



Antimicrobial Use and Resistance in Canadian Beef Production

Antimicrobial resistance is a naturally occurring phenomenon. Resistance takes place when mutations within the bacteria's DNA enable them to withstand antimicrobials designed to kill them or prevent their growth. In Canada, surveillance indicates that resistance levels in healthy cattle and retail beef are extremely low and have not increased over time.

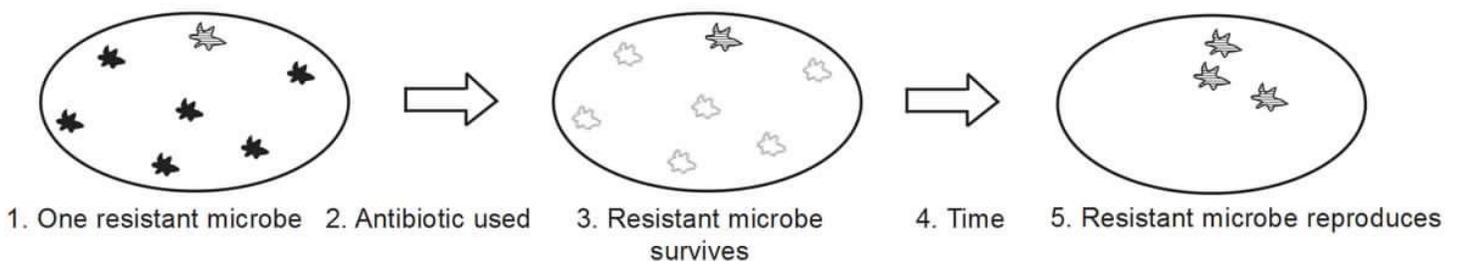
How do Antimicrobials Work?

Antimicrobials are widely used, including for aquaculture, fruit production, beekeeping, livestock production, pets, industrial and household chemicals and human medicine.

In livestock, antimicrobials are used therapeutically to *treat* illness; prophylactically to *control or prevent* illness; and to improve production (i.e. improve feed efficiency). In **Canada, label claims for production purposes will be phased out by the end of 2016.**

How does Antimicrobial Resistance Occur?

Antimicrobial resistance is not caused by antimicrobial use, rather it occurs when a bacteria naturally mutates to become resistant. If the antimicrobial is used when an antimicrobial resistant disease-causing bacteria is present, the antimicrobial resistant bacteria will have a competitive advantage over its susceptible cousins.



If the antimicrobial continues to be used, the resistant bacteria will survive, reproduce and become more common, while the susceptible bacteria will gradually become scarcer. In this case, the antimicrobial will be less effective, and the animal will not respond to continued treatment with the same antimicrobial, even if the dose is increased. When this happens, a veterinarian or doctor may switch to an antimicrobial from a different class or category.



