Turning the Tide: How to Improve Antibiotic Use and Stop a Killer
Melinda C. Joyce, Pharm.D., FAPhA, FACHE
Commonwealth Health Corporation
Bowling Green, Kentucky
mbjoyce@chc.net

Timothy P. Gauthier, Pharm.D., BCPS-AQ ID
Miami Veteran Affairs Healthcare System
TimothyPGauthier@gmail.com
Social media: @IDstewardship

Disclosures
• Dr. Joyce and Dr. Gauthier “declares no conflicts of interest, real or apparent, and no financial interests in any company, product, or service mentioned in this program, including grants, employment, gifts, stock holdings, and honoraria.”

The American Pharmacists Association is accredited by the Accreditation Council for Pharmacy Education as a provider of continuing pharmacy education.

• Target Audience: Pharmacists
• ACPE#: 0202-0000-16-057-L01-P
• Activity Type: Knowledge-based

Learning Objectives
1. Describe current patterns of antibiotic resistance in the United States, including pathogens identified by the Centers for Disease Control and Prevention as urgent or serious threats.

2. Describe incentives for implementing prescribing practices that reduce rates of antibiotic resistance.

3. Explain strategies that can be used by pharmacists in health systems and other settings to support appropriate antibiotic use and reduce the development of antibiotic resistance.

4. Given a clinical scenario, identify strategies which may be employed to achieve the primary goals of antimicrobial stewardship.
1. The Centers for Disease Control (CDC) has identified all of the following resistant organisms as urgent threats except
   A. *Clostridium difficile*
   B. Carbapenem-Resistant Enterobacteriaceae (CRE)
   C. *Neisseria gonorrhoeae*
   D. Methicillin-Resistant *Staphylococcus aureus*

2. Which of the following is true regarding the goals of the National Action Plan for Combatting Antibiotic Resistant Bacteria?
   A. Eradicate the emergence of resistant bacteria
   B. Curtail the development of rapid diagnostic tests for identification of resistant bacteria
   C. By 2020, decrease *Clostridium difficile* infections by 50% as compared to 2011 estimates
   D. Require all providers to obtain at least 2 hours of continuing education on prudent antimicrobial prescribing each year

3. Why are antimicrobial drugs considered to be “societal” in nature?
   A. They are used by most people in society
   B. Use in one person can impact their utility in others
   C. They are expensive
   D. They can be toxic

4. Which of the following two drug classes are highly associated with “collateral damage”?
   A. Penicillins and tetracyclines
   B. Fluoroquinolones and cephalosporins
   C. Lincosamides and oxazolidinones
   D. Glycopeptides and carbapenems

5. Utilization of an extended-infusion to enhance antibacterial killing is an example of which antimicrobial stewardship activity?
   A. Dose optimization
   B. Education
   C. Prospective audit with intervention and feedback
   D. Formulary restriction

**OBJECTIVE #1**

Describe current patterns of antibiotic resistance in the United States, including pathogens identified by the Centers for Disease Control and Prevention as urgent or serious threats.
Antimicrobial Resistance

- Since the discovery of penicillin in 1928, antibiotics have been a critical component for the treatment of infections.
- The emergence of drug resistant bacteria is quickly reversing the miracles that have been seen from antibiotics.
- In fact, when Alexander Fleming made his acceptance speech for the Nobel Prize, he warned of bacteria becoming resistant to penicillin.
- Some experts are predicting that “superbugs”, those multi-drug resistant microorganisms could kill more people than cancer by 2050 if more aggressive steps are not taken now to mitigate the growth of antibiotic-resistant bacteria.
- Since the 1990s, new antibiotic development has fallen sharply while bacterial resistance continues to increase.

