Antimicrobial Stewardship
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Objectives

• Recognize the urgent need for antimicrobial stewardship
• List the benefits of having an antimicrobial stewardship program
• Provide examples of effective Antimicrobial Stewardship in a Community Hospital
Why Stewardship?

• Inappropriate antimicrobial use
  – Adverse drug events
  – *Clostridium difficile*
  – Antimicrobial resistance
  – Mortality
  – Cost

• Limited antimicrobials in development

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Optimize Patient Safety and Outcomes

Limit inappropriate and Excessive Antibiotic Use

Reduce Drug Resistance

Ensure Cost Effectiveness

In recognition of the urgent need to improve antibiotic use in hospitals and the benefits of antibiotic stewardship programs, in 2014 CDC recommended that all acute care hospitals implement Antibiotic Stewardship Programs.
Not Just an Inpatient Issue…

Community Antibiotic Prescriptions per 1,000 Population by State — 2014

At least 30% of antibiotics prescribed in doctors’ offices, emergency departments and hospital clinics are unnecessary.*

Data source: IMS Health Xponent 2014.

Southwest General

Get Better Here.
Southwest General

• Business plan for Antimicrobial Stewardship Pharmacist drafted July 2014
  – Implemented January 2015

• Key members
  – ID Physician (0.25 FTE)
  – ID Pharmacist (1 FTE)
  – Infection Prevention Nurse
  – Microbiology
  – Quality
Daily Stewardship

• Daily Chart Review
  – House wide review
  – Allergies
  – Antimicrobial indication
  – Appropriate drug, dose, and duration
  – Culture review for de-escalation or drug bug mismatch
  – Discontinuation

• Pharmacy Services
  – Emergency Department culture/sensitivity review
  – IV to PO
  – Renal adjustments
  – Dosing and monitoring
    • Vancomycin
    • Pip/tazo
    • Aminoglycosides
  – Penicillin allergy testing
Stewardship Tracking

• Daily
  – De-escalation
  – Discontinuation
  – Dose Optimization
  – Formulary Substitution
  – Renal Adjustment
  – Culture/ Sensitivity Review
  – New Drug
  – Information Provided
  – IV to PO
  – Level Ordered
  – Contraindication
  – Discharge Intervention

• Monthly
  – Percentage of accepted recommendations
  – Total interventions

• Quarterly
  – Days of Therapy (DOT)
  – Acquisition cost
  – Highest cost antimicrobials

• Yearly
  – Acquisition cost
  – Drug resistance
  – Antibiogram
Stewardship Focus

- Sepsis core measures
- Asymptomatic bacteriuria
- Allergy reporting
- Transitions of care
Sepsis

• Pharmacist carries sepsis pager 7a-11p
  – Alerted if lactate >2.0
• Sepsis bundle “cheat sheets” at all workstations
• Pharmacist worklist
• Achieving compliance
  – Emergency department education
    • Role of ED Pharmacist
  – Automatic lactate rule
### SEVERE SEPSIS Core Measure Definition (A + B + C)\(^1,2\)

<table>
<thead>
<tr>
<th>A. Source of Infection</th>
<th>B. Any two (2) SIRS criteria</th>
<th>C. ANY one (1) Organ dysfunction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp &gt; 38.3 or &lt; 36</td>
<td>Acute Respiratory Failure: new requirement for invasive or noninvasive mechanical ventilation</td>
<td></td>
</tr>
<tr>
<td>HR &gt; 95</td>
<td>SBP &lt; 90 or MAP &lt; 65 or SBP drop by &gt;40 points from normal</td>
<td></td>
</tr>
<tr>
<td>RR &gt; 22</td>
<td>Creatinine &gt; 2 or UO &lt; 0.5 kg/hr x 2 hrs</td>
<td></td>
</tr>
<tr>
<td>WBC &gt; 12 or &lt; 4 or 10% bands</td>
<td>Bilirubin &gt; 2</td>
<td></td>
</tr>
<tr>
<td>Documentation of infection or possible infection by provider with date/time</td>
<td>Platelet count &lt; 100,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>INR &gt; 1.5 or PTT &gt; 60</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lactate &gt; 2</td>
<td></td>
</tr>
</tbody>
</table>

