EUROPEAN MEDICINES AGENCY
SCIENCE MEDICINES HEALTH

Sales of veterinary antimicrobial agents in 30 European countries in 2016

Trends from 2010 to 2016
Eighth ESVAC report

An agency of the European Union

Mission statement

The mission of the European Medicines Agency is to foster scientific excellence in the evaluation and supervision of medicines, for the benefit of public and animal health.

Legal role

The European Medicines Agency (hereinafter 'the Agency' or EMA) is the European Union (EU) body responsible for coordinating the existing scientific resources put at its disposal by Member States for the evaluation, supervision and pharmacovigilance of medicinal products.

The Agency provides the Member States and the institutions of the EU and the European Economic Area (EEA) countries with the best-possible scientific advice on any questions relating to the evaluation of the quality, safety and efficacy of medicinal products for human or veterinary use referred to it in accordance with the provisions of EU legislation relating to medicinal products.

The founding legislation of the Agency is Regulation (EC) No 726/2004 of the European Parliament and the Council of 31 March 2004 laying down Community procedures for the authorisation and supervision of medicinal products for human and veterinary use and establishing a European Medicines Agency[1].

Principal activities

Working with the Member States and the European Commission (EC) as partners in a European medicines network, the Agency:

- provides independent, science-based recommendations on the quality, safety and efficacy of medicines, and on more general issues relevant to public and animal health that involve medicines;
- applies efficient and transparent evaluation procedures to help bring new medicines to the market by means of a single, EU-wide marketing authorisation granted by the EC;
- implements measures for continuously supervising the quality, safety and efficacy of authorised medicines to ensure that their benefits outweigh their risks;
- provides scientific advice and incentives to stimulate the development and improve the availability of innovative new medicines;
- recommends safe limits for residues of veterinary medicines used in food-producing animals, for the establishment of maximum residue limits by the EC;
- involves representatives of patients, healthcare professionals and other stakeholders in its work, to facilitate dialogue on issues of common interest;
- publishes impartial and comprehensible information about medicines and their use;
- develops best practice for medicines evaluation and supervision in Europe, and contributes alongside the Member States and the EC to the harmonisation of regulatory standards at the international level.

Guiding principles

- We are strongly committed to public and animal health.
- We make independent recommendations based on scientific evidence, using state-of-the-art knowledge and expertise in our field.
- We support research and innovation to stimulate the development of better medicines.
- We value the contribution of our partners and stakeholders to our work.
- We assure continual improvement of our processes and procedures, in accordance with recognised quality standards.
- We adhere to high standards of professional and personal integrity.
- We communicate in an open, transparent manner with all of our partners, stakeholders and colleagues.
- We promote the well-being, motivation and ongoing professional development of every member of the Agency.

[1] OJ L 136, 30.4.2004, p. 1

Sales of veterinary antimicrobial agents in 30 European countries in 2016

Trends from 2010 to 2016

Eighth ESVAC report

15 October 2018
EMA/275982/2018
Veterinary Medicines Division

Acknowledgements

The members and observers of the ESVAC sales advisory expert group — Kari Grave (chair), Christina Greko, Katariina Kivilahti-Mäntylä, Laura Mie Jensen, Gérard Moulin and Lucie Pokludová — are acknowledged for providing valuable comments and scientific advice during the production of this report.

Furthermore, Reinhard Fuchs, Klemens Fuchs, Bart Hoet, Ivaylo Ivanov, Iva Gruden Zdunić, Lucie Pokludová, Jana Wojtylová, Marios Genakritis, Laura Mie Jensen, Marju Sammul, Katariina Kivilahti-Mäntylä, Gérard Moulin, Anne Chevance, Inke Reimer, Christoph Bode, Spyridon Farlopoulos, Ioannis Malemis, Edit Nagy, Katalin Mészárosné Árvai, Jóhann M. Lenharðsson, Jeremiah Gabriel Beechinor, Gavin Ryan, Loredana Candela, Inese Pereverteņa, Zanda Auce, Sigitas Siriukaitis, Marcel Bruch, Bart van den Assum, Inge van Geijlswijk, Kari Grave, Kari Olli Helgesen, Nina Pora, Maria Azevedo Mendes, João Pedro Duarte da Silva, Camelia Voicu, Anton Svetlin, Rinaldo Zidar, Judita Hederová, Iveta Sincaková, Cristina Muñoz Madero, Sara Sacristán Álvarez, Kinfe Girma, Christina Greko, Cedric Müntener, Ana Vidal, Stacey Brown and Alexandra Pickering are all acknowledged for providing data and valuable comments for the report.

European Medicines Agency staff members Kristine Ignate, Jordi Torren Edo, Rosa Peran and Manuela Mazzuferi are gratefully acknowledged for the preparation of the report.

Citation

Suggested citation: European Medicines Agency, European Surveillance of Veterinary Antimicrobial Consumption, 2018. 'Sales of veterinary antimicrobial agents in 30 European countries in 2016'. (EMA/275982/2018)

Correspondence

Any correspondence relating to this report should be sent by e-mail to: ESVAC@ema.europa.eu

About the European Medicines Agency

The European Medicines Agency (EMA) is a decentralised body of the EU, located in London. Its main responsibility is the protection and promotion of public and animal health, through the evaluation and supervision of medicines for human and veterinary use.

The Agency is responsible for the scientific evaluation of applications for European marketing authorisations for both human and veterinary medicines (centralised procedure). Under the centralised procedure, companies submit a single marketing authorisation application to the Agency. Once granted by the EC, a centralised marketing authorisation is valid in all EU Member States and, after implementation at national level, in the EEA-EFTA states (Iceland, Liechtenstein and Norway).

The Agency, with the help of its Committee for Medicinal Products for Veterinary Use (CVMP), and its Antimicrobials Working Party (AWP), has produced a strong body of scientific advice[2] in relation to the use of antimicrobials and the risk of antimicrobial resistance (AMR), with the intention of promoting the continued availability of effective antimicrobials for use in animals, while at the same time acting to minimise risks to animals or humans arising from their use.

The European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) project was launched by the Agency in September 2009, following a request from the EC to develop a harmonised approach to the collection and reporting of data on the use of antimicrobial agents in animals from the Member States.

About the report

The eighth ESVAC report presents data on the sales of veterinary antimicrobial agents from 30 European countries in 2016, provided at package level according to a standardised protocol and template. In addition, it includes a chapter describing changes in consumption of veterinary antimicrobials for the years 2010-2016 (Chapter 2.8).

Chapter 2.8.2. focuses on the changes across time in each country. Explanations for the possible reasons for the changes across time in the various ESVAC participating countries have been provided by the ESVAC national contact points (NCs). This chapter emphasises in particular certain classes/subclasses of antimicrobials included in Category 2 of the categorisation made by the EMA Antimicrobial Advice ad hoc Expert Group (AMEG) (see classification criteria in Annex 5). The AMEG categories take into account the World Health Organization (WHO) categorisation of antimicrobials, the consumption of those antimicrobials in veterinary medicine, the hazards of zoonotic relevance in Europe and the risk of resistance transfer to humans. The AMEG classification is published on the EMA webpage[3].

Category 2 of the AMEG categorisation includes those veterinary antimicrobials where the risk for public health is estimated to be higher than other classes of antimicrobials; fluoroquinolones, 3rd- and 4th-generation cephalosporins and polymyxins are included in this category. Macrolides are not included in Category 2 of the AMEG categorisation[4]. Aminoglycosides and certain penicillins (aminopenicillins, i.e. amoxicillin, ampicillin and metampicillin) have been recently revised by the CVMP without suggesting a category for those groups of antimicrobials[5]. A revision of the classification of AMEG is currently ongoing[6].

---

[2] Available from the European Medicines Agency website (www.ema.europa.eu) via Home > Veterinary regulatory > Overview > Antimicrobial resistance

[3] Available from the European Medicines Agency website (www.ema.europa.eu): http://www.ema.europa.eu/docs/en_GB/document_library/Other/2014/07/WC500170253.pdf (pages 29-31).

[4] Although macrolides are not included in Category 2, the CVMP has made recommendations indicating that, amongst others, the responsible use of antimicrobials (macrolides) should be strongly promoted, and that although acknowledging that macrolides are first-line treatment against a number of animal diseases, there is a need to avoid unnecessary use.

[5] See the EMA website (www.ema.europa.eu): via Home> Veterinary regulatory> Research and development > Scientific guidelines > Safety and residues > Antimicrobials (http://www.ema.europa.eu/ema/index.jsp?curl=pages/regulation/general/general_content_000829.jsp&mid=WC0b01ac0580a74c89)

[6] EC request for an update of the advice on the impact on public health and animal health of the use of antibiotics in animals: http://www.ema.europa.eu/docs/en_GB/document_library/Other/2017/07/WC500232322.pdf

This report places emphasis primarily on food-producing animals.

The data and information included in this report has been reviewed and approved by the ESVAC NCs and alternates.

It is generally agreed that it usually takes at least three to four years to establish a valid baseline for the data on sales of veterinary antimicrobial agents. Consequently, the data from countries that have collected such data for the first or even second time should be interpreted with due caution.

It should be emphasised that the data presented in this report should not be used alone as a basis for setting management priorities, additional data on production of animals per country, available medicines and other factors should be considered.

It is also recommended not to use data presented in this report to directly compare countries as more detailed insight and analysis may be needed.

Table of contents

List of figures

List of tables

Tables and charts in Annexes 1-8

Summary

A total of 30 European countries — 29 EU/EEA countries and Switzerland — submitted data on sales or prescriptions (two countries) of antimicrobial veterinary medicinal products (VMPs) to the European Medicines Agency for 2016.

A population correction unit (PCU) is applied as a proxy for the size of the food-producing animal population (including horses). The main indicator used in the current report to express the sales is milligrams of active ingredient sold per population correction unit — mg/PCU.

A large difference in the sales, expressed as mg/PCU, was observed between the most- and least-selling countries (range 2.9 to 453.4 mg/PCU) for 2016; the total sales for all 30 countries which delivered data in 2016 was 124.6 mg/PCU, while the median was 57.0 mg/PCU.

Of the overall sales of antimicrobials in the 30 countries in 2016, the largest amounts, expressed as a proportion of mg/PCU, were accounted for by tetracyclines (32%), penicillins (26%) and sulfonamides (12%). Overall, these three classes accounted for 70% of total sales in the 30 countries. Of the highest priority critically important antimicrobials (HP CIAs) for human medicine listed by the WHO[7] – 3rd- and 4th-generation cephalosporins, quinolones, polymyxins (colistin only) and macrolides – the sales for food-producing animals accounted for 0.2%, 2.6%, 5.1% and 7.0%, respectively, of the total sales in the 30 countries participating in the ESVAC in 2016[8].

The prescribing patterns of the various antimicrobial classes, expressed as mg/PCU, varied substantially between the countries. In 2016, notable variations were observed between countries in the proportion of antimicrobial classes included in the EMA AMEG Category 2 – 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins – with sales (mg/PCU) ranging from <0.01 to 0.7 mg/PCU, <0.01 to 9.7 mg/PCU and 0 to 22.0 mg/PCU, respectively (Table 5). The aggregated sales of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins were 0.21 mg/PCU, 2.70 mg/PCU and 6.62 mg/PCU in those 25 countries that provided the data from 2011 to 2016 (Figure 34).

Aggregated across the 30 countries, the sales (mg/PCU) of pharmaceutical forms for group treatment accounted for 90.1% of the total sales: premixes accounted for 40.8%; oral powders for 11.9%; and oral solutions for 37.4% (Figure 9). The proportion accounted for by pharmaceutical forms for group treatment varied substantially between countries, ranging from 5% to 96% (Figure 8). Of pharmaceutical forms for treatment of individual animals (9.9%), 9.0% of the sales were accounted for by injectable preparations, 0.6% by intramammary preparations and 0.3% by oral pastes, boluses and intrauterine preparations (Figure 9).

For all 30 countries, the proportion of the total sales in 2016 of veterinary antimicrobials applicable for group treatment (oral powder, oral solution and premix) containing two or more active ingredients was relatively low (17.8%) compared to the proportion of presentations containing only one active ingredient (82.2%). Of antimicrobial VMPs applicable for group treatment, 82.2%, 17.3% and 0.5% contained one, two and three active ingredients, respectively (Table A9).

In total, 25 countries provided data for all years between 2011 and 2016. For these countries an overall decline in sales (mg/PCU) of 20.1% was observed. Sales fell from 162.0 mg/PCU in 2011 to 129.4 mg/PCU in 2016 (Figure 34). A fall in sales (in mg/PCU) of more than 5% was observed in 16 of these countries (in the range -8.7% to -57.8%), whilst there was an increase of more than 5% in six countries during the reference period (a range from 7.9% to 67.7%) (Table 8).

From 2011 to 2016 a noticeable decrease in sales (mg/PCU) was identified for some of the highest selling countries, which has had a significant impact on the observed 20.1% reduction for these 25 countries during this period.

The proportion of sales of the HP CIAs for human medicine was low. In addition, sales of these antimicrobial classes showed a decreasing trend, which contributed to the overall decrease. Between 2011 and 2016, sales of 3rd- and 4th-generation cephalosporins decreased by 15.4%, polymyxins decreased by 39.9% in those 25 countries that provided data during this period, and sales of quinolones declined by 13.6%. Of these, fluoroquinolones increased by 6.3%, at the same time showing a decrease of 9.8% from 2014.

