ANTIMICROBIAL STEWARDSHIP: THE ROLE OF THE CLINICIAN

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Crisis: Antibiotic Resistance

Success Strategy
OBJECTIVES

• Discuss the importance of antibiotic stewardship for nursing homes
  – Current use in this setting
  – Consequences of misuse
• Describe the mechanisms of antibiotic resistance
• Discuss the goal of antibiotic stewardship in nursing homes
• Discuss the key nursing actions in decreasing antibiotic resistance and influence antibiotic management
“Microbes are educated to resist penicillin and a host of penicillin-fast organisms is bred out … In such cases, the thoughtless person playing with penicillin is morally responsible for the death of the man who finally succumbs to the infection with the penicillin Resistant organism. I hope this evil can be averted.”

Alexander Fleming
DEFINITION: ANTIMICROBIAL STEWARDSHIP

• The optimal selection, dosage, and duration of antimicrobial treatment that results in the best clinical outcome for the treatment or prevention of infection, with minimal toxicity to the patient and minimal impact on subsequent resistance

🌟 Should also focus on appropriate diagnosis.

IMPACT OF ANTIBIOTIC RESISTANCE IN U.S.
ANTIBIOTIC RESISTANCE IN THE U.S.

According to the CDC, each year, about 2 million Americans develop antibiotic-resistant infections, and roughly 23,000 die.

Cost the US health system over $20 billion.

An estimated 8 million extra hospital days.


MECHANISMS OF ANTIBIOTIC RESISTANCE

Pssst! Hey kid, stick this in your genome and antibiotics can't even touch you!
ANTIBIOTIC RESISTANCE

- Antibiotic resistance in bacteria may be
  - An Inherent (natural) resistance. Bacteria may be inherently resistant to an antibiotic. For example, an organism lacks a transport system for an antibiotic; or an organism lacks the target of the antibiotic molecule
  - Acquired resistance. Bacteria develop several mechanisms in order to acquire resistance to antibiotics. All require either the modification of existing genetic material (DNA) or the acquisition of new genetic material (DNA) from another source.

http://textbookofbacteriology.net/resantimicrobial_3.html
THREE PROCESSES OF RESISTANCE

**Transformation**: when parts of DNA are taken up by the bacteria from the external environment. This DNA is normally present in the external environment due to the death and lysis of another bacterium.

**Transduction**: when bacteria-specific viruses (bacteriophages) transfer DNA between two closely related bacteria.

**Conjugation**: when there is direct cell-cell contact between two bacteria and transfer of small pieces of DNA called plasmids takes place. This is thought to be the main mechanism.

Furuya EY, et al. *Nature Reviews Microbiology* 2006; 4, 36-45
Modes of Resistance

- Bacteria respond to selection pressure
  - Evolution
- Main types of resistance
  - Mutated target site
  - Destruction or alteration of drug
  - Efflux pumps that move drug out of cell
  - Reduced uptake into cell

http://textbookofbacteriology.net/resantimicrobial_3.html
IMPACT OF ANTIBIOTIC RESISTANCE IN NURSING HOMES
ANTIBIOTICS FREQUENTLY USED

• Antibiotics are among the most commonly prescribed medications in nursing homes.

Estimates of the cost of antibiotics in the long-term care setting range from $38 million to $137 million per year.

Up to 70% of long-term care facilities’ residents receive an antibiotic every year

**ANTIBIOTICS FREQUENTLY USED**

Up to 75% of antibiotic are prescribed incorrectly (prescribing the wrong drug, dose, duration or reason)

Nearly 50% of antibiotics prescribed in nursing homes may be given longer than necessary

Residents in nursing homes with higher antibiotic use have a 24% increased risk of antibiotic-related harm.

In nursing homes with higher antibiotic use, even residents who do not receive antibiotics are at increased risk of indirect antibiotic-related harms due to the spread of resistant bacteria or C. difficile germs from other patients.

## TOP ANTIBIOTIC RESISTANCE THREATS IN NURSING HOMES

<table>
<thead>
<tr>
<th>Organism</th>
<th>Est. Hospitalizations per year</th>
<th>Est. deaths per year</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>C. difficile</td>
<td>250,000</td>
<td>14,000</td>
<td>4-30%</td>
</tr>
<tr>
<td>VRE</td>
<td>20,000</td>
<td>1,300</td>
<td>5-18%</td>
</tr>
<tr>
<td>MRSA</td>
<td>80,000</td>
<td>11,000</td>
<td>30%</td>
</tr>
<tr>
<td>MDR GNR</td>
<td>26,000</td>
<td>1,700</td>
<td>20%</td>
</tr>
</tbody>
</table>

VRE = Vancomycin resistant enterococci;  
MDR GNR = multidrug-resistant Gram negative rods  
MRSA = Methicillin-resistant Staphylococcus  

CONSEQUENCES OF ANTIBIOTIC RESISTANCE

• Antibiotic resistance in long-term care is associated with:
  – Increased risk of hospitalization
  – Increased cost of treatments
  – Increased risk of death

CONSEQUENCES OF INAPPROPRIATE ANTIBIOTIC USE:

- **Excessive Use:** e.g. long duration or combination therapy
- **Inappropriate drug administration:** e.g. viral infections
- **Suboptimal dosing:** e.g. loading dose or underdosing

