

# Educational Module for Nurses in Long-term Care Facilities: Antibiotic Use & Antibiotic Resistance

Antibiotic resistance is an increasing concern for everyone.

This module:

- Defines antibiotic resistance
- Describes how antibiotic-resistant organisms develop
- Outlines the impact of antibiotic resistance on you, your family, and long-term care facility residents
- Provides action steps to manage the development and spread of antibiotic-resistant organisms

This module complements your facility's infection prevention and control guidance, so be sure to review other infection prevention and control modules.



## Pre-test

1. Define the term "antibiotic resistance".
2. Describe at least one mechanism of the development of antibiotic resistance.
3. Define at least three factors that contribute to antibiotic resistance in long-term care facility residents.
4. List at least three action steps that you can take in your nursing practice to prevent antibiotic resistance and the spread of antibiotic-resistant organisms in long-term care facilities.

Antimicrobials are a large group of medications that include:

- Antibiotics - to treat bacterial infections
- Antivirals - to treat viral infections
- Antifungals - to treat fungal infections
- Antiparasitics - to treat infections caused by parasites

This educational module specifically deals with antibiotic use and antibiotic resistance among bacteria. Be aware that documented resistance to varying antimicrobial drugs exists among other types of microorganisms.

Antibiotic resistance is one of the most important public health threats that we face today. Infections caused by antibiotic-resistant organisms require treatment with more toxic and expensive antibiotics, and often result in increased rates of hospitalization and healthcare costs.

Antibiotic use is the biggest driving factor in the development of antibiotic-resistant organisms. This is particularly a concern in long-term care facilities (LTCF) where antibiotic use is very common. LTCF residents are frequently prescribed antibiotics. Unfortunately, antibiotics are often prescribed for symptoms that resemble a bacterial infection but actually may be due to viruses, or even non-infectious causes. When this happens, antibiotics are not only ineffective in resolving the symptoms but also increase the resident's chance of developing a future infection caused by antibiotic-resistant organisms. Once antibiotic-resistant organisms are present in an individual or in a healthcare facility, these organisms can spread easily via inadequate infection control and prevention - often as a result of poor hand hygiene.

## Antibiotic Resistance

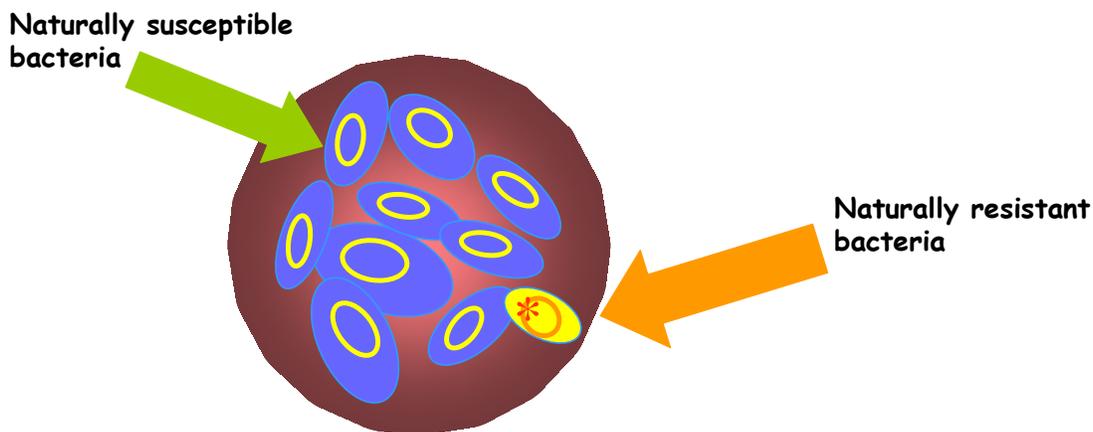
### What is antibiotic resistance?

Antibiotic resistance is the ability of an organism to mutate or change to fight against antibiotics intended to kill it.