[7] http://who.int/foodsafety/cia/en

[8] According to the WHO classification, both fluoroquinolones and other quinolones are categorised as the highest priority CIAs (http://www.who.int/foodsafety/cia/en/). Sales of quinolones accounted for 2.6% of the total sales in 30 countries in 2016, 2.2% was accounted for by fluoroquinolones and 0.4% by other quinolones. The WHO also includes 5th generation cephalosporins, glycopeptides and ketolides as highest priority but those are not reported as sold in the ESVAC participating countries.

Between 2011 and 2016 a decrease in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins was noted in 12 countries (variation in sales ranged from <-0.01 mg/PCU to -0.3 mg/PCU) and an increase was observed for 13 countries (variation ranging from 0.03 mg/PCU to 0.5 mg/PCU). A wide range of increases (<0.01 mg/PCU and 2.9 mg/PCU) in sales of fluoroquinolones was noted in 11 Member States and also in those 14 countries that showed a decreasing trend (between <-0.01 mg/PCU and -3.0 mg/PCU). Of those 25 countries that provided the sales data from 2011 to 2016, 3 (Iceland, Finland and Norway) have reported no sales of polymyxins for any of the years, while in 14 countries sales of polymyxins decreased in a range between -0.01 mg/PCU and -15.6 mg/PCU, and in 8 countries sales of this antimicrobial class increased in a range from 0.02 mg/PCU to 5.6 mg/PCU.

Tentative explanations provided by the countries (see Chapter 2.8.2) for the decline in sales across 2010 to 2016 include, among others, the implementation of responsible-use campaigns, the setting of targets, restriction of use, benchmarking, increased awareness of the threat of AMR, changes in animal demographics and changes in systems for collecting data.

Variations between the 30 countries on reported sales (mg/PCU) and on sales patterns are likely to be partly due to differences in the composition of animal populations and in the production systems in various countries. There are considerable variations in terms of the daily dose used for the various antimicrobial agents, and pharmaceutical forms and duration of treatment. These factors can only partly explain the differences in the sales observed between the 30 countries, so other factors must also be considered. Some countries have changed their national data collection systems over the years (e.g. Slovenia in 2013, Spain in 2014 and Romania 2015) and/or have identified under-reporting for some of the years (e.g. Bulgaria 2014, Spain 2014); this may have an impact on the data. Overall, this emphasises that data presented in this report should not be used for direct comparison between countries without taking into account differences between them and that changes observed over the years for certain countries should be interpreted with caution.

The European Centre for Disease Prevention and Control (ECDC)/European Food Safety Authority (EFSA)/EMA second joint report on the integrated analysis of the consumption of antimicrobial agents and occurrence of AMR in bacteria from humans and food-producing animals (JIACRA II report)[9], while recognising the complexity of evaluating the association between the sales of antimicrobials and occurrence of AMR in animals and humans, confirms that reduction of the sales of antimicrobials is a desirable objective in order to contain AMR.

ECDC, EFSA and EMA have jointly established a list of harmonised outcome indicators[10] to assist EU Member States in assessing their progress in reducing the use of antimicrobials and occurrence of AMR in both humans and food-producing animals. For food-producing animals, proposed indicators for antimicrobial consumption include: overall sales of veterinary antimicrobials; sales of 3rd- and 4th-generation cephalosporins; sales of quinolones (specifying the proportion of fluoroquinolones); and sales of polymyxins, measured in mg/PCU.

[9] Available on the EMA webpage (www.ema.europa.eu) via: Home > Veterinary regulatory > Overview > Antimicrobial resistance > Analysis of consumption and resistance (JIACRA): http://www.ema.europa.eu/docs/en_GB/document_library/Report/2017/07/WC500232336.pdf

[10] Available on the EMA webpage (www.ema.europa.eu) via Home > Veterinary regulatory > Overview > Antimicrobial resistance > Analysis of consumption and resistance (JIACRA) > Outcome indicators (http://www.ema.europa.eu/docs/en_GB/document_library/Report/2017/10/WC500237745.pdf)

Introduction

Terms of reference from the European Commission

In 2008, the Council of the EU adopted the Council Conclusions on Antimicrobial Resistance (AMR)[11], calling upon the European Commission (EC) and the Member States to strengthen surveillance systems and improve data quality on antimicrobial resistance and the consumption of antimicrobial agents within both the human and veterinary sectors. In response to the Council Conclusions, the EC requested the Agency to take the lead in the collection of data on sales of veterinary antimicrobial agents in the Member States. To guarantee an integrated approach, the EMA was requested to consult the ECDC, the EFSA and the EU Reference Laboratory for Antimicrobial Resistance (EURL-AMR).

The European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) project was launched in September 2009, following a request to develop an approach for the harmonised collection and reporting of data on the use of antimicrobial agents in animals in the Member States (SANCO/E2/KDS/rz D(2008) 520915). Through the terms of reference from the EC, the EMA was requested, among other activities:

- to identify the existing data/surveillance systems established for collection of sales and use of antibacterial drugs in the Member States;
- to develop a harmonised approach for the collection and reporting of data based on national sales figures, combined with estimations of usage in at least major groups of species;
- to collect the data from Member States and manage the database;
- to draft and publish a summary annual report presenting the data from Member States.

Regarding the data collection:

- comparability with the sale/use of antimicrobials in humans should be ensured.

About ESVAC activity

Through the ESVAC, data are collected on sales of antimicrobial VMPs at package level from the EU Member States, EEA countries and Switzerland. Furthermore, in 2016, the ESVAC established defined daily doses for animals (DDDvet) and defined course doses for animals (DCDvet) (EMA/224954/2016[12]). To prepare for the collection of data by animal species, in 2018 the ESVAC published guidance for the collection of harmonised and standardised data from Member States on the use of antimicrobials by species[13]. The ESVAC Vision and Strategy 2016-2020 published on the EMA's web page details the intended future development of ESVAC activity[14].

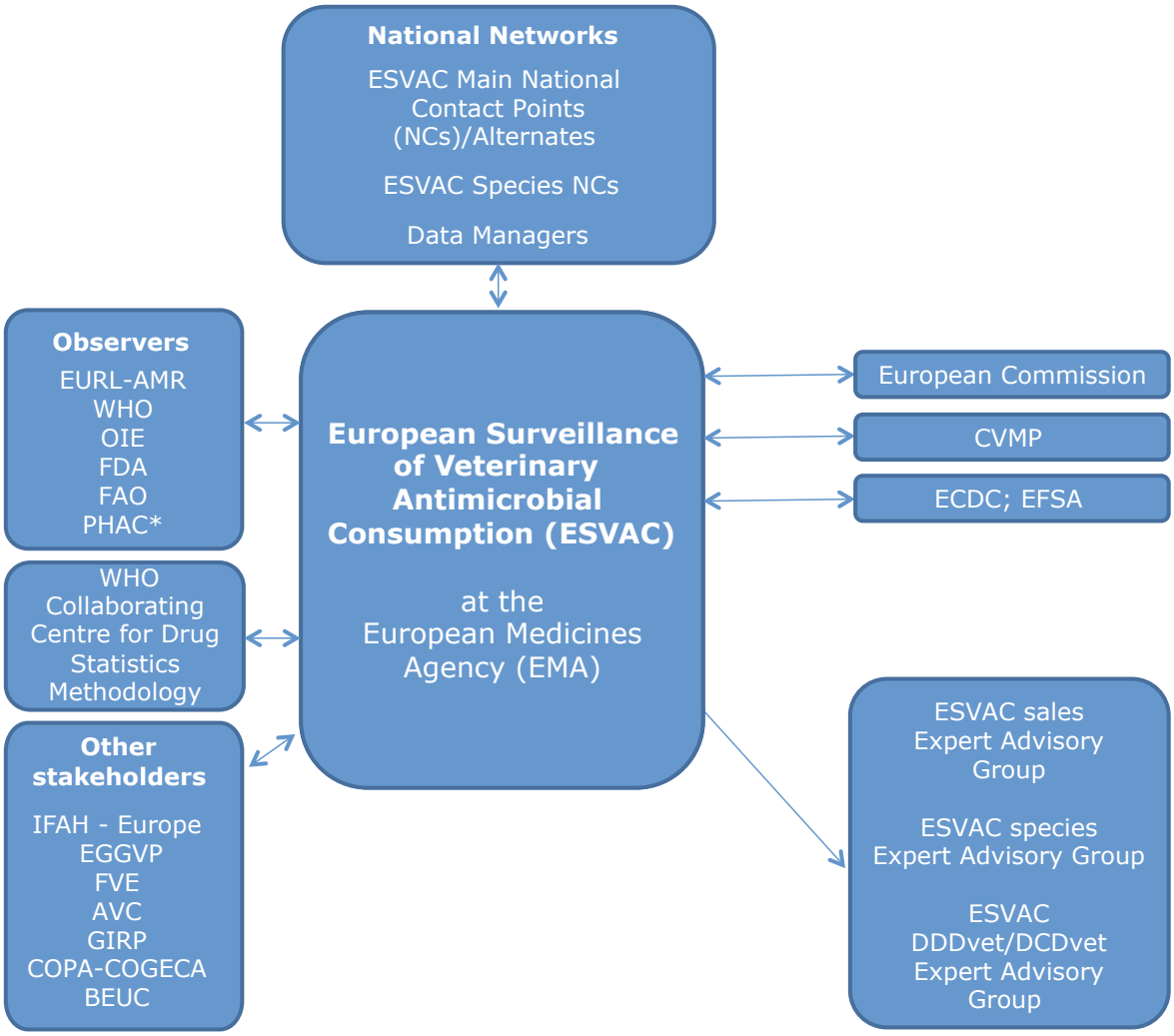
Organisation of the ESVAC project is illustrated in Figure 1.

The core of ESVAC sales activity is the ESVAC network of main NCs and alternates, nominated by the national competent authorities in the participating EU and EEA countries. The country and affiliation of the ESVAC main NCs/alternates can be found in Annex 8 of this report. The tasks of the ESVAC main NCs are: to provide sales data to the ESVAC team at the EMA in response to annual data calls; to revise the data in terms of quality and validity, following requests from the ESVAC team; to validate the data applied to calculate the PCU; and to provide comments on the annual ESVAC report.

[11] http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/lsa/101035.pdf
[12] Available on the EMA website (www.ema.europa.eu) via: Home > Veterinary regulatory > Antimicrobial resistance > European Surveillance of Veterinary Antimicrobial Consumption > Units of measurement
[13] Available on the EMA website (www.ema.europa.eu) via Home > Veterinary regulatory > Antimicrobial resistance > European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) > Reporting data by animal species: http://www.ema.europa.eu/ema/doc_index.jsp?curl=pages/includes/document/document_detail.jsp?webContentId=WC500224492&murl=menus/document_library/document_library.jsp&mid=0b01ac058009a3dc
[14] Available on the EMA website (www.ema.europa.eu) via: Home > Veterinary regulatory > Antimicrobial resistance > European Surveillance of Veterinary Antimicrobial Consumption (http://www.ema.europa.eu/docs/en_GB/document_library/Regulatory_and_procedural_guideline/2016/04/WC500204522.pdf)

The ESVAC sales data activity is supported by an Expert Advisory Group (EAG) which comprises representatives of the ESVAC main NCs or alternate network. There are also observers from the EC, ECDC and the EFSA. The task of the sales ESVAC EAG is to provide technical advice on surveillance of overall sales data of antimicrobial agents, including collection, analysis and reporting of data, and preparation of the annual reports. A list of the ESVAC EAG members and observers can be found in Annex 9 of this report.

Figure 1. Organisation of the ESVAC



* Public Health Agency of Canada

ESVAC deliverables also include publication by ESVAC BI (Oracle Business Intelligence Enterprise Edition) of the core graphs and tables of the ESVAC sales reports available on the EMA's website[15].

[15] ESVAC Interactive Database accessible via ESVAC activity web page: http://www.ema.europa.eu/ema/index.jsp?curl=pages/regulation/document_listing/document_listing_000302.jsp&mid=WC0b01ac0580153a00

1. Technical notes

1.1. Veterinary antimicrobial medicinal products included in the data sets

To obtain harmonised data on sales of veterinary antimicrobial medicinal products from the ESVAC participating countries, the ESVAC protocol[16] has defined which antimicrobials are to be included in the data sets by using the Anatomical Therapeutic Chemical classification system for VMPs (ATCvet[17]) (Table 1). All pharmaceutical forms[18] are included except dermatological preparations (ATCvet group QD) and preparations for sensory organs (ATCvet group QS). The contribution from these pharmaceutical forms, in tonnes of active ingredient, to the total amount of veterinary antimicrobials sold is shown to be negligible and thus the underestimation of total sales is insignificant. It should be noted that antimicrobial growth promoters are not allowed to be used in ESVAC participating countries. Ionophore coccidiostat feed additives and veterinary medicines containing zinc oxide are not included in the data material.

To harmonise the reporting of sales of VMPs with the data on sales of antimicrobial agents in human medicine, they are presented according to the classes/subclasses defined by the ATCvet hierarchical system, using WHO international non-proprietary names (INN), where available. If INNs have not been assigned, the ATCvet system applies either USAN (United States Adopted Names) or BAN (British Approved Names).

