Antibiotic Resistance

Questions about Bacteria, Viruses, and Antibiotics

Q: What are bacteria and viruses?

A: Bacteria are single-celled organisms usually found all over the inside and outside of our bodies, except in the blood and spinal fluid. Many bacteria are not harmful. In fact, some are actually beneficial. However, disease-causing bacteria trigger illnesses, such as strep throat and some ear infections. Viruses are even smaller than bacteria. A virus cannot survive outside the body's cells. It causes illnesses by invading healthy cells and reproducing.

Q: What kinds of infections are caused by viruses and should not be treated with antibiotics?

A: Viral infections that should not be treated with antibiotics include:

- Colds
- Flu
- Most coughs and bronchitis
- Sore throats (except for those resulting from strep throat)
- Some ear infections

Q: What is an antibiotic?

A: Antibiotics, also known as antimicrobial drugs, are drugs that fight infections caused by bacteria. Alexander Fleming discovered the first antibiotic, penicillin, in 1928. 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 contributed to the problem of antibiotic resistance.

Questions about Antibiotic Resistance

Q: What is antibiotic resistance?

A: 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.

Q: Why should I be concerned about antibiotic resistance?

A: Antibiotic resistance has been called one of the world's most pressing public health problems. 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.

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.

Q: Why are bacteria becoming resistant to antibiotics?

A: 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

Q: How do bacteria become resistant to antibiotics?

A: 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 escape 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. 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.

Q: How can I prevent antibiotic-resistant infections?
Only use antibiotics when they are likely to be beneficial

A: 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 the 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.

Q: How can healthcare providers help prevent the spread of antibiotic resistance?
A: Prevent the spread of antibiotic resistance by

- 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

Questions about Antibacterial Cleaning Agents, Acne Medication, and Probiotics

Q: Are antibacterial-containing products (soaps, household cleaners, etc.) better for preventing the spread of infection? Does their use add to the problem of resistance?

A: An essential part of preventing the spread of infection in the community and at home is proper hygiene. This includes hand-washing and cleaning shared items and surfaces. Antibacterial-containing products have not been proven to prevent the spread of infection better than products that do not contain antibacterial chemicals. Although a link between antibacterial chemicals used in personal cleaning products and bacterial resistance has been shown in vitro studies (in a controlled environment), no human health consequence has been demonstrated. More studies examining resistance issues related to these products are needed.

Q: Can antibiotic resistance develop from acne medication?

A: Antibiotic use, appropriate or otherwise, contributes to the development of antibiotic resistance. This is true for acne medications that contain antibiotics. Short and long-term use of antibiotics for treatment or prevention of bacterial infections should be under the direction of a physician to ensure appropriate use and detection of resistance.

Adapted from : Centers for Disease Control and Prevention
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