### Mechanisms of antibiotic resistance

Antibiotic use is the biggest driver in the development of antibiotic-resistant organisms. To help prevent antibiotic resistance, antibiotics should not be misused.

The biological mechanisms by which organisms become resistant to antibiotics vary depending on the organism. Bacteria can become resistant through changes in genes (mutations) or bacteria can acquire new genes from other bacteria (gene transfer).



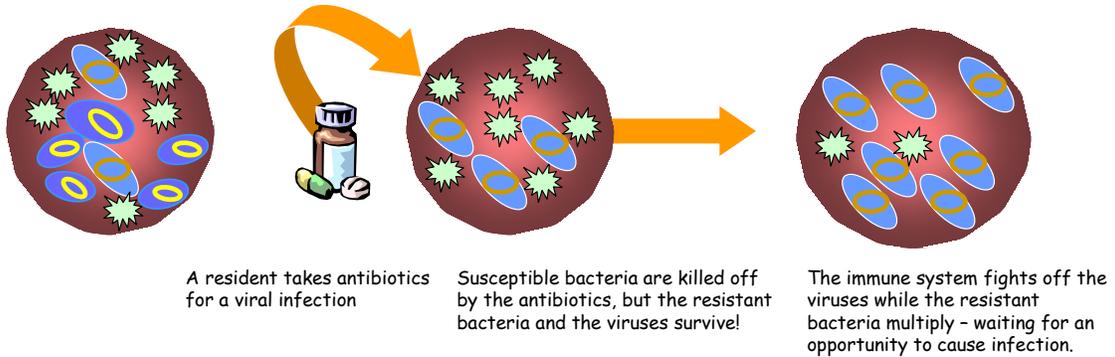
If bacteria with resistant genes are exposed to antibiotics, the antibiotics will kill the susceptible bacteria, allowing the resistant bacteria to survive and multiply. If these antibiotic-resistant bacteria cause an infection, the infection may be more serious and difficult to treat with routine antibiotics.

The following diagram shows how misusing antibiotics (not finishing a prescription or taking antibiotics for a viral infection) can cause antibiotic-resistant bacteria to multiply.

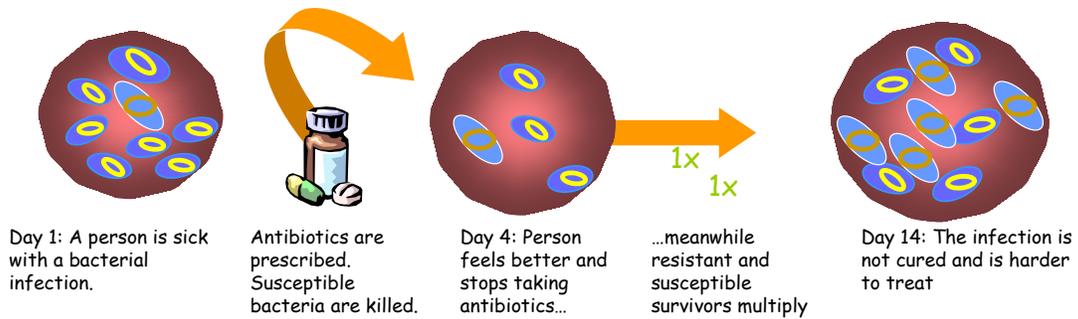
Here are the players:

-  Virus
-  Naturally Resistant Bacteria
-  Susceptible Bacteria

Taking antibiotics for a viral infection:



Not finishing the full course of antibiotics can also lead to antibiotic resistance:



## Examples of antibiotic misuse

Here are more examples of antibiotic misuse that can lead to the development of resistant microorganisms.

