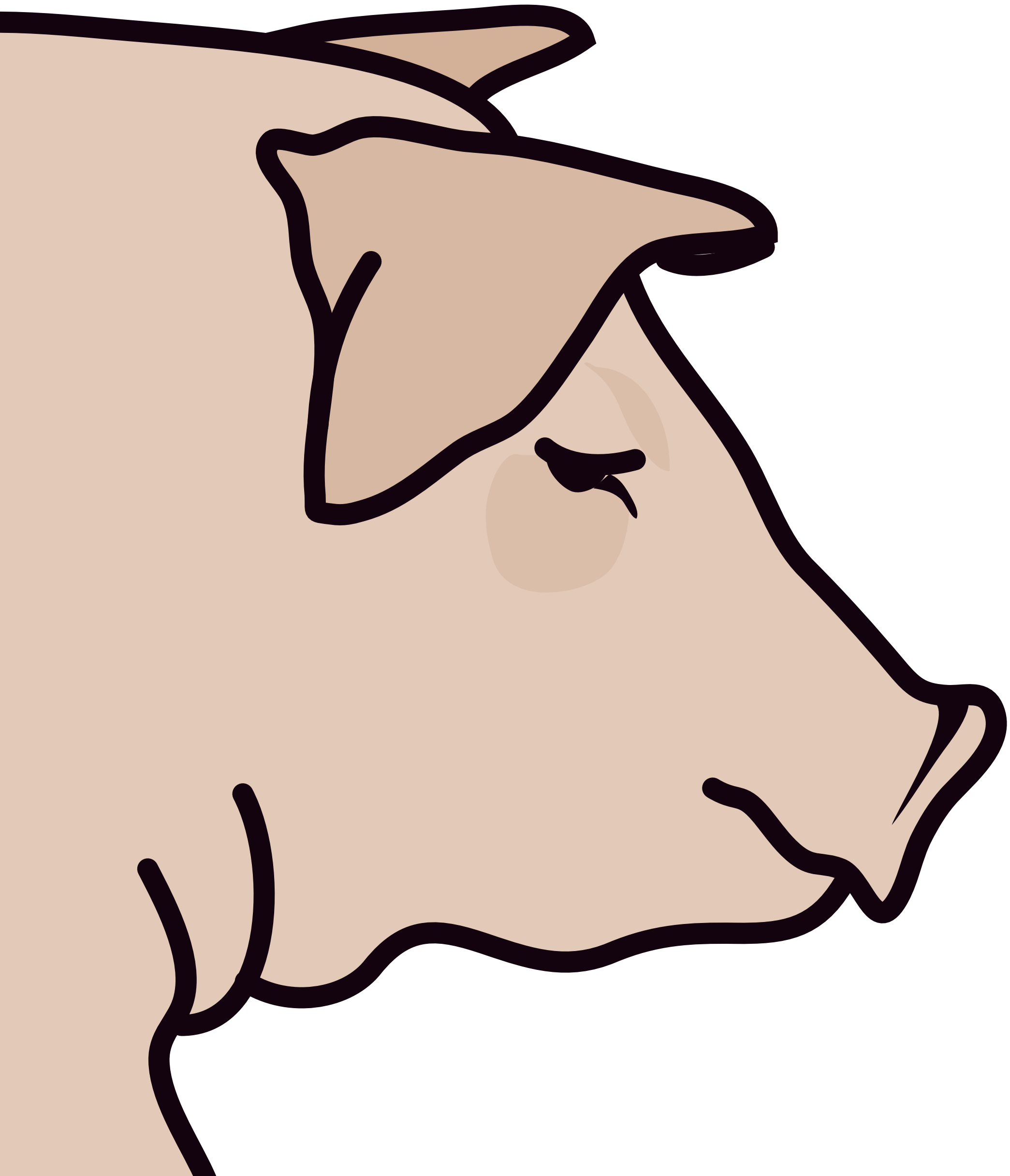
Judicious Use of Antimicrobials for

Swine Veterinarians



The material contained in this brochure was developed in cooperation with the American Veterinary Medical Association.

