Antimicrobial stewardship: Balancing health, profitability and sustainability

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AT A GLANCE

Antimicrobial stewardship is vital for responsible farm management, as it prevents costly consequences like antibiotic resistance, highlighting the need for informed antibiotic use and preventive measures to ensure animal health, farm profitability and societal well-being.

Antimicrobial stewardship is a crucial aspect of responsible farming practices. For many dairy producers, however, antimicrobial stewardship may appear as one of the many "annoying" extra steps required by processors and consumers.

The immediate benefits of reviewing and potentially reducing antibiotic usage on farms might not be readily apparent, but the consequences of inappropriate antibiotic use can be significant.

It may lead to unneeded expenses due to treatment costs and milk withdrawal times, an increased risk of contamination of milk with antibiotic residues and an increased risk of development of resistant bacteria, posing risks to cows, farm workers and the public.

Antimicrobial resistance explained

Dairy cows, like humans and most living organisms, harbour various bacterial species and other microorganisms, most of which coexist with their hosts harmoniously. When an antibiotic is administered, susceptible bacteria may be eliminated, allowing resistant bacteria to thrive and become dominant. This can make the antibiotic ineffective for future treatments and can therefore increase the risk of infections persisting in the afflicted animal and spreading to other animals in the herd, or to humans.

In essence, antimicrobial resistance is a kind of genetic selection applied to microbes. To improve milk production of cows, we can drive selection pressure to boost the offspring from dams and sires with high production potential, and the same applies to bacteria. We can "select" – using an antibiotic – the resistant bacteria (see **Figure 1**).

The more we use antibiotics, the more we select for resistant bugs, perpetuating the cycle until the available antibiotics are no longer efficient. However, by limiting usage of antibiotics, we can break and even reverse this cycle and allow bacterial populations to regain their original diversity. Retrieving a more-diverse and less-resistant population of bacteria after years of antibiotic usage is not instantaneous, but it can be observed over a few months after we stop using a given drug.

Is antimicrobial stewardship the solution?

Antimicrobial stewardship is simply the concept of promoting an optimal use of antibiotics. There are three pillars that are essential to the antimicrobial stewardship concept:

1. Preventing diseases
2. Identifying which animal and condition need an antibiotic
3. Choosing the appropriate antibiotic, dosage, route of administration and treatment duration

So, clearly, antimicrobial stewardship starts with preventive measures such as vaccination, preventing stress in cows, managing stall and cow hygiene, improving milking procedures and so on. As your parents (or grandparents) already told you, "An ounce of prevention is worth a pound of cure." Indeed, preventing diseases is usually cheaper than treating sick animals.

Despite all this, every now and then we will still have a sick animal. When this happens, we then must determine whether an antibiotic is needed. On a dairy, many diseases are not caused by microbes, for instance, sole ulcers, ketosis and other metabolic diseases. In such cases, antibiotics are certainly not an essential component of the treatment. Moreover, many diseases are actually caused by viruses, and antibiotics are not effective against viruses, only against some bacteria. For instance, diarrhea in very young calves is often caused by a rotavirus or a coronavirus. In such cases, keeping the calves hydrated is more important than an antibiotic treatment.

Finally, for many cases of diseases caused by bacteria, which could in theory be treated using an antibiotic, we do not always have efficient antibiotics available. For instance, the cure rate of a *Staphylococcus aureus* intramammary infection in an old cow that has been infected for a while is expected to be extremely low. In such cases, using an antibiotic is probably a waste of money.

