

Exploring Antibiotic Use and the Problem of Resistance

Learning Session #4, Webinar 1 of 4

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Review of Introductory Work

Exploring Antibiotics

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Topics covered in this webinar:

- Bacteria characteristics
- Describing antibiotics
- How antibiotics work with the immune system
- How antibiotics work
- How antibiotics are used
- Tools to help choose antibiotics
- Classes of antibiotics

http://qioprogram.org/sites/default/files/editors/141/NCC_BSL_ExploringAntibiotics_03032017.mp4



National Nursing Home Quality Care Collaborative Change Package

Change Bundle: To prevent Healthcare-Acquired Infections

<https://www.lsqin.org/wp-content/uploads/2015/10/ChangePackage-bundle-HACs.pdf>



Objectives

- Describe how antibiotics work
- Describe the risks and benefits of antibiotic use
- Describe what is meant by antibiotic resistance
- Describe strategies to decrease the development and spread of antibiotic resistance

Antibiotic use in nursing homes

- 70% of nursing home residents prescribed one or more courses of antibiotics each year
- 40-75% of antibiotics prescribed to nursing home residents may be unnecessary

Centers for Disease Control, February 2017

How do antibiotics work?

- Bacteriostatic Antibiotics - inhibit the growth of bacteria
- Bactericidal Antibiotics - kill bacteria by preventing the reproduction of bacteria



Image credit: Pixabay

Bacteriostatic antibiotics

- Act on the internal workings of the bacterial cell to stop it from dividing
- Prevent nutrients from reaching the bacteria, which stops them from dividing and multiplying
- May directly attack the bacterial cell wall, which injures the cell
- May block the bacteria's growth or reproduction
- Examples: the tetracyclins, the macrolides, chloramphenicol and trimethoprim

Bactericidal antibiotics

- Penicillin/Cephalosporins: Kill bacteria through direct action, usually by causing the cells to split open, or lyse
- Aminoglycosides: Bind to intracellular structure (the ribosome)
- Quinolones: Disable bacterial enzymes that normally replicate bacterial DNA

Narrow spectrum antibiotics

- Highly specialized antibiotics that are only effective against certain bacteria
- Clindamycin, Erythromycin, Vancomycin, etc.

Broad spectrum antibiotics

- Broad-spectrum antibiotics attack a wide range of bacteria
- Act on structures or processes that are common to many different bacteria, such as the components of the cell wall
- Amoxicillin, Levofloxacin, Tetracycline, Ciprofloxacin, etc.

Risks of antibiotic use

- Allergic reactions
- Gastrointestinal effects including *Clostridium difficile* infection
- Liver and kidney toxicity
- Ototoxicity
- Neurologic effects
- Development of antibiotic resistance
- Increased drug interactions

Side effects by antibiotic class

<http://www.qioprogram.org/sites/default/files/editors/141/Antibiotics%20table.pdf>

Antibiotic Class	Antibiotic Names	Known potential adverse drug reactions/side effects
Penicillin	Penicillin, Amoxicillin, Ampicillin, Dicloxacillin, Oxacillin Sodium, Piperacillin, Ampicillin/Sulbactam, Nafcillin	Allergic reaction* If given in high doses: Coma, seizure, hyperreflexia, myoclonus, electrolyte disturbance, neutropenia, acute interstitial nephritis Pseudomembranous colitis
Cephalosporins	Cefazolin, Cefuroxime, Cefoxitin, Cefotetan, Cefotaxime, Ceftriaxone, Cefazidime, Cefepime, Ceftaroline	Allergic reaction* Abdominal cramps, seizure, hepatitis, blood disorders, increase serum creatinine, fever
Miscellaneous	Nitrofurantoin (Brands: Macrobid, Furadantin, Macrochantin)	Allergic reaction* Gastrointestinal distress, peripheral neuropathy, rash, acute pulmonary reaction, hepatotoxicity, hemolytic reaction, ECG changes
Sulfonamide derivative	Trimethoprim-Sulfamethoxazole (Brand: Bactrim, Sulfatrim)	Allergic reaction* Nausea, diarrhea, vomiting, fever, thrombocytopenia, leukopenia, megaloblastic anemia – G6PD deficiency, crystalluria, acute interstitial nephritis, acute tubular necrosis, false elevation of serum creatinine in patients with decreased renal function, hyperkalemia, acute psychosis
Fluoroquinolones	Ciprofloxacin, Levofloxacin, Ofloxacin	Allergic reaction* Nausea, abdominal discomfort, vomiting, diarrhea, rash, pruritus, hypo/hyperglycemia, liver failure, nephritis, nephropathy, crystalluria, prolongation of the QTc interval, confusion, headache, dizziness, agitation, anxiety, restlessness, hallucinations, depression, sleep disturbances, seizures, tendonitis, tendon rupture, peripheral neuropathy
Uncosamide	Clindamycin (Brand: Cleocin)	Allergic reaction* Colitis, abdominal pain, <i>Clostridium difficile</i> associated diarrhea, esophageal ulcer, esophagitis, abnormal hepatic function tests, hypotension, metallic taste, azotemia
Macrolides	Erythromycin (Brand: Zithromax), Clarithromycin, Erythromycin	Common: Vomiting, diarrhea Less common: Dizziness, drowsiness, fatigue, headaches, skin rash, dermatitis, increased serum potassium, decreased serum glucose, dyspepsia, gastritis, vaginitis, blood disorders, hepatitis, increased serum creatinine, bronchospasm, rash
Tetracycline derivatives	Doxycycline (Brand: Doryx, Oracea, Monodox), Minocycline, Tetracycline	Allergic reaction* Gastrointestinal distress, esophagitis/esophageal ulceration Bluish grey nail, skin and sclera pigment With Minocycline – CNS effects including vertigo, light-headedness, loss of balance, dizziness, and tinnitus; autoimmune disorders: lupus, hepatitis, serum sickness, vasculitis, pneumonitis
Miscellaneous	Methenamine (Brand: Hiprex)	Nausea, vomiting, dyspepsia, diarrhea, rash