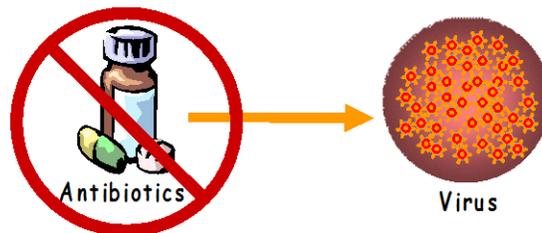
- Use of broad-spectrum antibiotics when a narrow-spectrum antibiotic would be effective.
  - Broad-spectrum antibiotics are active against a wide variety of bacteria. As a result, these drugs kill infection-causing bacteria and bacteria that exist in the intestinal tract or other parts of the body but do not cause disease (“normal bacterial flora”). Broad-spectrum antibiotics are stronger than narrow-spectrum antibiotics and therefore often cause more severe side effects. Narrow-spectrum antibiotics, on the other hand, kill a smaller range of bacteria but are generally better tolerated. For instance, prescribing ciprofloxacin (a broad-spectrum antibiotic) when lab results indicate that penicillin (a narrow-spectrum agent) can kill the bacteria that are present.
- Prescribing antibiotics for too many days.
  - An example is giving a resident a prescription for a 14-day course when a 7-day course is sufficient.
- Not completing an antibiotic prescription.
  - The person stops taking the antibiotic when they feel better instead of when their prescription is gone. Even when symptoms improve, bacteria remain and multiply. The infection returns a few weeks later, and this time a different antibiotic may be needed to treat it.

## Misuse of antibiotics

### Antibiotics are not effective against viral infections

Antibiotics will not:

- Cure viral infections
- Stop the spread of viruses
- Make you feel better if you have a viral infection



Antibiotics have NO EFFECT on viruses!

Most upper respiratory infections (like the common cold) are caused by viruses; antibiotics cannot treat viral infections.

Taking antibiotics when they are not clinically indicated can result in:

- Drug-drug interactions
- Medication side effects
- Increased health care costs

### When are antibiotics not needed?

One example of antibiotic misuse is prescribing antibiotics for "asymptomatic bacteriuria" (bacteria in the urine without the presence of clinical symptoms).

Another example is green or yellow nasal discharge. This symptom alone does not mean that a person has a bacterial infection. A physician or nurse practitioner must assess all of the person's symptoms to determine if the person needs antibiotics. Green and yellow nasal discharge without other symptoms is not an indication for antibiotics.

