putting a face to the case: the power of patient stories
- Key insights and learnings from the Pilot testing
- Hospitalist-led antibiotic stewardship

Driving Change:
Why Antimicrobial Stewardship?

Arjun Srinivasan, MD
Centers for Disease Control and Prevention
Atlanta, GA
Why Antimicrobial Stewardship?

- Antibiotics are misused in hospitals
- Antibiotic misuse adversely impacts patients and society
  - Improving antibiotic use is a public health imperative
- We’re running out of antibiotics to treat our patients.
- Improving antibiotic use improves patient outcomes and saves money

Antibiotics are misused in hospitals

- “It has been recognized for several decades that up to 50% of antimicrobial use is inappropriate”
- IDSA/SHEA Guidelines for Antimicrobial Stewardship Programs
- Up to 20% in a recent pediatric survey
  - Most common problem- failure to stop or change therapy based on culture results
    - ICHE 2012;33:346
Antibiotics Have Side Effects *Clostridium difficile*

- Antibiotic exposure is the single most important risk factor for the development of *Clostridium difficile* associated disease (CDAD).
- Exposure to antibiotics increases the risk of *C. difficile* by at least 3 fold for at least a month.

C *difficile* Incidence and Mortality Are Increasing


Antibiotic misuse adversely impacts patients - resistance

- Getting an antibiotic increases a patient’s chance of becoming colonized or infected with a resistant organism.
### Susceptibility Profile: KPC-Producing *K. pneumoniae*

<table>
<thead>
<tr>
<th>Antimicrobial</th>
<th>Interpretation</th>
<th>Antimicrobial</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amikacin</td>
<td>I</td>
<td>Chloramphenicol</td>
<td>R</td>
</tr>
<tr>
<td>Amox/clav</td>
<td>R</td>
<td>Ciprofloxacin</td>
<td>R</td>
</tr>
<tr>
<td>Ampicillin</td>
<td>R</td>
<td>Ertapenem</td>
<td>R</td>
</tr>
<tr>
<td>Aztreonam</td>
<td>R</td>
<td>Gentamicin</td>
<td>R</td>
</tr>
<tr>
<td>Cefazolin</td>
<td>R</td>
<td>Imipenem</td>
<td>R</td>
</tr>
<tr>
<td>Cefpodoxime</td>
<td>R</td>
<td>Meropenem</td>
<td>R</td>
</tr>
<tr>
<td>Cefotaxime</td>
<td>R</td>
<td>Pipercillin/Tazo</td>
<td>R</td>
</tr>
<tr>
<td>Cetotetan</td>
<td>R</td>
<td>Tobramycin</td>
<td>R</td>
</tr>
<tr>
<td>Cefoxitin</td>
<td>R</td>
<td>Trimeth/Sulfa</td>
<td>R</td>
</tr>
<tr>
<td>Ceftazidime</td>
<td>R</td>
<td>Polymyxin B</td>
<td>MIC &gt;4mg/ml</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>R</td>
<td>Colistin</td>
<td>MIC &gt;4mg/ml</td>
</tr>
<tr>
<td>Cefepime</td>
<td>R</td>
<td>Tigecycline</td>
<td>S</td>
</tr>
</tbody>
</table>

### Geographical Distribution of KPC-Producers: 2001

![Map showing geographical distribution of KPC-Producers: 2001](image-url)
Effect of antibiotic prescribing in primary care on antimicrobial resistance in individual patients: systematic review and meta-analysis

Clinical outcomes better with antimicrobial management program

RR 2.8 (2.1-3.8) RR 0.2 (0.1-0.4)

AMP = Antibiotic Management Program
UP = Usual Practice

Stewardship Optimizes Patient Safety: Decreased \textit{C. difficile} Infection

- Carney hospital
  - Review of broad spectrum agents followed by form on patient’s chart with recommendations
  - 7 day automatic stop orders for antibiotics
  - Exclusion of pharmaceutical detailing

- 3 acute care wards for elderly at an English tertiary center
  - Restriction of broad spectrum agents

**Stewardship Optimizes Patient Safety:**
**Decreased Patient-Level Resistance**

<table>
<thead>
<tr>
<th></th>
<th>Cipro</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibiotic duration</td>
<td>3 days</td>
<td>10 days</td>
</tr>
<tr>
<td>LOS ICU</td>
<td>9 days</td>
<td>15 days</td>
</tr>
<tr>
<td>Antibiotic resistance/superinfection</td>
<td>14%</td>
<td>38%</td>
</tr>
</tbody>
</table>

Study terminated early because attending physicians began to treat standard care group with 3 days of therapy


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**Total costs of parenteral antibiotics at 14 hospitals**

Carling et al. *CID* 1999;29;1189.
Mandates for Antibiotic Stewardship

- California Senate Bill 739 mandated that, by January 1, 2008, CDPH require general acute care hospitals to monitor and evaluate the utilization of antibiotics and charge a quality improvement committee with the responsibility for oversight of the judicious use of these medications.

