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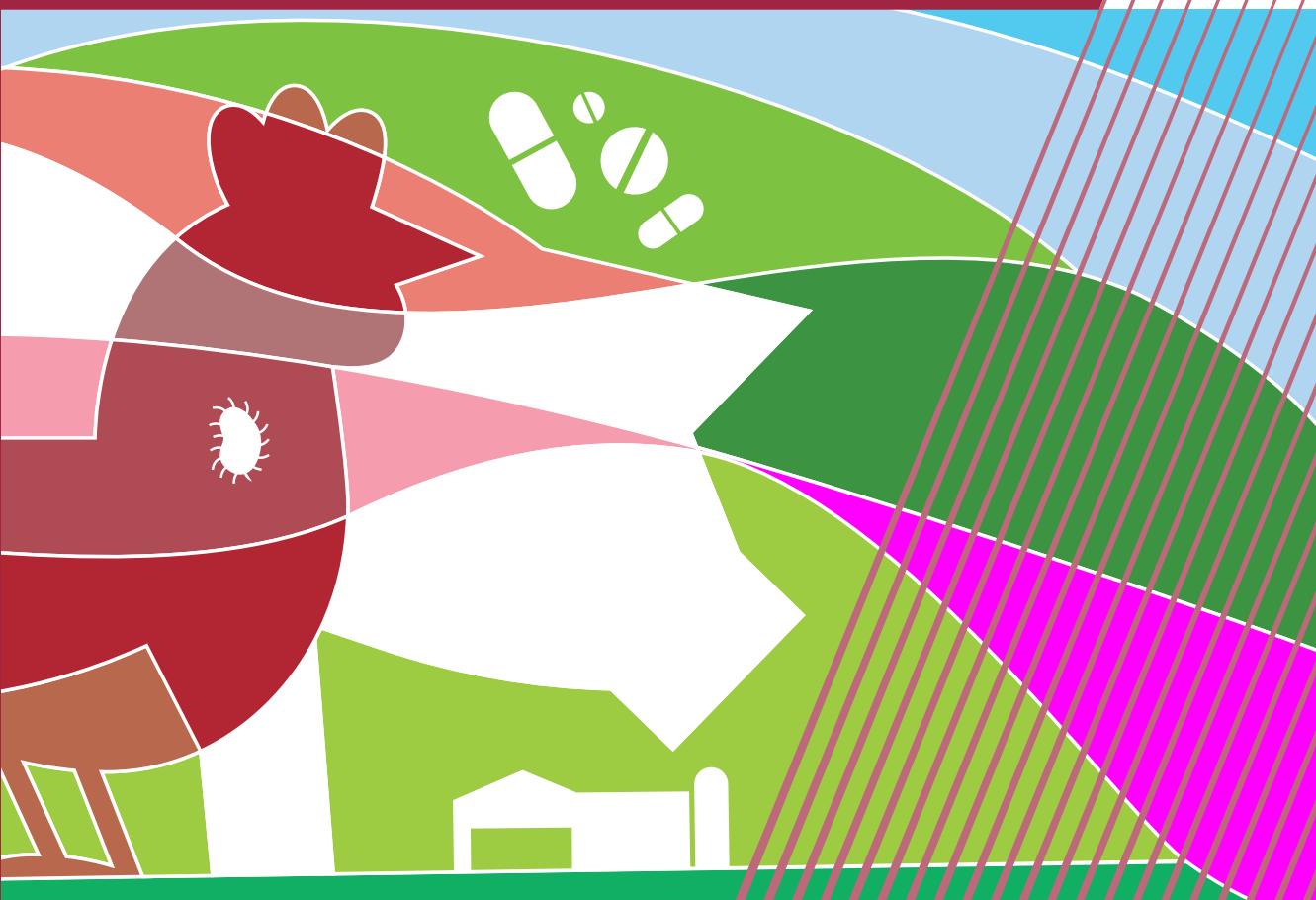
FAO ANIMAL PRODUCTION AND HEALTH / **MANUAL 23**



FAO ANIMAL PRODUCTION AND HEALTH / **MANUAL 23**

Prudent and efficient use of antimicrobials in pigs and poultry

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Foreword

The Food and Agriculture Organization of the United Nations (FAO) is strongly committed to the global fight against the emergence and spread of antimicrobial resistance (AMR). This commitment is described in the FAO Action Plan on Antimicrobial Resistance 2016-2020 (FAO, 2016b), which supports the 2015 Global Action Plan on AMR (WHO, 2015) by underlining the importance of a One Health approach (i.e. the understanding that the health of people, animals and the environment are connected) in this work. Thus, FAO works closely with the World Health Organization (WHO) and the World Organisation for Animal Health (OIE) in a Tripartite Initiative, as well as with other partners such as the Codex Alimentarius Commission, the United Nations Environment Programme and academia.

The FAO Action Plan on Antimicrobial Resistance focuses on four areas:

1. improving awareness on AMR and related threats;
2. developing capacity for surveillance and monitoring of AMR and antimicrobial use in food and agriculture;
3. strengthening governance related to AMR and antimicrobial use in food and agriculture;
4. promoting good practices in food and agricultural systems and the prudent use of antimicrobials.

This manual will contribute directly to the fourth focus area of the FAO Action Plan by promoting the prevention of infections and the prudent use of antibiotics in the pig and poultry sectors. The pig and poultry sectors are addressed together, as these sectors generally have the highest use of antibiotics. This manual is jointly applicable to veterinarians, other health professionals and farmers; a key to success in using antibiotics effectively and prudently is good dialogue among these professions. The manual is intended to assist pharmacists, veterinarians, other animal health workers, farm owners and their staff in using antibiotics in a prudent and medically efficient way without loss in productivity. The manual is especially targeted to farmers with commercialized medium- or large-scale production, veterinarians and other animal health personnel in non-EU Eastern European and Balkan countries, the Caucasus, and Central Asia, who are dealing with pigs and poultry. However, in many cases the principles and practices described here are universally useful and may be applied elsewhere. The goal is to promote good practices and reduce the inappropriate use of antibiotics and thereby to mitigate the emergence and spread of AMR. The manual should be regarded as a practical, on-the-ground complement to national governance and regulatory measures.

The manual is divided into four chapters: 1) Introduction; 2) Prevention of infectious diseases without antibiotics; 3) How to use antibiotics in a prudent and medically efficient way; and 4) Practical recommendations on how to combine prudent use with preventive measures for good productivity.

Acronyms

AMR	Antimicrobial Resistance
CIA	Highest Priority Critically Important Antimicrobials for Humans
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
OIE	World Organisation for Animal Health
WHO	World Health Organization

Key messages

1. Antimicrobial resistance (AMR) threatens the efficiency of antimicrobials in the public health as well as the animal health sector, and thereby also jeopardizes the welfare of livestock, profitability of livestock production and safety of animal products.
2. The use of antibiotics in the livestock sector contributes to the overall emergence of AMR and there is scientific evidence to support the interweaving of resistant bacterial populations in animals and humans; however, the precise burden for human health originating from antibiotic use in animals is unknown.
3. A critical component in mitigating the emergence of AMR in the livestock sector is to reduce the use of antibiotics by applying prudent and medically rational use.
4. It is possible to have healthy and productive livestock by combining prudent and medically rational use of antibiotics with disease preventive measures other than use of antibiotics.
5. Other disease preventive measures include:
   a) Good animal husbandry and welfare such as appropriate management, housing, feeding, and water supply;
   b) Effective external as well as internal biosecurity at the farm;
   c) Efficient and relevant vaccinations.
6. The prudent and medically effective use of antibiotics comprises several elements:
   a) Phasing out use of antibiotics as growth promoters and avoiding regular preventive use of antibiotics;
   b) Avoiding use of the Highest Priority Critically Important Antimicrobials (CIAs) for human medicine in animals and adhering to the OIE List of Antimicrobials of Veterinary Importance;
   c) Only using antibiotics based on a diagnosis of disease by a veterinarian or other animal health professional and only for authorized indications;
   d) Striving for individual treatment of animals with the correct dose and duration and avoiding using antibiotics for group treatments except for poultry flocks, especially via feed.
   e) Using only quality-assured pharmaceuticals and always consulting an animal health professional before use;
   f) Disposing of unused and expired antibiotics in a proper way.

Chapter 1
Introduction

Antimicrobials are widely used in both humans and livestock and have greatly contributed to better human and animal health. As a consequence, animal health, welfare and productivity have improved in the livestock sector, and ultimately food safety, food security and nutrition and economic growth have shown positive development. However, the achievements in modern medicine and in the livestock sector due to the discovery and development of antimicrobials are threatened by the global emergence of antimicrobial resistance (AMR). Worst case scenarios estimate that AMR will contribute to 10 million human deaths per year in the world and 10 percent loss of production in the livestock sector in low-income countries by 2050, if the emergence and spread of AMR is not curbed. It is important that livestock producers are aware of the risks caused by AMR, not only to protect human health but also to ensure the effectiveness of antimicrobials as a remedy for animal diseases to allow profitable food production.

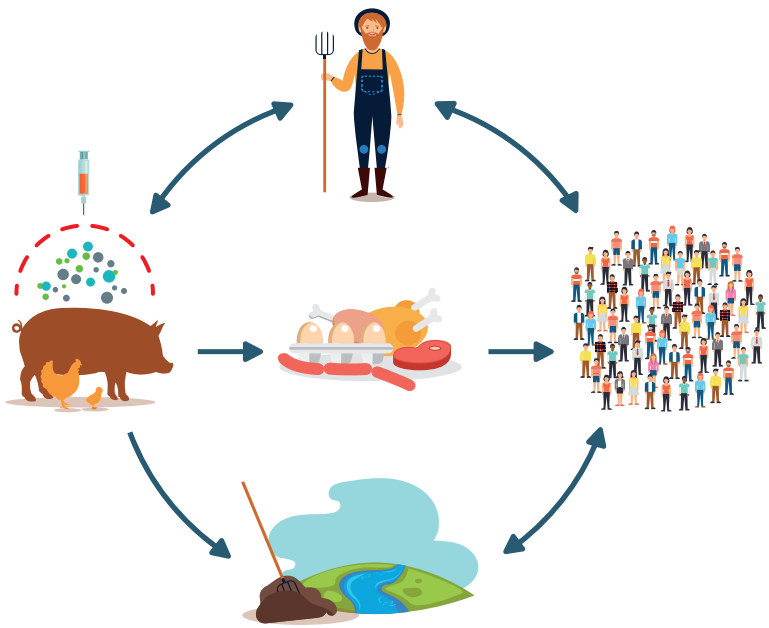
Notably, AMR may develop independently in nature. This process is accelerated, however, by selection for resistant microbes that results from excessive and medically unnecessary use of antimicrobials in human and veterinary medicine, as well as in plant agriculture. These practices allow resistant microbes to survive while susceptible microbes are killed. Some of these resistant microbes are transmitted from animals to humans or vice versa through direct contact, through the food chain in animal products and possibly through the environment, although to what extent this happens is insufficiently known (Figure 1). There is plenty of evidence of direct transmission – e.g. from livestock to farm workers – but indirect transmission is difficult to substantiate and so the relative importance of different routes of transmission is not well understood.

Given the context of a One Health approach (i.e. the perspective that the health of people, animals and the environment are interconnected), the emergence of resistance to antibiotics (antibacterials) is the primary issue (Box 1).

BOX 1

Antimicrobial resistance (AMR) comprises the resistance of microbes to antiviral, antiparasitic, antifungal and antibacterial drugs. From a One Health perspective, bacterial resistance to antibacterials (antibiotics) is the most critical aspect of AMR in the livestock sector, as humans and animals often share the same bacteria and may be treated with the same types of antibacterial drugs. This manual therefore focuses on resistance to antibiotics. International standards, such as the OIE Terrestrial Code chapter on responsible and prudent use of antimicrobial agents in veterinary medicine (http://www.oie.int/index.php?id=169&L=0&htmfile=chapitre_antibio_use.htm) are useful in this context.

FIGURE 1
Possible routes of transmission



Possible routes of transmission of resistant bacteria and resistance genes from livestock to the general human population

Therefore, a key task for all livestock sectors is to reduce the inappropriate use of antibiotics, as such use is closely linked to development of AMR.

The use of and access to antibiotics in the livestock sector vary a great deal throughout the world. In some low-income countries there is often poor access to antibiotics, particularly for extensive livestock production. A common problem, especially in low-income countries, is substandard or falsified pharmaceuticals for sale on a free and unregulated market. This permits the use of antibiotics without instructions from veterinarians or other professional animal health workers. In agriculture, most antibiotics are used in intensive poultry and pig rearing in emerging economies as well as in some high-income countries; notably these two species are the ones that are expected to increase in numbers the most in the coming decades (see Table 1). One aspect that distinguishes the use of antibiotics in the livestock sector from that in human medicine is the use of antibiotics for growth promotion purposes in some intensive livestock systems. This contributes to the fact that, in some parts of the world, more antibiotics are used in animals than in humans.

In contrast, in countries with a very low use of antibiotics in the livestock sector (e.g. Norway, Sweden and Finland) the opposite is true – i.e. the use of antibiotics for livestock

is lower than in the human health sector. Many countries around the world, especially in Europe, are making good progress in reducing the use of antibiotics. Notably, these countries have managed to combine a low use of antibiotics with high productivity in the livestock and aquaculture sectors.

Several actions may be taken to achieve prudent and, consequently, reduced use of antibiotics in the livestock sector. However, the paths toward this goal vary among countries and among sectors and farms. In some countries the general public and farmers are well aware of AMR but in others even the professionals in the sector have poor knowledge about the risks. Therefore, awareness campaigns and education may be useful. Other possible actions are improvement of governance and strengthening of regulations. Such regulations may include: making antibiotics available only by prescription; not allowing antibiotics for growth promotion purposes; implementing withdrawal periods; ensuring proper quality control of pharmaceutical drugs. Effective implementation of regulatory measures requires strong institutions to ensure compliance. Regardless of the regulatory infrastructure, it is necessary to increase the knowledge of animal health professionals and farmers on how to prevent infectious diseases. Along with good animal husbandry and welfare practices, using vaccines and biosecurity measures in combination with a medically rational use of antibiotics (i.e. making correct diagnoses and using the right kind of good quality drugs in adequate doses) is key to such an approach. In low-income countries and emerging economies, this would not only contribute to reducing the need for antibiotics but improve productivity in the livestock sector as well. Many of the measures designed to reduce the use of antibiotics for the sake of curbing the development of AMR can also reduce the risk of spread of AMR.

The implementation of the recommendations given in this manual may not be possible for all farmers or producers. The recommendations are highly relevant for those who have larger, more commercial and professional production systems. However, the principles for disease prevention and use of antibiotics may be applied by all categories of farmers.

TABLE 1
World number of heads of three livestock species 2016 and projected 2030 and 2050 in a business-as-usual scenario (changes in percentages vs. the 2016 numbers)

	2016	2030	2050
Cattle (No. heads)	1 474 887 717	1 369 630 600 (-7.9%)	1 463 737 000 (-0.8%)
Pigs (No. heads)	981 797 339	1 066 422 000 (+8.6%)	1 106 747 000 (+12.7%)
Poultry (No. heads)	24 824 750 000	25 573 689 000 (+3.0%)	27 681 972 000 (+11.5%)

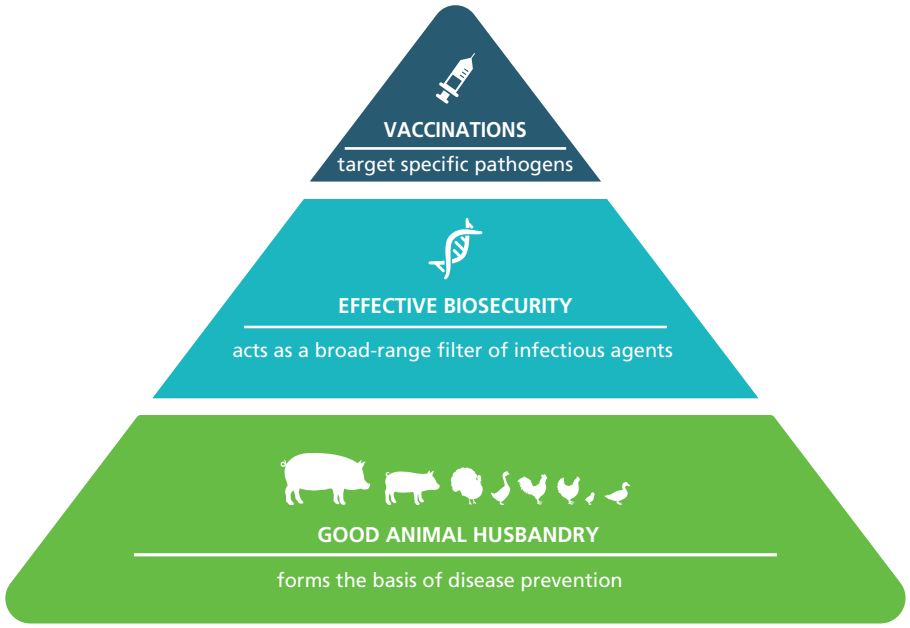
References: Faostat 2016, http://www.fao.org/faostat/en/#data/QA
and *The future of food and agriculture - Alternative pathways to 2050: Food and agriculture projections to 2050*, http://www.fao.org/global-perspectives-studies/food-agriculture-projections-to-2050/en

Chapter 2

Prevention of infectious diseases without antibiotics

Prevention of infectious diseases without antibiotics involves a whole set of measures. These may be put into three main categories: good animal husbandry; effective biosecurity[1] and vaccination (see Figure 2). These measures are described in detail below, starting with general principles and progressing to specific measures that apply to pig production and poultry production, respectively.

FIGURE 2
The three main measures to prevent infectious diseases in a farm



[1] Management and physical measures designed to reduce the risk of introduction, establishment and spread of infections to, from and within a farm.

GOOD ANIMAL HUSBANDRY

Good animal husbandry and welfare means attention to the following:

- safe, clean and comfortable housing (whether indoors or outdoors) and manure management;
- all-in/all-out system;adequate space allowance with no over-stocking;
- good lighting and air quality through appropriate ventilation;
- appropriate temperature (adapted to animal species and age);
- quarantine possibilities for sick animals (pigs);
- nutritious feed (good hygienic quality, adequate amount and nutrient content);
- free/continuous access to clean drinking water;
- regular veterinary advice on disease prevention, animal health programmes, and treatment regimens;
- observance of stress behaviours in animals and taking measures to reduce those behaviours;
- good biosecurity, described under a separate heading below.

Good animal health and welfare will reduce instances of infectious disease and therefore minimize the need for antibiotics. Professional advice may be needed to design optimal housing and management routines for each farm. Keeping large numbers of animals or their offspring healthy may be challenging, as this requires more attention from the herd-keeper. Fewer animals may give a higher economic return if they are healthy and productive.

For specific prevention of infections, biosecurity is essential. In addition, the herd veterinarian plays an important role in giving advice on vaccination and other specific animal health measures, based on the local risks of different infectious diseases. Regular consultation between the herd veterinarian or other qualified animal health personnel and the farmer is recommended, not only when disease occurs but to monitor animal health and management practices and address shortcomings before they cause disease.

Another issue, which is beyond the scope of this manual, is the possible spread of resistant bacteria from the farm to the environment via manure or disposal of carcasses and other waste. However, proper manure management is an inbuilt element of good animal management at the farm. To mitigate this particular route of spread, the same principles apply as for containing the spread of other pathogens from the farm via manure or carcasses.

EFFECTIVE BIOSECURITY

External biosecurity means actions taken to prevent the introduction of infectious diseases into the farm (see Figure 3). Internal biosecurity means actions to prevent the spread of infections within the farm, between animals or groups of animals. Effectiveness of all biosecurity procedures will be enhanced if they are well structured, clearly communicated and clearly documented (see Chapter 4).

Some biosecurity routines are very simple to implement – e.g. handwashing and personal hygiene, analysis of water quality, cleaning and disinfection routines including use of footbaths when entering animal housing, access control and vehicle disinfection. Others

may require a little more effort, such as introducing a "hygiene lock" or small room inside the entrance to each house or barn in which to change clothes/boots and wash hands before and after entering the premises. Even if a complete hygiene lock cannot be installed, careful handwashing, changing of shoes or footbaths and clean overalls may still provide an improvement. Similarly, the "all-in/all-out" production concept (i.e. batch-wise production, with total emptying of the animal compartments and cleaning and disinfection before new animals are introduced) requires thorough planning of the entire production system. This is discussed further in Chapter 4.

A good rule of thumb is the "age rule". When entering or working on the farm, always move from the youngest animals to the oldest and never the other way around. This is because young animals are highly susceptible to bacteria and diseases that can be transmitted from older animals.

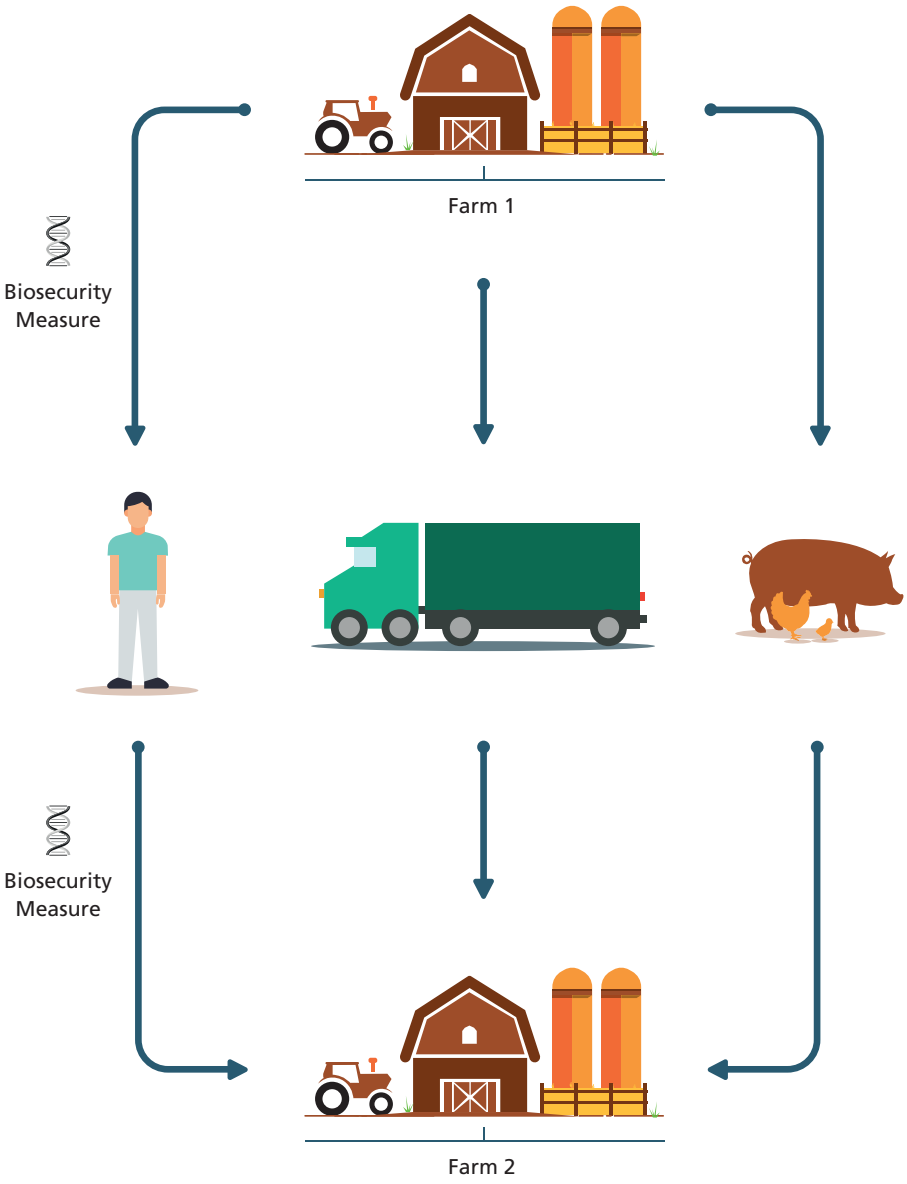
It is also advisable to limit traffic on the farm. Have a vehicle dedicated to the farm, if possible. Always have important biosecurity procedures clearly visible (such as posters or signs) and make sure all personnel and visitors understand the procedures and policies.

A crucial aspect of a good biosecurity programme is educating every person who will be in contact with the animals. People are often the weakest link when it comes to the introduction and/or movement of infectious diseases, and therefore training and re-training is recommended on a regular basis. Restrict admittance of visitors and do not allow entrance of transport personnel or other people (e.g. maintenance workers, pharmaceutical representatives, salespersons, people who come to purchase farm products such as eggs) into the rooms where animals are kept. If any of these individuals must enter the premises, apply active biosecurity (i.e. require that they use disposable footwear and protective clothing) as indicated in Figure 3.

Pest control and protection of feed from rodents, wild birds and other wildlife can be seen as part of both external and internal biosecurity. Wild birds should be kept away by means of mesh or nets and other measures, as they have been reported to introduce infectious agents as well as drug-resistant microorganisms into farms. It is also critical to have an effective rodent control programme in place. The control activities must also be documented and monitored. Mice and rats can carry numerous infectious diseases that are easily spread from house to house and farm to farm. Remove points of entry or shelter for rodents; cut grass and put gravel around the house 0.5 metre around the drip line; remove weeds around houses and fence lines; trim or remove trees near houses. Remove obvious food and water sources such as spilled feed and rubbish. Repair leaky pipes. Avoid storing equipment near houses. If necessary, install insect screens at all entries and ensure both that they remain intact and that they do not impede ventilation. Ideally, dead animals should be put in a container placed on the outskirts of the farm to ensure that trucks do not need to enter the farm for removing carcasses. On-site carcass burning or deep burial in a pit are other valid practical solutions.

For more information on biosecurity on farms and valuable tips on how to improve it, consult the free biosecurity checking tool developed by the University of Ghent, Belgium: http://www.biocheck.ugent.be/index.php

FIGURE 3
Schematic overview of where to intervene with external biosecurity measures



Effective biosecurity protects the farm
from introduction and spread of infectious diseases.

VACCINATIONS

Vaccination routines should be adapted to the diseases circulating in each region and production sector. The veterinarian should know the epidemiology of the area and is thus the best person to advise on which vaccinations to perform and when, making sure they protect against the most important diseases and that they cover the relevant strains. This allows the farmer and veterinarian to choose the most (cost-) effective vaccination strategy. This strategy should be updated regularly based on disease monitoring of the flock or herd health status. If vaccination is perceived to be ineffective it is important to investigate potential causes for this failure and address the identified problems.

If proper consultation and oversight is not done during vaccine selection and application it is possible that the vaccination will not be successful in protecting the animals, leaving them vulnerable to disease after spending a significant amount of money and labour. Sometimes, a good option is to produce and use a herd-specific, autogenous vaccine; such vaccines may be produced against both bacteria and viruses.

For both pigs and poultry, vaccines targeting immunosuppressive diseases have a positive impact on general animal health. These are diseases that decrease the capacity of animals to fight infection (For poultry: Gumboro disease; chicken infectious anemia; and Marek's disease. For pigs: Porcine reproductive and respiratory syndrome; and porcine circovirus infection). Such vaccinations will decrease the need for further use of antibiotics and should therefore be applied.

In summary, when deciding to use vaccination, the following should be taken into account:

- a long-term vaccination plan is established so the herd stays protected;
- the disease of concern is circulating in the region or there is a risk that it will;
- there is an efficient vaccine (against the circulating strains) available with low/acceptable side effects;
- it is possible to transport and handle the vaccine in a way so that its efficacy is not impaired;
- caution is taken to ensure that the most appropriate age population is vaccinated, and that repeated vaccination is applied if needed.

Chapter 3

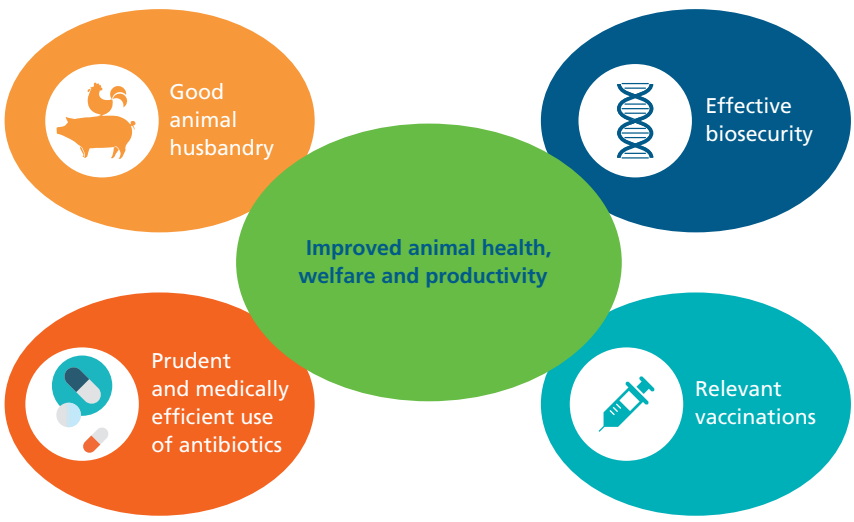
How to use antibiotics in a prudent and medically efficient way

PREVENTION IS BETTER THAN CURE – AVOID UNNECESSARY USE OF ANTIBIOTICS

Inappropriate and excessive use of antibiotics rarely improves animal health. Such use just drives the development of AMR. Therefore, it is critical to use antibiotics restrictively and in a medically rational way. Such use is an important element of holistic animal health management (Figure 4).

Animals that are well cared for and appropriately fed and housed will experience better welfare and be less prone to infections and less likely to contract diseases that require treatment with antibiotics. Good animal husbandry is described in Chapter 2. Antibiotics should not replace good husbandry, including hygiene and biosecurity measures. Keeping animals healthy will, of course, also increase productivity and profitability.

FIGURE 4
Key elements of holistic animal health management



Continuous dialogue between farmer and veterinarian is crucial in this process

Every farm is unique. It is beneficial for farmers to invest in good one-to-one relationships with their veterinarians and other professional animal health personnel. Through regular veterinary farm visits, a farm-specific herd/flock health plan can be developed, implemented and updated. Studies have shown that this approach not only improves the health and welfare of the animals on the farm, but is also financially beneficial. If the veterinarian is used only as a "fire-fighter" – meaning contacted only in case of emergencies or disease outbreaks – they will not be able to advise how to keep animals healthy and prevent disease. By targeting the current situation on the farm, disease prevention will be more effective, and profitability is likely to increase.

The administration of antibiotic agents to animals simply to increase the rate of weight gain or the efficiency of feed utilization is called "growth promotion" and is mostly given at low doses for long durations. This practice contributes to the development and establishment of AMR. As a consequence, the use of antibiotics in feed and water to promote growth was prohibited within the European Union in 2006.[2] Several other countries have restricted the categories of antibiotics permitted for growth promotion and further controls and changes are expected. WHO, OIE and FAO have also called for phasing out the use of antibiotics for growth promotion.

Preventive use (also called "prophylactic use") of antibiotics should be applied only in exceptional situations, such as when a few animals in a group have been diagnosed with an infection that has probably already been infecting – or will soon be infecting – the rest of the group and the economic consequences are likely to be severe. It may then be necessary to treat animals that are not yet infected/clinically ill but are at an immediate and high risk of becoming infected and contributing to further spread of the disease.

For pigs, oral treatments of groups of animals should be avoided whenever possible. Instead, treatment and care targeted to single or small groups of infected pigs in separate rooms or pens should be the goal. This ensures that each animal receives the correct dose and the total amount of antibiotics used can be kept to a minimum, while still tackling the infection. For poultry, whole house or whole flock treatment via drinking water is usually the most practical and effective treatment approach. Therefore, it is very important to have a correct diagnosis from a veterinarian before treatment of a poultry flock.

ACCESS TO AND HANDLING OF ANTIBIOTICS

In many countries, antibiotics are available over the counter in pharmacies or shops without a prescription from a veterinarian. This is a regulatory issue and is not dealt with in this manual. However, a basic principle is that the use of antibiotics should always be based on a proper disease diagnosis by qualified animal health personnel (i.e. a veterinarian). If possible, laboratory identification of the causative bacterial strain and its antibiotic susceptibility pattern should be carried out before antibiotic treatment.

In many countries, large volumes of antibiotics sold are substandard or falsified. Such medicines will not cure the diseased animal but may drive the development of AMR and may even be dangerous for the animals. Therefore, when possible, farmers should buy antibiotics only from licensed, credible merchants and/or established businesses, especially those that explicitly stand behind the quality of the antibiotics they sell.

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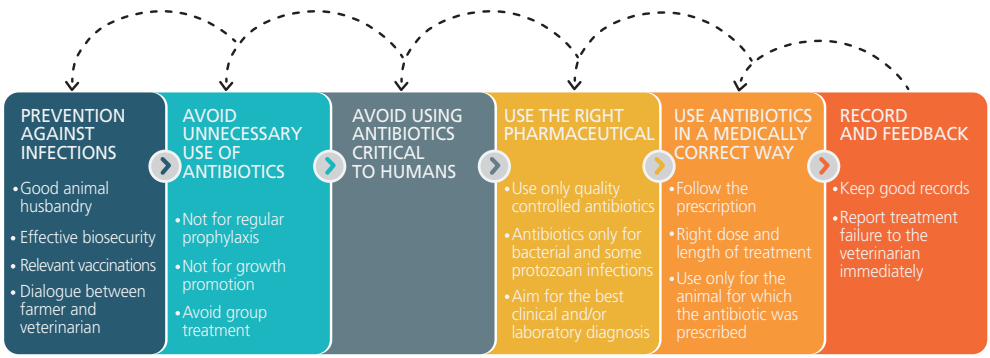
[2] (Regulation (EC) Nº 1831/2003.)

FIGURE 5
Stepwise approach towards prudent and efficient use of antibiotics



Leftover, outdated medicines should be disposed of in environmentally friendly ways (i.e. not in wastewater systems), if possible by returning them to the retailer. These medicines may have lost much of their potency or might even be harmful to the diseased animal. They may also contribute to the development of resistant bacteria, either in the animal (if used) or in the environment (if disposed of inappropriately).

Daily health checks are important to detect sick animals as early as possible. Diseased animals require treatment to protect both their welfare and the productivity of the farm. Infectious diseases can spread very rapidly in groups of animals; therefore, it is vital that the farmer quickly seek assistance from a competent veterinarian or animal health worker.

Clinical examination of the sick animal(s) by a veterinarian is crucial for determining a correct diagnosis and making an appropriate treatment plan. If a tight relationship of trust has been established between veterinarian and herd-keeper, an agreement on standard treatment by the farmer for recurrent diagnoses may be established. However, this still requires careful monitoring, with regular visits by the veterinarian. Sometimes, a laboratory diagnosis is needed in order to determine the exact disease agent and to choose the most effective treatment. Unfortunately, laboratory capacity is highly variable among countries and regions and there is also a matter of cost and timing, as it can take some time to conduct laboratory testing. Thus, in countries with poor laboratory services and where farmers have limited resources, the clinical skills of the veterinarian become even more important.

ANTIBIOTICS ARE NOT ALWAYS THE ANSWER

Antibiotics only work against infectious diseases that are caused by bacteria. Common signs of disease, such as coughing or diarrhoea, can be caused by different disease agents, including viruses, bacteria, fungi and parasites. Therefore, it is essential to have a correct diagnosis before starting any antibiotic treatment. For instance, African swine fever and Classical swine fever – which are devastating diseases in pigs – as well as influenzas in both pigs and poultry are all caused by viruses. No antibiotics can cure these diseases. However, viral infections – e.g. viral respiratory infections – may be followed by bacterial infections.

This calls for careful monitoring of the animals by the herd-keeper and veterinarian. Notably, any superfluous use of antibiotics, such as using antibiotics to try to cure viral diseases, drives selection of resistant bacteria which can make the next bacterial infection harder or even impossible to treat.

AVOID USING ANTIBIOTICS THAT ARE CRITICALLY IMPORTANT FOR HUMANS

Highest Priority Critically Important Antimicrobials for humans (CIAs) include antibiotics which should be avoided for animal use in order to discourage the development of AMR, mainly because they are critical and often lifesaving in human health care (WHO 2017). Some countries have completely banned the use of CIAs in pigs and/or in poultry, and in others prescription is only allowed after a susceptibility test has been carried out showing they are the only treatment option. Other categories of critically important antibiotics are those critically important in veterinary medicine (OIE 2018); hence, recommendations on their use in animals must entail consideration for animal health. The overlap of these lists calls for careful consideration to appropriately balance the need for animal health and the public health aspects.

USING THE RIGHT ANTIBIOTICS

When a disease of infectious origin occurs, a proper tentative clinical diagnosis by a veterinarian is needed before starting any treatment. Clinical experience and knowledge about the disease challenges at the farm or in the region can help to pinpoint the correct antibiotics. However, such knowledge is supported by regular (if not frequent) sampling for laboratory analyses to understand the commonly circulating infections and resistance trends.

Not all antibiotics are effective against all bacteria. Antibiotic susceptibility, also called antibiotic sensitivity, describes how likely certain bacteria will be killed by a certain antibiotic. This can also vary among different strains of the same bacterial species. Thus, if such testing is available and feasible to perform, it is highly recommended, especially to avoid repeated therapeutic failures. The antibiotic used for treatment must be effective against the disease-causing bacteria and reach the site of infection at a sufficient concentration for a sufficient amount of time.

Inappropriate use of antibiotics not only promotes AMR but may also aggravate the disease. Commensal beneficial (protective) bacteria provide a natural barrier and defense system against pathogenic (disease-causing) bacteria. When treating with antibiotics, beneficial bacteria are also killed, removing the natural defense system of the animal and making it more vulnerable to disease. In addition to the OIE list of veterinary antimicrobials (OIE 2018), several countries have specific recommendations on what kind of antibiotics should or should not be used for livestock (see "Suggested further reading"). Usually in these national guidelines, it is strongly recommended not to use colistin, fluorqinolones, or third and fourth generations of cephalosporines.

In the region covered by this manual, one country reported Pasteurellosis, Salmonellosis and Glasser's disease as some of the main enzootic diseases requiring antibiotic treatment in pigs. The major antimicrobials applied are Tiamulin, Tylosin, Enrofloxacin, Oxytetracycline, Apramycin, Trimethoprim and Marbofloxacin. In the poultry sector, the most common antibiotics used are Doxycycline, Colistin, Enrofloxacin, Polimixin E, Amoxicillin, Lincospectin

and substances from the sulfonamide group. In this same country, resistance to several of these antibiotics has been detected in *Escherichia coli*, *Salmonella* spp., *Staphylococcus* spp. and *Streptococcus* spp. isolated from livestock.

RECORD-KEEPING GIVES NECESSARY OVERVIEW AND PAYS OFF

Record-keeping is essential for professional farming and can save both time and money. These records can be used to improve farm productivity management and farm health planning and as medical history for future disease outbreaks. Knowing the productivity and health data is essential to improve profitability of the farm. Indications for use and data about kinds of antibiotics, dosage, route of administration and, if available, data from laboratory diagnostics and susceptibility testing can be very helpful.

Chapter 4

Practical recommendations on how to combine prudent use with preventive measures for good productivity

Healthy animals do not need antibiotics and they are also the key to optimal productivity and hence, profitability. The health of animals depends on their resilience and the infection pressure in their immediate environment. Healthy animals grow faster and require less feed before reaching market weight than unhealthy animals. Absence of disease reduces losses due to culling or deaths and reduces expenses for purchasing antibiotics. Health, well-being and adequate feed and water intake are cornerstones that lead to improved profitability for the farmer.

GENERAL STRATEGIES FOR HOW TO USE ANTIBIOTICS IN PIGS AND POULTRY

- Plan to phase out any use of antibiotics for growth promotion through dialogue between farmer and veterinarian.
- Replace preventive use of antibiotics with other measures, such as improved management, better housing, increased biosecurity and efficient vaccination schemes, and address the root of any recurring disease problems.
- Strive for individual treatment over group treatment of pigs if antibiotics are necessary.
- Administer antibiotics in drinking water rather than feed if group treatment cannot be avoided, as distribution of pharmaceuticals via water is more precise.
- Keep detailed treatment records to monitor disease and inform management decisions.

Phase out growth promoters

Antibiotics used as growth promoters have been successfully phased out in many high-producing livestock systems in the world. Careful and sustained management changes will ensure a successful transition to healthy and productive animals without the use of antibiotics as growth promoters. Hence, when starting the process of phasing out, it is important that as many preventive measures (good animal husbandry, biosecurity and efficient vaccination) as possible are in place, to avoid an initial increase of infectious diseases occurring at the farm, which could lead to an increased need for more antibiotics and loss of productivity.

Avoid preventive use of antibiotics

Antibiotics should be reserved for the treatment of animals with a diagnosed and curable infectious disease and should be used for the full length of the prescribed course. Preventive use of antibiotics should only be applied temporarily when there is a high risk of infection and other disease prevention is not possible to implement. Good management practices and effective biosecurity, as well as more specific disease preventive measures, should also

be implemented and established. The routine use of antibiotics to prevent diseases usually masks poor management practices or other shortcomings.

Strive for individual treatment and avoid antibiotics in feed

Even though it is not a recommended/prudent practice because of the long-term negative effects, antibiotics are sometimes included in commercial starter feed for newly weaned piglets or for the first week in the lives of chicks, which are vulnerable and susceptible to infections at these stages. However, this routine use of antibiotics at a certain production stage, without targeting a particular disease in the herd or flock, can be detrimental. Over time, these antibiotics can become ineffective, due to the development of AMR, and thus unable to cure diseased animals. Therefore, this practice can in fact effectively decrease the antibiotic choices and limit the ability to treat infections.

Administer in drinking water if group treatment cannot be avoided

When an outbreak of disease, such as diarrhoea or respiratory disease, is observed in many animals, and the disease is expected to affect all animals in the group, it may be advisable to implement a treatment for all animals in the group in addition to individual treatment of the animals that show symptoms. Group level treatments should preferably be administered via drinking water, as a sick animal will still drink water even when it has lost its appetite. For small pig herds, treatment can be prepared in a bucket; for large pig herds and poultry flocks it may be convenient to install a water medication unit. In addition, when medication is administered via water, the decision to either start or stop treatments can be made more quickly, according to how the signs of disease develop and resolve.

Be aware of your own use of antibiotics and keep records

Awareness of prudent use of antibiotics in a herd or flock is based on the farmer's knowledge. Data should be recorded on how much, which type, how long and for which production stage antibiotics are used, as well as on effectiveness of treatment, so that treatment failures are detected as soon as possible and the treatment regime can be revised accordingly. This way, unnecessary production losses are avoided while antibiotic use is kept to a minimum.

PRACTICAL RECOMMENDATIONS FOR PIG PRODUCTION

Good animal husbandry

A holistic view is important for achieving sustainable profits in pig production. Too much focus on large litter sizes at birth leads to small piglets with poor vitality and health. This, in turn, means having to spend time caring for weak or sick animals, and often leads to the unnecessary use of antibiotics. One should aim for litter sizes of 11-14, matching the number of working teats of the sow.

The immediate environment of the animals is important for productivity. Bedding material for all age categories will improve comfort and stimulate natural behaviour that reduces stress. Less stress means less disease which means less use of antibiotics. Heat lamps should be provided in a protected resting area for piglets, and adequate space must be provided

for the sow to avoid crushing the piglets. In some management systems, diseases such as post-weaning diarrhoea were previously regarded as inevitable without routine treatment with antibiotics, but improved management has proven that this disease can be prevented. Usually post-weaning diarrhoea is not an infectious disease but a gastrointestinal disorder caused by shortcomings in management and feeding. Therefore, this kind of diarrhoea can often be addressed by optimizing management and feeding strategies. The intestinal tracts of the piglets need to be exposed to feed well before weaning; adjusting feed composition and texture as well as frequency of feeding will reduce the risk of gastrointestinal disorders. Feed must be of high hygienic quality, free from pathogens and mycotoxins that will have negative effects on both health and reproduction. The younger the piglets, the less robust and the more they are susceptible to infections. Weaning before 28 days of age is associated with an increased treatment rate for infections and is therefore recommended to be avoided.

Poor air quality may lead to disease, such as respiratory disease. Therefore, it is important to have a well-functioning ventilation system without draughts. In addition, it is important that room temperatures are optimal for every age category. Depending on the floor type, 30-33 °C is recommended for newborn piglets, and 15-25 °C for growing animals, depending on their age, with younger pigs requiring higher temperatures. The fertility of breeding animals is impaired at high ambient temperatures.

Group size

For large herds it is recommended to divide the stables into compartments, because infection pressure is lower in smaller units with fewer pigs. When more pigs are kept within a limited space, disease transmission is facilitated. In Sweden, for example, if farmers want to rear fattening pigs recruited from several different piggeries, national regulations state a maximum of 400 fatteners in one compartment, although this number may be increased to 600 if certain biosecurity criteria are met. It is also important not to overstock the stables, as this will be stressful for the pigs, making them more susceptible to disease as well as facilitating disease transmission.

Observations and informed decisions

The observations of the herd-keeper provide very important information that forms the basis of all health decisions. Did the problem occur after changing the feed? Do treatments work as expected? Does the health status of the herd need to be checked by sending samples (e.g. blood) to a diagnostic laboratory? The effect of initiated treatment should be evaluated and the health of the diseased pigs should improve within a few days; otherwise the treatment can be considered ineffective, due either to resistance or to having chosen an antibiotic that is not effective against the relevant pathogen or that does not reach the site of infection (for details, see Chapter 3).

Looking ahead: Planning for production

The production process – from insemination to farrowing and from piglet to slaughter – involves events that will occur repeatedly. Good management means that the farmer is constantly prepared and looking ahead. What happens today will affect tomorrow and the

future. Order feed in time to ensure availability of good quality feed and a smooth transition between different feed batches. If pigs are purchased, limit the number of sources to as few as possible, because mixing of pigs from different sources facilitates the spread of disease.

Workflow

It is important to be vigilant and deliberate when working with the animals. Always move from younger to older pigs. Change boots and clothes between units with piglets and units with fatteners, to achieve high internal biosecurity that prevents the spread of disease among pigs within the herd. The same goes for equipment, such as brooms, barrels, shovels, etc. A disinfectant footbath can be used to reduce bacterial transmission within a farm, but it should be kept in mind that footbaths are only effective when there is no visible dirt or manure on the boots (as soil and organic material inactivate the disinfectant or prevent the contact of the disinfectant with the microorganism). The disinfectant must be changed frequently as it loses strength over time. In many cases, it may be more cost-effective to provide a separate set of gumboots or other footwear for each section of the farm rather than trying to maintain and properly supervise footbaths. Washing hands between "clean" and "dirty" work, and when moving between different age groups, is also important to prevent the spread of diseases.

Using your senses

It is important to be observant at all times in the stable, particularly for veterinarians during their routine visits. Look, hear, smell and feel. What is the temperature near the outer wall? Is it cold? Is there a draught, especially from doors or windows? Look at the bigger picture: is the air quality good? Are the pigs coughing or sneezing? Are there signs of diarrhoea observed on the floor? Are there signs of tail biting? Have all the sows eaten their feed? Are the piglets calm and satisfied? If not, check the sows and piglets: are any udders swollen and hot with signs of mastitis or do you find other signs of disease? The farmer and qualified animal health personnel should discuss upcoming problems or challenges.

Hygienic procedures

Hygienic practices aim to reduce the pathogen load and reduce the impact of environmental factors that exacerbate diseases. Caretakers need to wear clean clothing and footwear, as well as to wash and disinfect their hands between compartments or age groups or when hands are dirty. Disposable gloves should always be worn at high-risk moments such as castration to avoid spread of disease between individual pigs.

The use of hygienic procedures around farrowing and when handling newborn piglets is crucial. Use clean gloves (or very clean hands) for assisted farrowing. Use a non-irritating skin disinfectant at the navel, and when docking a tail or castrating. Reduce the number of routine surgical interventions as all skin breaches are potential entry points for bacterial infections.

Keep the pig facilities clean. Remove manure, urine, soiled bedding material and unconsumed feed on a regular basis. Manually clean premises between batches. This includes thorough cleaning, then washing followed by disinfection of dried surfaces. Feeding and watering systems need to be checked and cleaned on a regular basis as microorganisms

may grow and multiply in pipes and troughs, increasing to levels which may cause disease in pigs.

Remember to include regular checks on the ventilation system. Sufficient ventilation is a prerequisite for good respiratory health. Furthermore, it ensures that stable units are not damp. A damp environment will promote the survival of pathogens in the environment, which can lead to outbreaks of diseases.

Biosecurity in pig herds

Biosecurity can be improved tremendously by using closed production systems (i.e. farrow-to-finish, with sows, piglets, growing and finishing pigs in one system) where transport of animals between farms is kept to a minimum. Closed systems can be maintained outdoors but require vigilance regarding direct and indirect contacts with other animals (including wildlife). In closed systems, the risk of introducing infections via transport vehicles and other animals is reduced. Even in more specialized herds, application of all-in/all-out systems with cleaning and disinfection between batches is necessary to maintain good hygiene and reduce the risk of infections.

External biosecurity

- Isolate/quarantine all new animals for at least three weeks to prevent direct or indirect contact (via people, tools, equipment) with the other animals on the farm.
- When new genetic material is introduced via artificial insemination, make sure it originates from certified healthy animals.
- Wash and disinfect hands, change or clean protective clothing and boots, before and after direct contact with the animals on the farm.
- Change footbaths frequently; they are inefficient if they are dirty (change of footwear is preferable).

Internal biosecurity

- Physically separate animal groups – for example, different age groups – and use all-in/all-out systems for each group.
- Wash and disinfect hands, clothes and boots (or change protective clothing) when moving between animal groups that are physically separated. Try to work from younger to older pigs and change clothes when returning to younger pigs.
- Clean and disinfect tools and equipment when moving between animal groups that are physically separated or keep separate tools and equipment for different groups.
- Regularly clean (and disinfect when possible) the animals' immediate environment, with particular focus on water and feed troughs.
- Ensure clean water and feed for the animals.

Age segregation

Aim for age-segregated rearing systems where contact between pigs of different ages and/or physiological stages is minimized. Avoid contact between younger and older pigs as younger pigs are more likely to contract disease and older pigs often harbour more pathogens. Age-segregated rearing is dependent on a group of sows farrowing within a limited time-span, preferably shorter than one week.

All-in/all-out flow

An all-in/all-out flow requires that all pigs in a batch are moved into a compartment at the same time. Moving pigs out of the compartment is either also done at the same time or the compartment is completely emptied of pigs at the end of the production stage. With an all-in/all-out flow, compartments can be thoroughly cleaned and disinfected so that they are clean, dry and warm when new pigs are moved in. Pigs from other batches should not be moved into the compartment after the introduction of one batch. When emptying the compartment, underweight finishers not ready for shipment should not remain in the compartment. They can be gathered together in a separate, smaller unit for a limited period of time to allow them to reach at least near market weight. Remember that such a unit must also be emptied, cleaned and disinfected on a regular basis, to keep disease pressure down and avoid antibiotic use.

Moving and mixing of pigs

Moving and mixing of pigs is stressful for them and increases susceptibility to infections. Plan for as little movement and mixing of pigs as possible. Remember that moving a single pig from one pen to another is stressful for the individual pig as well as for the group it is moved from and the group it is moved into. When pigs are mixed there is also a potential for exchange of bacteria and viruses between the animals, at a time when their immune defenses are likely to be compromised due to stress, increasing the odds of requiring antibiotic treatment.

How to manage bacterial infections on a pig farm

To minimize and contain antibiotic resistance and to ensure that antibiotics will remain effective in the future, strategies for prudent and medically effective use of antibiotics must be implemented on every pig farm. The veterinarian and the farmer should jointly develop and revise a herd health plan. The aim of such a plan is to ascertain proper disease prevention, control, diagnosis and treatment, to identify shortcomings in housing or herd management and to take appropriate action. A close collaboration between a professional animal health advisor and the farmer is likely to improve production profitability.

At the farm, it is important to have properly trained staff and conduct daily health checks to detect sick pigs as early as possible. If a sick pig is identified, measures must be taken immediately. Sick pigs should be isolated, to avoid spread of infection to other pigs. If possible, the veterinarian should diagnose and treat the sick animal and make a plan for subsequent cases.

Correct use of antibiotics plays an important role in animal production, animal welfare and the containment of antibiotic resistance. Only correct treatments will lead to therapeutic success, ensure the well-being of the herd and help to minimize resistance.

In particular, the consultation of the veterinarian is necessary in the following situations:

- increased numbers of dead piglets;
- deaths of adult pigs for unknown reasons;
- increased numbers of physically retarded pigs;
- several cases of febrile illnesses with body temperatures > 40.5 °C;
- increased numbers of stillbirths or abortions.

Diagnosis

Antibiotics are only effective against bacterial infections. Common symptoms in pigs, such as respiratory problems or diarrhoea, can result from single or combined infections with different pathogens including viruses, bacteria or parasites. A skilled veterinarian should be capable of making a good tentative/initial clinical diagnosis of the disease, allowing a decision as to whether antibiotics are indicated or not.

Ideally, samples for bacterial culture and susceptibility testing should always be taken. If this cannot be achieved, treatment should be based on the veterinarian's clinical diagnosis. If the chosen antibiotic is not efficient, a laboratory diagnosis including antibiotic susceptibility testing is needed.

Sampling for bacterial isolation, identification and susceptibility testing may include a variety of different samples, such as:

- nasal swabs
- rectal swabs
- urogenital swabs
- faecal samples
- blood samples
- urine samples
- dead pigs
- aborted material (fetuses, placentas)

Depending on symptoms, infection site and clinical experience, the veterinarian should select the appropriate kind and number of samples. It may be necessary not only to sample diseased animals but also those that appear clinically healthy. If available, samples should be sent to an accredited laboratory. It is also highly advisable to contact the laboratory before shipping samples to get proper instructions about how to package the samples and to make sure that the laboratory is prepared to receive them.

Treatment with antibiotics

Antibiotics should be used only with a veterinary prescription or based on veterinary advice. It is crucial that all treated pigs receive the medication at the correct dose during the appropriate time period. The instructions given by the veterinarian should be followed.

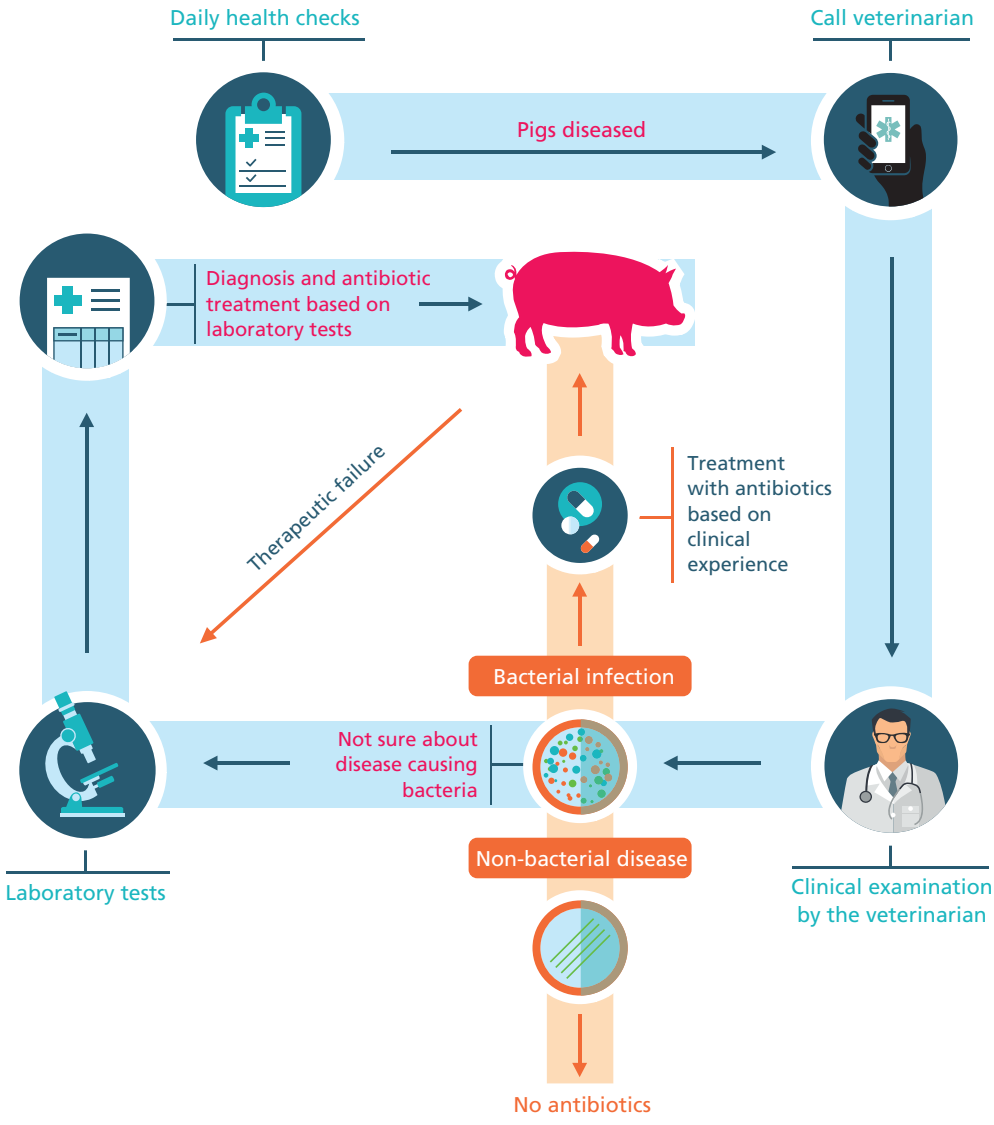
As herd treatments promote the development and spread of AMR, individual treatment should always be favoured. The number of animals treated and the spread of antibiotic residues via dust and manure must be kept as low as possible. In pig production, individual administration can sometimes be difficult if large numbers of animals are kept together and many require treatment. Nevertheless, experience shows that with a rapid identification of sick animals and isolation in sick-pens, it is possible to apply an individual treatment strategy for pigs, especially adult pigs.

Antibiotic treatment at herd level can be administered via drinking water, but this also requires proper training of personnel/farmers to calculate correct dosing and avoid spillover treatment. A homogenous distribution of the antibiotic within the drinking water and sufficient uptake by all animals has to be assured. After medication, intake pipes and used containers should be carefully cleaned to avoid cross-contamination.

Injections increase the risk of disease transmission if needles are not changed regularly. One should ideally change to a new needle when treating the next litter or next pen.

Change the needle immediately after injecting a diseased pig as the likelihood for spreading disease increases when the needle is reused. Keep syringes clean. Keep antibiotics in a clean cupboard – or refrigerator if they should be kept cold. Follow the instructions on medicine packages regarding shelf life (for unopened as well as opened vials) and storage temperature. Be sure to shelve antibiotics and vaccines at the right temperature. Some vaccines become ineffective if they are frozen or kept too warm.

FIGURE 6
How to manage bacterial infections on a pig farm



Obviously the laboratory testing may be hampered by logistic and resource constraints

PRACTICAL RECOMMENDATIONS FOR POULTRY PRODUCTION

Good animal husbandry

Good temperature control systems and ventilation are essential. Heat stress affects animal welfare, disease susceptibility, productivity and the farmer's profit. Correct ventilation is a key factor in poultry production. No matter what ventilation system is being used (natural or power ventilation), monitoring is important to ensure functionality and proper air quality.

If partial depopulation (thinning) is practised, feed withdrawal should be minimized for the remaining birds and an optimal temperature should be maintained. Thinning should be done in accordance with biosecurity standards by ensuring that equipment used in the catching process is thoroughly cleaned before entering the house. This includes the hands, footwear and clothing of catchers at the time of thinning. This will help to minimize the introduction of infectious agents.

Litter type, litter quality and litter management have direct impacts on the bacterial microflora of chickens. Litter should not be re-used as it could contain pathogens that infect the new flock and may eventually require the use of antibiotics. Litter should be dry and friable and moist areas must be prevented (e.g. underneath nipple drinkers). Drinkers with cups or bells are more likely to contain standing water, which can become contaminated and detrimental to bird health or increase the humidity in the house, causing damp litter.

Feed should be free of pathogens. The contamination risk is generally lower with plant-based diets that do not contain animal by-products. Recycling of waste from the food industry is considered a high risk as it may introduce infections and should therefore be totally avoided. Mycotoxins predispose the birds to diseases such as necrotic enteritis, which generally will require the use of antibiotics.

Using your senses

It is important to be observant at all times when in the poultry house. Look, hear, smell and feel. What is the temperature near the outer wall? Is it cold? Is there a draught, especially from doors or windows? Look at the bigger picture: is the air quality good? Are the birds thriving? What is the condition of the flock? Are there any signs of diarrhoea or respiratory disease? Are the birds calm and satisfied? Do the eggs appear normal? Qualified animal health personnel should assist farmers to resolve any problems observed.

Observations and informed decisions

The observations of the farmer provide very important information and form the basis of health decisions. Did the problem occur after changing the feed? Do treatments work as expected? Does the health status of the flock need to be checked by sending samples to a diagnostic laboratory? Evaluate the effect of initiated treatments. The health of the flock should improve in a few days; otherwise the treatment can be considered ineffective, due either to resistance or to having chosen an antibiotic that is not effective against the relevant pathogen or that does not reach the site of infection (for details, see Chapter 3).

Biosecurity in poultry farms

External biosecurity

To produce good-quality broiler chicks, the parent source flocks must be in good health status. The parent source flock should be free from vertically transmitted diseases such as Mycoplasmosis and Salmonellosis and be vaccinated/protected against diseases such as Chicken Anemia Virus and Avian Encephalomyelitis. The most secure practice regarding the health of day-old chicks is to buy only from the same hatchery and breeder farm. The higher the number of parent flocks supplying day-old chicks, the higher the risk of introduction of resistant bacteria and pathogens to a flock.

It is very important to ensure that staff handling the chicks are healthy. Because catching crews and operators such as truckers, drivers, and workers/farmers can be the source of resistant bacteria, stringent access restrictions should be in place. The staff should be instructed not to have contact with other birds (any species, wild or domestic) or to keep birds as pets.

To avoid spread of contamination it is best not to share equipment with other poultry farms, and one effective measure is to put up perimeter fencing to control the movement of people, vehicles, and animals (e.g. dogs and cats) onto the farm. Contaminated transport vehicles can spread disease both between and within farms so disinfection of all incoming vehicles – or at least of their wheels – is advisable. If the vehicle is used to remove dead birds, or used litter from another flock, it must be thoroughly cleaned and disinfected before the next use.

Clean drinking water is essential. Protection of drinking water and feed from contamination by droppings of wild birds and rodents, as well as by dust and insects, is crucial. If collected surface water is used, it should be treated in a way that will eliminate microbial contamination.

A control programme for pests such as rats or mice is crucial. Wild birds should be prevented from getting into the poultry house or having access to the feed.

Internal biosecurity

A very effective measure is to install a hygiene lock or anteroom in each building. The anterooms must be easy to clean and should be divided into an external and an internal zone, separated by a low barrier. All outside clothes and footwear must remain in the external zone and dedicated coveralls and boots for use exclusively in the broiler house should stay in the internal zone. It is also important to replace and wash personal protective equipment located in such anterooms regularly. Staff should be trained to implement the hygiene barrier systems effectively and consistently.

Personal hygiene among staff and visitors is very important and it is a good idea to provide masks, hats, coveralls, boots and gloves for staff and visitors. The biosecurity measures should apply to any person entering the farm, including visitors, family members or animal health personal such as vaccinators. It is essential to provide and maintain clean and functional toilets and handwashing facilities.

All-in/all-out flow

With an all-in/all-out flow, houses or compartments can be thoroughly cleaned and disinfected so that they are clean, dry and warm when new birds are introduced. Regardless of whether thinning is practised, cleaning and disinfection of each house between batches of birds is necessary and it is important to ensure an appropriate downtime before introducing new birds. The downtime must be long enough for the house to be efficiently emptied, cleaned and disinfected to avoid carryover of infectious agents between flock cycles. All equipment used in the poultry house (header tanks, rafters, sills, lighting fixtures, fan blades, etc.) should also be cleaned and disinfected between batches of birds. It is important to use detergents and/or hot water to remove any grease or organic material that may be present. It is also extremely important to clean and sanitize the drinking water systems with approved products to remove biofilms (layers of bacteria).

Anterooms and feed hoppers, as well as other areas and equipment, inside and outside the poultry houses, should be regularly cleaned and disinfected during the production cycle and between cycles, and it is a good practice to regularly empty and clean boot dips or footbaths and change the disinfectant frequently. It is important to be aware about the proper methods for disposal of dead birds (incinerator, container for disposal by an external company or compost). Dead birds should be removed from the flock at least every day.

How to manage bacterial infections on a poultry farm

Proper management of a diseased flock and the correct use of antibiotics on a poultry farm play important roles for bird production, bird health and welfare and the prevention or containment of AMR. Only correct treatments will lead to therapeutic success, ensure the well-being of the flock and help to minimize the development of resistant bacteria.

Good record-keeping includes data on health and medications of all animals. Information and instructions should be provided in written form and be easily accessible, to ensure that everyone involved in the care of the animals is properly informed and can act accordingly. Instructions should include disease prevention measures and details on current treatments and withdrawal periods.

The veterinarian and farmer should work together on a regular basis in order to develop and revise a flock health plan for the farm. The goal is to ascertain proper disease prevention, control, diagnosis and treatment, to identify shortcomings in housing, management and infrastructure, and to take appropriate corrective actions. In particular, the timely intervention of the veterinarian is necessary in case of increased mortality and decreased feed and/or water consumption.

Diagnosis

Proper clinical diagnosis of a disease allows for the choice of an appropriate treatment. Usually an initial tentative veterinary diagnosis is made based on clinical symptoms and experience. If prompt onset of an antibiotic therapy is required, an appropriate first-line therapy must be chosen. Ideally, samples for laboratory susceptibility testing should be taken at this first stage prior to administering any antibiotics. If this cannot be achieved, treatment must be based on the veterinarian's tentative clinical diagnosis. If the chosen antibiotic is not effective, the second-line therapy should always be based on a laboratory diagnosis and antibiotic susceptibility testing.

Depending on symptoms, infection site and clinical experience, the veterinarian will select the appropriate type and number of samples. It may be necessary to sample not only diseased or dead birds but also those that appear clinically healthy. Antibiotic susceptibility tests should be conducted on isolated bacteria, to aid in proper antibiotic selection for an efficient and targeted therapy.

Treatment with antibiotics

Antibiotics should be used only with a veterinary prescription or based on veterinary advice. It is crucial that all treated flocks receive the medication at the correct dose during the appropriate time period, according to instructions given by the veterinarian. A homogenous distribution of the antibiotic within the drinking water and sufficient uptake by all animals must be assured. After medication, intake pipes and used containers should be carefully cleaned to avoid cross-contamination.

Concluding remarks

Antibiotic resistance is a challenge for One World, One Health

Bacteria that are resistant to antibiotics behave in many ways just like any other bacteria. They may spread from one place or country to another by human travel or through trade of livestock or livestock products, including food. This makes the spread of AMR a true One World, One Health challenge.

Resistant bacteria can be transmitted directly from animals to humans and vice versa, or through manure and waste from the farm into the environment. The frequency of these kinds of interspecies transmissions is currently not fully understood but, even so, this is a concern that must be taken into account and makes the AMR issue a significant One Health matter.

Curbing the emergence of AMR is everyone's responsibility.

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Antimicrobials are widely used in both humans and livestock and have greatly contributed to better human and animal health. However, these benefits are being threatened by the global emergence of antimicrobial resistance (AMR). Because humans and animals often share the same bacteria and may be treated with the same types of antibacterial drugs, resistance to antibiotics is the most critical aspect of AMR for the livestock sector. One way to mitigate the emergence of AMR is to reduce the overall use of antibiotics by combining prudent and medically rational use with other disease preventive measures.

This manual will contribute to addressing the challenge of AMR by promoting the prevention of infections and the prudent use of antibiotics in the pig and poultry sectors, the livestock sectors that generally have the highest use of antibiotics. It should be regarded as a practical complement to national governance and regulatory measures.

The manual is intended to assist pharmacists, veterinarians, other animal health workers, farm owners and their staff in using antibiotics in a prudent and medically efficient way without loss in productivity. It is especially targeted to farmers with commercialized medium- or large-scale production, veterinarians and other animal health personnel in non-EU Eastern European and Balkan countries, the Caucasus, and Central Asia, who are dealing with pigs and poultry. However, in many cases the principles and practices described here are universally useful and may be applied elsewhere.

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