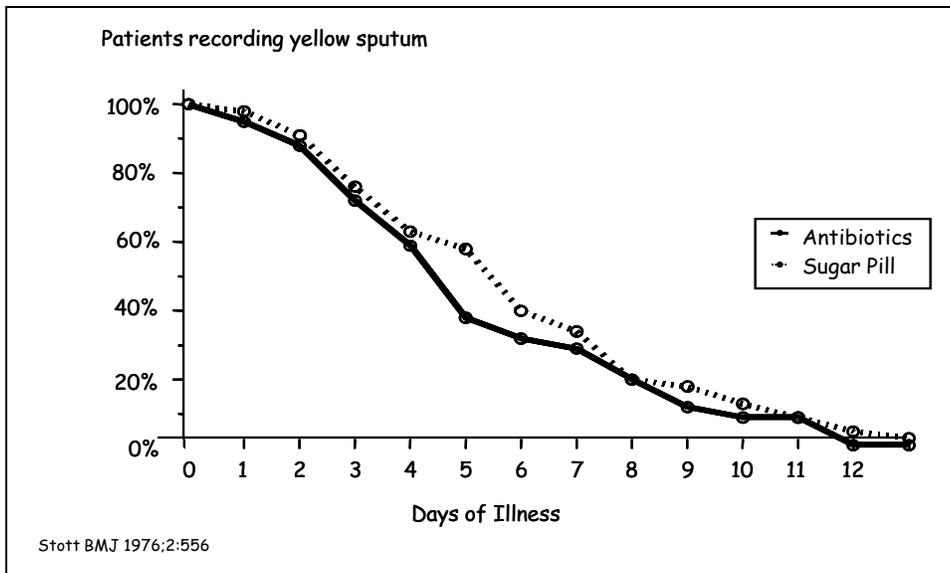


Figure 1: Effect of Antibiotics on Respiratory Symptoms<sup>4</sup>

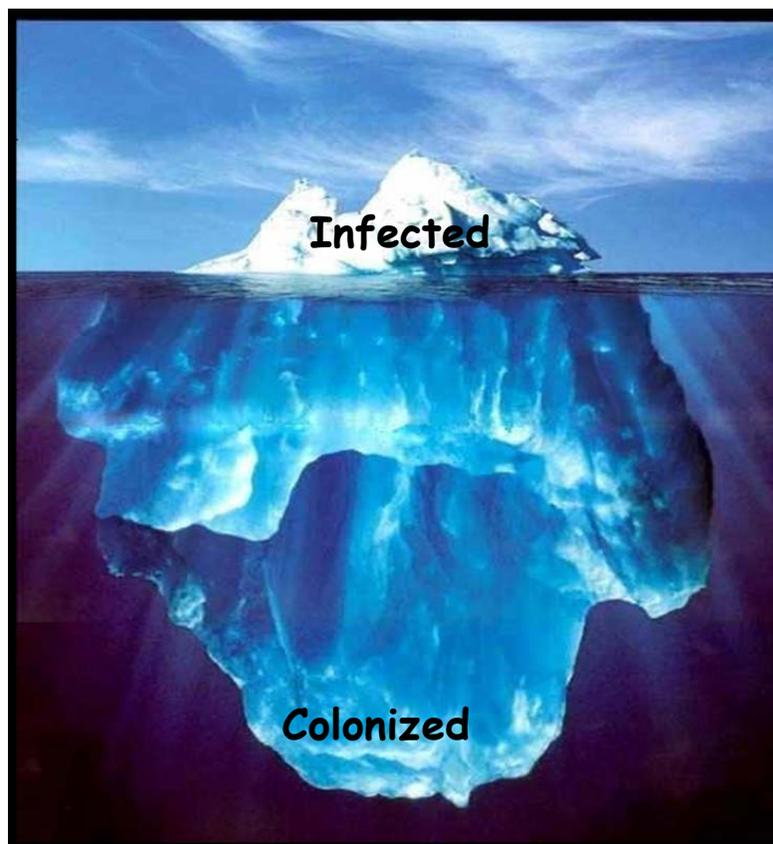
The figure above is from a study that looked at patients with yellow sputum and split them into two groups. Group 1 was given antibiotics while Group 2 was given a sugar pill. As you can see from the graph above, both groups of patients improved at the same rate - regardless of their treatment!

**Are there new antibiotics to take the place of existing antibiotics that are no longer effective due to antibiotic resistance?**

The effectiveness of existing antibiotics must be preserved as much as possible through judicious antibiotic use. While some pharmaceutical companies are engaged in the research and development of new antibiotic agents, this is not the answer. On average, it takes 10 years and \$800 million dollars per new antibiotic that comes on the market!

## Infection vs. colonization

Bacteria can be present in your body or on your skin, but not cause an infection. This is called colonization. An example of colonization is a person with *Staphylococcus aureus* on their skin or in their nose - without clinical symptoms of an infection. However, if that person develops a wound, a cut, or experiences any other event that causes an opening in their skin, they have an increased chance that the *S. aureus* bacteria will enter the skin opening and cause an infection.



This iceberg graphically represents colonization versus infection. Patients that are infected with an organism represent just the "tip of the iceberg" of patients that are colonized or infected. Just because a patient is not infected or showing signs of infection (e.g. fever, increased white blood cell count, reddened skin lesion, etc.), does not mean that they do not carry organisms that could be transferred to another patient. Caring for colonized residents can result in contamination of healthcare workers hands. Contaminated hands spread organisms to other residents and the environment. Hand hygiene is critical in preventing disease transmission!

## Prevent antibiotic resistance

- Take antibiotics only for bacterial infections. Let your healthcare provider decide if antibiotics are needed to treat your infection!
- Do not demand antibiotics: for yourself, your family, or LTCF residents.
- Finish the entire prescription - even if the symptoms resolve. Not completing a course of antibiotics contributes to antibiotic resistance.
- Do not share antibiotics with others - even if they have the same symptoms.

