Frequently Asked Questions about

Antimicrobial Use and Antimicrobial Resistance

Antimicrobial use and antimicrobial resistance are hot issues in the news right now, and there's a lot of confusion and misinformation in the media and on the Internet. With these FAQs, we hope to clear up some of the confusion and provide you with science-based information to help you make educated decisions.

Healthy animals make healthy food, and veterinarians are on the frontlines when it comes to keeping our nation's food supply safe. Advances in animal health care and management have greatly improved food safety over the years and have reduced the need for antimicrobials in food production systems. Nevertheless, antimicrobials are an important part of the veterinarian's toolkit, and veterinarians agree that they should be used judiciously and in the best interest of animal health and public health.

Q: What microorganisms?
A: Microorganisms are living organisms that are too small to be seen individually by the naked eye (they are usually viewed with microscopes). They include bacteria, viruses, protozoa, and some fungi and algae. You might see with your naked eye a group of these organisms – such as a mold growth on bread – but you can't see each individual fungal cell without a microscope.

Q: What are antimicrobials?
A: Antimicrobials are products that kill microorganisms or keep them from multiplying (reproducing) or growing. They are most commonly used to prevent or treat disease and infections due to microorganisms.

Q: What's the difference between an antibiotic and an antimicrobial?
A: Antibiotics are substances that are actually produced by one microorganism and have the ability to kill or inhibit the growth or multiplication (reproduction) of other microorganisms. Penicillin is a classic example of an antibiotic: it is produced by *Penicillium* fungi but has the ability to kill a number of bacteria and is, therefore, an effective antibiotic (and also an antimicrobial) when used appropriately to treat organisms that are susceptible to its effects.

Although the definition of "antibiotic" doesn't specifically say that they are only effective against bacteria, the vast majority of antibiotics are used primarily to kill or inhibit the growth of bacteria. Additionally, antibiotics are subdivided into two categories, broad spectrum and narrow spectrum, based on the number and types of bacteria they affect. Broad spectrum antibiotics are effective against many types of bacteria, while narrow spectrum antibiotics are effective against a more limited range of bacteria.

Antibiotics are a type of antimicrobial, but not all antimicrobials are antibiotics. For example, anti-viral drugs and anti-fungal drugs are also antimicrobials, but they are not antibiotics.

Q: What does "susceptible mean when it comes to antimicrobials?
A: The term "susceptible" simply means that the microorganism is capable of being affected by the antimicrobial. For example, if we say that a type of *Streptococcus* bacteria is susceptible to penicillin, it means that the bacteria are killed or growth is inhibited (stopped) by the penicillin.

Q: Are the antimicrobials used in animals the same ones used in people?
A: Antimicrobials and antibiotics are grouped in "classes" based upon their mechanism of action (how they affect the bacteria, viruses and fungi). There are only a few classes that are specific to either human medicine or veterinary medicine. In fact, the vast majority of antibiotic classes are used in both humans and animals, so there really is no such thing as "human drugs used in animals."

Many antimicrobials used in human medicine are not approved for use in animals or are, quite simply, too expensive to use in animals. When antimicrobials are needed for an animal, veterinarians base their choices on many factors, including:

- the type of infection;
- the organism causing the infection and its susceptibility (either likely susceptibility based on prior experience and knowledge, or susceptibility based on the results of laboratory testing) to the antimicrobial;
- the method by which the antimicrobial is given (whether it's given orally or by injection, for example) and how that will be tolerated, as well as whether or not it should be given to the animal that way;
- whether or not it is approved for use in that animal species;
- the risk of side effects; and
- its cost.

Regarding the antimicrobials used in food production systems, some are the same as those used in people, but some are not. There are strict federal regulations that govern the use of antimicrobials in food-producing animals, including the specific antimicrobials that can be used. The U.S. Food and Drug Administration (FDA) is responsible for approving antimicrobials and other medications for use in animals, including antimicrobials that may be added to the feed (considered a form of oral administration) of food-producing animals.

Q: What is antimicrobial resistance and how does it happen?
A: Antimicrobial resistance (as well as antibiotic resistance) occurs when a microorganism develops the ability to resist the action of an antimicrobial. Basically, the microorganism develops the ability to survive and reproduce in the presence (and dose) of an antimicrobial that used to prevent these actions.

In general, it's really only considered "resistance" when it occurs in an organism that used to be susceptible to an antimicrobial's effects but now is not susceptible; this doesn't really apply to an organism that was never susceptible to that antimicrobial.

