Antibiotic Use and Antibiotic Resistance: Just the Facts
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Antibiotic Use and Antibiotic Resistance Objectives
• Define the term “antimicrobials”
• Define the term “antibiotic resistance”
• Define the term “antibiotic stewardship”
• Define the term “diagnostic stewardship”

Antibiotic Use and Antibiotic Resistance Objectives
• Describe mechanisms of the development of antibiotic resistance
• Define factors that contribute to antibiotic resistance
• Describe action steps that one can take to prevent antibiotic resistance and the spread of antibiotic-resistant organisms

What are Antimicrobials?
• Antimicrobials are a large group of medications that include:
  • Antibiotics – to treat bacterial infections
  • Antivirals – to treat viral infections
  • Antifungals – to treat fungal infections
  • Anti-parasitics – to treat infections caused by parasites

Background: Antibiotics Past, Present
“In such a case the thoughtless person playing with penicillin treatment is morally responsible for the death of the man who finally succumbs to infection with the penicillin-resistant organism. I hope the evil can be averted.”
Alexander Fleming; 1945 New York Times

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Background: Antibiotics Past, Present

“If we are not careful, we will soon be in a post-antibiotic era.”
Dr. Thomas Frieden, past Director of CDC; 2013

Antibiotic Resistance Affects Everyone
• Antibiotic resistance threatens the use of antibiotics for people of all ages
• Antibiotics are essential treatment for some infections, but also can produce harmful side effects
  • Upset stomach
  • Rashes
  • Interactions with other medications
  • Diarrhea (e.g., Clostridium difficile)

Antibiotic Resistance Affects Everyone
• 1 out 5 visits to EDs are related to adverse events to antibiotics and #1 for ED visits for children < 18 years of age

What is Antibiotic Resistance?
• Antibiotic resistance happens when germs like bacteria and fungi develop the ability to defeat the drugs designed to kill them.
• Resistant germs are not killed and continue to grow.
What is Antibiotic Resistance?
• Infections caused by antibiotic-resistant germs are difficult, and sometimes impossible, to treat.
• Increased follow-up doctor visits, more lengthy recovery times and costly and toxic alternatives
• Resistance depends on organism
  • Mutations
  • Gene transfer

[Link: https://www.cdc.gov/drugresistance/about.html]

Antibiotic Stewardship
• CDC has identified antibiotic resistance has one of the most important public health threats
• Antibiotic use is the biggest driving factor in the development of antibiotic-resistant organisms (MDROs)

[Link: https://www.cdc.gov/drugresistance/solutions]

Antibiotic Stewardship
• Infections caused by antibiotic-resistant organisms require treatment with more toxic and expensive antibiotics
• Antibiotic resistance is of concern in all healthcare settings----hospitals, LTCF, physician offices and home care
• In order to be effective, must include all levels of healthcare workers

[Link: https://www.cdc.gov/drugresistance/solutions]

Antibiotic Stewardship
• The appropriate use of antibiotics — often called antibiotic stewardship — can help to:
  • Preserve the effectiveness of current antibiotics
  • Extend the life span of current antibiotics

[Link: https://www.mayoclinic.org/healthy-lifestyle/consumer-health/in-depth/antibiotics/art-20045720]

Antibiotic Stewardship
• Protect people from antibiotic-resistant infections
• Avoid side effects from using antibiotics inappropriately

[Link: https://www.mayoclinic.org/healthy-lifestyle/consumer-health/in-depth/antibiotics/art-20045720]
Among the Highest Rates of Antibiotics

National and state antibiotics prescribed per 1,000 beneficiaries. The data shows that Community Group A’s prescribing rate (1.9102) is significantly higher (17%) than the national rate (1,583.7). All Alabama Cohort communities are prescribing at a higher rate than national cohorts.

Antimicrobial Stewardship
- Prevents misuse, enabling the benefits of antimicrobials to outweigh the risks
- Ingredients for successful stewardship include:
  - Education for nurses and providers
  - Evidence-based guidelines for clinical assessment, testing for and treating infections
  - Use antibiotics only when clinically indicated

Examples of Antibiotic Misuse
- Taking antibiotics when not indicated
- Drug-drug interactions
- Medication side effects
- Increased health costs
- Not finishing an antibiotic prescription
- Inappropriate prescribing
- Use of broad-spectrum antibiotics when a narrow-spectrum antibiotic would be effective
Step 1: Prevent the Spread of MDROs
- Use nursing assessment skills to accurately evaluate symptoms and communicate changes in condition
- Encourage the discontinuation the use of invasive devices when clinically appropriate

Step 2: Effective Diagnosis and Treatment
- Obtain microbiology cultures whenever possible to guide appropriate antibiotic use
- Collect specimens prior to initiating antibiotic therapy

Step 3: Optimize Antibiotic Use
- Perform an antibiotic susceptibility test on bacteria identified in a lab specimen (blood, urine, etc.)

