


ACHIEVING RESPONSIBLE FARM ANTIBIOTIC USE THROUGH IMPROVING ANIMAL HEALTH AND WELFARE IN PIG AND POULTRY PRODUCTION

ENDING ROUTINE FARM ANTIBIOTIC USE IN EUROPE

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January 2022

Publication details: **Ending routine farm antibiotic use in Europe. Achieving responsible farm antibiotic use through improving animal health and welfare in pig and poultry production.**

January 2022

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Image acknowledgment: figure 3 derives from: ECDC/EFSA/EMA. Third joint inter-agency report on integrated analysis of consumption of anti-microbial agents and occurrence of antimicrobial resistance in bacteria from humans and food-producing animals in the EU/EEA, JIACRA III, 2021.

Cover images: unsplash.com (Thomas Iversen and Marek Piwnicki) and shutterstock.

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To ensure that the new EU Regulations on farm antibiotics are implemented in full, ending all forms of routine antibiotic use, and in particular ending the use of antibiotics to compensate for inadequate husbandry and poor hygiene, new targeted policies are now needed.

Summary and recommendations

On 28 January 2022, the EU will ban all forms of routine farm antibiotic use, including prophylactic group treatments. Using antibiotics to compensate for inadequate husbandry or poor hygiene will also become illegal.

This is a major step forward for more responsible and sustainable antibiotic use in European farming. If properly implemented, it should lead to a large reduction in farm antibiotic use, help tackle the serious crisis of antibiotic resistance, and protect human and animal health.

Unfortunately, there are real concerns that full compliance with the new legislation will not be achieved and that some key aspects may not be implemented in practice. This is because there is very limited evidence that Europe is moving away from highly intensive livestock farming systems, which often have poor hygiene, high levels of disease and excessive antibiotic use, and towards livestock farming systems which promote good animal health and welfare, low levels of stress and much lower levels of antibiotic use.

Therefore, while prophylactic group treatments with antibiotics are likely to end after 28 January 2022, or at least be greatly reduced, it now seems inevitable that antibiotics will continue to be used, in breach of the new legislation, to prop up farming systems with inadequate husbandry and suboptimal animal health. On some farms it seems likely that routine antibiotic use will continue.

Data published by the European Medicines Agency show that huge differences in the levels of farm antibiotic use currently exist between different European countries, despite significant reductions in use having occurred in many countries over the past decade.

The lowest European users, Iceland, Norway and Sweden, generally have higher minimum statutory animal-welfare standards that contribute to their ability to minimise routine antibiotic use. In these countries, around 90% of antibiotics are administered as individual treatments to sick animals.

More average users, such as large producers France and Germany, have antibiotic usage levels about 5–10 times higher per livestock unit than the lowest users, demonstrating how much further their use can be cut. The highest users, which include large producers such as Poland, Italy and Spain, still have antibiotic usage levels which are 10–20 times higher per livestock unit than the lowest users. In average and above-average using countries, the vast majority of farm antibiotics (over 75%) are administered as group treatments, because antibiotic use is less targeted and often aimed at controlling persistent disease problems.

A large amount of scientific evidence shows that high levels of antibiotic use in farming are associated with increased antibiotic resistance in both human and animal infections. An analysis by EU agencies, EFSA, EMA and ECDC, of antibiotic use and resistance data by European country shows for some bacterial infections and antibiotics, resistance in humans is statistically more closely linked to farm antibiotic use or resistance in farm animals than it is to human antibiotic use. So while human antibiotic use is a major contributor to antibiotic resistance, EU data confirms that farm antibiotic use is contributing significantly to the problem.

A major reason why so many countries still have such excessive farm antibiotic use and significant animal-health problems is because of a decades-long commitment from many governments and the EU itself to increasing farm productivity and delivering cheap meat and dairy products.

However, according to experts, the rise of antibiotic resistance threatens to cause an “antibiotic apocalypse” which could undermine major achievements in modern medicine, such as hip replacements, organ transplants and cancer chemotherapy. The overuse of antibiotics in intensively farmed animals is contributing to this crisis.

Governments across Europe, the European Parliament and the European Commission all now say they are committed to solving the antibiotic-resistance crisis by adopting a One Health approach that recognises that the health of people is closely connected to the health of animals and our shared environment.

A decade ago, the European Parliament called for farm animals to be kept healthy through good husbandry and hygiene, rather than relying on routine antibiotic use. In December 2021, the European Commissioner for Health and Food Safety, Stella Kyriakides, said that “the preservation of public health relies on the preservation of animal health” and admitted that more should be done to avoid infections in farm animals, notably by improving animal husbandry. She said that upcoming revisions of EU animal-welfare legislation will aim to help keep animals healthier and reduce the need for antibiotics.

Tackling the antibiotic-resistance crisis means that it is essential that the new EU legislation is fully implemented, and the claimed commitments from policy makers to improving animal health and welfare are realised. Farming systems and husbandry practices aimed solely at increasing productivity, and which cannot deliver good animal health and low levels of antibiotic use, must be phased out.

Recommendations

To ensure that the new EU regulations on farm antibiotics are implemented in full, ending all forms of routine antibiotic use, and in particular ending the use of antibiotics to compensate for inadequate husbandry and poor hygiene, new targeted policies are now needed.

Below is a checklist of ten key areas where improvements and actions are required on antibiotic use, on surveillance, on improving animal husbandry and on eliminating certain practices of intensive farming associated with poor animal health and higher levels of antibiotic use.

Taking these actions should help achieve very significant cuts in farm antibiotic use across Europe and contribute to major improvements in animal health and welfare.

Policies and targets for antibiotic use and data collection:

1. Low levels of farm antibiotic use.

In each animal species, antibiotic use should be kept below 30 mg per kg of “population correction unit” (PCU). Eventually, use should be cut to 15 mg/kg or less in each species.

2. Most antibiotic use should be for individual treatments.

In most farm-animal species, most antibiotics should be used for individual treatments of sick animals, and not as group treatments (with the exception of the poultry industry where all treatments have to be group treatments). Countries should aim for group treatments to account for less than 30% of all farm antibiotic treatments, and eventually to just 15% or less.

3. Antibiotic-use data should be collected by species and by farming system.

The new EU regulations will require Member States to collect antibiotic-usage data by species. Countries should also publish data by farming system, such as intensive, higher-welfare indoor, free-range, organic or pasture-fed. Obtaining data by farming system will provide extremely important information on which husbandry factors are most linked with reducing or increasing infections and antibiotic use.

4. Restrictions on highest-priority critically important antibiotics.

The veterinary use of the antibiotic colistin should be banned, since it is used as a last-resort for treating life-threatening infections in humans and there is clear evidence that resistance to colistin has passed from farm animals to humans. The use of fluoroquinolone and modern cephalosporin antibiotics, which are classified as highest-priority critically important antibiotics, should be restricted to the treatment of individual sick animals where no other treatments are likely to work. These antibiotics should never be used for group treatments nor should they be used for prophylaxis, even in individual animals. It should also not be permitted to use these antibiotics off-label.

Numerous husbandry factors can contribute to antibiotic use, but some of the key ones requiring action that have been identified in this report are:

1. Later weaning in piglets.

EU legislation currently allows for pigs to be weaned as early as 21 days. This early weaning causes post-weaning diarrhoea and is a major cause of antibiotic use in the pig industry. In many European countries, post-weaning diarrhoea is also controlled by the medical use of high doses of zinc oxide in feed, but this practice will be banned in the EU on 26 June 2022 because of the harmful environmental effects of spreading manure containing high levels of zinc on land. Post-weaning diarrhoea will therefore have to be minimised by weaning piglets when they are older. A new minimum weaning age of about 35 days should be adopted, as evidence shows this leads to far lower antibiotic use.

2. Use appropriate breeds.

Modern broilers grow so fast they can be slaughtered when they are as young as 32 days old. This extremely rapid growth rate is a major cause of poor chicken health and welfare. Evidence shows that using slower-growing breeds can drastically reduce the need for antibiotics. A new minimum slaughter age of 56 days should be introduced. More resilient and healthy breeds should be used in all farm-animal species. Hyper-prolific sows, which produce very large numbers of piglets, should be abandoned as later weaning becomes impossible when a sow cannot sustainably feed a very high number of growing piglets.

3. Improve hygiene, reduce indoor stocking density and provide proper "enrichment".

Poor hygiene is a major cause of intestinal and respiratory infections. Animals should be kept in conditions which enable them to avoid ingesting faeces or inhaling bad air. High stocking densities are associated with worse hygiene, increased levels of stress and easier disease transmission between animals. Current EU regulations set a maximum stocking density for broiler chickens of 42 kg of animal per square metre, which means that the average space allowance per chicken is less than an A4 sheet of paper. This maximum stocking density should be reduced to 25 kg/m^2, particularly for animals housed entirely indoors. Similarly, there should be significant reductions to the stocking densities for all animals farmed indoors, including pigs. Animals should not be kept in barren environments and must be provided with appropriate enrichment materials, for example straw bedding for pigs, which allow them to express natural behaviours and reduce stress.

4. Provide access to the outdoors.

Antibiotic-use data by farming system remains scarce, but the available data suggests that animals raised with good access to the outdoors, as occurs in organic or free-range production, tend to have significantly lower antibiotic use. Providing animals with access to the outdoors should be encouraged in order to reduce animal disease and antibiotic use. However, appropriate breeds need to be used for animals to be farmed successfully outdoors.

5. Include sufficient fibre in diets.

The inclusion of some types of fibre in diets can promote good gut health, promoting the growth of beneficial bacteria and reducing that of pathogens. Fibre in diets can also reduce stress and abnormal behaviours, such as tail biting in pigs. Reducing the protein content and increasing the fibre content of diets has been used successfully to reduce disease incidence and antibiotic use in both pigs and poultry. Animal-welfare standards should ensure that all farm animals receive sufficient fibre in their daily diets, particularly when they are raised indoors.

6. Ban tail docking of piglets.

Routine tail docking of piglets is illegal in the EU, but in most countries the legislation is widely flouted and routine tail docking still occurs on a large majority of European pig farms. Tail-docking can cause long-term chronic pain and infections. It is done to minimise tail biting, an abnormal behaviour of pigs linked with the intensive conditions in which pigs are kept. Risk factors associated with tail biting include high stocking densities, the lack of rooting material, such as deep-straw bedding, poor health and low-fibre diets. Many of these risk factors are also associated with high antibiotic use. A small number of European countries which have fully banned tail docking, except in cases of medical need, avoid significant tail-biting behaviour through their higher welfare standards. These include keeping their pigs at lower stocking densities and using bedding material such as straw. Higher welfare standards also help reduce antibiotic use and all of Europe’s lowest users of farm antibiotics have banned tail docking. All countries should ban tail docking of pigs except in cases of medical need.

The new Veterinary Medicines Regulation will prohibit any form of routine antibiotic use, not just routine prophylactic use. The use of antibiotics to compensate for inadequate animal husbandry or poor hygiene will also be prohibited.

The latter two measures could potentially have a major impact on how European livestock are farmed, since a number of husbandry factors are strongly linked with disease incidence and antibiotic use, particularly in intensive livestock farming.

1. Introduction

On 15 November 2011, the European Commission published an “Action Plan on the Rising Threats of Antimicrobial Resistance” [1]. The Commission warned that human mortality from resistant infections was increasing and that hugely important medical procedures such as hip replacements, organ transplants and cancer chemotherapy were seriously jeopardised by increasing antibiotic resistance. It also said that antibiotic resistance was resulting in greater animal suffering and mortality.

The Commission blamed the “inappropriate” use of antibiotics in both human and veterinary medicine for accelerating emergence and spread of antibiotic-resistant organisms. It proposed a 12-point action plan for human and veterinary medicine. The top action on the veterinary side was a proposal to introduce a new regulatory framework for veterinary medicines and medicated feed containing antibiotics.

The action plan contained few details about what would be included in the new regulations, but just three weeks earlier the European Parliament had adopted a resolution calling on the Commission to make “legislative proposals to phase out the prophylactic[1] use of antibiotics in livestock farming” [2]. The European Parliament called for livestock and farmed fish to be kept healthy through good husbandry and hygiene, rather than relying on prophylactic antibiotic use.

A few months later, the Council of Ministers also supported new restrictions on prophylactic use and called for Member States to limit such use to “cases of defined clinical need” [3]. So from 2011-12 onwards it was understood, including by industry [4], that new restrictions on farm antibiotic use, and in particular on prophylactic treatments, were likely. However, progress towards taking action was to prove very slow.

Finally, after years of negotiations, new regulations on veterinary medicines and medicated feed were adopted on 11 December 2018 [5][6]. The Regulations will apply from 28 January 2022, just over a decade after the publication of the Commission’s 12-point plan.

The new regulations should have a major impact on European farm antibiotic use. They limit prophylactic use to individual treatments of animals at high risk of disease. So prophylactic mass medication in feed or drinking water, widely practised in most of Europe for decades, will no longer be allowed. Knowledge that major restrictions like this were likely to be implemented has already contributed to significant falls in European farm antibiotic use in recent years [7], and further large falls in use are expected in high-using countries once the ban on preventative group treatments comes into force.

The new Veterinary Medicines Regulation will also prohibit any form of routine antibiotic use, not just routine prophylactic use. The use of antibiotics to compensate for inadequate animal husbandry or poor hygiene will also be prohibited.

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1 Prophylactic use of medicines is purely preventative use. It is the administration of a medicine to an animal (or human) or group of animals before any clinical signs of infection in order to prevent the occurrence of infection.

However, there is little evidence that farmers have been altering their husbandry in preparation for these particular restrictions, which are still not well known. This is perhaps not surprising since these new rules have not been well publicised and are not even mentioned in the EU's official summary of the Regulation [8].

European authorities are, however, aware that current production methods often rely on excessive, and unsustainable, use of antibiotics. In 2017, the European Food Safety Authority and the European Medicine Agency said:

> "In some farming systems, much reliance is placed on the routine use of antimicrobials for disease prevention or for the treatment of avoidable outbreaks of disease, such that these systems would be unsustainable in the absence of antimicrobials" [9].

Furthermore, they recommended that:

> "Farming systems with heavy antimicrobial use should be critically reviewed, to determine whether/how such systems could sustainably reduce the use of on-farm antimicrobials. If a sustainable reduction in the use of on-farm antimicrobials is not achievable, these systems [should] ideally be phased out."

Unfortunately, this recommendation has not yet lead to any significant re-assessment of current livestock production methods.

The lack of movement towards more health-orientated systems of livestock farming in most of Europe makes it very likely that the new Regulations on veterinary medicines and medicated feed will not be fully implemented in practice, and that in some, and perhaps most, Member States, antibiotics will continue to be used to prop up unhealthy, intensive farming practices.

Concerns about lack of full implementation led 18 MEPs to write a letter, coordinated by the German Green MEP Manuela Ripa, to the European Commissioner for Health and Food Safety, Stella Kyriakides. They expressed their concerns about possible non-compliance with the new regulation banning routine antibiotic use [10]. They said that "If the EU animal production sector does not respect the legislation, it will be putting human health at risk". They indicated that the solution was to improve animal husbandry and animal health, saying:

> "In order to comply with the legislation, we need to move to 'health-oriented' systems for keeping animals, in which good health is inherent in the farming methods rather than being propped up by routine use of antimicrobials. Such systems would avoid overcrowding and excessive herd and flock size. They would minimise stress and ensure that animals can perform their natural behaviours. Moving to such systems would not only minimise use of antimicrobials but also support the ambition of the European Commission and the Parliament to improve animal welfare."

In response, Commissioner Kyriakides said that farmers had had three years to prepare for the implementation of the new regulations and that in April 2021 she had written to the relevant Ministers in Member States calling on them to prepare effectively and to dedicate sufficient resources to achieving effective implementation. She said that audits in Member States would be carried out by the Commission to ensure compliance. However, she also said that "more can be done to prevent infections from occurring in farmed animals, notably by improving vaccination, hygiene and biosecurity, but also animal husbandry practices" and that this was important because “public health relies on the preservation of animal health”. She said that the upcoming revision of the EU animal welfare legislation will aim to increase animal-welfare standards, which will contribute to keeping animals healthier and to reducing the need for antibiotics.

This report attempts to explore the changes to current animal-production methods, and antibiotic-usage practices, that will be required to achieve the “health-orientated systems” the MEPs and many others wish to see adopted in European livestock farming, which will enable the new EU regulations to be properly, and fully implemented. While legal preventative group treatments will end on 28 January, many current farming practices will need to change if all routine use is to be ended. Our analysis will focus primarily on pig and poultry production, with a particular reference to the situations in France and Poland.

France has been chosen because it is an example of a country which has significantly reduced its antibiotic use in recent years, partly as a result of European policies, but also because of initiatives taken at a national level. French farm antibiotic use, however, remains far higher than it needs to be and is still fairly typical of current European usage levels and well above the best-performing countries.

Poland, on the other hand, has been chosen because it is one of the highest users of farm antibiotics in Europe and one of the few countries where usage has increased significantly in recent years. Key reasons for this are the lack of national policies, as a result of insufficient focus on the issue of antibiotic use, and the ongoing expansion of intensive livestock production, particularly of poultry production, in Poland.

The lack of movement towards more health-orientated systems of livestock farming in most of Europe makes it very likely that the new Regulations on veterinary medicines and medicated feed will not be fully implemented in practice, and that in some, and perhaps most, Member States, antibiotics will continue to be used to prop up unhealthy, intensive farming practices.

2. The new EU regulations

On 28 January 2022, two important new regulations, on medicated feed and veterinary medicines, will start to apply across the EU. Both of these regulations contain rules affecting substances other than antibiotics, but key articles affecting the use of antibiotics in livestock are summarised here.

2.1. Definitions

To understand the meaning of restrictions included in these new regulations and in our discussion, it is worth first defining some of the terms used.

Antibiotic: a substance with a direct action on bacteria, either killing them or preventing them from reproducing. Antibiotics are used for treatment or prevention of infections or infectious diseases.