How resistance develops is a very complex process, and we don't really know *all* of the factors or events that can make it happen. We do know that an organism can undergo a change in its DNA that makes it

resistant to one or more antimicrobials – this change might just be an accident that turns out to be fortunate for that organism, or it might be in response to something else, such as the use of antimicrobials – and it might transfer that changed DNA to another organism or pass it on to its offspring when it reproduces.

Q: What causes antimicrobial resistance?
A: Current science can't really prove what causes all of the different types of antimicrobial resistance that create public health risks.

Antimicrobial resistance can be caused by "selection pressure." Regardless of how effective an antimicrobial might be, rarely, if ever, will 100% of the organisms be killed during a course of treatment. This means that at least one organism out of thousands may have developed resistance to the antimicrobial. The few surviving and potentially resistant organisms could then transfer their genetic material to offspring or even other unrelated organisms.

There are also some who say that antimicrobial resistance is caused by widespread use of antimicrobials in food production systems. Their argument is that the more antimicrobials are used in animals, the more we expose the organisms to the antimicrobials and give them the opportunity to develop resistance. Although that may be true in a very simplified, general sense, the scientific evidence of how, if or to what extent such exposure affects human health remains unclear.

The assumption that simply giving antimicrobials to a larger number of animals creates a public health hazard due to resistance isn't accurate, because it doesn't account for the benefits of preventing disease and the need for higher doses and potentially stronger types of antimicrobials if an animal is sick. For example, if a disease is not prevented or effectively treated by a low dose of an antimicrobial, a higher dose or a different antimicrobial treatment, or both, are often needed to eliminate the infection. This would obviously increase the amount of antimicrobials used, and it would effectively kill most of the target organisms. Yet, it could potentially increase the development of resistance to a stronger drug in the organism you're targeting. As previously stated, no antimicrobial is 100% effective and therefore the remaining few bacteria may be resistant and transfer that resistance. The greater dose could also decrease the potential for the development of resistance by minimizing the numbers of remaining bacteria. Yet, you can't pick and choose which organisms will be exposed to the antimicrobial – organisms that aren't the targets of that antimicrobial will also be exposed to these high drug doses and stronger drugs. These "innocent bystander" organisms could potentially develop resistance mechanisms and pass on that resistance to their offspring and to other organisms.

Sometimes a lower dose is enough to prevent an infection, and this may be the best way to prevent the disease before the entire herd or flock is affected and higher doses or stronger types of antimicrobials must be used. For some, this would translate into "less use" because it's a lower dose of antimicrobials used, but others would interpret this to mean "more use" because the antimicrobial is given to a larger number of animals. This lack of agreement in terminology is why AVMA supports *judicious* use and opposes measurements in terms of quantity or unclear definitions of "use." The AVMA has consistently supported veterinary involvement in any use of antimicrobials due to the complexity of this decision-making process. A big part of veterinary medical education is understanding how antimicrobials affect microorganisms and how they can responsibly be used to protect human and animal health.

Q: Is all antimicrobial resistance a threat to public health?
A: Antimicrobial resistance is only a threat to public health when humans are infected with a resistant organism that is difficult or impossible to treat. This is an issue seen more frequently with human pathogens transmitted between humans (such as extremely drug resistant tuberculosis, also called XDRTB, and MRSA). While outbreaks of resistant foodborne pathogens have been reported, very few have been epidemiologically traced back to the farm. Even fewer have been specifically associated with a specific indication such as increased rate of gain or prevention of a particular disease.

Q: How are antimicrobials used in animals?
A: Antimicrobials are generally used to prevent or treat infection in companion animals much like they are used in human medicine. For example, a physician or veterinarian might administer or prescribe an antimicrobial to treat skin, bone or systemic infections. They are often used before and after surgery to prevent postoperative infection.

In food production systems, the U.S. Food and Drug Administration (FDA) approves the use of antimicrobials for four purposes:

- *Growth promotion/feed efficiency:* the antibiotics are administered, usually in feed, to increase growth rates and improve feed efficiency. The goal of this is to maximize production from the animals.
- *Prevention of disease:* there is a known disease risk present and the antibiotics are administered to prevent infection of animals.
- *Control of disease:* disease is present in a percentage of a herd or flock and antibiotics are administered to decrease the spread of disease in the flock/herd while clinically ill animals are treated.
- *Treatment of disease:* the antibiotics are administered to treat sick animals.