Antibiotic Use Leads to Antibiotic Resistance

Person to person spread

Prescribing

Agriculture

CDC Hot List for Resistant Organisms

- Urgent Threats
  - Clostridium difficile
  - Carbapenem-Resistant Enterobacteriaceae (CRE)
  - Neisseria gonorrhoeae

CDC Hot List for Resistant Organisms

- Serious Threats
  - Multidrug-Resistant Acinetobacter
  - Drug-Resistant Campylobacter
  - Fluconazole-Resistant Candida
  - Extended Spectrum Enterobacteriaceae (ESBL)
  - Vancomycin-Resistant Enterococcus (VRE)
  - Multidrug-Resistant Pseudomonas aeruginosa
  - Drug-Resistant Non-Typhoidal Salmonella
  - Drug-Resistant Salmonella Serotype Typhi
  - Drug-Resistant Shigella
  - Methicillin-Resistant Staphylococcus aureus (MRSA)
  - Drug-Resistant Streptococcus pneumoniae
  - Drug-Resistant Tuberculosis

What is a “Superbug”

- A “Superbug” is an organism that shows significant antibiotic resistance, usually to two or more classes of antibiotics.

Kirby Bauer Disc Plates: a clear area around the disc represents “zone of inhibition” or sensitive to that antibiotic.
Resistant Organisms

- Carbapenem-resistant Enterobacteriaceae (CRE) can cause deadly infections and have become resistant to all or nearly all antibiotics that are currently available.
  - CRE can easily spread between hospitals and long-term care facilities when appropriate actions are not taken.
- *Clostridium difficile* (C diff) is commonly found in hospitals and long-term care facilities and can be spread from contaminated surfaces or healthcare provider’s hands.
  - Although careful attention to cleaning and isolation precautions is necessary, the most common reason for C diff infections is the overuse of antibiotics.
- Strains of both Pseudomonas and Acinetobacter that are resistant to most antibiotics have been found in most hospitals and long-term care facilities.

Inappropriate Antimicrobial Use

| Diagnostic Uncertainty and Fear | Knowledge Gaps | Indiscriminate Lab Testing | Inadequate Documentation and Transitions of Care |

Poor Antibiotic Prescribing

- Poor antibiotic prescribing puts patients at risk.
- About half of patients receive an antibiotic for at least one day during the course of an average hospital stay.
- The most common types of infections for which hospital clinicians wrote antibiotic prescriptions were lung infections (26%), urinary tract infections (14%), and suspected infections by MRSA (17%).
  - About 1 out of 3 times, prescribing practices to treat urinary tract infections do not have proper testing or evaluation and the antibiotics are given for too long.
- Over half of antibiotic prescribing in outpatient settings is unnecessary and most of the inappropriate use is for acute respiratory infections, such as pharyngitis, sinusitis or bronchitis.

CDC Vital Signs

- Includes several important topics including healthcare-associated infections.
- Issues include graphic fact sheet and website, a media release, and social media tools.
- Can sign up to receive the issues at no cost.

Vital Signs: Healthcare-Associated Infections

Six separate articles related to antibiotic usage:

1. Stop Spread of Antibiotic Resistance
2. Making Healthcare Safer – Antibiotic Rx in Hospitals: Proceed with Caution
3. Making Healthcare Safer – Antibiotic Rx in Hospitals: Proceed with Caution
4. Making Healthcare Safer – Stop Infections from Lethal CRE Germs Now
5. Making Healthcare Safer – Stopping C. difficile Infections

OBJECTIVE #2

Describe incentives for implementing prescribing practices that reduce rates of antibiotic resistance.
Antibiotic Prescribing Impact

- In addition to the concern for the health of the public, various quality metrics that affect reimbursement for the health-system involve infections and antibiotic usage
  - Safety Domain of Value-Based Purchasing (VBP): Healthcare-Associated Infections as well as Hospital-Acquired Conditions (HACs)
  - CLABSI: Central line-associated bloodstream infections among adult, pediatric, and neonatal ICU patients
  - CAUTI: Catheter-associated urinary tract infections among adult and pediatric ICU patients
  - SSI: Surgical site infections specific to abdominal hysterectomy and colon surgeries
  - Clostridium difficile infections
  - MRSA bacteremias

