OPTIMIZING ANTIMICROBIAL STEWARDSHIP: IT STARTS IN THE EMERGENCY DEPARTMENT!

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Objectives

1. List three activities pharmacists can implement to support health-system antimicrobial stewardship programs (ASPs)

2. Identify potential barriers to implementing antimicrobial stewardship in the emergency department (ED)

3. Discuss the role of the Emergency Medicine pharmacist (EMP) in hospital ASPs

Antimicrobial Stewardship Program (ASP) Core Elements

- Leadership Commitment
- Accountability
- Drug Expertise
- Action
- Tracking
- Reporting
- Education

Centers for Disease Control: Core Elements of Hospital Antibiotic Stewardship Program, 2014.

Why is it important to prevent resistance?

- Annually $20 billion in direct U.S health care costs
- 8 million additional hospital days

Bad Bugs, Need Drugs!

Dramatic Decrease in Antibiotic Drug Approvals from FDA

Facts on Antimicrobial Resistance, IDSA 2012

Estimated minimum number of illnesses and deaths caused annually by antibiotic resistance*:

At least 2,049,442 illnesses, 23,000 deaths

*bacteria and fungus included in this report
Getting Smart About Antibiotics

- Improving antibiotic use through ASPs has shown to improve patient outcomes, safety, and be cost effective
- ASPs have also been shown to decrease antimicrobial resistance
- Antibiotics are the **ONLY** drug where use in one patient can impact the effectiveness in another!
  - If everyone does not use antibiotics well, we all suffer the consequences

A Call to Action for ED Antimicrobial Stewardship

- Estimated rates of inappropriate or unnecessary antibiotic use among outpatient practitioners exceeds 50%!
  - Important preventable cause of antimicrobial resistance in both the hospital and community settings
  - Many ED revisits are medication related
  - Choice of antimicrobial in the ED influences decision for inpatient therapy

ED Antimicrobial Stewardship?

- Unfortunately many traditional programs do not include the ED in their initiatives
  - Antimicrobials are the second most common therapeutic drug class prescribed during ED visits
    - 15.7% of patients
  - High volume and quick throughput
    - Practice site is not amenable to many of the more traditional stewardship activities

Assessing ED Capacity for ASP Implementation

Barriers to ED ASP Implementation

- High patient volume
- Provider turnover
- Provider pushback
- Operational challenges
  - Patient throughput
  - Limited patient or diagnostic information/history
  - Limited culture data
  - Sepsis
    - Door to antibiotic goals
    - Antibiotic decision metric

Patient flow through the ED
Steps to Emergency Department Antimicrobial Stewardship

- Even with limited resources steps can be put into place to guide prescribers at this important transition of care junction
- Can involve ED pharmacists, ASP pharmacists, pharmacist generalists, trainees
  - Anyone can be a steward!

Building a Stewardship Program

<table>
<thead>
<tr>
<th>Core Strategies</th>
<th>Supplemental Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Prospective audit and feedback</td>
<td></td>
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<tr>
<td>• Preauthorization</td>
<td></td>
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<tr>
<td>• Local institutional guidelines/policies</td>
<td></td>
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<tr>
<td>• Antibiograms</td>
<td></td>
</tr>
<tr>
<td>• Disease-state specific guidelines</td>
<td></td>
</tr>
<tr>
<td>• Rapid diagnostic testing</td>
<td></td>
</tr>
<tr>
<td>• Education</td>
<td></td>
</tr>
</tbody>
</table>

Low Hanging Fruit – Improving Antimicrobial Selection

- Modifying medication administration system selection
- Increase access to PO antibiotics
- Remove high cost/broad-spectrum agents

Optimizing your IV Medication Cabinet

- Aztreonam 2 gram IVPB
- Azithromycin 500 mg IVPB
- Ceftriaxone 250 mg vials
- Ceftriaxone 1 gram vials
- Cefazolin 1 gram vials
- Ceftazidime 1 gram
- Ciprofloxacin 400 mg
- Ciprofloxacin 200 mg
- Ertapenem 1 gram IVPB
- Levofloxacin 500 mg IVPB
- Levofloxacin 750 mg IVPB
- Metronidazole 500 mg IVPB
- Piperacillin/tazobactam 3.375 gram
- Piperacillin/tazobactam 2.25 gram
- Penicillin Benzathine 1.2 million units
- Penicillin Benzathine 600,000 units
- Vancomycin 1000 mg
- Piperacillin/tazobactam 4.5 gram
- Cefepime 2 gram IVPB