Antimicrobial: a substance with a direct action on micro-organisms, either killing them or preventing them from reproducing. Antimicrobials are used for treatment or prevention of infections or infectious diseases. Antimicrobials include antibiotics, antivirals, antifungals and anti-protozoals. All antibiotics are antimicrobials, but antimicrobials that have no effect on bacteria are not antibiotics.

Veterinary Medicines or Veterinary Medicinal Products: Substances having properties for treating or preventing disease in animals, or for restoring, correcting or modifying physiological functions in animals. All veterinary medicines used in food animals, including antimicrobial veterinary medicines, require a veterinary prescription.

Medicated Feeds: Homogenous mixtures of animal feeds and veterinary medicines.

Prophylactic use: the administration of a medicinal product to an individual animal or a group of animals before clinical signs of a disease, in order to prevent the occurrence of disease or infection. Prophylactic use means the same as preventative or preventive use.

Metaphylactic use: the administration of a medicinal product to a group of animals after a diagnosis of clinical disease in part of the group has been established, with the aim of treating the clinically sick animals and controlling the spread of the disease to animals in close contact and at risk and that may already be subclinically infected.

Individual treatments and group treatments: the administration of antibiotics can be to an individual animal, for instance when antibiotics are given by injection, tablets or as intramammary treatments. Individual treatments can be therapeutic, if the animal is already infected, or prophylactic, if for example the animal is undergoing surgery. Antibiotics can also be administered as group treatments, when they are added to animal feed or to drinking water. Group treatments can be either metaphylactic, if some animals have already been diagnosed as infected, or they can be prophylactic.

2.2 Regulation 2019/4 of 11 December 2018 on Medicated Feed

Medicated feeds are one of the three ways by which antibiotics are given orally to groups of animals. The other two methods used for group treatment are by adding antibiotics to drinking water and by the manual mixing of antibiotics into feed (often call "top dressing"). These two other types of group treatment are not covered by this regulation, although all three methods are covered by the veterinary medicines regulation.

2.2.1. No use of antimicrobial medicated feed for prophylaxis

Regulation 2019/4 contains a complete prohibition on the use of antimicrobial veterinary medicines for prophylactic treatments. Article 17.3 says:

> "Medicated feed containing antimicrobial veterinary medicinal products shall be used in accordance with Article 107 of Regulation (EU) 2019/6, except as regards paragraph 3 thereof, and shall not be used for prophylaxis."

2.3 Regulation 2019/6 of 11 December 2018 on Veterinary Medicinal Products

Many of the key restrictions being introduced on antibiotic use are contained in Article 107.

2.3.1. No routine antimicrobial use and no use to compensate for poor hygiene and husbandry

Article 107.1 introduces a general principle that antimicrobials cannot be used routinely or to compensate for poor husbandry.

Article 107.1 states:

> "Antimicrobial medicinal products shall not be applied routinely nor used to compensate for poor hygiene, inadequate animal husbandry or lack of care or to compensate for poor farm management."

This is an important article since it is effectively saying that if animals are managed in ways that cause them to fall ill routinely, then antimicrobials cannot be used to resolve this problem. Antimicrobials may only be used if hygiene is good and poor husbandry and poor farm management are not the cause of the infections being treated.

2.3.2. No antimicrobial use for growth promotion

Article 107.2 explicitly bans using antimicrobials for growth promotion. No antimicrobials have been licensed for growth promotion in the EU since 2006, but this article makes clear that the practice itself is now banned.

The ban on antibiotic growth promotion will also apply in situations where animal-derived products are being imported into the EU.

2.3.3. Ban on prophylactic group treatments

Article 107.3 restricts prophylactic antibiotic use to "exceptional cases" when "the risk of an infection or of an infectious disease is very high and the consequences are likely to be severe".

The article allows for prophylactic use to be given to more than one animal on the farm, if necessary. However, it does not allow for any form of group administration of antibiotics for prophylactic use. It says that "the use of antibiotic medicinal products for prophylaxis shall be limited to the administration to an individual animal only".

Situations where prophylactic use could be appropriate would be, for example, when an animal undergoes surgery, or when tests show that a cow is at high risk of developing mastitis or is showing evidence of a subclinical mastitis infection.

2.3.4. Restrictions on metaphylactic use of antimicrobials

Article 107.4 deals with metaphylactic use and says:

> "Antimicrobial medicinal products shall be used for metaphylaxis only when the risk of spread of an infection or of an infectious disease in the group of animals is high and where no other appropriate alternatives are available. Member States may provide guidance regarding such other appropriate alternatives and shall actively support the development and application of guidelines which promote the understanding of risk factors associated with metaphylaxis and include criteria for its initiation."

The restriction on metaphylactic antibiotic use to situations where the risk of infection is "high" and no alternatives are available is important, but is not as strong or as clear as it could have been. The word "exceptional" that is used for prophylaxis was also included in an earlier draft of the restriction on metaphylactic use, but was removed from this final version.

There could therefore be some concerns that metaphylactic use will simply replace most preventative group treatments. However, Article 107.1 applies to all forms of antibiotic use, and therefore, if applied properly, rules out routine metaphylactic use.

2.3.5. List of antibiotics to be reserved for human use

Article 37(5) requires the Commission to draw up a list of antibiotics that are to be reserved for human use, and cannot be used in veterinary medicine under any circumstances. This was due to apply from 28 January 2022, but because the list has still not been established, it will only come into force sometime in late 2022.

The ban on using these antibiotics in livestock will also apply in situations where animal-derived products are being imported into the EU.

2.3.6. Collection of antibiotic-usage data by animal species

Article 57 requires Member States to collect sales data and usage data for antimicrobial veterinary medicinal products and to submit this data annually to the European Medicines Agency (EMA)

Sales data is already collected by Member States, often from pharmaceutical companies, and submitted annually to the EMA. This sales data is then published in annual European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) reports [7]. However, since many products are licensed for use in more than one species, sales data does not generally provide good data by animal species nor the ability to determine usage at the farm level.

The usage data, in contrast will be given by animal species. It will also enable much better evaluation of usage at the farm level.

The requirement to collect data by species will be phased in over a number of years. The Delegated Regulation (EU) 2021/578 [12] sets out the following timeline:

- From 2024, reporting of usage data for beef cattle, dairy cattle, pigs, chickens (broiler chickens and laying hens being reported separately) and turkeys begins.
- From 2027, reporting of usage in other food animals (e.g. sheep, goats, fish, rabbits and horses) begins.
- From 2030, reporting of usage in cats, dogs and animals farmed for fur (e.g. mink) begins.

It is widely recognised that the collection of sales data, and the annual publication of this data by country, has contributed to significant reductions in farm antibiotic use in Europe. ESVAC data shows that European farm antibiotic sales have fallen by over 34% between 2011 and 2018. But the introduction of usage data, published by species, can be expected to drive usage levels even lower. The collection and publication of usage data by species has certainly contributed to large reductions in farm antibiotic use in some Europe countries where such data is already collected on a statutory (Denmark, Netherlands) or voluntary (UK) basis [13][14][15].

Although the collection of usage data by species is a very welcome development, albeit long overdue, it is regrettable that data will still not be collected by farming system, e.g. intensive, higher-welfare indoor, free-range, organic or pasture-fed. Since much of the usage data is likely to be collected directly from farms or their veterinary surgeons, it would be fairly straightforward to separate usage levels by farming system, particularly for types of farming such as free-range or organic where certifying and labelling systems exist, and to publish the data in this form.

Publishing data by farming system would certainly highlight large differences in usage between different types of husbandry, and it would therefore provide critical information on how husbandry generally could be improved.

2.3.7. Possible lack of action on limiting the use of the use of the highest-priority critically important antibiotics

Certain antibiotics used in farming in the UK are classified by the World Health Organization as "highest-priority critically important antibiotics" in human medicine. These include the antibiotic colistin, the fluoroquinolones, the 3rd and 4th generation cephalosporins (also called the "modern cephalosporins") and the macrolides[2] [28].

The WHO believes that the need to minimise the antibiotic-resistance threat to humans from the use of these antibiotics is the most urgent out of all the antibiotics used in farming.

The European Medicines Agency (EMA) also has a similar classification of antibiotics used in animals according to their importance to human health and the risk to human health caused by their veterinary use [29]. The EMA's highest classification for antibiotics that are currently licensed for use in livestock in the EU is the "restrict" category. This includes colistin, the fluoroquinolones and the modern cephalosporins. Macrolides, however, are classified as slightly less important by the European Medicines Agency (EMA) because it concluded that "in the EU, the public health

2 The glycopeptide antibiotics are also on this list, but are not currently used in livestock in the EU.

Article 107.1 introduces a general principle that antimicrobials cannot be used routinely or to compensate for poor husbandry.

This is an important article since it is effectively saying that if animals are managed in ways that cause them to fall ill routinely, then antimicrobials cannot be used to resolve this problem. Antimicrobials may only be used if hygiene is good and poor husbandry and poor farm management are not the cause of the infections being treated.

burden of infections with 3rd- and 4th-generation cephalosporin- and fluoroquinolone-resistant bacteria is higher than that for macrolide-resistant zoonotic bacteria".

The EMA says that specific restrictions should be put in place for the use of "restrict" antibiotics and that in particular that use should only occur when less important antibiotics are not likely to work, based on sensitivity testing.

Unfortunately, despite both the WHO and EMA highlighting the significant risk to human health from overusing colistin, fluoroquinolones and modern cephalosporins in livestock, there is no guarantee that any of these antibiotics are going to have their use restricted under the new legislation.

Campaigners are rightly calling for colistin, an antibiotic used as a last-resort in human medicine for treating life-threatening infections that cannot be cured with other antibiotics, to be fully banned from all veterinary use by being included on the EU's list of antibiotics reserved for human use [30]. There is clear evidence that the use of colistin in livestock, particularly in pigs, has contributed to resistance in human infections [31]. Unfortunately, the EMA has previously supported continued use of colistin as a feed additive, including in pig farming, albeit with some targets set for reducing use [32]. There is therefore no guarantee will be on the list of antibiotics reserved for human use once it is published.

In addition to banning colistin use in livestock, some campaigners have long called for the use of fluoroquinolones and modern cephalosporins to be restricted to individual treatments of sick animals where no alternative treatments exist, and for all group treatments and prophylactic treatments with these antibiotics to be banned [33]. Other campaigners also call for the macrolides to be restricted to individual treatments or even for all antibiotics classified as highest-priority critically important to be completed banned from farming [34].

The use of fluoroquinolones for group treatments of poultry has been banned in the US since 2005 because of the very clear evidence that it is a major contributor to fluoroquinolone resistance in human Campylobacter infections [35]. Most EU Member States, however, continue to allow fluoroquinolone group treatments of poultry. As a result all of these countries have much higher fluoroquinolone resistance in human Campylobacter infections than occurs in the US, despite most of them having lower use of fluoroquinolones in humans [36]. The European Food Safety Authority and the European Centre for Disease Prevention and Control have blamed fluoroquinolone use in poultry for the high levels of resistance found in human Campylobacter saying: "Given the high levels of resistance to fluoroquinolones in broilers and the assessment that a large proportion of human campylobacteriosis infections comes from handling, preparation and consumption of broiler meat, this is a compelling example of how AMR in food and animals may impact the availability of effective antimicrobial agents for treating severe human Campylobacter infections" [37]. Despite this, there do not appear to be any plans to end the mass medication of poultry or other livestock with fluoroquinolones.

Similarly, the use, sometimes prophylactic use, of modern cephalosporin antibiotics in livestock has been linked with the emergence of and spread of certain highly antibiotic-resistant E.coli in livestock that are considered to be a threat to human health [38][39]. Furthermore, the widespread and unnecessary use of modern cephalosporins in pig production is suspected of being the main reason for the emergency of a new type of MRSA (methicillin-resistant Staphylococcus aureus) in livestock that can spread to humans and cause infections [40].

In the case of macrolides, there is clear evidence that farm use has led to resistance, and that this can lead to increased resistance in some human infections, including Campylobacter. However, despite decades of widespread overuse and misuse in farming, including previously as growth promoters, there is significantly less macrolide resistance in Campylobacter than there is fluoroquinolone resistance, which is one reason why the EMA says that the public health burden of infections which are resistant to fluoroquinolones and 3rd and 4th generation cephalosporins is higher.

Macrolide antibiotics should clearly not be used as first-line treatments, and should be restricted to situations where less important antibiotics are unlikely to work. However, a full ban on the use of macrolides, or a restriction to individual use only could, in the absence of large reductions in overall antibiotic use, lead to more use of other antibiotics, such as beta-lactams, where resistance arises more easily.

Despite the lack of clear plans to limit the use of any HPCIAs that will remain available to be used in livestock, two articles of the new veterinary medicines legislation could lead to some new restrictions being introduced.

Article 107.6 says that a list will be established of antibiotics that cannot be used "off-label" under any circumstances. Off-label use of antibiotics occurs when antibiotics are used in ways other than that for which they are licensed. For example, under certain exceptional circumstances, an antibiotic licensed for use in one species can be legally used in another species for which it is not licensed. If modern cephalosporins and fluoroquinolones are included on this list, this could end some misuses. It is known that modern cephalosporins have been widely used off-label in poultry in the past in a way that was not considered completely in line with legislation [41]. Colistin is also known to be used off-label in the French poultry industry [42], and may well be used in a similar way in some other European countries.

Article 107.7 says that a Member State may "further restrict or prohibit the use of certain antimicrobials in animals on its territory if the administration of such antimicrobials to animals is contrary to the implementation of a national policy on prudent use of antimicrobials". This means that Member States could choose to further restrict the use of HPCIAs, and in particular ban the use of colistin and end all group treatments and prophylactic treatments with modern cephalosporins and fluoroquinolones. Action at a national level could also eventually lead to wider EU action. Therefore campaigns at a national level should continue to push for greater restrictions on the use of these hugely important antibiotics.

2.3.8. Lack of regulation of imported produce

Only two aspects of the new regulations will apply to animal-derived foods produced outside of the EU and imported to the EU. As mentioned above, these are the ban on the use of antibiotics as growth promoters and the list of antibiotics which are to be reserved for human use.

This means that non-EU farmers producing for export into the EU will be permitted to use antibiotics completely routinely and in particular their use for prophylactic group treatments will be allowed. Using antibiotics to compensate for inadequate husbandry or poor hygiene will also be permitted.

The lack of consistency between the regulations which will apply to EU and non-EU farmers could put EU farmers at a commercial disadvantage, as it will allow non-EU producers to continue to misuse antibiotics with the goal of achieving cheaper production. Clearly, a more fair and rational approach would be to apply the same rules to all farmers producing for the EU market.

However, significant tariffs are currently imposed on many animal foods imported into the EU [43], so non-EU produce is often uneconomic despite lower production standards. In cases where trade deals are reached, however, and tariffs are lifted or reduced on some or all imports from a particular country, it will be crucial that the EU insists that EU antibiotic standards apply to all such imports.

2.4. Ban on the use of zinc oxide at full therapeutic doses

In many European countries, high, therapeutic doses of zinc oxide are frequently added to the feed of piglets which have recently been weaned. This is primarily done to help control post-weaning diarrhoea, which frequently occurs when piglets are weaned too early, but it is also done because high doses of zinc have a growth-promoting effect [44].

However, most zinc oxide ingested by piglets is excreted in manure and ends up in the environment when manure is spread on land. In 2017, the European Medicine Agency's Committee for Medicinal Products for Veterinary Use recommended that because of harmful environmental effects, zinc oxide should no longer be permitted as a veterinary medicine. There is also evidence that including zinc oxide in feed can increase the levels of antibiotic-resistant bacteria in pigs, including in particular the incidence of MRSA [45][46].

The European Commission subsequently decided that on 26 June 2022 all veterinary medicines containing zinc oxide must be withdrawn from the market [47]. Since pigs do require some zinc in their diet, including zinc oxide in feed at much lower, nutritional doses, at up to 150 parts per million (ppm) will still be permitted, but the high, therapeutic doses of 2,500 ppm will no longer be allowed [47][48].

Some countries have decided to ban the use of zinc oxide earlier than required by the EU. Belgium and France both banned zinc oxide use from January 2021, and in the Netherlands zinc oxide was never licensed as a veterinary medicine [49][50].

In contrast, the UK, which left the EU in 2020, it is still not completely clear if the zinc oxide ban is going to be implemented. According to the British government's Veterinary Medicines Directorate (VMD), the ban is part of UK retained law, which does mean that at present British law says that on 26 June 2022 veterinary medicines containing zinc oxide will have their marketing authorisations withdrawn [51]. However, the VMD has also recently made it clear that it is carrying out its own environmental assessment for zinc oxide veterinary medicines, and will then decide what it thinks the risks and benefits of allowing medicinal zinc oxide use to continue are [52].

In Member States where routine zinc oxide use at weaning time is widely practiced, the ending of such use could lead to increased reliance on antibiotic use to control post-weaning diarrhoea. Antibiotic use at weaning time is already very high in many countries, and the banning in 2022 of both group prevention with antibiotics and of therapeutic zinc oxide use will mean that husbandry improvements will need to be implemented to avoid diarrhoea problems if the regulations are to be followed (see section 4.3).

2.5. Ionophores and other coccidiostats are not covered by these new regulations

The ionophore antibiotics, and some other antimicrobials are used to control the disease coccidiosis in poultry, which is caused by single-celled organisms called coccidia. Coccidia are not bacteria (which are also single-celled organisms) because they have a cell nucleus and bacteria do not. Ionophores and other medicines used to control coccidiosis are called "coccidiostats".

However, despite being licensed to control a disease, ionophores have not been classified by the EU as "veterinary medicines". Furthermore, when coccidiostats are included in animal feed, the mixture is not classified as a "medicated feed".

The significance of this is that ionophores and other coccidiostats, when used as coccidiostats, are not covered by the new Medicated Feeds or Veterinary Medicines regulations.

Instead, coccidiostats are classified as "feed additives", and EU Regulation 1831/2003 governs the use of feed additives. EU regulations allow for coccidiostats and other feed additives to be bought "over the counter", without the need for a veterinary prescription.