VBP for FY 2017

- Clinical Care – 30%
  - Clinical Process – 5%
    - Influenza Immunization (IMM-2)
    - Early Elective Delivery (PC-01)
  - Outcomes – 20%
    - 30 Day Mortality – AMI
    - 30 Day Mortality – HF
    - 30 Day Mortality – PN
- Patient and Caregiver Experience – 25%
  - HCAHPS including Care Coordination Questions
- Efficiency and Cost Reduction -25%
  - Medicare Spending per Beneficiary

VBP for FY 2018

- Clinical Care – 25%
  - Outcomes
    - 30 Day Mortality – AMI
    - 30 Day Mortality – HF
    - 30 Day Mortality – PN
  - Patient and Caregiver Experience – 25%
    - HCAHPS including Care Coordination Questions
- Safety – 25%
  - Early elective delivery (PC-01)
  - CLABSI
  - CAUTI
  - SSI
  - AHRQ PSI-90
  - MRSA Bacteremia
  - C. Diff
- Efficiency and Cost Reduction -25%
  - Medicare Spending per Beneficiary

Safety – Infection Rates

<table>
<thead>
<tr>
<th>Infection</th>
<th>National Rate</th>
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<tr>
<td>Central-line associated bloodstream infections (CLABSIs) - ICU</td>
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<tr>
<td>Catheter-associated urinary tract infections (CAUTIs) - ICU</td>
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<td>Surgical site infections from colon surgery (SSI: Colon)</td>
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<tr>
<td>MRSA bloodstream infections (laboratory identified)</td>
<td>0.883</td>
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<tr>
<td>Clostridium difficile infections (laboratory identified)</td>
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The rate is the Standardized Infection Rate, which compares the expected to the actual data submitted to NHSN between April 1, 2014 – March 30, 2015.

Healthcare-AssOCIated Infections as Part of the Safety Domain

- Some of these measures are also included as part of hospital-acquired conditions (HACs)
- Scoring is based against national benchmarks – Standardized Infection Rate (SIR)
  - Numerator: Number of observed infections
  - Denominator: Number of predicted infections
  - Equals a standardized infection ratio (SIR)
- Central-line associated bloodstream infections (CLABSI) and catheter-associated urinary tract infections (CAUTIs)
- Surgical site infections
  - Post-op infections within 30 to 90 days of the surgery
  - Dependent on the type of surgery

Hospital-Acquired Condition (HAC) Reduction Program

- HAC Reduction program reduces total Medicare payments by 1% for worst performing quartile of hospitals
  - Began in FY 2015
  - All or none reduction
- Two domains
  - Agency for Healthcare Research and Quality (ARHQ) measures
  - Centers for Disease Control (CDC) and Prevention National Healthcare Safety Network (NHSN) measures
- It is possible to have multiple penalties for the same measure as some of these infections are also part of VBP Safety domain
### Overlapping HAC and VBP Measures

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<th>Not Eligible for Higher Payment</th>
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Core Actions to Combat Resistance

4. Developing New Drugs and Diagnostic Tests

Because antibiotic resistance occurs as part of a natural process in which bacteria evolve, it can be slowed but not stopped. Therefore, we will always need new antibiotics to keep up with resistant bacteria as well as new diagnostic tests to track the development of resistance.

www.cdc.gov

National Action Plan for Combatting Antibiotic Resistant Bacteria

- In March, 2015, the White House issued the first-ever plan aimed at slowing antibiotic resistance over the next five years through major investments and policy changes at a range of federal health agencies.
- Goals:
  - Slow the emergence of resistant bacteria and prevent the spread of resistant infections
  - Strengthen national One-Health surveillance efforts to combat resistance
  - Advance development and use of rapid and innovative diagnostic tests for identification and characterization of resistant bacteria
  - Accelerate basic and applied research and development for new antibiotics, other therapeutics, and vaccines
  - Improve international collaboration and capacities for antibiotic-resistance prevention, surveillance, control, and antibiotic research and development

https://www.whitehouse.gov/sites/default/files/docs/national_action_plan_for_combating_antibiotic-resistant_bacteria.pdf