The dosage of antibiotics administered, as well as the type of antibiotic and the route of administration (e.g., in feed, in water or by injection), depends on the intended use. For example, one antibiotic might be administered in the feed at a low level labeled for growth promotion/feed efficiency, at a slightly higher dose for prevention and at higher doses in feed or by injection for control and treatment.

Q: Where do producers get antimicrobials for animals?
A: Producers can purchase certain antimicrobials over-the-counter (OTC) from livestock supply stores. Products available for OTC purchase have been approved by the FDA for use only as directed on the label.

Producers can also obtain antimicrobials from their veterinarian with a prescription. Animal feed can be formulated with an antimicrobial when there is a Veterinary Feed Directive (VFD) directing the feed mill to add a specific antimicrobial to the feed at a specific dose or if the OTC product is approved and labeled for use in feed (in which case it must be added to food according to the label directions). In most states, prescriptions and VFDs require that a valid veterinarian-client-patient relationship (VCPR) exists. Simply put, a VCPR is established when a veterinarian examines an animal patient (or flock or herd) and there is an agreement between the client and the veterinarian that the veterinarian will provide medical care for the animal(s).

Q: How does antimicrobial use in animals differ from that in humans?
A: In human medicine, antimicrobials are approved for disease treatment and prophylaxis or prevention and physicians can prescribe and use antimicrobials without restrictions determining the

dose and duration of treatment. In veterinary medicine antimicrobials used in food-producing animals are approved for treatment, control, prevention and growth promotion/feed efficiency. (See the "How are antimicrobials used in animals?" question above for descriptions of these uses).
Antimicrobials (and all other drugs, for that matter) given to food animals must be used according to approved label directions or according to federal regulations (such as the Extra Label Drug Use regulation). In fact, many of the drugs shared by both human and veterinary medicine are restricted to a very specific use, dose and duration and can only be administered by a veterinarian if they are used in animals. This means that if you have respiratory infection in a person, it can be treated with whatever your doctor determines to be the best drug, at the best dose, for the appropriate length of time. If there is a respiratory infection in a food-producing animal or a herd/flock, it can only be treated with approved drugs at a specific dose and for a specific length of time.

Q: How can an antimicrobial be a "growth promoter?"
A: In certain instances, we know that antimicrobials that are labeled for growth promotion and feed efficiency promote growth by altering the populations of microorganisms that normally live in the animal's gut. In other instances, we don't really know exactly how the antimicrobials promote growth, but many studies support the theory that the antimicrobials treat subclinical disease, enabling more of the body's resources to go toward achieving maximum growth potential.

Q: What is "nontherapeutic" use of antimicrobials?
A: "Nontherapeutic" is a term that is inappropriately used by some groups to describe the use of antimicrobials in animals to promote growth, feed efficiency, weight gain, disease prevention and other purposes. These groups feel that antimicrobials should only be used when animals show clinical signs of a disease.

Neither the FDA nor the AVMA uses this term.

Q: How frequently are antimicrobials used in food production?

A: Lots of numbers have been thrown out there by groups and the media, but the reality is that no one really knows just how often antimicrobials are used in food production because there is no mechanism to track how often they are used or even the ways in which they are used.

The issue shouldn't be the amount or frequency of antimicrobials used. The real issues are:

- the judicious use of antimicrobials;
- determining if the use of a specific drug is causing an impact on the development of resistance that is significant to animal and/or human health.

Q: What's the bigger risk for causing antimicrobial resistance – antimicrobial use in humans or use in livestock?
A: This is a matter of debate, but the simple truth is that no one really knows. It's common sense to think that both types of use can contribute to the formation of resistance in some way, although risk assessments have shown that the use of antimicrobials in food production systems plays an extremely small role.[1]

Not all antibiotics are the same, and not all antibiotics have the same impact on resistance. We find no evidence that over- the-counter antibiotic products used in food-producing animals pose a specific risk to human health. There is no evidence that prescription-only use of antimicrobials, or banning particular uses such as growth promotion in food-producing animals, has decreased the rate and severity of resistant infections in humans. For example, although the Danish ban may have decreased the overall amounts of antimicrobials used in animals and lowered the frequency of antimicrobial resistant infections in animals, human antimicrobial use continues to increase and **the ban has had little to no effect on the growing resistance problem in their human population.**[2]

Q: Should I be concerned about antimicrobial resistance?
A: Of course you should – we should all be concerned about antimicrobial resistance. But placing inordinate blame on antimicrobial uses in food-producing animals for resistance in human pathogens is unreasonable.