The Food and Drug Administration Center for Veterinary Medicine

Judicious Use Of Antimicrobials For Swine Veterinarians

INTRODUCTION

The use of drugs in animals is fundamental to animal health and well-being. Antimicrobials are needed for the relief of pain and suffering in animals. For food animals, the gains that have been made in food production capacity would not have been possible without the ability for reliable drugs to contain the threat of disease to animals. The increased capacity of the United States livestock and poultry producer has kept high quality protein available and affordable for the majority of the U.S. consumers and consumers in many other countries. The World Health Organization stated, "Antimicrobials are vital medicines for the treatment of bacterial infections in both humans and animals. Antimicrobials have also proved to be important for sustainable livestock production and for the control of animal infections that could be passed on to humans." And the report by the National Research Council and Institute of Medicine states, "The benefit to human health in the proper use of antibiotics in food animals is related to the ability for these drugs to combat infectious bacteria that can be transferred to humans by either direct contact with the sick animal, consumption of food contaminated with pathogens from animals, or proliferation into the environment." However, the use of antimicrobials in food animals is not without risks.

In recent years, concerns about the use of antimicrobial products in food-producing animals have focused on human food safety because foods of animal origin are sometimes identified as the vehicles of food borne disease in humans and, therefore, also vehicles of resistant food borne pathogens and resistant genetic material. The major zoonotic pathogens of concern for the development of antimicrobial resistance are *Salmonella* spp. and *Campylobacter jejuni*. A recent report estimated that 80% of the estimated 2.5 million annual human cases in the United States of campylobacteriosis are food borne and that 95% of the 1.4 million annual human cases of nontyphoidal salmonellosis are food borne. This equates to 1.96 million cases of food borne campylobacteriosis and 1.34 million cases of food borne salmonellosis per year in the United States in 1998. The Centers for Disease Control and Prevention reported a 19% decrease in 1999 of food borne disease caused by *Campylobacter*. If a significant percentage of *Salmonella* or *Campylobacter* become resistant to the antibiotics used to treat those infections in humans, then there can be a significant impact on human health.

Resistance to antimicrobials existed even before antimicrobials were used. However, this intrinsic form of resistance is not a major source of concern for human and animal health. The vast majority of drug-resistant organisms have instead emerged as a result of genetic changes, acquired through mutation or transfer of genetic material during the life of the microorganisms, and subsequent selection processes. Mutational resistance develops as a result of spontaneous mutation in a locus on the microbial chromosome that controls susceptibility to a given antimicrobial. The presence of the drug serves as a selecting mechanism to suppress susceptible microorganisms and allow the growth of resistant mutants. Spontaneous mutations are transmissible vertically. Resistance can also develop as a result of transfer of genetic material between bacteria. Plasmids, which are small extra-chromosal DNA molecules, transposons and integrons, which are short DNA sequences, can be transmitted both vertically and horizontally and can code for multi-resistance. It is believed that the major part of acquired resistance is plasmid-mediated although the method of resistance transfer varies for specific drug/bacteria combinations.

Resistance depends on different mechanisms and more than one mechanism may operate for the same antimicrobial. Microorganisms resistant to a certain antimicrobial may also be resistant to other antimicrobials that share a mechanism of action or attachment. Such relationships, known as cross-resistance, exist mainly between agents that are closely related chemically (e.g. neomycin-kanamycin), but may also exist between structurally unrelated chemicals (e.g. erythromycin-lincomycin). Microorganisms may be resistant to several unrelated antimicrobials. Use of one such antimicrobial will therefore also select for resistance to the other antimicrobials.