National Action Plan

- The thought is that by 2020, implementation of the National Action Plan will lead to major reductions in the incidence of urgent and serious threats, including:
  - Carbapenem-resistant Enterobacteriaceae (CRE)
  - 60% reduction of CRE infections acquired during hospitalizations compared to 2011 estimates
  - Methicillin-resistant Staphylococcus aureus (MRSA)
  - 50% overall reduction in MRSA bloodstream infections as compared to 2011
  - Clostridium difficile (C diff)
  - 50% reduction compared to 2011 estimates
  - Ceftriaxone-resistant Neisseria gonorrhoeae
  - Maintain the prevalence of this resistant organism below 2% compared to 2013 estimates

https://www.whitehouse.gov/sites/default/files/docs/national_action_plan_for_combating_antibiotic-resistant_bacteria.pdf

The Joint Commission (TJC)

- Proposed Medication Management Standards for ambulatory centers, critical access hospitals, hospital, nursing care centers (long-term care), and behavioral health facilities
  - Comments were taken through the end of 2015
  - Although housed within the Medication Management standards, there are ties back to the Leadership and the Infection Prevention chapters

www.jointcommission.org

The Joint Commission (TJC)

- MM.09.01.01: The organization has an antimicrobial stewardship program based on evidence-based national guidelines
  - EP.1 – Leaders establish antimicrobial stewardship as an organizational priority
  - EP.2 – Educate staff and licensed independent practitioners involved in antimicrobial ordering, dispensing, administration, and monitoring about antimicrobial resistance and antimicrobial stewardship practices. Education occurs upon hire and annually thereafter.
  - EP.3 – Educate patients and their families as needed, regarding the appropriate use of antimicrobial medications, including antibiotics.

www.jointcommission.org

The Joint Commission (TJC)

- EP. 4 – The organization has an antimicrobial stewardship multidisciplinary team that includes the following members, when available in the setting:
  - Pharmacist(s)
  - Infection disease physician
  - Infection preventionist(s)
The Joint Commission (TJC)

EP.5 – The hospital’s antimicrobial stewardship program includes the following core elements:
- Leadership commitment
- Accountability
- Drug expertise
- Action
- Tracking
- Reporting
- Education

EP.6 – The hospital’s antimicrobial stewardship program uses organization-approved multidisciplinary protocols

EP.7 – The hospital collects and analyzes data on its antimicrobial stewardship program, including antimicrobial prescribing and resistance patterns

EP.8 – The hospital takes action on improvement opportunities identified in its antimicrobial stewardship program

CMS’ Hospital Infection Worksheet

Not the complete worksheet

What is Antimicrobial Stewardship?

Antimicrobial stewardship (AS) is a multidisciplinary approach for rational antibiotic therapy
- Must be based on evidence-based guidelines
- Must be based on data
- Must apply to all practitioners
- Coordinated interventions designed to improve and measure the appropriate use of antimicrobial agents by promoting the selection of the optimal antimicrobial drug regimen including dosing, duration of therapy, and route of administration.

What is Antimicrobial Stewardship?