The connection between specific antimicrobial uses in food animals with foodborne or other human disease remains unclear. Based on studies to date, the risk to people of becoming infected with resistant organisms by consuming animal products (meat, milk, eggs) is extremely low.

Veterinarians are concerned about the development of antimicrobial resistance in organisms that infect animals because it may compromise the effectiveness of antimicrobial therapy for animal diseases and make them harder to treat. Antimicrobials are needed for the relief of pain and suffering caused by bacterial diseases.

Q. Why can't we just stop using antimicrobials in food-producing animals?
A: The elimination of antimicrobial use in food-producing animals, or even the placement of further and more stringent restrictions on their use, removes a very valuable tool in the veterinarian's kit for preventing and reducing animal disease and suffering. Healthy animals mean healthy food products.

There is little to no evidence that restricting or eliminating the use of antimicrobials in food-producing animals would improve human health or reduce the risk of antimicrobial resistance to humans.

We support the judicious use of antimicrobials. What does this mean? It means that anyone using antimicrobials – whether it's for use in people, animals or the environment – should use good judgment and base this decision on maximizing the results and minimizing the risk of resistance. If scientific research and risk-based assessments demonstrate that the use of an antimicrobial poses significant public health risks, we support the restriction or removal of its use. The U.S. Food and Drug Administration (FDA) already has the authority to remove a product or place additional restrictions on its use in food-producing animals if the product poses a public health risk. In 2005, the FDA did just that – they announced that the antibiotic enrofloxacin could no longer be used in poultry because of an increased risk to public health. To date, there has not been any proof that currently approved antimicrobials pose a public health risk.

It is also important to recognize that approval of animal antimicrobials is already more strict than that of human-use antimicrobials. The continued availability of safe, effective antimicrobials for veterinary medicine, including the retention of currently approved drugs and future approvals of new drugs, are critical to maintaining a safe food supply as well as preserving animal health and welfare.

Q. You say that banning antimicrobials could have negative effects on animal welfare. Why?
A: Animal welfare is a description of how well an animal is coping with the conditions in which it lives. Animals have good welfare if, based on a scientific evaluation, they are healthy, comfortable, well-nourished, safe, able to express the natural behaviors of their species, and are not suffering from unpleasant states such as pain, fear, and distress. Ensuring good animal welfare is a human responsibility that includes consideration of all aspects of animal well-being, including proper housing, management, nutrition, disease prevention and treatment, responsible care, humane handling and, when necessary, humane euthanasia. Banning or severely restricting the use of antimicrobials in animals may negatively impact the veterinarian's ability to protect animal health and prevent suffering from disease, which can lead to poor welfare.

Q. You say that banning antimicrobials could have negative effects on the safety of our food. Why?
A: Healthy animals provide healthy food. Banning or severely restricting antimicrobial use limits veterinarians' ability to prevent or control animal diseases. The prevention and control of disease in food animals to make sure that we have healthy animals entering the food supply is a necessity to protect public health and is a judicious use of antimicrobials.

When an animal is obviously ill, it does not enter our food supply until it has recovered and the withdrawal times for any medications have elapsed. However, if an animal has a subclinical disease – meaning that it is ill but isn't yet showing noticeable signs of disease – there is a risk that the animal could enter our food supply while it is not completely healthy. That's not a guaranteed public health risk, but there could be some additional risks. By allowing the judicious use of antimicrobials to prevent and control disease, the risk of unhealthy animals entering our food supply is further reduced.

Q. What are veterinarians doing to prevent antimicrobial resistance?
A: Veterinarians use pharmaceuticals, including antimicrobial agents, judiciously. It is important to recognize that veterinarians are trained professionals who know when antimicrobials are indicated in animals and when they are not.

They also work with the producers to keep the animals healthy with vaccination, parasite treatment, good nutrition and good management practices.

For more information on the AVMA's philosophy regarding antimicrobial use, read the AVMA's policy on the Judicious Therapeutic Use of Antimicrobials.