Antibiotic resistance is everyone's problem. Infections caused by antibiotic-resistant organisms can spread from person to person in healthcare settings, childcare settings, and families. We all have to do our part to prevent antibiotic resistance from occurring and spreading.

Table 1 shows how the number of antibiotic prescriptions could be decreased by over 50 million/year if antibiotics were not prescribed for five infections that are commonly caused by viruses.

Table 1: Estimated Potential Reduction in Antibiotic Prescriptions

Diagnosis	Appropriate management	Potential annual reduction	Potential annual reduction (# of prescriptions)*
Common Cold	No antibiotics needed	100%	17,922,000
Bronchitis (chest cold)	No antibiotics unless specific bacterial organism is identified or underlying lung disease	80%	13,059,200
Otitis Media (ear infection)	No antibiotics for clear fluid in the middle ear	30%	7,094,400
Pharyngitis (sore throat)	No antibiotics unless positive for Group A Strep	50%	6,555,000
Sinusitis	No antibiotics unless ill for more than 10 days or patient has severe symptoms	50%	6,480,500
<b>Total</b>		<b>46.3%</b>	<b>51,115,600</b>

\*Estimated from National Ambulatory Medical Care Survey data, 1992

## Antibiotic Use in Long Term Care Facilities

Antibiotics account for about 40% of all prescriptions written in LTCF. Up to 70% of LTCF residents receive at least one systemic antibiotic every year. Up to 75% of these antibiotics are not needed because they are prescribed for non-bacterial infections or conditions. There are many reasons antibiotics are prescribed unnecessarily, including inability of LTCF residents to communicate their symptoms to care givers and the effects of aging that alter the immune response to infections in the elderly.

At the same time, infections are very common among LTCF residents. The most frequent infections among LTCF residents are:

- Urinary tract infections (UTI)
- Lower respiratory tract infections such as influenza or pneumonia
- Skin and soft tissue infections
- Gastroenteritis

Elderly people, often LTCF residents, are at higher risk for infections than healthy, younger adults for several reasons including:

- Factors associated with living in a LTCF setting
- Resident factors (e.g., chronic illness, age, functional impairment)
- High rates of antibiotic usage

### Facility factors

- Close living conditions
  - The likelihood of exposure to a variety of bacteria and viruses is increased when people live in close proximity to one another and participate in frequent group activities.
- Low influenza vaccination rates among LTCF staff
  - One study of healthcare workers in LTCF found that when even just 61% of the healthcare workers were vaccinated, total resident mortality was reduced from 17% to 10%.<sup>1</sup>
- Transfer between acute and long-term care settings
  - Many LTCF residents are admitted to the LTCF from an acute care setting, and transfer to and from these types of facilities is common among the elderly and those requiring extended care. Each transfer provides an opportunity for organisms to spread between facilities.

- Inadequate hand hygiene
  - A study of a 255-bed facility observed staff-resident interactions and found that staff washed their hands 27% of the time it was needed before interacting with a resident.<sup>2</sup> They further determined that microbes could be transmitted from staff to residents in 82% of the staff-resident interactions.<sup>2</sup>

### **Resident factors**

- Increased age
  - Older people have weaker immune systems and are less able to fight infections.
- Chronic disease
  - Chronic diseases like diabetes, heart disease, and kidney disease lower a person's ability to fight infections.
  - Residents with degenerative neurological diseases (e.g. Alzheimer's, Parkinson's, and cerebrovascular diseases) often have a neurogenic bladder. This increases their risk for a UTI.
- Functional impairment
  - Decreased mobility increases the risk for skin breakdown leading to skin infections.
- Invasive devices
  - Devices that enter the body (like catheters) provide a pathway for bacteria and viruses to enter the body.

## Preventing Transmission of Antibiotic-resistant Organisms in Long Term Care Facilities

For the most part, facility factors that increase residents' risk of infections such as close living quarters or transfer from acute care hospitals to LTCF cannot be altered. Additionally, little can be done to alter resident factors like increased age and decreased immune capacity.