There are five main principles of AS
1. Preventing infections
2. Prevent the spread of resistance
3. Tracking and surveillance
4. Improve antibiotic prescribing through stewardship
5. Development of new antibiotics and new diagnostic tests for resistance bacteria
Core Elements of AS

- Leadership
  - Dedicate necessary human, financial, and information technology (IT) resource
- Accountability
  - A single leader needs to be appointed to be responsible for program outcomes. This is often a physician, although that is not a requirement.
- Drug Expertise
  - A single pharmacist leader needs to be appointed to support improved prescribing
- Active Oversight
  - Continually review intervention actions

Core Elements of AS

- Tracking
  - Monitor prescribing and antibiotic resistance patterns
- Reporting
  - Regularly report to staff prescribing and resistance patterns along with steps for improvement
- Ongoing Education
  - Education about antibiotic resistance and improving prescribing practices

Most Common Antimicrobial Stewardship Interventions

- Process to review new antibiotic before adding to the formulary
- Creation of antibiotic treatment guidelines
- Protocol for dose adjustment based on organ dysfunction
- Regular pharmacy and/or infection prevention review of “drug/bug” mismatches
- Protocol for switching form IV to oral drug therapy
- Restriction or prior authorization of certain antibiotics
- Prospective audit and feedback
- Provider education, both by groups or departments and to individuals

Other Interventions

- Selective reporting of susceptibility profiles for positive cultures
- Sophisticated information technology systems for improving antibiotic prescriptions through clinical decision support systems
- Point-of-care diagnostic testing for a faster result of non-bacterial etiologies
- Patient education

Barriers to Antimicrobial Stewardship

- Lack of staff resources to identify or implement stewardship interventions
  - Pharmacist resources
  - Physician resources
  - Administrative support
- Resistance from front-line physicians
- Difficulty in obtaining data to determine opportunities or impact
  - Real-time data
- No good mechanisms for feedback and communication
A Little About Me

- PYG2 trained in infectious diseases & antimicrobial stewardship
- Experience in academia & hospital pharmacy
- Currently with Miami VA Healthcare System
- Enthusiastic about pharmacy education and social media

Find me on social media: @IDstewardship

My motivation...

OBJECTIVE #3

Explain strategies that can be used by pharmacists in health systems and other settings to support appropriate antibiotic use and reduce the development of antibiotic resistance

How to fight antimicrobial resistance

1. Prevent infections and prevent the spread of resistance
2. Track resistant bacteria
3. Improve the use of today’s antibiotics
4. Promote the development of new antibiotics and develop new diagnostic tests for resistant bacteria
How to fight antimicrobial resistance

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How to fight antimicrobial resistance

1. Prevent infections and prevent the spread of resistance
2. Track resistant bacteria
3. Improve the use of today’s antibiotics
4. Promote the development of new antibiotics and develop new diagnostic tests for resistant bacteria

Practice location & patient mix

Antimicrobial stewardship is not one-size-fits all

- Inpatient
- Transitions of care
- Long-term care
- Outpatient

Common comorbidities

Local resistance patterns

Acuity

Practice location & patient mix

Antimicrobial stewardship is not one-size-fits all

- Inpatient
- Transitions of care
- Long-term care
- Outpatient

Common comorbidities

Local resistance patterns

Acuity

Local providers

Local culture & customs
Antimicrobial stewardship strategies

Active/Core Strategies
1. Prospective audit with intervention and feedback
2. Formulary restriction with preauthorization

Supplemental Strategies
1. Education
2. Guidelines and clinical pathways
3. Antimicrobial cycling
4. Antimicrobial order forms
5. Combination therapy
6. Streamlining and de-escalation of therapy
7. Dose optimization
8. Parenteral to oral conversion

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Education → raising awareness

• Antibiotics are “societal” drugs

Education → distributing resources

• Antibiotics can be toxic

Education → raising awareness

• “Collateral damage”
  – Ecologic adverse effects of antibiotic therapy
    • Cephalosporin use linked to VRE, ESBLs, C. difficile
    • Quinolones use linked to MRSA, Gram negative resistance
  – Message: 3rd-generation cephalosporins and fluoroquinolones are poor “workhorse” antibiotics

Education → raising awareness

• Antibiotics are responsible for almost 1 out of 5 emergency department visits for adverse drug events

www.cdc.gov/getsmart/community
Education → sharing your knowledge

- A pharmacist is 1 of 2 core ASP members
- Pharmacist involvement is essential
  - Dose selection
  - Monitoring for toxicity
  - Managing drug-drug interactions
  - Cost-effective therapy selection
  - Patient counseling

CDC, Antibiotic resistance threats in the US, 2013

IV to PO – If the gut works, use it!

