HEALTHY PIGS: SAFE FOOD

By H. Scott Hurd
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The risk of antibiotic use in food animals for purposes other than disease treatment is receiving renewed scrutiny. In the United States, the question is being addressed with qualitative and quantitative risk assessments. In Scandinavia, it has been addressed with prohibitions on the uses labeled as growth promotion (Cox and Popken, 2004, Hurd, et al., 2004, U.S., FDA, 2002). However, every risk assessment is likely to calculate some level of risk, albeit extremely low. Generally, society and regulators are not willing to permit or accept additional risk unless there is some benefit.

Is it possible that this perceived “risky activity” of food animal antibiotic use could decrease consumer risk? What if it reduced the burden of human illness associated with meat-borne bacteria such as Salmonella or Campylobacter? What if healthier animals resulted in healthier meat, milk, and eggs? Clearly, society has a longstanding belief in the benefits of consuming healthy animals, demonstrated in meat hygiene inspection rules dating back to 1914 in the U.S.

How could the use of antibiotics decrease Salmonella and Campylobacter rates on carcasses and meat, thereby decreasing human risk? Risk is about probabilities and dose; the probability of an event happening and the exposure dose if it does. For example, chronic stress of disease will increase the likelihood and degree of animal infection with pathogens such as Salmonella; disease control reduces risk. Additionally, animal health likely influences slaughter and evisceration quality, processes that affect the probability and amount of fecal contamination. Conditions that may increase the probability or amount of fecal contamination include:

- Peritonitis (inflammation of the abdominal area)
- Pleuritis (inflammation of the chest area)
- Adhesions (“scar tissue” connecting viscer to the interior of body cavity)
- Amount and fluidity of gut contents (increased probability of tears or spills)
- Gut friability (increased probability of tears or spills)

- Airsacculitis (inflammation and adhesions in the chest area of poultry)
- Any health condition that leads to extra handling for trimming, e.g. skin lesions, abscesses, arthritis

Meat inspectors will notice many of these issues and remove obviously unwholesome product; however, pathogens are invisible. The resulting feces from a gut spill are quickly cleaned up, but the unseen bacteria on hands, machinery, or tools are not so easily detected. The extra handling required to trim contaminated surfaces or remove an arthritic joint has been shown to decrease shelf life due to extra bacterial load. Inflammation of the airsacs in a poultry flock has been associated with increased Salmonella and Campylobacter loads (Russell, 2003). Antibiotic-free pigs tend to have more fluid gut contents. Any of these conditions may increase the probability and dose of pathogen contamination.

Common diseases

Many animal diseases produce the types of conditions just described. These diseases include Escherichia coli infection (airsacculitis) and Clostridium perfringens infection, producing necrotic enteritis in poultry. Pleuritis is common due to porcine respiratory disease of various bacterial causes at an early age. Inflammation of the small intestine in swine (ileitis) may increase gut friability. Liver abscesses in cattle and infectious arthritis in all animals lead to extra handling for trimming of unwholesome tissue.

Antibiotic use reduces or eliminates these diseases. Treatment with virginiamycin is effective in preventing necrotic enteritis in poultry. Prevention of porcine respiratory disease at an early age will avoid lesions such as chronic pleuritis or peritonitis and the resulting adhesions affecting evisceration quality. Lastly, uses labeled for improved performance have been shown to actually reduce infections with Clostridium perfringens (Stutz and Lawton, 1984). Additionally, when avoparcin was removed from Norwegian poultry, necrotic conditions...
enteritis reached “epidemic proportions” (Kaldhusdal, 2000). The loss of “growth promotion” antibiotics in all phases of Danish swine production (1999) has been followed by a 100 percent increase in the use of antibiotics labeled for treatment. To this point, there has been no decrease in Salmonella or Campylobacter illness or resistance levels in humans.

Could these disease-related conditions really affect public health? Based on available data, the answer is “yes.” A simple calculation will demonstrate.

An example
Say a pork processing plant, using antibiotic-treated pigs, has about 5 percent of its carcasses Salmonella-positive in the cooler. A large plant (15,000 head/day) would produce 750 Salmonella-positive carcasses per day. But some research, based on quantification of Salmonella loads, shows that only about 4 percent of the resulting servings will be potentially infectious; computing to about 25,000 potentially infectious servings per day (assumes: 110kg carcass weight, 20 percent of contaminated carcass is ground and potentially contaminated, 250g serving size) (Alban et al., 2002).

If antibiotic-free pigs are used and if they have slightly more disease, which increases the Salmonella carcass positive rate only 2 percentage points to 7 percent, that plant is now producing 1,050 Salmonella-positive carcasses per day; a 40 percent increase. Additionally, if the dose on those positive carcasses is increased 2 points so that 6 percent of the resulting servings will be potentially infectious, then the number of potentially infectious servings sold per day increases to 55,000, a 115 percent increase over the antibiotic-treated pigs.

