Recent research on antibiotic resistance and animal agriculture

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Bioaerosol Distribution Patterns Adjacent to Two Swine-Growing-Finishing House Confined Units in the American Midwest. *by P.V Scarpino (pscarpin@uceng.uc.edu) and H. Quinn, department of Civil Engineering, The University of Cincinnati, Cincinnati, OH 45221-0071*

AIRBORNE ANTIBIOTIC RESISTANT PATHOGENS

This study found aspergillus, Monilia, Mucor Penicillum, and Rhizopus near swine barns. Much of the staph was antibiotic resistant. Levels of staph and fungi were discovered in nearby residences.

The presence of microbes in the air environment inside of housed confinement swine-production facilities used in modern animal husbandry has been well documented (Elliotet al., Clark et al., 1983; Crook et al., 1991; Wathes, 1995). Concern has been raised about the possibility of health effects of airborne microbes on both the swine and agricultural worker. The purpose of this study was to determine the presence of microbes from two swine -growing-finishing facilities in downwind areas around such operations. A series of bioaerosol studies were conducted around two Midwestern swine-growing- finishing operations thaat assessed microbial (bacteria and fungi) numbers and types released in are made at one of the facilities. Antibiotics in animal feed promotes animal growth, improved efficiency of feed conversion to body weight, and may affect disease prophylaxis among the confined microbes in dosed animals, and their subsequent impact on human health.

Neighbors in close proximity to these operations complained of serious odors emanating from the facilities, personal discomfort due to the odors, loss of sleep, possible allergic manifestations, and respiratory difficulties.

Six stage bioaerosol samplers were used to recover bacterial and fungal aerosols at sampling sites in the vicinity of the swine growing operations. Plate Count Agar (PCA) for bacterial and Mold Inhibitory Agar for fungal recoveries were used. Subcultures using the replica plate procedure were made of PCA master plates using selective media for staphylococci, streptococci, and coliforms. In one swine operation studied, isolated staphylococci were tested for their sensitivity to antibiotics. Recoveries of total Colony Forming Units (CFU) of microbes (fungi and bacteria) at levels of 10 to the third /m to the third of air was used as an indicator of possible danger to nearby inhabitants.

Swine Production Facility 1

About 1439 CFU/mto the third of total microbes were found downwind of the swine operation; 930 CFU/mto the third air at a site downwind of the swine confinement bard and a recently manured field; and ca. 1870 CFU/m to the third of air in a nearby residence. The residence had a 1130 CFU of molds of air alone in the inside air. Many of the staphylococcal isolates from the air near the swine barn were antibiotic-resistant. No Klebsiella, Salmonella, or Shigella bacteria were recovered at any of the sampling sites, and just an occasional coliform of Streptococcus were detected. Air fungi identified included species of Alternia, Aspergillus, Monilia, Mucor, Penicillum, and Rhizopus.

Swine Production Facility 2

Three separate studies were made during a seven month period. The first study was done in the fall, and showed in the morning at two different sampling stations a few hundred yards away from the swine-production facility recoveries of 388 and 1303 CFU/m to the third of air for bacteria, and 978 and 1600 CFU/m to the third of air for the fungi. The afternoon levels downwind of the facility were 370 and 1614 CFU/m to the third of air for the bacteria, and 763 aand 2567 CFU/m to the third for the fungi. Significant levels of staphylococci and fungi were also found in the nearby residences. Al of the staphylococci isolated were coagulase-positive. The area was again sampled in the spring and later at the beginning of summer. In the spring sampling, low sampling low bacterial and fungal levels were observed, while in early summer high numbers of aerosolized staphylococci at one downhill station constituted 54% of the total bacteria recovered downwind of the facility.

Animal confinement facilities should be sited with consideration of the location of human habitation. The use of antibiotics in animal feed should be reviewed to minimize the development of antibiotic-resistant bacteria.