- Potential benefits of IV to PO include…
  - Increase patient comfort
  - Reduce length of stay / discharge facilitation
  - Removal of IV catheters and risks they bring
  - Reduced healthcare (and drug) costs

Potential benefits of IV to PO include…
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Common IV to PO Targets

<table>
<thead>
<tr>
<th>Azithromycin</th>
<th>Ciprofloxacin</th>
<th>Moxifloxacin</th>
<th>Doxycycline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluconazole</td>
<td>Levofloxacin</td>
<td>Linezolid</td>
<td>Metronidazole</td>
</tr>
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Dose optimization

- Patient characteristics
- Causative organism
- Site of infection
- Pk/Pd characteristics

Dose optimization – prolonged infusions

- Maximize on time-dependent antibacterial activity
  - > 50-70% of dosing interval for Gram negatives
  - >40-50% of dosing interval for Gram positives
- β-lactams
  - Penicillins
  - Cephalosporins
  - Carbapenems
### Dose optimization – prolonged infusions

- **Dose Absorption**
- **Elimination**

### Dose optimization – time above the MIC

<table>
<thead>
<tr>
<th>T &gt; MIC</th>
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### Dose optimization – infusion strategies

<table>
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<tr>
<th>Strategy</th>
<th>Admin. Time</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV push</td>
<td>3 to 5 minutes</td>
<td>Ceftriaxone</td>
</tr>
<tr>
<td>Intermittent</td>
<td>30 minutes</td>
<td>Ampicillin</td>
</tr>
<tr>
<td>Extended infusion</td>
<td>3 to 4 hours</td>
<td>Piperacillin-tazobactam</td>
</tr>
<tr>
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<td>20 to 24 hours</td>
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Dose optimization – infusion options

Dose optimization – intermittent

Dose optimization – extended

Dose optimization – continuous

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Dose optimization – prolonged infusions

• T > MIC

Time < MIC

Loading dose may be helpful

Loading dose may be helpful
Loading dose may be helpful

Ct

First dose as intermittent infusion

Start continuous infusion directly afterwards

Re-dose to keep level above MIC

Extended infusions: piperacillin-tazobactam (example)

<table>
<thead>
<tr>
<th>Dose</th>
<th>Frequency</th>
<th>Infusion time</th>
<th>% Target Attainment</th>
<th>Daily Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.375 gm</td>
<td>Q6H</td>
<td>30 min</td>
<td>84</td>
<td>$$$$</td>
</tr>
<tr>
<td>3.375 gm</td>
<td>Q6H</td>
<td>90 min</td>
<td>89</td>
<td>$$$$</td>
</tr>
<tr>
<td>3.375 gm</td>
<td>Q6H</td>
<td>4 hr</td>
<td>96</td>
<td>$$$$</td>
</tr>
<tr>
<td>3.375 gm</td>
<td>Q8H</td>
<td>30 min</td>
<td>77</td>
<td>$$$$</td>
</tr>
<tr>
<td>3.375 gm</td>
<td>Q8H</td>
<td>90 min</td>
<td>83</td>
<td>$$$$</td>
</tr>
<tr>
<td>3.375 gm</td>
<td>Q8H</td>
<td>4 hr</td>
<td>91</td>
<td>$$$$</td>
</tr>
<tr>
<td>10.125 gm</td>
<td>Q24H</td>
<td>24 hr</td>
<td>95</td>
<td>$$$$</td>
</tr>
<tr>
<td>13.5 gm</td>
<td>Q24H</td>
<td>24 hr</td>
<td>99</td>
<td>$$$$</td>
</tr>
</tbody>
</table>