These calculations are based on the assumption that animal health conditions do impact the probability and dose of final product contamination. A more sophisticated analysis for poultry was presented recently (Singer, et al. 2005, http://www.ahc.umn.edu/news/releases/chickens110204/). More data are needed on this topic, especially in cattle and swine. These types of studies should be fairly easy to conduct. It is useful, but not necessary that antibiotic-free animals be used in these studies, as the key hypothesis is the relationship between conditions such as pleuritis, arthritis, etc., and carcass contamination with microbial load. Until these studies can prove there is no connection between animal health and pathogen load, we must assume that removal of antibiotics in food production would increase the human risk of generic Salmonella, Campylobacter; and Yersinia infection more than it would decrease risk from resistance.

Conclusion
A quantitative risk assessment of the impact on human health relative to the continued use of virginiamycin has also been concluded. The report determined that the quantitative human health risk from continued use of virginiamycin in the U.S. is less than one statistical life saved in the entire U.S. population over the next 15 years (Cox and Popken, 2004). Consistent with the Cox/Popken study, the Food and Drug Administration, in the U.S. draft risk assessment of virginiamycin (2004), demonstrated a risk of virginiamycin use in the range of 0.7 to 14 chances in 100 million. Additionally, work by this author shows the risk of any adverse human effects (e.g., extra days of illness) of macrolide use in poultry, pork, and beef cattle was less than 10 in 100 million per human year (Hurd et al., 2004). Risk managers must compare the hypothetical risk of increased resistance to the thousands of excess Campylobacter and Salmonella cases expected if medicated feed additives come to be banned.

References
HAVE YOU SEEN THE NEW PIG?

The Pork Information Gateway—or PIG—is an interactive, intuitive, Web-based tool to help producers and others find information on a range of subjects related to production of pigs and pork. The tool has a virtual library of resources, including peer-reviewed fact sheets and other publications, a glossary, and pork industry pictures.

But the unique component is the “frequently asked questions” (FAQ) portion of the program. This is the most extensive collection of research-based, peer-reviewed information available to the pork industry. To visit PIG, go to http://ncsu.porkgateway.org or follow the link from http://mark.asci.ncsu.edu


The site includes a database of 183 fact sheets, 2,057 frequently asked questions, 297 reference materials, and 100 images. The information grows daily as new questions are posed and answered and new sources of information added.

PIG was developed through a national collaboration of specialists and educators that was led by the U.S. Pork Center of Excellence and Dr. Todd See at North Carolina State University. The mission of the U.S. Pork Center of Excellence is to add value to the pork industry by facilitating research and learning for pork producers through national collaboration. The vision is development of a new paradigm for how research is conducted and information is delivered. This new organization is initially supported by grants from USDA’s Agricultural Research Service, USDA’s Cooperative State Research, Education, and Extension Service, the National Pork Board, and the National Pork Producers Council; through financial support from several land-grant universities, including North Carolina State University, Iowa State University, the University of Minnesota, the University of Illinois, Purdue University, the University of Missouri, the University of Nebraska, The Ohio State University, Kansas State University, South Dakota State University, the University of Wisconsin, Texas A & M University, Michigan State University, Penn State University, the University of Tennessee, North Dakota State University, and Virginia Polytechnic Institute and State University; and through the financial support of several state pork producer organizations including Mississippi Pork Producers Association, Missouri Pork Producers Association, Tennessee Pork Producers Association, and Utah Pork Producers Association.

—Todd See

CALENDAR OF EVENTS

October
13-22 North Carolina State Fair
North Carolina State Fairgrounds
Raleigh, N.C.
27 Healthy Hog Seminar
Clinton, N.C.

November
16 Southeast Regional Pork Conference
Kenansville, N.C.
21 Wilson Regional Pork Conference
Wilson, N.C.

ON-FARM PERFORMANCE TESTING: The following breeders with validated herds have tested animals in the past 30 days.

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<thead>
<tr>
<th>Breeder</th>
<th>Address</th>
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<tr>
<td>Bob Ivey*</td>
<td>314 N.C. 111 S, Goldsboro 27530</td>
<td>L,D,Y,CW</td>
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<tr>
<td>Wesley Looper*</td>
<td>4695 Petra Mill Road, Granite Falls 28630</td>
<td>Y,L,H,D,X</td>
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<tr>
<td>Thad Sharp, Jr. &amp; Sons</td>
<td>5171 N.C. 581 Hwy., Sims 27880</td>
<td>Y,D,X</td>
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<tr>
<td>Thomas Farms</td>
<td>8251 Oxford Road, Timberlake 27583</td>
<td>X</td>
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<tr>
<td>Tidewater Research Farm*</td>
<td>207 Research Station Road, Plymouth 27962</td>
<td>X</td>
</tr>
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*Realtime Ultrasound

—Frank Hollowell, David Lee
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