Establishing Antimicrobial Stewardship Practices in the Emergency Department

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The presenter has no real or potential conflicts of interest to report
Objectives

• Discuss the importance of antimicrobial stewardship with a focus on the emergency department
• Discuss literature supporting antimicrobial stewardship practices in the emergency department
• Discuss the role of pharmacists in assisting with antimicrobial stewardship in the emergency department
• Discuss the role that pharmacy technicians might play in an antimicrobial stewardship program in the emergency department
How Many People Work At A Site With An Antimicrobial Stewardship Program?
How Many People Work At A Site With A Clinical Pharmacist In The Emergency Department?
How Many People Work At A Site Where The Emergency Department Pharmacist And The Antimicrobial Stewardship Program Work Closely Together For Unified Goals?
Antimicrobial Resistance

• Widely recognized as a looming threat in American healthcare
• The emergency department is one of the biggest contributors to inappropriate antimicrobial usage
• Antimicrobials are the most used medicine in the world

Antimicrobial Resistance Statistics

- 2 million people acquire an antimicrobial resistant bacteria every year
- 23,000 people die from antimicrobial resistant bacteria every year
- 250,000 people every year are hospitalized with *C. difficile*
- Antimicrobial resistance may add 20 billion dollars in additional direct healthcare costs every year

## Antimicrobial Resistance

### Urgent Threats
- *C. Difficile*
- CRE
- Resistant *gonorrhea*

### Serious Threats
- MDR *Acinetobacter*
- Resistant *Campylobacter*
- Fluconazole resistant *Candida*
- ESBL
- VRE
- MDR *Pseudomonas*
- Drug resistant *Salmonella*
- Drug resistant *Shigella*
- MRSA
- Drug resistant *S. pneumoniae*

### Concerning Threats
- VRSA
- Erythromycin resistant GAS
- Clindamycin resistant GBS

### Drug resistant tuberculosis

*Antibiotic Resistance Threats 2013. CDC*
Antimicrobial Stewardship

• “To optimize clinical outcomes while minimizing the unintended consequences of antimicrobial use including toxicity, selection of pathogenic organisms, and emergence of antimicrobial resistance”

Antimicrobial Stewardship Strategies

- Policies
- Guidelines
- Surveillance
- Education
- Intervention
Antimicrobial Usage

• Anywhere from 30-50% of antimicrobials used in the hospital are either inappropriate or unnecessary

• Recent study showed that majority of antimicrobials used for respiratory infections in adults in the emergency department are inappropriate

Antimicrobial Usage in the ED

- Greater than 50% of ED visits for upper respiratory infections resulted in the use of antimicrobials
- 40% of ED visits for urinary tract infections involve the use of broad spectrum fluoroquinolones

Antimicrobial Usage in the ED

- Of 320 patients with cultured cellulitis, abscess, or SSTI with complication
- 97% cultured S. aureus or streptococci
- 60-80% were on broad GN coverage
- 73-83% were on anaerobic coverage
- Duration of therapy was 13-14 days

Antimicrobial Safety in the ED

• 1 out of 5 ED visits for an adverse drug event is because of an antimicrobial
• Allergic reactions, drug interactions, side effects, and *C. difficile* infection are adverse effects associated with antimicrobials
Why Is The Emergency Department Important?

- Bridge between community and hospital (best and worst of both worlds)
- Overuse for common infections (URI)
- Overuse of broad agents (SSTI / UTI)
- Guidelines adherence starts in ED
Challenges Facing Stewardship in the Emergency Department

- High patient turnover
- High physician turnover
- Low levels of accountability
- Diagnostic uncertainty
- Concern for poor outcomes
- Patient satisfaction
- Auto-verification
Specific Interventions
Interventions In The Emergency Department

- Incorporate ED leadership and hospital administration into an existing antimicrobial stewardship program
- Education and guidelines
- Audit and feedback
- Rapid diagnostics
- Clinical decision support

Get Leadership Buy In

• Support from the top down is key
• Allocation of resources
• Incorporate into performance reviews
• Access for education and audit initiatives
• Engage thought leaders

Get Leadership Buy In

• Leaders are needed to change existing mindsets
  • “One dose of Zosyn won’t hurt!”
  • “Let the hospitalist decide on antibiotics”
  • “I’d rather give this prescription for antibiotics than have a bad Press-Ganey score”
Education

