Prevention of Disease Using Antibiotics

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.

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.
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.

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:

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

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Prevention</th>
<th>Control</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welfare</td>
<td>Best</td>
<td>Moderate</td>
<td>Poor</td>
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<tr>
<td>Mortality</td>
<td>Best</td>
<td>Moderate</td>
<td>Poor</td>
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<tr>
<td>Cost: Benefit</td>
<td>Best</td>
<td>Moderate</td>
<td>Poor</td>
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<tr>
<td>Dose needed</td>
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<td>Moderate</td>
<td>Highest</td>
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<tr>
<td>Resistance potential</td>
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<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Effect on carcass</td>
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<td>Poor</td>
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<tr>
<td>Efficacy of antibiotics</td>
<td>Best</td>
<td>Good</td>
<td>Least effective</td>
</tr>
</tbody>
</table>

### Key points about antibiotic use in swine

**Treatment**
- 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**
- 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**
- 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**
- 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