Q. What are food producers doing to prevent antimicrobial resistance?
A: Keeping animals healthy is the main goal – after all, sick animals aren't allowed to enter our food chain – and healthy animals are less likely to become infected and are more likely to successfully fight off infection if they're exposed to an organism. The use of vaccines, parasite treatments, good nutrition and good management and husbandry to reduce stress and minimize the risk of disease are all necessary strategies. It is also reasonable to expect producers to use antimicrobials judiciously. When producers use antimicrobials and other medications, they are required to follow the label directions, which include the withdrawal times for the medications. The withdrawal time is the amount of time (days, weeks or months) after the last treatment (or dose) has been given that the animal's milk must be discarded or the amount of time before it can be slaughtered. The withdrawal times are based on how the body processes the medications, and observing them ensures that there are no drug residues in the milk or meat.

Q. What is the federal government doing to prevent antimicrobial resistance?
A: Antimicrobial use is regulated by the U.S. Food and Drug Administration (FDA). In addition to approving the use of antimicrobials in animals, the FDA also collects data on antimicrobial sales from companies since 2008 and makes that information publicly available.

The National Antimicrobial Resistance Monitoring System (NARMS) was established by the U.S. Department of Health and Human Services (HHS), and the Department of Agriculture (USDA) performs research and provides information about antimicrobial resistance in humans, animals and retail meats. The USDA also funds research on antimicrobial resistance.

FoodNet is a foodborne illness surveillance network and is a cooperative effort between the U.S. Centers for Disease Control and Prevention (CDC), FDA, USDA and members of the Emerging Infections Program (EIP). The system collects information about foodborne diseases and related illnesses.

Q. What can I do to prevent antimicrobial resistance?
A: One very simple thing you can do is to avoid requesting antimicrobials if you have the flu or a cold. Because colds and the flu are due to infection with viruses, antibiotics won't help. Antimicrobials should only be prescribed if your physician feels they are absolutely necessary. If your physician determines that you need to be given antimicrobials, make sure you follow the directions and take the right doses at the right times for the right number of days as prescribed – don't skip doses, don't take antimicrobials prescribed for someone else, and don't save any antimicrobials for later use.

Similarly, trust your veterinarian to determine when and if your animals need treatment with antimicrobials.

Even though there's no real proof that the consumption of animal products (meat, milk, etc.) is related to the development of antimicrobial resistance in humans, it's always smart to handle food properly. Follow proper hygiene when handling food (including vegetables), cook meat to recommended temperatures, drink pasteurized milk and use good common sense. Also, wash your hands often, especially before meals.

Q: Doesn't Europe ban the use of antimicrobials?
A: The European Union does not have a ban on the use of antimicrobials – they have bans on the use of antimicrobials for the purpose of growth promotion. Sweden banned all growth promotants in 1986. Denmark instituted antimicrobial-specific bans in 1995 and 1998, and the country completed the ban of all growth promotants in 2001. The Netherlands banned growth promotants in 2006, and the European Union banned one growth promoting antimicrobial in 1997 and others in 1999. The European Union utilizes the same definitions of antibiotic use as the AVMA and FDA (see "How are antimicrobials used in animals?" question), and disallows growth promotion, which they consider a "non-therapeutic" use of antibiotics. The other uses of antibiotics – prevention, control and treatment – remain, with greater flexibility for the veterinarian to determine doses than what the FDA allows of veterinarians in the U.S.

Q: People keep referring to Denmark's ban on antimicrobial use for growth promotion, but there are conflicting interpretations. Why is that happening?
A: It's really a matter of how you interpret the data. When Denmark banned antibiotic use for growth promotion in pork and poultry, animal deaths and disease rose, requiring more therapeutic antibiotic use

to treat the resultant diseases.[1] In addition, the Danish ban has not resulted in decreased antimicrobial-resistant human infections in Denmark and has not improved human health.

The European Union's (EU) Scientific Committee on Animal Nutrition agreed that there is insufficient data to support bans such as the one enacted by Denmark.[3]

The Danish ministry claims a successful 50% reduction in the **total** use of antibiotics in animal food production as a result of stopping the "nontherapeutic" use of antimicrobial growth promoters without compromising animal health and welfare. However, if you look at the data itself, there are some loopholes in that argument. We certainly agree it is a step in the right direction to scientifically evaluate antimicrobial use and resistance to determine if changes should be made.