Quality Measures for Antibiotic Use

- The Centers for Medicare and Medicaid Services included a few antibiotic use “quality measures” in the pilot version of the Acute Care Infection Control Worksheet.
- Piloting of the worksheet is on-going.
Quality Measures

1. C.2.a Facility has a multidisciplinary process in place to review antimicrobial utilization, local susceptibility patterns, and antimicrobial agents in the formulary and there is evidence that the process is followed.

2. C.2.b Systems are in place to prompt clinicians to use appropriate antimicrobial agents (e.g., computerized physician order entry, comments in microbiology susceptibility reports, notifications from clinical pharmacist, formulary restrictions, evidenced based guidelines and recommendations).

Quality Measures

3. C.2.c Antibiotic orders include an indication for use.

4. C.2.d There is a mechanism in place to prompt clinicians to review antibiotic courses of therapy after 72 hours of treatment.

5. C.2.e The facility has a system in place to identify patients currently receiving intravenous antibiotics who might be eligible to receive oral antibiotic treatment.
My Opinion

- Not whether, but how.
- State and Federal experience with healthcare associated infections continues to fuel enthusiasm for more quality improvement mandates.
- Will stewardship become one?
- Maybe, but the key will be to ensure that it is written well and then monitored for unintended consequences.

Tell Us How We Can Help

- CDC’s Get Smart for Healthcare Program is meant to be a resource for anyone interested in improving stewardship.
- Please send me a note if you have ideas on things we can do.
Resources on Get Smart for Healthcare Website

Slide set with evidence to support stewardship interventions

Evidence summaries

Impact of Antibiotic Stewardship Programs on Multiple End Points

<table>
<thead>
<tr>
<th>Reference</th>
<th>Setting</th>
<th>Key staff</th>
<th>Intervention</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eady-Callart S, Causse R, Puthman C, Le Pahic MP, Frehault A and Chouard C.</td>
<td>100-bed teaching hospital, Crolles Cedex, France</td>
<td>Infectious disease physician, clinical pharmacist, pharmacist</td>
<td>Multidisciplinary implementation of a local prescribing guide, restricted antibiotic order sets, resistance monitoring, feedback, and audit and feedback.</td>
<td>Audits of use over three years showed that the proportion of skin grafts that were not streptococcal fell from 9% to 0% (p &lt; 0.001), then increased to 0% (p &lt; 0.001), and then stabilized. The cost of antibiotics per patient-day fell from $33.5 to $18.5 (p &lt; 0.001) over 3 years. Erythromycin-resistant staphylococci decreased from 15% to 5% over three years (p &lt; 0.001). MRSA and carbapenem-resistant pseudomonas (prevalence did not have significant changes (22% vs. 16% at 3 years) and 28% vs. 25% at 3 years) remained stable.</td>
</tr>
</tbody>
</table>

Conclusions

- We must improve the way we use antibiotics.
- Doing so will have vital benefits to individual patients, to society and to the bottom line.
- We have the tools to do it.
- Our patients are counting on us to do it- NOW.
Developing & Testing of the CDC/IHI Antibiotic Stewardship Framework

Diane Jacobsen MPH, CPHQ

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**Developing**
the CDC/IHI Antibiotic Stewardship Framework

- **IHI/CDC partnership**: develop a conceptual framework and driver diagram to describe highly leveraged system components for improving antibiotic utilization for use in hospitals across the country.

- **Goal**: a practical change package focusing on the key things we’d recommend every healthcare organization in America to at least try to do to improve patient care and save money related to antibiotic utilization.
Convening an Expert Panel

- Contribute expertise to the development of a robust, practical change package and measurement framework

- Review the current body of work from clinical practice and research related to antibiotic stewardship to elicit the “real” changes that people can get their hands around.
Expert Panel

Edina Avdic, Pharm.D., MBA  
Program Director, Infectious Diseases Specialty Residency  
Department of Pharmacy  
The Johns Hopkins Hospital

Neil Fishman, M.D.  
Director of the Department of Healthcare Epidemiology and Infection Control  
Director of the Antimicrobial Management Program  
University of Pennsylvania Health System

Scott Alan Flanders, M.D.  
Clinical Professor, Department of Internal Medicine; Associate Division Chief of General Medicine for Inpatient Programs; Director, Hospitalist Program  
A. Alfred Taubman Health Care Center, Taubman General Medicine