Definitive answers about the safety of antimicrobial use in animals remain scientifically challenging, but more information is accumulating that raises concerns about food safety. As a result of treatment of the animal with antibiotics, food borne microbes may become resistant to the antibiotics used to treat human disease. When an animal is treated with an antimicrobial drug, a selective pressure is applied to all bacteria exposed to the drug. Bacteria that are sensitive to the antimicrobial are killed or put at a competitive disadvantage, while bacteria that have the ability to resist the antimicrobial have an advantage and are able to grow more rapidly than more susceptible bacteria. In addition, bacteria can become resistant when resistance genes are passed from a resistant bacterium to a sensitive one. Thus, antimicrobial agents may increase the prevalence of resistant bacteria among both target pathogens and normal bacterial flora. For example, despite several restrictions placed on the use of the two approved poultry fluoroquinolone products in the U.S., ciprofloxacin-resistant *Campylobacter* were recently isolated from 20% of domestic retail chicken products sampled. Molecular subtyping revealed an association between resistant *C. jejuni* strains from chicken products and *C. jejuni* strains from domestically acquired human cases of campylobacteriosis. The 1998 Annual Report of the National Antimicrobial Resistance Monitoring System-Enteric Bacteria (NARMS) reported 13.3% of the human *Campylobacter* isolates were resistant to ciprofloxacin. Preliminary data from 1999 reveal an increase to 20.5% resistance. Temporal relationships between ciprofloxacin-resistant *Campylobacter* and approval of fluoroquinolones for food-producing animals have also been noted in the Netherlands, the United Kingdom, and Spain.

Similarly, a temporal association has been noted between lessened susceptibility to fluoroquinolones among *Salmonella enterica* serotype Typhimurium Definitive Type 104 (DT104) and the approval and use of a fluoroquinolone for veterinary therapeutic use in the United Kingdom. This organism has also been identified in livestock and poultry in the U.S. Human disease caused by DT104 in the U.S. has been associated with consumption of unpasteurized dairy products and direct contact with livestock. NARMS has identified small numbers of human *Salmonella* isolates in the U.S. with reduced susceptibility to ciprofloxacin. Although the numbers are small, there is a worrisome upward trend of reduced susceptibility to ciprofloxacin as measured by the percentage of *Salmonella* isolates with a minimum inhibitory concentration equal to or greater than 0.25 mg/ml. The percentage rose from 0.4% of the *Salmonella* isolates in 1996 to 0.6% in 1997, 0.7% in 1998, and 1% in 1999 (preliminary data).

NARMS also tests *Salmonella* and *Campylobacter* isolates obtained from several species of animals. The isolates come from diagnostic laboratories, healthy animals on farms, and raw products collected at slaughter or processing plants. The *Salmonella* isolates are tested for susceptibility to 17 antimicrobials and the *Campylobacter* isolates are tested for resistance against eight antimicrobials. In 1998, resistance of the *Salmonella* isolates was most common to tetracycline (38% of the isolates), sulfamethoxazole (32%), streptomycin (35%), ampicillin (18%), ticarcillin (17%), kanamycin (15%), and gentamicin (11%). Resistance of the *Campylobacter* isolates was most common to tetracycline (60%), nalidixic acid (16%), ciprofloxacin (11%), clindamycin (7%), azithromycin (6%), and erythromycin (6%). Resistance to multiple antimicrobials is a concern. As organisms become resistant to more antimicrobials, the problem of therapy is compounded. In 1998, 40% of the animal *Salmonella* isolates were resistant to 2 or more antimicrobials. This is an increase from 25% in 1997. In 1998, 18% were resistant to 5 or more antimicrobials compared to 11% in 1997.

Unfortunately there is not a national monitoring system that tests for resistance in animal pathogens so we are unable to track and report trends.

This document has been prepared to help swine practitioners in their efforts to use antimicrobials judiciously to minimize the development of resistance in human and animal pathogens while maintaining effectiveness to treat and prevent diseases of food animals.

JUDICIOUS USE

Whenever an animal or human host is exposed to antimicrobials, there will be some degree of selection for resistant bacterial population. Selection will depend upon the type of antimicrobial used, the number of individuals treated, the dosage regimen, and the duration of treatment. Therefore, it is vital to limit therapeutic antimicrobial use in animals and humans to those situations where they are needed.