Step 1: Prevent the Spread of MDROs
- Use infection control practices – especially hand hygiene
- Always use Standard Precautions – gowns, gloves, masks, etc. as indicated according to symptoms (coughing, incontinence) and the care given (e.g. change a dressing or perform tracheostomy care)

Step 2: Effective Diagnosis and Treatment
- Do not request antibiotics for:
  - Viral infections
  - Asymptomatic bacteriuria
  - Change in condition not likely due to bacterial infection (e.g. falls, confusion)

Step 3: Optimize Antibiotic Use
- Antibiotic susceptibility tests are important to determine which antibiotic should be prescribed to effectively treat the infection
Step 3: Optimize Antibiotic Use
- Obtain and use antibiogram to guide empirical therapy

Step 3: Optimize Antibiotic Use
• Assist with Optimizing Antibiotic Use
  • Upon receiving laboratory results, notify the prescriber and facilitate an “antibiotic time-out” (re-assessment of the antibiotic prescribed).
  • If culture results are negative:
    • Recommend discontinuation of antibiotics

Step 3: Optimize Antibiotic Use
• If culture results are positive:
  • Provide susceptibility report to encourage use of a narrower spectrum antibiotic, if available
  • Assess for de-escalation opportunities (e.g., from IV to P.O.)

How Nurses Can Influence Antibiotic Management
1. Ensure pertinent information about antibiotics is available
2. Ensure the appropriate antibiotic administration route
3. Reassess antibiotic therapy in 2 to 3 days

Everyone’s Role in Stewardship
• Use antibiotics only when clinically indicated; Avoid asking your provider for antibiotics
• Practice excellent hand hygiene
• Follow recommended infection prevention and control practices
• Use antibiotics only as prescribed by your doctor including taking the full prescription

How Nurses Can Influence Antibiotic Management
4. Reassess antibiotic therapy in 2 to 3 days
5. Review antibiotic therapy when your patient develops a new C. difficile infection
6. Reconcile antibiotics during all patient-care transitions

https://www.mayoclinic.org/healthy-lifestyle/consumer-health/in-depth/antibiotics/art-20045720
Everyone’s Role in Stewardship

- Never take leftover antibiotics for a later illness.
- Never take antibiotics prescribed for another person.
- Stay home from work when you’re sick.
- Get a flu shot every year.
- Cover your cough or sneeze with a tissue or use your sleeve (near the shoulder or elbow).

Improving the Use of Antibiotics in Bacteriuria for the Elderly

Increased Risk for Infections

6 Reasons the elderly are more susceptible to infection:
1. Their immune system has aged and is not as effective.
2. The skin is the first line of defense against infection and the aging skin is thinner.
3. The elderly are usually less hydrated – especially their skin.

Increased Risk for Infections

4. Many elderly retain urine – increasing the likelihood of urinary track infection.
5. The elderly have decreased ability to cough up secretions.
6. The use of medications that can suppress the elder’s ability to fight infection.

Urinary Tract Infections

- Facts:
  - UTIs are the second most commonly reported infection in community dwelling and hospitalized adults over the age of 65 (preceded only by respiratory infection).
  - They account for over 1/3 of all infections reported in long-term care residents.

Urinary Tract Infections

- Treatment should be reserved for symptomatic UTI (SUTI) only.
Prevalence of ASB in the Elderly

- Rate of Asymptomatic Bacteremic (ASB) increases 1-2% per decade of life
- In the community:
  - Men - up to 19%
  - Women - up to 16%
  - Men over the age of 80 – 20% or more

Presence of WBCs in the urine---- does it differentiate ASB from SUTI?

- Presence of pyuria is not a reliable indicator of infection
- Asymptomatic bacteremic urinary tract infections (ASB) and Symptomatic bacteremic urinary tract infections (SUTI) both provoke an immune response
  - Increased inflammatory markers in the urine including pyuria

Why is ASB so prevalent in the elderly?

- Decrease in estrogen leads to a change in the vaginal flora
- Anatomical changes such as prolapsed bladder or enlarged prostate make it difficult to empty the bladder
- Increased incidence of diabetes

Prevalence of ASB in the Elderly

- In long-term care
  - Women - 25-50%
  - Men - 15-40%

Presence of WBCs in the urine---- does it differentiate ASB from SUTI?

- WBCs are present in the urine in 78% of people with diabetes
- Up to 90% of elderly nursing home residents have pyuria with or without bacteriuria

Why is ASB so prevalent in the elderly?

