Antibiotic Stewardship: Where to Start

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CDC/Division of Healthcare Quality and Promotion
Participant Poll

Did you attend the May 22 webinar
“Antimicrobial Stewardship: What, Why, and How?”

A. Yes
B. No
C. Don’t Know
Participant Poll

What is your main position?

A. Infection Preventionist
B. Nurse
C. Pharmacist
D. Physician
E. Lab/Microbiologist
F. Other


**Participant Poll**

Do you have a secondary position?

A. Infection Preventionist
B. Nurse
C. Pharmacist
D. Other
Objectives

- Learn what is a Driver Diagram
- Identify drivers and change ideas for antibiotic stewardship
- Discuss examples of successful antibiotic stewardship interventions in rural settings
While all changes do not lead to improvement, all improvement requires change.
Success Factors for Change

- Clear goal
- Belief in the need for change
- Participation in planning
- Visible progress and results
What is a *Driver Diagram*?
Antibiotic Stewardship Driver Diagram

A Map...
for improving appropriate use of antibiotics

- Displays destinations
- Shows paths to get there
- Notes landmarks
- Potentially offers guidance
- Multiple ways to reach same destination
Using Driver Diagram as a Map

- A map is only a tool

- Using a map requires
  - Knowledge
  - Decisions
  - Communication

- An map shows an ideal picture, but not road conditions

_Ultimately, you are the driver!_
Driver Diagram

- A way to visualize an improvement effort
  - Connects specific interventions and activities to a larger goal
  - Outlines specific changes that can result in improvement

- A conceptual model for health care organizations to identify improvement strategies and processes
GOAL

Underlying Factors

Primary Drivers
Secondary Drivers

Change Ideas

Driver Diagram

- Improvement Activity A
- Improvement Activity B
- Improvement Activity C
- Improvement Activity D
Antibiotic Stewardship Driver Diagram

- **GOAL:** Timely and appropriate antibiotic utilization in the acute care setting

- **WHY?**
  - Decreased antibiotic related adverse events
  - Decreased antibiotic resistant pathogens
  - Decreased incidence of *C. difficile*
  - Decreased pharmacy cost
Antibiotic Stewardship Driver Diagram

**Primary Drivers**

- 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

**Secondary Drivers**

- Appropriate administration and de-escalation
  - 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

- Data monitoring, transparency, and stewardship infrastructure
  - 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

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

**Leadership and Culture**
Development
Creating the CDC/ IHI Driver Diagram

- **Partnership**
  - CDC
  - Institute for Healthcare Improvement (IHI)
  - Clinicians involved in stewardship

- Broke the process of prescribing and administering antibiotics into discrete steps

- Determined what interventions could improve each of those steps
Antibiotic Prescribing is Complex

- Extensive background knowledge needed
- Many people and departments involved
- Data for decisions are available at different times
- Measurement of use is challenging
Eight hospitals assessed the feasibility of implementation of recommended changes
  - At least one specific change idea
  - From at least two different drivers

Driver diagram was revised based on experience from the pilot testing.
Antibiotic Stewardship Driver Diagram

Primary Drivers

- Timely and appropriate initiation of antibiotics

Secondary Drivers

- 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

Leadership and Culture

- 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 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

- 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

- Appropriate administration and de-escalation

- Data monitoring, transparency, and stewardship infrastructure

- Availability of expertise at the point of care
Driver Diagram: Pilot Testing

<table>
<thead>
<tr>
<th>Pilot Testing Sites</th>
<th>Size</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centerpoint Medical Center, Independence, MO</td>
<td>220 beds</td>
<td>Community</td>
</tr>
<tr>
<td>Community Hospital, Tallassee, AL</td>
<td>69 beds</td>
<td>Community</td>
</tr>
<tr>
<td>Rogue Valley Medical Center, Medford, OR</td>
<td>378 beds</td>
<td>Community</td>
</tr>
<tr>
<td>Seton Medical Center, Austin, TX</td>
<td>425 beds</td>
<td>Community</td>
</tr>
<tr>
<td>St. Francis Medical Center, Peoria, IL</td>
<td>616 beds</td>
<td>Teaching</td>
</tr>
<tr>
<td>The Reading Hospital &amp; Medical Center, West Reading, PA</td>
<td>711 beds</td>
<td>Teaching</td>
</tr>
<tr>
<td>UCLA, Los Angeles, CA</td>
<td>668 beds</td>
<td>Academic</td>
</tr>
<tr>
<td>Wellstar Cobb Hospital, Austel, GA</td>
<td>370 beds</td>
<td>Community</td>
</tr>
</tbody>
</table>

