Overuse of Antibiotics in Animal Agriculture
Air and Water Quality Impacts
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Antibiotics are routinely fed to livestock as growth promoters to increase profits and to ward off potential disease in the stressed and crowded livestock factory environment. Because stress lowers immune system function in animals, antibiotics are seen as especially useful in intensive animal confinements.[1]

In a report by the Union of Concerned Scientists, it is estimated that every year livestock producers in the United States use close to 25 million pounds of antimicrobials for nontherapuetic purposes. This usage estimate accounts for about 70% of total U.S. antibiotic production. The new report, "***Hogging It***," illustrates the total use of antibiotics in healthy livestock has climbed from 16 million pounds in the 1980's to 25 million pounds today. Tetracycline, penicillin, erythromycin, and other antimicrobials that are important in human use are used extensively in the absence of disease. This report can be accessed through www.ucsusa.org [2]

The Centers for Disease Control has concluded that in the United States, antimicrobial use in food animals is the dominant source of antibiotic resistance among food-borne pathogens. The World Health Organization has also called for a ban on the use of subtheraputic antibiotics that are also used for human therapy. It is important to note that antibiotics are not a necessary evil of livestock production. In other countries, such as Sweden, antibiotics are used stringently and are applied for curative purposes only. [3]

The American Medical Association has approved a resolution to eliminate non-therapeutic use of antibiotics in agriculture. The AMA estimates that 80% of all antibiotics used are employed in agriculture for reasons other than to heal sick animals, such as for promoting growth, for pesticides, or to prevent disease. It opposes such uses because of the growing inability of antibiotics to cure serious human disease.

Evidence suggests that antibiotic use in agriculture has contributed to antibiotic resistance in the pathogenic bacteria of humans and a team of researchers in the international medical journal **PLoS Medicine suggest that "transmission from agriculture can have a greater impact on human populations than hospital transmission."**[4]

In January 2004, the American Public Health Association (APHA) called for a precautionary moratorium on the construction of new CAFOs until more research is completed regarding their impacts on public health. The Association also called for federal and state governments to initiate and support research on the air pollutants, water and soil emissions, as well as investigate the greater vulnerability of infants and children to such pollutants.[5]

Antibiotic Resistance and Water Supplies

Because of the massive amounts of antibiotics used in agriculture, manure can harbor dangerous bacteria that have the ability to contribute to antibiotic resistance in humans. **This is proving to be a concern for our water supplies. It was reported in August 1999 that Federal Health investigators found potentially harmful bacteria and other pollutants commonly associated with hog manure in wells and waterways near Iowa hog confinements.** Researchers at the Centers for Disease Control and Prevention found that contaminants including pathogens, metals, antibiotics commonly fed to hogs, bacteria, nitrates, and parasites were found in manure lagoons, surrounding wells, drainage ditches and underground water. This study presented 3 significant findings:

1. It is clear that pathogens of concern for human health are in fact surviving in liquid manure
2. Pathogens that are surviving in manure show a disturbing pattern of antibiotic resistance
3. The same antibiotic resistant pathogens identified in liquid manure were also found in surface and groundwater near CAFOs suggesting that they may be viably transported.

The researchers of this pilot study stress that these results are a clear warning signal and more research is definitely warranted.[6]

A Pilot Environmental Investigation Around Large Poultry Operations in Ohio studied groundwater, surface water, and sediment downgradient from large poultry houses. One surface water sample tested positive for antibiotics. E Coli, Salmonella and various types of Enterococcus were identified in water, soil, and sediment samples. The study also found antibiotic resistant bacteria and concluded that this presence indeed warrants "future investigation."[7]

The EPA and the U.S. Geological Survey have identified antibiotic contamination of waters near two North Carolina hog farms. The samples contained sulfamethazine, lincomycin, and chlortetracycline, antibiotics that are commonly fed to hogs. These drugs were identified in lagoons and in the samples from nearby streams. Researchers also discovered antibiotics in the Neuse River. Antibiotics were also found flowing from tap water on one of the hog farms. The faucet drew water from a well; a finding that suggests groundwater is laced with the drugs, according to the U.S. Geological Survey. Additionally, this study also found that bacteria in the streams had acquired resistance to common antibiotics, according to the EPA.[8] (After pressure from drug companies, the FDA approved the use of sulfamethazine, a drug that is used to promote growth and control rampant disease in animal confinements. In 1988, the National Center for Toxicological Research announced that this drug is a known carcinogen.[9])