### 3 HOUR BUNDLE
1. Measure lactate level
2. Obtain blood cultures prior to administration of antibiotics
3. Administer broad spectrum antibiotics
4. Administer crystalloid fluids at 30 ml/kg

### SEPTIC SHOCK Core Measure Definition (A or B)\(^1,2\)

<table>
<thead>
<tr>
<th>A.</th>
<th>B.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lactate level &gt; 4 (automatically treat as shock)</td>
<td>Identification of severe sepsis (as above) <strong>AND</strong> Tissue hypoperfusion within the 1st hour after fluids infused: readings meeting BP criteria defined under C above</td>
</tr>
</tbody>
</table>

### 6 HOUR BUNDLE
1. Repeat initial lactate if level > 2
2. Vasopressor initiated if unresponsive to fluids
3. Focused exam documented by provider after fluids started
   a. Vitals
   b. Cardiopulmonary evaluation
   c. Capillary refill examination
   d. Peripheral pulse evaluation
   e. Skin examination
**Antibiotic Therapy**

### SEVERE SEPSIS ANTIBIOTIC THERAPY

Within 3 hours of diagnosis of Severe Sepsis, **MUST HAVE 1 MONOTHERAPY OR 2 COMBINATION THERAPY (1 from Column A + 1 from Column B)**

<table>
<thead>
<tr>
<th>MONOTHERAPY</th>
<th>COMBINATION THERAPY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin/clavulanate</td>
<td>Amikacin</td>
</tr>
<tr>
<td>Ampicillin/subactam</td>
<td>Gentamicin</td>
</tr>
<tr>
<td>Piperacillin/tazobactam</td>
<td>Tobramycin</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>Aztreonam</td>
</tr>
<tr>
<td>Cefepime</td>
<td>Ciprofloxacin</td>
</tr>
<tr>
<td>Meropenem** Consulting**</td>
<td>Cefazolin</td>
</tr>
<tr>
<td>Levofloxacin</td>
<td>Clindamycin IV</td>
</tr>
<tr>
<td></td>
<td>Vancomycin IV</td>
</tr>
<tr>
<td></td>
<td>Linezolid** Consulting**</td>
</tr>
<tr>
<td></td>
<td>Daptomycin** Consulting**</td>
</tr>
<tr>
<td></td>
<td>Azithromycin</td>
</tr>
<tr>
<td></td>
<td>Penicillins (Ampicillin, Nafcillin, Oxacillin, PCN G)</td>
</tr>
</tbody>
</table>

*For antibiotics specific to source of infection, refer to Sepsis Order Set*

### GUIDED ANTIBIOTIC THERAPY

**INFECTION**

- **Abdominal**
  - **NKDA**
    - Zosyn 3.375 g IV Q6H
  - **PCN Allergy**
    - Ceftriaxone 1 g IV Q24H + Metronidazole 500 mg IV Q8H

- **Pyelonephritis**
  - **NKDA**
    - Zosyn 3.375 g IV Q6H
  - **PCN Allergy**
    - Cefepime 1 g IV Q8H

- **Localized SSTI**
  - **NKDA**
    - Unasyn 3g IV Q6H +/- Vancomycin 15 mg/kg IV Q12
  - **PCN Allergy**
    - Ceftriaxone 1 g IV Q24H +/- Vancomycin 15 mg/kg IV Q12

- **Necrotizing SSTI**
  - **NKDA**
    - Zosyn 3.375 g IV Q6H + Vancomycin 15 mg/kg IV Q12 + Clindamycin 900 mg IV Q8H
  - **PCN Allergy**
    - Meropenem 1 g IV Q8 + Vancomycin 15 mg/kg IV Q12 + Clindamycin 900 mg IV Q8H