Kristine Kuper, Pharm.D.  
Cardinal Health

Christopher A. Ohl, M.D.  
Associate Professor of Medicine; Co-Director, I.D. Fellowship Program  
Medical Director, the Center for Antimicrobial Utilization, Stewardship and Epidemiology Section on Infectious Diseases  
Wake Forest University School of Medicine

Antibiotic Stewardship Driver Diagram

Primary Drivers

- Timely and appropriate antibiotic utilization in the acute care setting
- Appropriate administration and de-escalation
- Data monitoring, transparency, and stewardship infrastructure
- Availability of expertise at the point of care

Secondary Drivers

- Leadership and Culture

Primary Drivers

- Decreased incidence of antibiotic-related adverse drug events (ADEs)
- Decreased prevalence of antibiotic resistant healthcare-associated pathogens
- Decreased incidence of healthcare-associated C. difficile infection
- Decreased pharmacy cost for antibiotics

Secondary Drivers

- Data monitoring, transparency, and stewardship infrastructure
- Availability of expertise at the point of care

Leadership and Culture

- Timely and appropriate initiation of antibiotics
- Decreased incidence of antibiotic-related adverse drug events (ADEs)
- Decreased prevalence of antibiotic resistant healthcare-associated pathogens
- Decreased incidence of healthcare-associated C. difficile infection
- Decreased pharmacy cost for antibiotics

Leadership and Culture
Testing the CDC/IHI Antibiotic Stewardship Framework

Recruited eight “pilot testing” hospitals of varying: size, acuity, structure and geographic location:

- Organizational commitment from Sr Leadership to improve antibiotic utilization
- Antibiotic utilization is designated as a strategic improvement area by the organization
- Demonstrated success with prior improvement projects
- Active participation of a multidisciplinary team to include: physician champion, clinical pharmacy, microbiology, nursing, others, to test, adapt, and implement changes related to selected drivers of antibiotic stewardship
- Commitment to test changes related to at least 2 "primary drivers"


Pilot Testing Hospitals

Centerpoint Medical Center, Independence, MO
Community Hospital, Tallassee, AL
Rogue Valley Medical Center, Medford, OR
Seton Medical Center, Austin, TX
St. Francis Medical Center, Peoria, IL
The Reading Hospital & Medical Center, West Reading, PA
UCLA, Los Angeles, CA
Wellstar Cobb Hospital, Austel, GA
**Goals of Testing**
the CDC/IHI Antibiotic Stewardship Framework

- Test recommended “change ideas”
- Assess the impact of the changes that are tested
- Refine the understanding of which of the changes can be implemented in a variety of setting and contexts

Testing across 8 pilot testing hospitals
* each hospital focusing on (at least) 2 primary drivers

<table>
<thead>
<tr>
<th>Driver 1</th>
<th>Driver 2</th>
<th>Driver 3</th>
<th>Driver 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timely &amp; appropriate initiation of antibiotics</td>
<td>Appropriate administration &amp; de-escalation</td>
<td>Data monitoring, transparency &amp; stewardship infrastructure</td>
<td>Availability of expertise at the point of care</td>
</tr>
<tr>
<td># of hospitals</td>
<td>3</td>
<td>7</td>
<td>3</td>
</tr>
</tbody>
</table>
Objectives for Testing

- Deciding how to adapt the proposed change to the care processes within the hospitals
- Deciding which of several proposed approaches to the change will work in individual participating hospitals
- Evaluating how much improvement we can expect from the change
- Evaluating staffing, cost implications and possible side effects of the change.
- Giving individuals a chance to experience the change prior to implementation.

Driving Appropriate Use

Key Factors Facilitating “Success” in the CDC/IHI Pilot Testing

- Antibiotic Stewardship seen as an important safety initiative
- Positive and trusting relationship of physician champion to physicians
- High energy work team
- IT support
- Collaborating with infection prevention, sp: C difficile rates
- Collaborating with pharmacy network and IT for support in understanding antibiotic cost data and usage
Driving Appropriate Use

Barriers identified by the CDC/IHI Pilot Testing Hospitals

- Engaging front-line providers (hospitalists, intensivists, surgeons, nurses)
  - Large / multiple groups make communication difficult
  - Nurses are overwhelmed
- Embedding antibiotic review into the process of care
  - High patient load, no multidisciplinary rounds
- “Another QI project!?!#$%”
- IT / CPOE
- Time / ability to collect data

Outcome of initial Pilot Testing

- Revised the Change Package and Measurement Framework, based on learnings from initial pilot testing
- Identified key gap/opportunity to embed antibiotic stewardship into the process of care
- Hospitalist-led antibiotic stewardship kicked off Nov 2nd!
Case #1

32 year male presents to the ER with a 4-5 day of sore throat, low grade fever, and myalgias followed by a 1 day history of increasing shortness of breath and cough. Patient has no underlying diseases.