Steps that you can take to prevent transmission of antibiotic-resistant organisms in your facility:

- Practice excellent hand hygiene; clean your hands every time you provide care for a resident
- Follow recommended infection prevention and control practices
- Use antibiotics only when clinically indicated
- 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)

Steps you can take to reduce the risk of infection among LTCF residents:

- Discontinue the use of invasive devices when clinically appropriate. For example, remove indwelling urinary catheters within 48 hours after admission to a LTCF unless medically indicated.
- Limit the exposure of healthy residents to infected residents by cohorting (grouping or rooming residents with the same illness or infection together).
- Use excellent infection control practices - especially hand hygiene.
- Always use Standard Precautions. That is, use personal protective equipment such as gowns, gloves, masks, etc. as indicated by the symptoms the resident has (coughing, incontinence) and the care you are going to give that resident (e.g. change a dressing or perform tracheostomy care).
- Use nursing assessment skills to accurately evaluate a resident's symptoms and notify their primary care provider of changes as needed.
- Clean your hands (soap and warm water or alcohol-based hand rubs if hands are not visibly soiled) before and after providing resident care.

## Effective diagnosis and treatment

- Obtain microbiology cultures whenever possible to guide appropriate antibiotic use.
  - Collect specimens for cultures prior to the initiation of treatment to ensure accurate results
- Do not request antibiotics for viral infections (like influenza, colds, acute bronchitis) or for asymptomatic bacteriuria (bacteria in the urine when the resident does not have clinical symptoms of a UTI).

## Optimize antibiotic use

- If bacteria are identified in a laboratory specimen (blood, urine, etc.), the microbiology lab can perform an antibiotic susceptibility test. This test will identify if the bacteria are susceptible (can be killed by the antibiotic) or resistant (cannot be killed by the antibiotic) to specific antibiotics. Antibiotic susceptibility tests are important to determine which antibiotic should be prescribed to effectively treat the infection.
- When laboratory results are complete, notify the prescriber and facilitate a re-assessment of the antibiotic prescribed.
  - If culture results are negative, recommend discontinuation of antibiotics.
- If culture results are positive:
  - Ensure that the provider has the susceptibility report to facilitate changing to a narrower spectrum agent.
  - Assess for de-escalation opportunities (e.g. from IV to P.O.)
- Promote the 5 D's of optimal antibiotic therapy: diagnosis, drug, dose, duration, and de-escalation.
  - While providers are responsible for making treatment decisions, nursing assessment, communication, and documentation are essential contributions to 1) informed provider decision making and 2) resident health and safety promotion, as described below.

## Antimicrobial stewardship

Antimicrobial stewardship is a multidisciplinary approach that includes strategies to prevent antimicrobial misuse so that the benefits of antimicrobials outweigh the risks.

Principles of antimicrobial stewardship in LTCF include:

- Using antibiotics only when they are needed
- Assisting residents in managing symptoms of non-bacterial infections
- Using evidence-based guidelines regarding indication for treatment, antibiotic selection, and duration of antibiotic therapy

Ingredients for a successful antimicrobial stewardship program:

- Education for nurses and providers
  - Evidence-based guidelines for clinical assessment, testing for and treating infections
- Accurate assessment of resident changes in condition
  - Thorough, accurate and timely assessment of a resident's change in condition leads to correct symptom recognition
- Accurate, timely communication of resident signs/symptoms and laboratory results to key healthcare personnel
  - Communication of resident changes in condition to appropriate staff leads to correct action being taken
- Documentation of resident changes in condition, including signs and symptoms of a possible infection
  - Documentation of resident assessment findings leads to correct follow-up
- Participation of all care providers within the LTCF

## Prevent Transmission

Stopping the spread of organisms from one person to another is a critical way to control antibiotic resistance. Transmission of organisms can be prevented by using:

### Hand hygiene

- Clean your hands before and after caring for all residents.