The veterinary profession shares the concerns of the public, governmental agencies, and public health community regarding the broad issue of antimicrobial resistance and specifically the potential risk of resistance developing in animals with subsequent transfer to humans. Because of that concern and to maintain the long-term effectiveness of antimicrobials for animal and human use and to increase the possibility of future antimicrobial drug approvals for the treatment of animals, the American Veterinary Medical Association is committed to judicious use of antimicrobials by veterinarians for the prevention, control, and treatment of animal diseases. The AVMA started a profession-wide initiative, including companion and food animal practitioner groups, to develop and implement judicious use principles for the therapeutic use of antimicrobials by veterinarians. The AVMA Executive Board has approved a general set of judicious use principles. The species practitioner groups are using the general principle as a template to develop more detailed guidelines appropriate to each species.

The overarching position of the AVMA is, "When the decision is reached to use antimicrobials for therapy, veterinarians should strive to optimize therapeutic efficacy and minimize resistance to antimicrobials to protect public and animal health." The objectives of the AVMA are to:

- Support development of a scientific knowledge base that provides the basis for judicious therapeutic antimicrobial use,
- Support educational efforts that promote judicious therapeutic antimicrobial use,
- Preserve therapeutic efficacy of antimicrobials, and
- Ensure current and future availability of veterinary antimicrobials.

Judicious use of antimicrobials is an integral part of good veterinary practice. It is an attitude to maximize therapeutic efficacy and minimize selection of resistant microorganisms. Judicious use principles are a guide for optimal use of antimicrobials. They should not be interpreted so restrictively as to replace professional judgment of practitioners or to compromise animal health or welfare. In all cases, animals should receive prompt and effective treatment as deemed necessary by the prescribing or supervising veterinarian.

There are fifteen general principles which emphasize preventive actions to avoid disease, consideration of other options before choosing to use antimicrobials, and consideration of use of less important drugs before using the drugs of last resort, especially those that are very important to human or animal medicine.

The principles with explanatory notes are:

1) Preventive strategies, such as appropriate husbandry and hygiene, routine health monitoring, and immunizations, should be emphasized.

Antimicrobial use should not be viewed in isolation from the disciplines of animal management, animal welfare, husbandry, hygiene, nutrition, immunology, and vaccination. Diseases must be controlled to reduce the need for antimicrobial use and they can only be controlled successfully by a holistic approach. The objective is to prevent disease to the greatest extent possible so that antimicrobial treatment is not required. Implicit in this objective is the need to establish a definitive diagnosis.

In food animals, antimicrobial use should always be part of, and not a replacement for, integrated disease control programs. These programs are likely to involve hygiene and disinfection procedures, biosecurity measures, management alterations, changes in stocking rates, vaccination, and other measures. The examples of preventive strategies are not exhaustive. Continued antimicrobial use in such control programs should be regularly assessed regarding effectiveness and whether their use can be reduced or stopped.

Additional research is needed on economical and efficacious alternatives to the use of antimicrobials and to evaluate their effects on selection of resistant bacteria. Evaluation is needed of vaccines, probiotics, competitive exclusion principles and products, nutrition, and new health technologies and strategies.

Swine practitioners must recognize the roles played by a number of factors in the course of a disease. Genetic sources and genetic predisposition may affect the severity and extent of a disease in a swine herd. Nutrition is also a vital part of the health of pigs. Included in nutrition are the primary concerns over availability of adequate water, protein, energy, and micronutrients. Pens of pigs should have adequate feeder and waterer space for the number and size of pigs present in the pen.

Close attention must be paid to the housing of the pigs. Proper ventilation and appropriate air space per pig are elements of suitable housing. In addition, meteorological conditions and seasonal weather patterns can dictate the type of housing and ventilation needed. Temperature extremes beyond the thermal neutral zone of swine can certainly affect a disease process. The chilling of baby pigs can foster and complicate the occurrence of diarrhea.

Proper management of pigs can assist in the prevention and treatment of disease. Appropriate stocking densities of pens and buildings should be based on the weight and age of the pigs, as well as the type of flooring and housing. The isolation and acclimatization of incoming breeding swine can prevent the introduction of new pathogens to a herd, as well as facilitate the exposure of the new animals to existing pathogens on that farm. Appropriate serological testing and other diagnostic laboratory procedures can be used to monitor the health status of incoming swine. The appropriate and timely use of washing and disinfection of premises and equipment will decrease the pathogen load in the pigs' environment, thus decreasing the transmission between subsequent groups of pigs. The removal of as much organic material as possible is part of the washing process. The depopulation and subsequent repopulation of a herd can be used to eliminate a disease organism. These are all management tools that can be used to augment the prevention and control of disease.