In the ER, patient was in respiratory distress, hypoxic, and febrile. CXR extensive left-sided consolidation. The patient required intubation and was admitted to the ICU with the diagnosis of CAP. The patient was started on a macrolide and a third-generation cephalosporin c/w IDSA and ATS guidelines.
Does Patient Meet Core Measures?

What other information would you like?
Case #1 cont

Take home message

In addition to obtaining cultures take advantage of all the information at point of care including gram stains, local antibiograms, and local epidemiology

CASE #2

This is a 46 year old female admitted with hypotension, fever, and flank pain. She had no underlying medical or urologic problems. Her urine showed pyuria and bacteriuria, the peripheral WBC was 16,000. She was admitted to the ICU and empirically started on _______.

What would you start?
Case #2 cont

She was admitted to the ICU and started on cefepime. By day 2, her urine and blood grew *E. coli* sensitive to all tested antibiotics except ampicillin. She stabilized and was transferred to the floor before susceptibilities were posted in the EHR. She was continued on cefepime. On day 11, she spiked a new fever. Blood cultures were drawn and grew _________. Antibiotics were change to _________.

On day 12 her WBC increased to 30,000 and she reported unformed stools. Your diagnosis__________

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Treatment of Acute Uncomplicated Cystitis and Pyelonephritis:
A 2010 Update by the IDSA and the European Society for Microbiology and Infectious Diseases *Clin Infect Dis* 2011; 52:e103-120

- Women with pyelonephritis requiring hospitalization should initially be treated with an IV antibiotic such as a FQ; an aminoglycoside with or without ampicillin; an extended-spectrum cephalosporin or penicillin with or without an aminoglycoside; or a carbapenem. The choice of initial antimicrobial treatment should be based on local susceptibility patterns. (B-III)

- Oral ciprofloxacin (500mg BID) for 7 days is an appropriate choice in patients not requiring hospitalization where the prevalence of community uropathogens resistant to FQ does is <10%. (A-I)

- A once-daily FQ including ciprofloxacin (1000mg extended release for 7 days) or levofloxacin (750 mg for 5 days) is appropriate for patients not requiring hospitalization if the prevalence of resistance to FQ is <10%. (B-II)

- If the prevalence of resistance to FQ is >10%, an initial IV dose of an agent like ceftriaxone (B-III) or an aminoglycoside (B-III) is recommended.

- TMP-SMX (160/800 mg [1 DS tablet] BID for 14 days) is an appropriate choice if the pathogen is known to be susceptible. (A-I)
CDC/IHI
Antibiotic Stewardship Pilot Testing Project

Driver 1:
Timely and Appropriate Antibiotic Management

Ed Septimus, MD, FACP, FIDSA, SHEA

Driver #1 Timely and Appropriate Initiation of Antibiotics:

Secondary Drivers
What needs to be in place to ensure those practices can be carried out consistently?

- Prompt identification of patients who require antibiotics
- Obtain appropriate cultures prior to starting antibiotics
- Do not give antibiotics with overlapping activity or combinations not supported by evidence
- Start treatment promptly (e.g. within 1 hour severe sepsis)
- Consider local susceptibility patterns and antibiotic allergies
- Specify expected duration based on evidence (e.g. VAP 8d)
Appropriate Use of Microbiology Lab

If possible, appropriate cultures should be obtained before starting antimicrobial therapy; prior antimicrobial therapy may interfere with bacterial growth.

Duration of hypotension before initiation of effective antimicrobial therapy

Crit Care Med 2006; 34:1589
Mortality associated with initial inappropriate therapy in patients with serious infections


Trends in Antimicrobial Resistance

Impact of Previous Therapy on Outcome of Gram-Negative Severe Sepsis

![Bar chart showing hospital mortality by prior antibiotic exposure and APACHE II score categories.]