Optimizing your medication cabinet

- Azithromycin 500 mg IVPB
- Ceftriaxone 1 gram vials
- Ceftriaxone 250 mg vials
- Cefazolin 1 gram vials
- Cefepime 2 gram IVPB
- Ciprofloxacin 400 mg IVPB
- Metronidazole 500 mg IVPB
- Levofloxacin 750 mg IVPB
- Piperacillin/tazobactam 4.5 gram IVPB
- Vancomycin 2000 mg
**Optimizing your Medication Cabinet: Oral Antimicrobials**

- Mix of suspension and solid dosing formulations
- Remove high-cost, low frequency oral medications
- Tailor to empiric therapy guidelines

**Improving Antimicrobial Selection with Allergy Assessment**

- **Allergy documentation**
  - Allergies are the primary reason patients do not receive first-line antimicrobial therapy
  - Penicillin allergy most commonly documented
  - First-line antibiotics for many infections
  - Common misconception: patients who have a severe allergy cannot receive a cephalosporin
  - Reality: <1% of patients with a documented penicillin allergy will not tolerate a cephalosporin

- Many documented with no reaction or incorrect reaction such as hives when true reaction was non-severe such as rash

**Provider Education**

- **Types of education:**
  - Formal/didactic presentation
  - Email communication
  - In-person feedback

**Dearest ED providers:**

Your ED pharmacy team would like to update you regarding treatment of urinary tract infections in patients being discharged.

**Updates**

1. Please keep using macrobid 100 mg bid x 5 days as your first line agent for treating UTIs in young women with good kidneys. The duration for macrobid is still 5 days (not 3 and definitely not 10).
2. Cipro is still our preferred agent for patients that cannot get macrobid. Cipro is first line for pyelonephritis and complicated UTIs. Remember, men and their urinary tracts are inherently complicated and thus men cannot be treated with macrobid.
3. Bactrim is third line. For uncomplicated UTIs patients only require 3 days of bactrim or cipro. For complicated UTIs cipro or bactrim should be given for 7 days (not 14 days as previously recommended) as treatment outcomes are the same when compared to longer courses of therapy.

Please contact your ED pharmacy team with any questions via email or in person. We will also respond to questions sent via postcard if attached to a $5 bill.

**ED-specific Antibiogram**

- Microbiology Laboratory and/or clinical-decision support
Developing Empiric Therapy Guidelines

- National guidelines and local susceptibilities
  - Use your antibiogram!
- Provides guidance
  - Limit use of high cost, broad-spectrum agents, agents with high risk of *Clostridium difficile*
- Targets
  - Most frequent conditions
  - Recent changes
    - Durations of therapy
    - Susceptibility
- Separate inpatient and outpatient guidelines

Utilizing Empiric Therapy Guidelines

- Multi-disciplinary support/education
- Post with easy access
  - Paper vs. electronic access
  - Mold into electronic order sets
- Creates concrete stewardship targets

Inpatient Guidelines

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Suspected Pathogens</th>
<th>Empiric Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Septicemia</td>
<td>Staphylococci, Streptococci, enterococci</td>
<td>Ceftriaxone 1 g IV q 12 h. Ampicillin 1 g IV q 6 h. Imipenem 1 g IV q 4 h.</td>
</tr>
<tr>
<td>Sepsis</td>
<td>Staphylococci, Streptococci</td>
<td>Ceftriaxone 1 g IV q 12 h. Piperacillin/tazobactam 3.4 g IV q 6 h.</td>
</tr>
</tbody>
</table>

Electronic Order Sets

Outpatient Guidelines

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Suspected Pathogens</th>
<th>Empiric Therapy</th>
<th>Duration of Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sepsis</td>
<td>Staphylococci, Streptococci</td>
<td>Clindamycin 300 mg PO q 12 h.</td>
<td>3 - 7 days</td>
</tr>
<tr>
<td>Sepsis</td>
<td><em>Clostridium</em></td>
<td>Metronidazole 400 mg PO q 8 h.</td>
<td>2 - 3 days</td>
</tr>
</tbody>
</table>

