



THE HUMANE SOCIETY
OF THE UNITED STATES

An HSUS Fact Sheet

Antibiotics in Animal Agriculture & Human Health

The U.S. meat industry continues to feed medically important antibiotics to factory-farmed chickens, fish, pigs, and cattle to speed their growth and prevent the incidence and spread of disease in cramped unhygienic environments typical of American agriculture. A strong scientific consensus exists that this practice fosters antibiotic resistance in bacteria to the detriment of human health.¹ In response to this public health threat, the European Union took steps a decade ago to ban the use of antibiotics of human importance in farm animals for non-treatment purposes. The U.S. meat industry should likewise rethink this risky practice.

Lion's Share Fed to Farm Animals. According to the Centers for Disease Control and Prevention (CDC), at least 17 classes of antimicrobials (a larger category including antibacterial antibiotics, antivirals, and antiparasitic drugs) are approved for farm animal growth promotion in the United States,² including many families of antibiotics, such as penicillin, tetracycline, and erythromycin, which are critical for treating human disease.³ The Union of Concerned Scientists (UCS) estimates that 70% of antimicrobials used in the United States are fed to chickens, pigs, and cattle for non-therapeutic purposes.⁴ Additionally, three antimicrobials have been approved by the Food and Drug Administration (FDA) for use in the U.S. aquaculture industry, which consumes more than 50,000 pounds of antibiotics annually.⁵ The majority of the antibiotics produced in the United States and the world go not to human medicine, but to usage on the farm.⁶

Factory Farming's Antibiotic Crutch. The unnatural crowding of animals and their waste in factory farms creates such a strain on the animals' immune systems that normal body processes like growth may be impaired. A constant influx of antibiotics is thought to accelerate weight gain by reducing this infectious load.⁷ "Present production is concentrated in high-volume, crowded, stressful environments, made possible in part by the routine use of antibacterial in feed," the congressional Office of Technology Assessment wrote as far back as 1979. "Thus the current dependency on low-level use of antibacterial to increase or maintain production, while of immediate benefit, also could be the Achilles' heel of present production methods."⁸

Antibiotic-Resistant Bacteria from Farm to Fork. Indiscriminate antibiotics use may select for drug-resistant pathogens that can affect both human and non-human animals. As the bacteria become more resistant to the antibiotics fed to chickens and other animals raised for meat, they may become more resistant to the antibiotics needed to treat sick people. Antibiotics and antibiotic-resistant bacteria can be found in the air, groundwater, and soil around farms and on retail meat,⁹ and people can be exposed to these pathogens through infected meat, vegetables fertilized with raw manure, and water supplies contaminated by farm animal waste.¹⁰ Resistance genes that emerge can then be swapped between bacteria. Italian researchers published a DNA fingerprinting study in 2007 showing that antibiotic-resistance genes could be detected directly in chicken meat and pork.¹¹

Scientific Consensus Over Public Health Threat. The world's leading medical, agricultural, and veterinary authorities have reached consensus that antibiotic overuse in animal agriculture is contributing to human public health problems.¹² According to a former head of the CDC's food poisoning surveillance program, "[t]he reason we're seeing an increase in antibiotic resistance in foodborne diseases [in the United States] is because of antibiotic use on the farm."¹³ The American Medical Association, the American Public Health Association, the Infectious Diseases Society of America, and the American Academy of Pediatrics are among the 350 organizations nationwide that have endorsed efforts to phase out the use of antibiotics important to human medicine as animal feed additives.¹⁴ With few, if any, new classes of antibiotics in clinical development,¹⁵ an expert on antibiotic resistance at the Institute for Agriculture and Trade Policy warned that "we're sacrificing a future where antibiotics will work for treating sick people by squandering them today for animals that are not sick at all."¹⁶

Superbug Lineup

Campylobacter. Quinolone antibiotics such as Cipro have been used in human medicine since the 1980s, but widespread antibiotic-resistant *Campylobacter* did not arise until after quinolones were licensed in the mid-'90s for use in chickens via mass administration in their drinking water.¹⁷ In countries like Australia, which reserved quinolones exclusively for human use, resistant bacteria are practically unknown.¹⁸ The FDA concluded that the use of these antibiotics in chickens compromise the treatment of nearly 10,000 Americans a year, meaning that thousands infected with *Campylobacter* who sought medical treatment were initially treated with an antibiotic to which the bacteria was resistant, forcing the doctors to switch to more powerful drugs.¹⁹ Studies involving thousands of patients with *Campylobacter* infections showed that this kind of delay in effective treatment led to up to six times more complications—infections of the brain and the heart, and, the most frequent, serious complication noted, death.²⁰ When the FDA announced it intended to join other countries and ban quinolone antibiotic use on U.S. poultry farms, the drug manufacturer Bayer initiated legal action that successfully delaying the process for five years. During that time, Bayer continued to dominate the estimated annual \$15 million market²¹ and resistance continued to climb.²² In 2005, the first multidrug-resistant isolate was detected, *C. jejuni* resistant to ciprofloxacin, erythromycin, and ceftriaxone.²³

