Food Safety and Antibiotic Use: A Practitioner’s Role in Beef Stewardship

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Premise 1: Public Concerns

• Residues and bacteria in food: meat, dairy, eggs, fruits and vegetables
• Bacterial resistance to antibiotics created by use in animals
• Welfare of animals in food production systems
Premise 2: Public Trust

• Public generally trust veterinarians
  – VETFUTURES 2015
    • 34% Completely trust veterinarians
    • 61% surveyed generally trust veterinarians
  – Gallup last survey for veterinarians 2007
    • Very high among professionals
      – 71% ranked very high or high for honesty and integrity

• Public generally trust individual farmers and ranchers who raise animals
Premise 3: How the FDA Sees Veterinarians and Judicious Antibiotic Use

- Veterinarians are trained in animal health.
  - Recognition and treatment of disease
  - Educate clients on recognition of disease (VCPR)

- Veterinarians are regulated through licensure.
  - Consequences include loss of ability to practice (VCPR)

- Veterinarians understand food systems.
  - Not always experts but understand the interactions of various areas of production
Premise 4: Producers Utilize Veterinary Expertise

• Large production units
  – Served by staff veterinarians
  – Consultants and local veterinarians

• Smaller production units
  – Access to veterinarians for animal health needs

• Beef Magazine (September 2015):
  – 92% have a herd veterinarian
  – More than ½ had the same veterinarian for 10 years
Food Safety: Antibiotic Use Concerns

• Residues
  – No residue of concern since 1996.

• USDA-FSIS
  – Oversee food safety
  – Effective targeted monitoring of tissue residues
  – “Third Party” oversight for the consumer, producer, packer and processor
Food Safety: Antibiotic Use Concerns

• Resistant bacteria that cause illness in humans
  – Potential for food born illness associated with highly resistant bacteria.
  – General resistance of antimicrobials due to antibiotic use in food producing animals.
  – FDA responsible for implementation of practices that mandate judicious use of antibiotics.

• Consequences to misuse of antibiotics are real.
• Veterinarians are in charge of antibiotic use.
Antibiotic Resistance Monitoring

• FDA Center for Veterinary Medicine-National Animal Resistance Monitoring System
  – Looks at Salmonella, Campylobacter, Enterococcus and E. coli.

• Overall resistance has increased. Also multi-drug resistance strains rose.
  – not always consistent.
  • Campylobacter coli resistance rose from 2002 to 2005 to almost 30%. At that time flouroquinalone use was stopped in poultry. Since resistance has fallen to about 18 percent.
  • During the same time Campylobacter jejuni resistance increased.
Animal Welfare: Antibiotic Use

• Most of the antibiotics used in beef cattle are for treatment of Respiratory disease.

• Untreated cattle often suffer from chronic illness or die.

• Chronically affected animals suffer painful lung adhesions and oxygen deficient.
Animal Welfare: Antibiotic Use

• Appropriate response to treatment depends on:
  – Early recognition of disease
  – Availability of effective medications for use
  – Timely treatment of the animal (VCPR)

• The ability to use of antibiotics in the treatment of animals is very important for animal welfare.
  – Must be judicious
What is Judicious Use of Antibiotics?

• Using antibiotics in a manner which minimizes the development of resistant bacteria that can impact both human and animal health.

• Providing for the treatment of disease in animals for their welfare.
How does resistance develop?

- Mechanisms of resistance vary
  - Create an impermeable barrier to antibiotics.
  - Pump antibiotics out of the cell.
  - Resistance due to mutation.
  - Inactivate the drug in the cell.

Common Classes of Antibiotics Used in Animals

- **Beta-lactams**: Penicillin, Ceftiofur, Ampicillin  
  - Weaken bacterial cell walls
- **Tetracyclines**: Chlortetracycline, Oxytetracycline  
  - Inhibit protein synthesis (inactivate ribosomes)
- **Macrolides**: Tilmicosin, Tulathromycin, Gamithromycin, Tildipirosin, Tylosin  
  - Inhibit protein synthesis (inactivate ribosomes)
- **Quinolones**: Enrofloxacin and Danofloxacin  
  - Block bacterial DNA synthesis
- **Amphenicols**: Nuflor  
  - Blocks protein synthesis (binds to 50s ribosome)
Key Points to Resistance

