Get Smart: Know When Antibiotics Work

About Antibiotic Resistance

What is an antibiotic?

Antibiotics, also known as antimicrobial drugs, are drugs that fight infections caused by bacteria. Alexander Fleming discovered the first antibiotic, penicillin, in 1927. After the first use of antibiotics in the 1940s, they transformed medical care and dramatically reduced illness and death from infectious diseases.

The term "antibiotic" originally referred to a natural compound produced by a fungus or another microorganism that kills bacteria which cause disease in humans or animals. Some antibiotics may be synthetic compounds (not produced by microorganisms) that can also kill or inhibit the growth of microbes. Technically, the term "antimicrobial agent" refers to both natural and synthetic compounds; however, many people use the word "antibiotic" to refer to both. Although antibiotics have many beneficial effects, their use has created the new problem of antibiotic resistance.

What is antibiotic resistance?

Antibiotic resistance is the ability of bacteria or other microbes to resist the effects of an antibiotic. Antibiotic resistance occurs when bacteria change in some way that reduces or eliminates the effectiveness of drugs, chemicals, or other agents designed to cure or prevent infections. The bacteria survive and continue to multiply causing more harm.

Why should I be concerned about antibiotic resistance?

Antibiotic resistance has been called one of the world's most pressing public health problems. Over the last decade, almost every type of bacteria has become stronger and less responsive to antibiotic treatment when it is really needed. These antibiotic-resistant bacteria can quickly spread to family members, schoolmates, and co-workers - threatening the community with a new strain of infectious disease that is more difficult to cure and more expensive to treat. For this reason, antibiotic resistance is among CDC's top concerns.

Antibiotic resistance can cause significant danger and suffering for children and adults who have common infections, once easily treatable with antibiotics. Microbes can develop resistance to specific medicines. A common misconception is that a person's body becomes resistant to specific drugs. However, it is microbes, not people, that become resistant to the drugs.

If a microbe is resistant to many drugs, treating the infections it causes can become difficult or even impossible. Someone with an infection that is resistant to a certain medicine can pass that resistant infection to another person. In this way, a hard-to-treat illness can be spread from person to person. In some cases, the illness can lead to serious disability or even death.

Why are bacteria becoming resistant to antibiotics?

Antibiotic use promotes development of antibiotic-resistant bacteria. Every time a person takes antibiotics, sensitive bacteria are killed, but resistant germs may be left to grow and multiply. Repeated and improper uses of antibiotics are primary causes of the increase in drug-resistant

bacteria.

While antibiotics should be used to treat bacterial infections, they are not effective against viral infections like the common cold, most sore throats, and the flu. Widespread use of antibiotics promotes the spread of antibiotic resistance. Smart use of antibiotics is the key to controlling the spread of resistance.

Antibiotics kill bacteria, not viruses

How do bacteria become resistant to antibiotics?

Antibiotic resistance occurs when bacteria change in some way that reduces or eliminates the effectiveness of drugs, chemicals, or other agents designed to cure or prevent infections. The bacteria survive and continue to multiply causing more harm. Bacteria can do this through several mechanisms. Some bacteria develop the ability to neutralize the antibiotic before it can do harm, others can rapidly pump the antibiotic out, and still others can change the antibiotic attack site so it cannot affect the function of the bacteria.

Antibiotics kill or inhibit the growth of susceptible bacteria. Sometimes one of the bacteria survives because it has the ability to neutralize or evade the effect of the antibiotic; that one bacterium can then multiply and replace all the bacteria that were killed off. Exposure to antibiotics therefore provides selective pressure, which makes the surviving bacteria more likely to be resistant. In addition, bacteria that were at one time susceptible to an antibiotic can acquire resistance through mutation of their genetic material or by acquiring pieces of DNA that code for the resistance properties from other bacteria. The DNA that codes for resistance can be grouped in a single easily transferable package. This means that bacteria can become resistant to many antimicrobial agents because of the transfer of one piece of DNA.

The Food and Drug Administration's (FDA's) Center for Veterinary Medicine (CVM) produced a nine-minute animation explaining how antimicrobial resistance both emerges and proliferates among bacteria. Over time, the use of antimicrobial drugs will result in the development of resistant strains of bacteria, complicating clinicians' efforts to select the appropriate antimicrobial for treatment.

How can I prevent antibiotic-resistant infections?

Only use antibiotics when they are likely to be beneficial

By visiting this website, you are taking the first step to reducing your risk of getting antibiotic-resistant infections. It is important to understand that, although they are very useful drugs, antibiotics designed for bacterial infections are not useful for viral infections such as a cold, cough, or flu. Some useful tips to remember are:

1. Talk with your healthcare provider about antibiotic resistance:
   - Ask whether an antibiotic is likely to be beneficial for your illness
   - Ask what else you can do to feel better sooner.
2. Do not take an antibiotic for a viral infection like a cold or the flu.
3. Do not save some of your antibiotic for the next time you get sick. Discard any leftover medication once you have completed your prescribed course of treatment.
4. Take an antibiotic exactly as the healthcare provider tells you. Do not skip doses. Complete the prescribed course of treatment even if you are feeling better. If treatment stops too soon, some bacteria may survive and re-infect.
5. Do not take antibiotics prescribed for someone else. The antibiotic may not be appropriate for your illness. Taking the wrong medicine may delay correct treatment

and allow bacteria to multiply.

6. If your healthcare provider determines that you do not have a bacterial infection, ask about ways to help relieve your symptoms. Do not pressure your provider to prescribe an antibiotic.

How can healthcare providers help prevent the spread of antibiotic resistance?

- Only prescribe antibiotic therapy when likely to be beneficial to the patient
- Use an agent targeting the likely pathogens
- Use the antibiotic for the appropriate dose and duration

View CDC's Academic Detailing Sheets for providers

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