- Cognitive defects
- Functional impairments
- FOLEY CATHETER USE
No Benefit for Treating ASB
(Exceptions: Pregnancy, Surgery Involving the Urinary System, Renal Transplant)

- Cochrane meta-analysis
  - Looked at 9 RCTs (randomized clinical trials) with 1,614 participants
  - Compared outcomes in adult patients with ASB who were treated to those that weren’t treated

Antibiotics for Asymptomatic Bacteriuria”. Published 2015. Cochrane Database of Systematic Reviews

No Benefit for Treating ASB
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- Findings
  - No differences in:
    - Subsequent development of SUTI
    - Complications including pyelonephritis and bacteremia
    - Death
  - Those treated suffered more adverse events

Antibiotics for Asymptomatic Bacteriuria”. Published 2015. Cochrane Database of Systematic Reviews

MDROs in UTI

- Repeated exposure to antibiotics increases the chance of subsequent infections with MDROs
- Cohort study of long term care residents (Journal of Critical Care, 2016)
  - 26% of all urine isolates were resistant to Bactrim
  - 40% were resistant to Levaquin


Consequences of Treating ASB

- C diff
- MDROs
- Side Effects
- Cost

Hazards of Misdiagnosis

- Complicated UTI (extended beyond the bladder) is the most common cause of sepsis in adults over 65 years of age

“Risk Factors for Urosepsis in Older Adults”. Published 2016. Gerontology and Geriatric Medicine

Hazards of Misdiagnosis

- UTIs cause approximately 10% to 30% of all severe sepsis or septic shock

“Risk Factors for Urosepsis in Older Adults”. Published 2016. Gerontology and Geriatric Medicine
Hazards of Misdiagnosis

- 28% to 50% of elderly patients with septic shock will die

Balancing Act

- Prevention
- Reducing Foley Catheter Use
- CAUTI Bundle
- Treat only SUTI
- Diagnostic Stewardship
- Unintended Consequences

If you must use a Foley....
- Insert using aseptic technique only for appropriate indications and leave only as long as needed
- Securement device
- Bag below the level of the bladder at all times
- Maintain a closed drainage system
- Leg bags in long-term care – no consensus. Have a policy.

If you must use a Foley.... (con't)
- Consider alternatives – condom catheters or external female catheter
- Do not change catheters or bags at routine intervals
- Perform audits and provide feedback to staff
- Change out long-term catheters prior to culture collection
- Catheter in place for 2 weeks

If you must use a Foley....
- Avoid irrigation
- Maintain unobstructed urine flow
- Free from kinks and dependent loops
- Empty bag regularly using a separate clean container for each patient

Things you can do
- Teach patient and family to practice good hand hygiene
- Promote adequate hydration
- Encourage prompt voiding
- Encourage proper hygiene – Don’t leave them wet or dirty!!
Things you can do

• Encourage mobility as much as possible
• Use of cranberry capsules remains controversial
• RCT in 2012 showed a decrease in bacteriuria and pyuria in female nursing home residents
• RCT in 2016 showed no statistically significant difference when compared to placebo

Reduce Foley Catheter Use

• Bacteriuria risk increases 3-10% per day
• 100% of patients with long-term catheters will have urine that is colonized with bacteria
• Biofilm can form in as little as 3 ½ days
• Biofilm organisms can ascend the catheter in 1-3 days

Treat only Symptomatic UTI

• Symptom detection in the elderly is difficult!
• Significant cognitive deficits
• Chronic genitourinary symptoms such as incontinence, urgency, and frequency unrelated to infection
• Nonspecific symptoms such as anorexia, confusion, and a decline in their abilities to perform ADLs
• Fever is often absent or diminished

Clostridium difficile Infection- CDI

• Almost always related to antibiotic exposure
• 2015 study- half a million infections/year
• 15,000 deaths directly attributable to C diff
• $3,800,000,000 in medical costs could be saved over 5 years if C diff infections can be curtailed
CDI
- Most common cause of acute infectious diarrhea in long-term care
- More likely to be admitted to an acute care hospital
- Significant increase in 3-month mortality

* CDC Antibiotic/Antimicrobial Resistance. [HTTP://www.cdc.gov/drugresistance/biggest_threats.html]

Fluoroquinolone RX Rate

Cephalosporins RX Rate

Respiratory Tract Infections

- Upper Respiratory tract infections (URTIs)
  - Common cold, laryngitis, pharyngitis/tonsillitis, acute rhinitis, acute rhinosinusitis and acute otitis media.
- Lower respiratory tract infections (LRTIs)
  - Acute bronchitis, bronchiolitis, pneumonia and tracheitis.