Table 1. Categories and ATCvet code[17] of antimicrobial VMPs included in the data

Categories of veterinary antimicrobial agents	ATCvet codes
Antimicrobial agents for intestinal use	QA07AA; QA07AB
Antimicrobial agents for intrauterine use	QG01AA; QG01AE; QG01BA; QG01BE; QG51AA; QG51AG
Antimicrobial agents for systemic use	QJ01
Antimicrobial agents for intramammary use	QJ51
Antimicrobial agents belonging to antiparasitic products[1]	QP51AG

[1] Solely sulfonamides

1.2. Variables reported for each antimicrobial veterinary medicinal product

Detailed information on the variables to be reported for each antimicrobial veterinary medicinal product is given in Annex 2 of this report, as well as in the ESVAC protocol and ESVAC data-collection form published on the Agency's website[19]. To standardise the information, including for the purpose of data management, the following categories of pharmaceutical forms have been applied for reporting the sales data to the ESVAC: boluses, injectable medicines, intramammary preparations for lactating cows, intramammary preparations for dry cow treatment, intrauterine preparations, oral solutions (includes powders for administration in drinking water), oral pastes, oral powders (powder to be administered with the feed), premixes (premix for medicated feeding stuff) and tablets (including capsules). It should be noted that when, for example, there are instructions such as "powder for solution" or "powder for administration in drinking water" on the name/label and/or SPC, this should be reported as an oral solution. Premixes are VMPs, usually in the form of powders or granules, which are intended to be mixed into animal feed by feed mills.

[16] Available on the EMA website (www.ema.europa.eu): http://www.ema.europa.eu/docs/en_GB/document_library/Other/2010/04/WC500089584.pdf
[17] www.whocc.no/atcvet/
[18] Includes premixes used to produce medicated feed.
[19] Available on the EMA website (www.ema.europa.eu) via: Home > Regulatory > Veterinary medicines > Overview > Antimicrobial resistance > European Surveillance of Veterinary Antimicrobial Consumption > Sales data collection form and protocol.

1.3. Collection and calculation of sales data

The ESVAC participating countries provided the number of packages sold for each product presentation – i.e. name of VMP, pharmaceutical form, strength and pack size. The ESVAC participating countries uploaded these data directly to the ESVAC database using a web-based application. The sales (in weight of active substance) for each product presentation were calculated by multiplying the number of packages sold by the amount of active ingredient (strength) in each package; for combination preparations, the amount sold is calculated for all ingredients. Tonnes sold for each product presentation were automatically calculated in a standardised and harmonised manner. This implies application of standard conversion factors to calculate from international units (IU) to mg when strength was given in IU (Table A11); when prodrug standard conversion factors are used to convert to mg active ingredient (Table A12). In the case of combination preparations, the amount sold was calculated for each ingredient separately.

1.4. Denominator: population correction unit (PCU)

The amounts of veterinary antimicrobial agents sold in the different countries are normalised by the animal population at risk for being treated with antimicrobials in each country. The PCU has been established as a denominator for the sales data. The data sources used and the methodology for the calculation of the PCU are comprehensively described in Appendix 2 of the Agency's report 'Trends in the sales of veterinary antimicrobial agents in nine European countries: 2005-2009' (EMA/238630/2011)[20]. Animal categories included in the calculation of the PCU and the weights used to calculate the PCU are described in Annex 3 of this report. It must be emphasised that the PCU is purely a surrogate for the animal population at risk.

1.4.1. Calculation of PCU

The PCU for each animal category is calculated by multiplying numbers of livestock animals (dairy cows, sheep, sows and horses) and slaughtered animals (cattle, goat, pigs, sheep, poultry, rabbits and turkeys) by the theoretical weight at the most likely time for treatment. However, due to the limited availability of living goat data in Eurostat, this category was not included when the PCU methodology was established for the first ESVAC report[21]. For countries with a relatively high number of goats compared to other food-producing animals, this results in an underestimate of the PCU. For animals exported or imported for fattening or slaughter (cattle, goat, pigs, sheep and poultry), the PCU was calculated by multiplying the number of animals by a standardised weight.

For farmed fish, Eurostat data are given only as live-weight slaughtered rather than numbers slaughtered, and thus for fish biomass live-weight slaughtered is used for calculation of the total PCU. The PCU of the animals exported for fattening or slaughter in another Member State — i.e. cattle, pigs, poultry, goats and sheep — was added to the PCU of livestock and slaughter animals in the country of origin because young animals are typically treated more frequently than other age classes. The PCU for animals imported for fattening or slaughter in another Member State was subtracted from the total PCU of livestock and slaughter animals, since it is included in the data on slaughter animals (Eurostat data) to avoid double counting (counting by both the exporting and importing country).

The PCU is calculated for each species, weight class and/or production type, as follows:

PCU domestic

- Number of animals slaughtered × estimated weight at treatment
- Number of livestock × estimated weight at treatment

PCU export

- Number of animals transported to another country for fattening or slaughter × estimated weight at treatment

PCU import

- Number of animals imported from another country for fattening or slaughter × estimated weight at treatment

Total PCU is calculated as follows: PCU = total $PCU_{Domestic}$ + total PCU_{Export} – total PCU_{Import}

The total PCU by country is calculated according to the above data.

1 PCU = 1 kg of animal biomass.

[20] Available on the EMA website (www.ema.europa.eu) via: Home > Veterinary regulatory > Overview > Antimicrobial resistance > European Surveillance of Veterinary Antimicrobial Consumption

[21] Trends in the sale of veterinary antimicrobial agents in nine European countries (http://www.ema.europa.eu/docs/en_GB/document_library/Report/2011/09/WC500112309.pdf)

1.4.2. Animal species and categories included in the PCU; selection of data sources

Eurostat, the Statistical Office of the EU, covers data on numbers of food-producing animals slaughtered, as well as numbers of livestock animals. Eurostat[22] was therefore selected as the source for these data. If data were not available in Eurostat (e.g. for rabbits and fish), national statistics were applied. In addition, national statistics on animal categories were applied for non-EU countries: Iceland, Norway and Switzerland, as data for these countries are not available from Eurostat. For horses (food-producing species according to EU legislation), national statistics provided by the ESVAC NCs were used. Data on dogs and cats are not available in all participating countries; these species were not included in the PCU, to have comparable data. As tablets are typically approved only for companion animals, they were excluded from the data sets prior to the normalisation of the sales by the PCU.

The Eurostat data on numbers of cattle, pigs, poultry, sheep and goats exported or imported for fattening or slaughter might not be complete, as exports and imports are only reported above a certain amount. Therefore, data were obtained from TRACES (TRAde Control and Expert System run by the EC's DG SANTE), as these are based on health certificates, which are obligatory for all animals crossing any border, and thus the data are complete.

In cases where the deviation between the Eurostat data and/or TRACES data and national statistics was more than 5%, countries could provide national statistics for calculating the PCU.

1.5. Correction of historical data

Note that subsequent to the correction of historical data, the updated values were published in the ESVAC Interactive Database as soon as they had been validated and approved by Member States.

1.5.1. Sales data

Minor revisions have been made to the 2015 sales data for two countries: Slovakia identified an error in the reported number of packages sold for one injectable product for years 2011, 2013 and 2015; Germany identified that the sales for a second ingredient were not initially reported for six VMPs. The changes in tonnes and thus mg/PCU in these countries were minor compared to the data published in the ESVAC 2015 report. For Portugal, it was identified that some wholesalers failed to report a considerable number of VMPs for the 2015 sales dataset (for more details, see Chapter 2.8.2) and therefore corrections were provided. All above mentioned updates are included in the ESVAC database and also in the results of this ESVAC report.

1.5.2. PCU data

Minor updates have been made to the PCU data compared to the ESVAC 2015 report. For Croatia, the data for turkeys, slaughtered sheep and goats were revised for 2014 and 2015. For Norway, the data on horses were updated for previous years, i.e. 2010–2015. However, the difference in mg/PCU following the updates was insignificant.

1.6. Quality check and validation of the sales and PCU data

The ESVAC participating countries upload sales data directly using a web-based submission tool (ESVAC web application) designed for data collection. To ensure consistency of variables submitted automated warning and error messages are displayed instantaneously when any of the figures uploaded do not meet standardisation requirements. When data are uploaded, various summary reports can be created using the ESVAC BI application and can be used for validation. Each country is responsible for the quality of the sales delivered to the ESVAC. The ESVAC secretariat assists with the data validation including the identification of outliers, mainly by comparison against available data from previous years. Possible outliers are cross-checked and addressed with each ESVAC NC until final agreement is reached.

Development of suitable quality control measures, including assessment of data coverage and accuracy, are defined and set up by each country individually, taking into account the distinctive aspects of each country's data collection.

Reference data for the denominator (PCU) gathered by the Agency from the Eurostat database and TRACES are uploaded to the ESVAC web application. The data are subsequently validated by the ESVAC participating countries. To ensure data quality and validity, the PCU data are displayed in the ESVAC BI reports in a way that allows for comparison with values per animal category and the overall PCU approved for previous years. Possible outliers are cross-checked and addressed with each ESVAC NC until final agreement is reached.

[22] http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/themes

1.7. Analysis and reporting of the data

Based on the assumption that tablets are almost solely used for companion animals (boluses in food-producing animals), tablets are excluded from the dataset used to report sales for food-producing animals. In this report, sales data for tablets are reported separately as sales for use in companion animals; all other pharmaceutical forms are reported as sold for use in food-producing animals, including horses. Of note is that some of the sales allocated for food-producing animals could be for non-food-producing animals such as fur animals. In the current report, the term 'group treatment' is used for medication via feed or water; intramammary preparations for lactating cows and for dry cow treatment are reported aggregated.

The main indicator applied in this report to express the consumption of veterinary antimicrobials is mg of active ingredient normalised by the population correction unit (mg/PCU):

$$\frac{\text{Amount sold in tonnes} \times 10\text{^}9}{\text{PCU in kg}}$$

In this report, the term food-producing species includes horses. The data are presented according to the classes/subclasses defined by the ATCvet hierarchical system. For combination preparations, sales of each active ingredient are reported according to the ATCvet class/subclass name for each single substance in question. Maps of the spatial consumption of the various veterinary antimicrobial agents were created using Adobe Illustrator CC 2015.

It should be noted that data presented in this report are calculated using the exact sales figures for each product (five decimals), but in the tables and graphs the numbers are aggregated and rounded. Therefore, the total sales of tables, for example, may differ slightly from the more detailed data presented in this report.

All data presented in this report reflect the datasets available on 15 June 2018; any updates made to the data at a later stage are not included in the data analyses.

1.8. Summary of included data sources/types, by country

Information concerning the years of collecting data, legal basis for the data collection at national level, systems for distribution of antimicrobial VMPs, sources from which the data were obtained, type of data, and the data included by country are shown in Table 2.

Table 2. Summary of information on years of collecting data, legal basis for collecting data at national level, national data providers, sources for ESVAC data and characteristics of data, by country, for 2016

Country	Years collecting data	Legal basis	National data provider to ESVAC	Sources for ESVAC data (approx. no)	Sales data, prescription data or purchase data[1]	Sales between wholesalers and/or MAHs[2] excluded (Yes/No)	Products sold on special licence included (Yes/No)
Austria	>5 years	Mandatory to report	Austrian Agency for Health and Food Safety	MAHs (n=9); Wholesalers (n=9)	Sales to veterinarians, pharmacies	Yes	No
Belgium	>5 years	Mandatory to report	Federal Agency for Medicines and Health Products	Wholesalers (n=25); Feed mills (n=52)	Sales to veterinarians and pharmacies. Sales by feed mills to farmers	Yes	Yes
Bulgaria	>5 years	Not mandatory	Bulgarian Food Safety Agency	Wholesalers (n=36)	Sales to retailers, veterinarians, farmers and pharmacies	Yes	No
Croatia	3 years	Mandatory to report	Ministry of Agriculture, Veterinary Directorate	Wholesalers (n=17)	Sales to pharmacies and veterinarians	Yes	No
Cyprus	>5 years	Mandatory to report	Ministry of Agriculture, Natural Resources and Environment — Veterinary Services	Wholesalers (n=21); Feed mills (n=32)	Sales to veterinarians, pharmacies, wholesalers and feed mills	Yes	No
Czech Republic	>5 years	Mandatory to report	Institute for State Control of Veterinary Biologicals and Medicines	Wholesalers (n=84); Feed mills (n=51)	Sales to veterinarians, pharmacies and farmers. Sales by feed mills to farmers	Yes	Yes (<0.1%)
Denmark	>5 years	Mandatory to report	Danish Veterinary and Food Administration	VetStat (n=1) obtaining data from pharmacies (n=350), veterinarians (n=150), feed mills (n=3)	Prescription data from pharmacies, veterinarians, distributors and feed mills	Yes	Yes (0.1%)
Estonia	>5 years	Mandatory to report	State Agency of Medicines	Wholesalers (n=9)	Sales to veterinarians and pharmacies	Yes	Yes (1% of tonnes sold)
Finland	>5 years	Mandatory to report	Finnish Medicines Agency	Wholesalers (n=1); Feed mills (n=1); Importers of medicated feed (n=1)	Sales to pharmacies and veterinarians	Yes	Yes (5.5% of tonnes sold)