<table>
<thead>
<tr>
<th>Antimicrobial Agent</th>
<th>Prior Antibiotic Exposure (n = 310)</th>
<th>No Prior Antibiotic Exposure (n = 444)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cefepime</td>
<td>71.0%</td>
<td>93.0%</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Piperacillin–tazobactam</td>
<td>68.1%</td>
<td>88.5%</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Imipenem/meropenem</td>
<td>80.0%</td>
<td>97.5%</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>60.3%</td>
<td>82.4%</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>73.9%</td>
<td>92.1%</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Multidrug-resistanta</td>
<td>37.4%</td>
<td>11.3%</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Table 5. Multivariate analysis of independent risk factors for hospital mortality of Gram-Negative Severe Sepsis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adjusted Odds Ratio</th>
<th>95% CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior antibiotic exposure</td>
<td>1.70</td>
<td>1.41–2.06</td>
<td>.005</td>
</tr>
<tr>
<td>Use of vasopressors</td>
<td>1.83</td>
<td>1.47–2.29</td>
<td>.006</td>
</tr>
<tr>
<td>Pseudomonas infection</td>
<td>1.75</td>
<td>1.39–2.21</td>
<td>.016</td>
</tr>
<tr>
<td>Inappropriate initial therapy</td>
<td>2.03</td>
<td>1.66–2.49</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Acute Physiology and Chronic Health</td>
<td>1.33</td>
<td>1.11–1.55</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Evaluation II score (1-point increments)</td>
<td>1.93</td>
<td>1.75–2.14</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>
Seasonality and Temporal Correlation between Community Antibiotic Use and Resistance in the United States

Optimize Duration of Antibiotic Therapy

Avoid automatic 10-14-day course of therapy

New evidence for duration of therapy
- Uncomplicated urinary tract infection: 3-5 days\textsuperscript{1}
- Community-acquired pneumonia: 3-7 days\textsuperscript{2}
- Ventilator-associated pneumonia: 8 days\textsuperscript{3}
- CR-BSI Coagulase-negative staphylococci: 5-7 days\textsuperscript{4}
- Acute Hem Osteomyelitis in children-21 days\textsuperscript{5}
- Meningococcal meningitis-7 days\textsuperscript{6}
- Uncomplicated secondary peritonitis with source control: 4-7 days\textsuperscript{7}

Monitor, feedback, and make visible data regarding antibiotic utilization, antibiotic resistance, ADEs, *C. difficile*, costs, and adherence to the organization’s recommended culturing and prescribing practices.

CDI: Incidence and Mortality are Increasing in US

Antibiotic misuse adversely impacts patients- *C. difficile*

- Antibiotic exposure is the single most important risk factor for the development of *Clostridium difficile* infection (CDI).
  - Up to 85% of patients with CDI have antibiotic exposure in the 28 days before infection\(^1\)
- 20% of patients admitted to the ICU with CDI were receiving antibiotics without evidence of infection with an accompanying 28% in-hospital mortality\(^2\)

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ED Visits for Antibiotic-Associated Adverse Events

*Clin Infect Dis 2008; 47:735-743*

- An estimated 142,000 ED visits each year are due to ADE associated with antibiotics.
- Antibiotics were implicated in 19% of all ED visits for ADEs.
- Most were allergic reactions; 50% due to penicillins or cephalosporins
<table>
<thead>
<tr>
<th>Secondary Driver</th>
<th>Key Change Concepts</th>
<th>Specific Change Ideas</th>
</tr>
</thead>
</table>
| Monitor, feedback, and make visible data regarding antibiotic utilization, antibiotic resistance, ADEs, C. difficile, cost, and adherence to the organization's recommended culturing and prescribing practices | Establish real-time monitoring and measurement systems | 1. Develop a process for ongoing monitoring and measurement of:  
   - Antibiotic utilization and resistance patterns  
   - Adverse drug events (ADEs) related to antibiotics  
   - C. difficile rates  
2. Develop a way to communicate local and hospital data on antibiotic susceptibility patterns.  
   - Inform antibiotic formulary selections based on local and hospital susceptibility patterns. |

<table>
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<th>Specific Change Ideas</th>
</tr>
</thead>
</table>
| Monitor, feedback, and make visible data regarding antibiotic utilization, antibiotic resistance, ADEs, C. difficile, cost, and adherence to the organization's recommended culturing and prescribing practices | Establish real-time monitoring and measurement systems | 3. Develop a mechanism for systematically reviewing antibiotic selection and administration and influencing physician choice based on behavior science principles, including but not limited to:  
   - Prospective audit and feedback of adherence to hospital standards with peer benchmarking  
   - “Academic detailing”  
   - Education targeted at continuing medical education and maintenance of certification requirements  
   - Mobilization of local opinion leaders and change agents  
   - One-on-one mentoring of non-adherent physicians about antibiotic use and evidence-based care |
<table>
<thead>
<tr>
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</tr>
</thead>
</table>
| Monitor, feedback, and make visible data regarding antibiotic utilization, antibiotic resistance, ADEs, C. difficile, cost, and adherence to the organization’s recommended culturing and prescribing practices | Establish real-time monitoring and measurement systems | 4. Develop a mechanism to provide visible and ongoing feedback:  
• Prominently post data on ADEs, C. difficile rates, antibiotic utilization, and resistance patterns where all hospital staff can see  
• Provide direct feedback data to prescribers on their antibiotic use, including cost  
• Provide staff with feedback about antibiotic compliance using posters, email, newsletters, etc.  
• Consider making data on utilization, resistance, and ADEs available in public areas to inform and educate patients and families about the importance and role of antibiotic usage  
• Ensure the C-suite and CFO understand the rationale and results of the program to support it financially. |
CDC/IHI Antibiotic Stewardship Pilot Testing