This means that ionophores are the only antibiotics that the EU allows to be used, completely routinely, without a veterinary prescription.

The justification generally given for this separate treatment of the ionophores is that ionophores are not currently used in human medicine due to their toxicity, and therefore we should be less concerned about ionophore resistance than for other antibiotics [16].

However, because ionophores have activity against human pathogens like MRSA or Clostridium difficile, scientists are examining whether they could be used in humans in the future to treat these infections. A study published in Nature in January 2021 reported on the development of an ionophore that retained good antibacterial effects without affecting mammalian cells. The scientists concluded in their paper that "our study suggests the exciting prospect of optimizing polyether ionophores for use as antibiotics" [17].

Furthermore, for a number of years there has been evidence collected in Norway that the use of one ionophore, narasin, in poultry may increase the number of enterococci bacteria in poultry that are resistant to the human antibiotic vancomycin, through a process called "co-selection"[3] [18]. Vancomycin-resistant enterococci (VRE) can cause serious infections in humans, and VRE can also transfer from animals to humans.

Because of negative publicity in the Norwegian media about narasin use and the possible connection with VRE, the Norwegian chicken-meat industry stopped using ionophores in 2016. Subsequently research failed to find any VRE in Norwegian broilers. The scientists also found that narasin resistance in the enterococci bacteria had reduced. They said that the ending of narasin use in the chicken industry in Norway appeared to have contributed to the reduction in VRE in chickens [19]. Other scientists also argue that ionophore use may be contributing to vancomycin resistance in enterococci based on evidence from the Swedish poultry industry [20].

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3 Co-selection can occur if bacteria that are resistant to one antibiotic (in this case vancomycin) also happen to be resistant to another (in this case narasin), and then use of the second antibiotic selects for resistance to the first antibiotic.

The Federation of Veterinarians of Europe has called for ionophores to be made prescription-only medicines [21], a move which would result in the Veterinary Medicines Regulation becoming applicable to these antibiotics. The FVE is concerned about coccidia developing resistance to ionophores but also about possible harmful residues in food. The FVE also believes that data on the use of ionophores and other coccidiostats should be collected [22].

2.6. EU Farm to Fork Strategy

In May 2020, the European Commission adopted a new Farm to Fork Strategy that aims to enable and achieve a transition towards a more “sustainable EU food system that safeguards food security and ensures access to healthy diets sourced from a healthy planet” [23][24].

The strategy includes a target to reduce farm antibiotic use in the EU by 50% between 2018 and 2030. While this target may appear ambitious, as explained later on in this report (see Chapter 3 and in particular section 3.3), most Member States are currently using farm antibiotics at a far higher level than the lowest using Member States. This suggests that there is a very large potential for reducing total European use of farm antibiotics, and a 50% reduction should just be seen as a first step in the right direction for many countries.

The strategy also includes a commitment to revise animal-welfare legislation, with the intention of improving animal health and food quality and reducing the dependence on veterinary medicines. If significant improvements to animal health and welfare are achieved, this could make a very important contribution to reducing antibiotic use.

Other targets in the strategy are aimed at protecting biodiversity, including increasing the land under organic management to 25% of EU land, reducing pesticide use by 50% and reducing artificial fertiliser use by 20%, all by 2030, there is also a goal to reduce the climate footprint of European food production.

In October 2021, the strategy was endorsed by the European Parliament [25], despite a “lobbying blitz” by agribusiness industry [26]. The EU farming organisation, Copa-Copega was particularly strongly opposed to the proposed targets for reforming farming as it believed that these would be used for future Farm to Fork legislative initiatives [27].

The goal of reaching 25% of EU land being farmed organically by 2030 could have some very beneficial consequences for reducing farm antibiotic use if it also means that there will be a policy aimed at encouraging more organic approaches to farming livestock. This is because organic livestock production has much stricter rules on using antibiotics and furthermore the available evidence suggests that antibiotic use in organic livestock production is far lower than in non-organic production (see Chapter 4).

3. Trends in European farm antibiotic use

3.1. Ban on the use of antibiotic growth promoters

Between 1999 and 2006 the EU phased out the use of all antibiotic growth promoters, and since the 1st January 2006 no antibiotics have been licensed for growth promotion. However, despite this tightening of regulation, in the years that followed there was little evidence of significant reductions in total farm antibiotic use.

Many countries were not collecting any data on their antibiotic usage, making it difficult to establish the extent to which the growth-promoter ban affected total antibiotic use.

However, in the Netherlands, one of a minority of countries that was collecting data, we know that after growth promoters were banned, total antibiotic sales initially continued on their increasing trend, reaching record levels in 2006 and 2007 [53]. This happened because farmers simply replaced much of their use of antibiotic growth promoters with increased use of antibiotics under veterinary prescription, for disease prevention [54].

However, after livestock-associated MRSA (methicillin-resistant *Staphylococcus aureus*) was first detected on a Dutch pig farm in 2005 and began to spread to humans, policy makers gradually began to put pressure on farmers to reduce their use [54]. In 2008, the farming industry had to sign a Memorandum of Understanding, or a Covenant, with the government regarding antibiotic use. Furthermore, ambitious targets for antibiotic-use reduction were set in 2009, and in 2011 a ban on all preventative group treatments was implemented. New restrictions were also introduced on the use of the highest-priority critically important antibiotics. It was these later actions, rather than the ban on antibiotic growth promoters, which led to a reduction of nearly 70% in the use of antibiotics in the Netherlands over the past decade [55][56].

3.2. European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) and the “population correction unit” (PCU)

In 2009, the European Surveillance of Veterinary Antimicrobial Consumption project was launched. This aimed to develop a harmonised approach for the collection and reporting of data on the use or sales of veterinary antibiotics.

In 2011, the EMA published the first EU report on the sales of veterinary antibiotics in nine countries, which covered the period from 2005 to 2009. Eight Member States provided data for the five years and Switzerland submitted data for four years [57].

Since the amount of antibiotics sold in each country depends, amongst other things, on the number of animals of different species in that country, the EMA introduced a new unit, the “population correction unit” (PCU), for measuring the estimated size of a livestock population at the moment of treatment. The PCU is a purely technical unit and is given in kilos [58].

In terms of mg of active ingredient of antibiotic per kg of PCU (mg/kg), the EMA found major differences in antibiotic sales between lowest-consuming countries (Norway 14 mg/kg and Sweden 19 mg/kg in 2009) and the highest-consuming countries (Netherlands 165 mg/kg and France 141 mg/kg in 2009). These differences were partly due to some countries having relatively more of the high-consuming species, like pigs, and others having more of the lower-consuming species, like sheep. However they were also due to major differences in usage.

This first EMA report found that between 2005 and 2007, sales increased by 3% for the eight EU countries, showing that ending growth promotion had not resulted in major reductions. Overall sales fell by 18% between 2007 and 2009, resulting in a reduction of 13% over the five-year period.

However, the sales of the highest-priority critically important antibiotics had increased significantly: those of fluoroquinolones increased by 27% and those of modern cephalosporins by 19% over the five years.

3.3. Decline in European veterinary antibiotics sales

Subsequently, the number of countries submitting farm antibiotic sales data to the EMA for the ESVAC reports increased. In total 31 countries now submit data annually, and 25 countries have done so each year since 2011 [7].

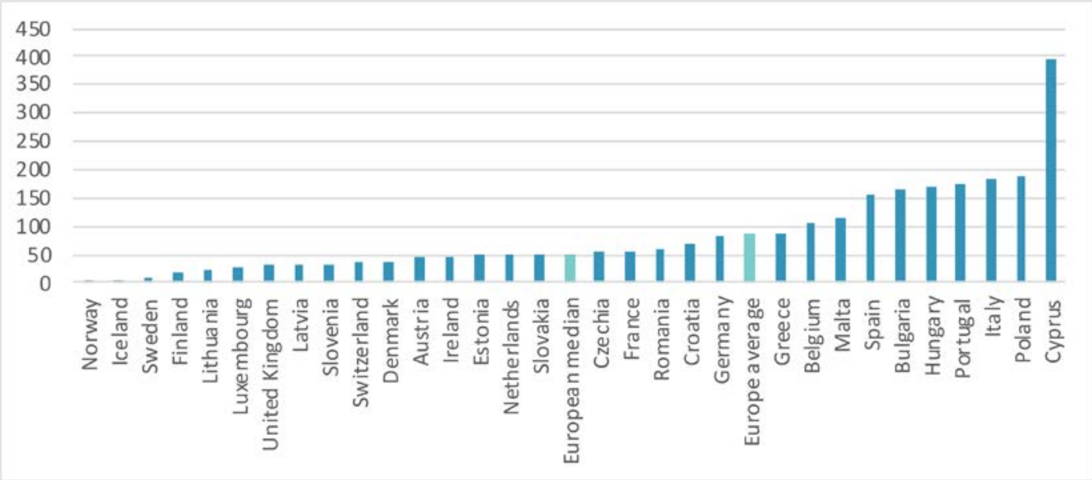
For these 25 countries, overall sales (in terms of mg of active ingredient per kg of PCU) have fallen by 43.2% between 2011 and 2020, although in 2020 sales increased by 6% in comparison with 2019.

Furthermore, there have been some reductions in the use of the highest-priority critically important antibiotics between 2011 and 2020, the fluoroquinolones (-12.8%) and the 3rd and 4th generation cephalosporins (-32.8%). Use of the last-resort antibiotic colistin has also fallen by 85.4%. Average farm use of colistin in 2020 was 2.5 mg/kg, and median use was just 0.8 mg/kg. However, the EU's policy of allowing continued colistin use in farming means that some countries still use colistin at a high level. This includes Cyprus (15.9 mg/kg), Portugal (11.7 mg/kg), Poland (9.1 mg/kg), Hungary (7.5 mg/kg), Germany (7.3 mg/kg) and Bulgaria (5.4 mg/kg).

Some countries have achieved large reductions in use, in terms of mg of active ingredient per kg of PCU, for example: Belgium (-43% since 2010), Czechia (-45% since 2005), France (-67% since 2005), Germany (-60% since 2011), Italy (-57% since 2010), Netherlands (-69% since 2007), Spain (-41% since 2010), United Kingdom (-58% since 2005). However, use has also increased in some countries such as Poland (+49% since 2011) or Greece (+55% since 2015). It should be noted that some of the data, in particular in the case of Greece, may have been unreliable in earlier years.

Despite these reductions, very large differences in usage per PCU remain between different countries. The lowest users tend to be Nordic countries, in particular Norway, Iceland, Sweden and Finland, where usage goes from 2.3 mg/kg to 16.2 mg/kg. On the other hand, the highest users are certain Mediterranean countries and some Central/Eastern European countries, in particular Cyprus, Poland, Italy, Portugal, Hungary, Bulgaria and Spain, where usage is between 393.9 mg/kg and 154.3 mg/kg. Figure 1 shows how antibiotic use varies by country.

Figure 1 Veterinary antibiotic use in Europe in 2020 (mg per kg of PCU) [7]



Some of the large differences in usage between the different countries are due to the different species being farmed. For example, in Norway there is a very large salmon-farming industry that has very low antibiotic use, and which brings average Norwegian use down to just 2.3 mg/kg. However, even when Norwegian usage is restricted to terrestrial animals, it remains very low at just 6.8 mg/kg [59].

Most of the differences between countries are in fact likely due to large differences in usage in each species. This will become clearer once Member States begin collecting data on usage in each species, as they will be required to do under the new Veterinary Medicines Regulation (see section 2.3.6.).

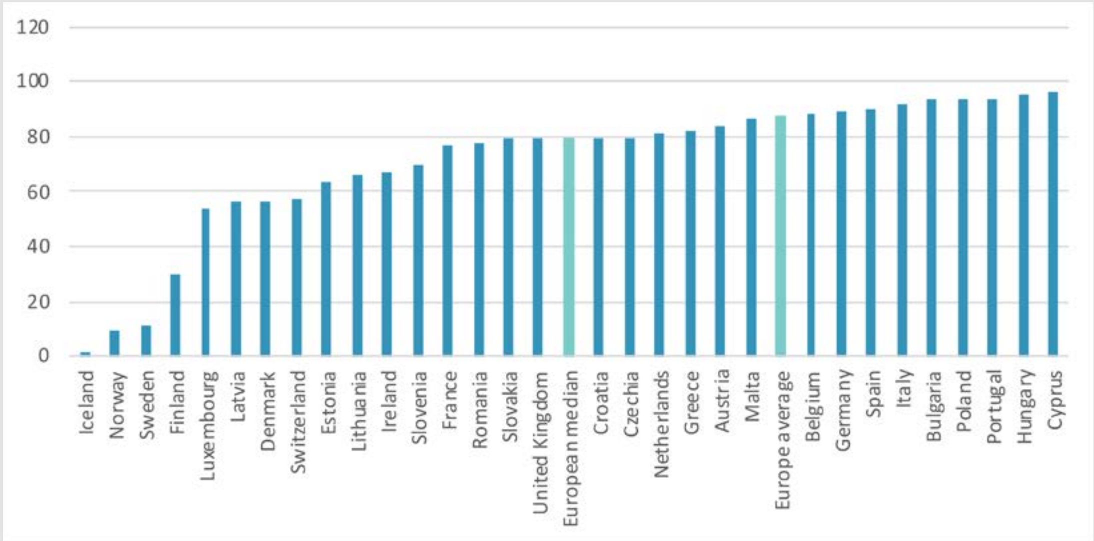
3.4. Percentage of European farm antibiotic sales that are for group treatments

The different approaches to using, and often overusing, antibiotics in livestock in Europe are evident from examining the percentage of antibiotics that are used for group treatments and the percentage used for individual treatments. Across the 31 countries, the percentage of antibiotics that were delivered as premixes (medicated feed), oral powders and oral solutions (used for top dressing feed or in drinking water) was 22.5%, 7.4% and 57% in 2020 [7].

According to the EMA these three types of treatments are overwhelmingly group treatments, which means that group treatments accounted for 86.9% of veterinary antibiotic sales in Europe in 2020.

However, Figure 2 shows that there are very large variations in the percentage of veterinary antibiotics being used for group treatments between the different countries. Whereas in Iceland, Norway and Sweden group treatments only account for 1.3%, 9.1% and 10.9% respectively, in Cyprus, Hungary, Portugal and Poland group treatments account for 96%, 94.9%, 93.7% and 93.4% respectively.

Figure 2 Percentage of veterinary antibiotics being used for group treatments in Europe in 2020 [7]



Comparing Figure 1 with Figure 2 we see that the countries with the lowest percentage of treatments as group treatments also tend to have the lowest level of total antibiotic use in animals. This is because more effort is being made in these countries to target antibiotic use at individual sick animals.

On the other hand, the countries with particularly high percentages of their veterinary antibiotic use being group treatments also tend to be particularly high overall users of veterinary antibiotics. A possible explanation for this is that these high users are relying on antibiotics as a routine preventative treatment and using these particularly important medicines as management tools, rather than as treatments that should be kept in reserve for when they are really needed.

There is unfortunately no breakdown given in ESVAC reports, or national reports on farm antibiotic use, of group treatments into those that are purely prophylactic and those that are metaphylactic, and in the scientific literature there is also very little information on this topic. However, one study, published in 2012, surveyed antibiotic use on 50 Belgian pig farms. It found that 49 of the 50 farms used group antibiotic treatments and that 93% of group antibiotic treatments were prophylactic, with just 7% being metaphylactic [60].

While farm antibiotic use in Belgium and in many European countries has fallen since this survey was carried out, it nevertheless suggests that group antibiotic use in some countries may be very largely dominated by prophylactic rather than metaphylactic use.

In contrast, six European countries have already banned prophylactic group treatments. These are Denmark, Finland, the Netherlands and Sweden, and two non-EU members, Iceland and Norway.

The countries with particularly high percentages of their veterinary antibiotic use being group treatments also tend to be particularly high overall users of veterinary antibiotics.

A possible explanation for this is that these high users are relying on antibiotics as a routine preventative treatment and using these particularly important medicines as management tools, rather than as treatments that should be kept in reserve for when they are really needed.

3.5. Total European antibiotic use in animals remains higher than in humans

Despite the decline in farm antibiotic use in Europe, overall antibiotic use in animals remains higher than in humans. The "joint inter-agency antimicrobial consumption and resistance analysis" (JIACRA) reports, jointly published by the EMA, the European Food Safety Authority (EFSA) and the European Centre for Disease Prevention and Control (ECDC), compare antibiotic use and antibiotic resistance in animals with that in humans [61].

The most recent JIACRA report shows that total veterinary antibiotic sales in 29 European countries accounted for 61.4% of all antibiotic sales in Europe in 2017, a reduction on the 70% figure found in earlier reports for 2012 and 2015. Taking total animal and total human biomass, or PCU, into account, use in animals in 2017 was higher at 130 mg/kg compared with 108.3 mg/kg in humans.