E. coli. Evidence is mounting that antibiotic-resistant bladder infections may also be tied to farm animal drug use.²⁴ University of Minnesota medical researchers took more than 1,000 food samples from multiple retail markets and found evidence of fecal contamination in 69% of the pork and beef tested, and 92% of the poultry samples as evidenced by the presence of *E. coli*. More than 80% of the *E. coli* recovered from beef, pork, and poultry products were resistant to one or more antibiotics, and greater than half of the samples of poultry bacteria were resistant to more than five drugs. Half of the poultry samples were contaminated with extraintestinal pathogenic *E. coli* bacteria,²⁵ supporting the notion that UTI-type *E. coli* may be food-borne pathogens.²⁶ Scientists suspect that by eating animal products, women infect their lower intestinal tract with these antibiotic-resistant bacteria, which can then migrate up the urethra and into the bladder.²⁷ A number of genetic fingerprinting technologies, including PCR-based phylotyping, multilocus sequence typing,²⁸ and full genomic sequencing,²⁹ have solidified the relationship between chicken *E. coli* and human bladder infections.

Influenzavirus A. Drug resistance is not limited to bacteria. In the 2005 *Washington Post* exposé, “Bird Flu Drug Rendered Useless,” it was revealed that for years Chinese chicken farmers had been lacing the animals’ water supply with the antiviral drug amantadine to prevent economic losses from bird flu.³⁰ The use of amantadine in the water supply of commercial poultry as prophylaxis against avian influenza was pioneered in the United States after a massive outbreak in Pennsylvania in the 1980s, despite evidence that drug-resistant mutants arose within nine days of application.³¹ The use of amantadine in China has been blamed for the emergence of widespread resistance of avian influenza strain H5N1 to a potentially life-saving drug that could be used in a human pandemic.³² “In essence,” wrote Frederick Hayden, Professor of Clinical Virology in Internal Medicine at the University of Virginia School of Medicine, “this finding means that a whole class of antiviral drugs has been lost as treatment for this virus.”³³

MRSA. Alarming high rates of methicillin-resistant *Staphylococcus aureus* (MRSA) detection in farm animals and retail meat in Europe has led to increased scrutiny of the agricultural use of antibiotics. The Dutch Agriculture, Nature, and Food Standards Minister, Cees Veerman, was recently reported as saying that “the high usage of antibiotics in livestock farming is the most important factor in the development of antibiotic resistance, a consequence of which is the spread of resistant microorganisms (MRSA included) in animal populations.”³⁴ The recent discovery of MRSA in North American pigs suggests the potential public health risk attributed to farm animal-associated MRSA may be a global phenomenon.³⁵

Salmonella. Antibiotic-resistant *Salmonella* has also led to serious human medical complications.³⁶ Food-borne *Salmonella* emerged in the U.S. Northeast in the late 1970s and has since spread throughout North America. One theory holds that multidrug-resistant *Salmonella* was disseminated worldwide in the 1980s via contaminated feed made out of farmed fish fed routine antibiotics,³⁷ a practice condemned by the CDC.³⁸ The CDC is especially concerned about the recent rapid emergence of a strain resistant to nine separate antibiotics, including ceftriaxone, the primary treatment used in children.³⁹ *Salmonella* kills hundreds of Americans every year, hospitalizes thousands,⁴⁰ and sickens more than a million.⁴¹ The poor ventilation, high dust levels,⁴² high stocking density,⁴³ and stress levels⁴⁴ in modern commercial chicken production have been blamed for potentially contributing to the extent of the problem.