Pilot testing was conducted from October 2011 - June 2012
Using the Driver Diagram To Improve Antibiotic Use
Model for Improvement

- Set an aim
- Establish a measure
- Plan to improve
- Specific ‘Tests of Change’

The Plan-Do-Study-Act (PDSA) Cycle

**Plan**
- Idea for change
- Questions and predictions (why)
- Plan to carry out the cycle (who, what, where, when)
- Plan for data collection

**Do**
- Carry out the plan
- Document problems and unexpected observations
- Begin analysis of the data

**Study**
- Analyze of the data
- Compare data to predictions
- Summarize what was learned

**Act**
- What changes are to be made?
- Next cycle?

Are we doing this? What keeps us from doing it? How can we do it differently?
Repeated Use of the PDSA Cycle

Multiple cycles
- Evaluate an outcome
- Improve upon it
- Test it again

Proposals, Theories, Ideas

Learning from Data, Tests

Changes that Result in Improvement

• Specific
• Rapid
Model for Improvement: Example

Driver 1: Timely and Appropriate Initiation of Antibiotics

Cycle 1: Compliance with empiric guidelines for treatment of UTI
- Retrospective assessment
  - 29 patients evaluated
  - Empiric selection consistent with guidelines in 15/29 (52%)
  - 14 patients met criteria for de-escalation
  - De-escalation performed in 7/12 (58%)*

  **FOCUS:** Empiric selection and treatment duration

Cycle 2: Education
- One on one education to physician team member
- UTI recommendations from Empiric Antibiotic Guidelines
- Availability of guidelines via website

  **EVALUATE CHANGE:** 1 patient with positive urine culture; appropriate empiric antibiotic selections and duration

Cycle 4: Retest compliance
- 4 patients evaluated
- 3/4 (75%) patients with appropriate empiric selection
- Appropriate duration of therapy

  **OPTIMIZE COMPLIANCE:** UTI order set and website “Quick Link”

Cycle 6: UTI Order Set
- Developed order set with Hospitalist
- Tested utilization of order set with 2nd Hospitalist
- Pre-selected urinalysis and urine culture orders (UA reflex to Ucx)

WellStar Hospital (Austell, GA) participated in piloting Antibiotic Stewardship Driver Diagram
**Model for Improvement: Example**

**Driver 2: Appropriate Administration and De-escalation**

- **Cycle 1**
  - Assess rate of de-escalation in the treatment of UTI
  - 29 patients evaluated
  - 14 patients met criteria for de-escalation
  - 7/12 (58%) de-escalation of antibiotic therapy performed
  - *2 patients excluded: 1 left AMA; 1 discharged to hospice*

- **FOCUS:** De-escalation of antibiotic therapy

- **Cycle 2**
  - De-escalation rate for “no growth” or “normal skin flora”
  - 21 patients identified
  - 7 patients followed by Hospitalist
  - 1/7 (14%) continued on antibiotics; no urinary symptoms

- **EVALUATE:** De-escalation/streamlining for positive urine culture

- **Cycle 3**
  - Evaluate positive urine culture reports
  - 36 positive urine cultures
  - 4 patients followed by Hospitalist
  - 2 patients eligible for de-escalation/streamlining
  - 0/2 (0%) de-escalation performed

WellStar Hospital (Austell, GA) participated in piloting Antibiotic Stewardship Driver Diagram
Model for Improvement: Example