- **Neutropenic**
  - **NKDA**
    - Cefepime 1 g IV Q8H + Vancomycin 15 mg/kg IV Q12
  - **PCN Allergy**
    - Levofloxacin 750 mg IV Q24 +/- Vancomycin 15 mg/kg IV Q12

- **Respiratory/CAP**
  - **NKDA**
    - Ceftriaxone 1 g IV Q24H + Azithromycin 500 mg IV Q24 +/- Vancomycin 15 mg/kg IV Q12
  - **PCN Allergy**
    - Levofloxacin 750 mg IV Q24 +/- Vancomycin 15 mg/kg IV Q12

- **Respiratory/HCAP/HAP**
  - **NKDA**
    - Zosyn 3.375 g IV Q6H + Levofloxacin 750 mg IV Q24 +/- Vancomycin 15 mg/kg IV Q12
  - **PCN Allergy**
    - Cefepime 1 g Q8H + Levofloxacin 750 mg IV Q24 +/- Vancomycin 15 mg/kg IV Q12

- **Unknown Source**
  - **NKDA**
    - Vancomycin 15 mg/kg IV Q12 + Zosyn 3.375 g IV Q6H

*SEE SPECIFIC ORDERSETS FOR GUIDED THERAPY  **SKIN AND SOFT TISSUE INFECTION*
## Asymptomatic Bacteriuria

<table>
<thead>
<tr>
<th>Population</th>
<th>Prevalence, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy, premenopausal women</td>
<td>1-5%</td>
</tr>
<tr>
<td>Pregnant women</td>
<td>1.9-9.5%</td>
</tr>
<tr>
<td>Postmenopausal women aged 50-70</td>
<td>2.8-8.6%</td>
</tr>
<tr>
<td>Diabetic patients (Women, Men)</td>
<td>9-27%, 0.7-11%</td>
</tr>
<tr>
<td>Elderly person in the community (≥70 years) (Women, Men)</td>
<td>10.8-16%, 3.6-19%</td>
</tr>
<tr>
<td>Elderly person in long term care facility (≥70 years) (Women, Men)</td>
<td>25-50%, 15-40%</td>
</tr>
<tr>
<td>Patient with spinal cord injuries</td>
<td></td>
</tr>
<tr>
<td>Intermittent catheter use</td>
<td>23-89%</td>
</tr>
<tr>
<td>Sphincterotomy and condom catheter in place</td>
<td>57%</td>
</tr>
<tr>
<td>Hemodialysis</td>
<td>28%</td>
</tr>
<tr>
<td>Indwelling catheter use</td>
<td></td>
</tr>
<tr>
<td>Short term</td>
<td>9-23%</td>
</tr>
<tr>
<td>Long term</td>
<td>100%</td>
</tr>
</tbody>
</table>

Clin Infect Dis (2005) 40, 643-54
Asymptomatic Bacteriuria, cont’d

• Identify the problem
  – Data collection

• Develop a solution
  – Education
  – Algorithm to assist clinical decision making
  – Ordering urine cultures

• Pushback
  – Change in mental status
  – Family pressure
Allergy Testing

• Program developed June 2016 after PGY-1 resident identified area of need
• ID consult needed to allow for appropriate chart review
  – 59% of patients missing reaction
  – Student utilization
• Pushback
  – Time commitment
  – Pharmacists cannot administer testing
Transitions of Care

• Program developed by PGY-2 Ambulatory Care resident
• Daily communication with ECF
• Identify potential discharges with antimicrobial therapy
  – Duration of antibiotics
  – Stop date
  – IV to PO opportunities
  – Laboratory Monitoring
  – De-escalation opportunities
<table>
<thead>
<tr>
<th>Element of Performance</th>
<th>Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>EP 2: Physician Education</td>
<td>• Quality dashboard available on intranet</td>
</tr>
<tr>
<td></td>
<td>• Yearly presentation to all departments</td>
</tr>
<tr>
<td></td>
<td>• Antibiogram distribution annually at Medical Staff</td>
</tr>
<tr>
<td></td>
<td>• Computer based learning on program highlights</td>
</tr>
<tr>
<td>EP 3: Patient Education</td>
<td>• Admission binder with educational materials from CDC for all patients</td>
</tr>
<tr>
<td></td>
<td>• Educational material on discharge for patients treated with antimicrobials</td>
</tr>
<tr>
<td>EP 5: CDC Core Elements</td>
<td>• Action: indication is specified in chart, 48 hour phone calls to assess therapy, antibiotics time out at 5 days</td>
</tr>
</tbody>
</table>
Program Outcomes

