Raising resistance: Industrial production of livestock—and antibiotic-resistant bacteria that threaten human health

Antibiotic-resistant bacteria are a major public health threat, increasingly leading to infections that can be difficult to treat, require longer and more expensive hospital stays, and are more likely to be fatal.[1] There are some infections, in fact, for which there are now few effective antibiotics or none at all.[2] At the same time, the development of new antibiotics has slowed to a trickle.[3] Meanwhile, consumers are exposed to antibiotic-resistant bacteria through their food, air, water, and soil; people in contact with farm animals can also transmit antibiotic-resistant bacteria to communities. While improper use of antibiotics in the health care sector is a contributing factor, organizations such as the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) recognize that the "overuse and misuse of antibiotics in food animals" is a major source of the antibiotic-resistant bacteria that affect humans.[4] Many classes of antibiotics used in U.S. animal agriculture are the same as those used to treat human infections.[5] When bacteria develop resistance, they can become resistant to multiple drugs within an antibiotic class, including those that are used primarily in human medicine.[6]

NRDC

For more information, please contact:

Carmen Cordova , Ph.D.
ccordova@nrdc.org
switchboard.nrdc.org/blogs/ccordova

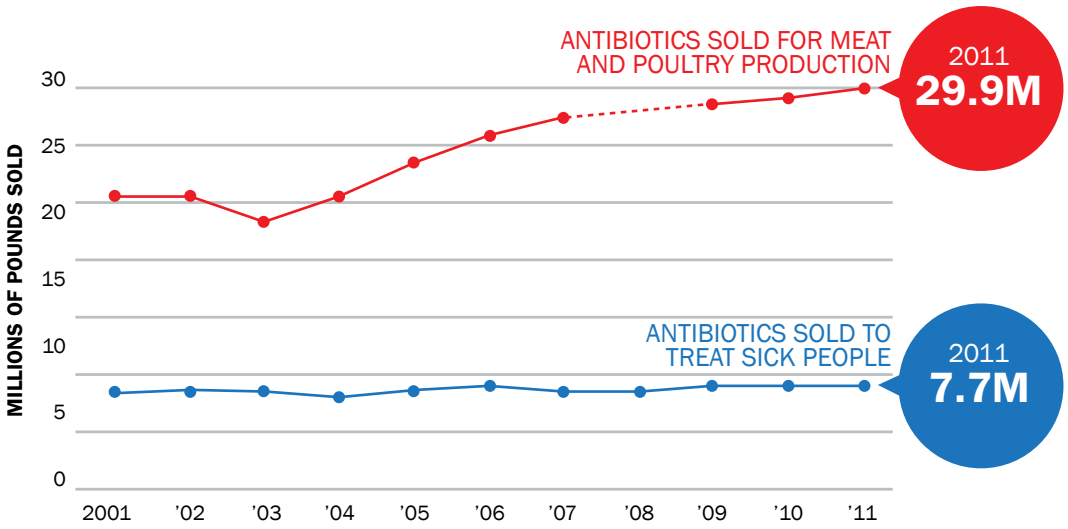
Jonathan Kaplan
jkaplan@nrdc.org
switchboard.nrdc.org/blogs/jkaplan

MEAT+DRUGS =SUPERBUGS

THE GROWTH OF ANTIBIOTIC USE IN LIVESTOCK

Since the 1950s, livestock producers have been routinely incorporating low levels of antibiotics into the feed or water of poultry, cattle, and swine to promote faster growth and to prevent infections that tend to occur when animals are housed in crowded, unsanitary conditions.[7] Currently, 80 percent of all antibiotics sold in the United States are sold for livestock use (70 percent if one considers only those antibiotic classes used in both humans and animals).[8]

Figure 1: Antibiotics Sold for Use in Livestock Production and for Human Treatment, 2001–2011



Source: Adapted from *Record High Antibiotic Sales for Meat and Poultry Production*, Pew Campaign on Human Health and Industrial Farming, February 6, 2013.