### Standard Precautions

- Use Standard Precautions in the care of all residents - all the time - regardless of whether they are known to be colonized or infected with any organism.
- Standard Precautions are sufficient for most LTCF residents with antibiotic-resistant organisms.
- Standard Precautions include:
  - Hand hygiene
  - Use of appropriate personal protective equipment (PPE):
    - Gloves when you expect to have contact with blood, body fluids, secretions, excretions and contaminated items
    - Gown to protect your clothing against contact with resident blood, body fluid, secretions or excretions or contaminated items.
    - Mask and eye protection (goggles) when you anticipate spraying or splashing when providing care to the resident
  - Respiratory hygiene and cough etiquette
    - Cover your mouth and nose with a tissue when coughing or sneezing; dispose of the tissue and perform hand hygiene
    - Use your sleeve if tissues are not available

The type of PPE that you need is determined by the type of care you are going to give the resident. Screening for antibiotic-resistant organisms among LTCF patients is not recommended; care givers must take steps to protect themselves and their residents by following Standard Precautions.

### Contact Precautions

- Contact Precautions should be implemented for any resident that:
  - Has a wound or skin lesion that cannot be covered fully by dressings or has drainage that cannot be completely contained by dressings;
  - Is incontinent and has urine and/or stool that cannot be contained in incontinence products, urine bags, or ostomy bags;
  - Has a tracheostomy with large amounts of secretions that cannot be contained and are contaminating the environment;

- Has been epidemiologically linked to infections caused by antibiotic-resistant organisms in other residents.
- Contact Precautions include:
  - Hand hygiene
  - Gloves: clean, non-sterile; should be changed and hands cleaned after contact with material that may contain high concentrations of microorganisms
  - Gowns: clean, non-sterile, long-sleeved; for duration of exposure to resident or resident's environment
    - When providing direct care to residents with antibiotic-resistant or other disease-causing organisms (e.g., performing ADLs) or if anticipating contact with secretions/excretions (e.g., linen changes, incontinence care)
    - When anticipating contact with items or surfaces potentially contaminated with antibiotic-resistant or other disease-causing organisms (e.g., those close to or used by the resident)
  - Resident care equipment: dedicate to a single resident

### **Cohorting**

- If private rooms are not available, room residents with others known to be colonized or infected with the same organism. During an outbreak, a wing or area of a facility may need to be identified for housing residents who are ill or infected with the same organism.

## Resident, Family and Visitor Education

- Infection prevention and control recommendations for residents in LTCF differ from those for patients in an acute care setting. Hospitalized patients are at increased risk of infection due to patient acuity level, frequent presence of invasive devices, and vulnerability of many patients in the acute care setting. Therefore, Contact Precautions are generally implemented for all patients known to have antibiotic-resistant organisms while they are in an acute care hospital.

## Antibiotic Resistance Can Affect Everyone

- Increasing antibiotic resistance threatens the use of antibiotics for common infections in people of any age. For example, one type of bacteria that causes ear infections in children used to be treated easily with a type of penicillin. However, because of the development of antibiotic resistance, these bacteria are now often resistant to penicillin, and require a stronger, more expensive antibiotic to treat the infection.
- Everyone is at risk for getting an antibiotic-resistant infection - not just people with weak immune systems or those who are taking antibiotics. Antibiotic-resistant bacteria, like methicillin-resistant *Staphylococcus aureus* (MRSA), can spread through direct contact within a family, a childcare center, or a healthcare facility.
- While antibiotics are powerful medicines and are essential to the treatment of some infections, antibiotics can also cause harmful side effects. Side effects of antibiotics often include: upset stomach, rashes, interactions with other medications, and diarrhea. Antibiotic-associated diarrhea can be caused by a bacterium called *Clostridium difficile* (*C. difficile*). *C. difficile* infection (CDI) is the most common cause of infectious diarrhea acquired in healthcare settings. Symptoms range from mild to severe and include watery diarrhea, fever, malaise, and abdominal cramping. (See *Clostridium difficile* module.)
- Antibiotic resistance is increasing healthcare costs in many ways. Patients with resistant infections often need to be hospitalized, seen by their doctor many times, and treated with more expensive antibiotics.