The ability of veterinarians to influence the health of pigs is dependent on the immune status of the swine. The competence of the pigs'immune system is essential, especially if alternatives to antimicrobials are being considered (e.g., vaccines). If an animal is unable to immunologically respond to an injected or ingested antigen, then the effectiveness of that vaccine is null. The herd dynamics and health status of the sow herd plays an important part of the pig's health status, especially in the weaning and nursery stage of production.

The presence and importance of concurrent infections can also affect the effectiveness of other interventions. An example of a concurrent infection in swine is that of porcine reproductive and respiratory virus and mycoplasma. Once again underscoring the need to establish a definitive diagnosis and designing the appropriate interventions.

If pigs are purchased, then the source of pigs (e.g., single source or multiple sources) and the timing of the additions become important factors. The commingling of pigs of dissimilar age and health status can certainly exacerbate and potentiate disease processes.

2) Other therapeutic options should be considered prior to antimicrobial therapy.

Effective therapeutic options other than antimicrobials are viable choices for the treatment and prevention of disease. Pig scours may only need to be treated with fluid replacement, not with antimicrobials. Altering the temperature in the farrowing house may aid pigs in recovering from the disease. Other examples include the acidification of feed or water and supportive care such as antipyretic therapy.

3) Judicious use of antimicrobials, when under the direction of a veterinarian, should meet all the requirements of a valid veterinarian-client-patient relationship.

The use of prescription antimicrobials or any antimicrobial used in an extralabel manner requires a valid veterinarian-client-patient relationship. A valid VCPR exists when **all** of the following conditions have been met:'

a) The veterinarian has assumed the responsibility for making clinical judgments regarding the health of the animal(s) and the need for medical treatment, and the client has agreed to follow the veterinarian's instructions.
b) The veterinarian has sufficient knowledge of the animal(s) to initiate at least a general or preliminary diagnosis of the medical condition of the animal(s). This means that the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of an examination of the animal(s) or by medically appropriate and timely visits to the premises where the animal(s) are kept.
c) The veterinarian is readily available for follow-up evaluation, or has arranged for emergency coverage, in the event of adverse reactions or failure of the treatment regimen.

When it is not possible to make a direct clinical evaluation, the diagnosis should be based on past experience and knowledge of the farm epidemiological status. Consideration should be given to prior culture results and on-going susceptibility testing, as well as prior serological testing of animals at a similar stage of production or of the herd.

4) Prescription, Veterinary Feed Directive, and extralabel use of antimicrobials must meet all the requirements of a valid veterinarian-client-patient relationship.

Federal regulations mandate a valid VCPR for the dispensing and use of prescription and VFD drugs and for the extralabel use of drugs. Veterinarians need to be mindful that the law prohibits the extra label use of antimicrobials in or on animal feeds.

5) Extralabel antimicrobial therapy must be prescribed only in accordance with the Animal Medicinal Drug Use Clarification Act amendments to the Food, Drug, and Cosmetic Act and its regulations.

No drug can be marketed unless its quality, safety, and efficacy have been demonstrated. Therefore, the first line of choice should be based on the products approved for the species and the indication concerned. When no suitable product is approved for a specific condition or species, or the approved product is ineffective, the choice of an alternative product should be based, whenever possible, on the results of well performed scientific studies and a proven efficacy for the condition and species concerned.