- ¹ Falkow S and Kennedy D. 2001. Antibiotics, animals, and people—again! *Science* 291(5503):397.
- ² Anderson AD, McClellan J, Rossiter S, and Angulo FJ. 2003. Appendix A: public health consequences of use of antimicrobial agents in agriculture. In: *The Resistance Phenomenon in Microbes and Infectious Disease Vectors: Implications for Human Health and Strategies for Containment: Workshop Summary* (Washington, D.C.: National Academies Press, pp. 231-43). <http://books.nap.edu/openbook.php?isbn=0309088542&page=231>. Accessed March 5, 2008.
- ³ Mellon MG, Benbrook C, and Benbrook KL. 2001. Hogging It! Estimates of Antimicrobial Abuse in Livestock (Cambridge, MA: Union of Concerned Scientists). http://www.ucsusa.org/food_and_environment/antibiotics_and_food/hogging-it-estimates-of-antimicrobial-abuse-in-livestock.html. Accessed March 12, 2008.
- ⁴ Ibid.
- ⁵ Viola C and DeVincent SJ. 2006. Overview of issues pertaining to the manufacture, distribution, and use of antimicrobials in animals and other information relevant to animal antimicrobial use data collection in the United States. *Preventive Veterinary Medicine* 73(2-3):111-31.
- ⁶ Tilman D, Cassman KG, Matson PA, Naylor R, and Polasky S. 2002. Agricultural sustainability and intensive production practices. *Nature* 418:671-7, citing: Mellon MG, Benbrook C, and Benbrook KL, op. cit.
- ⁷ Office of Technology Assessment. 1979. *Drugs in Livestock Feed: Volume 1: Technical Report* (Washington, D.C.: U.S. Government Printing Office). http://govinfo.library.unt.edu/ota/Ota_5/DATA/1979/7905.PDF. Accessed March 12, 2008.
- ⁸ Ibid.
- ⁹ Smith DL, Dushoff J, and Morris JG. 2005. Agricultural antibiotics and human health. *Public Library of Science Medicine* 2(8):e232.
- ¹⁰ Acar JF and Moulin G. 2006. Antimicrobial resistance at farm level. *Revue Scientifique et Technique de l'Office International des Epizooties* 25(2):775-92.
- ¹¹ Garofalo C, Vignaroli C, Zandri G, et al. 2007. Direct detection of antibiotic resistance genes in specimens of chicken and pork meat. *International Journal of Food Microbiology* 113(1):75-83.
- ¹² World Health Organization, Food and Agriculture Organization of the United Nations, and the World Organization for Animal Health. 2003. Expert workshop on non-human antimicrobial usage and antimicrobial resistance, Geneva, December 1-5. <http://www.who.int/foodsafety/publications/micro/en/amr.pdf>. Accessed March 12, 2008.
- ¹³ Drexler M. 2002. *Secret Agents: The Menace of Emerging Infections* (Washington, D.C.: Joseph Henry Press).
- ¹⁴ Keep Antibiotics Working. 2007. Kennedy, Snowe & Slaughter introduce AMA-backed bill to cut antibiotic resistance linked to misuse of antibiotics in animal agriculture. Press release issued February 12. http://keepantibioticsworking.com/new/resources_library.cfm?RefID=97314. Accessed March 12, 2008.
- ¹⁵ Cassell GH and Mekalanos J. 2001. Development of antimicrobial agents in the era of new and reemerging infectious diseases and increasing antibiotic resistance. *Journal of the American Medical Association* 285:601-5.
- ¹⁶ Nierenberg D. 2005. Happier meals: rethinking the global meat industry. *Worldwatch Paper* 171, September. <http://www.worldwatch.org/pubs/paper/171/>. Accessed March 12, 2008.
- ¹⁷ Gupta A, Nelson JM, Barrett TJ, et al. 2004. Antimicrobial resistance among *Campylobacter* strains, United States, 1997-2001. *Emerging Infectious Diseases* 10:1102-9.
- ¹⁸ Price LB, Johnson E, Vailes R, and Silbergeld E. 2005. Fluoroquinolone-resistant *Campylobacter* isolates from conventional and antibiotic-free chicken products. *Environmental Health Perspectives* 113(5):557-60. <http://www.ehponline.org/members/2005/7647/7647.html>. Accessed March 12, 2008.
- ¹⁹ Anderson AD, McClellan J, Rossiter S, and Angulo FJ, op. cit.
- ²⁰ Helms M, Simonsen J, Olsen KE, and Molbak K. 2005. Adverse health events associated with antimicrobial drug resistance in *Campylobacter* species: a registry-based cohort study. *Journal of Infectious Disease* 191:1051.
- ²¹ Palmer E. 2002. Bayer urged to eliminate animal version of Cipro. *Kansas City Star*, February 20. http://keepantibioticsworking.com/news/news.cfm?News_ID=176. Accessed March 12, 2008.