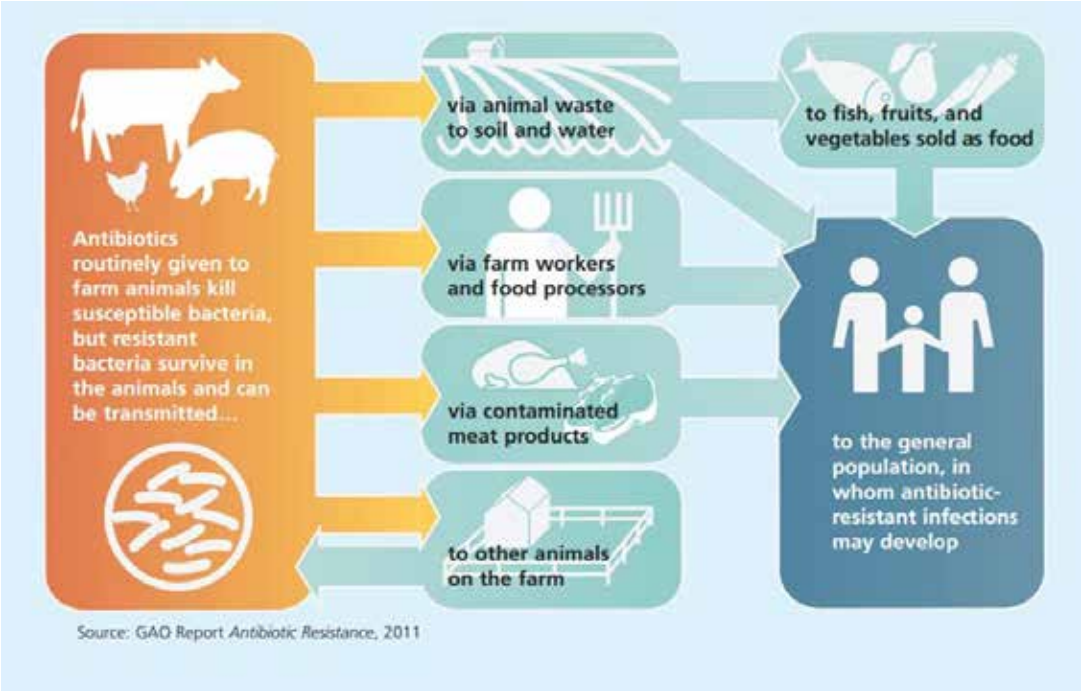
WHY NONTHERAPEUTIC USE OF ANTIBIOTICS IS A PROBLEM

In animal agriculture, producers routinely give antibiotics to food animals day after day, even when the animals are not sick. Generally, people take antibiotics only to treat a bacterial infection. We wouldn't add antibiotics to kids' cereal day after day to keep them from getting sick at school, but that is how many industrial farms use antibiotics. Instead producers should use better management practices such as vaccinations, more frequent facility cleaning, improved ventilation, and reduced animal density.

When animals are routinely given antibiotics in their feed, the bacteria that live in the animal's gut, respiratory tract, and skin can become resistant to these antibiotics and to other, similar antibiotics. These bacteria can then spread from livestock operations to people in a number of ways (see Figure 2):

- **Food:** Antibiotic-resistant bacteria are transported from livestock facilities to slaughterhouses and are routinely found on fresh meat sold in grocery stores. In addition to spreading drug resistance traits, some of these organisms, like *Salmonella*, can cause disease.
- **Environment:** Antibiotic-resistant bacteria are transported out of livestock facilities via manure and wastewater and may also travel through the air.
- **Workers:** Bacteria may be carried on farm workers' skin and clothing into the larger community.

Resistant bacteria multiply rapidly and can pass their resistance to other non-resistant bacteria they come in contact with. Therefore, resistance traits can be spread to new bacteria even when no antibiotics are present.[9] This leads to widespread drug resistance and the emergence of multi-drug-resistant bacteria—including bacteria that infect humans.



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THE DANGERS AND COSTS OF ANTIBIOTIC-RESISTANT INFECTIONS

According to the CDC, antibiotic resistance is "one of the world's most pressing health problems."[10] Last year, the CDC estimated that more than 2 million people are sickened every year from antibiotic-resistant infections and at least 23,000 die.[11] Infections from common procedures like surgeries and cancer therapy are becoming harder to treat.[12] Increasingly, when first line antibiotics fail, doctors have to use other toxic and less effective antibiotics.[13] A 2009 study at Cook County Hospital in Chicago showed that, compared with non-resistant bacterial infections, resistant infections are much more dangerous: they increase the risk of death twofold and extend hospital stays 6.4 to 12.7 days.[14] Extrapolating the data nationwide, the Alliance for the Prudent Use of Antibiotics (one group that helped conduct the study) concluded that antibiotic-resistant infections cost the U.S. health care system more than $20 billion annually in additional costs and $35 billion in lost productivity.[15]

GOVERNMENT AND HEALTH AGENCIES ARE SOUNDING THE ALARM

The CDC released a landmark report in September 2013 stating that "much of antibiotic use in animals is unnecessary and inappropriate and makes everyone less safe."[16] The FDA and the U.S. Department of Agriculture (USDA) also acknowledge that the nontherapeutic use of antibiotics in food animals puts public health at risk, as do many leading health and medical groups, including the WHO, the American Medical Association, and the American Academy of Pediatrics.[17] Among the classes of antibiotics at risk of losing their efficacy because of overuse in animal agriculture, many have been identified as "critically important" or "highly important" in human medicine because they are among a small number of drugs available for treating specific diseases (see Table 1).