Country	Years collecting data	Legal basis	National data provider to ESVAC	Importers of medicated feed (n=1)	Sales data, prescription data or purchase data[1]	Sales between wholesalers and/or MAHs[2] excluded (Yes/No)	Products sold on special licence included (Yes/No)
France	>5 years	Mandatory to report	National Agency for Veterinary Medicinal Products (Anses-ANMV)	MAHs (n=43)	Sales to veterinarians, pharmacies, wholesalers and feed mills	Yes	No
Germany	>5 years	Mandatory to report	Federal Office of Consumer Protection and Food Safety	MAHs (n=33); Wholesalers (n=18); PSURs[3] data for premix	Sales to veterinarians	Yes	No
Greece	2 years	Mandatory to report	Greek National Organisation for Medicines	MAHs (n=75)[4]	Sales to wholesalers and retailers	Yes	No
Hungary	>5 years	Not mandatory	National Food Chain Safety Office Directorate of Veterinary Medicinal Products	Wholesalers (n=34)	Sales to veterinarians, feed mills, farmers and retailers	Yes	No
Iceland	>5 years	Mandatory to report	Icelandic Medicines Agency	Wholesalers (n=2)	Sales by wholesalers to veterinarians and pharmacies	Yes	Yes
Ireland	>5 years	Mandatory to report	Health Products Regulatory Authority	MAHs (n=71)	Sales to pharmacies or veterinarians, farmers and wholesalers within the country	Yes	No
Italy	>5 years	Mandatory to report	Italian Ministry of Health	MAHs (n=50)	Sales to wholesalers, pharmacies, feed mills, and farms authorised to produce medicated feed for self-consumption	Yes	No
Latvia	>5 years	Mandatory to report	Food and Veterinary Service	Wholesalers (n=25)	Sales to pharmacies, veterinarians, veterinary clinics and farmers	Yes	No
Lithuania	>5 years	Mandatory to report	State Food and Veterinary Service	Wholesalers (n=38)	Sales to pharmacies, veterinarians and farmers	Yes	No

Country	Years collecting data	Legal basis	National data provider to ESVAC	Sources for ESVAC data (approx. no)	Sales data, prescription data or purchase data[1]	Sales between wholesalers and/or MAHs[2] excluded (Yes/No)	Products sold on special licence included (Yes/No)
Luxembourg	5 years	Mandatory to report	Ministry of Health	Wholesalers (n=3)	Sales to pharmacies, veterinarians	Yes	Yes (cascade use)
Netherlands	>5 years	Not mandatory	Federation of the Dutch Veterinary Pharmaceutical Industry (FIDIN)	MAHs (n=17)	Sales to wholesalers and veterinarians	Yes	No
Norway	>5 years	Mandatory to report	Norwegian Veterinary Institute	Wholesalers (n=5) Feed mills (n=2)	Sales to pharmacies, veterinarians and feed mills (feed mills deliver VMPs only to fish farmers)	Yes	Yes (0.7%)
Poland	>5 years	Mandatory to report	Ministry of Agriculture and Rural Development	Wholesalers (n=123)	Sales to veterinarians	Yes	No
Portugal	>5 years	Mandatory to report	General Directorate for Food and Veterinary Affairs	Wholesalers (n=77)	Sales to retailers, veterinarians, farmers, producer organisations, veterinary clinics and feed mills	Yes	No
Romania	3 years	Mandatory to report	Institute for Control of Biological Products and Veterinary Medicines	MAHs (n=70)[5]	Sales to pharmacies, veterinarians and farmers	Yes	No
Slovakia	>5 years	Mandatory to report	Institute for State Control of Veterinary Biologicals and Medicaments	Wholesalers (n=46)	Sales to veterinarians, pharmacies, medicated feed mills and farmers	Yes	No
Slovenia	>5 years	Mandatory to report	Administration of the Republic of Slovenia for Food Safety, Veterinary Sector and Plant Protection (AFSVSPP)	Wholesalers (n=12)	Sales to pharmacies, feed mills and veterinarians	Yes	Yes (7.5%)
Spain	>5 years	Not mandatory	Spanish Agency for Medicines and Health Products	MAHs (n=48)	Sales to wholesalers and retailers, i.e. veterinary organisations and pharmacies	Yes	No

Country	Years collecting data	Legal basis	National data provider to ESVAC	Sources for ESVAC data (approx. no)	Sales data, prescription data or purchase data[1]	Sales between wholesalers and/or MAHs[2] excluded (Yes/No)	Products sold on special licence included (Yes/No)
Sweden	>5 years	Mandatory to report	National Veterinary Institute and Swedish Board of Agriculture	The Swedish eHealth Agency (n=1) obtaining data from pharmacies	Dispensed prescriptions	Yes	Yes (5–6 % of total tonnes of active substance)
Switzerland	>5 years	Mandatory to report	Federal Office of Food Safety and Veterinary Affairs	MAHs (n=15)	Sales to veterinarians, pharmacies, medicated feed mills	No	No
United Kingdom	>5 years	Mandatory to report	Veterinary Medicines Directorate	MAHs (n=61)	Sales to wholesalers, veterinarians, farmers and veterinary pharmacies	Yes	No

[1] Purchase/import data from e.g. pharmaceutical industry and/or from wholesalers in other countries.
[2] MAHs = marketing authorisation holders.
[3] PSURs = periodic safety update reports.
[4] Negligible sales from a few MAHs with a very small market share, and which do not have local representatives in Greece, are not included in the dataset.
[5] Since 2015, data have been collected from MAHs, while for 2014 the data were obtained from MAHs and wholesalers.

2. Results

2.1. Overall sales (tonnes) of veterinary antimicrobial agents

The overall national sales data cover sales of antimicrobial VMPs for use in food-producing animals, including horses (all pharmaceutical forms except tablets) plus sales of tablets that are used almost solely in companion animals. Injectable veterinary antimicrobial agents are also used in companion animals. As injectable presentations are frequently marketed for both food-producing and companion animals and their use in companion animals is minor in terms of weight of active ingredient, such sales are included in the statistics for food-producing animals. Sales of tablets, and therefore use in companion animals, accounted for a minor proportion of the total sales of veterinary antimicrobial agents in 2016, except in Finland, Iceland, Luxembourg, Norway, Slovenia, Sweden and the United Kingdom, where they represented 13.5%, 17.3%, 6.2%, 8.2%, 7.7%, 8.1% and 4.8% of the total sales, respectively (Table 3). Overall, sales of tablets in the 30 countries represented 0.9% of the total sales in tonnes.

Table 3. Distribution of overall sales, in tonnes of active ingredient, split into tablets (used in companion animals) and all other pharmaceutical forms (used mainly in food-producing animals), by country, in 2016

Country	Tablets		All other pharmaceutical forms		Total tonnes
	Tonnes	% of overall sales	Tonnes	% of overall sales	
Austria	0.3	0.6%	44.1	99.4%	44.4
Belgium	1.9	0.8%	240.4	99.2%	242.3
Bulgaria	0.1	0.1%	61.1	99.9%	61.1
Croatia	0.1	0.3%	26.6	99.7%	26.7
Cyprus	0.05	0.1%	46.3	99.9%	46.4
Czech Republic	1.2	2.6%	43.2	97.4%	44.3
Denmark	0.8	0.9%	98.7	99.1%	99.5
Estonia	0.1	1.9%	7.2	98.1%	7.4
Finland	1.5	13.5%	9.7	86.5%	11.2
France	15.5	2.9%	513.9	97.1%	529.4
Germany	8.4	1.1%	779.2	98.9%	787.6
Greece	0.7	0.8%	79.9	99.2%	80.6
Hungary	0.3	0.2%	155.6	99.8%	155.9
Iceland	0.1	17.3%	0.6	82.7%	0.7
Ireland	1.1	1.1%	102.3	98.9%	103.4
Italy	10.1	0.8%	1,213.2	99.2%	1,223.4
Latvia	0.1	1.8%	5.4	98.2%	5.5
Lithuania	0.1	0.8%	12.7	99.2%	12.8
Luxembourg	0.1	6.2%	1.9	93.8%	2.1
Netherlands	3.0	1.6%	181.7	98.4%	184.7
Norway	0.5	8.2%	5.6	91.8%	6.1
Poland	2.8	0.5%	570.2	99.5%	573.0
Portugal	1.1	0.5%	210.9	99.5%	212.0
Romania	3.5	1.3%	265.4	98.7%	268.9
Slovakia	0.2	1.7%	12.2	98.3%	12.4
Slovenia	0.4	7.7%	5.4	92.3%	5.8
Spain	1.7	0.1%	2,724.9	99.9%	2,726.5
Sweden	0.9	8.1%	9.8	91.9%	10.6
Switzerland	0.1	0.2%	37.6	99.8%	37.7
United Kingdom	16.4	4.8%	321.7	95.2%	338.1
Total 30 countries	**73.3**	**0.9%**	**7,787.1**	**99.1%**	**7,860.4**

2.2. Population-adjusted sales for food-producing animals, including horses, by antimicrobial class

The sales of veterinary antimicrobial agents, expressed as mg sold per population correction unit (PCU), ranged from 2.9 mg/PCU to 453.4 mg/PCU across the 30 countries (Table 4). The sales patterns of the antimicrobial classes also varied substantially between the countries (Table 5).

Table 4. Sales, in tonnes of active ingredient, of veterinary antimicrobial agents marketed mainly for food-producing animals[1], population correction unit (PCU) and sales in mg/PCU, by country, for 2016

Country	Sales (tonnes) for food-producing animals	PCU (1000 tonnes)	mg/PCU
Austria	44.1	957	46.1
Belgium	240.4	1,715	140.1
Bulgaria	61.1	393	155.3
Croatia	26.6	286	92.9
Cyprus	46.3	102	453.4
Czech Republic	43.2	705	61.2
Denmark	98.7	2,420	40.8
Estonia	7.2	113	64.0
Finland	9.7	521	18.6
France	513.9	7,143	71.9
Germany	779.2	8,734	89.2
Greece	79.9	1,258	63.5
Hungary	155.6	832	187.1
Iceland	0.6	120	4.7
Ireland	102.3	1,963	52.1
Italy	1,213.2	4,116	294.8
Latvia	5.4	180	29.9
Lithuania	12.7	338	37.7
Luxembourg	1.9	55	35.5
Netherlands	181.7	3,446	52.7
Norway	5.6	1,896	2.9
Poland	570.2	4,407	129.4
Portugal	210.9	1,014	208.0
Romania	265.4	3,116	85.2
Slovakia	12.2	242	50.4
Slovenia	5.4	178	30.3
Spain	2,724.9	7,518	362.5
Sweden	9.8	805	12.1
Switzerland	37.6	806	46.6
United Kingdom	321.7	7,142	45.0
Total 30 countries	**7,787.1**	**62,521**	**124.6***

[1] Tablets excluded as used almost solely in companion animals; injectable antimicrobial VMPs can also be used in companion animals; a few other products may solely be used in companion animals, but as their proportional use is minor, these are included in the sales for food-producing animals.

*Total mg/PCU for 30 countries represents aggregated sales (tonnes) for food-producing animals normalised by the aggregated PCU (1000 tonnes).

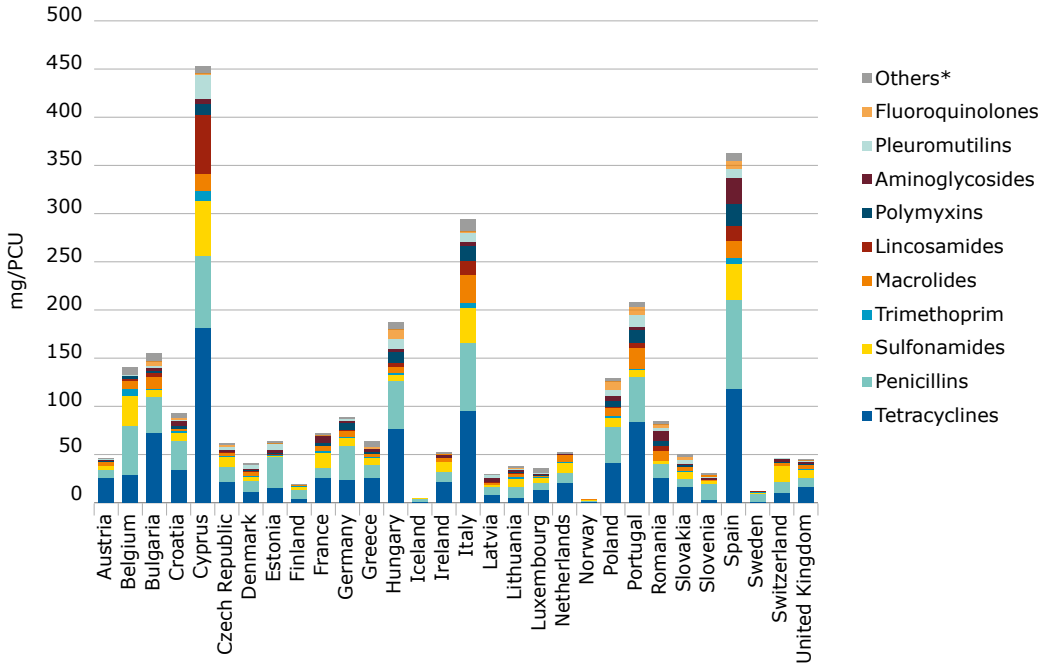
Table 5. Sales for food-producing animals, in mg per population correction unit (mg/PCU), of the various veterinary antimicrobial classes in the 30 European countries in 2016[1]

