Antibiotic Resistance and the Industrial Animal Farm

An Overview of Antibiotic Resistance

Antibiotics are commonly prescribed drugs that kill bacteria or suppress their ability to grow, allowing the human immune system to respond and heal from illness. *Antibiotic resistance* is a dangerous bacterial trait which enables bacteria to survive and continue to grow instead of being inhibited or destroyed by therapeutic doses of the drug. As a result, antibiotic-resistant bacteria can evade the effects of the antibiotic and multiply, with severe consequences for human health. For example, some of the major bacterial causes of illness in the United States, including *E. coli*,[1] *Salmonella*, *Campylobacter*, *Enterococcus*,[2] *Streptococcus*[3] and *Staphylococcus*[4] are increasingly resistant to treatment with first-line antibiotics.

The trait for resistance to an antibiotic is a result of mutations in the genetic material of bacteria. These mutations can occur spontaneously, be inherited or simply be transmitted between bacteria, spreading very easily. Moreover, because a gene that provides resistance to one type of antibiotic is often located right next to another gene that provides resistance to a different type of antibiotic, the result is often multidrug resistance. The rise of multidrug resistance has been documented in a study of incoming patients to a Boston hospital from 1998 to 2003, which showed that the likelihood of multidrug resistance in *E. coli* increased from two to almost 20 percent during the study period.[5]

Repeated and improper use of antibiotics appears to be the main cause of the increase in antibiotic-resistant bacteria. In general, low doses of antibiotics for long durations are more likely to cause resistance.[6] Antibiotic-resistant genes can also be acquired through our food supply: bacteria present in food-producing animals may be resistant, and humans can acquire these bacteria when they eat meat from these animals or do not use proper hygiene techniques during food preparation.[7] Farm workers also are at risk of exposure to drug-resistant bacteria and can transfer resistant infections to the broader public if they become ill.[8] Lastly, antibiotic-resistant bacteria can reach the human community through surface and groundwater that has been contaminated by farm animal waste.[9]

Antibiotic Use and Resistance in Humans Versus Farm Animals

In humans, antibiotic use is generally confined to treatment of illness. In contrast, antibiotics are used in cattle, poultry and swine not only for disease treatment, but also for disease prevention and growth promotion. In fact, many estimates suggest that nontherapeutic (i.e., not to treat disease) agricultural use of antibiotics and related drugs accounts for approximately 70 percent of all antibiotic use in the U.S.[10] While treatment and prevention usually involve high doses of antibiotics for short periods of time, antibiotics used for animal growth enhancement are generally given in low doses for long periods of time. Compounding the problem is that antibiotics are generally distributed via feed or water to entire herds or flocks, including animals that are not ill.

Many antibiotics that are used in food animal production belong to the same classes that are used to treat humans. These include tetracyclines, penicillins, cephalosporins and macrolides, among others.[11] The similarity between human and animal drugs frequently means that bacteria resistant to antibiotics used in animals also are likely to be resistant to those used in humans.

Impacts on Public Health

The public health implications of antibiotic-resistant bacteria go far beyond the immediate threat of infection. Because the infection lingers while an effective antibiotic is identified, the potential for more severe illnesses, and transmission to others, are greatly increased. This is troubling for public health and our health care system on several different levels.

- Contagious infection risk is multiplied, as an infected person may spread the illness before finding an effective antibiotic.

- More severe illnesses result in both higher frequency and longer duration of hospitalizations, raising the cost of health care. Researchers with the Alliance for the Prudent Use of Antibiotics and Cook County Hospital in Chicago estimate the extra costs to the U.S. health care system due to antibiotic-resistant infections range from $16.6 billion to $26 billion per year.[12]

- There is an overall higher risk of complications and death as there are fewer effective drugs available to treat serious infections.

- One study estimates that in 2005 MRSA infections (methicillin-resistant *Staphylococcus aureus),* a severe bacterial infection that is resistant to antibiotics, caused over 18,000 deaths in the United States[13]—a mortality level greater than that of AIDS.[14]

- Children, the elderly and individuals with cancer and other immune-compromising illnesses face the greatest risk of acquiring an antibiotic-resistant bacterial infection.

- According to the Infectious Disease Society of America, 90,000 people die each year of a hospital-acquired infectious disease. Of these individuals, an estimated 70 percent have infections that are resistant to at least one antibiotic drug.[15]

Urgent action is needed to address antibiotic resistance. Individuals can improve resistance to infections through good hygiene and avoiding taking prescription antibiotics unnecessarily. Antibiotic resistance in bacteria should continue to be monitored, and data collection should be improved regarding antibiotic use. However, the most critical step to ensure the availability and efficacy of antibiotic drugs is to create policies that drastically reduce their use where they are being applied most inappropriately and in the greatest numbers: in the production of our food supply.

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[6] The Department of Health and Human Services; Center for Disease Control and Prevention; "National Antimicrobial Resistance Monitoring System (NARMS) Frequently Asked Question about Antibiotic Resistance." <www.cdc.gov/narms/faq_antiresis.htm>.

[7] *Ibid.*

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[9] *Ibid.*

[10] Mellon, *et al.,* 2001, *Op cit.*

[11] *Ibid.*

[12] Roberts, R.R., et al. 2009. Hospital and Societal Costs of Antimicrobial-Resistant Infections in a Chicago Teaching Hospital: Implications for Antibiotic Stewardship. *Clinical Infectious Diseases* 49:1175–84.

[13] Klevens, *et al.*, 2007, *Op cit.*

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