AVMA's evaluation of the same data finds their statements to be true only if the all of the following criteria is used in the data interpretation:

- All antimicrobials are used in the calculations, not just those that are important in human medicine. Here in the U.S., both human and animal health officials agree that only antimicrobials that are important in human medicine are relevant.
- The comparison of "before" and "after" the ban uses only data from 1992 and 1994 as the "before" data. AVMA believes that it would be more appropriate to use all of the available data from the years before the ban, beginning in 1990. Using only the two years with the greatest antimicrobial usage, as opposed to using all data available, provides misleading results.

Although Denmark does not believe that the ban on growth promotants has compromised animal health and welfare, citing productivity statistics, the AVMA believes differently based on a wider look at the same statistics. The data does show that swine production, average annual number of piglets per sow, and weaned and finishing (just prior to slaughter) pig average daily weight gains have increased and weaned pig mortality (death rate) has drastically decreased in recent years. We aren't arguing that overall productivity has decreased as a long-term result of the ban. However, there is data that indicates animal health and welfare have been negatively affected:

- Weaned pig mortality rates increased for several years after the ban, reflecting an increased number of animals that died from disease.[2]
- After the ban was instituted in 1998, the use of tetracycline antibiotics increased by more than 30% (from 12,000 tonnes to more than 16,000 tonnes) from 1998-1999. This increased use was due to increased frequency of gastrointestinal disease that required treatment with higher doses of the drugs.[2]
- From 1999-2000, the use of macrolide antibiotics increased. Along with this increase there was in increase in resistance to macrolides by the *Campylobacter coli* bacteria.[2]

Q: What is PAMTA?

A: PAMTA is the Preservation of Antibiotics for Medical Treatment Act (H.R. 1549/S. 619). The bill's stated purpose is to decrease the development of antibiotic-resistant bacteria in humans by eliminating "nontherapeutic" use of antibiotic drugs considered important for human health. The bill defines "nontherapeutic use" as the use of a drug as a feed or water additive for an animal in the absence of any clinical signs (symptoms) of disease in the animal for growth promotion, improved feed efficiency, increased weight gain, routine disease prevention or other routine purposes. It seeks to restrict the use of many classes of antibiotics, including penicillins, tetracycline, macrolides, lincosamides, streptogramins, aminoglycosides, sulfonamides or any other drug or derivative of a drug that is used to prevent or treat disease or infection in humans.

Q: Does the AVMA support PAMTA? Why or why not?

A: No, the AVMA does not support PAMTA. Although PAMTA may seem simple at first glance, we don't support broad bans that aren't based on science. Passing legislation that would ban the use of these antibiotics before science-based studies and risk-based evaluations are done to determine if there is an actual risk to human health would have negative impacts on animal health and potentially on food safety.

This ban would be much more restrictive than the Denmark ban, as it would eliminate two or three of the four currently approved uses of antibiotics. By restricting antimicrobial use for only treatment purposes, antimicrobials cannot be administered until the animal is physically ill and its health and welfare have been compromised.

Another critical, and often overlooked, difference between Denmark and the United States is the flexible drug labeling system used by EU countries. In the United States, drugs are approved by the FDA at specific doses for specific uses. For example, a drug might be labeled with one dose for growth promotion, a second for prevention, a third for control and potentially a fourth for treatment of disease. In the EU, the drugs are labeled with one wider range of accepted dosages, allowing more flexibility in drug dosage selection as opposed to specific U.S. dosing.

Neither the Netherlands' nor Denmark's antimicrobial ban has resulted in decreased antimicrobial resistance in humans. In addition, a study performed in the Netherlands concluded that the therapeutic use of antimicrobials in food animals has nearly doubled in the past decade – one of the likely factors in that increase is the ban on the use of antimicrobials for growth promotion.[2,4]

Q: What is the solution?

A: Antimicrobial resistance doesn't happen overnight, and neither does the solution. First and foremost, we need more discussion, more research and more risk-based analyses. We need more data to really determine the risks and the best measures to reduce or eliminate those risks while also weighing the benefits of antimicrobial use. This includes science- and risk-based evaluation of antimicrobials to determine their appropriate use and/or continued approval.

Following the best available methods for managing food-producing animals, with continual evaluation and improvement when possible, keeps animals healthier and decreases the need for antimicrobials.

Collaboration and coordination between government, industry and other stakeholders is vital. Everyone should take responsibility for the part we may play in the development of antimicrobial resistance and take steps to address it.

We also need more veterinarians working in food supply veterinary medicine, making sure our food is safe from farm to fork.

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