ALTERNATIVES ARE AVAILABLE TO PRODUCERS

Consumer demand for meat from animals raised without antibiotics is growing, and food companies such as Chipotle Mexican Grill, Whole Foods, Applegate, and Panera Bread are increasingly offering antibiotic-free meat. The Chick-fil-A fast-food chain, recently announced its intention to sell only antibiotic-free chicken within five years.[18] Livestock producers in the United States are responding by using a number of tools to reduce nontherapeutic antibiotic use, including improved biosecurity and herd/flock management, vaccination, alternative feed additives that improve animal health and productivity, improved litter/manure management and sanitation, and a reduction of environmental stressors (such as overcrowding).[19] Over the past two decades, industrial pork and poultry producers in Denmark successfully transitioned away from all nontherapeutic use of antibiotics with no significant changes in animal mortality or production, only a small decrease in growth efficiency, and increased costs of less than 1 percent. This transition was accomplished through minor changes in management and animal husbandry, including more frequent facility cleaning, improved ventilation, and reduced animal density.[20]

Table 1: World Health Organization Classification of Antibiotics Used in People and Food Animals

Class of Antibiotics	Animal Use	Most Commonly Used to Treat These Human Infections	Particularly Important for Treating These Human Infections[21]
Critically Important Antibiotics*			
Tetracyclines	Cattle, poultry, swine	Stomach ulcers caused by bacteria, acne	*Chlamydia* (a venereal disease), *Rickettsia* infections
Macrolides	Cattle, poultry, swine	Pneumonia, conjunctivitis (pink eye)	Legionnaire's Disease (a form of pneumonia), food poisoning due to *Campylobacter* or multi-drug-resistant *Salmonella*
Penicillins	Poultry, swine	Strep throat, ear infections, sinus infections	*Pseudomonas* (a hospital superbug), *Listeria* (a dangerous infection for pregnant women and people with immune deficiency), syphilis (a venereal disease)
Streptogramins	Cattle, poultry, swine	A variety of MRSA infections, including skin and soft tissue infections	Urinary tract infections, heart infections, meningitis due to resistant *Enterococcus*, skin and bloodstream methicillin–resistant *Staph. aureus* (MRSA) infections
Aminoglycosides	Poultry, swine	Eye infections, various other bacterial infections	Lung infections, especially in cystic fibrosis patients
Highly Important Antibiotics**			
Sulfonamides	Cattle, poultry, swine	Urinary tract infections	May be one of limited therapies for meningitis and other infections in certain geographic areas
Important Antibiotics			
Lincosamides	Poultry, swine	A variety of bacterial infections	Toxic shock syndrome due to certain bacteria

* These antibiotics meet both of the following criteria:
A) They are the only option, or one of a very few options, for treating a serious human disease.
B) The bacteria that these drugs target can be transmitted from nonhuman sources (such as agricultural animals) or can acquire resistance genes from nonhuman sources (such as agricultural animals).

** These antibiotics meet either one of the criteria above.

WHAT YOU CAN DO TO SUPPORT RESPONSIBLE USE OF ANTIBIOTICS

Curbing inappropriate use of antibiotics is crucial to maintaining their effectiveness in humans and slowing the growing problem of antibiotic resistance. While this effort will require work on multiple fronts—including the policy arena and the marketplace—there are some important steps you can take at home right now:

- **Request prescriptions for illnesses only when absolutely necessary.** Individuals taking antibiotics due to a bacterial infection should finish the whole prescription to kill the pathogen and to avoid creating resistant ones.
- **When buying meat, poultry, and dairy, look for products from animals raised without the use of antibiotics.** Look for any of these labels: USDA Certified Organic, USDA Process Verified Never Ever 3, and Animal Welfare Approved. Animal products bearing these labels are third-party certified as coming from farms where nontherapeutic use of antibiotics is prohibited. Labels saying "No Antibiotics Administered" or something similar also communicate the producer's commitment to antibiotic-free production but are not verified. More information on labels is available from Consumer Reports.
- **Prepare foods safely at home.** Follow these CDC-recommended practices to reduce risks from pathogens: Use separate cutting boards for meat; wash hands, knives, and surfaces after each use with hot, soapy water; always cook meat to the proper internal temperature, checking with a meat thermometer; and refrigerate meat before cooking and within two hours after. For more information, visit www.cdc.gov/foodsafety/prevention.html.

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