Country	Tetracyclines	Amphenicols	Penicillins	1st- and 2nd-gen. cephalosporins	3rd- and 4th-gen. cephalosporins	Sulfonamides	Trimethoprim	Macrolides	Lincosamides	Fluoroquinolones	Other quinolones	Aminoglycosides	Polymyxins	Pleuromutilins	Others*	Total mg/PCU
Austria	25.6	0.4	8.4	0.04	0.2	3.4	0.7	3.1	0.3	0.5	0	1.2	1.6	0.3	0.3	46.1
Belgium	29.0	1.8	50.1	0.2	0.3	31.7	6.4	8.7	2.7	0.6	0.4	0.5	2.4	0.6	4.9	140.1
Bulgaria	72.4	7.7	37.0	0.02	0.1	7.2	1.2	12.4	4.2	4.9	0.4	2.7	2.3	2.3	0.6	155.3
Croatia	33.9	3.5	30.0	0.4	0.2	8.5	1.1	2.4	0.1	2.8	0.5	4.5	3.8	1.1	0.2	92.9
Cyprus	180.7	4.4	75.6	0.1	0.7	56.3	10.9	17.1	61.9	1.6	0.5	5.1	11.1	24.8	2.5	453.4
Czech Republic	21.3	0.4	15.9	0.3	0.4	10.1	1.0	3.3	0.2	1.7	0.03	1.8	0.8	3.6	0.5	61.2
Denmark	11.2	0.6	11.2	0.02	0.01	4.0	0.8	4.8	0.9	<0.01	0.4	1.3	0.5	4.0	1.1	40.8
Estonia	15.2	0.4	32.0	0.2	0.7	1.5	0.3	0.9	0.3	1.3	0	3.2	0.7	6.5	0.8	64.0
Finland	3.9	0.2	8.4	0.03	0.01	3.9	0.8	1.0	0.1	0.1	0	0.1	0	0.04	0	18.6
France	25.9	0.8	10.0	0.3	0.1	15.2	2.4	5.0	0.4	0.2	0.4	7.2	2.8	0.6	0.7	71.9
Germany	23.3	0.6	35.4	0.1	0.4	7.7	1.1	6.3	1.1	1.0	0	1.9	7.9	1.4	1.0	89.2
Greece	25.4	0.3	13.7	<0.01	0.1	7.0	1.2	3.0	0.3	2.2	4.7	3.6	1.0	0.3	0.6	63.5
Hungary	76.7	3.3	49.0	0.1	0.4	6.9	1.4	6.8	3.6	9.6	0.1	2.3	12.2	11.0	3.7	187.1
Iceland	0.2	0	3.7	0	<0.01	0.4	0.1	0	0	0.01	0	0.3	0	0	0	4.7
Ireland[2]	21.0	1.2	10.5	0.4	0.1	10.0	0.8	3.4	0.3	0.5	0	3.2			0.7	52.1
Italy	94.5	4.7	71.6	0.1	0.4	36.2	4.4	29.2	15.2	2.3	2.4	4.2	15.1	8.7	5.7	294.8
Latvia	7.7	0.1	8.8	0.2	0.3	1.3	0.3	2.6	0.1	0.8	0.01	3.6	0.9	3.1	0.2	29.9
Lithuania	4.5	0.4	12.2	0.2	0.1	8.1	1.8	3.2	1.0	1.0	0.1	1.9	1.0	1.2	1.2	37.7
Luxembourg	13.5	1.2	6.6	0.1	0.7	5.3	1.0	0.8	0.6	0.8	0.02	0.9	1.0	0.1	2.7	35.5
Netherlands	19.8	1.4	11.0	0.04	<0.01	9.6	1.8	6.9	0.03	0.1	0.9	0.5	0.3	0.2	0.2	52.7
Norway	0.1	0.1	1.6	0	<0.01	0.7	0.1	<0.01	0	0.01	0.03	0.2	0	0.03	0	2.9

Country	Tetracyclines	Amphenicols	Penicillins	1st- and 2nd-gen. cephalosporins	3rd- and 4th-gen. cephalosporins	Sulfonamides	Trimethoprim	Macrolides	Lincosamides	Fluoroquinolones	Other quinolones	Aminoglycosides	Polymyxins	Pleuromutilins	Others*	Total mg/PCU
Poland	41.5	1.4	36.7	0.2	0.2	10.2	1.3	8.6	0.9	9.7	0.03	5.2	5.6	6.5	1.4	129.4
Portugal	83.9	1.7	46.3	0.1	0.5	7.2	1.4	21.5	4.8	8.9	0.1	3.8	13.5	12.2	2.2	208.0
Romania	25.2	3.2	15.1	0.01	0.1	2.7	0.5	10.1	4.8	3.3	0.2	9.9	5.6	4.1	0.5	85.2
Slovakia	15.9	0.2	8.7	0.3	0.4	7.1	0.8	4.2	0.3	3.6	0.03	1.7	1.2	3.7	2.1	50.4
Slovenia	2.6	0.7	16.5	0.1	0.2	2.9	0.6	0.3	0.1	2.9	0.03	2.3	0.1	0.5	0.3	30.3
Spain	117.5	3.5	92.4	0.1	0.3	37.3	7.2	17.5	15.4	8.5	0.8	27.5	22.0	9.3	3.2	362.5
Sweden	0.6	0.1	7.8	0.01	<0.01	2.0	0.4	0.4	0.01	0.02	0.05	0.3	0.1	0.3	0	12.1
Switzerland[3]	10.3	0.3	11.0	0.1	0.2	16.3	1.0	2.5		0.3	0	4.0	0.5		0.2	46.6
United Kingdom	16.2	0.6	9.4	0.1	0.1	7.7	1.5	4.0	0.5	0.2	0	2.7	0.02	1.5	0.5	45.0
Total sales[4] for 30 countries (mg/PCU)	**40.3**	**1.6**	**32.1**	**0.1**	**0.2**	**14.4**	**2.4**	**8.7**	**3.8**	**2.7**	**0.5**	**6.4**	**6.4**	**3.5**	**1.5**	**124.6**
Median[5] of 30 countries (mg/PCU)	**21.2**	**0.7**	**12.9**	**0.1**	**0.2**	**7.2**	**1.1**	**3.7**	**0.4**	**1.0**	**0.04**	**2.5**	**1.0**	**1.3**	**0.6**	**57.0**

∗Other antibacterials (bacitracin, fosfomycin, furaltadone, metronidazole, novobiocin, paromomycin, rifaximin and spectinomycin, classified as 'other antibacterials' in the ATCvet system).
1 For the countries where the injectable 3rd- and 4th-gen. cephalosporins are almost solely marketed for dogs and cats, the data provides a considerable overestimate for food-producing animals.
2 Polymyxins and pleuromutilins are aggregated with 'others' for reasons of commercial confidentiality.
3 For confidentiality reasons, pleuromutilins are grouped with others and lincosamides are grouped with macrolides.
4 Total sales expressed in mg/PCU consist of total amount of antimicrobial agents sold (mg) divided by total PCU (kg) for 30 countries.
5 Median shows the average of 15th and 16th values ranked from smallest to largest per each variable of 30 observations.

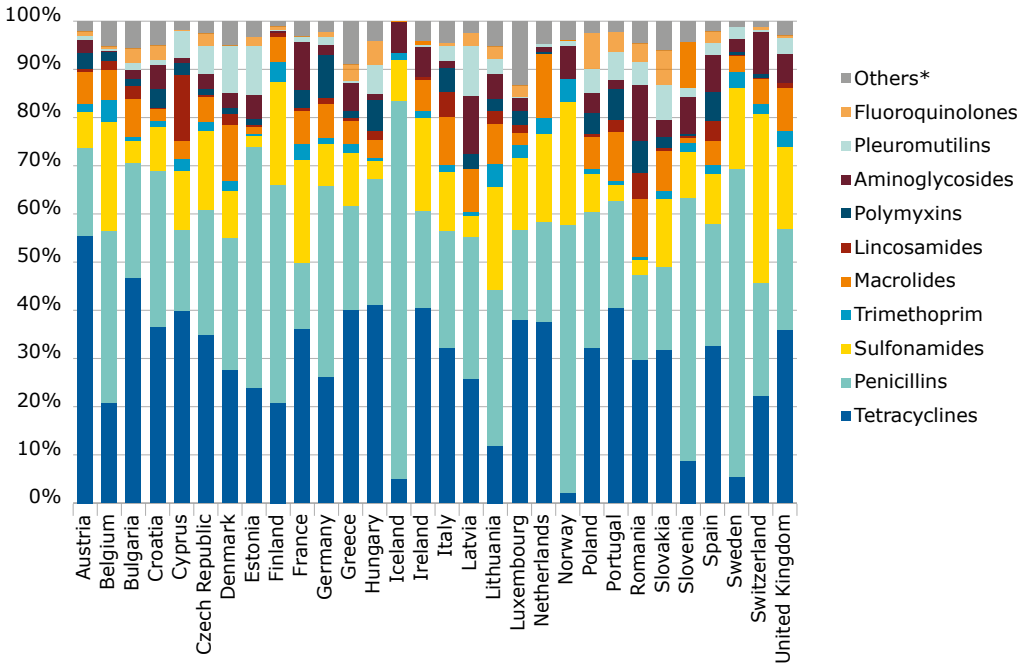
Figure 2. Sales for food-producing species, in mg/PCU, of the various veterinary antimicrobial classes, for 30 European countries, in 2016[1]



*Amphenicols, cephalosporins, other quinolones and other antibacterials (classified as such in the ATCvet system).

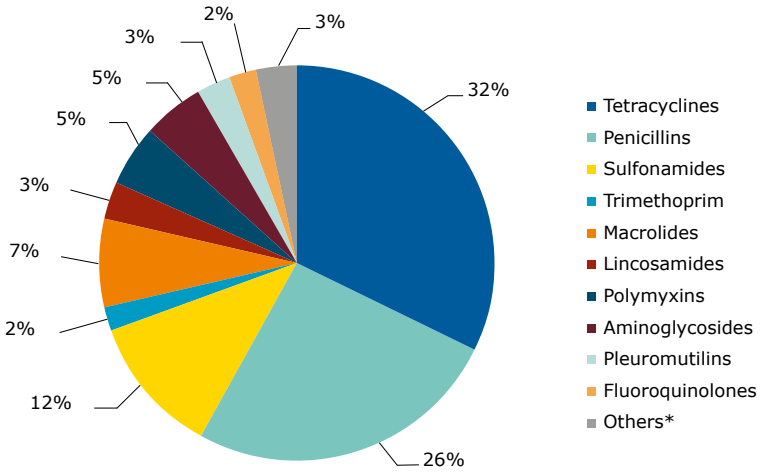
[1] Differences between countries can be partly explained by differences in animal demographics, in the selection of antimicrobial agents, in dosage regimes, in type of data sources, and veterinarians' prescribing habits.

Figure 3. Proportion of the total sales of the different veterinary antimicrobial classes, in mg/PCU, in the 30 European countries, for 2016



*Amphenicols, cephalosporins, other quinolones and other antibacterials (classified as such in the ATCvet system).

Figure 4. Sales of antimicrobial agents by antimicrobial class as percentage of the total sales for food-producing species, in mg/PCU, aggregated by 30 European countries, for 2016

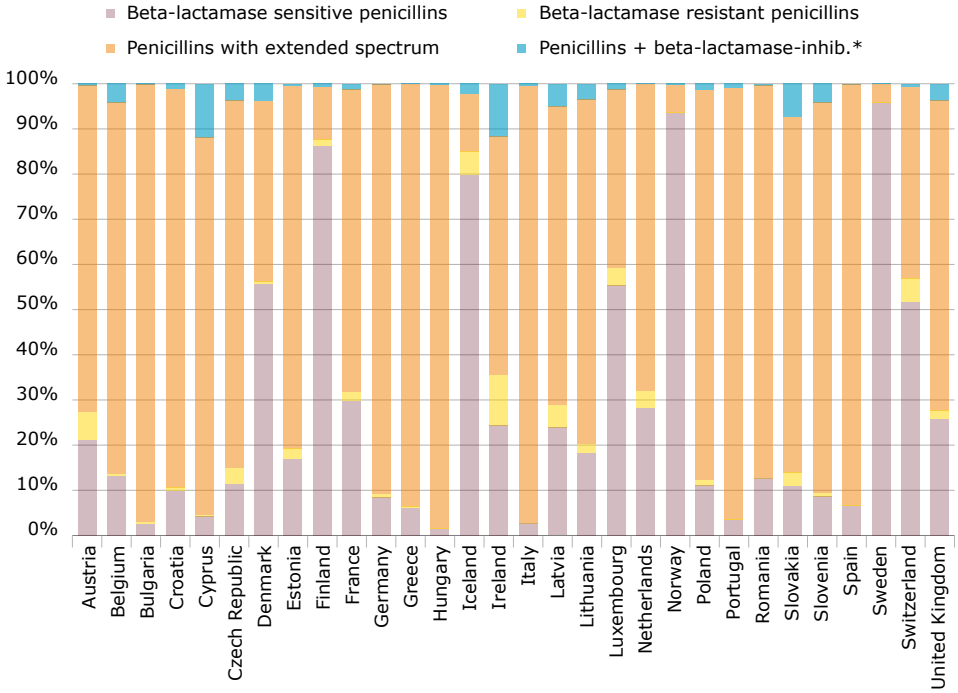


*Amphenicols, cephalosporins, other quinolones and other antibacterials (classified as such in the ATCvet system).

For all 30 countries, the sales of tetracyclines, penicillins and sulfonamides, in mg/PCU, accounted for 70% of the total sales in 2016 (Figure 4). Of the overall sales in the 30 countries, 0.1% was accounted for by 1st- and 2nd-generation cephalosporins, 0.2% were for 3rd- and 4th-generation cephalosporins, 1.3% were for amphenicols, and 0.4% for other quinolones.

The percentage of sales of penicillins attributed to the various subclasses differed substantially between the 30 countries (Figure 5). In the Nordic countries, where the proportion of sales of penicillin is typically high, beta-lactamase-sensitive penicillins[23] accounted for the majority of penicillins sold (range: 56% to 96%). For countries other than the Nordics, penicillins with an extended spectrum (mainly represented by amoxicillin) accounted for the major proportion of penicillin sales.