Airborne Antibiotic Resistant and Nonresistant Bacteria and Fungi Recovered from Two Swine Herd Confined Animal Feeding Operations. Shawn Gibbs, Christopher Green, Patrick Tarwater, Pasquale Scarpino *Journal of Occupational and Environmental Hygiene*. Volume 1, Number 11 / November 2004: 699 - 706

Abstract:
Inhalation of microorganisms could be a health concern for workers inside and downwind of animal confinement units. Using the Andersen two-stage viable microbial particle sizing sampler, air samples were collected from locations upwind, inside, and downwind during two visits to two swine herd confined animal feeding operations. Six samples were taken at each location on each site. Bacteria isolated from each site were then tested for antibiotic resistance using the Kirby-Bauer disc diffusion method. Resistant bacterial forms were found inside and downwind of the swine confinement facilities, indicating that resistant organisms were being produced in and released from these facilities. Resistance to a battery of an-tibiotics including ampicillin, erythromycin, oxytetracycline, penicillin, tetracycline, and tylosin was found in the following bioaerosols: Staphylococcus aureus Salmonella spp., and fecal coliforms. The major conclusion reached by this study was that bacteria were recovered inside and downwind of these facilities in levels that previous studies had stated could cause a potential human health hazard.

Multidrug-Resistant Bacteria Found to be Airborne in Concentrated Swine Operation
Johns Hopkins Bloomberg School of Public Health Research
For Immediate Release: December 3, 2004
Contact: Donna Mennitto 410-502-7578 or Tim Parsons 410-955-6878 or paffairs@jhsph.edu

People could be exposed to antibiotic-resistant bacteria from breathing the air from concentrated swine feeding facilities, according to researchers at the Johns Hopkins Bloomberg School of Public Health. They detected bacteria resistant to at least two antibiotics in air samples collected from inside a large-scale swine operation in the Mid-Atlantic region of the United States. Until now, little research has been conducted regarding the presence of antibiotic-resistant bacteria in the air within industrial swine facilities. The study 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 soil, surface water and groundwater near production operations. The article is published in the online edition of Environmental Health Perspectives.

“Eating retail pork products is not the only pathway of exposure for the transfer of antibiotic-resistant bacteria from swine to humans. Environmental pathways may be equally important,” said Amy Chapin, the study’s lead author and a doctoral candidate at the Bloomberg School of Public Health’s Department of Environmental Health Sciences.

Chapin explained that the use of antibiotics in industrial animal production has a significant impact on the emergence of antibiotic-resistant bacteria that threaten human health. Using antibiotics in animals can decrease the effectiveness of the same antibiotics used to combat human infections. The non-therapeutic use of antimicrobials in livestock production in the United States comprises an estimated 60 to 80 percent of the total antimicrobial production nationally. Non-therapeutic doses of drugs are given to swine to promote growth and improve feed efficiency - not to treat actual swine disease.

The airborne bacteria samples that were found to be multidrug-resistant were: Enterococcus, coagulase negative staphylococci and viridans group streptococci. These bacteria are associated with a variety of human infections. The study found that 98 percent of the isolated samples were resistant to at least two of the following antibiotics: erythromycin, clindamycin, virginiamycin and tetracycline. All of these drugs (or their human drug counterparts) are important antibiotics in the treatment of human infections. In contrast, none of the bacterial samples were resistant to vancomycin – an antibiotic that has never been approved for use in swine production in the United States.

The researchers believe workers at concentrated animal feeding operations are at greatest risk for airborne exposure to antibiotic-resistant bacteria. However, the same workers may also become reservoirs of drug-resistant bacteria that can be spread to family and the broader community. The study also raises questions about the spread of drug-resistant bacteria to areas beyond the immediate site through ventilation fans and by the application of manure from feeding operations to off-site fields.

"These research findings add another piece to our understanding of human exposure to antibiotic-resistant bacteria," said Kellogg Schwab, PhD, assistant professor in the Bloomberg School of Public Health's Department of Environmental Health Sciences and the study's corresponding author. "Finding and documenting the multiple environmental pathways of exposure are critical to finding solutions to the growing, serious problem of antibiotic-resistant bacteria in humans."

Sources:
The study was supported by the Johns Hopkins Center for a Livable Future at the Johns Hopkins Bloomberg School of Public Health and the National Institute for Occupational Safety and Health, Education Research Center. Amy Chapin is a Howard Hughes Medical Institute Pre-doctoral Fellow.