3.6. Statistical links between antibiotic use and resistance in farm animals and antibiotic resistance in humans

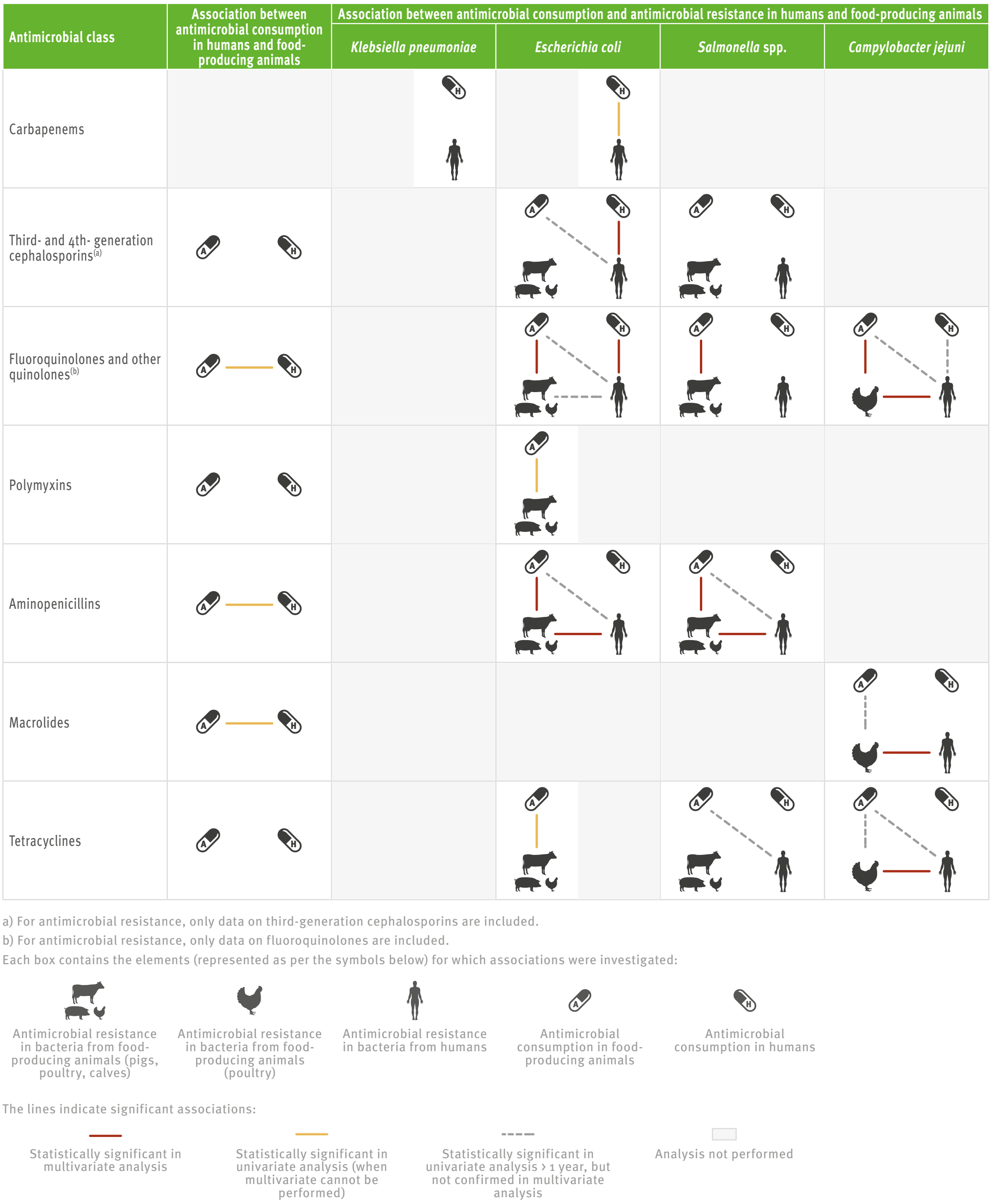
The EU's JIACRA reports also analyses antibiotic use in animals, antibiotic resistance in some bacteria from animals, antibiotic use in humans and antibiotic resistance in some bacteria humans, all by country, and then attempts to see if any statistically significant links can be established between these different quantities.

For the antibiotics licensed in farm animals, the JIACRA analysis focuses on *E. coli*, *Salmonella* and *Campylobacter* bacteria. Lack of data on antibiotic resistance, and inconsistent resistance data availability between different countries, means that sometimes the analysis can't be done or is inconclusive.

However, in some cases statistically significant links could be established. For *Campylobacter* and *Salmonella* the report found that there were more statistically significant links between resistance in humans and either antibiotic use in animals or resistance in animals, than there were between resistance in humans and antibiotic use in humans. *Campylobacter* is the most commonly reported foodborne illness in the EU and *Salmonella* is the second most commonly reported [62][63].

For *E. coli*, on the other hand, antibiotic resistance in humans was more often more strongly linked to antibiotic use in humans than to antibiotic use in animals (in particular for modern cephalosporins and fluoroquinolones), but this was not the case for aminopenicillin antibiotics.

Figure 3 Schematic overview of the potential associations between antimicrobial consumption and antimicrobial resistance in humans and food-producing animals (3rd JIACRA report [61])



3.7. Farm antibiotic use in Poland

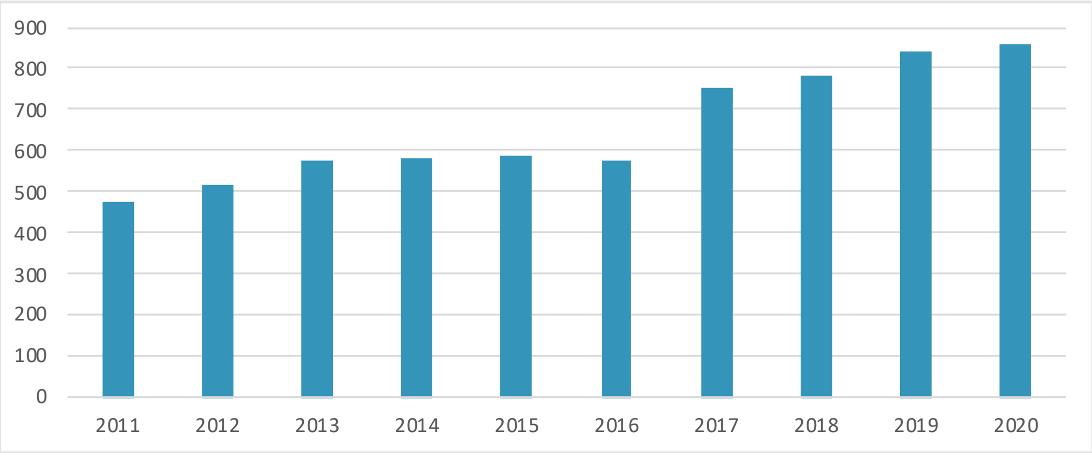
Poland is the second highest user of veterinary antibiotics per PCU out of 31 European countries, behind only Cyprus, see Figure 1.

Veterinary antibiotic sales in 2020 were 187.9 mg/kg, which is over twice as high as EU average (89 mg/kg) and nearly three times the European median (57 mg/kg) [7].

3.7.1. Increasing farm antibiotic sales in Poland

Unlike many other European countries, Poland does not publish its own reports on its farm antibiotic use. However it has submitted veterinary antibiotic-sales data for every year since 2011 to the EMA for the annual ESVAC reports. This data shows that Polish farm antibiotic sales are still on an increasing trend. Between 2011 and 2020, Polish veterinary antibiotic sales increased by 81%, from 472.9 tonnes of active ingredient in 2011 to 856.7 tonnes in 2020, see Figure 4.

Figure 4 Veterinary antibiotic sales in Poland 2011-2020 (tonnes of active ingredient) [7]



In 2020, Polish veterinary antibiotic sales, in terms of the total tonnage sold, was the second highest in Europe, behind only Spain. Polish veterinary antibiotic sales account for 15.4% of all veterinary antibiotics sales in the 31 European countries covered by ESVAC, even though Polish livestock only represent 7.3% of all European livestock (in terms of PCU).

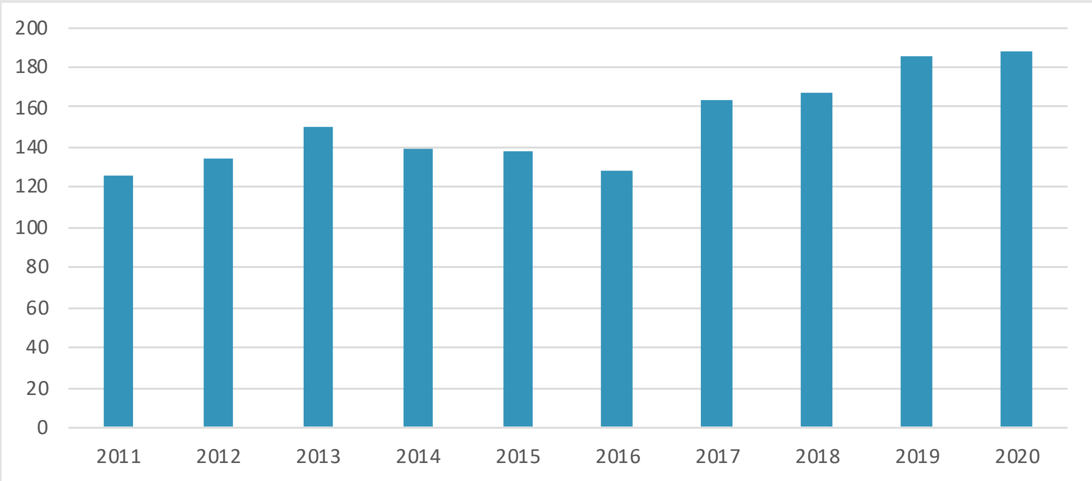
Part of the explanation for these increasing sales of veterinary antibiotics has been an increasing farm-animal population in Poland and therefore an increasing “population correction unit” (PCU) [58], the unit the EMA uses to measure the size of a livestock population being treated with antibiotics, which takes into account imports and exports of live animals. Total Polish PCU has increased from 3,929,000 tonnes in 2011 to 4,542,000 tonnes in 2020 [7].

The poultry population has increased sharply, with the poultry PCU increasing by 91% since 2011. Poland is now the EU’s largest producer of poultry meat [64].

On the other hand, there has been a decrease in the pig PCU (-12%) since 2011, due to an ongoing outbreak of African Swine Fever, which began in 2014 [65]. Cattle numbers have remained stable.

However, the increasing overall size of the farm-animal population is not the only reason for the increasing veterinary antibiotic sales. Sales per PCU have also increased by 48.8% between 2011 and 2020, see Figure 5.

Figure 5 Veterinary antibiotic sales per PCU in Poland 2011-2020 (mg/kg) [7]



In 2015, the Ministry of Agriculture and Rural Development of the Republic of Poland developed a strategy to combat antimicrobial resistance. The strategy covered issues such as the prudent use of antibiotics by veterinarians, monitoring antibiotic resistance and improving the system for collecting data on sales of veterinary medicines. This has resulted in improvements quality of the antibiotics sales data submitted from 2017 onwards [66]. However, despite this plan, the widespread overuse of antibiotics in Polish farming continues.

In 2018, an investigation by the Polish Supreme Audit Office found that antibiotics were widely used in Polish livestock, including in particular in chickens raised for meat (broilers) and in turkeys. The Audit Office said in its report that the scale of the use raised concerns [67]. Also in 2018, the Polish Chief Veterinary Officer warned farmers against inappropriate antibiotic use and said that any farmers using antibiotics illegally could face serious consequences, including financial losses [68]. Despite this warning, Polish farm antibiotic use has continued to grow, reaching record levels in 2019 and 2020.

According to the latest EU JIACRA report, animals account for 72% of antibiotic sales in Poland, compared with just 28% going to humans. Furthermore, as mentioned in section 3.4, approximately 93.4% of Poland's veterinary antibiotic use is used for group treatments, a particularly high percentage. This very heavy reliance on group treatments suggests that in Poland antibiotic use is not sufficiently targeted and is instead being used as a management tool. Unfortunately, there is no data on antibiotic use by species in Poland, which means it is not possible to say where use is highest.

3.7.2. Very high veterinary use of highest-priority critically important antibiotics in Poland

In addition to high overall use of antibiotics in Polish animals, the use of the highest-priority critically important antibiotics is also well above average, see Table 1.

Table 1 Use of all antibiotics and of highest-priority critically important antibiotics in veterinary medicine Poland and Europe in 2020 (mg per kg of PCU) [7]

	Poland	European average	European median
3rd & 4th gen cephalosporins	0.38	0.2	0.2
Fluoroquinolones	12.92	2.3	1.1
Polymixins (colistin)	9.12	2.5	0.8
All antibiotics	187.9	89	51.9

Polish veterinary use of fluoroquinolones, in terms of mg per kg of PCU, is the highest of the 31 countries included in the ESVAC reports, and is over five times higher than the European average and over 10 times higher than the European median. Over 90% of fluoroquinolone use is for group treatment in Poland. Furthermore the use of colistin is the third highest in Europe (after Cyprus and Portugal).

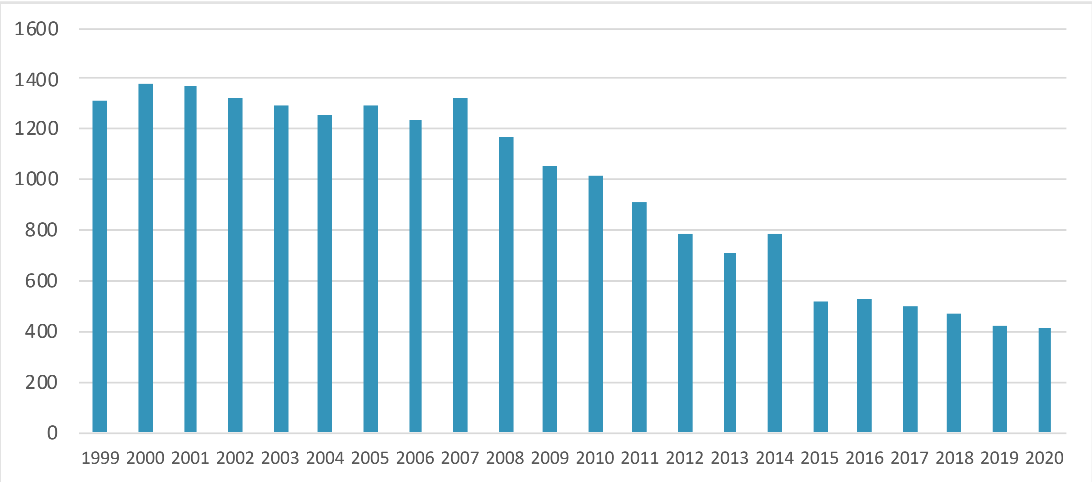
3.8. Farm antibiotic use in France

Sales of veterinary antibiotics in France are the 14th highest out of 31 European countries, see Figure 1. In 2020, French sales of veterinary antibiotics were 56.6 mg/kg, below the European average of 89 mg/kg but slightly above the European median of 51.9 mg/kg. Veterinary antibiotic use is estimated to account for approximately 39% of all antibiotic use in France [61].

3.8.1. Reduction in overall farm antibiotic use in France

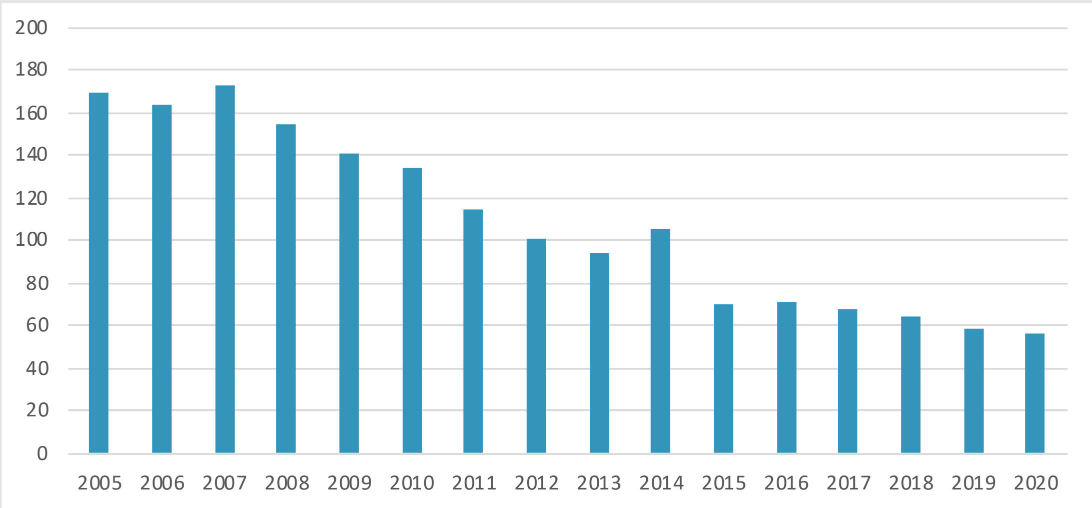
In addition to submitting annual sales data to the EMA for the ESVAC reports, the French Agency for Food, Environmental and Occupational Health & Safety (Anses) also produces its own annual report on its veterinary antibiotic sales [69]. Anses data shows that, at the beginning of the century, French veterinary antibiotic sales were very high. However, since 2008, sales have been on a decreasing trend. In 2020, sales were 69% lower than in 2007, see Figure 6.

Figure 6 Sales of veterinary antibiotics in France (tonnes of active ingredient) 1999–2020 [69]



Some of the reduction in the overall tonnage of antibiotics used can be explained by a 7% reduction in the overall farm-animal population (measured in tonnes of PCU) between 2007 and 2020. However, a large majority of the reduction is due to a cut in usage per PCU, see Figure 7.

Figure 7 Veterinary antibiotic sales per PCU in France 2005–2020 (mg/kg) [7]



As Figure 7 shows, French farm antibiotic sales have also been falling nearly each year since 2008. There was a significant increase in 2014, but this is believed to have been linked to increased stockpiling of antibiotics in 2014, rather than increased usage [69]. A law introduced in October 2014 (n°2014-1170) made it illegal to offer discounts on the sales of antibiotics from the 1 January 2015. The purpose of the law was to try and reduce overall farm antibiotic sales, but the immediate, short-term effect was to increase sales while discounts and offers were still available. The stockpiles that were built up in 2014 were then used up in 2015, which meant that usage in 2015 was probably higher than indicated by raw sales data.

Approximately 76.5% of French veterinary antibiotic use is for group treatments, primarily in drinking water (44.2%) or as medicated feed (32.2%). This percentage is below the European median (79%) and the European average (86.9%), but it remains far higher than in the Nordic countries Iceland, Norway, Sweden and Finland, see Figure 2 in section 3.4. When a large majority of farm antibiotic use is used for group treatments, as is the case in France, this shows that antibiotic use is still not sufficiently targeted. It also suggests that further, large cuts in French farm antibiotic use should be achievable if the new regulations, banning all forms of routine antibiotic use, are fully implemented.