The problem of antibiotic resistance



C. difficile
Image credit:
Centers for
Disease Control
and Prevention

What is antibiotic resistance?

- The ability of bacteria to change or resist the effects of an antibiotic – that is, the bacteria are not killed, and their growth is not stopped
- Resistant bacteria continue to multiply, potentially causing more harm or spreading to other animals or people
- Often referred to as “superbugs”

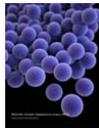


The Evolution of Bacteria on a “Mega-Plate” Petri Dish (00:01:54)
<https://youtu.be/pIVk4NVIUh8>

The impact of antibiotic resistance

- Rate and development of new antibiotics has declined
- Antibiotic resistance is a global problem
- Multiple ways of spreading antibiotic resistant bacteria

Global antibiotic resistant threats



MRSA
Image credit:
Centers for
Disease Control
and Prevention

- Carbapenem-resistant (CRE)
- Vancomycin-resistant (VRE)
- Staphylococcus aureus-methicillin resistant (MRSA)
- *Helicobacter pylori*, clarithromycin-resistant
- *Salmonellae*, fluoroquinolone-resistant
- *Neisseria gonorrhoeae*, cephalosporin-resistant, fluoroquinolone-resistant
- *Haemophilus influenzae*, ampicillin-resistant
- Tuberculosis

Strategies to decrease the development of antibiotic resistance

Prevent antibiotic resistant infections

- Promote hand hygiene
- Prevent transmission of infections by staff, residents, and visitors
- Establish and implement system-wide environmental cleaning policies
- Identify and treat infections appropriately
- Avoid indwelling catheter use unless appropriately indicated
- Keep vaccinations up to date

Chat Question



Image credit: Pixabay

What do you feel contributes to antibiotic overuse or misuse in nursing homes?

Create a culture that supports antibiotic stewardship

- Develop and implement policies that encourage best practices for antibiotic prescribing
- Identify physician, nurse, and pharmacy leads responsible for promoting and overseeing antibiotic stewardship activities
- Include antibiotic stewardship responsibilities in job descriptions of medical director/nurse leads/pharmacists

Work collaboratively

- Discuss efforts to address antibiotic overuse and misuse with providers
- Ensure that policies are in place for clinicians to receive and review reports and to detect trends in antibiotic resistance
- Use standing orders or care pathways to guide care when changes in condition are noted

Implement best practices

- Avoid use of antibiotics to treat viral illnesses
- Use antibiotics only for as long as needed
- Antibiotics are not generally indicated to treat colonization
- Obtain microbiology cultures prior to starting antibiotics
- Review the facility's microbiology reports and/or antibiogram to detect trends in antibiotic resistance
- Use tools and resources to assess changes in resident condition in order to present a clear and accurate picture to the prescribers

Engage staff, residents, and families

- Question antibiotic orders that are not supported by the resident’s clinical symptoms, lab testing, imaging, or culture results
- Engage residents and their family members in addressing the need to improve antibiotic use
- Provide education that explains why antibiotic stewardship is important for residents, staff and families

Engage residents and families



Core Elements for Antibiotic Stewardship in Nursing Homes
What You Need to Know About Antibiotics in a Nursing Home

What are antibiotics?
Antibiotics are drugs used to treat infections caused by bacteria. They do not work for illnesses caused by viruses, like the flu, and do not cure cases of bronchitis.

When are antibiotics necessary?
There are times when antibiotics are urgently needed, for example, to treat septic shock when bacteria cause a severe infection of the bloodstream, pneumonia caused by bacteria, and meningitis caused by bacteria. Using antibiotics when they are not necessary increases the risk they will not work when needed most.

Can taking antibiotics be harmful?
Antibiotics, like any medications, can have some side effects like upset stomach or a rash, as well as certain drug reactions or dangerous interactions with other medications a person is taking. In particular, antibiotics put people at risk for a deadly type of diarrhea caused by C. difficile. Frequent or excessive use of antibiotics leads to developing bacteria that are resistant to these antibiotics. Antibiotic-resistant bacteria are harder to kill, and can cause untreatable infections. A person also can carry resistant bacteria without feeling sick (also called "colonization"), but if the bacteria cause an infection, it can require more complex treatments and transfer to the hospital.