Antimicrobial Cost per Year

<table>
<thead>
<tr>
<th>Year</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>785035.24</td>
</tr>
<tr>
<td>2013</td>
<td>705817.74</td>
</tr>
<tr>
<td>2014</td>
<td>625363.65</td>
</tr>
<tr>
<td>2015</td>
<td>459611.22</td>
</tr>
<tr>
<td>2016</td>
<td>396688.61</td>
</tr>
</tbody>
</table>

Total Acquisition Cost
Program Outcomes - Costs

Cost per Patient per Day Adjusted for 1000 Patient Days

---|---|---|---|---|---|---|---|---|---|---|---
$8.65 | $6.54 | $7.30 | $7.97 | $8.37 | $5.19 | $5.36 | $5.84 | $6.03 | $4.86 | $5.36 | $4.66
Program Outcomes, C-Diff

C-Difficile (Hospital Acquired)

2015: N=42
2016: N=23

C-Difficile (Community Acquired)

2015: N=82
2016: N=37
# Program Outcomes-Antibiotics

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>DOT per 1000 pt days before ASP (2014)</th>
<th>DOT per 1000 pt days after ASP (2016)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meropenem</td>
<td>19.2</td>
<td>11.3</td>
</tr>
<tr>
<td>Ertapenem</td>
<td>3.8</td>
<td>3.3</td>
</tr>
<tr>
<td>Daptomycin</td>
<td>1.9</td>
<td>1.1</td>
</tr>
<tr>
<td>Linezolid</td>
<td>6.0</td>
<td>3.7</td>
</tr>
<tr>
<td>Tigecycline</td>
<td>0.6</td>
<td>0.3</td>
</tr>
<tr>
<td>Micafungin</td>
<td>1.0</td>
<td>1.5</td>
</tr>
<tr>
<td>Ceftaroline</td>
<td>5.5</td>
<td>0</td>
</tr>
<tr>
<td>Aztreonam</td>
<td>3.0</td>
<td>0.4</td>
</tr>
<tr>
<td>Pip/tazo</td>
<td>71.3</td>
<td>78.6</td>
</tr>
<tr>
<td>Vancomycin IV</td>
<td>99.4</td>
<td>100.4</td>
</tr>
</tbody>
</table>
Effective Practices

- Antimicrobial Stewardship Guide
- Daily face-to-face interaction
- Education
- Automatic stop orders
- Strict 24 hour restricted antibiotic policy
- Allergy clarification
- Utilize students
- Program growth
Lessons Learned

- ASP members have multiple roles in a community hospital
- Continuous surveillance lacking
- No formal mechanism of data collection or clinical support technology
- Contacting private practice practitioners
- Practitioners may be hesitant to adopt new practices
Key Concepts

• Pharmacist driven stewardship efforts can be effective and successful
• Education to practitioners is vital for program success
• Stay visible on floors
• Utilize stewardship team and resources
• Be persistent but don’t jeopardize physician autonomy
Next Steps

- Continued education to staff
- Identified areas for improvement
  - Antimicrobial use in respiratory infections
  - Antimicrobial use in abdominal infections
  - Discharge prescriptions
  - NHSN reporting
  - Reduction of PPIs
Southwest General Stewardship Team

- David Blossom, MD
- Rebecca Margevicius, PharmD, BCPS
- Karen Shrimpton, BS MT(ACSP)
- Colleen Gazzillo, RN
- Sue Markland, RN
- Sandra Chisar, MD
Contact Information

February 14, 2017

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References