Drivers 2 and 4: Lessons Learned
Scott A. Flanders MD

Antibiotic Stewardship Driver Diagram

Primary Drivers
- Timely and appropriate initiation of antibiotics
- Appropriate administration and de-escalation
- Data monitoring, transparency, and stewardship infrastructure
- Availability of expertise at the point of care

Secondary Drivers
- Decreased incidence of antibiotic-related adverse drug events (ADEs)
- Decreased prevalence of antibiotic resistant healthcare-associated pathogens
- Decreased incidence of healthcare-associated C. difficile infection
- Decreased pharmacy cost for antibiotics

Timely and appropriate antibiotic utilization in the acute care setting

Leadership and Culture

- Promptly identify patients who require antibiotics
- Obtain cultures prior to starting antibiotics
- Do not give antibiotics with overlapping activity or combinations not supported by evidence or guidelines
- Determine and verify antibiotic allergies and tailor therapy accordingly
- Consider local antibiotic susceptibility patterns in selecting therapy
- Start treatment promptly
- Specify expected duration of therapy based on evidence and national and hospital guidelines
- Make antibiotics patient is receiving and start dates visible at point of care
- Give antibiotics at the right dose and interval
- Stop or de-escalate therapy promptly based on the culture and sensitivity results
- Reconcile and adjust antibiotics at all transitions and changes in patient’s condition
- Monitor for toxicity reliably and adjust agent and dose promptly
- Monitor, feedback, and make visible data regarding antibiotic utilization, antibiotic resistance, ADEs, C. difficile, cost, and adherence to the organization’s recommended culturing and prescribing practices
- Develop and make available expertise in antibiotic use
- Ensure expertise is available at the point of care
# Secondary Driver

## Key Change Concepts

Ensure a clear history of patient antibiotic use is obtained and available.

## Specific Change Ideas

1. Define a prominent location in the medical record and at the bedside for antibiotic therapy to be documented (e.g., “this is day X of Y”).
2. Develop a system to ensure that antibiotic days are counted correctly (e.g., does the first day of therapy count as day zero or day one?).
3. On admission, collect a complete list of the antibiotics a patient is taking (i.e., what antibiotic the patient is on, at what dose, when it was started).

## Secondary Driver

## Key Change Concepts

Establish a process for delivery customized to the antibiotics and the patient.

## Specific Change Ideas

1. Imbed dose and interval in guidelines, clinical pathways, and order sets.
2. Customize the administration based on individual patient, pathogen, site of infection, toxicity, and pharmacokinetic and pharmacodynamic characteristics of the drug.
3. Ensure guidelines, pathways and order sets include alerts on when dose adjustments might be indicated (e.g., for renal dysfunction).
4. Establish a mechanism for pharmacy to review cases where dose adjustments might be indicated (e.g., in patients with renal dysfunction, or when more toxic agents like aminoglycosides are prescribed).

## Secondary Driver

## Key Change Concepts

Establish process for prompt notification of culture and antibiotic susceptibility results.

## Specific Change Ideas

1. Set a time frame within which culture results must be reported and to whom.
2. Develop list of “critical results” to report to the physician via page or automated means such as a text message (e.g., MDRO).
   - Ensure that the reporting system includes mechanisms to alert responsible clinical staff when the attending physician is unavailable.
   - Develop and monitor a standard timeframe for reporting and receiving critical results.

## Secondary Driver

## Key Change Concepts

Stop or de-escalate antibiotic based on culture result.

## Specific Change Ideas

1. Develop a process to discontinue antibiotics:
   - When positive cultures most likely represent colonization rather than infection.
   - If cultures are negative or alternative non-infectious agent is diagnosed in 48 to 72 hours. Permit physicians to opt out of automatically discontinuing antibiotics based on negative culture results, but require documentation of the rationale.
2. If indication for antibiotics is clearly identified, de-escalate therapy to target the susceptibilities of the pathogen.
3. Standardize all hand offs to include review of culture results or pending culture results, antibiotic duration, and current plans for antibiotic discontinuation.
### Reconcile and adjust antibiotics, at all transitions and changes in patient’s condition

- Look for all opportunities to stop or change (de-escalate or broaden) antibiotic therapy when patient condition changes and/or when changing levels of care.