• Multidisciplinary education initiatives (i.e. grand rounds and nursing inservices)
• Do what is effective for your institution (academic vs community)
• Have goals in mind for educational objectives
• Education can’t be only intervention

Use of Emergency Department Specific Guidelines

• Allows ability to individualize treatments to facility based on local conditions
• Encourages and promotes uniform treatment regardless of provider
• Allows venue for provider feedback upfront and on back end

Clinical Decision Support

• The “Holy Grail” of computerized physician order entry and electronic medical record
• Ideal is incorporating “real time” data at time of prescribing to optimize antimicrobial use while not being cumbersome

Emergency Department Pharmacist

• Widely recognized as an important component of any comprehensive antimicrobial stewardship program
• Facilitates appropriate antibiotic selection and dose

Post-Prescription Review

• More of an inpatient strategy versus an ED strategy
• Requires routine follow-up
• Idea is shortening duration versus optimizing initial ordering

Rapid Diagnostic Tests

- Coordination between Stewardship, Pharmacy, Emergency Department, and Lab
- Results vary from POC to < 4 hours
- Tests exist for a variety of organisms (i.e. MSSA vs MRSA)

Disease Specific Pathways
Cystitis and Pyelonephritis

- Study Conducted at MetroHealth in Cleveland, OH
- Targeted guideline adherence to cystitis/pyelonephritis in ED
- Interventions included an electronic orderset, financial incentive and audit & feedback

# Protocol for Treatment and Management of Outpatient UTI from Emergency Department

## Uncomplicated UTI in Females (Non-Pregnant)
- **Bactrim DS 1 PO bid for 3 days**  
  Normal, Disp-6 Tab, R-0
- **Macrobid (Nitrofurantoin SR) 100mg PO bid for 5 days**  
  Normal, Disp-10 Cap, R-0
- **Cipro 500 mg PO bid for 3 days - Reserve for allergy to above agents**  
  Normal, Disp-6 Tab, R-0

## Pyelonephritis Eligible for Outpatient Treatment (Non-Pregnant)
- **Bactrim DS on tab bid for 14 days**  
  Normal, Disp-28 Tab, R-0
- **Ciprofloxacin (Cipro) 500 mg bid for 7 days**  
  Normal, Disp-14 Tab, R-0
- **Urine Culture - Add on Micro - Complete the Information in the Order**  
  *ADD-ON MICRO, Starting 6/19/13*

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Cystitis and Pyelonephritis

• After order set implemented audit and feedback was started
• Pharmacist and ID physician
• Feedback provided via EMR messaging regarding: diagnosis, culture order, drug, and duration

Cystitis and Pyelonephritis

Cystitis and Pyelonephritis

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Baseline N=200</th>
<th>Period 1 N=200</th>
<th>Period 2 N=200</th>
<th>Baseline-Period 1</th>
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</thead>
<tbody>
<tr>
<td>Mean duration of therapy for cystitis(^a) (days)</td>
<td>5.6</td>
<td>3.9</td>
<td>3.6</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Percentage of fluoroquinolone regimens for cystitis</td>
<td>44.4</td>
<td>14.5</td>
<td>12.9</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Unnecessary antibiotic days of therapy, total</td>
<td>250</td>
<td>119</td>
<td>52</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Treatment failure(^b)</td>
<td>22 (11.0)</td>
<td>14 (7.0)</td>
<td>17 (8.5)</td>
<td>.16</td>
</tr>
<tr>
<td>Primary adverse events(^c)</td>
<td>12 (6)</td>
<td>17 (8.5)</td>
<td>19 (9.5)</td>
<td>.66</td>
</tr>
<tr>
<td>Other adverse events(^d)</td>
<td>49 (24.5)</td>
<td>54 (27)</td>
<td>47 (23.5)</td>
<td>.54</td>
</tr>
</tbody>
</table>

Cystitis and Pyelonephritis

• Targeting a condition and applying resources will get results
• Use guidelines, order sets, and technology to your advantage
• Simple measures can go a long way!

