Balancing the Health Impacts of Antibiotic Use in Animal Feed

Authors: William Hueston, College of Veterinary Medicine, University of Minnesota (UMN); James R. Johnson, Medical School Department of Medicine, UMN; Michael Osterholm and Jamie Umber, Center for Infectious Disease Research and Policy, UMN; and Kirk Smith, Minnesota Department of Health.
Multidisciplinary review team and references available at z.umn.edu/PolicyBriefs

Summary of Findings:

● Antibiotics are important for both animal and human health and welfare.
● Administration of antibiotics through feed or water is often the most humane and labor-efficient method of treating groups of animals such as chickens, pigs, or fish.
● Administration of antibiotics to food-producing animals – like all antibiotic use, regardless of setting or route of administration – contributes to the development of antibiotic resistance.
● While the human health and economic implications of resistance vary widely depending on antibiotics and pathogens of concern, the Centers for Disease Control and Prevention (CDC), United States Food and Drug Administration (FDA), and World Health Organization (WHO) conclude that feeding certain antibiotics for production purposes (i.e., growth promotion or increased feed efficiency) is a public health problem.
● Current science supports three complementary food animal-related strategies for maintaining the benefits of antibiotic use for animal health and welfare while reducing the antibiotic resistance risks: elimination of long term, low dose use of most antibiotics for production purposes; good animal husbandry practices; and more judicious use of antibiotics in prevention and control of disease in food animals.

Background

The discovery of antibiotics to combat infectious diseases is one of the most important medical advances ever. However, choices in antibiotic use are currently under scrutiny because of the health threat posed by disease-causing microorganisms that are resistant to antibiotics. Any antibiotic use fosters the development of antibiotic-resistant bacteria and can result in environmental contamination with antibiotics and their metabolites. The transfer of genetic material among microorganisms can perpetuate resistance even after antibiotic use has ceased. Current, unbiased, scientific data demonstrate that antibiotic use in food-producing animals (e.g., cattle, swine, poultry, and fish), particularly large-scale administration (e.g., in feed) of low doses over long periods of time, poses a public health threat.

Why are antibiotics used in food-producing animals?

● Therapeutic Use: to treat existing infections. Typically given at relatively higher doses (compared to preventive, control, and production uses) for a limited time.
● Preventive or Control Uses: to prevent development of or control the spread of disease in situations where disease is likely to occur due to environmental conditions and exposure to disease-causing organisms.
• **Production or Growth Promotion Use**: to increase daily body weight gain or the amount of growth per unit of feed eaten (i.e., feed efficiency) by administering doses lower than those required to treat or prevent disease, over extended periods of time. Some antibiotics labeled and used for production purposes may also be labeled to prevent or control some disease transmission.

**Why administer antibiotics in animal feed?**
Almost all food-producing animals are raised in groups (e.g., herds of cattle, flocks of poultry, schools of fish). Catching individual animals to administer drugs is stressful and dangerous for the animals (and animal caretakers) and may itself cause disease spread; it can also be labor intensive, expensive, and impractical. Therefore, the addition of antibiotics to animal feed (or water) is commonly used to administer drugs to groups of animals.

**Why is feed administration of antibiotics to animals a potential problem?**
Concern focuses primarily on the routine use of low doses of antibiotics over long periods of time for production purposes. Despite FDA mandated withdrawal times (i.e., the drug-specific waiting period from when an animal is treated to when the animal can be slaughtered for food or the animal's milk can go to market),^3^ production use of antibiotics fosters the development of resistant organisms in the animals and contributes to environmental contamination with such organisms, antibiotics, and antibiotic metabolites. Although direct measurements of the public health threat in the United States (US) are unavailable, such use has resulted in an increased potential for human exposure to and infection with resistant organisms through animal contact, animal-derived food products, and the environment.^4^

**Available policy options & current policy approaches**
Policy options range from continuing with current practices to outright bans on the administration of antibiotics through animal feed; all options involve potential trade-offs between animal and human health and welfare. In the US, the FDA approves and regulates drugs for animals, including antibiotics. The FDA's proposed approach regarding the use of antibiotics in food-producing animals is to: 1) limit the use of those considered medically important (for treating humans) to situations deemed necessary for animal health (i.e., stopping growth promotion use), and 2) require the oversight of a veterinarian before food-producing animals can be given medically important antibiotics for therapeutic, preventive, or control uses.^8^ Antibiotics currently considered medically important are listed in FDA Guidance for Industry #152.^10^ Almost all antibiotics given to animals will require a Veterinary Feed Directive (VFD) if given in feed or water and a prescription from a veterinarian. Antibiotics in classes with no human medicine counterparts (e.g., ionophores), will remain available over-the-counter and still may be used for production purposes.

**Implications of specific policies regarding antibiotic use in animal feed**
- Bans on growth promotion antibiotic use in other countries have resulted in significant decreases in the total amount of antibiotics used and in some cases considerable decreases in the prevalence of resistance to antibiotics in some organisms carried by food-producing animals.^11,12,13^ Other resistance patterns and the interconnectedness between human and animal antibiotic use are more complicated to interpret (e.g., some organisms show increased susceptibility while others remain unaffected or have worsened, usually due to increases in use of other antibiotics) and mechanisms continue to be studied.

- The quantitative health impact that antibiotic bans for food-producing animals in the US will have on the occurrence of human illness caused by resistant organisms is unknown. Animals and food products derived from them can harbor resistant bacteria regardless of whether the animals are raised with or without antibiotics. Resistant organisms are more commonly isolated from animals that receive antibiotics versus those that do not.^14,15,16^

- The impact of banning production use of medically important antibiotics in the US on the availability and cost of human foods of animal origin is unknown. In-feed administration of low levels of antibiotics can enhance feed efficiency and growth in food-producing animals;^18^ however, recent reports suggest that it does not provide an important effect on productivity or a significant economic benefit to farmers.^19,20^

- Banning growth promotion antibiotic use hypothetically could result in more animal disease and thus create animal welfare issues. The Danish ban had little net impact on animal health but led to more reported therapeutic antibiotic use;^12,13^ however, to what extent the ban itself was responsible and how much of the
reported therapeutic use may actually be for prevention or production purposes is disputed. Most animal health issues with this and other growth promoter bans appear to have been minor and transient.19

- Banning in-feed administration of antibiotics, regardless of dose, would decrease environmental contamination with antibiotics and antibiotic-resistant organisms. The health and ecological implications of such decreased contamination are not understood but would be expected to be favorable.
- Current reporting requirements make statistics regarding antibiotic use in the US difficult to obtain and interpret.21,22,23 More specific information regarding actual antibiotic use in food-producing animals and humans is needed to properly analyze connections between use and resistance. Many estimates of US antibiotic use in both animals and humans have relied on incomplete data of questionable accuracy.
- Increasing veterinary oversight of antibiotic use in food-producing animals should increase judicious use and therefore reduce resistance. However, the availability of food-animal veterinarians in the US and the ability of farmers to pay for veterinary services could be limiting factors for successful implementation of increased veterinary oversight, particularly for smaller operations.

Comprehensive assessments of the benefits and risks of specific policies in terms of human health and nutrition; animal health and welfare; environmental impacts; and food availability, cost, and bacterial contamination combined may never be available nor able to satisfy all interested parties.24,25 Ultimately, elimination of production antibiotic use in animal agriculture should decrease resistance and benefit both human and animal health.

_Note: Although according to a strict definition, the term antibiotic denotes substances that are produced by microorganisms and that destroy or inhibit the growth of other microorganisms, we use the term here loosely, to include also synthetically derived antimicrobial substances._

References