A. Rule, K.Gibson, and T.J. Buckley, from the Johns Hopkins Bloomberg School of Public Health, co-authored the study.

Antibiotics in dust originating from a pig fattening farm: a new source of health hazard for farmers? Gerd Hamscher, Heike Theresia Pawelzick, Silke Sczesny,Heinz Nau, and Jörg Hartung. *Journal of the National Institute of Environmental Health Sciences.* Online at ehponline.org doi:10.1289/ehp.6288 (available at http://dx.doi.org/) Online 18 June 2003

Abstract
Pig house dust originates from feed, bedding, feces and the animals themselves. If the animals receive drugs such as antibiotics, residues of these substances may occur in manure, in the air or on surfaces of the respective animal house. In a retrospective study, we investigated dust samples collected during a period of two decades from the same piggery for the occurrence of various antibiotics. In 90% of these samples, we detected up to five different antibiotics including tylosin, various tetracyclines, sulfamethazine and chloramphenicol in total amounts up to 12.5 mg/kg dust. High dust exposure in animal confinement buildings is believed to be a respiratory health hazard because of the high content of microorganisms, endotoxins and allergens. Further risks may arise from the inhalation of dust contaminated with a cocktail of antibiotics. Apart from that, our data provide first evidence for a new route of entry for veterinary drugs in the environment.

USDA Research: Evidence for Transfer of Tylosin and Tylosin-Resistant Bacteria in Air from Swine Production Facilities using Sub-Therapeutic Concentrations of Tylan in Feed J.A. Zahn, National Swine Research and Information Center, USDA-ARS, 2150 Pammel Drive, Ames, IA 50011. Published abstract presented at the International Animal Agriculture and Food Science Conference, July 24-28, 2001, Indianapolis, IN.

Abstract:
Macrolides are an important class of antibiotics used in human and veterinary medicine for therapy and prevention of diseases caused by Gram-positive bacteria, and as animal growth promotants. Tylosin belongs to the class of 16-membered macrolide antibiotics, and has been used exclusively in veterinary medicine for treatment of animal diseases or for enhancing animal growth rate. Antibiotic resistant studies have recently focused on measuring tylosin residues and tylosin-resistant bacteria (TRB) in animal products or in effluent streams from animal production facilities as potential routes for transfer of antibiotic resistance to humans. However, these studies have not considered aerial transfer from point sources as a significant route in human exposure. This study quantified the concentration of tylosin and TRB in air from three mechanically ventilated swine (finisher stage) confinements using tylosin at sub-therapeutic concentrations (20 g/ton) in feed. Tylosin residues and culturable bacteria in air at exhaust fans were trapped on absorbent resins or impinger samplers, respectively. Tylosin concentration was determined by high-performance liquid chromatography-electrospray tandem (MS-MS) mass spectrometry followingsolvent desorption of absorbent resins. The number of culturable bacteria and culturable, TRB were determined by plating on standard plate count agar containing no tylosin or 50µg*ml?¹ tylosin, respectively. The mean concentration of TRB (49,400 ±16,700 CFU*m?³) accounted for approximately 80% of the total culturable bacteria (62,100 ± 18,300 CFU*m?³) present in air streams from confinements, with Corynebacterium the predominant genus of TRB. The mean concentration oftylosin in the air from the three confinements was shown to be 8.1 ±5.3ng*L?¹ of exhaust air. Feeder operation, ventilation rate, and animal activity were shown to be the most significant variables influencing emission rate of tylosin and culturable TRB from the swine confinements. ***The results indicate that aerial transfer of antibiotics and antibiotic-resistant bacteria from swine***

confinements may represent an important, and previously overlooked mechanism for transfer of antibiotic resistance to humans and to the environment.

Antibiotic-resistant genes traced from farms to groundwater University of Illinois Research: May 2001 Contact: Jim Barlow, Life Sciences Editor b-james3@uiuc.edu 217-333-5802 University of Illinois at Urbana-Champaign <http://www.eurekalert.org/releases/uiuc-arg043001.html>

CHAMPAIGN, Ill. Genes resistant to tetracycline have been found in groundwater as far as a sixth of a mile downstream from two swine facilities that use antibiotics as growth promoters. The finding is significant in part because it shows the potential for spreading resistance back into the food chain of animals and people, researchers say. U.S. farmers for more than 50 years have used tetracycline and other antibiotics to enhance the growth of livestock. In humans, an overuse of antibiotics is blamed for a growing resistance to many antibiotics, and agricultural use has been suspected in the spread of resistance genes. The European Union is phasing out such agricultural use; Sweden banned it in the 1980s. Researchers from the University of Illinois and Illinois State Geological Survey used a DNA-amplification technique (polymerase chain reaction or PCR) to analyze samples from lagoons, wells and groundwater on and near Two Illinois facilities, said Rustam I. Aminov, a visiting professor of Animal sciences at the UI. Their research appeared in the April issue of Applied and Environmental Microbiology. Aminov had reported his creation of primers for use with PCR to detect resistance genes in the environment earlier this year in the same journal. In the earlier paper, he also reported the detection of resistance genes in livestock intestines and feces and in commercial feed.