Driver 1: Timely and Appropriate Initiation of Antibiotics

- **Assess perceived microbiology needs to optimize pathogen isolation for wound specimens**
  - Verbal interview with microbiology laboratory manager
  - Perceived needs:
    - Proper tube used for anaerobic cultures (blue cap vs. red cap)
    - Proper labeling of specimen with source of culture

- **Cycle 7a**
  - **Assess wound culture specimens**
  - **EVALUATE**: Wound specimens submitted to microbiology
    - 23 wound cultures submitted
    - 4/23 (17%) not appropriately labeled with culture source
    - 22/23 (95%) with correct tube utilized for culture
  - **FOCUS**: Increase proper labeling of wound specimens
    - In-service to nursing staff on acute care floor
    - Nurse manager e-mail distribution of information to additional nursing staff

- **Cycle 7b**
  - **Educate**

- **Cycle 7c**
  - **Assess compliance**
  - **EVALUATE CHANGE**: Determine impact of education
    - 3/3 (100%) wound cultures submitted with proper labeling

WellStar Hospital (Austell, GA) participated in piloting Antibiotic Stewardship Driver Diagram
The point is NOT to implement everything, but to pick a specific intervention that’s important to your facility

- Select a change
- Test a change
- Implement a change

Small steps towards a big goal
Antibiotic Stewardship: Where to Start?
Primary Driver 1. 
*Timely and Appropriate Initiation of Antibiotics*
Timely and Appropriate Initiation

- Promptly identify patients who require antibiotics
  - Specify situations when antibiotics are not needed
- Obtain cultures prior to starting antibiotics
- Do not give antibiotics with overlapping activity or combinations

http://www.cdc.gov/getsmart/healthcare/learn-from-others/driver-diagram/primary-driver1.html
Timely and Appropriate Initiation (cont.)

- Determine and verify antibiotic allergies and tailor therapy accordingly
- Consider local susceptibility patterns in selecting therapy
- Start treatment promptly
- Specify expected duration of therapy based on evidence and national and hospital guidelines

http://www.cdc.gov/getsmart/healthcare/learn-from-others/driver-diagram/primary-driver1.html
Participant Poll

What statement describes your pharmacy support?

A. On-site, full time
B. On-site, part time
C. Off-site
D. Other
Participant Poll

Which statement describes your microbiology laboratory (e.g. cultures)?

A. Available at the facility
B. All microbiology cultures are sent out
C. Not known
Participant Poll

Does your facility have available a summary of resistance patterns (antibiogram)?

A. Yes
B. No
C. Not known
Primary Driver 2.
Appropriate Administration
And De-escalation
Administration and De-escalation

- Make antibiotics patient is receiving and start dates visible at point of care and in health records
- 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
Primary Driver 3. 
*Monitoring, Transparency, Infrastructure*
Monitoring, Transparency, Infrastructure

- Monitor, feedback, and make visible data
  - Antibiotic utilization
  - Antibiotic resistance
  - *C. difficile*
  - Cost
  - Adherence recommended culturing and prescribing practices

http://www.cdc.gov/getsmart/healthcare/learn-from-others/driver-diagram/measurement-framework.html
Recommended Measures

- Percent of patients where cultures were obtained prior to first dose of antibiotics
- Percent of patients sampled where antibiotic start date was documented/visible at the point of care
- Percent of patients sampled where antibiotic stop date/duration was documented/visible at the point of care
- Percent of patients sampled where antibiotic indication was documented/visible at the point of care

Recommended based on pilot testing
http://www.cdc.gov/getsmart/healthcare/learn-from-others/driver-diagram/measurement-framework.html
## Antibiotic Stewardship Measurement Framework

### Primary Driver | Measure
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Timely antibiotic management</td>
<td>COMPOSITE MEASURE: Percent of patients sampled where antibiotic • start date, • stop date/duration and • indication were documented/visible at the point of care</td>
</tr>
<tr>
<td>Appropriate administration and de-escalation</td>
<td></td>
</tr>
</tbody>
</table>

http://www.cdc.gov/getsmart/healthcare/learn-from-others/driver-diagram/measurement-framework.html
Participant Poll

How available is an infectious disease (ID) physician to your facility?

A. Available at the facility or by consult
B. Available at a referral hospital
C. Available by tele-medicine
D. Difficult to access
Driver 4. Expertise at Point of Care

- Develop and make available expertise in antibiotic use
  - Cultivate local expertise among staff
  - Develop a process for antibiotic formulary management

- Ensure expertise is available to clinicians at the point of care
  - Create processes to ensure availability of expertise
Overarching Driver: Leadership and Culture

- Promote a culture of optimal antibiotic use
- Engage administrative and clinical leadership to champion stewardship effort
Engaging Clinicians

- Improve patient outcomes
- Involve physicians from the beginning
- Identify and activate champions
- Use the 20/80 rule

Engaging Clinicians

- Standardize what is standardizable
- Generate light, not heat, with data
- Make the right thing easy to try, and
  - Easy to do
- Communicate candidly, often

Antimicrobial Stewardship in Rural Settings
Antimicrobial Stewardship on the Frontier

- **Setting:** Four rural and frontier hospitals in NM
- **Support:** Extension for Community Health Outreach
- **Intervention:**
  - Seven biweekly lectures
    - Q&A with University of NM Faculty (ID physicians, Antimicrobial pharmacists, Clinical Microbiologists)
    - Participants sharing their own interventions
  - **Electronic Access to:**
    - Guidelines
    - Literature
    - Order sets

Antimicrobial Stewardship on the Frontier

- Lecture topics:
  - Making the case for stewardship
  - Key formulary interventions
  - Developing clinical guidelines
  - Reviewing individual orders
  - Working with the microbiology laboratory and infection control staff
  - Measuring the impact of the program

## Antimicrobial Stewardship
on the Frontier

<table>
<thead>
<tr>
<th>Antimicrobial stewardship element</th>
<th>In place prior to curriculum</th>
<th>Implemented during or after the curriculum</th>
<th>Expanded during or after the curriculum</th>
<th>Planning to add this element at time of survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antimicrobial stewardship team</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Regular review of selected antimicrobial drug orders</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Review of antimicrobial therapy for patients with</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>selected organisms in blood culture</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Dissemination of antibiograms to medical staff</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Indication required for all antibiotic orders</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>% of elements implemented</td>
<td>40</td>
<td>15</td>
<td></td>
<td>25*</td>
</tr>
</tbody>
</table>

* Planned implementation.
Antimicrobial Stewardship on the Frontier

Take-aways

- You don’t need to be a big hospital to have an antimicrobial stewardship team
- You don’t need to do everything
- Even the hospitals with a team found ways to expand
- Solutions and support for stewardship may exist outside your walls
- Peer-sharing was important
  - “Hearing questions from other participants”
  - “Learning how other facilities solved problems”

Case study: Small, rural hospital

- Private-practice physicians admit patients
  - No hospitalist
  - Infectious disease specialist available by consult
- Pharmacy operates 7am-10pm
- Pharmacy and therapeutic committee staffed by chief medical office
- Microbiology is outsourced

Ohl and Dodds-Ashley, CID. 2011;53(S1)S23-S28.
Proposed approach: Small, rural hospital

Institutional Support?

Yes
- Financial support ID specialist
- Establish a stewardship committee run by ID specialist
- Review antimicrobial formulary
- Institute daily pharmacist review of antibiotic prescriptions
- Create a antibiogram

No
- Identify an AS champion to advocate for a stewardship committee
- Advocate for initiatives and improvements through P&T committee
- Review antimicrobial use
- Implement changes based on studies of use
  - Develop empiric treatment guidelines
  - IV to oral conversion
  - Limited duration
  - De-escalation
Antimicrobial Stewardship in a Rural Hospital