Figure 5. Distribution of the sales, in mg/PCU, of penicillins by subclass for food-producing species, in 30 European countries, for 2016



*Note: In the ATCvet system classified as combinations of penicillins that include beta-lactamase inhibitors.

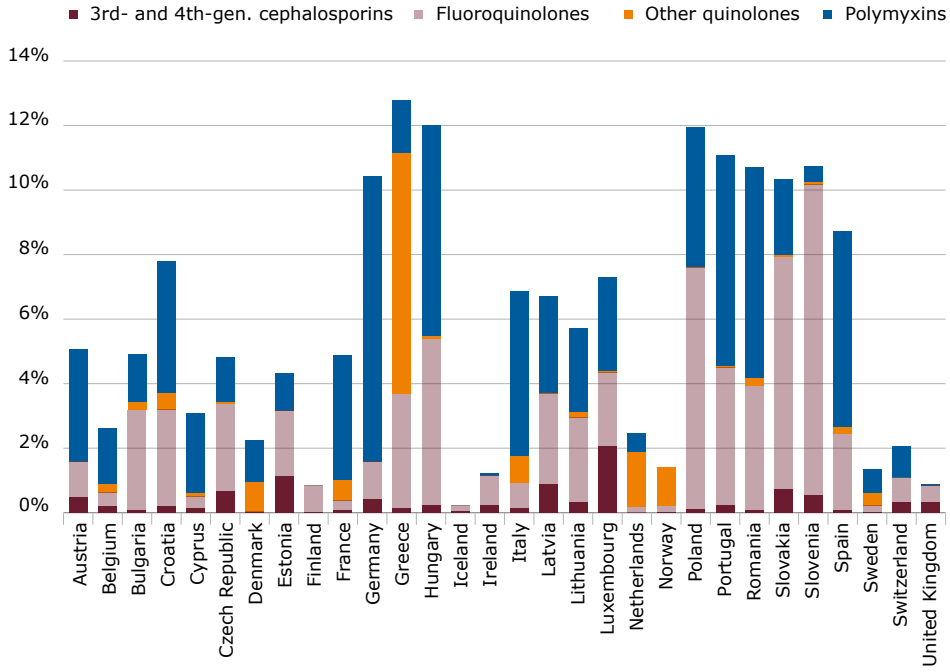
[23] Beta-lactamase-sensitive penicillins belong to ATCvet code QJ01CE. Procaine benzylpenicillin, penethamate hydriodide and phenoxymethylpenicillin accounted for the majority of sales of these penicillins.

The substances included in each of the categories in the above figure are detailed in Annex 4, Table A15. Penicillins plus beta-lactamase inhibitors refer to penicillins in combination with clavulanic acid.

The proportion of sales in 2016 of antimicrobials classified as the highest priority CIAs, and as included in the AMEG Category 2 (see Annex 5, Table A16), i.e. 3rd- and 4th-generation cephalosporins, fluoroquinolones, other quinolones and polymyxins, varied substantially between the 30 countries, ranging from 0.001% to 2.1%, 0.01% to 9.6%, 0% to 7.5% and 0% to 8.8%, respectively (Figure 6). The changes in total sales, in mg/PCU, of these classes/subclasses in the 30 European countries are shown in Figures 40 to 44.

Overall, in the 30 countries, the sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones, and polymyxins accounted for 0.2 %, 2.2 % and 5.1 %, respectively, of the total sales of antimicrobial VMPs in 2016.

Figure 6. Proportion of the total sales of 3rd- and 4th-generation cephalosporins, fluoroquinolones, other quinolones and polymyxins for food-producing species, in mg/PCU, for 30 European countries, in 2016[1,2,3]



[1] Variations between the countries should be interpreted with great care due to the large differences in dosing between these classes/ sub-classes of antimicrobials.
[2] No sales of other quinolones in Austria, Estonia, Finland, Germany, Iceland, Ireland, Switzerland and the United Kingdom.
[3] No sales of polymyxins in Finland, Iceland and Norway.

Throughout this report a special focus is given to certain antimicrobials that are either included in the AMEG Category 2 or are among the highest priority WHO CIAs. The emphasis also lies on the list of harmonised outcome indicators developed by EMA/EFSA/ECDC following the request of the EC. The aim of establishing such indicators is to assist EU Member States in assessing their progress in reducing the use of antimicrobials and AMR in both humans and food-producing animals.

Sales (mg/PCU) across time and by country of the relevant classes/subclasses in the 30 countries are shown in Chapter 2.8.2.

2.3. Population-adjusted sales for food-producing animals, including horses, by pharmaceutical form

The sales of veterinary antimicrobial agents for food-producing animals, including horses (hereafter designated as food-producing animals), stratified into pharmaceutical forms, by country, are shown in Figure 7. Tablets are not included in the data as these are used almost solely in companion animals.

Figure 7. Distribution of sales of veterinary antimicrobial agents for food-producing animals, in mg of active substance per population correction unit (mg/PCU), by pharmaceutical form in 30 European countries for 2016

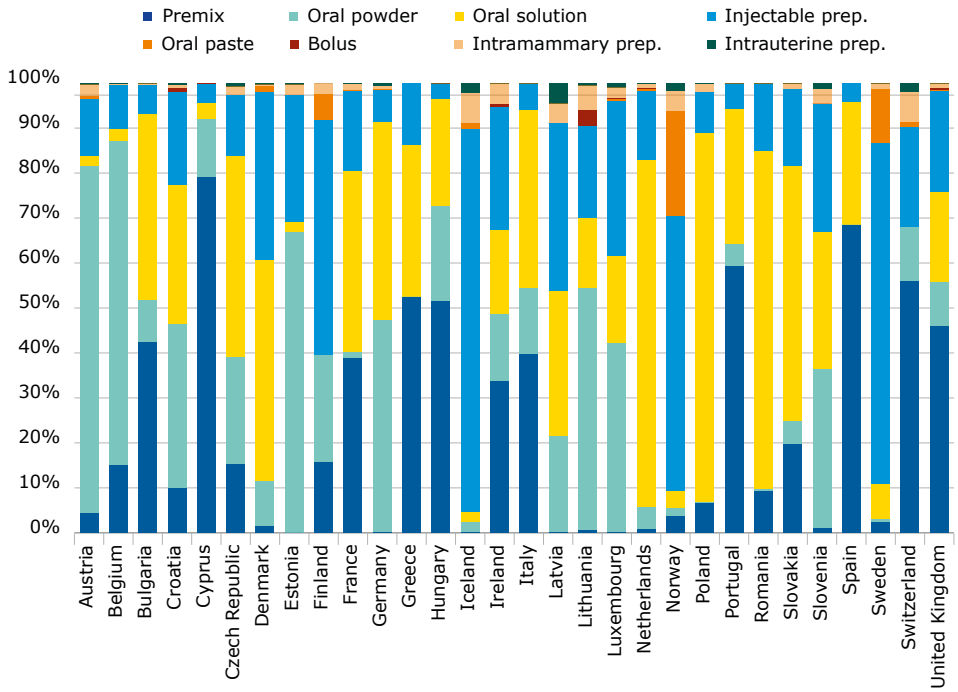
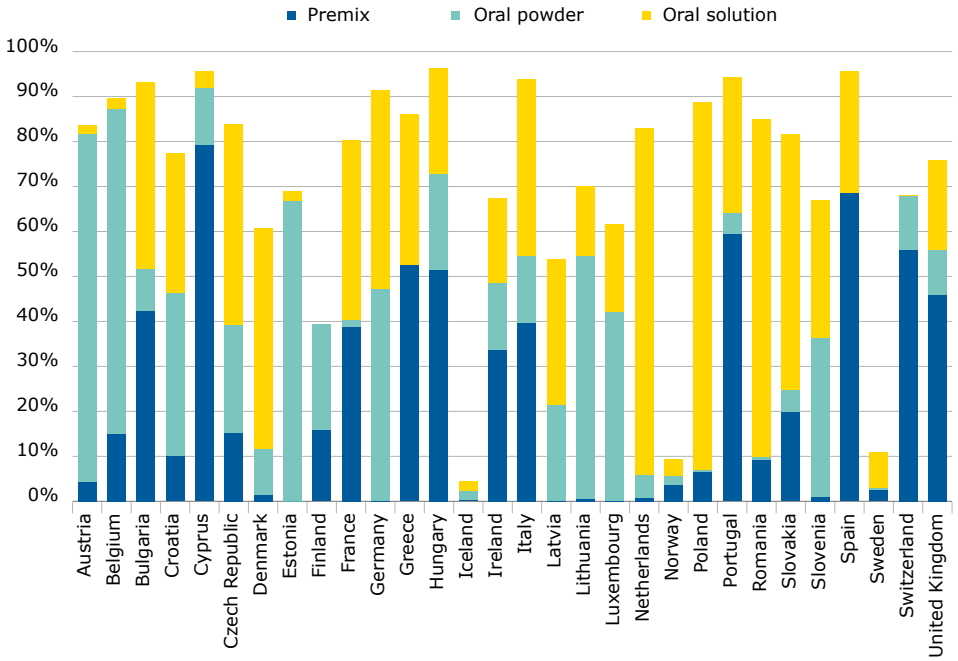


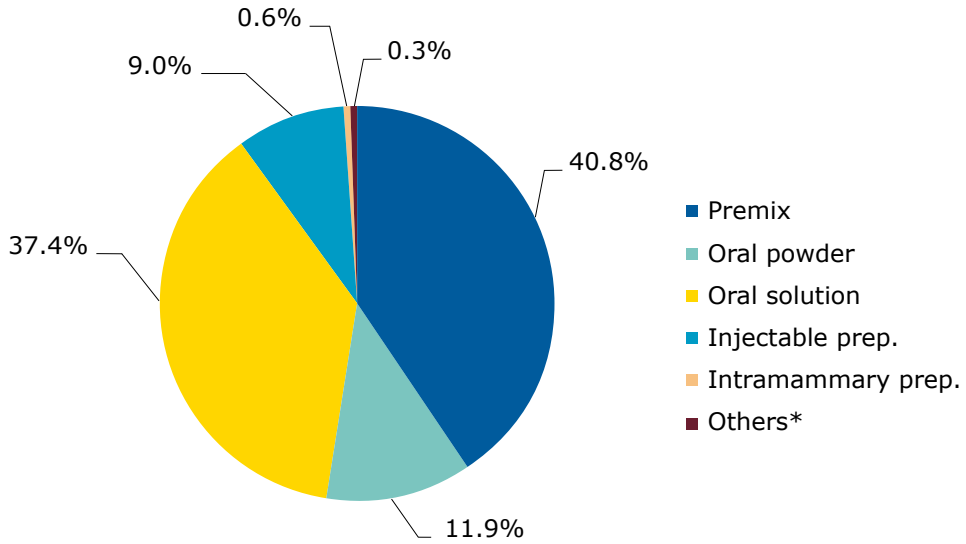
Figure 8. Oral solutions, oral powders and premixes as percentages of total sales, in mg per population correction unit (mg/PCU), of veterinary antimicrobial agents for food-producing animals, in 30 European countries for 2016



The proportions accounted for by premixes and oral powders vary considerably between the countries, which could be attributed to whether or not the farmers in the country administer medicated feed stuff prepared by a feed mill from premixes, or whether group treatment is performed by the application of oral powder as e.g. a top dressing on the feed at the farm. It could also be influenced by the distribution of the animal species as group medication is used mainly in poultry and pigs, and less, for example, in sheep or goats. The products available and national policies for in-feed medication can also influence the sales patterns in terms of forms.

As shown in Figure 9 aggregated by the 30 countries, sales (mg/PCU) of premixes accounted for 40.8 % of the overall sales, 11.9 % were oral powders and 37.4 % were oral solutions, i.e. 90.1 % were for group treatment; 9.0 % were injectables, 0.6 % were intramammary preparations and 0.3 % were oral pastes, boluses and intrauterine preparations.

Figure 9. Distribution of sales, in mg/PCU, of the various pharmaceutical forms of veterinary antimicrobial agents for food-producing animals, aggregated by the 30 European countries for 2016



*Oral pastes, boluses and intrauterine preparations.

Although a small proportion of the oral powders and oral solutions are suitable for treatment of one single animal or a very limited number of animals, the sales figures for these pharmaceutical forms provide a reasonable estimate of sales for group treatment, including groups in one pen/farm.

Additional graphs showing the distribution of sales for the most-selling antimicrobial classes and the highest priority CIAs by pharmaceutical form, aggregated by the 30 European countries, can be found in Annex 1, Figures A1-A7.