a) For food animals, extralabel drug use (ELDU) is not permitted if a drug exists that is labeled for the food animal species and contains the needed ingredient, is in the proper dosage form, is labeled for the indication, and is clinically effective.
b) ELDU is permitted only by or under the supervision of a veterinarian.
c) ELDU is allowed only for FDA approved animal and human drugs.
d) ELDU is permitted for therapeutic purposes only when an animal's health is suffering or threatened. ELDU is not permitted for production drugs (e.g., growth promotion).
e) ELDU is permitted to be used for preventative purposes when an animal's health is threatened.
f) ELDU in feed is prohibited.
g) ELDU is not permitted if it results in a violative food residue, or any residue that may present a risk to public health.
h) ELDU requires scientifically based drug withdrawal times to ensure food safety.
i) The record and labeling requirements must be met.
j) The FDA prohibits specific ELDU. For example, the following drugs are prohibited for extralabel use in food animals: chloramphenicol, clenbuterol, diethylstilbestrol, dimetridazole, ipronidazole, other nitroimidazoles, furazolidone (except for approved topical use), nitrofurazone (except for approved topical use), sulfonamide drugs in lactating dairy cows (except

approved use of sulfadimethoxine, sulfabromomethazine, and sulfaethoxypyridazine), fluoroquinolones, and glycopeptides (example is vancomycin).

6) Veterinarians should work with those responsible for the care of animals to use antimicrobials judiciously regardless of the distribution system through which the antimicrobial was obtained.

Since 1988, FDA has approved new therapeutic antimicrobials for use in animals as prescription-only products. The prescription-only policy is based on the need to assure the proper use of antimicrobials through precise diagnosis and correct treatment of disease to minimize animal suffering and to avoid drug residues in food. However, many of the older antimicrobials are available for over-the-counter (OTC) sale to producers. For these drugs, the FDA has determined that the producers can use the antimicrobials safely and effectively. The extra label uses of OTC antimicrobials fall within the regulatory constraints of the Animal Medicinal Drug Use Clarification Act and thus requires the oversight a veterinarian and a valid veterinary-client-patient relationship.

Regular, close veterinary involvement can assist the producers by providing informed advice and guidance on judicious use. Veterinarians are the primary source of information on the use of swine antimicrobials. They must accurately communicate written, adequate directions to the clients for antimicrobial use.

The Pork Quality Assurance[SM] (PQA) program of the National Pork Producers Council also provides guidance to producers on the proper storage, administration, and withdrawal times of drugs.

7) Regimens for therapeutic antimicrobial use should be optimized using current pharmacological information and principles.

For labeled use of an antimicrobial, the most accessible source of information is the label, which includes the package insert. For extralabel use, the Food Animal Residue Avoidance Databank can assist with determinations of withdrawal times. To assist with determinations of possible alternatives to antimicrobial therapy and with drug use regimens when using antimicrobials, several veterinary organizations and two producer organizations are funding the development of the Veterinary Antimicrobial Decision Support System (VADS). The objective of VADS is to provide veterinarians with a source of easily accessible information on the therapy of specific diseases to help them make wise treatment decisions. The new decision support system will allow veterinarians to access current, peer-reviewed information when selecting treatment regimens. The available information will include a full-range of therapeutic options, and the supporting data for each antimicrobial available to treat a disease. The pathogen data will include susceptibility profile information, when available, as well as an interpretation of susceptibility breakpoints as related to clinical efficacy.

The choice of the right antimicrobial needs to take into account pharmacokinetic parameters, such as bioavailability, tissue distribution, half-life, tissue kinetics to ensure the selected therapeutic agent reaches the site of infection. Duration of withdrawal times may be a factor in choosing suitable products. Consideration must also be given to the available pharmaceutical forms and to the route of administration. Continuing education is an important component of maintaining and enhancing the veterinarian's pharmacological knowledge.

The compounding of antimicrobials should be avoided in those instances where there is a lack of supporting scientific pharmacological data. Unapproved combinations that include therapeutic antimicrobials should not be used in the absence of supporting scientific pharmacological data. Veterinarians should not consider cost as a factor when considering the use of a compounded therapeutic antimicrobial.

8) Antimicrobials considered important in treating refractory infections in human or veterinary medicine should be used in animals only after careful review and reasonable justification. Consider using other antimicrobials for initial therapy.