"The use of tetracycline on farms is pushing the evolution of these genes," he said. "We found tetracycline resistance genes in soil and groundwater bacteria. The genes are transferred to this type of bacteria, where they can survive and travel long distances in the environment. It has been suggested that there is horizontal transfer of antibiotic resistance genes,but we had only seen it in laboratory experiments, not in in-situ studies. Here, we see such a transfer is occurring in the environment."

The researchers were able to identify the trail taken by the resistance genes. The DNA fingerprints in the samples matched the resistance genes previously identified in livestock and feed." These genes were found to be predominant in the gastrointestinal tracts of pigs and steers," the authors wrote. "The elevated frequencies of these genes in the environment surrounding the farms were consistent with the hypothesis that this occurrence was the result of gene flow from the animals." Once resistance genes make their way into drinking water, they will find their way into the guts of the people, animals and wildlife that drink it, Aminov said. "We are potentially passing on resistance in a continuous genecycle in the environment," he said.

Source:
The five-member research team consisted of Aminov and Roderick I. Mackie, a professor of animal sciences; Natalie Garrigues-Jeanjean, a postdoctoral researcher in veterinary pathobiology; J.C. Chee-Sanford, now with the USDA; and Ivan J. Krapac of the State Geological Survey.

Overuse of Antibiotics in Animal Agriculture
Air and Water Quality Impacts

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

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[1] Halverson, Marlene, The Price We Pay for Corporate Hogs, (Institute for Agriculture and Trade Policy, 2000), p. p.33.
[2] Mellon, Margaret et al., eds. Hogging It-Estimates of Antimicrobial Abuse in Livestock, Union of Concerned Scientists, 2001. Executive Summary. P6-9. www.ucsusa.org/publications
[3] Mellon, Margaret. "Prescription for Trouble," Nucleus, Vol.20 No.4, winter 1998-1999.
[4] Press Release: Agricultural antibiotic use contributes to 'suber-bugs in humans, Paul Ocampo, press@plos.org, 415-624-1224, Public Library of Science http://www.eurekalert.org/pub_releases/2005-07/plos-aau_1063005.php
[5] American Public Health Association, Precautionary Moratorium on New Concentrated Animal Feed Operations, http://www.apha.org/legislative/policy/2003/2003-007.pdf January, 2004

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

[6] Kendall Thu, PhD., "What's New in Research? Water Contamination and Large-Scale Swine Operations," The Voice: Friends of Rural America, fall 1999, pp. 10,11.
[7] Karparti, Adam. MD. Et al. Report of a Pilot Environmental Investigation Around Large Poultry Operations in Ohio, (November 1998) p.9
[8] Fackelmann, Kathleen, "Drugs Found in Tap Water," USA Today Health, 8, November 2000.
[9] "Bringing Home the Bacon," The Humane Farming Association, (co.1995).
[10] Ananthaswamy, Anil, "Spreading problem: Suberbug genes are getting into soil and water-will humans be next?" New Scientist Magazine, 18 April 2001 http://www.newscientist.com/dailynews/news.jsp?id=ns9999640
[11] Beeman, Perry. "New Tests of waterways Planned," DesMoines Register, 30 March 2001
[12] Marberry, Steve," Slurry, Sewage and Antibiotics," Feedstuffs Magazine, 16, April, 2001.
[13] Dennis A. McBride,M.D., M.P.H, "Public Health Aspects and Hog Farm Odors,"12/7/98.

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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[14] Perry Beeman, "New fear from hog lots: Odor may spread illness," DeMoines Register, 10/25/98.

[15] Scarpino, P.V. and H. Quinn., Bioaerosol Distribution Patterns Adjacent to Two Swine Growing Finishing Housed Confinement Units in the American Midwest, Abstracts of the 14th Annual Scientific Symposium of the Ohio River Basin Consortium for Research and Education, Oct 14-16 1998

[16]Gibbs, Shawn, Green, Christopher Tarwater,Patrick, Scarpino, Pasquale, Airborne Antibiotic Resistant and Nonresistant Bacteria and Fungi Recovered from Two Swine Herd Confined Animal Feeding Operations, Journal of Occupational and Environmental Hygiene, 1:699-706 November 2004.