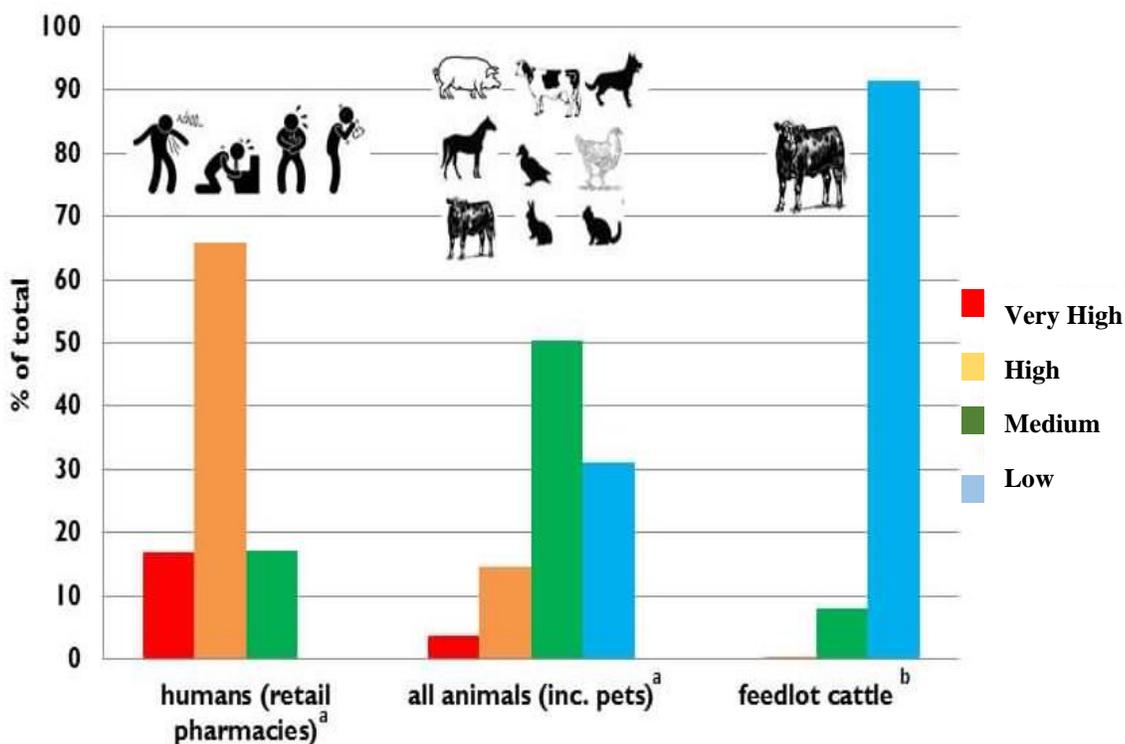
Antimicrobial Categories

Antimicrobials are divided into four categories based on their importance in human medicine. Each category of importance contains antimicrobial drugs of different classes which are based on their chemical makeup.

- Antimicrobials classified as **'Very High Importance'** are used to treat very serious human infections.
- **'High Importance'** antimicrobials are of intermediate concern in human medicine.
- **'Medium Importance'** drugs are rarely used to treat serious human health issues. For example, the tetracycline used for treating acne is classified as Medium Importance.
- Antimicrobials of **'Low Importance'**, like ionophores used in beef cattle, are not used to treat infectious diseases in human medicine at all.

Antimicrobials from all four categories (Low, Medium, High or Very High importance) are registered for use in beef cattle in Canada. **The majority of antimicrobials that are used in Canadian beef production are of Low importance in human health (category IV), which are not used in human medicine.**

Antimicrobials Use by Category



^aCanadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) Annual Report, 2009

^bDevelopment of a Longitudinal Antimicrobial Resistance and Antimicrobial Use Surveillance Program for the Feedlot Sector in Western Canada (BCRC 6.41)

Table I. Category and Class of Drugs for Beef Cattle in Canada

Category of Importance in Human Medicine	Antimicrobial Class	Brand Names of Antimicrobial Products Registered for Use in Beef Cattle in Canada
I: Very High	e.g. fluoroquinolones	e.g. Baytil, A180
	e.g. 3rd/4th generation cephalosporins	e.g. Excenel, Excede, Ceftiocyl
II: High	e.g. macrolides	e.g. Tylan, Micotil, Draxxin, Zuprevo, Zactran
III: Medium	e.g. tetracyclines	e.g. Liquamycin, Aureomycin, Nuflor, Resflor
IV: Low	e.g. ionophores	e.g. Rumensin, Bovatec, Posistec

What are the Implications of Antimicrobial Resistance for Livestock and Human Health?

Antimicrobial resistance is a concern in livestock production for two reasons:

If pathogens develop resistance, antimicrobials will stop working, so animals will not respond to treatment. Animal welfare may be compromised, performance will suffer, and death losses may increase.

Antimicrobial resistant livestock pathogens may be able to pass their resistance on to human pathogens. This would result in antimicrobial drugs not being as effective in treating human infections as well.

The greatest concern is with antimicrobials that are of Very High Importance in human medicine and that are used in livestock. These are drugs of last resort in human medicine (and in veterinary medicine) and are used for infections when there are no other alternatives. If the Very High Importance drugs fail to work, doctors and veterinarians have no other options.

The use of all antimicrobials in veterinary medicine are approved and regulated by Health Canada.

The Public Health Agency of Canada has developed the *Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS)* to monitor antimicrobial resistance in humans and livestock, and retail meat. Surveillance results may fluctuate, but CIPARS results to date indicate that antimicrobial resistance is relatively low. Multidrug resistance is similarly low, and is not increasing.

Research and surveillance evidence suggests that eliminating antimicrobial use in beef production will have clear negative health consequences for cattle with no obvious benefit for human health.



How are Antimicrobials Used and Administered in Beef Cattle?