Skin and Soft Tissue Infections

• Recent study looking at ED visits from 2007-2010
• 3.2% of all ED visits were for skin infections
• 22% of skin infections were associated with an incision and drainage procedure

Skin and Soft Tissue Infections

- 83% of visits had antibiotics prescribed
- 68% of antibiotic regimens included an antibiotic active against MRSA (56% of all visits)
- 28% of antibiotic regimens were sulfamethoxazole/trimethoprim monotherapy

Skin and Soft Tissue Infections

Four quality measures were described

1. Use of antibiotics for discharged abscess patients
2. Use of no MRSA active agents for abscess
3. Use of MRSA active agents for cellulitis
4. Use of TMP/SMX monotherapy for cellulitis

Antibiotics For Discharged Abscess Patients

- Efficiency measure assessing potential overuse
- Guidelines recommend that systemic antibiotics are rarely needed
- Exceptions: immunosuppressed, difficult to drain, large area and cellulitis
- Only 13% of eligible visits met criteria

CA-MRSA Active Agents For Abscess

- Effectiveness criteria assessing potential underuse
- 84% of abscess visits were prescribed an antibiotic active against CA-MRSA
- Though antibiotics are not typically recommended for abscesses, regimens should always cover CA-MRSA

CA-MRSA Active Agents For Cellulitis

• Efficiency criteria assessing potential overuse
• IDSA guidelines recommend only covering *streptococcus* for non-purulent cellulitis
• 63% of regimens for cellulitis contained an agent active against CA-MRSA

TMP/SMX Monotherapy For Cellulitis

- Effectiveness criteria assessing potential misuse
- Traditionally TMP/SMX isn’t considered active against *streptococcus*
- 23% of cellulitis visits (29% of antibiotic regimens)

Rapid Diagnostic Tests
Rapid Diagnostic Tests

• Diagnosing infections typically based on clinical suspicion and basic lab values
• ED physicians often operating and prescribing on limited data
• Limited use in ED but can provide rapid results soon after admission
GeneXpert MRSA/MSSA PCR

- PCR based, rapid test performed on wound swabs
- 3 Phase Study
  - Phase 1: Baseline data collection
  - Phase 2: Introduction of test and MD education
  - Phase 3: Active Pharmacist direction

Talan DA, Abstract Presented at IDSA Annual Meeting 2011
## GeneXpert MRSA/MSSA PCR

### Table 2. Inappropriate use* of antibiotics among hospitalized patients with a skin and soft tissue infection by study phase

<table>
<thead>
<tr>
<th></th>
<th>Phase I n/total (%)</th>
<th>Phase II n/total (%)</th>
<th>Phase III n/total (%)</th>
<th>p-value†</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All Patients</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRSA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-MRSA**</td>
<td></td>
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<td>n/total (%)</td>
<td></td>
</tr>
<tr>
<td>All Patients</td>
<td>31/53 (58)</td>
<td>31/50 (62)</td>
<td>28/62 (45)</td>
<td>0.16</td>
</tr>
<tr>
<td>MRSA</td>
<td>1/15 (7)</td>
<td>2/13 (15)</td>
<td>0/19 (0)</td>
<td>0.44</td>
</tr>
<tr>
<td>Non-MRSA**</td>
<td>30/38 (79)</td>
<td>29/37 (78)</td>
<td>28/43 (65)</td>
<td>0.17</td>
</tr>
</tbody>
</table>

*Treatment with vancomycin, linezolid, daptomycin and TMP/SMX were considered inappropriate for Non-MRSA
** Non-MRSA includes those with no growth and contaminants
† Chi-square and Fishers exact p-values comparing Phase I and Phase III patients
Figure 2. Days of inappropriate antibiotics* among non-MRSA patients by study phase

Median Days

IQR

Phase I 1.5
Phase II 1.6
Phase III 0.7

p=0.04 **
Ongoing Study

• “Antimicrobial Stewardship Through MRSA Diagnosis in Emergency Department (ED) Patients With Abscesses”
• NCT01523899, 030927
• Prospective, randomized trial
• Results expected later in 2014
MALDI – TOF

- Matrix Assisted Laser Desorption/Ionization Time of Flight
- Organisms identified directly from samples
- Sample is converted to charged particles
- Each organism has a unique molecular signature

MALDI – TOF in Practice

• MALDI – TOF implemented for gram negative isolates from blood cultures
• ID pharmacist contacted 24/7 who then made subsequent appropriate recommendation

MALDI – TOF in Practice

- Decreased LoS (11.9 vs 9.3 days; p=0.01)
- Decreased ICU LoS (7.3 vs 6.3 days; p=0.05)
- Decreased hospital costs ($45,709 ± $61,806 vs $26,162 ± $28,996; p=0.009)