## Summary

Antibiotic resistance is increasing, and poses a health threat to LTCF residents, healthcare workers, and communities.

- Antibiotic resistance occurs through different mechanisms. These include genetic mutations (naturally occurring changes within the bacteria) or the transfer of genetic material between bacteria that allow the bacteria to survive against antibiotics.

Factors that contribute to antibiotic resistance include misuse of antibiotics:

- Treating non-bacterial infections with antibiotics.
  - Antibiotics are not effective against viruses - and cannot cure or ease the symptoms of viral infections.
- Not finishing a prescription.
  - This allows remaining bacteria - often those that have acquired antibiotic resistance - to multiply and cause another infection.
- Using a broad spectrum antibiotic when a narrow spectrum agent would be effective.

You can - and must - implement steps in your nursing practice to help prevent the development and transmission of antibiotic-resistant microorganisms.

Specific steps you can take include:

- Perform a thorough nursing assessment prior to contacting a physician or nurse practitioner about a resident's change in status.
- Document observations and assessment findings; communicate clearly and accurately to the resident's clinician.
- Implement comfort measures and further observation if recommended; do not demand an antibiotic if the provider does not believe one is indicated at that time.
- Recognize resident risk factors (compromised immune system, age, chronic conditions) for developing an infection.
- Be aware that symptoms of bacterial and viral infections are often similar and that antibiotics are never effective against viral infections.
- Educate residents and family members about antibiotic resistance and infection prevention measures.
- Practice excellent hand hygiene.
- Use Standard Precautions in the care of all residents.

## Post-test

1. Define the term "antibiotic resistance".
2. Describe at least one mechanism of the development of antibiotic resistance.
3. Define at least three factors that contribute to antibiotic resistance in LTCF residents.
4. List at least three action steps that you can take in your nursing practice to prevent antibiotic resistance and the spread of antibiotic-resistant organisms in LTCF.

## Glossary

**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** - 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.

**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.

## References

1. Potter J, Stott DJ, Roberts MA, et al. Influenza vaccination of health care workers in long-term-care hospitals reduces the mortality of elderly patients. *J Infect Dis.* 1997;175:1-6.
2. Thompson BL, Dwyer DM, Ussery XT, Denman S, Vacek P, Schwartz B. Handwashing and glove use in a long-term-care facility. *Infect Control Hosp Epidemiol.* 1997;18:97-103.
3. Nicolle LE, Bentley DW, Garibaldi R, Neuhaus EG, Smith PW. Antimicrobial use in long-term-care facilities. SHEA Long-Term-Care Committee. *Infect Control Hosp Epidemiol.* 2000;21:537-545.
4. Stott NC, West RR. Randomised controlled trial of antibiotics in patients with cough and purulent sputum. *Br Med J.* 1976;2:556-559.

## For more information

Minnesota Department of Health (MDH) Infection Prevention and Control  
[www.health.state.mn.us/divs/idepc/dtopics/infectioncontrol/guidelines.html](http://www.health.state.mn.us/divs/idepc/dtopics/infectioncontrol/guidelines.html)

Minnesota Antibiotic Resistance Collaborative [www.minnesotaarc.org](http://www.minnesotaarc.org)

Centers for Disease Control and Prevention (CDC) General Information about Antibiotic Resistance  
[www.cdc.gov/drugresistance/](http://www.cdc.gov/drugresistance/)

CDC Campaign to Prevent Antibiotic Resistance  
[www.cdc.gov/getsmart/healthcare/](http://www.cdc.gov/getsmart/healthcare/)

Alliance for the Prudent Use of Antibiotics  
[www.tufts.edu/med/apua/](http://www.tufts.edu/med/apua/)

Guideline for the Management of Antimicrobial Resistant Microorganisms in Minnesota Long-Term Care Facilities  
[www.health.state.mn.us/divs/idepc/dtopics/infectioncontrol/ltcguideline.htm](http://www.health.state.mn.us/divs/idepc/dtopics/infectioncontrol/ltcguideline.htm)