In this context, this principle takes into account development of resistance or cross-resistance to important antimicrobials. In December 1998, the FDA made available "A Proposed Framework for Evaluating and Assessing the Human Safety of the Microbial Effects of Antimicrobial New Animal Drugs Intended for Use in Food-Producing Animals" (Framework Document). A concept introduced by the Framework Document is the categorization of antimicrobials based on their unique or relative importance to human medicine. While the criteria for categorization remain under discussion, it is expected that antimicrobials such as the fluoroquinolones and third generation cephalosporins will probably be classified in the most important category. There are currently no approved fluoroquinolone products for swine.

9) Use narrow spectrum antimicrobials whenever appropriate.

Generally, antimicrobials with a broad spectrum of activity lead to development of resistance in non-target microorganisms more rapidly than those with a narrow spectrum because they exert a selection pressure on a greater number of microorganisms. Therefore to minimize the likelihood of broad antimicrobial resistance development, where an appropriate narrow spectrum agent is available, it should be selected in preference to a broad spectrum agent. The theory is that narrow spectrum antimicrobials will have lessened effect on non-target species of bacteria and therefore will lessen the chances of resistance development in commensal bacteria.

10) Utilize culture and susceptibility results to aid in the selection of antimicrobials when clinically relevant.

Susceptibility profiles can vary between herds and even between stages of production. Periodic culture and susceptibility testing can provide historical data on which to base future empirical treatment as well as assist in the treatment of refractory infections. Ideally the susceptibility profile of the causal organism should be determined before therapy is started. The veterinarian has a responsibility to determine the applicability to the specific disease indication of the breakpoints used by the laboratory. In disease outbreaks involving high morbidity and/or mortality or where there are signs of rapid spread of disease, treatment may be started on the basis of a clinical diagnosis. Even so, the susceptibility of the suspected causal organism should, where possible, be determined so that if treatment fails it can be changed in the light of the results of susceptibility testing. Antimicrobial susceptibility trends should be monitored over time, and such monitoring used to guide clinical judgement on antibiotic usage.

Susceptibility tests are intended to be a guide for the practitioner, not a guarantee that an antimicrobial will be effective in therapy. Susceptibility testing can only give an indication of what the clinical activity of the drug will be. The effect of the drug in vivo depends on its ability to reach the site of infection in a high enough concentration, the nature of the pathological process, and the immune responses of the host. Clinical outcomes, history, and experience should also be used in the selection of antimicrobials

Veterinarians should utilize appropriate references for proper procedures and accurate interpretation of susceptibility results. One such reference is the NCCLSW publication M31-A, *Performance Standards for Antimicrobial Disk and Dilution Susceptibility Tests for Bacteria Isolated from Animals; Approved Standard.*

11) Therapeutic antimicrobial use should be confined to appropriate clinical indications. Inappropriate uses such as for uncomplicated viral infections should be avoided.

An accurate diagnosis includes characterization of the etiology. Veterinarians should use their professional knowledge and clinical judgment to decide whether other disease conditions are or are likely to involve a superimposed bacterial infection. Swine practitioners should strive to rule out parasitism, mycotoxicoses, nutritional imbalances, and viral infections. The treatment of any underlying disease may reduce the need for the treatment with antimicrobials; however, secondary bacterial pathogens may still require antimicrobial therapy in some cases. Early identification of disease etiology is essential to timely and effective therapy.

12) Therapeutic exposure to antimicrobials should be minimized by treating only for as long as needed for the desired clinical response.

Theoretically, infections should be treated with antimicrobials only until the host's defense system is adequate to resolve the infection, but that period is difficult to judge in a clinical setting. Therapeutic exposure involves both the dose and the treatment duration. Limiting the dose and the duration of use to only that required for therapeutic effect will minimize the exposure of the bacterial population to the antimicrobial. The adverse effects on the surviving commensal microflora are minimized and the medical impact of the remaining zoonotic organisms is reduced. However, treatment for too short a period can also be problematic because it can lead to recrudescence of the infection. It is then likely that a higher percentage of the pathogens involved in the recrudescence episode have reduced susceptibility to the antimicrobial.

The continued use of antimicrobials in a chronic, non-responsive clinical case should be discouraged. Removal of these pigs from the herd may be the best choice. The withdrawal time for a specific antimicrobial must always be considered during the selection of antimicrobials. Short withdrawal times are preferable for those pigs close to market.