Guideline-development Process

- Stewardship leaders develop draft guideline
- ED Providers
- ID providers
- ICU providers
- IM/FM providers
- Other services
- Update with suggestions
- Resubmit to provider groups
- Additional changes suggested?
  - Yes
  - No
- Submit to antimicrobial subcommittee and P&T committee
- Educate providers/post guidelines
- Audit and feedback/maintenance

“This is not a substitute for clinical judgement”
Silence = agreement
Set deadlines
Pediatric Empiric Therapy Guidelines

Guideline Feedback: Updating and Maintaining

Bactrim suspension dosing is based on the trimethoprim component.
Dosing for acute otitis media, MRSA skin soft tissue infections and for urinary tract infections is 8 mg/kg/day of the trimethoprim component. The dose is typically divided every 12 hours. The suspension is available as 200 mg sulfamethoxazole and 40 mg of trimethoprim per 5 mL.

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>ml per dose</th>
<th>Weight (kg)</th>
<th>ml per dose</th>
<th>Weight (kg)</th>
<th>ml per dose</th>
<th>Weight (kg)</th>
<th>ml per dose</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>0.5</td>
<td>11</td>
<td>3.5</td>
<td>21</td>
<td>10.3</td>
<td>31</td>
<td>15.5</td>
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<tr>
<td>2</td>
<td>1.5</td>
<td>13</td>
<td>5.5</td>
<td>23</td>
<td>11.5</td>
<td>33</td>
<td>16.5</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>12</td>
<td>6</td>
<td>20</td>
<td>31</td>
<td>12</td>
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<td>7</td>
<td>24</td>
<td>12</td>
<td>34</td>
<td>17</td>
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<tr>
<td>5</td>
<td>3.5</td>
<td>15</td>
<td>7.5</td>
<td>28</td>
<td>13.5</td>
<td>35</td>
<td>17.5</td>
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<tr>
<td>6</td>
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<td>8</td>
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<tr>
<td>7</td>
<td>3</td>
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<td>8.5</td>
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<td>4</td>
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<td>9.1</td>
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<td>14</td>
<td>38</td>
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<tr>
<td>9</td>
<td>4.5</td>
<td>19</td>
<td>9.5</td>
<td>29</td>
<td>14.5</td>
<td>39</td>
<td>19.5</td>
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<td>5</td>
<td>20</td>
<td>10</td>
<td>30</td>
<td>15</td>
<td>40</td>
<td>20*</td>
</tr>
</tbody>
</table>

*20 mL is equivalent to one Bactrim ED (TM)

How can ED pharmacists help with stewardship?

The ED Antimicrobial Stewardship “Dream Team”

Guidelines on Emergency Medicine Pharmacist Services

- Direct patient care
  - Direct patient care rounds
  - Medication order review
  - Therapy monitoring
  - Resuscitation/high-risk procedures
  - Medication procurement and preparation
  - Documentation

- Administrative
  - Medication and patient safety
  - Quality improvement initiatives
  - Leadership duties and professional service
  - Emergency preparedness

ED ASP

- Real-time assistance with antimicrobial selection
  - Audit and feedback
  - Pre-authorization

- Culture follow-up

- Collaborative practice agreements

Am J Health Syst Pharm. 2011 Dec 1;68(23):e81-95.
Provider feedback

- Use patient case examples
- Avoid expectations of perfection
- Identify barriers to compliance
- Make sure feedback is given for good and bad work
- “what did I do now?”