2.4. Distribution of sales for food-producing animals – overall and by antimicrobial class and pharmaceutical form

2.4.1. Distribution of sales of antimicrobials for food-producing animals by country

Figure 10. Spatial distribution of overall sales of all antimicrobials for food-producing animals, in mg/PCU, for 30 countries, for 2016

2.4.2. Distribution of sales of antimicrobials by class and forms by country

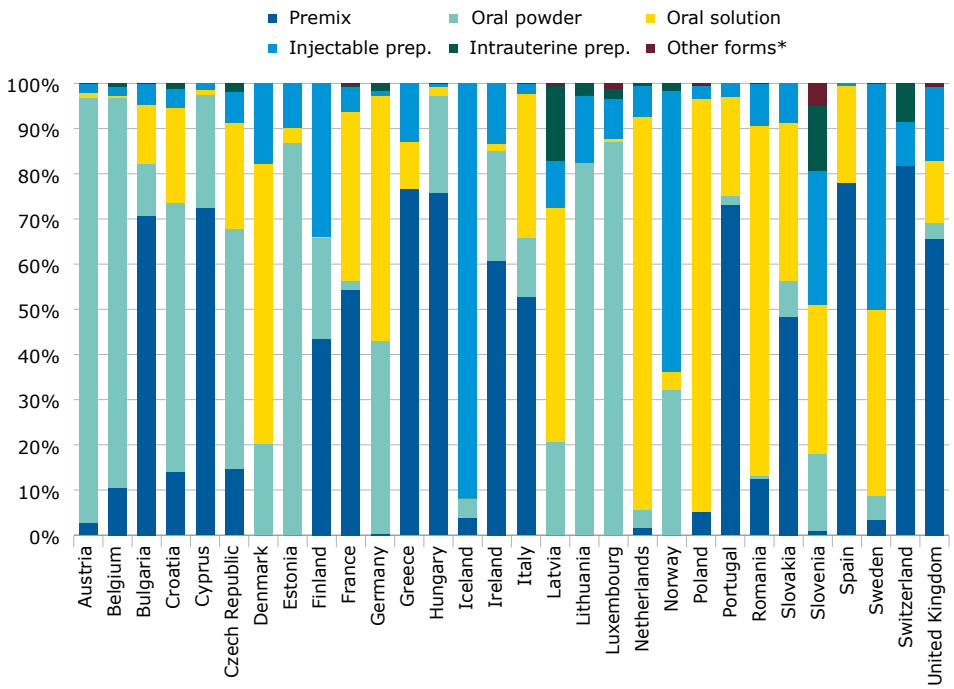
There was considerable variation among the participating countries in the distribution of sales, in mg/PCU, in terms of antimicrobial classes and pharmaceutical forms.

Chapter 2.4.2 presents the distribution of sales of antimicrobials by those classes that are among high-selling and are among those included in the AMEG Category 2 and/or are listed by the WHO as the highest priority CIAs for human medicine. Similar maps and graphs for other antimicrobial classes are included in Annex 1, Figures A8-A19.

2.4.2.1. Tetracyclines

Figure 11. Spatial distribution of sales of tetracyclines for food-producing animals, in mg/PCU, by country, for 2016

Figure 12. Distribution of sales by pharmaceutical forms of tetracyclines, in mg/PCU, by country, for 2016

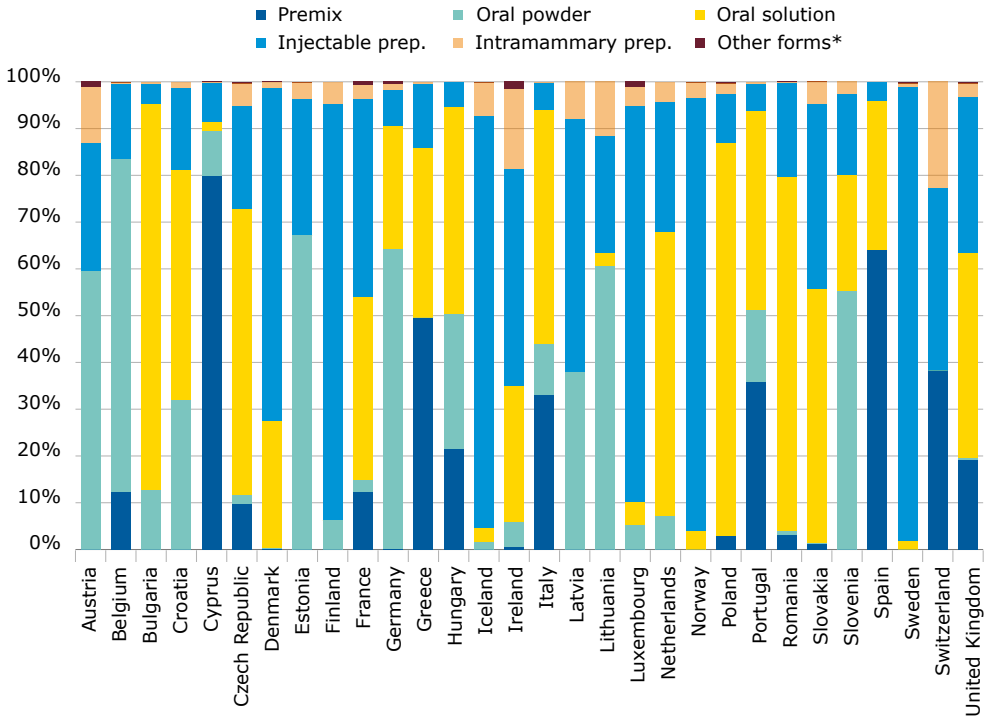


*Other forms include negligible amounts sold as boluses, intramammary preparations and/or oral pastes in some countries.

2.4.2.2. Penicillins

Figure 13. Spatial distribution of sales of penicillins for food-producing animals, in mg/PCU, by country, for 2016

Figure 14. Distribution of sales by pharmaceutical form for penicillins, in mg/PCU, by country, for 2016

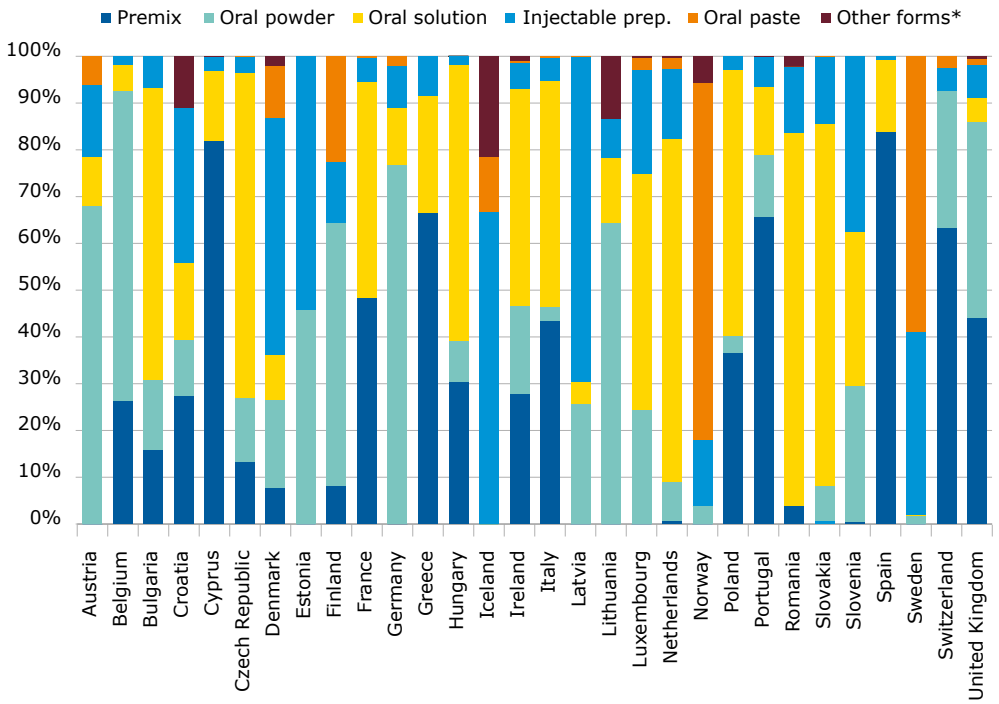


*Other forms include negligible amounts sold as boluses, intrauterine preparations and/or oral pastes in some countries.

2.4.2.3. Sulfonamides

Figure 15. Spatial distribution of sales of sulfonamides, in mg/PCU, by country, for 2016

Figure 16. Distribution of sales by pharmaceutical form for sulfonamides, in mg/PCU, by country, for 2016

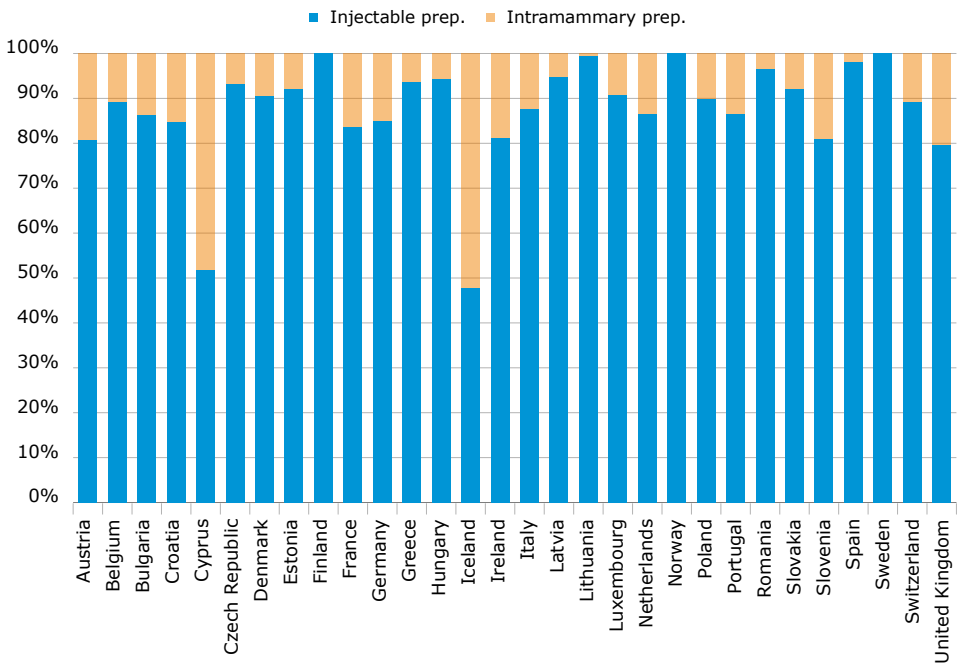


*Other forms include negligible amounts sold as boluses, intramammary and/or intrauterine preparations in some countries.

2.4.2.4. 3rd- and 4th-generation cephalosporins

Figure 17. Spatial distribution of sales of 3rd- and 4th-generation cephalosporins, in mg/PCU, by country, for 2016

Figure 18. Distribution of sales by pharmaceutical form for 3rd- and 4th-generation cephalosporins, in mg/PCU, by country, for 2016[1,2]



[1] Sales <1 kg in Iceland and Norway.
[2] For countries where the injectable 3rd- and 4th-generation cephalosporins are almost solely marketed for dogs and cats, the data provide a considerable overestimate for food-producing animals.

2.4.2.5. Fluoroquinolones

Figure 19. Spatial distribution of sales of fluoroquinolones, in mg/PCU, by country, for 2016

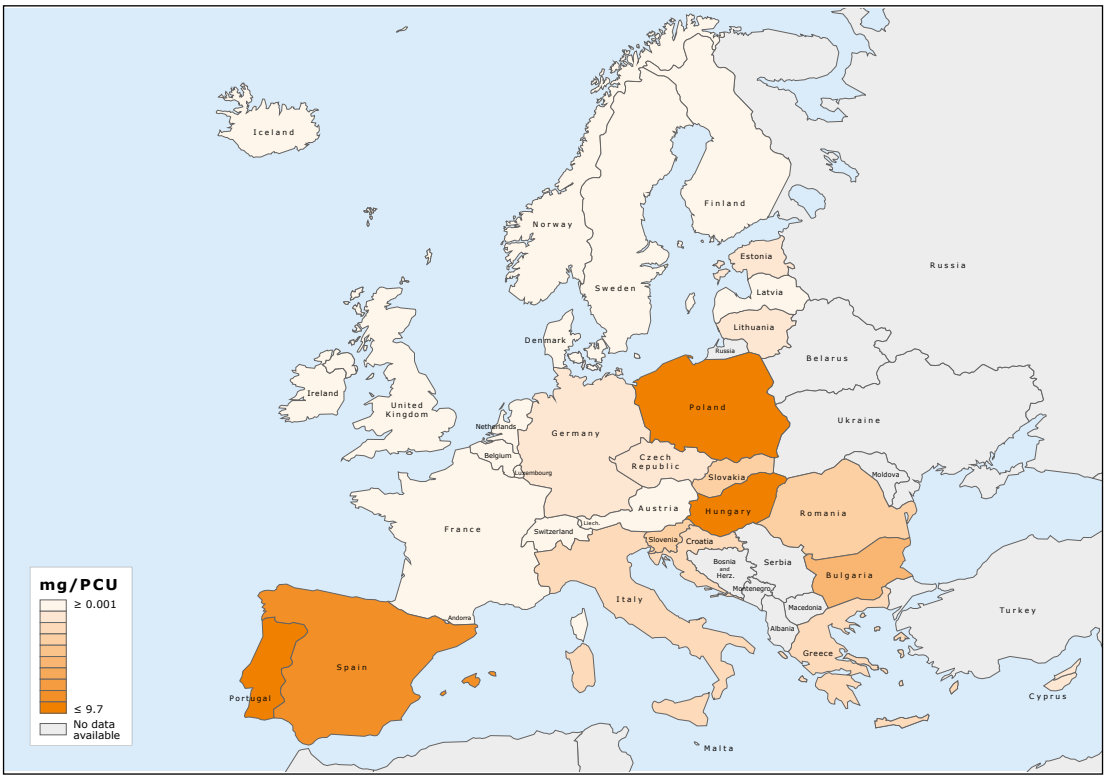
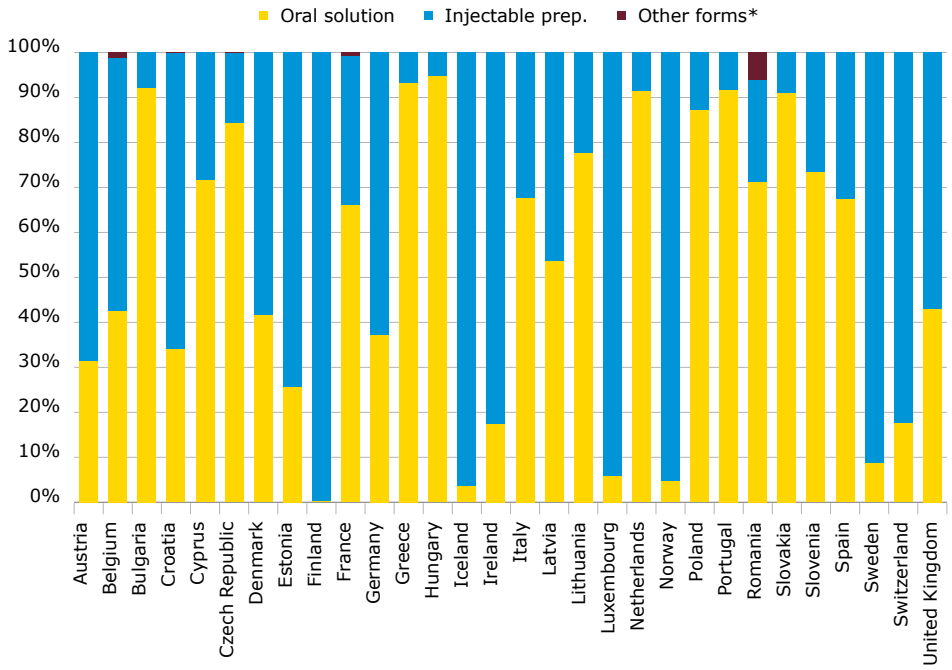


