

Prevention of Disease Using Antibiotics

Veterinarians have been asked why they sometimes administer antibiotics to healthy animals. Under certain circumstances, disease can be prevented by administering antibiotics to healthy swine prior to the appearance of clinical signs. To fully understand this issue, one must understand how bacteria cause disease and how antibiotics interact with the bacteria.

Introduction

Bacteria are microscopic living organisms, some of which make animals sick. Antibiotics may inhibit growth, destroy, or have no impact on bacteria depending on the specific bacteria and antimicrobial characteristics. The use of antibiotics to treat disease can result in the selection of bacteria resistant to specific antibiotics or classes of antibiotics.

Treatment, Control, Prevention, and Growth Promotion

Antibiotics are approved for use in swine for four purposes as defined by the FDA: Treatment, Control, Prevention, and Growth Promotion. The label approvals for growth promotion of antibiotic classes considered "important" for human use have been withdrawn as a result of recent actions by the U.S. Food and Drug Administration (Guidance for Industry #209¹ and # 213²).

Definitions³

Prevention of Disease - Treatment of an animal or a group of animals before clinical signs of disease, in order to prevent the occurrence of disease or infection. Preventive treatment is applied to animals diagnosed at high risk of bacterial disease for the period in which the threat exists and is based on epidemiology and clinical knowledge.

Control of Disease - Treatment of a group of animals after the diagnosis of clinical disease in part of the group, with the aim of treating the clinically sick animals and controlling the spread of disease to animals in close contact and at risk which may already be (subclinically) infected.

Treatment of Illness - Treatment of an ill animal or group of animals, when the diagnosis of disease or infection has been made. Antibiotics administered for treatment are delivered by injection, in feed or in water.

Why use antibiotics to prevent disease?

Antibiotics are not the first choice for preventing disease. Swine farmers and veterinarians employ a number of strategies to prevent disease including:

1

Biosecurity to prevent the introduction of pathogens into the herd.



2

Vaccination to increase herd immunity and provide maternal protection for newborn piglets.



3

Controlled animal flows to decrease exposure of naïve animals.



4

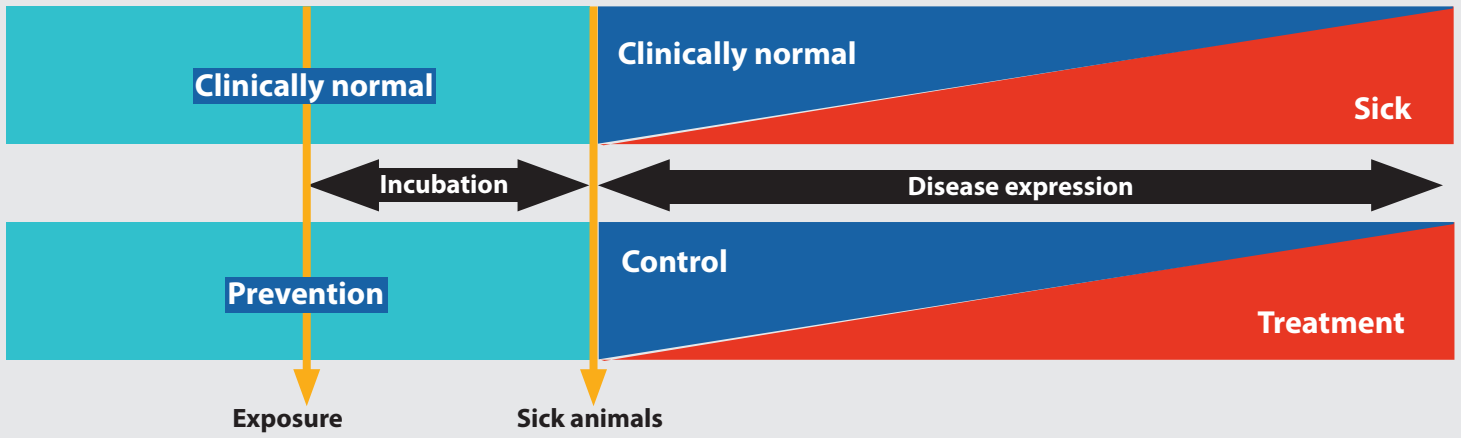
Facility design and management to provide optimal environmental conditions to promote animal health.