• Is not necessarily created by therapeutic treatment
  – Arises from naturally occurring resistant strains, accumulation of mutations, or organisms that have acquired resistance genes

• Resistance hastened by exposure to insufficient concentrations of antimicrobials at site of infection

• Exposure time increases chance of resistance

• The antimicrobial is merely exerting selective pressure

• Resistance often causes reduced fitness, so what happens when therapy is removed?
  – No free lunch for bacteria

Loy 2014.
WHO Classification of Antibiotics

• Classes
  – Critically important
  – Highly important
  – Important

• Criterion
  1. An antimicrobial agent which is the sole, or one of limited available therapy, to treat serious human disease.
  2. Antimicrobial agent is used to treat diseases caused by either:
     • Organisms that may be transmitted to humans from non-human sources, or
     • Human diseases caused by organisms that may acquire resistance genes from non-human sources.
Classification of Antibiotics Used in Food Producing Animals?

• Macrolides, Beta-lactams (approved for Cattle), Quinolones, ALL listed as **Critically Important**

• Tetracyclines (chlortetracycline and oxytetracycline) and Amphenicols (florfenicol) listed as **highly important**

WHO. Critically Important Antimicrobials for Human Medicine. 3rd Revision 2011.
Are there others? Example Ionophores

- Ionophores are classified as antibiotics but not listed as medically important.
  - Antibiotic resistance not well supported:
    1. Not used as an antimicrobial for humans
    2. Different mode of action from other antibiotics
    3. Ionophore resistance appears to be an adaptation not a mutation.
    4. Typically used to control the parasite coccidia.
Judicious Use of Antibiotics: Key Points

1. FDA has implemented changes in regards to feeding antibiotics.

2. All effective antibiotics are available by prescription use only.
   - OTC options remain but use continues to decline.

3. Therapeutic use of antibiotics is paramount for animal welfare.
FDA Changes: Judicious Use

1. Use of antibiotics in the feed no longer may be done for enhanced growth or feed efficiency.

2. Use of antibiotics in the feed for prevention has been limited both for indications as well as length of feeding time.

3. Use of antibiotics in the feed requires a veterinary feed directive.

4. More than two decades, all new antibiotic approvals have been prescription only.
Importance and Challenges of Veterinarians Role in the Beef Industry

- Veterinarians are important for oversight of Antibiotic use.
- Beef cattle veterinarians are diverse.
- Serve a diverse group of clients which represent a large part of the industry
- Education and training on new regulations
- Client education
Importance of Veterinary Oversight

• Veterinarians are comprehensively trained.
  – Physiology, Pharmacology, Diagnostics, Animal Welfare

• Form strong producer relationships.
  – Access to producers
  – Ability to communicate and educate
    • Farm visits: VCPR and 24/7 access
    • Producer meetings
Beef Cattle Veterinarians in the U.S.

- 9000 Veterinarians considered “food animal”
  - Not defined by species
  - Little more than ½ are “food animal exclusive”
  - Rest are “mixed”

American Veterinary Medical Association.
Clients: Beef Perspective Differences

• 90 percent of cow-calf operations have less than 100 head
  – Average size of the nation's herd is near 40 head

• 45% of calves come from these herds

NAHMS 2011
Beef Perspective Differences

• Feedlots with capacity of 1000 head or more comprise only 5% of operations but account for nearly 90% of fed cattle.
  – Feedlots with 32,000 head capacity or larger account for 40% of fed beef harvested.

NAHMS 2011
Challenges

• Diversity of Clients and Veterinarians
  – Ability to communicate changes in regulations
    • Veterinarians
    • Clients
  – Operations vary
    • Access to veterinarians
    • Access to information
    • Ability to deliver recommendations
  – Understanding the true impact of antibiotic use in animal agriculture
Further Impacts on Antibiotic Use?

• Best practices to improve animal health
  – Preconditioning
    • Vaccination for respiratory disease improves animal health.
  – Stress
    • Management practices?
    • Weaning strategies?
    • Direct marketing?
    • Transportation consideration?
  – Nutrition
    • Proper diet considerations for both the cow and calf
  – Parasite management
    • Parasitism affects animals ability to mount an immune response.
  – Epidemiology: Sandhills calving management
  – Breeding?
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