- ²² Keep Antibiotics Working. 2005. Keep Antibiotics Working praises FDA's first ever ban of agricultural drug due to antibiotic-resistance effects in humans. July 28. http://keepantibioticsworking.com/new/resources_library.cfm?refid=73539. Accessed March 12, 2008.
- ²³ Moore JE, Barton MD, Blair IS, et al. 2006. The epidemiology of antibiotic resistance in *Campylobacter*. *Microbes and Infection* 8:1955-66.
- ²⁴ Ramchandani M, Manges AR, DeRoy C, Smith S, Johnson JR, and Riley LW. 2004. Possible animal origin of human-associated, multidrug-resistant, uropathogenic *Escherichia coli*. *Clinical Infectious Diseases* 40:251-7.
- ²⁵ Johnson JR, Kuskowski MA, Smith K, O'Bryan TT, and Tatini S. 2005. Antimicrobial-resistant and extraintestinal pathogenic *Escherichia coli* in retail foods. *Journal of Infectious Diseases* 191:1040-9.
- ²⁶ Jones TF and Schaffner W. 2005. New perspectives on the persistent scourge of foodborne disease. *Journal of Infectious Diseases* 205:1029-31.
- ²⁷ Brownlee C. 2005. Beef about UTIs. *Science News* 167(3).
- ²⁸ Moulin-Schouleur M, Reperant M, Laurent S, et al. 2007. Extra-intestinal pathogenic *Escherichia coli* of avian and human origin: link between phylogenetic relationships and common virulence patterns. *Journal of Clinical Microbiology* 45(10):3366-76.
- ²⁹ Johnson TJ, Kariyawasam S, Wannemuehler Y, et al. 2007. The genome sequence of avian pathogenic *Escherichia coli* strain O1:K1:H7 shares strong similarities with human extraintestinal pathogenic *E. coli* genomes. *Journal of Bacteriology* 189:3228-36.
- ³⁰ Sipress A. 2005. Bird flu drug rendered useless: Chinese chickens given medication made for humans. *Washington Post*, June 18.
- ³¹ Webster RG, Kawaoka Y, Bean WJ, Beard CW, and Brugh M. 1985. Chemotherapy and vaccination: a possible strategy for the control of highly virulent influenza virus. *Journal of Virology* 55:173-6.
- ³² Sipress A, op. cit.
- ³³ Hayden F. 2004. Pandemic influenza: is an antiviral response realistic? *Pediatric Infectious Disease Journal* 23:S262-9.
- ³⁴ Soil Association. 2007. MRSA in farm animals and meat. [http://www.soilassociation.org/Web/SA/saweb.nsf/89d058cc4db16d80256a73005a2866/5cae3a9c3b4da4b880257305002daadf/\\$FILE/MRSA%20report.pdf](http://www.soilassociation.org/Web/SA/saweb.nsf/89d058cc4db16d80256a73005a2866/5cae3a9c3b4da4b880257305002daadf/$FILE/MRSA%20report.pdf). Accessed March 12, 2008.
- ³⁵ Khanna T, Friendship R, Dewey C, and Weese JS. 2007. Methicillin resistant *Staphylococcus aureus* colonization in pigs and pig farmers. *Veterinary Microbiology* 128(3-4):298-303.
- ³⁶ Varma JK, Greene KD, Ovitt J, Barrett TJ, Medalla F, and Angulo FJ. 2005. Hospitalization and antimicrobial resistance in *Salmonella* outbreaks, United States, 1984-2002. *Emerging Infectious Diseases* 11(6):943-6. <http://www.cdc.gov/ncidod/EID/vol11no06/pdfs/04-1231.pdf>. Accessed March 12, 2008.
- ³⁷ Drexler M, op. cit.
- ³⁸ Angulo F. 1999. Use of antimicrobial agents in aquaculture: potential for public health impact. Centers for Disease Control Memo to the Record, National Aquaculture Association Release, October 18. <http://www.nationalaquaculture.org/pdf/CDC%20Memo%20to%20the%20Record.pdf>. Accessed March 12, 2008.
- ³⁹ Centers for Disease Control and Prevention. 2002. Outbreak of multidrug-resistant *Salmonella* Newport—United States, January-April 2002. *Morbidity and Mortality Weekly Report* 51(25):545-8. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5125a1.htm>. Accessed March 12, 2008.
- ⁴⁰ Schroeder CM, Naugle AL, Schlosser WD, et al. 2005. Estimate of illnesses from *Salmonella enteritidis* in eggs, United States, 2000. *Emerging Infectious Diseases* 11(1):113-5.
- ⁴¹ Burrows M. 2006. More *Salmonella* is reported in chickens. *New York Times*, March 8. <http://nytimes.com/2006/03/08/dining/08well.html>. Accessed March 1, 2008.
- ⁴² Holt PS, Mitchell BW, and Gast RK. 1998. Airborne horizontal transmission of *Salmonella enteritidis* in molted laying chickens. *Avian Diseases* 42:45-52.
- ⁴³ Braden CR. 2006. *Salmonella enterica serotype Enteritidis* and eggs: a national epidemic in the United States. *Clinical Infectious Disease* 43:512-7.
- ⁴⁴ Bailey MT, Karaszewski JW, Lubach GR, Coe CL, and Lyte M. 1999. In vivo adaptation of attenuated *Salmonella typhimurium* results in increased growth upon exposure to norepinephrine. *Physiology and Behavior* 67:359-64.