Benefits of Rapid Diagnostic Tests

• Improved diagnostic and management capabilities
• Simple tests to perform
• Equal or better performance compared to cultures
• Direct specimen testing
Limitations of Rapid Diagnostic Tests

• False positives and false negatives
• Clinician buy-in and interpretation
• Turn-around-time
• Training of personnel
• Cost
• Limited susceptibility information
• Need for manual tests (24 hour services)
Procalcitonin
Procalcitonin

• Precursor of calcitonin
• Biomarker that is indicative of systemic infection
• Rapid turn around time
• Has been studied extensively as a prognostic and diagnostic indicator for numerous disease states
Procalcitonin in COPD Exacerbations

- 208 hospitalized patients randomized to PCT guided therapy or standard of care
- 40% rate of antibiotic use in PCT group vs 72% in the standard of care group
- No difference in length of stay, exacerbation rate, time to next hospitalization, and time to next exacerbation

Procalcitonin in Acute Respiratory Tract Infections

- Performed in primary care offices
- Patients were felt to need antibiotics before enrollment
- Randomized to standard care or PCT algorithm
- 85% adherence to PCT algorithm
- Antibiotics prescribed for 25% of PCT group and 97% of standard of care group

Procalcitonin in Lower Respiratory Infections

- RCT of patients with LRTIs
- PCT algorithm vs evidence based guidelines
- 1359 patients enrolled at 6 EDs
- 68% CAP, 17% COPD, 11% bronchitis, 4% other
- 92.5% hospitalized; median LoS was 8 days

Procalcitonin in Lower Respiratory Infections

- Primary endpoint and mortality were similar between the two groups at 30 days
- Antibiotic exposure less in PCT group (5.7 days vs 8.7 days)
- 75.4% of patients prescribed antibiotics in PCT group vs 87.7% in standard of care
- IV antibiotic duration decreased from 3.8 to 3.2 days and oral antibiotic duration decreased from 4.9 to 2.5 days

Procalcitonin in Sepsis

- Meta-analysis of 7 trials totaling 1075 patients
- No difference in hospital mortality and 28-day mortality between PCT groups and controls
- LoS in hospital and in ICU did not differ between groups
- Statistically significant reduction in antibiotic duration in PCT group compared to control (6 days vs 8 days)

Pharmacy Technicians
Role of Pharmacy Technicians

- Medication histories
  - Tracking down outpatient antibiotic therapies
  - Contacting pharmacies, doctor’s offices, and nursing homes for complete histories
- Vaccination history
Role of Pharmacy Technicians

• Allergy history
  • Clarifying that “PCN-rash” allergy!
  • Looking through history for previous received antibiotics
Role of Pharmacy Technicians

- Other potential roles
  - Data collection
  - Safety and quality reporting
  - DUE/MUE (daily, monthly, quarterly, or annual)
  - Medication preparation
  - Med safety roles
  - Facilitating medication assistance program enrollment
Questions
Why is antimicrobial stewardship important?

A. Reducing hospital costs
B. Improving outcomes
C. Reducing antimicrobial resistance
D. All of the above
Which of the following are important for antimicrobial stewardship in the ED?

A. Administrative Buy-in
B. Pharmacy and laboratory involvement
C. Change in prescriber culture
D. Optimal utilization of IT resources
E. All of the Above
Which of the following is not a potential limitation of rapid diagnostic tests?

A. Often requires positive culture
B. Equal or better performance compared to cultures
C. Limited or no susceptibility information
D. Cost
Which of the following are ways pharmacists contribute to antimicrobial stewardship?

A. Correct drug selection
B. Optimizing antibiotic dosing
C. Following up on diagnostic studies
D. De-escalating on admission
E. All of the above
Which of the following are ways pharmacy technicians can be involved in an antimicrobial stewardship program?

A. Collecting allergy histories
B. Collecting vaccine histories
C. Running antibiotic usage reports
D. All of the above
Conclusions
Conclusions

• Antimicrobial stewardship is critically important from economic, humanistic, and clinical perspectives
• The emergency department is an underserved area for antimicrobial stewardship
Conclusions

• Establishing antimicrobial stewardship practices in the emergency department can be difficult for numerous reasons

• Utilizing all available resources from technology, microbiology, laboratory, pharmacy residents, students, and technicians is important to maximize results
Thank You.