Some antimicrobials are administered to animals via feed and water. In some cases, the method of administration is confused with why it is being used. For example, some drugs are delivered via feed or water (rather than injected into individuals); that does not mean that the medication is fed to promote growth. In fact, if a large number of animals need to be treated on a daily basis for a period of time for an illness such as respiratory disease, it is much safer and less stressful to leave the animals in their pen and to deliver medicine orally rather than handling them and injecting them individually several days in a row. Keeping animals healthy keeps them eating and growing, which may also contribute to the confusion between antimicrobial use for health purposes and growth promotion.

Antimicrobials may be used to prevent disease in high-risk calves. New arrivals in a feedlot may be stressed, depending on how recently they were weaned, how far they have been transported, whether they were mixed and comingled, or whether they have been adapted to dry feed. Effective vaccines are not available for all of the respiratory pathogens that cause illness in feedlot cattle, therefore a metaphylactic antimicrobial treatment may be used upon feedlot arrival to prevent disease until calves have adapted and overcome stress. Metaphylactic treatment can reduce the need to use more powerful antimicrobial drugs of Very High Importance to treat or cure disease once the disease has progressed and become more serious.

An antibiotic will not be effective against diseases caused by viruses (e.g. BVD, IBR, PI-3, BRSV, coronavirus, rotavirus). However, these conditions may predispose the animal to secondary bacterial infections that can be treated with antibiotics.

How can cattle producers reduce antimicrobial resistance?

The development of antimicrobial resistant microbes can be mitigated by appropriate antimicrobial stewardship practices as well as preventative measures that may result in avoiding antimicrobials altogether.

Using Antimicrobials Responsibly

- **Monitor** cattle health on an ongoing basis to ensure prompt treatment or care. This will facilitate a quicker response rate, fewer treatments, a reduced risk of treatment failure, and a reduced risk of spreading infection to other animals. Closely assess effectiveness of treatment so that ineffective treatments are remedied quickly.
- Have an accurate **diagnosis** before using antimicrobials. Ensure you aren't treating a virus with an antibiotic, or using an antimicrobial for a localized infection, such as an abscess, that may be unnecessary.
- Choose the **right product** to treat the condition. Have a conversation with your veterinarian to help determine whether the health benefit of treatment from a particular antimicrobial drug outweighs the potential risk and burden on resistance. When possible, select an antimicrobial that specifically targets the pathogens instead of broader-spectrum agents.
- Follow veterinary and/or label **instructions**. Use the proper route of delivery (oral, subcutaneous, intramuscular, or intravenous), the proper dosage, and administer treatment for the appropriate number of days. The Compendium of Veterinary Products can be used to search for product labels.
- Adhere to recommended practices in **Canada's Verified Beef Production Plus (VBP+)** on-farm food safety program. Properly dispose of expired product, empty containers and used needles. Avoid using antimicrobials in an animal that has a very poor prognosis and may be a candidate for euthanasia.

Veterinarians work with producers to ensure antimicrobials are used appropriately, withdrawal times are upheld and the benefit of using a particular antimicrobial outweighs the potential risk for resistance.

Prevent Illness to Reduce Need for Antimicrobials

- **Reduce stress** on animals. Stress can weaken the immune system, increase the risk of disease, and increase the reliance on antimicrobials. Consider practices such as preconditioning, low stress weaning, and low stress cattle handling.
- Implement a **vaccination** program in consultation with a veterinarian, based on the level of risk in the herd.
- Ensure adequate **nutrition** by testing water and feed quality.
- Maintain **clean, dry pens** with protection from the elements
- Use **biosecurity practices** to reduce spread of infection among animals, including minimizing comingling of animals from different sources if possible; isolating sick animals; and avoiding overcrowding.



Producers should work with their veterinarians to develop a suitable herd health management program and implement biosecurity protocols to prevent and contain diseases.



The Beef Cattle Research Council, a division of the Canadian Cattlemen's Association, sponsors research and technology development and adoption, in support of the Canadian beef industry's vision to be recognized as the preferred supplier of healthy, high quality beef, cattle and genetics.

For More Information Contact:

Beef Cattle Research Council
#180, 6815 – 8th St NE
Calgary, AB T2E 7H7
Tel: (403) 275-8558 Fax: (403) 274-5686
info@beefresearch.ca

For More Information, Visit:

www.beefresearch.ca

RESEARCH AND TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY