




Food and Agriculture
Organization of the
United Nations

HOW TO USE
antibiotics effectively
and responsibly
in
DAIRY
PRODUCTION –

for the sake of human and animal health



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Food and Agriculture Organization of the United Nations
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Key messages

What is antibiotic resistance?

- Antibiotic resistance – when antibiotics stop functioning – is threatening millions of human lives and the health, welfare and productivity of our livestock.
- The more we use antibiotics, the greater the chance that antibiotic resistance will develop. Therefore, it is important that we use antibiotics only when they are really needed.
- Disease prevention – good animal husbandry, biosecurity and vaccination – is the way to reduce the need for antibiotics in the herd. Antibiotics should be regarded as the very last resource for fighting disease.

What can you do?

- Good animal husbandry and most biosecurity measures comprise practices that you as a livestock keeper can control. These practices are in your hands.
- Do not use antibiotics for disease prevention – for instance as feed additives.
- Only use antibiotics when a veterinarian has diagnosed a disease, and treat animals individually.

Introduction

Antibiotics are a revolutionary discovery for curing infections in animals and humans. However, during the last decades it has emerged that more and more antibiotics are not functioning as expected – they do not cure the patient or animal of the disease; they do not kill the bacteria that cause it (*Box 1*). This is because the particular bacteria have become resistant to the antibiotic. Antibiotic resistance is an increasing threat to human and animal health worldwide. It is estimated that in the coming decades there will be several million deaths annually and a significant drop in livestock production attributable to infections by resistant bacteria. In order to protect the effectiveness of antibiotics, it is critical to reduce their overall use and to restrict their use to when they are really needed. This applies to both the human health sector and livestock production. It should also be noted that there may be a spread of resistant bacteria from livestock to humans and that farmers are regarded as being at highest risk of being infected (*Figure 1*). Therefore the use of antibiotics in livestock production may also influence the occurrence of antibiotic-resistant bacteria in humans.

BOX 1

There are many different disease-causing bacteria, and different drugs (antibiotics) have been developed to kill them. Thus, there is a specific matching between disease-causing bacteria and kind of antibiotics. However, some bacteria develop resistance to the drug that originally would have killed them. The development of this antibiotic resistance – when the drug no longer kills the bacteria it is intended to kill – is driven by extensive use of antibiotics.

Globally, more antibiotics are used for livestock than for humans, even if in some countries the livestock share is just some 20 percent of the total use. The large use in livestock is mainly caused by regular use for disease prevention and to make the animals grow faster by mixing antibiotics in feed. These practices are not seen in human medicine. However, in many countries, such as those in the European Union, the use of antibiotics to promote growth has been banned, and in several countries the regular use of antibiotics for disease prevention is restricted. However, these restrictions have not lowered animal productivity in the long term. Thus, farmers have many options to contribute to reducing the amount of antibiotics used worldwide and thereby attenuating the development of antibiotic resistance. At the same time, these options can protect the effectiveness of antibiotics in livestock production.

Here, we provide advice on how to reduce the need for antibiotics in dairy farming and how to use antibiotics in a responsible and efficient way when needed. Dairy producers in some countries have taken this approach and proven it to be successful without hampering the cows' productivity. The advice is directed to you if you have more than 15 cows and use a milking machine.

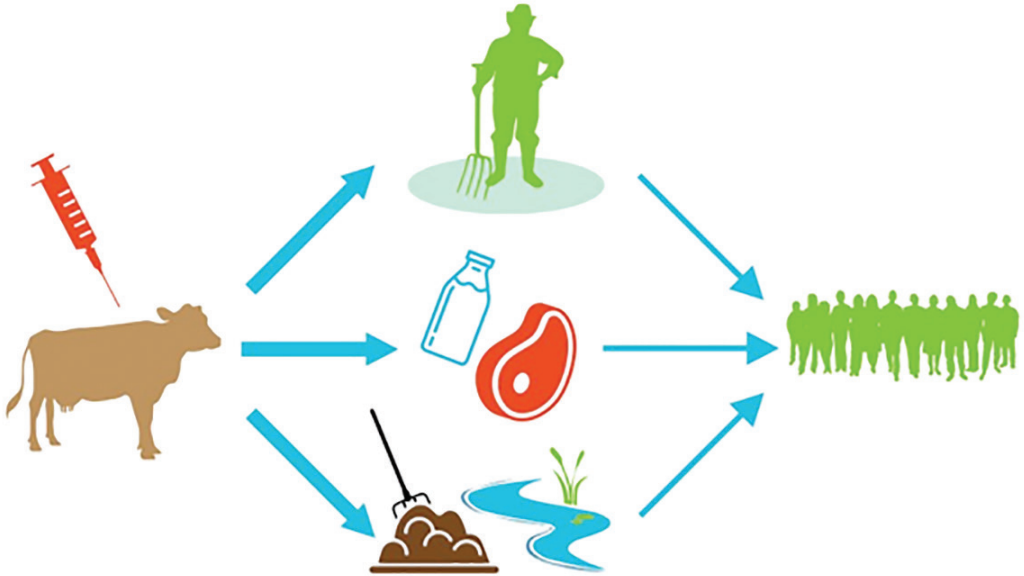


Figure 1. Resistant bacteria can move from cattle to humans: (i) via direct contact with the farmer; (ii) via food products; or (iii) via the environment. The routes via direct contact and food products are regarded as the most important. Also, note that resistant bacteria may be spread from the general human population to cattle via farmers or the environment.

How to reduce the need for antibiotics

This section is about how to keep your animals healthy and productive without the regular use of antibiotics. The number of countries where there are restrictions about the use of antibiotics in livestock is increasing every year. Notably, milk production in these countries continues to increase. This is because at the same time they have adopted good husbandry practices that made their animals not only healthier but enabled them to produce more milk.

The transition to animal farming with low use of antibiotics is a stepwise process that must be carefully monitored. We describe a set of measures that have proven to be successful in several countries with maintained productivity. However, it is important to have these measures in place before changing the use of antibiotics. The measures fall into three levels of disease prevention (*Figure 2*), which are arranged in a hierarchical order. We also discuss the costs and benefits of these measures.

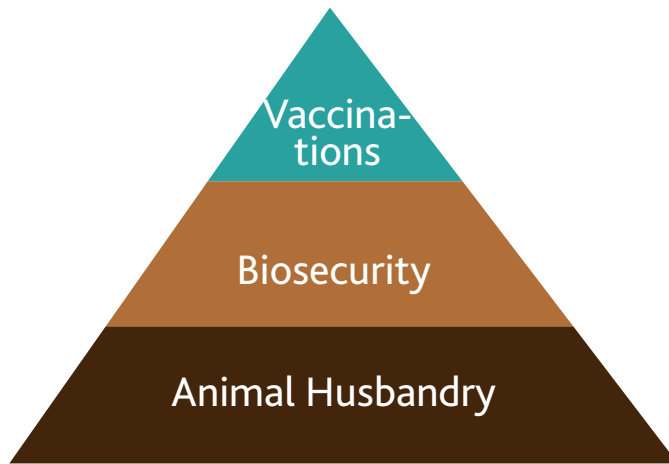


Figure 2. The three main measures to prevent infectious disease on a farm: Good animal husbandry is the basis for robust and healthy animals (e.g. quality of feed, cows' welfare and comfort, care of calves, milking routines); Effective biosecurity acts as a broad-range filter for keeping diseases out of your farm (e.g. use of artificial insemination, quarantine for new animals); Vaccinations protect your animals against specific disease (very specific for each region, e.g. brucellosis, leptospirosis).

GOOD ANIMAL HUSBANDRY

This area of disease prevention is where you as a dairy farmer can make the most difference to keep your cows healthy and reduce the need for antibiotics. Good animal husbandry includes several elements, and most of them are applicable for most kinds of animal-rearing. However, as dairy cows are kept for milk production, husbandry practices aiming at good calf care and udder health are given special attention.

COMMON GOOD ANIMAL HUSBANDRY

In order to be able to raise robust and healthy animals, a set of fundamental conditions must be fulfilled at the farm.

Both feed and water must be of good quality and in sufficient amounts. The feed must contain sufficient energy and appropriate minerals as well as have proper hygienic quality. Sufficient fresh and clean water (ideally freely available) is crucial for high milk production.

The facilities where the cows are kept are important for the cows' welfare and comfort and thereby their productivity. They should be kept in a clean area with sufficient space. Attention should be given to the ambient temperature. Temperatures that are either too cold or too hot can stress the

cow's body functions and may risk her health, and reduce her fertility and overall production. One very important practice that is sometimes overlooked is the regular trimming of the hoof of the cow (*Figure 3*). Good care of the hoofs, including appropriate flooring and alleys that are clear of stones and deep mud, is critical for preventing hoof lesions that may cause pain, reduced milk production and fertility, and that may need antibiotics to be cured. Besides mastitis, claw diseases are regarded as the most costly diseases in modern dairy production.

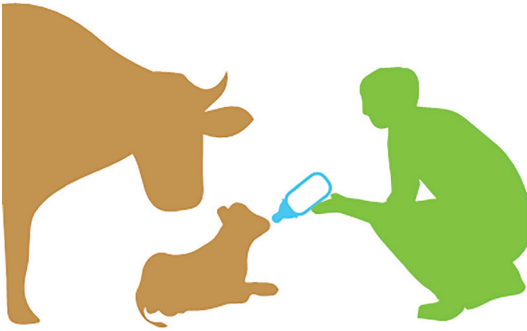


Figure 3. Regular trimming of the hoofs prevents the cow from suffering from hoof lesions that may require antibiotic treatment.

Another preventive measure is parasite control. Some tick-borne diseases are prevented by vaccination against the parasite, whereas others are prevented by controlling the ticks. Deworming is critical for controlling parasites that enter the cow or calf via the intestines and that may then spread throughout the body. As with vaccinations, tick control and deworming must follow a planned scheme in order to be effective. Your veterinarian can advise you on how to arrange this, but please note that parasites may also develop drug resistance if the drug is overused or misused.

CALF CARE

A good start in life is fundamental for a calf to become a successful milking cow. The “good start” comprises being born in a clean, temperate and quiet environment and fed with sufficient amounts of colostrum from the mother (*Figure 4*). In the colostrum, there are antibodies that are taken up by the calf during the first days of life and protect it from infections that could lead to diarrhoea and respiratory disease. It is a wise practice to collect and freeze colostrum from older cows that can be given to calves from dams that produce little or low-quality colostrum, as with some heifers.



Only use colostrum milked between 1 and 6 hours after calving.

Feed the calf 2–4 litres of colostrum as soon as possible after birth (within an hour).

Repeat this once or twice during the first 24 hours of the calf's life.

The colostrum should hold a temperature of 37–39° C and be of good hygienic quality.

Figure 4. Feeding the calf with colostrum is the key for a good start in life.

STEP BY STEP TOWARDS HEALTHY UDDERS

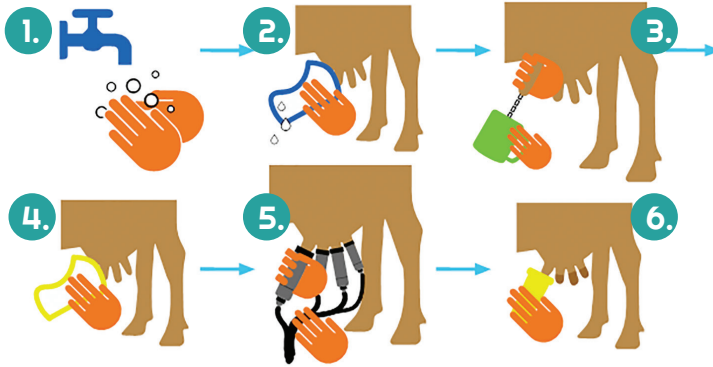
Udder health is not so much about sick cows but more about keeping healthy cows healthy and productive. The cow thrives at her very best if she has neither clinical (visible) nor subclinical (invisible) mastitis. Fortunately, this is also very convenient for you as a farmer since less time is spent on treating animals with antibiotics.

Some of the practices described in this section need support from a certified veterinarian, but most of them you can actually do yourself. It is wise to begin with general action areas listed in the table below. In the meantime, conduct an analysis of milk samples as soon as possible discover to what kinds of bacteria are present in the udders of your cows.

ACTION AREAS AT START	Type of Udder Bacteria Unknown
	Dispose of milk with clots
	Do thorough teat-dipping
	Properly prepare udder before milking*
	Cull cows with chronic mastitis
CMT & culturing	

*Clean and ensure enough contact time with teats when preparing cows for milking; foremilk all teats in a test cup. See also Figure 5.

1. Use and change disposable gloves or wash your hands thoroughly before handling each cow.
2. Clean the teats carefully with a humid individual cloth.
3. Forestrip the teats, which stimulates milk letdown, reduces micro-organisms in the teat and allows detection of signs of mastitis in the milk.



4. Manually dry with an individual cloth or paper towel.
5. Attach the milking units between 1 and 2 minutes after the start of cleaning of the udder (#2 above).
6. Dip each teat with disinfectant immediately after the milking units have been detached.

Figure 5. Good milking routines and hygiene are essential to avoid mastitis. They should be the same at each milking occasion and preferably performed by the same person.

There are two main types of bacteria that cause mastitis: those that are spread from one cow to another (contagious) and those that are spread from the environment to the udder (environmental). To improve udder health, it is important to know which main type is causing the problem in your herd, as each type has its own preventive strategy. You can ask your veterinarian for this information after the bacteriological examination of the milk samples. In the table below, you can see the primary action areas under each bacterial type.

TYPE OF UDDER BACTERIA			
		Contagious	Environmental
ACTION AREAS 1		Teat-dipping	Milking hygiene**
		Biosecurity at calving	Lying hygiene
		Milking routines*	Water hygiene
		Milk machine function**	Feeding hygiene
		Milking order	Minerals and vitamins
		Milking hygiene***	Low-stress handling
		Cows standing after milking	Biosecurity at calving

*Ensure enough contact time with teats when preparing cows for milking; foremilk all teats in a test cup.

** Make sure that the milking equipment is properly calibrated.

***Clean and dry cows, teats and milk machine, as well as the milker's hands and clothes.

Please also see Figure 5.

When you are satisfied with these areas, there is a second step to take:

ACTION AREAS 2	TYPE OF UDDER BACTERIA	
	Contagious	Environmental
	Dry-cow antibiotic treatment*	Feeding balance
	Lying hygiene	Dry-cow routines
	Water hygiene	Other diseases
	Feeding hygiene	Milking routines
	Strategic CMT & culturing	Teat-dipping
	Minerals and vitamins	Milking order
	Low-stress handling	Milk machine function

*Apply selective treatment, i.e. you only treat cows suffering from subclinical (invisible) mastitis diagnosed by a veterinarian.

When all of the action areas listed above have been carried out, you have all the pieces in place for healthy cows and high productivity.

BIOSECURITY

Biosecurity is about stopping infections from entering the herd as well as protecting the individual animals within the herd if an infection does enter. Infections may enter the farm or herd in many ways (Figure 6).

The most common way that an infection can spread into a farm is by livestock from another farm, a livestock market or by a breeding bull. To mitigate this risk, it is crucial to keep newly arriving cattle in quarantine from the other animals for at least three weeks and to monitor them for signs of disease on a daily basis. Additionally, using artificial insemination is safer than taking the cow to a bull that is not part of the herd or vice versa.

Within the herd, it is critical to stick to the hygiene in the milking routines as described above, so that bacteria do not enter the mammary gland and cause mastitis. Also, biosecurity at calving is important to keep the cow and calf healthy. Before and during calving, keep the cow separate from the rest of the herd in a clean area, ideally in an individual pen. Also, if you assist in the calving, make sure your hands and nails are clean; use clean water to avoid any uterine infection.

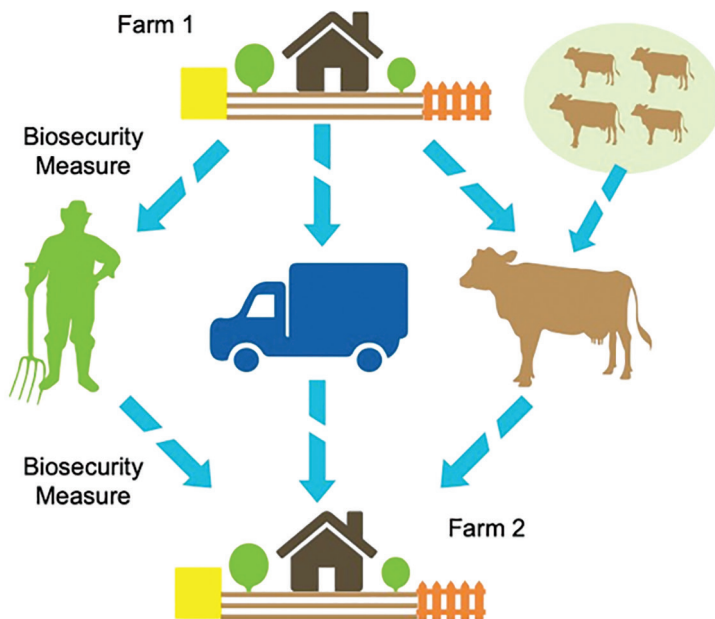


Figure 6. Biosecurity measures protect the farm from the introduction of infections. In this case, an infection in Farm 1 or at a livestock market (upper right corner) could be spread to Farm 2 if biosecurity measures are not applied to people, vehicles and, in particular, animals.

- i) Movement of people – for example, neighbours, animal health personnel, people delivering feed – into the farm should be restricted and they must wear protective clothing and wash their hands and boots before they come in contact with the herd.
- ii) Transport vehicles for feed, animal feed, milk, and slaughter animals may spread infections, and drivers of these vehicles should not come in contact with the animals.
- iii) Make sure that new cattle entering the farm are free from disease.

VACCINATIONS

Using good vaccines in a systematic manner is an effective way to prevent specific infectious diseases. Note that most vaccines are sensitive to how they are stored and handled before use and they must be quality-assured. You should request this information from your veterinarian, who also may advise you on which vaccines are relevant for your farm or area. This is important, since each vaccine is specific for just a certain disease (although there are some vaccines that function against more than one disease). Finally, it is critical that you stick to a vaccination scheme that includes an appropriate vaccination interval, a specification of which category of animal should be vaccinated, and other factors. These are aspects of a professional vaccination scheme that your veterinarian will know about.

Performing vaccination in a non-systematic manner may risk the immunity of the animals and the vaccination may thus not protect against disease as intended.

COSTS AND BENEFITS

Some of the disease prevention measures recommended may require capital for initial investments and then for running costs, whereas others are based on improved management skills. Many will increase revenues in both the short and long terms. It should be noted that the withdrawal time for milk, i.e. during antibiotic treatment and the stated time period after ending the treatment when the milk is not suitable for safe human consumption, is a considerable cost in settings where this regulation is applied. In the long term, farmers who apply a production with low use of antibiotics may gain access to more high-quality markets with better pricing. Below is a schematic summary of the costs and benefits in connection with improved preventive measures to be considered by you (Table 1).

Table 1. Overview of types of costs and benefits related to improved disease prevention.

COSTS			BENEFITS	
Investment	Running	Skills	Short term	Long term
Adequate housing and facilities; Extra clothes and boots	Better feed and vaccinations	Improved animal management	Reduced spending on antibiotics; Less disposal of milk	Better production; Access to new markets

How and when to use antibiotics

Antibiotics may be needed when a cow or calf becomes sick despite the disease prevention measures described. If so, the following two principles should be applied.

ONLY USE ANTIBIOTICS WHEN BASED ON A DIAGNOSIS OF DISEASE BY A VETERINARIAN

Only use antibiotics after consulting with a certified veterinarian, even if you can buy direct from a pharmacy or agrochemical shop (Figure 7). Note that antibiotics are effective only against bacterial disease and not against viruses. Many respiratory diseases and some diarrhoeal ones are caused by viruses. Using antibiotics for such diseases is a waste of money and only contributes to the development of antibiotic resistance. Obviously, a proper diagnosis of the cause of the disease is crucial for choosing the right treatment. An experienced veterinarian may make a tentative diagnosis distinguishing a viral from a bacterial disease. But this can be difficult without proper laboratory diagnosis.