Making the right choices

When we need to treat a sick

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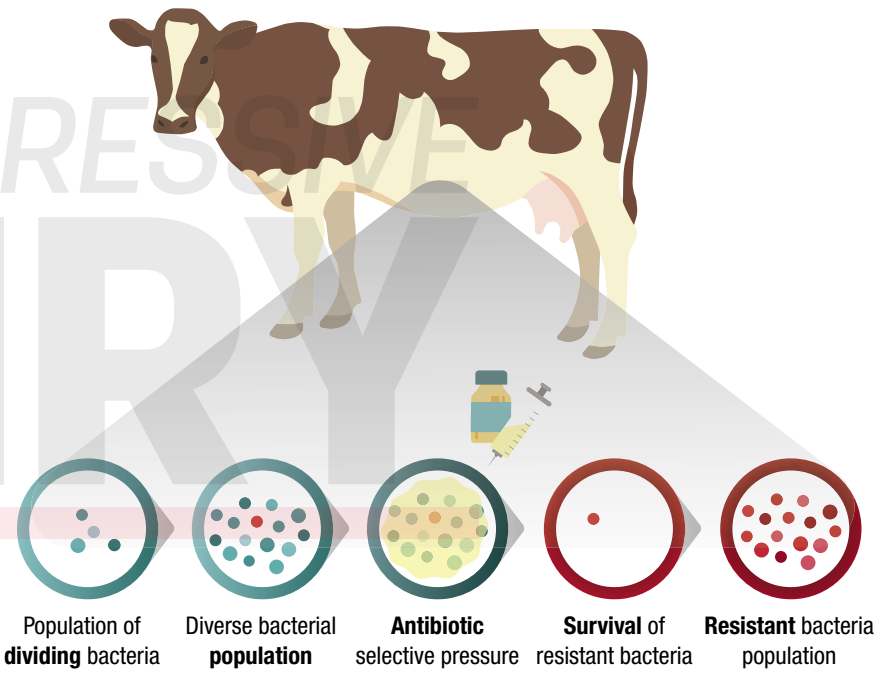
FIGURE 1 The rise of resistant bacteria populations



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animal with an antibiotic, then we need to select the appropriate antibiotic, dosage, route of administration and treatment duration. Your veterinarian is certainly the best source of information regarding these choices. But there are a few common mistakes to avoid:

• *Look beyond the dairy farm's interests when selecting an antibiotic.* Health Canada recommends restricting the use of certain antibiotics in animals if they are vital for treating severe infections in humans. These include antibiotics like quinolones and third- and fourth-generation cephalosporins. When choosing the antibiotic that will be used on the farm, it is valuable to consider the broader societal implications rather than simply the expected outcome for the treated animal.

• *Extending the treatment duration beyond what is recommended.* As an example, it is well known that the symptoms of clinical mastitis will usually be visible for two to five days, whether it is treated or not. Most clinical mastitis treatments are designed to be administered either as one single treatment or sometimes two treatments administered 24 hours apart. But, since the symptoms are often still visible at the end of the treatment, it is tempting to extend the treatment duration. This practice, however, will not necessarily improve the cure rate.

• *Using the same dose of oral, intravenous, intramuscular or subcutaneous antibiotic for all cows or calves.* Antibiotics designed for these routes of administration usually require a certain quantity of antibiotic per animal weight. On a dairy farm, it is not uncommon to have a small 600-kilogram cow and a large 750-kilogram cow. In this case, the dose of intravenous antibiotic required for the 750-kilogram cow will be markedly higher than the dose of the same antibiotic required for the smaller cow. Thus, using a one-size-fit-all dose results in unnecessary costs for the additional drug administered to the smaller cow, increased risk of antibiotic residues in milk and an increased risk of promoting antimicrobial resistance.

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Conclusions

Antimicrobial stewardship is not about leaving sick animals untreated or sacrificing farm profitability. In fact, judicious usage of antibiotics can help to maintain and improve animal health and farm profitability. It should not be viewed as another chore for dairy farmers but as a vital component of ensuring the health and sustainability of their operations. Embracing antimicrobial stewardship not only benefits individual farms but also contributes to the overall well-being of the dairy industry and wider society.

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Menéndez and Dufour are members of the Op+lait research network. Op+lait is an interuniversity working group composed of more than 65 researchers committed to optimizing milk quality and driving innovation in the dairy sector.

FIGURE 2 Antimicrobial stewardship decision tree