- **Setting:** 141-bed community hospital in rural Northwest
- **Team:** Pharmacist-led (non-ID), Remotely located ID physician
- **Intervention:**
  - Targeted review of six antimicrobials
    - Pip/Tazo, imipenam, cilastatin, ertapenam, vancomycin, linezolid, daptomycin
  - Weekly teleconference “rounding” with ID physician
  - Streamlined Therapy
    - Eliminated unnecessary combinations
    - Recommended more narrow spectrum
  - Dose optimization

Outcomes

- Number of interventions increased from 2 to 7 per week
- Streamlining was most common intervention
  - 44% before program, 96% after program began
- C. diff infections decreased from 5.5 to 1.6 (cases/10,000 pt days)
- Antimicrobial purchase costs decreased
  - $13,521 per 1,000 pt days (baseline) to
  - $ 9,756 (2010) to
  - $ 6,583 (2011 Quarter 1-2)
What can you do?
Nurses

- Ensure cultures are properly collected
- Ensure an appropriate duration of treatment
- Know and communicate culture results
  - Ensure treatment is in line with microbiology results
  - Limit use of broad spectrum antimicrobials
- Monitor IV antimicrobial prescriptions and engage physicians and pharmacists regarding oral therapy
- Test for symptoms consistent with *C. difficile*
- Recognize that antibiotics are not always indicated

Infection Preventionists

- Identify drug resistance patterns of organisms among the population served by your health care facility
  - Education of clinicians on prudent and appropriate use
  - Development of clinical algorithms for treating infections
  - Oversight of standard and transmission-based precautions
  - Compliance with hand hygiene

- Audit, analysis and reporting of data on antibiotic-related HAIs (e.g. *C. Difficile*)

Pharmacists

- Become involved in a multidisciplinary team
- Make recommendations for appropriate use
  - Agent selection
  - Dosing and therapeutic monitoring
  - De-escalation
- Contribute to antimicrobial use policies/procedures
- Generate quantitative data on use
- Enroll in formal training for pharmacists
  - American Society of Health System Pharmacists
  - MAD-ID antimicrobial stewardship training programs

http://mad-id.org/antimicrobial-stewardship-programs/
Resources on *Get Smart for Healthcare* Website – *For your use!*

- Fact sheets and fast facts
- Slide sets
- Tools to start a program
- Press kit to raise awareness

**Get Smart for Healthcare Topics**

**Why Inpatient Stewardship?**
Benefits of antibiotic stewardship, Overview, Slide sets, Fast facts...

**Implementing and Improving Stewardship Efforts**
Tools, Getting Started...

**Evidence to Support Stewardship Efforts**
Annotated bibliography, References...

**Learn from others**
Success stories, Hospital Programs, CE Training

**Get Smart for Healthcare**

- **Antibiotic Stewardship Drivers and Change Package**
  - Antibiotic Stewardship Drivers and Change Package is prepared by the Institute for Healthcare Improvement (IHI) and the Centers for Disease Control and Prevention (CDC)
  - **UPDATED July 2012** — Based on initial testing/experience across 6 pilot testing hospitals (Sept 2011–June 2012)
  - A conceptual framework and driver diagram to describe highly leveraged system components for improving antibiotic utilization with a robust change package

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  - Primary Driver 1: Timely and Appropriate Initiation of Antibiotics
  - Primary Driver 2: Appropriate Administration and Decalculation
  - Primary Driver 3: Data Monitoring, Transparency, and Stewardship Infrastructure

  **Piloting Project Team**
  - Ed Septimus, MD, FIDSA, FSHEA, FACP, IHI Faculty Chair
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  - Lloyd Provost, Improvement Advisor
  - Diane Jacobsen, MPH, CFSA, Director, IHI
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  - Abigail Ziaj, Research Associate, IHI

**Getsmart for Healthcare - Widgets**

[http://www.cdc.gov/getsmtarah](http://www.cdc.gov/getsmtarah)
Review of Objectives

- Learn what is a Driver Diagram
- Identify drivers and change ideas for antibiotic stewardship
- Discuss examples of successful antibiotic stewardship interventions in rural settings
Essential Elements for Strategic Improvement

Will

Ideas

Execution
Thank you!

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.