What is antibiotic stewardship?
Antibiotic stewardship refers to a set of coordinated and shared strategies to make sure patients receive the right drug, of the right antibiotic, for the right amount of time, and only when truly necessary. Improving antibiotic use will ensure those life-saving medications are effective and available when we need them.

Why is improving antibiotic prescribing practices important for nursing homes?
Nursing home residents have a higher risk of colonization with bacteria for many reasons: the presence of invasive devices such as urinary catheters and feeding tubes, wounds, and conditions that affect the bladder (e.g., diabetes or stroke) can all lead to colonization. Difficulties in separating colonization of bacteria from true illness in frail or older adults can lead to the overuse of antibiotics, which in turn drives antibiotic resistance.

continued on next page

<https://www.cdc.gov/longtermcare/pdfs/factsheet-core-elements-what-you-need-to-know.pdf>

Polling Question



Image credit: Pixabay

It is always best to start an antibiotic if you are not certain if there is a bacterial infection. (True/False)

Polling Question



Image credit: Pixabay

It is best to stick with antibiotics you know have worked before. (True/False)

Monitoring: What do the federal regulations say?

483.80

F880 Infection prevention and control program

System for preventing, identifying, reporting, investigating, and controlling infections and communicable diseases for all residents, staff, volunteers, visitors and other individuals providing services under a contractual arrangement based upon the facility assessment conducted according to 483.70 (e) and following acceptable national standards

New enhanced regulations

- Written standards, policies, procedures in accordance with 483.80 (a)(2) by 11/28/2016
- A system for recording incidents identified under the IPCP and corrective actions taken by the facility by 11/28/2016; and
- An antibiotic stewardship program (ASP)(F881) by 11/28/2017

Summary

- Antibiotic resistance is a global health threat
- The appropriate use of antibiotics is key to resident safety
- Implementing best practices will enhance your organization's infection prevention and control programs

Resources

- Centers for Disease Control
<https://www.cdc.gov/media/releases/2015/p0915-nursing-home-antibiotics.html>
- Agency for Healthcare Research and Quality
<https://www.ahrq.gov/professionals/quality-patient-safety/patient-safety-resources/resources/advances-in-hai/hai-article8.html>
- Minnesota Department of Health
<http://www.health.state.mn.us/divs/idepc/dtopics/antibioticresistance/asp/lc/modprintnurseabx.pdf>
- Lake Superior QIN QIO – www.lsqin.org

Next webinars

- Clostridium difficile: Clinical Overview
August 8, 2017
- What is an Antibiotic Stewardship Program?
August 15, 2017
- Antibiotic Stewardship – Where do I Start?
August 22, 2017

More information, including registration, can be found at: <https://www.lsqin.org/initiatives/nursing-home-quality/l4/>

Preparation for August 8 webinar

- Review NNHQIC's [Infections – Probing Questions](#) document

Prevent and Manage Infections Safely: C. difficile

Probing Questions

November 21, 2016



Why is our C. difficile infection (CDI) rate high?

- Is our CDI rate higher than in previous years?
- What is driving our high CDI rate?
- Are CDI rates high at the hospitals that frequently transfer residents to our nursing home?

Which groups are most affected?

- Are the CDI cases mainly happening with residents that have had a recent history of CDI? Or, are they brand new cases (incident cases)?
- Are CDI rates higher among residents that have been hospitalized within the last 30 days?
- Are CDI rates higher among residents who were admitted on antibiotics or who have recently (within past 2 weeks) received an antibiotic course?

Other Learning Opportunities

<http://www.qiprogram.org/nursing-home-training-sessions>

The screenshot shows a website page with a navigation menu at the top: PATIENTS & FAMILIES, HEALTH CARE PROVIDERS, PARTNERSHIPS & INITIATIVES, ABOUT, EVENTS, NEWS. The main content area is titled "Nursing Home Training Sessions Introduction". On the left, there is a list of training sessions:

- 1. TeamSTEPS® in LTC: Communication Strategies to Promote Quality and Safety
- 2. Exploring Antibiotics and their Role in Fighting Bacterial Infections
- 3. Antibiotic Resistance: How it Happens and Strategies to Decrease the Spread of Resistance
- 4. Antibiotic Stewardship
- 5. Clostridium difficile Part One: Clinical Overview
- 6. Clostridium difficile Part Two: Strategies to Prevent, Track, and Monitor C. difficile

The main text area contains a "Train-the-Trainer Series" diagram with three arrows pointing to the right, and a paragraph: "We hope that you find these training tools and resources helpful in your work to implement antibiotic stewardship and prevent C. difficile infections in your residents. All are welcome to explore this site and use the information as applicable to you and your organization. Thank you for your dedication to preventing infections in residents (and staff, too) and promoting appropriate antibiotic use." Below this is a section titled "Training sessions and resources for nursing homes to support:" with a bullet point: "Implementation of principles and practices of". To the right of this section is a blue box with the text "C. difficile harms residents!" and a small note: "C. difficile caused almost half a million infections".

Questions?

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