**Collateral Damage**
- Selection of drug resistance organisms
- Infection with MDR pathogens
- Super infection with fungal infection
- Clostridium difficile infections
FOUR CORE ACTIONS TO FIGHT RESISTANCE

1. Preventing infections, preventing the spread of resistance
   – Immunization
   – Safe food preparation
   – Handwashing
   – Using antibiotics as directed and only when necessary

2. Tracking
   – Data gathering (causes of infection and risk factors)

3. Improving antibiotic prescribing/stewardship

4. Developing new drugs and diagnostic tests

http://www.cdc.gov/drugresistance/about.html
ANTIBIOTIC STEWARDSHIP
DEFINITION: ANTIMICROBIAL STEWARDSHIP

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FIGURE 1. Schematic Representation of the Process of Antibiotic Prescribing Decision Making and the Role of Antibiotic Stewardship

The Antibiotic Decision-Making Process

Clinical Situation → Diagnostic Process and Decision Making → Decision RE: Watchful Waiting or Selection of Antibiotic(s), Dose and Duration → Monitoring Clinical Situation and Lab Results → Reassessment at 48-72 Hours: Stop or Change Antibiotic or Duration?

Goals: Antibiotics only when needed
Right drug at the right time for the right duration

Key Tools and Techniques: Evidence-based guidelines; monitoring of antibiotic prescriptions, culture ordering and results, and health outcomes; population-specific antibiograms; regular quality feedback to medical providers and nurses; and inclusion of antibiotic stewardship in facility QAPI plan

Note. QAPI, Quality Assurance/Performance Improvement.

BENEFITS: ANTIMICROBIAL STEWARDSHIP

• Benefits include:
  • Reduced mortality
  • Reduced adverse effects including clostridium difficile infections
  • Improvement of rates of antibiotic susceptibilities to targeted antibiotics
  • Optimization of resource utilization across the continuum of care

GOAL OF ANTIMICROBIAL STEWARDSHIP IN NURSING HOMES

Antibiotic stewardship refers to a set of commitments and activities designed to “optimize the treatment of infections while reducing the adverse events associated with antibiotic use.”

7 CORE ELEMENTS FOR ANTIBIOTIC STEWARDSHIP IN LTCFS

1. Leadership commitment
2. Accountability
3. Drug expertise
4. Action to improve use
5. Tracking: monitoring antibiotic prescribing, use, and resistance
6. Reporting information to staff and clinical providers
7. Education

MOST COMMON INFECTIONS TREATED WITH ANTIBIOTICS IN NURSING HOMES

- Urinary Tract Infections: 13%
- Respiratory Tract Infections: 32%
- Skin and Soft Tissue Infections: 12%
- Other: 10%
- Undocumented: 33%

12 COMMON NURSING HOME SITUATIONS IN WHICH ANTIBIOTICS ARE GENERALLY NOT INDICATED

1. Positive urine culture in an asymptomatic patient
2. Urine culture ordered solely because of change in urine appearance
3. Nonspecific symptoms or signs not referable to the urinary tract (with or without a positive culture)
4. Upper respiratory infection (common cold)
5. Bronchitis or asthma in a patient who does not have COPD

12 COMMON NURSING HOME SITUATIONS IN WHICH ANTIBIOTICS ARE GENERALLY NOT INDICATED

6. Infiltrate on chest x-ray in the absence of clinically significant symptoms
7. Suspected or proven influenza in absence of a secondary infection (do treat influenza with antivirals)
8. Respiratory symptoms in a patient with advanced dementia, on palliative care, or end of life
9. Skin wound without cellulitis, sepsis, or osteomyelitis (regardless of culture result)

12 COMMON NURSING HOME SITUATIONS IN WHICH ANTIBIOTICS ARE GENERALLY NOT INDICATED

10. Small (< 5 cm) localized abscess without significant surrounding cellulitis (note: drainage is required of all abscesses)
11. Decubitus ulcer in a patient at the end of life
12. Acute vomiting and/or diarrhea in the absence of a positive culture for shigella or salmonella, or a positive toxin assay for C. difficile

CLINICIAN’S RESPONSIBILITY

- Stewardship is every prescriber’s responsibility
- Obtain an accurate allergy history
- Timely antibiotic initiation
- Comply with infection prevention especially hand hygiene
- Follow evidence-based guidelines;
  - Avoid unnecessary use
- Obtain appropriate cultures before starting antibiotics
CLINICIAN’S RESPONSIBILITY

• Review antibiotic use in past 48 – 72 hours
  – Determine appropriateness and need of antibiotic coverage
  – Can therapy be de-escalate

• Reduce use of antibiotics with a high risk for C. difficile
  – Clindamycin
  – Broad-spectrum antibiotics, especially cephalosporins
  – Fluoroquinolones
CLINICIAN’S RESPONSIBILITY

• Monitor progress, future culture reports and antibiotic adjustments and resistance
• Optimize dosing and shortest effective duration of antibiotic therapy
• Documentation of indication, dose, and duration on orders
CONCLUSION

• Antibiotic resistance in long-term care is associated with:
  – Increased risk of hospitalization
  – Increased cost of treatments
  – Increased risk of death

• The goal of an antibiotic stewardship program is to “optimize the treatment of infections while reducing the adverse events associated with antibiotic use.”
CONCLUSION

• Clinicians have a vital role in promoting judicious use of antibiotics and ensuring patients receive care appropriate to their need