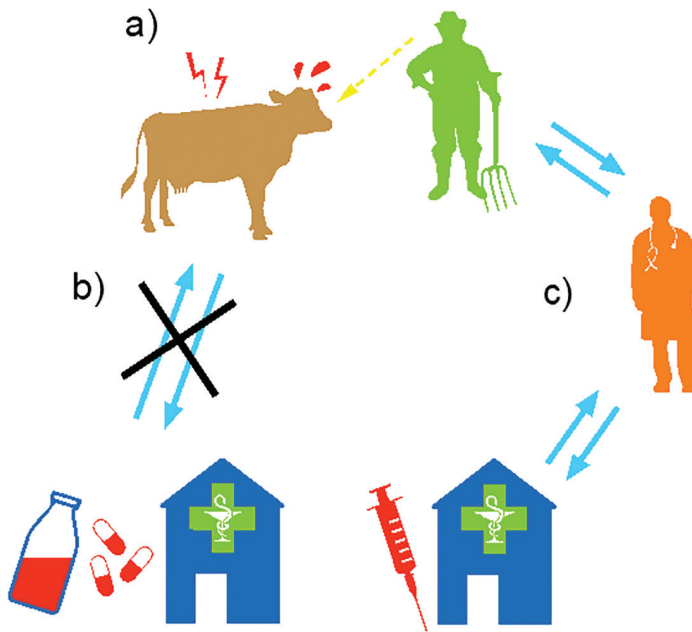


Figure 7. When a cow is sick (a), do not buy antibiotics and start treatment without consulting a veterinarian (b). Instead, always ask a veterinarian for a proper diagnosis and advice on whether antibiotics should be used (c). And if so, what kind, what dose and for how long.

When your veterinarian has decided which antibiotics to use, stay with the assigned dose and treatment period. If the animal's health doesn't improve in a few days, contact the veterinarian so the antibiotics can be changed or adjusted, ideally after laboratory testing. The lack of improvement may be due to resistance of the bacteria to the first choice of antibiotics.

TREAT ANIMALS INDIVIDUALLY WITH ANTIBIOTICS

To keep the use of antibiotics as low as possible in order to prevent the development of resistance, you should strive to treat animals individually. This means that you shouldn't use antibiotics mixed in the feed or water (*Figure 8*). Also, for dry-cow treatment with intramammary antibiotics, do not treat all cows (blanket therapy), only those that suffer from subclinical (invisible) mastitis as diagnosed by a veterinarian.

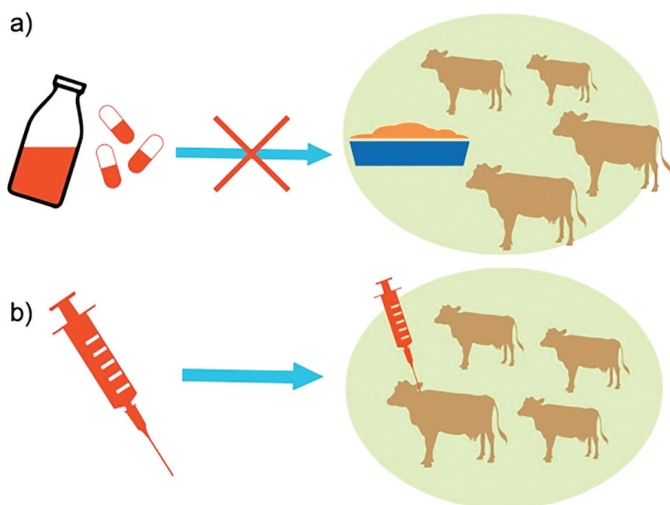


Figure 8. Do not add antibiotics to the feed or use prefabricated feed with antibiotics (a). Instead, always strive to treat a sick cow individually after consulting with a veterinarian (b).

Acknowledgements

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Further reading

FAO. 2020. *Tackling antimicrobial use and resistance in dairy cattle: Lessons learned in Sweden*. Rome. <https://doi.org/10.4060/cb2201en>

Landin H. *The udder health pyramids*. Växa, Sweden.

English version: <https://www.vxa.se/contentassets/60ed41163d1146578ab6ae73ed811259/englishudder-health-pyramids.pdf> (last accessed, 17 March 2021)

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