[17] J.A. Zahn, Evidence for Transfer of Tylosin and Tylosin-Resistant Bacteria in Ait from Swine Production Facilities using Sub-Therapeutic Concentrations of Tylan in Feed, National Swine Research and Information Center, USDA-ARS, 2150 Pammel Drive, Ames, Iowa, 50011

[18] Chapin, Amy et al., Airborne Multi Drug Resistant Bacteria Isolated from a Concentrated Swine Feeding Operation, Johns Hopkins Bloomberg School of Public Health, doi:10.11289/ehp.7473. available at http://dx.doi.org/

[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

Top Ten Facts:
Antibiotics in Animal Agriculture

1. Roughly 70% of all antibiotics in the United States are routinely used in animal agriculture without a prescription (and in the absence of disease) to make animals grow faster and compensate for crowded, stressful, unsanitary conditions on factory farms. (Antibiotics are used in 90% of starter feeds, 75% of grower feeds, and more than half of finishing feeds in the U.S.)

2. Approximately half of the antibiotics prescribed by doctors used to treat sick people are identical or very similar (same drug class) to antibiotics given to healthy livestock and poultry.

3. The AMA (American Medical Association) opposes the routine use of antibiotics in agriculture because it is contributing to antibiotic resistance (the inability of antibiotics to cure serious human disease).

4. Each year, two trillion pounds of animal waste is produced in the U.S. Up to 75% of antibiotics given to animals can end up in animal waste. Animal waste may contain antibiotics and bacteria resistant to antibiotics (commonly called *superbugs*).

5. A recent USDA study found that large-scale factory farms routinely overapply animal waste onto the ground. This waste runs off and causes water pollution. Manure storage facilities can also leak and spill, contaminating our water supplies.

6. Scientists have found evidence of antibiotic resistance in hogs, their waste, the soil, and in drinking water downstream from swine farms in Illinois. In Iowa, the CDC (Centers for Disease Control) found antibiotics commonly fed to hogs and antibiotic resistant bacteria (superbugs) in wells, ditches and waterways near Iowa hog confinements.

7. Dangerous resistant bacteria can also wind up in the meat and in other food products during processing, which is a hazard to humans eating the food.

8. The European Union will have a ban on all routine antibiotic use in animal feed by the end of 2006. To keep antibiotics working for people who need them, we must stop the overuse of antibiotics in pigs, poultry and cattle, especially the antibiotics that are also used in human medicine.

9. Animals *can* be raised without antibiotics. Animal production levels have not been affected in European Countries that have banned the use of antibiotics in healthy animals. Many farmers in the U.S. are successfully raising farm animals without the overuse of antibiotics.

10. You can protect your family and help to stop the overuse of antibiotics in animal agriculture by purchasing meat that has not been produced with routine use of antibiotics. Go to www.theatwellguide.com to find out more.

Sources:

Hogging It, Estimates of Antimicrobial Abuse in Livestock Union of Concerned Scientists, Margaret Mellon

KAW Keep Antibiotics Working, Myths and Realities at www.keepantibioticsworking.com

A Growing Health Threat to you and your family, KeepAntibioticsWorking.com 202-572-3250

Press Release: University of Illinois Antibiotic-resistant genes traced from farms to groundwater; 1 MAY 2001Contact: Jim Barlow, Life Sciences Editor b-james3@uiuc.edu, 217-333-5802 University of Illinois at Urbana-Champaign

Kendall Thu, PhD., *"What's New in Research? Water Contamination and Large-Scale Swine Operations,"* *The Voice*: Friends of Rural America, fall 1999, pp. 10,11.

For Immediate Release: March 16, 2005
Media Contact: Tim Parsons@ 410 955 6878

Johns Hopkins Research Antibiotic Resistance and Poultry
Drug-Resistant Bacteria on Poultry Products Differ by Brand

The presence of drug-resistant, pathogenic bacteria on uncooked poultry products varies by commercial brand and is likely related to antibiotic use in production, according to researchers at the Johns Hopkins Bloomberg School of Public Health. **Their study is the first to directly compare bacterial contamination of poultry products sold in U.S. supermarkets from food producers who use antibiotics and from those who claim they do not. The study focused on antibiotic resistance, specifically fluoroquinolone-resistance in Campylobacter, a pathogen responsible for 2.4 million cases of food-borne illness per year in the U.S., according to the Centers for Disease Control and Prevention.** The study is published online in the journal <http://ehp.niehs.nih.gov/docs/2005/7647/abstract.html%20> *Environmental Health Perspectives*.