### Monitor for toxicity reliably and adjust agent and dose promptly

- Ensure appropriate monitoring and adjustment of agent.

### Specific Change Ideas

1. Utilize every Multi-Disciplinary Round (MD) and transition in care to ensure:
   - Antibiotic matches pathogen and sensitivity;
   - The dose and dose interval are correct given current clinical status (e.g., renal function may change);
   - Appropriate toxicity monitoring is occurring;
   - Duration is clearly specified and there is an end date for the therapy;
   - Opportunities for discontinuation or de-escalation in therapy are considered;
   - Whether patient can be converted from intravenous to oral (IV to PO) antibiotics.

2. Pay special attention to antibiotic duplication on conversion day.

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### Driving Appropriate Use

**De-escalation**

- Success rates in clinical studies: 70%
- Success rates in actual clinical practice: 10%

Masterton, Crit Care Clinics, 2011
Driving Appropriate Use

De-escalation Barriers

- All cultures are negative and…
- “The patient improved on all 3 antibiotics, so they need all 3”
- The patient does not improve
- Patients being treated for more than 1 infection
  - Pneumonia and UTI
  - Cellulitis patient who aspirates

De-escalation Tests

Successes

- Pharmacist recommendations for de-escalation
  - Rounding (90% acceptance rate)
  - Text pages
- Transfers out of the ICU
  - Add on "antibiotic section" to lists of issues routinely addressed
- Annual web based "manditories"
  - Review treatment guidelines
  - De-escalation best practices
- Theradoc alerts re certain antibiotics
  - Prompts interaction with provider
De-escalation Tests

Failures (Challenges)

- Asking physicians to document day of therapy
  - And having it carry over to the next provider
- Educating and reminding as sole initiative
  - Expecting the 72 hour antibiotic timeout

Antibiotic Stewardship Driver Diagram

Primary Drivers
- Timely and appropriate initiation of antibiotics
- Appropriate administration and de-escalation
- Data monitoring, transparency, and stewardship infrastructure
- Availability of expertise at the point of care

Secondary Drivers
- Decreased incidence of antibiotic-related adverse drug events (ADEs)
- Decreased prevalence of antibiotic resistant healthcare-associated pathogens
- Decreased incidence of healthcare-associated C. difficile infection
- Decreased pharmacy cost for antibiotics

Leadership and Culture

- Promptly identify patients who require antibiotics
- Obtain cultures prior to starting antibiotics
- Do not give antibiotics with overlapping activity or combinations not supported by evidence or guidelines
- Determine and verify antibiotic allergies and tailor therapy accordingly
- Consider local antibiotic susceptibility patterns in selecting therapy
- Start treatment promptly
- Specify expected duration of therapy based on evidence and national and hospital guidelines

- Make antibiotics patient is receiving and start dates visible at point of care
- Give antibiotics at the right dose and interval
- Stop or de-escalate therapy promptly based on the culture and sensitivity results
- Reconcile and adjust antibiotics at all transitions and changes in patient’s condition
- Monitor for toxicity reliably and adjust agent and dose promptly

- Develop and make available expertise in antibiotic use
- Ensure expertise is available at the point of care
### Secondary Driver

**Develop and make available expertise in antibiotic use**

<table>
<thead>
<tr>
<th>Key Change Concepts</th>
<th>Specific Change Ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivate local expertise among staff</td>
<td>1. Improve antibiotic knowledge of clinical staff, including hospitalists, nurses, physician assistants, nurse practitioners, etc. (e.g., ordering of cultures, antibiotic spectra).</td>
</tr>
<tr>
<td></td>
<td>2. Develop and make available expertise in pharmacology (i.e., pharmacokinetics and pharmacodynamics) and antibiotic spectrum and activity, and ensure that such expertise is available to clinicians at the point of care.</td>
</tr>
<tr>
<td></td>
<td>3. Consider developing short, targeted educational messages, ideally based on local issues, that can be disseminated on a regular basis (e.g., monthly).</td>
</tr>
<tr>
<td></td>
<td>4. Develop and disseminate key antibiotic use messages to facility staff using a variety of mechanisms, depending on resources (e.g., posters, emails, meeting announcements, posters, academic detailing etc).</td>
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</tbody>
</table>