3.8.2. Veterinary antibiotic sales by animal species in France

French farm antibiotic data is currently based on sales data collected from the pharmaceutical industry, rather than on usage data collected directly from farms, veterinary practices or veterinary pharmacies. Sales data can be difficult to segregate by species, because many veterinary antibiotic products are licensed for use in more than one species. However, the French authorities require the pharmaceutical companies to provide estimates of the usage by species of the different products they sell, and from this data Anses derives estimates for all veterinary antibiotic use by species.

Using data in the Anses reports and the ESVAC reports, it is possible to present the estimated antibiotic use by species in four different ways:

- Tonnage of antibiotic used (this is given in the Anses reports)
- Weight of antibiotic per total liveweight of species (this is given in Anses reports)
- Weight of antibiotic per weight of PCU (using Anses data for antibiotic use and ESVAC PCU data).
- Animal Level of Exposure to Antimicrobials (ALEA). The ALEA is given in the Anses reports.

The weight of antibiotic per weight of PCU is usually higher than the weight of antibiotic per total live-weight. This is because the PCU of a species is a theoretical measurement that attempts to estimate the total average weight of the animals at the point of treatment. Since most antibiotic treatments occur with younger animals, the PCU of a species is usually lower than its live-weight. It is useful to also give usage in terms of usage per kg of PCU, even though this is not in the Anses reports, as this enables easier comparisons to be made with other European countries using this method.

To calculate the ALEA, the estimated total live-weight treated during the year by a full course of antibiotics is divided by the total live-weight in that species. It is important to note that if the ALEA is below 1, this does not mean that on average animals in that species received less than one full course of antibiotics during the year. This is because in many species antibiotic use tends to be much higher in younger, and therefore lighter, animals. The ALEA only includes oral and parenteral treatments (by injection) and does not include intramammary treatments (which are widely used in dairy farming).

Table 2 Estimated antibiotic use by food-animal species in France in 2020 [7][69]

	Cattle	Pigs	Poultry	Sheep/Goats	Rabbits
Tonnage (tonnes)	117.47	133.06	69.44	32.74	30.24
Use per live-weight (mg/kg)	13.42	47.1	33.11	58.21	390.02
Use per PCU (mg/kg)	38	73	64	51	775
ALEA	0.255	0.491	0.358	0.363	1.91

Table 2 shows that, in terms of total tonnage used, antibiotic use is highest in pigs, followed by cattle and then poultry.

However, in terms of antibiotic used per PCU, antibiotic use in rabbit farming is by far the highest, over ten times higher than in pigs, the species with the next highest use. Poultry is the next highest user, with antibiotic use per PCU being lowest in cattle.

Similarly, when measured using ALEA, rabbits have by far the highest level of use, about four times higher than pigs, the next highest-using species. Sheep/goats and poultry, are the highest users, with use in cattle again the lowest (although intramammary treatments are not included).

There have been significant reductions in all species over the past 10-15 years. Table 3 shows the reductions in terms of antibiotic per PCU since 2007 when overall French veterinary antibiotic use per PCU was at its highest.

Table 3 Antibiotic use per PCU by species in France in 2007 and 2020 (mg/kg) [7][69]

	Cattle	Pigs	Poultry	Sheep/Goats	Rabbits
2007	71	349	125	61	2538
2020	38	73	64	51	775
Reduction	-46%	-79%	-49%	-16%	-69%

The largest decrease in percentage terms has been in the pig industry, although use remains significantly higher than in some other European countries (see section 4.3.7.). There has also been a large fall in use in rabbits, although from an extraordinarily high usage level. Despite the fall, use remains extremely high in rabbits. In sheep and goats the reductions have been the smallest.

Table 4 Antibiotic use by species in ALEA in 2009 and 2020 [69]

	Cattle	Pigs	Poultry	Sheep/Goats	Rabbits
2009	0.33	1.16	1.43	0.79	3.9
2020	0.255	0.491	0.358	0.363	1.91
Reduction	-23%	-58%	-75%	-58%	-51%

In terms of ALEA, the largest reductions since 2009 have been in pigs, poultry and sheep/goats, see Table 4. Reductions in terms of ALEA have continued in pigs and poultry in recent years, but the ALEA for rabbits has been slowly increasing since 2017 (+8%) and has been relatively stable in cattle since 2016 (+3%).

3.8.3. Reductions in the veterinary use of highest-priority critically important antibiotics in France

In October 2014, a new law, "La loi d'avenir pour l'agriculture, l'alimentation et la forêt" (n° 2014-1170), introduced a target for reducing the veterinary use of fluoroquinolones and 3rd and 4th generation cephalosporins [70]. The target was to reduce the veterinary use of these antibiotics by 25% by the end of 2016, with 2013 used as a reference year.

Furthermore, a decree was introduced in March 2016 that put in place new restrictions on the veterinary use of fluoroquinolones and 3rd and 4th generation cephalosporins. These antibiotics are now no longer permitted to be used preventatively, and any prescription for their use can only occur after clinical examination of the animals and only after sensitivity testing has shown that less important antibiotics would not be effective.

These measures have led to very large reductions in the use of these antibiotics, which greatly exceed the 2014 targets. By 2020, the veterinary use (including use in companion animals) of fluoroquinolones was down by 87% since 2013 and that of 3rd and 4th generation cephalosporins was down by 94% [69].

French veterinary use of the last-resort antibiotic colistin has also fallen very significantly, down by 75% since 2011 [69].

Table 5 Use of all antibiotics and of highest-priority critically important antibiotics in veterinary medicine France and Europe in 2020 (mg per kg of PCU) [57]

	France	European average	European median
3rd & 4th gen cephalosporins	0.015	0.2	0.2
Fluoroquinolones	0.1	2.3	1.1
Polymixins (colistin)	1.37	2.5	0.8
All antibiotics	56.6	89	51.9

Table 5 shows that French veterinary use of the fluoroquinolones, 3rd and 4th generation cephalosporins and colistin are all well below the European average and the European median. French policies aimed at reducing the use of the antibiotics, including in particular the 2016 decree banning preventative use and requiring sensitivity testing for the first two families of antibiotics, have clearly had a major positive impact.

Use of the fluoroquinolones and 3rd and 4th generation cephalosporins could, and should, be made even more responsible by ending all forms of group treatments with these antibiotics. This would also end the use of fluoroquinolones in poultry (since all antibiotic treatments in poultry are group treatments). The use of fluoroquinolones in poultry is a major contributor to fluoroquinolone resistance in human *Campylobacter* infections and should be ended (see section 2.3.7.).

While the use of colistin has been cut very significantly in recent years, it is still the most widely used antibiotic in the poultry industry [69]. Furthermore, in broilers and egg layers it is being used off-label as it is only licensed to be used in turkeys [42].

All veterinary use of colistin, which is used as a last-resort antibiotic in human medicine, should be ended. European countries such Finland, Iceland and Norway have already eliminated all use of colistin and the UK has also achieved very close to zero use. This demonstrates that France too could eliminate colistin use completely.

3.8.4. The Ecoantibio plans

In late 2011, the French government's Ministry of Agriculture, Agro-Food and Forestry published a strategy aimed at reducing the risk to human health of antibiotic resistance caused by the veterinary use of antibiotics. It also aimed to preserve antibiotics for the future, given the poor prospects for antibiotic discovery.

The strategy, the "Plan Écoantibio 2012-2017", set a target to reduce veterinary antibiotic use, measured in ALEA, by at least 25% over the five-year period 2011-2016. It aimed to achieve this reduction by focusing on good husbandry, improving regulation, raising awareness, improving training, developing alternatives to antibiotics and by working internationally including in particular at a European level.

The 25% reduction target was achieved and surpassed: when measured in ALEA, veterinary antibiotic sales fell by 37% over the five-year period.

In May 2017 a second strategy was launched, "Écoantibio 2: plan national de réduction des risques d'antibiorésistance en médecine vétérinaire (2017 - 2022)".

It contains a target to reduce the use of colistin in cattle, pigs and poultry by 50% over a five-year period, with the average use in 2014 and 15 in terms of ALEA used as a base value. However, the target for colistin use reduction had already been achieved by the time that Écoantibio 2 was published. The plan does not contain any other targets for overall antibiotic reduction, although it does contain some targets for reducing antibiotic resistance.

The Écoantibio 2 aims to achieve more responsible, and reduced, veterinary antibiotic use through means other than regulation. The four key areas of focus in the plan are:

- **Prevention:** Prevent the emergence and transmission of infections through good biosecurity and good husbandry. Take account of France's decision to move to agroecological farming. Provide alternative treatments and encouraging vaccination.
- **Communications:** Improve communications and raise of awareness. Improve education.
- **Evaluation:** Improve surveillance of antibiotic resistance, develop diagnostics, produce and disseminate good-practice guides, produce better tools for evaluating the impact of antibiotic reductions.
- **International:** Ensure that current rules on antibiotic prescribing and use are adhered to. Work at a European level including ending inappropriate preventative use. Ensure that animals and food products imported into Europe meet European standards. Promote French positions globally including a ban on antibiotic growth promotion.

The French Écoantibio plans, and the efforts by farmers and vets to reduce antibiotic consumption, have clearly helped deliver significant reductions in French veterinary antibiotic use. Despite this, further large cuts in use are still achievable since, as explained in Chapter 4 (section 4.2.2.5. and section 4.3.7.), use in pigs and poultry in France remains far higher than in some other countries.

Furthermore, while good husbandry conditions and good hygiene are promoted within the plan as key to reducing disease incidence and spread, there are few specific goals and insufficient details regarding the kind of husbandry that is currently at fault for causing disease and excessive antibiotic use. Intensive production systems, with high stocking densities (i.e. high numbers of animals per area) that clearly enable more disease transmission and result in poor hygiene, are not criticised nor deemed unsustainable.

Écoantibio 2 refers to France's "Agroecology Project", which was launched in 2012 and aims to transform production systems so that they combine economic, social and environmental performance [71]. The objective of the French project is to roll out agroecology from a small number of ground-breaking pioneers to a commitment to agroecological farming by a majority of French farmers. Écoantibio 2 says that in order to minimise disease, agroecological animal husbandry conditions should be promoted. The Agroecology Project's commitment to rethinking production systems is welcome, as is the support for this project in Écoantibio 2. Unfortunately, there is still no clear commitment to phasing out production systems, such as intensive pig, poultry, veal and rabbit farming, which are all clearly inconsistent with agroecology.

4. Reducing farm antibiotic use through improved husbandry

4.1. Cheap meat or a One Health approach?

Worldwide it is estimated that approximately 66% of all antibiotic use occurs in farm animals [72], and even in Europe over 60% of antibiotics are used in animals [61]. Although industry lobbyists often deny that there is a link between farming system and the level of antibiotic use [73], it is in fact well known that the global growth of intensive farming has led to this widespread reliance on routine antibiotic use in livestock, for growth promotion or for disease prevention [74].

The introduction of antibiotic growth promoters to European livestock production in the 1950s was a major contributing factor to the growth of intensive livestock systems [75]. The legalisation of the practice of feeding regular low doses of antibiotics to animals, for growth promotion or disease prevention, meant that the spread of infections in densely housed populations could now be controlled.

Keeping large numbers of animals entirely indoors lowered land and labour costs and helped bring about much cheaper meat. This in turn led to huge increases in consumption and production, particularly in rich, developed countries where intensification was more advanced. Globally, per capita consumption of pig meat has doubled since the early 1960s and that of chicken meat has increased fivefold [76]. Cattle and sheep, when raised on pasture, do not generally respond as well to oral dosing with antibiotics because it inhibits their ability to digest grass. However, calves raised for white veal are fed on predominantly liquid diets and kept in intensive conditions can receive extremely high levels of antibiotics [77][78].

In an article published in 2018 about the global history of antibiotic use in food production, Dr Claus Kirchhelle of Oxford University describes how countries in Europe and around the world have repeatedly failed in their attempts to reduce antibiotic use and to achieve responsible use through adequate regulation, referring to past ineffective actions as a "history of failure" [75]. European bans on antibiotic growth promotion, for example, were largely circumvented by increasing antibiotic use for disease prevention (see section 3.1.) and outside of Europe many countries continue to use antibiotic growth promoters to this day.

Kirchhelle argues that "Probably the most important reason for this story of failure is that many countries have historically favoured reliable access to cheap meat over broader agricultural and antibiotic reform". He also says that "Historically, the international patchwork of regulations has been a major obstacle for effective antibiotic stewardship" and that there has been a "lack of enthusiasm when it comes to enforcing regulations or supporting further reform".

Kirchhelle says that one of the key lessons for regulators is that international cooperation and global actions against antibiotic misuse in farming are required.

However he warns that "Without challenging the ideals of factory-like production and cheap protein that are still driving antibiotic use, current reforms will have limited success".

Unfortunately, there are still mixed messages coming from governments and the EU regarding the links between poor husbandry, poor animal health and welfare, and the overuse of antibiotics.

On the one hand, many governments now say they endorse taking a "One Health" to antibiotic resistance. This is an approach that recognises that the health of people is closely connected to the health of animals and our shared environment [79]. The rise and spread of antibiotic resistance

Implementing this regulation correctly, will require any farms that currently have poor hygiene or inadequate animal husbandry to make important improvements to their farming systems.

However, there is currently little awareness of the importance of Article 107.1 and it does not appear that the governments have been adequately helping their farmers to prepare for full compliance.

is widely seen as a One Health issue, since antibiotic resistance can spread between humans, animals and the environment and because the overuse of antibiotics is often linked to poor health.

The preambles of the new regulations 2019/6 on Veterinary Medicinal Products and 2019/4 on Medicated Feed mention that the EU is taking a One Health approach to tackling antibiotic resistance, and that the World Health Organization (WHO) and the World Organization for Animal Health (OIE) both support a One Health approach too [5][6]. Furthermore, both the European Council and the European Parliament support this approach [6]. Governments therefore accept, or claim to accept, that a failure to achieve good animal health can lead to poor human health, and in particular to higher levels of antibiotic resistance.

Unfortunately, despite this recognition of the importance of good animal husbandry and animal health, there is still little hard evidence that countries are moving away from intensive livestock systems and attempts to produce protein as cheaply as possible.

The latest EU attempts to tackle antibiotic misuse do offer more cause for optimism than earlier flawed European regulations that allowed routine antibiotic use to continue under veterinary prescription. Regulation 2019/6 on Veterinary Medicinal Products clearly bans all forms of routine antibiotic use and prohibits using antibiotics to compensate for poor husbandry. Article 107.1 states that (see section 2.3.1.):

> “Antimicrobial medicinal products shall not be applied routinely nor used to compensate for poor hygiene, inadequate animal husbandry or lack of care or to compensate for poor farm management.”

This article is suggesting, correctly, that poor hygiene and inadequate animal husbandry can at present be compensated for through excessive and irresponsible antibiotic use. Implementing this regulation correctly, therefore, will require any farms that currently have poor hygiene or inadequate animal husbandry to make important improvements to their farming systems.

However, there is currently little awareness of the importance of Article 107.1 and it does not appear that the governments have been adequately helping their farmers to prepare for full compliance. It therefore seems likely that once the new regulations will start to apply, certain husbandry practices linked to high antibiotic use may continue, which would be in breach of Article 107.1.

A failure to properly implement the new legislation should not be deemed acceptable. Instead government and EU farm policies and regulations should support and enable a transition to much more sustainable forms of livestock farming, where animals have good health and welfare and do not need routine antibiotic use or rely on excessive use of other forms of medication. The historical commitment to cheap animal foods must also be abandoned, or else the misuse of antibiotics to support low husbandry standards is likely to continue, despite becoming illegal.

The European Commission, in collaboration with Member States, is planning to establish a European One Health antimicrobial-resistance research programme, as part of its Horizon Europe funding programme [80]. This is a welcome development, but the need for ongoing research should not be used as a reason for not taking action now, when there is already clear evidence that improving husbandry can reduce the need for antibiotics.

Although there is unfortunately still a lack of antibiotic usage data by species and by farming systems, there is already clear evidence that certain practices are associated with higher levels of animal disease and of antibiotic use. In the remainder of this report examines the poultry and pig industries in greater detail, and focuses in particular on those husbandry practices most linked with good or bad animal health, and with low or high levels of antibiotic use.

4.2. Reducing antibiotic use in poultry production

Poultry meat is the second most produced and consumed meat in the European Union, after pig meat [81][82]. In 2020, EU production reached 13.6 million tonnes, an all-time high and an increase of 2.6% compared with 2019. In 2020, the main poultry meat producers in the EU were Poland (19.8 % of total production), Spain (12.6 %), France (12.3 %), Germany (11.9 %) and Italy (10.2 %). Among these key producers, production levels rose in Poland (+4.0 %), Germany (+1.8 %) and Italy (+1.7 %), stabilised in Spain (+0.2 %) but declined in France (-1.3 %) [81].

Chicken meat production is by far the largest sub-sector of the poultry meat production chain, followed by turkey and duck. France is by far the greatest producer of duck meat, accounting for around 50 % of total EU production in 2014 (mainly meat and foie gras) [82].

EU chicken meat production is dominated by highly intensive production. It is estimated that 90% of broilers (i.e. chickens raised for meat) are kept in intensive systems. Intensive chicken-meat production is indoor production, with high stocking densities, and the use of very fast growing breeds obtained by genetic selection.

On the other hand, alternative chicken production systems only account for about 10% of European production: around 5% of EU production occurs in less intensive systems where slower-growing birds are raised indoors with lower stocking densities, 5% is free-range production and about 1% is organic [82]. Free-range and organic production also use slower-growing breeds.

France is the largest producer of organic chicken meat, accounting for about 35% of EU production [82]. Another example of alternative broiler production is 'Label Rouge' in France, which is characterised by a slow-growing breed, a low indoor stocking density and access to an outdoor area. In France, about 12 % of all broilers have access to an outdoor run [82].

A number of key husbandry factors are believed to have an important impact on chicken health and welfare. These include genetics, stocking density, diets and access to the outdoors. Below we discuss these issues and show how improvements in these key areas would result in improvements to animal health and to reductions in reliance on antibiotic use.

However, it is also worth noting that the poultry industry may attempt to reduce its use of medically important antibiotics without significantly improving its husbandry practices by, at least partly, relying on routine medication with ionophore antibiotics, which are not covered by the new legislation. Reductions in antibiotic use in the UK poultry industry appear to be an example of this kind of approach.

4.2.1. Routine use of ionophore antibiotics may be used to replace use of some medically important antibiotics

In addition to the use of medically important antibiotics, the chicken industry often relies on routinely adding coccidiostats, including the non-medically important ionophore antibiotics (see section 2.5.), to chicken feed. Even though ionophores are antibiotics, they are not included in the antibiotic sales data published by most European countries or in the EMA's ESVAC reports. The overall use of ionophores, however, is likely to be very high in many European countries.

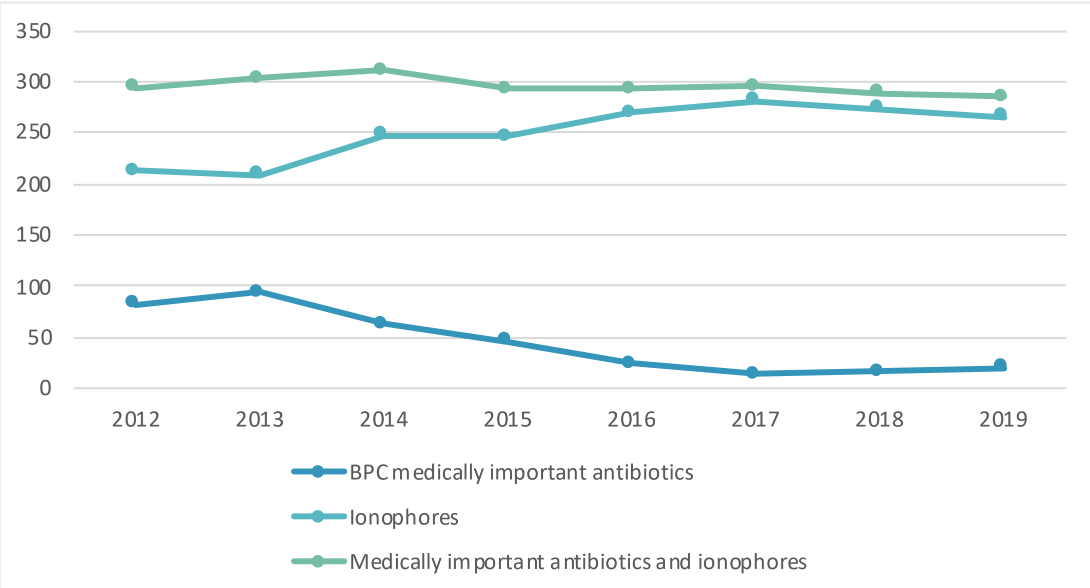
Most countries do not report their use of ionophores, but in the UK data on ionophore use is available via Freedom of Information requests, and this shows that in 2019 ionophore use was 265 tonnes of active ingredient [83]. This greatly exceeds the 20–30 tonnes of medically important antibiotics used in poultry in the UK in 2019, and even exceeds the 232 tonnes of medically important antibiotics that were used in all animal species in that year [84]. In Finland, ionophore use is reported, and in 2020 total use was 20.8 tonnes, which also exceeds the 8.9 tonnes of medically important antibiotics used in all species [85].

While ionophores are only licensed to control coccidiosis in poultry, it is also well known that they help control the intestinal infection necrotic enteritis in chickens [86], and this is partly why ionophores are more widely used than non-antibiotic coccidiostats. Necrotic enteritis, caused by *Clostridium perfringens* bacteria, is one of the most important intestinal diseases in poultry and is a high cost to the intensive industry worldwide. Some medically important antibiotics are licensed to prevent or treat the infection [87]. So in practice the widespread use of ionophores in intensive production can, to some extent, replace the use of other antibiotics, even though ionophores are not specifically licensed to control necrotic enteritis.

One method that European poultry producers may use to reduce their use of medically important antibiotics could be to increase their use of ionophores, particularly since ionophores are not counted in official statistics. This can happen despite concerns which already exist about the overuse of ionophores (see section 2.5.).

In the UK, the British Poultry Council (BPC), which represents about 90% of the poultry-meat sector (chickens, turkeys, ducks and geese), cut its use of (medically important) antibiotics between 2013 and 2017 by about 85%, from 94 tonnes of active ingredient to 14 tonnes. However, during the same period it increased its use of ionophores from 209 tonnes to 281 tonnes, so that overall antibiotic use barely changed. Figure 8 shows the trend in antibiotic use in British poultry.

Figure 8 Use of medically important antibiotics by the BPC and ionophore sales in poultry, 2012 to 2019 [83][88]



The use of ionophores remains extremely high in UK poultry production: 265 tonnes were used in 2019, which means that use was about 220 mg per kg of PCU. This very high level of routine medication is due to the ongoing health problems of many intensively farmed chickens. It suggests that the reduction in the use of medically important antibiotics in the British poultry industry has been achieved without significantly improving animal health or husbandry practices.

It is likely that if the British poultry industry were to implement changes actually aimed at improving animal health, further large reductions in use could be achieved.

It is also important to note that coccidiosis can be controlled or avoided in poultry without routinely using ionophores or other coccidiostats. In organic farming, the use of coccidiostats is not permitted, and poultry farmers limit coccidiosis through good husbandry, notably by rotating pasture to ensure that there is no build-up of coccidia or of other parasites.

Furthermore, vaccines which help prevent coccidiosis are available. However, because coccidiosis vaccines do not have a protective effect against necrotic enteritis [89], and because they tend to be more expensive than using coccidiostats, most intensive poultry producers tend to prefer to rely on using coccidiostats, including in particular the ionophores.

4.2.2. Ending the overuse of antibiotics in poultry production through improvements in husbandry

Protecting animal health and welfare has long been a concern of various alternative, less intensive certification systems, such as organic production, free-range production in the UK, Label Rouge in France or Beter Leven in the Netherlands. Many of these systems focus on similar aspects of husbandry, in the belief that these are key to delivering good health and welfare. Factors such as good genetics, lower stocking density, appropriate diets, access to the outdoors and the provision of sufficient enrichment materials are all viewed as essential. There is also now increasing evidence that improving these aspects of chicken farming can help significantly reduce antibiotic use.

4.2.2.1. Using slower-growing breeds

In intensive production systems, chickens are genetically selected for fast growth, in order to achieve the target live weight of 2-2.5 kg in 35 to 45 days [89]. In Ireland chickens are slaughtered when aged just 32–35 days, but the average slaughter age for the EU is roughly 38–40 days [90]. Nowadays, standard broilers reach 1.5 kg body weight in less than 30 days whereas 120 days were needed in the 1950s [89].

The European Food Safety Authority has identified this quadrupling of the growth rate as being a major factor adversely affecting chicken welfare [89][90]. Furthermore, the higher demand for breast meat rather than legs has led to genetic selection for more breast meat, which is now over 60% higher per bird than in the 1950s [91][92].

Unfortunately, it is well known that this rapid growth negatively impacts the welfare of broilers. Common issues include leg deformities and lameness, ascites, sudden death syndrome, metabolic problems and higher mortality [89][90]. Research has shown that, when kept in conditions representative of commercial farms, slower-growing breeds had significant welfare improvement: not only did they have better health, they also demonstrated more behaviour indicative of better welfare [93][94].

There is also now some clear evidence from the Netherlands that slower-growing breeds have far fewer antibiotic treatments.

Since 2012, a campaign lead by an animal-welfare group, Wakker Dier, has highlighted the plight of fast-growing chickens, which they refer to as “plofkip” (exploding chicken) [95]. By raising public awareness of the issue, the NGO managed pressure supermarkets into committing to selling more expensive, slower-growing birds. However, the standard the supermarkets have mainly adopted has a minimum slaughter age of 45 to 49 days, rather than the 56 days for which Wakker Dier had been campaigning.

The Dutch supermarket’s switch to slower-growing breeds, at least for their fresh meat (campaigners say that supermarkets still sell snacks using fast-growing breeds [96]) means that farms using slower-growing breeds are now the most common production system in the Netherlands [97]. Conventional fast-growing breeds are still used by the Dutch chicken industry for food service (restaurants and catering) and for the large Dutch export industry.

In the Netherlands antibiotic usage data, not just sales data, is collected and published by species by the Netherlands Veterinary Medicines Institute (SDa) [97]. In the case of chickens, the SDa publishes data separately for slower-growing and fast-growing breeds. This shows that in 2020 antibiotic use per animal was over six times higher for the fast-growing birds, see Table 6.

Table 6 Antibiotic use in fast and slow-growing chickens in the Netherlands in 2020 (defined daily dose animal[4]) [97]

Farms with fast growing chickens			Farms with slower-growing chickens		
	Number farms	Average use		Number farms	Average use
2016	570	12.3	**2016**	461	3.6
2017	487	13.9	**2017**	493	4.1
2018	498	14.3	**2018**	475	3.6
2019	455	13.1	**2019**	471	2.3
2020	394	13.4	**2020**	525	2.1

In a further success for animal-welfare campaigners, during 2021, all Dutch supermarkets announced that by 2023 all fresh chicken they sold would meet the “Beter Leven” (Better Life) one-star standard [98]. This requires the use of slow-growing breeds, and the chickens cannot be slaughtered before 56 days. It also requires a significant lowering of the maximum stocking density to 25 kg of chicken per square metre, compared with the maximum legal stocking density in the Netherlands of 42 kg/m^2, and birds also have access to a covered outdoor area [99].

Other higher-welfare certification systems also have minimum slaughter ages or require the use of slower-growing breeds. Minimum legal slaughter ages established by EU legislation exist for certain types of production system see Table 7.

4 The defined daily dose animal is gives the amount of antibiotics used at a particular livestock farm. It is determined by first calculating the total number of treated kilograms at a particular livestock farm for a specific year, and then dividing this number by the average number of kilograms of animal present at the livestock farm concerned.

Table 7 Minimum legal slaughter age for chickens in alternative production systems in EU [89]

Production system	Minimum slaughter age
Extensive indoor	56
Free-range	56
Traditional free-range	81
Free-range, total freedom	81
Organic	70–81

Furthermore, Label Rouge in France has a minimum slaughter age of 81 days [100].

In view of the clear evidence that an excessively high growth rate damages chicken health and welfare, and also leads to increased use of antibiotics, in order to comply with the new Veterinary Medicines Regulation, Member States should require the use of slower-growing birds. A minimum legal slaughter age should be introduced, which should be set at least at 56 days.

4.2.2.2. *Reducing stocking density*

“Stocking density” is a measure of the average amount of livestock per area of farm space. The baseline maximum permitted EU stocking density for standard broilers is 33 kg of chicken per square metre. However, a derogation allows for a 39kg/m^2 stocking density so long as a certain number of conditions are met, including keeping ammonia (NH3) in the air below 20 parts per million (ppm), avoiding excessive temperatures and humidity levels, and the keeping of relevant documentation.

A further derogation allows for stocking densities up to 42 kg/m^2, so long as mortality is kept below a particular level. A Member State’s authorities can also allow farms to stock at 42 kg/m^2 even when mortality is excessive, so long as the farmer has provided “sufficient explanation for the exceptional nature of a higher daily cumulative mortality rate or has shown that the causes lie beyond his sphere of control” [101].

The existence of EU rules on maximum stocking densities is due to a recognition that cramped conditions adversely affect animal welfare, increase animal stress and enable easier spread of infectious disease. However, the two derogations effectively permit very high stocking densities to be used in practice.

To give sense of how densely stocked chicken sheds are on intensive farms, it is worth comparing the average space per bird with an A4 sheet of paper. The area of an A4 sheet of paper is equal to 1/16 m^2, so when broilers weigh about 2 kg, which occurs at around five weeks of age, then at a stocking density of 34 kg/m^2 each bird has about an A4 sheet of paper space allowance. Of course higher stocking densities mean that birds on average have even less space than an A4 sheet of paper.

Some European countries have more stringent legislation than that required by the EU. Austria has a maximum legal stocking density of 30 kg/m^2 and Sweden and Norway have a maximum stocking density of 36 kg/m^2 [102][103]. Germany and the UK only allow stocking densities to go up to 39 kg/m^2, and industry Red Tractor standards in the UK, which most of the British poultry industry meets, only permit a maximum of 38 kg/m^2. The maximum legal stocking density in Denmark is 40 kg/m^2 [102].

An analysis prepared for the European Commission found that in 2013 only 34% of EU broilers were kept at stocking densities not exceeding the baseline maximum density of 33 kg/m^2, with 40% being kept at densities between 33 kg/m^2 and 39 kg/m^2 and 26% at densities between 39 kg/m^2 and 42 kg/m^2 [102]. So approximately two thirds of European broilers have less space than an A4 sheet of paper.

Several Member States keep most of their broilers at the highest permitted densities, between 39 kg/m^2 and 42 kg/m^2: in 2013 this was the case for Finland (96% kept at this density), Netherlands (93%), Denmark (93%), Belgium (90%) and France (82%). In 2013, France accounted for 55% of all the EU's broilers kept at the highest stocking density (39–42 kg/m^2).

Some countries keep most of their broilers at between 33 kg/m^2 and 39 kg/m^2: this is the case for Germany, Italy, the UK, Ireland and the Czech Republic. Finally, some countries do not exceed the 33 kg/m^2 level for most of their broilers: this is the case for Austria, Croatia, Greece, Poland and Spain [102].

According to a 2017 report by EMA and EFSA, higher stocking densities have been associated with increased preventative use of antibiotics due to the expectation of increased disease risk [9]. A 2010 EFSA study found that the top-ranking "environmental" hazard (i.e. other than poor genetics) for broiler welfare is stocking density [104].

Higher stocking densities mean that chickens usually suffer from a lack of exercise and cannot express their natural behaviour (perching, foraging and dustbathing) and can increase the incidence of lameness [89]. High stocking densities also promote stress, particularly thermal stress in the birds, and are associated with wet litter, increased ammonia concentrations in the air, more airborne dust, increased footpad dermatitis and lower welfare [9][89][104][105][106]. Heat stress damages the immune system and is associated with intestinal injury [105][107]. More airborne dust can also contribute to respiratory problems [106].

Ammonia concentrations in poultry houses can be very high. Ammonia is produced in the litter, particularly wet litter, by microbial decomposition. High levels of ammonia damage the immune system. Concentrations above 10 parts per million (ppm) can also damage the lung surface and increase the birds' susceptibility to bacterial respiratory disease, especially *E. coli* infection. These high concentrations have been linked with air sacculitis, pneumonia and septicaemia caused by *E. coli* [105][108]. These infections are a major cause of antibiotic use in the poultry industry [9].

The EU derogation allowing stocking densities of up to 39 kg/m^2 only requires ammonia concentrations to stay below 20 ppm. This is twice the concentration associated with increased susceptibility to respiratory infections.

Higher stocking densities also mean that there is a need to thin the flock (some birds are removed for early slaughter), which is a stressful event for the birds.

Lowering stocking densities would be likely to reduce wet litter problems, lower ammonia concentrations and reduce respiratory and intestinal diseases which require antibiotic treatment.

The cost of reducing stocking densities would not necessarily be very large. A report published in 2000 by an advisory committee to the European Commission calculated in that reducing stocking densities from 38 kg/m^2 to 30 kg/m^2 would increase production costs by 5% and the cost to the consumer by just 2.5%. Similarly, reducing the stocking density to 20 kg/m^2 would only increase production costs by 15% and the cost to the consumer by 7.5% [109].

Higher-welfare certification systems have much lower maximum stocking densities, set by EU Regulations, than the 42 kg/m^2 for intensive, indoor farms. Several of them also require that the birds have access to the outdoors. See Table 8.

Table 8 Stocking densities (kg/m^2) and access to the outdoors in different production systems for broilers according to EU Regulations [89][110][112]

Production system	Maximum stocking density	Access to outdoors
Intensive	42	No
Extensive indoor	25	No
Free-range	27.5	Yes, 1 m^2 per bird
Traditional free-range	25	Yes, 2 m^2 per bird
Free-range, total freedom	25	Yes, 2 m^2 per bird
Organic	21	Yes, 2.5–4 m^2 per bird[5]

In France, Label Rouge chickens have a maximum indoor stocking density of 25 kg/m^2 and access to the outdoor (2 m^2 per bird) [100].

In the Netherlands, Beter Leven one star standards have a maximum stocking density of 25 kg/m^2 but the only outdoor access is to a covered area [99]. Beter Leven 2 star and 3 star standards have a maximum stocking density of 27.5 kg/m^2 but both have outdoor access with 1 m^2 per bird. Organically farmed birds are automatically awarded Beter Leven three stars, provided they are stunned before slaughter.

The "Better Chicken" commitment, to which over 200 leading European food companies have signed, requires chickens to be kept at a stocking density which is no higher than 30 kg/m^2 [113].

In order to improve broiler health and welfare, and reduce the incidence of infectious diseases requiring antibiotic treatment, Member States should implement new, lower maximum stocking densities. The Norwegian Scientific Committee for Food Safety has said that some behavioural and health indicators show that chicken welfare is reduced when stocking densities rise about 25 kg/m^2 [111]. Based on this assessment and the experience of non-intensive farming systems, maximum stocking densities should be set at no higher than 25 kg/m^2, particularly for birds that have no access to the outdoors.

4.2.2.3. Access to the outdoors

Providing outdoor access is listed by EFSA and the EMA as one practice of free-range and organic farming systems that could be used in other farming systems to reduce antibiotic use [9]. EFSA and the EMA say that "The stress associated with intensive, indoor, large scale production may lead to an increased risk of livestock contracting disease".

Advocates of intensive farming methods often point to worse "external biosecurity" when animals have access to the outdoors. This means that it is more difficult for animals kept outdoors to avoid exposure to wildlife and pests and to pathogens in the air, soil or insects.

5 If the housing is fixed, 4 m2 per bird is required, but if it is mobile housing then only 2.5 m2 is needed.

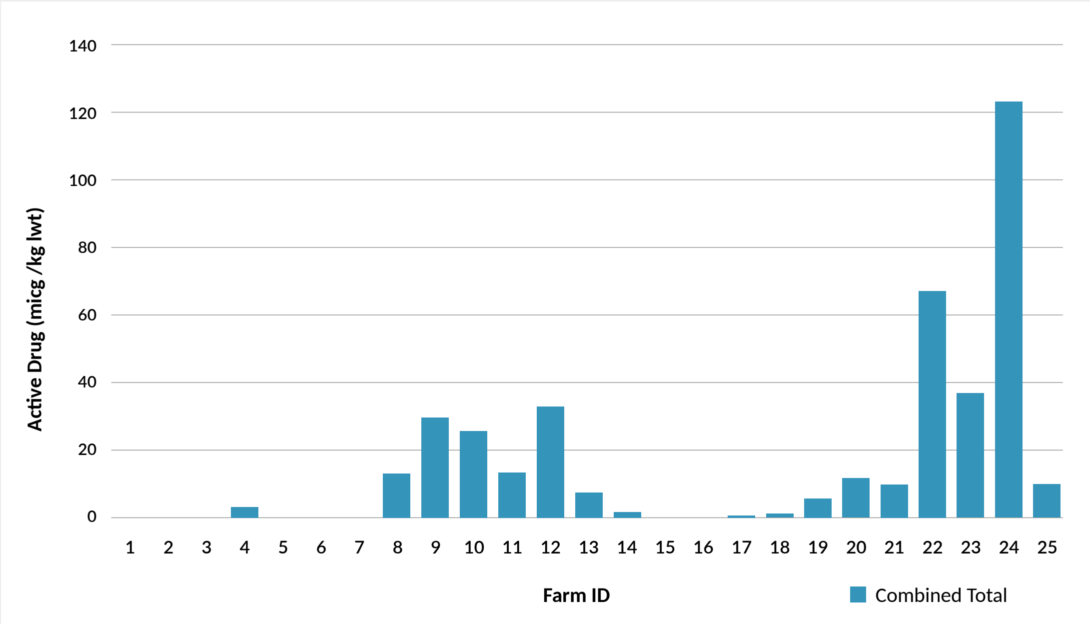
However, “internal biosecurity”, which is the risk of disease transmission between animals in a herd or flock, is far better because of decreased contact between animals and better air quality.

Animals kept outdoors also have more opportunity to express natural behaviours, such as foraging, pecking, scratching, feather maintenance and taking exercise [114][115]. However, it is important to use appropriate, slower-growing breeds, which are capable of engaging in these natural behaviours, rather than the fast-growing commercial breeds which have impaired mobility [116].

Unfortunately, there is still very little publicly available data on antibiotic use in animals kept indoors compared with those raised with access to the outdoors. Many higher-welfare certification systems require broilers to have access to the outdoors (see Table 8), but there is only a small amount of information available on antibiotic usage in these systems. Where information is available, it shows that antibiotic usage tends to be far lower than in intensive systems.

In the UK, a 2006 study by scientists employed by the Department of Environment Food and Rural Affairs (Defra) of seven organic poultry farms found that during the two years of the study, only one farm used any antibiotics at all [117]. See Figure 9.

Figure 9 Use of antibiotics (microgramme of active ingredient per kg of meat produced) on organic poultry (1 to 7) and pig (14-18) farms compared with non-organic poultry (8-13) and pig (19-25) farms [117]



Similarly, a survey of British organic farms certified by the Soil Association found that just one of six broiler farms used antibiotics in the year starting 1 June 2018 [118][119].

In the UK, many supermarkets hold data on antibiotic use in their poultry supply chains. However, despite pressure from the campaign group the Alliance to Save Our Antibiotics to fully publish this data by farming system, so far only one supermarket, Marks and Spencer, has published antibiotic-usage data for its free-range broilers compared with its standard, intensive range. It shows that for its standard intensively farmed chickens, antibiotic consumption in 2020 averaged 13.4 mg/kg, but for its slower-growing indoor chickens use was 2.3 mg/kg and for its free-range chickens use was 0 mg/kg [120][121].

4.2.2.4. Inclusion of sufficient fibre in diets

Dietary fibre, also called roughage, are the parts of plant foods that are not broken down by a human or animal's digestive enzymes or secretions. In humans, it is well known that the inclusion of high levels of fibre in a person's diet has important health benefits [122]. Since fibre is not digestible in the small intestine, it passes on to the large intestine where some of it feeds beneficial bacteria. This alters a person's gut microbiome (i.e. the types of bacteria living in a person's gut) and increases the number of healthy, beneficial bacteria [123][124]. The fermentation of fibre by gut bacteria produces short chain fatty acids which provide health benefits to the human host [124][125]. A lack of fibre in a person's diet also makes their gut more prone to being colonised by pathogenic bacteria [126].

In livestock farming, dietary fibre has often been viewed as a diluent of the diet and sometimes even an anti-nutritional factor [127]. In contrast, in organic farming it has long been recognised that fibre provides important health benefits to all farmed animals and EU organic rules require fibre to be included daily in poultry's diets [112].

While far less research has examined the importance of fibre to chicken health than to the health of humans, it is increasingly recognised that the inclusion of some types of fibre in chicken diets is important for their health, including their gut health [127][128][129].

In poultry, dietary fibre is preferentially utilised by beneficial bacteria, such as *Lactobacillus* and *Bifidobacteria* genera which lead to production of lactic acid and short chain fatty acids. This results in a low pH which will maintain the normal microorganism population, thus preventing the establishment of *Salmonella* and other pathogens in the gastrointestinal tract [129].

A study in egg-laying hens showed that including fibre in their diet lead to significant reductions in ammonia emissions from their manure [130]. As explained in section 4.2.2.2., high ammonia concentrations in the air in chicken housing can damage birds' immune systems and increase susceptibility to respiratory infections, especially *E. coli* infections, which can be a major cause of antibiotic treatment. Reducing ammonia concentrations can also alleviate welfare problems like contact dermatitis and foot burns [129][130].

Because of fibre's beneficial effects on gut health, scientists have highlighted the inclusion of dietary fibres in the diets of monogastric animals, including poultry, as a viable approach for maintaining a healthy gut [128].

In 1984, Sweden became the first country in the world to ban antibiotic growth promoters (although Iceland never licensed them), and in the following years and decades the use of all medically important antibiotics was reduced very significantly, so that Sweden is now one of the lowest users of veterinary antibiotics in Europe (see Figure 1 section 3.3.). Sweden is also an exceptionally low user of medically important antibiotics in broiler farming (see section 4.2.2.5.), although it does still use ionophore antibiotics as well. According to the Swedish Animal Health Service, the most important change that Swedish poultry farmers made to avoid intestinal problems, including in particular necrotic enteritis, developing after the growth-promoter ban was to reduce the protein content in feed and to have a feed composition richer in fibre and supplemented with enzymes [131].

In order to ensure good poultry health as routine antibiotic use is ended, European governments should ensure that poultry are fed sufficient fibre and that feed does not contain excessive amounts of protein.

4.2.2.5. Antibiotic use in poultry by country in 2020

Most countries do not publish data on their antibiotic use by animal species as those which do collect farm antibiotic data tend to collect sales data rather than actual usage data. Since many veterinary products can be used in more than one species, raw sales data do not enable estimates of use by species to be made.

However, a small number of countries including Austria, France and the US attempt to estimate use by species from the sales data, partly by asking the pharmaceutical companies about the types of farms to which they are selling.

Furthermore, Denmark and the Netherlands collect actual usage data on use at a farm level, so are able to publish detailed data on usage by species.

In the UK, data on antibiotic use in poultry is collected on a voluntary basis by the industry organisation the British Poultry Council. This only covers 90% of the industry, and may not be as reliable as the data collected on a statutory basis in the Denmark and the Netherlands, but it does appear to provide a reasonably accurate estimate of the usage level.

Most countries that do provide species data give it in terms of weight of active ingredient. So to enable international comparisons to be made we have had to obtain the PCU of the species, either from ESVAC reports, or by calculating it from livestock population data. This then enables us to calculate the usage in terms of mg of active ingredient per kg of PCU.

Table 9 gives the data we obtain for usage nine different countries. For eight of them, the data is for 2020, but for Australia it is for 2010 as this is the most recent data that Australia has published.

Table 9 Antibiotic use in poultry in 2020 (mg of active ingredient per kg of PCU)

Australia (data for 2010)	All poultry	299
Austria	All poultry	32.7
Denmark	All poultry	19
France	All poultry	63.9
Netherlands	Broilers	23
	Slow-growing broilers	5.5
Norway	Broilers	Only two flocks received one treatment in 2020
Sweden	Broilers	0.2
United Kingdom	Broilers	16.3
	Turkeys	25
	All poultry	21
United States	Chicken	15.4
	Turkey	474.5
	All poultry	78

The following reports have been used as sources for the antibiotic data: [15][69][132][133][134][135][136][137][138][139]

It is worth noting that usage in turkeys tends to be significantly higher than in broilers and because of this, overall use in all poultry tends to be higher than in chickens alone. Perhaps this is partly because intensively farmed turkeys are more prone to infections than intensively farmed chickens. However, another likely explanation is that there tends to be more focus on reducing antibiotic use in more widely farmed species than in those that are farmed less frequently. In the United States there have been major efforts to reduce antibiotic use in chickens, but in turkeys routine use at an extremely high level remains widespread.

Table 9 shows that antibiotic use in Swedish and Norwegian broilers is extremely low. In Sweden, the broiler industry also uses ionophore antibiotics, which are not included in the official antibiotic-usage figures. However, in Norway the poultry industry voluntary ended routine ionophore use in June 2016, although a few flocks were treated with these antibiotics when outbreaks of necrotic enteritis occurred [137].

Despite the large reductions that have been achieved in farm antibiotic use in France, including in poultry (see section 3.8.2.), use in French poultry remains far higher than it should be. This is likely because of the very high stocking density used by most French broiler farms (see section 4.2.2.2.) and the use of fast-growing birds. To achieve much lower use, the French poultry industry needs to adopt far better animal-welfare standards. Standards such as the Beter Leven standards being committed to by supermarkets in the Netherlands (see section 4.2.2.1.) would likely help significantly cut use.

4.3. Reducing antibiotic use in pig production

Pig meat is the most produced and consumed meat in the European Union [81][82]. In 2020, the EU produced 23 million tonnes of pig meat, an all-time high and an increase of 1.2% compared with 2019. In 2020, the largest EU producers were Germany (22.2% of total EU production), Spain (21.7%), France (9.6%), Poland (8.6%), Netherlands (7.2%), Denmark (6.9%) and Italy (5.5%). In 2020, production increased sharply in Spain (7.8%), but fell in Germany (-2.2%) [81].

Different farm sizes, from those keeping just one or two pigs to industrial installations, and different rearing methods, from extensive organic to intensive, exist across Member States. The organic pig sector represents less than 1% of EU pig farming. Overall, over 75 % of EU pigs are in large commercial holdings [140].

The vast majority of pigs in the EU are raised and slaughtered for meat within an intensive system that gives rise to numerous issues linked in particular to animal welfare and environmental pollution [140].

Council Directive 2008/120/EC of 18 December 2008 (the Pig Directive), lays down some minimum standards for the protection of pig welfare. It regulates accommodation, feed and the environmental conditions of farmed pigs: the living space per animal, the quality of floorings, the permanent access to fresh water and to material for rooting and playing, as well as the level of light and noise.

Despite the existence of this legislation, pig health and welfare often remains poor, resulting in high use of antibiotics. Pigs are frequently kept in a barren environment, at high stocking densities, devoid of stimulation, and in which they cannot express their natural behaviours, such as rooting. This can lead to stress, frustration and abnormal behaviour such as tail biting. Under EU legislation, sows can still be kept in stalls for the first four weeks of pregnancy. Sow stalls are steel cages which are so narrow the sow cannot even turn around or express any natural behaviour. Piglets are weaned from their mothers far too soon, leading to stress and diarrhoea. To make matters worse, existing EU welfare legislation is not fully implemented in most Member States. In particular, routine tail docking continues to be very widely practised, despite not being permitted by Directive 2008/120/EC.

Below we examine some of the key husbandry factors, where significant improvements could contribute to large reductions in disease and antibiotic use.

4.3.1. Later weaning of piglets

Pigs in intensive, indoor systems can receive antibiotic treatment at each stage of their lives until slaughter, usually at under 6 months old. But it is at weaning, when piglets are often mixed with other piglets, and develop post-weaning diarrhoea due to stress and dietary change, when antibiotic treatment is at its highest. Some antibiotics that are classified as critically important in human medicine, including the last-resort antibiotic colistin, the fluoroquinolones and the macrolides, are among the most widely used antibiotics to control diarrhoea [141]. In many European countries, zinc oxide feed additives are also used to control post-weaning diarrhoea, but this use is going to be banned in June 2022 (see section 2.4).

Council Directive 2008/120/EC sets a nominal minimum weaning age for piglets of 28 days. However, the Directive allows weaning to occur as early as 21 days if piglets are then moved into “specialised housings which are emptied and thoroughly cleaned and disinfected before the introduction of a new group and which are separated from housings where sows are kept” [142]. In practice, in many European countries most piglets are weaned before they are 28 days old, as farmers often aim to maximise the number of piglets reared per sow per year. The average weaning age in the 1950s was eight weeks (56 days) [143].

However, early weaning adversely affects piglet health [144][145][146][147]] and increases the chances they will develop post-weaning diarrhoea and require antibiotic treatment [148][149][150].

There is now clear evidence that farming systems designed to enable a later weaning age can achieve far lower antibiotic use, at weaning time.

A 2016 study comparing antibiotic use on 227 pig farms in four EU countries found that use in Sweden was nearly seven times lower than in France, and use in Belgium and Germany was even higher than in France [151]. Most of the difference in use occurred in weaners. In Belgium, France and Germany, antibiotic use increased sharply at weaning time, but in contrast in Sweden it fell. As a result, weaning piglets in the first three countries received 20 to 30 times more antibiotics than they did in Sweden, see Table 10.

Table 10 Antibiotic use in pigs in four European countries (mean number of doses per 1,000 animal days) [151]

	Belgium	France	Germany	Sweden
Suckling piglets	175.6	59.1	245	76
Weaned piglets	407.1	374.3	633.4	21.4
Fattening pigs	33	7.3	52.9	6.1
Entire life	142.9	108	242.8	22.7
Mean weaning age	23.5	24	24.4	35

The most obvious explanation for the large difference in antibiotic use at weaning was the later weaning of piglets in Sweden where the median age of weaning was 35 days, whereas in France, Belgium and Germany it was between 22 and 25 days [152]. In the latter three countries, some farms even began weaning at 19 days, earlier than the 21 days permitted by EU legislation.

Further evidence of the importance of late weaning comes from a study of antibiotic use in the pig industry in Denmark. Since 2000, the Danish Integrated Antimicrobial Resistance Monitoring and Research Programme (DANMAP) has collected antibiotic-usage data from every farm in Denmark [13]. Unfortunately, the annual DANMAP reports do not include any information on antibiotic use by farming system. However, in a 2021 study, Danish scientists used the national database to compare antibiotic use in Danish organic pigs with use in free-range non-organic pigs and indoor non-organic (mainly intensively farmed) pigs, see Table 11 [153].

Table 11 Antibiotic use in organic, non-organic free-range and indoor (intensive) pigs in Denmark in 2016-2018 (mean number of doses per 1000 animal days) [153]

	Organic	Free-range non organic	Indoor (intensive)	Indoor/Organic ratio
Sows and piglets	1.1	4	16.5	15
Weaner piglets	4.8	33.7	72	15
Finishers	2.88	8.2	10.5	3.75
Min weaning age	40 days	30 days	21 days	

Antibiotic use in indoor, intensively farmed pigs was 3.75–15 times higher than in organic pigs, and 1.3–4.1 times higher than in free-range non-organic pigs, depending on the age group examined. In piglets that had been recently weaned, antibiotic use in the indoor pigs was 15 times higher than for the organic pigs and over twice as high as for the free-range pigs.

The much lower use of antibiotics in organic weaner piglets is likely to be at least partly due to the much later weaning that occurs in organic farming. Organic piglets can only be weaned at 40 days [112], whereas the intensively farmed piglets can be weaned at 21 days and those raised in the Danish free-range system can be weaned at 30 days. However, in Denmark all three systems also currently use zinc oxide and no statistically significant differences in the use of this feed additive were found between the systems.

It is worth noting that preventative group treatments with antibiotics are already banned in Denmark, and antibiotic use in Danish intensively farmed pigs is already much lower than it is in many other countries (see section 4.3.7.), so the far lower levels of antibiotic use in organic pigs and, to a lesser extent, in non-organic free-range pigs in Denmark, are significant achievements.

Commenting on their findings, the Danish scientists highlights the later weaning age, and some other factors, as likely explanations for the lower antibiotic use in the higher-welfare systems, saying: “From our findings, it seems logical to suspect, that not only strict regulations on antibiotic usage but also improved health related to conditions like being born outdoor[s], higher weaning age and lower stocking density have an effect on antibiotic usage. Different conditions with respect to human supervision and possibilities for intervention could also play a role, as well as differences in treatment threshold”.

Outside of Denmark, there is little information on antibiotic use in pigs by farming system. However, in the UK a 2006 study by scientists employed by the Department of Environment Food and Rural Affairs (Defra) found that antibiotic use over a two-year period in five organic pig farms was minimal in comparison to use on seven conventional, indoor farms (see Figure 9).

More recently, a survey of 22 organic pig farms certified by the Soil Association found that in the year starting 1 June 2018, their average antibiotic use was just 1.4 mg of active ingredient per kg of PCU [118]. This compares with average use by the British pig industry in 2020 of 105 mg/kg. In interviews, one factor the organic farmers said helped them achieve their low level of antibiotic use was the later weaning age [154].

In Norway, as in Sweden, the minimum weaning age is 28 days, but in practice very few herds wean their piglets before 35 days [111]. Although Norway does not publish antibiotic use data by species, its' overall use across all land-based farm-animal species averages just 6.8 mg/kg [59], suggesting that antibiotic use in Norwegian pigs is likely to be far lower than in most other countries (see section 4.3.7.).

In order to reduce disease in piglets at weaning time and to significantly cut antibiotic use, European governments and the EU should introduce a new, later minimum weaning age. Learning from the experiences in Norway, Sweden and in organic farming, this should probably be set around 35 days or later.

However, in order to achieve later weaning, it will be important to use appropriate breeds, as sows that produce too many piglets will not be able to supply sufficient milk for longer periods of time without harming their own health.

4.3.2. Using appropriate breeds

A key indicator of performance used in the pig industry is the number of piglets reared per sow per year. The average in the UK is now over 26 piglets, with the top 10% producing over 30 piglets per sow [155]. Selective breeding has led to ever greater litter sizes. Some hyper-prolific sows are now producing in excess of 17 piglets born alive per litter [156] meaning that the number of piglets born can even exceed the number of teats the sow has [157][158]. Very large litter size may also mean that early weaning is necessary, as the sow is at risk of developing nutritional deficiency and losing condition from having to supply so much milk. Nutritional deficiency in the sow can result in reduced number of piglets being born in the next litter [143]. Early weaning, in turn, tends to lead to more antibiotic use.

A scientific review by scientists from Scotland, Denmark and Norway found that large litter size is associated with increased piglet mortality, low birth weight, teat competition and increased likelihood that piglets will not get access to adequate milk. The scientists said that long-term effects on the piglets could include impaired gut function and immune function. There were also likely consequences for the health of the sow, such as udder damage [159]. A Swedish study found that large litter size has also been found to shorten the sow's productive life, reducing her ability to produce more than 4 litters, as these highly productive sows have more udder and lameness problems [160].

Modern pigs are also genetically selected for rapid growth and for leanness. However, genetically selecting for high productivity and lean meat is suspected to favour stress and disease susceptibility, undesirable behaviours, such as tail biting, as well as leg weakness [143].

Breeding for more robust pigs rather than just for productivity and leanness, and for sows that have a more manageable number of piglets should be encouraged to reduce reliance on antibiotics. Outdoor systems, for example, breed for maternal traits in sows to reduce the need for intervention at farrowing, and have lower piglet numbers per litter [161][162].

4.3.3. Appropriate housing: reducing stocking density and providing straw and "enrichment"

High stocking densities are linked with increasing stress in pigs, which in turn affects animal health. Furthermore, higher stocking densities enable easier disease spread, increase the quantities of noxious gases, such as ammonia, and result in higher levels of respiratory and intestinal infections [9][163][164]. Pigs are also susceptible to heat stress, which makes them more prone to infection, and reducing stocking densities can help reduce this risk [164][165].

The EMA and EFSA have said that, in order to reduce the need for antibiotics in livestock farming, "husbandry factors should be aimed at minimising stress levels" and that in order to achieve this, stocking densities should be reduced [9].

There already exists an EU minimum floor space per pig, which depends on the weight of the pig. However, for pigs under 110 kg, this is just 0.65 m^2 per pig, and for lighter pigs it's even less than this [142]. In contrast, under the EU standards for organic farming, when pigs are not on pasture, they still need to be provided with a minimum of 1.3 m^2 of indoor area plus 1 m^2 of an outdoor exercise area (excluding pasture), making 2.3 m^2 per pig. The Danish scientists, who found much lower antibiotic use in organic pigs and free-range non-organic pigs (that have a minimum area of 1.2 m^2 per pig) compared with indoor, intensively farmed pigs, highlighted this lower stocking density as one key reason for the difference in antibiotic use (see section 4.3.2. and Table 10).

Providing straw or other forms of "enrichment"[6] in pig pens is also important for reducing stress and illness. EFSA and the EMA say that barren environments may result in behavioural abnormalities, such as tail biting and aggression [9]. The use of straw bedding has been reported to reduce gastric ulcers and lung damage [9][166][167]. EFSA and the EMA point out that Swiss "animal-friendly" farms (which have multiple areas, including straw bedding and access to outdoor facilities) used less group-based antimicrobial treatments than control farms with slatted floors [9][168].

The Porcine Reproductive and Respiratory Virus (PRRSV) has been a major cause of increased antibiotic use, and of economic loss, in the European pig industry as it increases pigs' susceptibility to many bacterial infections [169]. However, a Dutch study found that pigs in larger, enriched pens (with straw, peat and wood shavings) were significantly less susceptible to co-infection by PRRSV and *Actinobacillus pleuropneumoniae* (a cause of respiratory disease in pigs). The scientists said that "enriched-housed pigs showed a remarkably reduced impact of infection and were less prone to develop clinical signs of disease". They suggested that diminishing chronic stress in pigs could help reduce antibiotic use [167].

In order to reduce stress and illness in pigs, new, higher minimum flooring space needs to be introduced. Pig farmers should also be required to provide bedding material, such as straw, which meets pigs' needs for exploratory behaviour and for comfort.

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6 Enrichment is some form of modification of the barren environments in which intensively farmed animals are commonly kept, which improves the biological functioning of the animals, by for example enabling them to express natural behaviour. The use of straw is an example of good enrichment.

4.3.4. Access to the outdoors

Although there is still limited data, the available data shows that farming systems which require that pigs have outdoor access, such as organic farming, free-range non organic or Swiss "animal friendly" farming, have significantly reduced antibiotic use (see sections 4.3.1. and 4.3.3).

However, organic production also differs from conventional production in terms of feed used, weaning age, stocking densities, use of bedding and other husbandry practices. Nevertheless, EFSA and the EMA state in their report that access to outdoors is one of the practices used in alternative farming systems that "may also be used in other systems to reduce the need for antimicrobial use" [9].

Apart from reducing the likelihood of reducing stress and disease transmission between animals ("internal biosecurity"), a reason why outdoor rearing may reduce the need for antibiotics is that it appears to alter the gut microflora compared with indoor-housed pigs. A British study compared the gut bacteria from genetically related piglets raised outdoors and indoors. It found that piglets reared from sows kept outdoors had much higher levels of the beneficial *Lactobacilli* bacteria. In contrast, piglets from sows housed indoors, whether receiving antibiotics or not, had higher numbers of clostridia and other potentially pathogenic bacteria [170][171][172].

The scientists said "Rural, outdoor environments support the establishment of a natural microbiota dominated by *Lactobacilli* and containing low numbers of potentially pathogenic bacteria and this may be an important factor in maintaining mucosal immune homeostasis and limiting excessive inflammatory responses in the gut" [170]. A healthy gut is also likely to help reduce the need for antibiotics.

4.3.5. Inclusion of sufficient fibre in diets

As mentioned in section 4.2.2.4., in livestock farming dietary fibre has often been viewed as a diluent of the diet and sometimes even an anti-nutritional factor [127], but as with poultry, it is now recognised that dietary fibre is important for pigs' health [128].

Pigs are more capable of digesting fibrous food than humans because their gut microflora contains cellulose-degrading bacteria [173]. The feeding of certain types of dietary fibre has been linked with positively affecting pig gut health and with favouring the growth of beneficial bacteria and reducing that of pathogenic bacteria [128][173][175][175][176].

According to EFSA and the EMA, high-energy/low-fibre diets are also associated with promoting stress in animals [9]. A recent review of the scientific evidence concluded that including certain fibres in pig diets can reduce stress and abnormal behaviour, including tail biting [176]. Growing/finishing pigs provided with silage in addition to straw have been shown to utilise nutrients in the silage and to have milder reactions to social interactions than pigs only provided with straw, and thus had fewer wounds from adverse social interactions [177].

Increasing the amount of fibre in pigs' diets has also been used as a method for reducing antibiotic use. When Sweden ended the use of antibiotic growth promoters in 1986, to avoid the use of post-weaning diarrhoea, one management change that was introduced was to increase the fibre content of piglet feed and to reduce the protein content [9][131].

EU organic standards require pigs to be fed roughage (i.e. dietary fibre), fresh or dried fodder (i.e. coarse food like hay or straw), or silage as part of their daily ration [112] as this is recognised to be good for their health and welfare. In order to improve the health and welfare of all pigs, this practice should be recommended or required for all pig farmers.

4.3.6. Avoiding tail docking and tail biting

Tail-biting, i.e. a pig biting another pig's tail, is an abnormal behaviour which does not occur in wild pigs [178]. Resulting tail injuries are usually treated with antibiotics [179].

Tail-docking is the practice of removing the tail or part of the tail of a pig in order to minimise tail biting behaviour. It is done without anaesthesia, despite being a painful mutilation. Tail-docking can cause long-term chronic pain and infections, as well as redirection of the biting behaviour to other body parts, such as ears and legs. Routine tail-docking is the systematic docking of the tails of pigs, done in the early days of the piglet's life [180].

The EU Council Directive 2008/120/EC does not permit routine tail docking of piglets, saying that tail docking can only occur "where there is evidence that injuries to sows' teats or to other pigs' ears or tails have occurred". Furthermore, the Directive says "Before carrying out these procedures, other measures shall be taken to prevent tail-biting and other vices, taking into account environment and stocking densities. For this reason inadequate environmental conditions or management systems must be changed" [142].

Unfortunately, this rule is widely ignored by the pig industries, and national regulators and governments, in most Member States. It is estimated that, in the vast majority of Member States, 80–100% of piglets have their tails docked. The only exceptions are Finland (5% of pigs have their tails docked), Lithuania (0%) and Sweden (0%). These three countries have prohibited tail docking unless motivated by a medical need [180]. Non-EU countries Iceland, Norway and Switzerland have similar bans on tail docking [181][182][183]. In contrast, France and Denmark still dock the tails of 99% of their pigs [180][184].

The reason why most European countries continue to routinely tail dock piglets is that EU minimum pig husbandry and welfare standards are not good enough to avoid tail-biting and other abnormal behaviours. Pigs are naturally intelligent, curious animals that like to explore their environment, but in the barren conditions in which most intensively farmed pigs are kept, this instinct gets redirected to other pigs.

Tail biting is caused by a variety of factors commonly present in intensive farming. A barren environment, a lack of long straw or other suitable exploratory material, stressful conditions, high stocking densities and inadequate diets are all known contributing factors to tail biting [185][186]. There is also some evidence that pigs genetically selected for leanness are more prone to tail biting [143][186] and that pigs weaned at seven or nine weeks show less unwanted behaviour, such as tail biting [187]. Poor health is also a risk factor for tail biting: it has been shown that the presence of respiratory diseases and a high post-weaning mortality on the farm increased the risk of tail biting [188].

Avoiding tail biting requires significant improvements to many aspects of pig health and welfare standards. A technical report prepared for EFSA thus concluded that "An intact curly tail may well be the single most important animal-based welfare indicator for weaned, growing and finishing pigs" [189].

Swedish scientists have pointed to the Swedish success in rearing pigs with intact tails and said that it is due to higher minimum legal Swedish animal-welfare standards. These include lower maximum stocking densities, having access bedding material such as straw, no fully slatted floors and a requirement for later weaning. The scientists called for EU standards to be improved saying: "Swedish experiences show that lower stocking density, provision of sufficient feeding space, no fully slatted flooring, strict maximum levels for noxious gases and regular provision of litter material are crucial for success when rearing pigs with intact tails. To prevent tail biting and to eliminate the need for tail docking, we strongly recommend that EU legislation should more clearly match the biological needs of pigs, as is done in Swedish legislation" [190].

Welfare standards which are higher than the EU's, including the need for bedding material and lower stocking densities, are also used in other countries which have banned tail docking, including Norway, Iceland, Switzerland and Finland [191][192][193].

Many of the causes of tail biting are, as explained in previous sections, also the cause of excessive antibiotic use in the pig industry. So dealing with the causes of tail biting, by improving husbandry, will not only reduce the use of antibiotics for treating tail injuries, but it will certainly also reduce the incidence of other diseases and the need for antibiotics to treat them too.

In section 4.3.3., it was mentioned that there was scientific evidence that the PRRS virus, a major cause of antibiotic use in the pig industry because it increases pigs' susceptibility to many bacterial infections, could be controlled by lowering stocking densities and providing enrichment material such as straw, peat or wood shavings. While the PRRS virus remains a major problem in many European countries, it is striking to note that the pig industries of Sweden, Norway, Finland and Switzerland, which do not permit tail docking, have been unaffected [194] and that PRRS prevalence in Lithuania, which also does not permit tail docking, is much lower than in countries like the Netherlands or the UK which practice routine tail docking [195].

Furthermore, while most countries still do not collect and publish antibiotic usage by species (see section 4.3.7.), there is evidence to suggest that antibiotic use per animal in those countries that do not permit tail docking is significantly lower than in most countries that do permit the practice. The five European countries with the lowest total antibiotic use per PCU are all countries that do not permit tail docking (see Figure 1, section 3.3.), suggesting that their antibiotic use in pigs is also likely to be low by European standards. Sweden also has the lowest antibiotic use per pig out of those countries that do publish species data (see section 4.3.7.).

All European countries should introduce bans on pig tail docking. Minimum husbandry standards should also be increased to ensure that pigs can be raised with intact tails and to not have to suffer from tail biting. Introducing such legislation would likely have a major effect in reducing antibiotic use in the pig industry.

4.3.7. Antibiotic use in pigs by country in 2020

Average levels of antibiotic use in the pig industry are only available for a small number of countries. Most countries that do provide species data give it in terms of weight of active ingredient. So to enable international comparisons to be made we have had to obtain the PCU of the species, either from ESVAC reports or by calculating it from livestock population data. This then enables us to calculate the usage in terms of mg of active ingredient per kg of PCU.

Several countries (Australia, Austria, France, United States) estimate their species data from their sales data, whereas others (Denmark, Netherlands, Sweden) obtain it from farm, veterinary or veterinary pharmacy records. The data for the UK is industry data and that for Ireland is obtained from a one-survey covering over 30% of the industry.

Unfortunately, there does not appear to be any data on total antibiotic use in a format which would enable international comparisons to be made, for the very large pig industries in Germany, Spain, Poland and Italy.

Table 12 Antibiotic use in pigs in 2020 (mg of active ingredient per kg of PCU)

Australia (data for 2010)	293
United States	247
Ireland (data for 2016)	162
United Kingdom	105
Austria	90
France	73
Denmark	43
Netherlands	41
Sweden	16

The following reports have been used as sources for the antibiotic data: [15][69][132][133][134][135][136][138][139][196]

Table 12 shows that Sweden has by far the lowest usage per PCU of the countries where data is available. This is certainly largely due to Sweden having the highest welfare standards out of those countries: later weaning age, lower stocking density, no fully slatted floors, a requirement for bedding material and no tail docking.

The Netherlands and Denmark are the next lowest users and they, like Sweden, have already banned preventative group treatments, which partly explains their low use. They also have introduced numerous policies aimed at reducing their antibiotic use, including data collection at the farm level and the yellow card/red card scheme in Denmark, which involves taking actions against pig farms where antibiotic use is too high [197]. However, despite the large efforts that the Netherlands and Denmark have made over many years, their antibiotic use remains significantly higher than in Sweden because of their more intensive production methods and their lower welfare standards.

The pig industry in France has cut its antibiotic use per PCU by 79% since 2007, when use was approximately 349 mg/kg (see Table 3 in section 3.8.2.). Despite this significant achievement, use remains about 4 ½ times higher than in Sweden and nearly twice as high as in the Netherlands and Denmark. Clearly much lower levels of antibiotic use in French pigs could be achieved if improved welfare standards were introduced.

Finally, Table 11 in section 4.3.1 compared antibiotic use in Danish organic pigs with those raised indoors. No overall figure was given and furthermore the data is not given in terms of mg per PCU, but using the data is Table 11 we can roughly estimate that antibiotic use in mg per PCU in Danish organic pigs is likely to be about 9–10 times lower than in indoor pigs (which account for the vast majority of Danish production), and therefore is likely to be around 4–5 mg/kg. Furthermore, as mentioned in section 4.3.1., in the UK organic pig farms certified by the Soil Association that contributed to a survey had an average use of just 1.4 mg/kg.

These data indicate that even the Swedish pig industry could still significantly reduce its antibiotic use if it were to adopt even higher welfare standards. Unlike organic pigs, most Swedish pigs have no access to the outdoors. Furthermore stocking densities are higher and the minimum weaning age is lower in Swedish non-organic pigs than it is for all European organic pigs.

5. Conclusion

The European Medicine Agency's ESVAC data collection programme has revealed that huge differences in farm antibiotic use still persist between different European countries, despite antibiotic growth promoters having been banned 16 years ago.

Part of the explanation for these differences is that some lower-using countries in Europe, such as Denmark, Finland, Iceland, the Netherlands, Norway and Sweden, have already banned their farmers from using antibiotics for group prophylaxis. The new EU regulations will impose this restriction on all EU farmers from 28 January 2022, and should therefore go some way towards closing the gap in responsible antibiotic use between different European countries.

However, the evidence presented in this report shows that focusing just on ending prophylactic group treatments will not deliver the full antibiotic reductions that are achievable and required to help protect antibiotic efficacy. If farming systems with poor husbandry are allowed continue to make animals sick, then even with routine prophylactic antibiotic use banned, farmers will still rely on excessive antibiotic use to keep their animals reasonably healthy.

This is why policies on farm antibiotic use need to be delivered in conjunction with new policies on animal husbandry and animal health. Current EU animal-welfare regulations permit many practices described in this report that are associated with poor animal health, high levels of stress, poor hygiene and high levels of antibiotic use.

Revisions in EU animal-welfare regulations are now urgently required and considering how improvements in these regulations can contribute to reductions in antibiotic use should be a major consideration when new policies are developed.

Member States should not merely wait for the EU to take action, and should ensure that their own farmers are fully compliant with all aspects the new antibiotics regulations, including the requirement to end the use of antibiotics to compensate for poor hygiene and inadequate husbandry. Governments should therefore develop policies that aim to achieve a transition to more sustainable farming practices which prioritise human, animal and environmental health.

Focusing just on ending prophylactic group treatments will not deliver the full antibiotic reductions that are achievable and required to help protect antibiotic efficacy.

Policies on farm antibiotic use need to be delivered in conjunction with new policies on animal husbandry and animal health.

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