Despite all these efforts, however, animals still become exposed to pathogenic organisms and these management efforts alone are sometimes inadequate to prevent disease. In these cases, the properly timed application of appropriate antibiotics can minimize or prevent disease and thus improve animal health, productivity and welfare.



Figure 1: Highlighting the spread of the disease process within a population and the timing of antibiotic interventions.



As shown in Figure 1, antibiotics applied prior to the appearance of clinical signs is referred to as prevention. Whereas, application following the appearance of clinical signs in the herd is either to control or treat disease.

The timing of antibiotic administration relative to pathogen exposure can dramatically impact the outcome, as outlined in Table 1. Preventing rather than controlling or treating clinical disease results in the least adverse impact on animal health, well-being and production cost. The use of antibiotics to prevent disease may be appropriate in swine medicine under conditions such as the following:

- Illness can be prevented by administering an appropriately-timed antibiotic when swine are at risk.
- Administering antibiotics prior to the onset of clinical signs can prevent illness and reduce the need for treatment later.
- Swine are infected with an immune suppressive virus and exposure to disease-causing bacteria is likely.
- Swine are undergoing a stressful event likely to cause increased bacterial susceptibility.

Table 1: Illustrates the impact of antibiotic use depending on the timing of application during the disease progression.

Aspect	Prevention	Control	Treatment
Welfare	Best	Moderate	Poor
Mortality	Best	Moderate	Poor
Cost: Benefit	Best	Moderate	Poor
Dose needed	Lowest	Moderate	Highest
Resistance potential	Yes	Yes	Yes
Effect on carcass	Best	Moderate	Poor
Efficacy of antibiotics	Best	Good	Least effective

Veterinary considerations when using medically important antibiotics for prevention of disease:

1. Animals are deemed to be at risk of becoming sick through medically appropriate veterinary assessment and a Veterinary Client Patient Relationship exists.
2. Potential pathogen(s) are identified based on history, diagnostic testing, location, source herd, season, etc.
3. Alternative prevention strategies such as immunization have been attempted before antibiotics are applied.
4. Appropriate antibiotics deemed not medically important are considered before medically important antibiotics are utilized.
5. The veterinarian is responsible for discontinuing medically important prevention antibiotics when animals are no longer at risk.

In conclusion, the use of antibiotics to prevent, control or treat disease should be considered a last resort after all other efforts have been ineffective. The use of appropriately selected antibiotics early in the disease process can be most effective at improving animal health, well-being and production performance. Antibiotic therapy should be re-evaluated with the goal of minimizing its use.

References:

1. US Food and Drug Administration. Guidance for Industry #209 The Judicious Use of Medically Important Antimicrobial Drugs in Food -Producing Animals. Available at: <https://www.fda.gov/downloads/AnimalVeterinary/GuidanceComplianceEnforcement/GuidanceforIndustry/UCM216936.pdf>. Accessed 15 September 2017.
2. US Food and Drug Administration. Guidance for Industry #213 New Animal Drugs and New Animal Drug Combination Products Administered in or on Medicated Feed or Drinking Water of Food-Producing Animals: Recommendations for Drug Sponsors for Voluntarily Aligning Product Use Conditions with GFI #209. Available at: <https://www.fda.gov/downloads/AnimalVeterinary/GuidanceComplianceEnforcement/GuidanceforIndustry/UCM216936.pdf>. Accessed 15 September 2017.
3. 2016 PQAPlus Producer Education Handbook version 3. National Pork Board. Page 64.

Key points about antibiotic use in swine

Treatment	<ul style="list-style-type: none"> • Veterinary oversight required • Animals treated when they become sick • Rapid spread of disease leads to increased losses to producers and poor animal welfare • Prolonged and repeat dosing may be required • Treatment is targeted toward a specific set of bacteria
Control	<ul style="list-style-type: none"> • Veterinary oversight required • Antibiotics used to slow/stop spread of disease • Animals suffer from illness • Prolonged and repeat dosing may be required • Control is targeted to a specific set of bacteria
Prevention	<ul style="list-style-type: none"> • Veterinary oversight required • Antibiotics used to prevent disease • Animals receive targeted antibiotics before they become sick • Prevention antibiotics are targeted to a specific set of bacteria
Growth promotion	<ul style="list-style-type: none"> • Antibiotics not targeted at a specific pathogen • Not appropriate for medically important classes in human medicine • Reduces the amount of feed required to gain weight • FDA has eliminated the use of medically important antibiotics for this purpose