"Our use of medically important classes of antibiotics in food-animal production creates a significant public health concern," said the study's lead author Lance Price, a doctoral candidate and fellow at the Bloomberg School of Public Health's Center for a Livable Future <http://www.jhsph.edu/environment> . "Companies that use antibiotics foster the development of drug-resistant bacteria which can spread to the human population. Claims have been made that using antibiotics increases food safety by reducing pathogens on the meat. Interestingly, in addition to the results regarding fluoroquinolone-resistant Campylobacter, we also found that brands that do not use any antibiotics during production were no more likely to contain Campylobacter than those that do. In fact, the only brand with a significantly lower rate of Campylobacter contamination was actually an antibiotic-free brand."

Price explained that previous epidemiological studies have indicated that fresh poultry products are a major source of Campylobacter infections in humans. Exposure can occur from undercooked products or through cross-contamination during food preparation, when raw poultry is handled in the kitchen. The danger of infection is heightened when this pathogen is resistant to antibiotics. Not only can the bacteria itself cause illnesses such as diarrhea in humans, but fluoroquinolones are some of the most important drugs used to treat a variety of infections, including those caused by Campylobacter. The widespread presence of this drug-resistant form of the bacteria makes the antibiotic less effective in human medicine. Especially vulnerable are the very young, the elderly and people whose immune systems are compromised.

In 2000, the Food and Drug Administration proposed to withdraw approval of fluoroquinolone drugs for use in uncooked poultry production. That effort has since been stalled by legal objections from Bayer, one of the pharmaceutical companies manufacturing the drug. In the meantime, two major U.S. poultry producers, Tyson Food and Perdue Farms, separately announced in 2002 that they would immediately stop using fluoroquinolones to treat their flocks.

One year after the Tyson and Perdue announcements, Price and his team began a survey of Campylobacter isolates on chicken products from Tyson and Perdue and from two other producers, Eberly and Bell & Evans, who claim their production methods are completely antibiotic-free. Using both standard isolation methods and new methods modified to enhance detection of fluoroquinolone-resistant Campylobacter, they compared retail products purchased at grocery stores in Baltimore, Md. A high percentage of the products from the two conventional brands were contaminated with fluoroquinolone-resistant Campylobacter (96 percent from Tyson and 43 percent from Perdue) while significantly lower proportions of 'antibiotic-free' products were contaminated with fluoroquinolone-resistant Campylobacter (5 percent from Eberly and 13 percent from Bell & Evans).

"**These results suggest that fluoroquinolone-resistance may persist in the food supply for a substantial period of time even after antibiotic use is discontinued," said Price. "Assuming that what we are observing are lingering resistant strains rather than the result of continued drug use, then one has to conclude that fluoroquinolone use in poultry production presents a long-term threat to people."**

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E. Johnson, R. Vailes, and E. Silbergeld from the Johns Hopkins Bloomberg School of Public Health, co-authored this study.

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Research Article

Fluoroquinolone-Resistant *Campylobacter* Isolates from Conventional and Antibiotic-Free Chicken Products

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Abstract

The use of fluoroquinolones (FQs) in poultry production is an important issue in public health today. In February 2002, two prominent U.S. poultry companies pledged to stop using FQs for flock-wide treatment. One year later, we began a survey of *Campylobacter* isolates on chicken products from these two companies and from two producers claiming total abstention from antibiotic use. Using both standard isolation methods and new methods modified to enhance detection of FQ-resistant *Campylobacter*, we compared rates of FQ-resistant *Campylobacter* among these products. Four major findings were drawn from this study: *a*) antibiotic-free brands were not more likely to be contaminated with *Campylobacter*; *b*) a high percentage of products from the two conventional brands were contaminated with FQ-resistant *Campylobacter* (43 and 96%); *c*) these conventional brands had significantly higher odds of carrying resistant strains compared with antibiotic-free products; and *d*) supplementing media with FQs increased the sensitivity of detecting FQ-resistant strains among mixed populations of *Campylobacter*, thus reducing a bias toward underestimating the prevalence of FQ-resistant *Campylobacter* on samples. These results suggest that FQ resistance may persist in the commercial poultry environment in the absence of FQ-selective pressure and that these strains contaminate a larger proportion of foods than reported previously. *Key words:* bacterial, *Campylobacter*, chickens, drug resistance, drugs, fluoroquinolones, food microbiology, methods, poultry, veterinary. *Environ Health Perspect* 113:557-560 (2005). doi:10.1289/ehp.7647 available via *http://dx.doi.org/* [Online 2 February 2005]