Fighting the Impact of Antibiotic-Resistant Bacteria

Q&A with David White and Edward Cox

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The resistance of bacteria to antibiotics and similar drugs—called antimicrobials—is considered a major public health threat by the Food and Drug Administration (FDA) and its counterparts around the world.

Antibiotics have transformed health care since they were introduced in the 1940s and have been widely used to fight bacterial infections. These and similar drugs kill or inhibit the growth of disease-causing microorganisms.

However, some infectious organisms have developed resistance to the antibiotics used to treat patients with infections. When bacteria become resistant to an antibiotic, that medicine becomes less effective. Medical treatment of people infected with these drug-resistant organisms can become more complicated, leading to longer hospital stays, increased health care costs, and in extreme cases, to untreatable infections.

At FDA, the work to identify and contain antimicrobial resistance includes two parallel tracks:

- efforts to reduce drug-resistant bacteria in foods and in animals that enter the food supply, and
- facilitating the development of

Stuart Gaines, an FDA microbiologist who works with the National Antimicrobial Resistance Monitoring System, examines the growth of a bacterial culture.

new antibiotics to treat patients while preserving the effectiveness of existing antibiotics.

David White, Ph.D., chief science officer in FDA's Office of Food and Veterinary Medicine, and Edward Cox, M.D., M.P.H., director of FDA's Office of Antimicrobial Products in the Center for Drug Evaluation and Research (CDER), explain the challenges presented by antimicrobial resistance and the efforts being made to combat this public health risk.

Is antimicrobial resistance caused entirely by overuse or inappropriate use of prescription antibiotics, both in humans and animals?

Cox: Any use of antibiotics, even appropriate therapeutic use, can promote the development of resistant bacteria. An antibiotic acts on the bacteria causing the infection, but it also affects the "good" bacteria that we all have and need in our bodies (such as the bacteria in our gastrointestinal tract). That's why it's important to only use antibiotics when your doctor prescribes them for the treatment of a bacterial infection. Taking an antibiotic when you don't have a bacterial infection doesn't treat your illness and can set off a chain of events that can lead to the development of resistant bacteria. So it's vital that we use these drugs appropriately to help slow the rate at which bacteria develop resistance to antibiotics.

White: Some antimicrobial resistance occurs naturally and is known as intrinsic resistance, an inherent characteristic of some specific types of bacteria. These intrinsic resistances should generally be known by health care professionals to avoid the use of inappropriate or ineffective treatments.

Why are antibiotic-resistant bacteria such a risk to public health?

Cox: They can take away good treatment options that we need to treat patients' infections. When bacteria become resistant to the antibiotics typically used to treat an infection, doctors could be forced to resort to treatments not proven to be as effective, or that have more side effects.

White: The fundamental concern over the agricultural use of antibiotics arises from the potential that resistant bacterial strains can be transferred to humans via direct contact, or ingestion of food derived from treated animals. This is a legitimate concern as epidemiological and microbiological data show that resistant bacteria from food animals can reach humans via the food supply. And most classes of antimicrobials used in animals have human counterparts. Therefore, resistance to an animal drug might translate into resistance to a human drug.

Why are animals given antibiotics?

White: Antibiotics are given to animals for various reasons, including: 1) treatment of sick animals; 2) prevention of illness in healthy animals; and 3) control of disease in a group of animals when some in the group show overt signs of disease.

Antibiotics are also used to improve feed efficiency and weight gain in healthy animals, a practice the FDA has been working to change. In 2012, FDA released a guidance document for the animal health and animal agriculture industries that focuses on two primary principles: 1) limiting medically important antimicrobial

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drugs to uses in food-producing animals that are considered necessary for assuring animal health; and 2) limiting such drugs to uses in food-producing animals that include veterinary oversight or consultation. We think that this voluntary approach will move us forward in the quickest way possible, and it doesn't rule out future regulation.

What is being done to fight the prevalence of drug-resistant bacteria?

Cox: A lot of CDER's efforts are focused on facilitating the development of new antibiotic drugs for treating bacterial infections in patients. We've been revising our recommendations on approaches to developing new antibiotics so that development programs are both scientifically sound and practical, given the challenges of developing a new antibiotic and the urgent need for new therapies. It is important that we have ongoing development of new antibiotics as we try to stay ahead of the development of resistance in bacteria. The need is most urgent for new antibiotics to treat infections in patients for whom we have limited treatment options because their infections have become resistant to the antibiotics that we rely upon.

White: Many governments have initiated surveillance programs. In the U.S., the National Antimicrobial Resistance Monitoring System (NARMS) program monitors antimicrobial resistance among bacteria recovered from food animals, humans and retail meats. Retail meat samples are collected from grocery stores in states participating in the Foodborne Diseases Active Surveillance Network (FoodNet). Participating laboratories from FoodNet states isolate the bacteria of interest and forward the isolates to FDA for further analysis. FDA, the Centers for Disease Control and Prevention and the U.S. Department of Agriculture are all conducting research on resistant strains, including studying their genetic makeup to determine how resistance arises and transfers among microorganisms.

What can consumers do to protect themselves?

Cox: Patients should take antibiotics exactly as directed by their health care professional. They should not demand antibiotics to treat viral infections, such as coughs, colds and the flu. Taking an antibiotic drug when it won't treat your illness is still associated with the risk of side effects from that drug, and can contribute to the development of antibiotic resistance.

We can all play an important role—patients, healthcare providers, and health care institutions—in using antibiotics appropriately so that we have effective antibiotics when we need them to treat patients with a bacterial infection.

White: Thorough cooking will eliminate most bacteria—even resistant bacteria—from meat and poultry but there is always the danger of cross contamination. Consumers must carefully clean any kitchen surfaces used to prepare or store meat or poultry before using them to prepare raw ingredients that will not be cooked.

Are antibiotics still largely effective even with this concern?

Cox: For most patients, antibiotics still work well. But we're very mindful of the patients whose illnesses have become difficult to treat because of antibiotic resistance, and who urgently need new antibiotic treatment options.

White: NARMS data indicates that first line treatments for all four bacteria that we track—*Salmonella*, *Enterococcus*, *E.coli* and *Campylobacter*—are still effective. However, we need to stay vigilant in monitoring emerging antibiotic resistance trends in all disease-causing bacteria of significance to animal and human health.

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