### Develop and make available expertise in antibiotic use

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Develop a process for antibiotic formulary management</td>
<td>1. Designate a group to make decisions about the facility antimicrobial formulary (e.g., P&amp;T committee, antimicrobial subcommittee).</td>
</tr>
<tr>
<td></td>
<td>2. Consider developing criteria for use or requiring prior approval for the use of certain antibiotics, e.g., those that are “last lines of defense,” highly toxic or very expensive.</td>
</tr>
<tr>
<td></td>
<td>3. If not already done, consider closing the antimicrobial formulary.</td>
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</table>
Ensure expertise is available to clinicians at the point of care

<table>
<thead>
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</tr>
</thead>
</table>
| Create processes to ensure availability of expertise | 1. In hospitals with extensive clinical pharmacist support, develop protocols for pharmacists to directly intervene at the point of care to improve selection and administration of antibiotics.  
2. In hospitals without extensive clinical pharmacist and infectious disease specialist support:  
   - Develop a system to have access to clinical pharmacist and infectious disease experts for consultations in complex situations;  
   - Consider shared or virtual expertise in settings where infectious disease and/or clinical pharmacists are not available in house;  
   - Develop training for staff pharmacists to enhance their ability to support antibiotic therapy at the point of care.  
3. In academic centers, ensure that infectious disease fellows are fully trained and competent to provide advice at the point of care or virtually, including on nights and weekends.  
4. In facilities where ID consultation is available, consider developing criteria for situations where ID consultation is strongly recommended (e.g., complicated infections, prior to placing PICC lines for home IV antibiotics).  
5. Develop a process for real time decision support at the point of care.  
   - Create a structure for validating competency across disciplines and roles. |

Availability of Expertise : Tests

**Successes**

- Small hospital: Hospitalist based UTI guideline
- Training PAs in CT surgery pre-op clinic
  - Do not send routine pre-op UA
- Routine interaction with hospitalist groups
  - Weekly ID lesson
  - Hospitalist stewardship champion
  - Enhanced ID pharmacist-hospitalist interaction
- Theradoc alerts re antibiotics (educating pharmacists)
  - Prompts interaction with provider
- Web consults / Abx use app
Availability of Expertise: Tests

Failures

- Purchased the Johns Hopkins guide (web-based)
  - Few used it
- Using the ID consult service
- Guidelines for ID consultation

Improving Antimicrobial Utilization

Engaging Hospitalists: Barriers and Facilitators
Driving Appropriate Use

Barriers in the CDC/IHI National Pilot

- Hospitalist schedules / poor continuity / hand-offs
- Large / multiple groups make communication difficult
- Nurses are overwhelmed
- “Another QI project!?#$#%”
- IT / CPOE
- Time / ability to collect data
- High patient load, no multidisciplinary rounds

Driving Appropriate Use

Overcoming Barriers

- Physician champion is key
- The need to improve is obvious to many
  - Helps if you demonstrate the opportunities for improvement to all
- Some docs want more help than they are willing to admit
- ID / pharmacy will partner with you
- IT can help: order sets, etc.
- Start small with a coalition of the willing
- Ask for feedback and act on it
- Share successes
Why engage hospitalists?

- In the U.S., numbers of hospitalists are growing
  - > 30,000 in 2011
- Many hospitals have hospitalist programs
  - 2/3 of U.S. hospitals (over 90% if beds > 500)
- In 2006 > 50% of all U.S. non-surgical Medicare discharges were cared for by hospitalists
- Increasingly taking the lead on QI work
  - They understand systems redesign

Hospitalists and Antimicrobial Stewardship

- Antimicrobial resistance and antibiotic complications (*C. difficile*) hit home
- Templates, guidelines and checklists are commonplace in hospital medicine
- Hospitalists must tackle issues with signouts, handoffs, and care transitions
  - Dr X comfortable stopping the drug Dr Y started
- There often isn’t anyone else to do this?!
Overall Goal

“Identify and define interventions that can be readily incorporated into the normal work flow of hospitalists”

Removing Barriers

- Hospitalist scheduling problems
- Rotating between multiple hospitals
- Clinical volume too high to think
- High turnover: Leadership and Staff
- Lack of experience with QI
Overall Goal

Coalition of the Willing (and able?)

- Emory John’s Creek, GA
- Reading Hospital, PA
- Spectrum Health, MI
- Northshore University, NJ
- University of Michigan, MI

Interventions

- Documentation/visibility at the point of care: antibiotic, day of therapy, indication and expected duration

- Appropriate length of treatment (based on GLs for treatment duration for the 3 most common dx in the hospitalists program)

- 72 hour antibiotic time out to facilitate: de-escalation/discontinuation of AB, as appropriate
Build Changes into the Process of Care

- Utilize hand-offs
- Multidisciplinary rounds
- Checklists
- CPOE solutions
- Engage the team
  - Nursing, PAs, Clinical assistants, Pharmacy
- Other ideas?

Planned Interventions

- UM