13) Limit therapeutic antimicrobial treatment to ill or at risk animals, treating the fewest animals indicated.

In some classes of livestock (including swine), if a number of animals in a group have overt signs of disease, both sick and healthy animals will usually need to be treated with therapeutic levels of an antimicrobial. This is intended to cure the clinically affected animals, reduce the spread of the disease, and arrest disease development in animals not yet showing clinical signs. The early use of therapeutic antimicrobials in a number of animals will, in most cases, reduce the overall amount of antimicrobials used in those animals. Individual treatment of pigs demonstrating clinical signs within large groups of swine is often ineffective in halting a disease outbreak.

Practitioners should consider group morbidity and mortality rates when deciding whether or not to initiate herd, group, or individual therapy. The herd health history should also be considered for the therapeutic use of antimicrobials in the control and prevention of disease. Examining the "at risk" stages of production can assess the need for and the timing of antimicrobial treatment.

It is recognized that strategic medication may be appropriate in certain precisely defined circumstances. However, this should be part of an integrated disease control program and the need for such medication should be regularly re-evaluated. The use of antimicrobials in the absence of clinical disease or pathogenic infections should be restricted to situations where past experience indicates that the group of animals may develop the disease if not treated. In addition, long-term administration to prevent disease should not be practiced without a clear medical justification.

14) Minimize environmental contamination with antimicrobials whenever possible.

Unused antimicrobials should be properly disposed. Some antimicrobials may be environmentally stable in manure. If the antimicrobials are not bound in an inactive form, environmental exposure could theoretically contribute to resistance development. Consideration may need to be given to disposal methods that will not recycle antimicrobials or resistant genetic material or organisms to humans or animals.

Water medicators and hog feeders need to be properly adjusted to deliver the desired dose. Proper adjustment will also avoid the spillage and waste of medicated feed and water.

15) Accurate records of treatment and outcome should be used to evaluate therapeutic regimens.

The use of treatment records such as those proposed by the Pork Quality Assurance^{SM} (PQA) program of the National Pork Producers Council is highly recommended. Outcome records can greatly assist with design of future empiric treatment regimens. In addition, compliance to treatment regimens can be monitored by the review of pertinent records. Accurate animal or group identification must be employed within a production system for accurate records and effective residue avoidance.

The implementation of these general judicious use principles and the more specific guidelines developed for each species of animal will reduce the development of resistant zoonotic pathogens and commensals in animals and will lessen the risk of a human health impact related to the therapeutic use of antimicrobials in animals.

Sources Of More Information

American Association of Swine Practitioners
902 1st Avenue
Perry, IA 50220
Phone: 515-465-5255
Fax: 515-465-3832
www.aasp.org

National Pork Producers Council
PO Box 10383
Des Moines, IA 50306
Phone: 515-223-2600
Fax: 515-223-2646
www.nppc.org

BIBLIOGRAPHY

1. Anonymous. The Medical Impact of the Use of Antimicrobials in Food Animals—*Report and Proceedings of a WHO Meeting,* Berlin, Germany, 13-17 October 1997. WHO, p. 1, 1998.

2. Committee on Drug Use in Food Animals, NRC/IOM. The Use of Drugs in Food Animals: Benefits and Risks. National Academy Press, p. 65, 1999.

3. Mead PS., et al, Food-Related Illness and Deaths in the United States. Emerging Infectious Diseases 5(5): September-October 1999.

4. Anonymous. Risk Assessment on the Human Health Impact of Fluoroquinolone Resistant Campylobacter Associated with the Consumption of Chicken. FDA, December 1999.

5. Smith K, et al. The epidemiology of quinolone-resistant Campylobacter infections in Minnesota, 1992-1998. *N Engl J Med*, 340(20):1525-1532, 1999.

6. Anonymous. 1998 Annual Report – National Antimicrobial Resistance Monitoring System: Enteric Bacteria. CDC, 1999.

DEPARTMENT OF
HEALTH & HUMAN SERVICES
Food and Drug Administration
Center for Veterinary Medicine