In a groundbreaking study released from the University of Illinois, microbiologists discovered that bacteria in the soil and groundwater beneath farms are showing tetracycline resistant genes (tet genes) from bacteria that have been traced to pigs'

guts. These genes can survive in soil and water-borne bacteria. They can them be passed on to other bacteria in the environment or to humans who come into contact with or ingest the water. The scientists tested samples from manure lagoons and from groundwater reservoirs under the lagoons at two hog farms that routinely use tetracycline as a growth promoter. The researchers also discovered that people at both sites were drinking the affected groundwater. They concluded that this is a practice that may be contributing to antibiotic resistance and that the problem could be very widespread since groundwater is a major part of the water supply in the United States. The scientists called for an end to the practice of using antibiotics as growth promoters.[10]

Findings of antibiotics in our waters raise a red flag. It is the real danger that waters laced with these drugs can breed super bugs, which will be resistant to antibiotics that are commonly used to treat human illness. It was announced in March 2001 that Federal and state researchers plan to check Iowa waterways for antibiotics and other drugs after a preliminary check of 30 streams raised questions about pollution. The U.S. Geological Survey's Iowa City office, reported that in 1999 check of 30 Iowa streams turned up antibiotics and other unnamed substances.[11] The U.S. Geological Survey (USGS) is now in the process of analyzing 140 streams in 32 states in an attempt to document antibiotic residues in surface waters. Many samples are from the Midwest and will focus on urban population centers and watersheds with CAFOs. [12]

Antibiotic Resistance and Air Quality

Scientists now confirm that particulates generated by livestock factories can also be a serious health threat. **A 1995 Iowa State study** confirmed that at least 95% of the dust particles in swine confinement are smaller than three microns, which is in the respirable range.[13] These small invisible particles, which consist of animal dander, feed, manure, molds, saliva, and bug parts not only harbor odor, but also can also carry dangerous compounds and viruses and irritate the lungs just as cigarette smoke does. [14]The generation and dispersal of these particulates from large, concentrated animal feeding operations pose a potential public health threat for nearby residents.

The presence of microbes in the air environment inside of housed swine-production facilities is well documented. **Research in Ohio verified the presence of microbes from swine growing-finishing facilities and in areas downwind from such operations**. A series of bioaerosol studies were conducted around two Midwestern operations that assessed bacteria and fungi numbers and types released in air emissions. Many of the staphylococcal isolates from area near the swine barn were antibiotic resistant. Air fungi identified were species of Alternaria, Aspergillius, Monilia, Mucor, Penicillum, and Rhizopus. Significant levels of staphylococci and fungi were also found in the nearby residences. In early summer, high numbers of aerosolized staphylococci at one downhill station constituted 54% of the total bacteria recovered downwind of the facility. This study concluded that facilities should be sited with consideration of the location of human habitation.[15]

A follow up study released in 2004 again found resistant bacterial forms inside and downwind of swine confinement units and concluded that inhalation of microorganisms could be a health concern for workers inside and downwind. The major conclusion of this study was that bacteria were recovered inside and downwind of these facilities in levels that prior studies had stated could cause a potential human health hazard. **The study also recommends that it is logical to place these facilities in areas that do not have a large population living nearby.[16]**

Another recent study by the USDA concluded "aerial transfer of antibiotics and antibiotic- resistant bacteria from swine confinements may represent an important, and previously overlooked mechanism for the transfer of antibiotic resistance to humans and the environment."[17]

In December 2004, **researchers at Johns Hopkins University** research found airborne multidrug-resistant bacteria and antibiotics inside large scale swine operations. The airborne bacteria samples that were multidrug resistant were Enterococcus coagulase negative staphylococci and viridans group streptococci. These bacteria are associated with a variety of human infections. The researchers believe workers are at the greatest risk; however they could also become carriers of the drug resistant bacteria that can be spread to other humans in the community. The study also stressed that the presence of high concentrations of multidrug resistant staphylococci and other bacterial pathogens amidst endotoxin containing dust from animal and human waste could pose unique health concerns to people living near land application areas. [18] The study also raises questions about the spread of drug-resistant bacteria to areas beyond the immediate site through ventilation fans. This research adds to the understanding of various pathways in which humans can be exposed to antibiotic resistant bacteria, such as consumption of retail pork products, and contact with or ingestion of the soil, surface water, and groundwater near production facilities.[19]

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[19] Press Release: Multidrug –Resistant Bacteria Found to be Airborne in Concentrated Swine Operation, December 3, 2004 Johns Hopkins Center for a Livable Future and Bloomberg School of Public Health, and National Institute for Occupational Safety and Health. Contact Donna Mennito 410-502-7578 or Tim Parsons 410-955-6878 or paffairs@jhsph.edu