* Respiratory Tract Infections. Antibiotic Prescribing Prescribing of Antibiotics for Self-limiting Respiratory Tract Infections in Adults and Children in Primary Care. NICE Clinical Guidelines, No. 69
Respiratory Tract Infections (RTIs)

- 1/4 population will visit their GP because of a RTI each year
- 60% of all antibiotic prescribing in general practice is for RTIs
- At least 30% of these antibiotics are unnecessary
- 10% decrease in inappropriate prescribing in the community can result in a 17% reduction in Clostridium difficile infection

Effect of Antibiotics on Respiratory Symptoms

Educate Residents, Family and Visitors

- Infection prevention and control recommendations differ from those for patients in hospitals and nursing homes
- Contact Precautions are generally implemented for all patients known to have antibiotic-resistant organisms while they are in the hospital because:
  - People in hospitals are sicker, more vulnerable
  - Frequent presence of invasive devices

Educate Residents, Family and Visitors

- Assure family members that you are providing appropriate care to their loved one

7 Core Elements for Antimicrobial Stewardship
What is Diagnostic Stewardship?

• Ordering of tests is guided by careful clinical evaluation, recognition of a clinical syndrome, and estimation of the pretest likelihood of the condition for which test is obtained. (JAMA 2017)
• Reconsidering current practices, as empiricism gives way to diagnostics-guided therapy

Patient Safety First!
• As with any change in care delivery, a potential for unintended consequences and harm exists.
• Diagnoses may be missed.
• Close monitoring of diagnostic stewardship should be ongoing with changes made as needed.
• Tests targeted by stewardship should always be available to providers by special request or in certain circumstances

Antibiotic Stewardship

Questions?

Terms
• Antibiotic-resistant bacteria—Bacteria that have mutated, or changed, genetically so that they develop the ability to survive when exposed to antibiotics that are intended to kill them.
• Bacteria-(singular: bacterium) are single-celled life forms. Bacteria are present in soil, water, and all living organisms. Many disease-causing organisms are bacteria; however, not all bacteria cause disease. Some bacteria are necessary for essential functions like digestion
### Terms

**• Broad-spectrum antibiotics** – Antibiotics that target a wide range of bacteria. They are often more toxic and cause more side effects than narrow-spectrum antibiotics. Broad-spectrum antibiotics may be prescribed to treat an infection when the causative organism is not yet known; the antibiotic can be targeted to the organism once the lab results are available.

**• Colonization** – The presence of bacteria, or other microorganism, without symptoms of disease.

**• Infection** – The presence and multiplication of microorganisms that are causing symptoms (i.e. fever, redness, wound drainage). Infection generally implies that the person has clinical signs or symptoms of a disease.

**• Mutation** – A permanent change in genetic make-up of an organism.

**• Narrow-spectrum antibiotics** – Antibiotics that target a small, specific range of bacteria, such as gram-negative or gram-positive bacteria.

**• Normal flora bacteria** – Many bacteria are found in the body and provide useful and even essential functions to aid human survival. These bacteria, which under usual circumstances are present but do not cause disease, are called normal flora bacteria.

**• Virus** – A submicroscopic particle that can reproduce only if it is inside the cell of a living organism. Viruses cannot be killed by antibiotics.

### Resources

- **Special Thank You to Amy Stephens, CDC, Crestwood Medical Center, Huntsville, AL.**
- **Antibiotic Use in Long-Term Care Facilities (SHEA position paper)**
  - [https://www.shea-online.org/images/guidelines/Abx-LTCP96.PDF](https://www.shea-online.org/images/guidelines/Abx-LTCP96.PDF)
- **Alliance for the Prudent Use of Antibiotics**
  - [www.tufts.edu/med/apua/](http://www.tufts.edu/med/apua/)
- **CDC Campaign to Prevent Antibiotic Resistance**
  - [https://www.cdc.gov/antibiotic-use/](https://www.cdc.gov/antibiotic-use/)
- **Core Elements of Antibiotic Stewardship for Nursing Homes- CDC**
  - [https://www.cdc.gov/longtermcare/prevention/antibiotic-stewardship.html](https://www.cdc.gov/longtermcare/prevention/antibiotic-stewardship.html)
- **National Nursing Home Quality Improvement C. difficile Infection Prevention Assessment Checklists**
  - [https://www.nhqualitycampaign.org/files/AntibioticStewardship_Assessment.pdf](https://www.nhqualitycampaign.org/files/AntibioticStewardship_Assessment.pdf)
- **Field Guide to Antibiotic Stewardship in Outpatient Settings**
- **Nursing Home Antimicrobial Stewardship Guide;**
  - [https://www.aqha.gov/nhguide/index.html](https://www.aqha.gov/nhguide/index.html)
- **Nurses in Long-term Care Facilities: Antibiotic Use and Antibiotic Resistance**

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