Extended infusions: piperacillin-tazobactam (example)

Dose optimization – Remember MICs matter

Dose Frequency Infusion time % Target Attainment Daily Cost
3.375 gm Q6H 30 min 84 $$$$ 
3.375 gm Q6H 90 min 89 $$$$ 
3.375 gm Q6H 4 hr 96 $$$$ 
3.375 gm Q8H 30 min 77 $$$$ 
3.375 gm Q8H 90 min 83 $$$$ 
3.375 gm Q8H 4 hr 91 $$$$ 
10.125 gm Q24H 24 hr 95 $$$$ 
13.5 gm Q24H 24 hr 99 $$$$ 

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Dose optimization – Remember MICs matter

Notes on prolonged-infusion antibiotics

- Benefit is most likely for critically ill patients suffering from infection due to an organism with a high MIC
- Can assist transition patients out of the hospital
- Patient satisfaction an important consideration

OBJECTIVE #4

Given a clinical scenario, identify strategies which may be employed to achieve the primary goals of antimicrobial stewardship

3 questions to ask during each assessment

1. Does the patient have an infection?
2. What is the patient most likely infected with?
   - Organism, site of infection
3. What is the preferred treatment?
   - Pt-specific considerations

Clinical Scenario

- BB is a 45 y/o F who presents to ABC Hospital with CC of pain and swelling of the left lower extremity.
- PMH of hypertension
- Physical examination reveals cellulitis with abscess
- Vital signs show:
  - Temp: 98.9 F
  - HR: 79 bpm
  - BP: 160/90mmHg
  - RR: 16 bpm
- Labs:
  - WBC: 12 cells/mm³
  - SCR: 0.7 mg/dL
  - BUN: 12
  - PLT: 256
- Wt: 85 kg
- Ht: 64 in
- ALL: NKDA

Clinical Scenario

- Blood cultures are drawn
- Incision and drainage of the abscess is planned and specimen will be sent for culture
- Antibiotics are started...
Clinical Scenario

Orders are written for...
- Vancomycin 1gm IV Q12H
- Piperacillin-tazobactam 3.375gm IV Q6H
- Metronidazole 500mg IV Q8H
- Fluconazole 400mg IV Q24H

Clinical Scenario – potential interventions

Orders are written for...
- Vancomycin 1gm IV Q12H
- Piperacillin-tazobactam 3.375gm IV Q6H
- Metronidazole 500mg IV Q8H
- Fluconazole 400mg IV Q24H

Appropriate dosing & monitoring
- Extended-infusion
- Dual anaerobic therapy likely unnecessary

Antimicrobial w/o indication – if indication identified, IV to PO?

Clinical Scenario

Following discussion w/ pharmacist, patient is given:
- Vancomycin 1250 mg IV Q12H
  - Adjusted for weight and kidney function
  - Vancomycin trough level ordered prior to 4th dose
- Piperacillin-tazobactam 3.375 gm IV Q8H over 3 hour infusion
  - Extended-infusion dosing
- Fluconazole 100mg oral x1
  - Patient found to have vaginal yeast infection, which had been inadvertent left out of the progress note

Clinical Scenario – day 2

Day 2 antibiotics continued as ordered, blood cultures negative thus far, fluid from I&D shows Gram positive cocci in clusters, pt afebrile, WBC 12 → 8.6, no signs of clinical worsening of cellulitis
- Current antibiotics:
  - Vancomycin 1.25gm IV Q12H
  - Piperacillin-tazobactam 3.375gm IV Q8H, 3-hour infusion

3 questions to ask during each assessment

1. Does the patient have an infection?
2. What is the patient most likely infected with?
   - Organism, site of infection
3. What is the preferred treatment?
   - Pt-specific considerations