Electronic order entry sabotage

Pharmacist-Initiated ED Culture Follow-up

<table>
<thead>
<tr>
<th>Program</th>
<th>Study Site</th>
<th>Population</th>
<th>Pharmacy Interventions</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robert Wood Johnson UH</td>
<td>Urban hospital</td>
<td>Adults discharged from the ED with positive culture results</td>
<td>• Compliance teaching • Start or change Abs • Pharmacists made calls to patients</td>
<td>- Pharmacist intervened on approximately 20% of patients</td>
</tr>
<tr>
<td>Carolinas Medical Center</td>
<td>Urban tertiary care teaching hospital</td>
<td>Adults patients discharged home from the ED with positive culture results</td>
<td>• Culture review • Start or change Abs • Physician education</td>
<td>Decreased: • Physician workload • ADRs • Readmission at 96 hours • Treatment failure • Non-compliance</td>
</tr>
<tr>
<td>University of Rochester Medical Center/UK</td>
<td>University teaching hospital</td>
<td>Adults patients discharged home from the ED with positive culture results</td>
<td>• Culture review • Start or change Abs</td>
<td>Decreased: • Physician workload • Readmission at 96 hours • Improved time to follow-up</td>
</tr>
</tbody>
</table>
Antimicrobial Stewardship Metrics

- Antimicrobial use
  - Days of therapy (DOTs)
  - Defined daily doses (DDDs)
  - Antimicrobial cost
- Medication use evaluations
- Susceptibility trends
- Patient outcomes

Antimicrobial Utilization

Oral Antibiotic at Discharge

Susceptibility trends

S. pneumoniae susceptibilities

Pseudomonas susceptibilities
Tracking and Reporting: Utilizing Pharmacy Learners

Overall Percent of Appropriate Empiric Antibiotics for CAP and CA-IAI EMP Present vs Absent (n=320)

- **CAP**
  - EMP present: 95%
  - EMP absent: 79%
- **CA-IAI**
  - EMP present: 62%
  - EMP absent: 44%

\[ p = 0.005 \quad p = 0.025 \]

Kulwicki B, et al.

Tracking and Reporting: Medication Utilization

Kulwicki B, et al.

Tracking and Reporting: Transitions of Care

Continuation of Antibiotic Orders

<table>
<thead>
<tr>
<th></th>
<th>Appropriate Antibiotic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inpatient</td>
<td></td>
</tr>
<tr>
<td>Appropriate Antibiotic in ED</td>
<td>82.5%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Inappropriate Antibiotic in ED</td>
<td>18.8%</td>
<td></td>
</tr>
</tbody>
</table>

Kulwicki B, et al.

Tracking and Reporting: Patient Outcomes

Clinical Outcomes

<table>
<thead>
<tr>
<th></th>
<th>EMP present (n=185)</th>
<th>EMP absent (n=115)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital onset C. difficile, n (%)</td>
<td>2 (1.1)</td>
<td>2 (1.5)</td>
<td>1.0</td>
</tr>
<tr>
<td>In-hospital mortality, n (%)</td>
<td>8 (4.3)</td>
<td>2 (1.5)</td>
<td>0.2</td>
</tr>
<tr>
<td>Length of stay, days(^1)</td>
<td>2.8 (0.3-23)</td>
<td>2.5 (0.2-15.7)</td>
<td>0.18</td>
</tr>
</tbody>
</table>

\(^1\)Median (range)

Kulwicki B, et al.

Encouraging compliance

- Provider education
  - Re-education
  - Re-re-education

- Highlight improved outcomes
  - No increase in ADRs
  - Everyone hates C. difficile

ED Antimicrobial Stewardship

Take-away Points

- Antimicrobial stewardship in the emergency department is an important and evolving role for pharmacists
- Steps for implementation can be taken even with limited resources
- EMPs can target high-level ASP interventions focusing on improving quality of care and patient safety
- Increased use of guideline-concordant therapy
- Reduction in ED revisits and hospital admissions
Question 1:
Antimicrobial resistance can lead to:

a. Increased risk of death
b. Increased cost of antibiotic treatment
c. Increased risk of adverse events
d. All of the above

Pharmacist Question 1:
Which of the following is a potential barrier to the implementation of antimicrobial stewardship activities in the Emergency Department?

a. Provider pushback
b. Having a dedicated EMP
c. Low turnover of ED staff
d. All of the above

Question 2:
All pharmacists can implement which of the following aspects of Emergency Department antimicrobial stewardship programs?

a. Provider education
b. Empiric therapy guidelines
c. Reporting and tracking
d. All of the above

Question 3:
Emergency Medicine pharmacists are uniquely poised to impact which portion of antimicrobial prescribing at the transition of care?

a. Antimicrobial selection
b. Dosing
c. Monitoring
d. All of the above