3 questions to ask during each assessment

1. Does the patient have an infection? → YES
2. What is the patient most likely infected with?
   - Organism, site of infection → MSSA or MRSA (GPCs in clusters)
3. What is the preferred treatment?
   - Pt-specific considerations → Broad Gram-positive coverage
3 questions to ask during each assessment

1. Does the patient have an infection? → YES

2. What is the patient most likely infected with?
   - Organism, site of infection → MSSA or MRSA (GPCs in clusters)

3. What is the preferred treatment?
   - Pt-specific considerations → Broad Gram-positive coverage
     - Vancomycin 1.25gm IV Q12H
     - Piperacillin-tazobactam 3.375gm IV Q8H, 3-hour infusion

Discontinue?

Clinical scenario – day 3

- Day 3, patient continues to improve and physician wants to discharge patient. Cultures from I&D are showing...
  - Staphylococcus aureus
    - Resistant: cefazolin, oxacillin, nafcillin, piperacillin-tazobactam
    - Sensitive: SMX-TMP, clindamycin, vancomycin, linezolid, doxycycline

Clinical scenario: weighing outpatient options

<table>
<thead>
<tr>
<th>Drug</th>
<th>Oral Option</th>
<th>Frequency</th>
<th>Major/Common Toxicities</th>
<th>Collateral Damage</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMX-TMP</td>
<td>Yes</td>
<td>Q8-12H</td>
<td>Photosensitivity, hyperkalemia, GI, hematologic effects, rash</td>
<td>+</td>
<td>$</td>
</tr>
<tr>
<td>Doxycycline</td>
<td>Yes</td>
<td>Q12H</td>
<td>Photosensitivity, esophagitis, GI</td>
<td>+</td>
<td>$</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>Yes</td>
<td>Q6-12H</td>
<td>GI</td>
<td>++</td>
<td>$</td>
</tr>
<tr>
<td>Linezolid</td>
<td>Yes</td>
<td>Q12H</td>
<td>Few w/ short-term therapy</td>
<td>+</td>
<td>$$$</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>No</td>
<td>Q12H</td>
<td>Nephrotoxicity</td>
<td>+</td>
<td>$$$$</td>
</tr>
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</table>
Patient counseling

✓ When to take vs. when not to take antibiotics
✓ Antibiotics can be toxic, you should watch out for…
✓ What to do if you do not improve
✓ Preventative measures and symptomatic relief

Clinical Scenario – strategies covered

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Key Point

Antimicrobial stewardship is a team game with the patient at the center – pharmacists play an integral role and it is your teamwork that makes our dream work

1. The Centers for Disease Control (CDC) has identified all of the following resistant organisms as urgent threats except

A. *Clostridium difficile*
B. Carbapenem-Resistant Enterobacteriaceae (CRE)
C. *Neisseria gonorrhoeae*
D. Methicillin-Resistant *Staphylococcus aureus*
2. Which of the following is true regarding the goals of the National Action Plan for Combating Antibiotic Resistant Bacteria?

A. Eradicate the emergence of resistant bacteria  
B. Curtail the development of rapid diagnostic tests for identification of resistant bacteria  
C. By 2020, decrease *Clostridium difficile* infections by 50% as compared to 2011 estimates  
D. Require all providers to obtain at least 2 hours of continuing education on prudent antimicrobial prescribing each year

3. Why are antimicrobial drugs considered to be “societal” in nature?

A. They are used by most people in society  
B. Use in one person can impact their utility in others  
C. They are expensive  
D. They can be toxic

4. Which of the following two drug classes are highly associated with “collateral damage”?

A. Penicillins and tetracyclines  
B. Fluoroquinolones and cephalosporins  
C. Lincosamides and oxazolidinones  
D. Glycopeptides and carbapenems

5. Utilization of an extended-infusion to enhance antibacterial killing is an example of which antimicrobial stewardship activity?

A. Dose optimization  
B. Education  
C. Prospective audit with intervention and feedback  
D. Formulary restriction