Figure 20. Distribution of sales by pharmaceutical form for fluoroquinolones, in mg/PCU, by country, for 2016



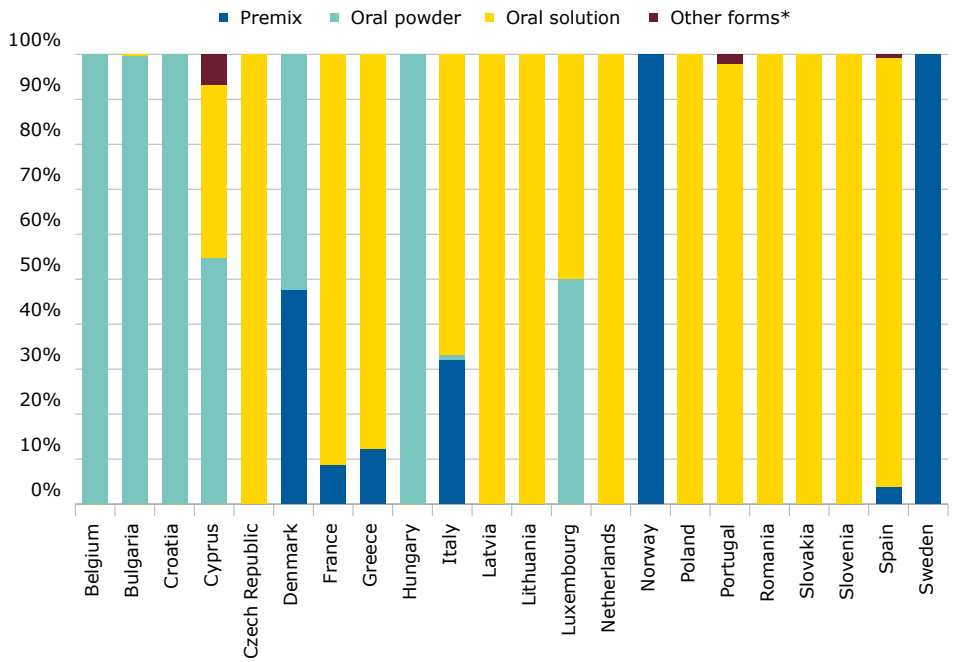
*Other forms include negligible amounts sold as boluses, premixes and/or intrauterine preparations in some countries.

2.4.2.6. Other quinolones

Figure 21. Spatial distribution of sales of other quinolones, in mg/PCU, by country, for 2016[1]

[1] No sales in Austria, Estonia, Finland, Germany, Iceland, Ireland, Switzerland and the United Kingdom.

Figure 22. Distribution of sales by pharmaceutical form for other quinolones, in mg/PCU, by country, for 2016[1]



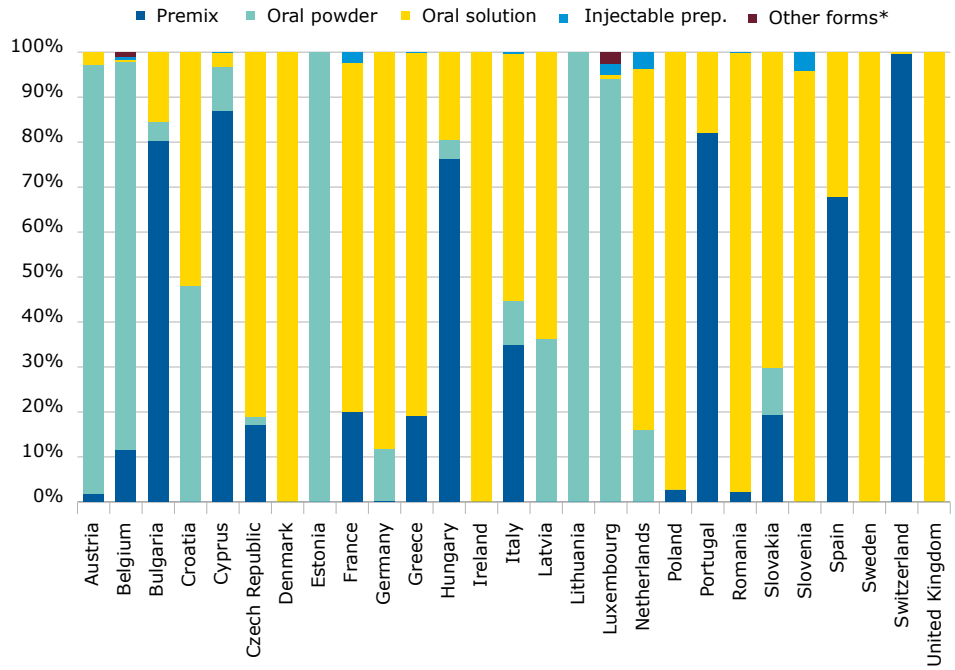
[1] No sales in Austria, Estonia, Finland, Germany, Iceland, Ireland, Switzerland and the United Kingdom.
*Other forms include negligible amounts sold as injections, boluses and/or oral pastes in some countries.

2.4.2.7. Polymyxins

Figure 23. Spatial distribution of sales of polymyxins, in mg/PCU, by country, for 2016[1]

[1] No sales in Finland, Iceland and Norway.

Figure 24. Distribution of sales by pharmaceutical form for polymyxins, in mg/PCU, by country, for 2016[1]



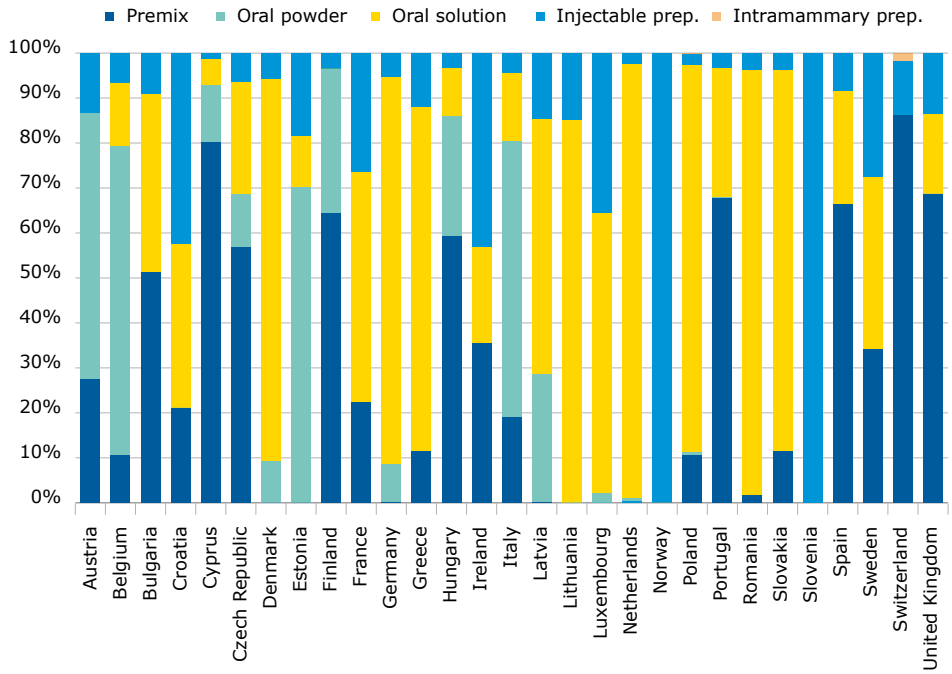
[1] No sales in Finland, Iceland and Norway.
*Other forms include negligible amounts sold as boluses and/or intramammary preparations in some countries.

2.4.2.8. Macrolides

Figure 25. Spatial distribution of sales of macrolides, in mg/PCU, by country, for 2016[1]

[1] No sales in Iceland.

Figure 26. Distribution of sales by pharmaceutical form for macrolides, in mg/PCU, by country, for 2016[1]



[1] No sales in Iceland.

2.5. Distribution of the population correction unit (PCU) by species and country

The value of the denominator (PCU) for the various species and countries is shown in Table 6. The EU countries included in the ESVAC 2016 data cover almost 100 % of the food-producing animal population in the EU measured as PCU.

Distribution of the various food-producing species by country, expressed by PCU, is shown in Table 6, Figure 27 and Figure 28.

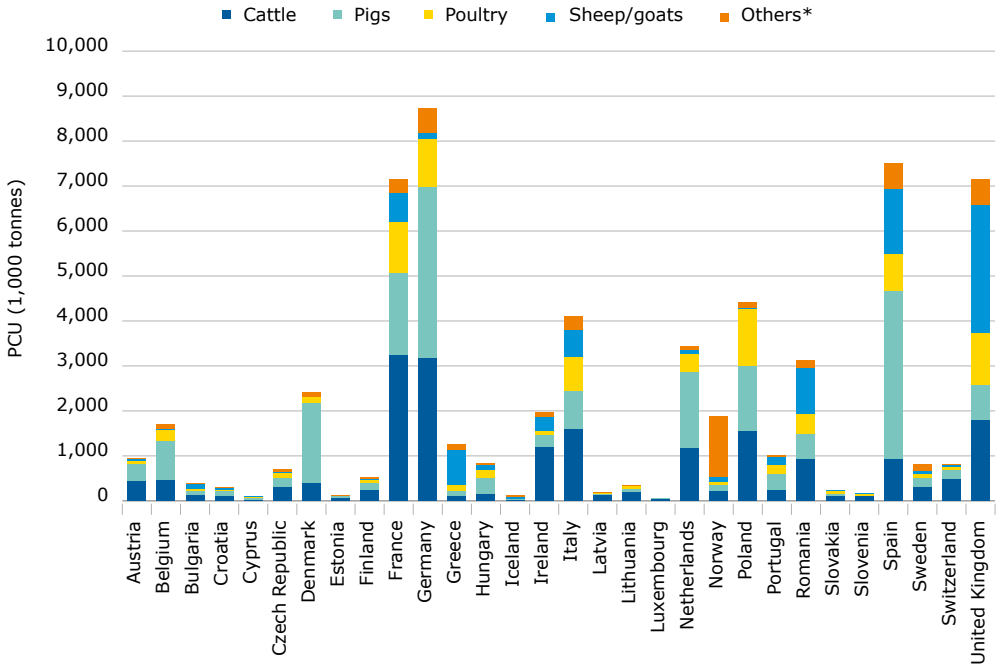
Overall, pigs, cattle, poultry and sheep/goats accounted for 32 %, 31 %, 14 % and 14 %, respectively, of the PCU in the 30 countries.

Table 6. Estimated PCU (in 1,000 tonnes) of the population of food-producing species[1,2], including horses, by country, for 2016

Country	Cattle	Pigs	Poultry	Sheep/ goats	Fish	Rabbits	Horses	Total
Austria	441	369	80	35	0	0	32	957
Belgium	455	882	236	16	0	4	121	1,715
Bulgaria	130	83	47	100	0	0.1	33	393
Croatia	111	90	38	47	0.02	0.004	0.1	286
Cyprus	17	45	13	25	0	0.1	2	102
Czech Republic	294	205	127	18	21	8	32	705
Denmark	398	1,773	123	13	43	0	70	2,420
Estonia	60	38	2	7	1	0.003	4	113
Finland	224	166	73	13	14	0	30	521
France	3,240	1,815	1,145	642	45	47	211	7,143
Germany	3,161	3,807	1,071	137	19	20	520	8,734
Greece	96	116	128	784	123	0	11	1,258
Hungary	149	346	193	97	23	2	21	832
Iceland	19	6	6	47	15	0	27	120
Ireland	1,184	276	91	308	44	0	60	1,963
Italy	1,592	847	755	590	171	29	132	4,116
Latvia	111	37	19	8	0	0.1	4	180
Lithuania	192	72	56	12	0	0.1	7	338
Luxembourg	40	12	0.1	1	0	0	2	55
Netherlands	1,174	1,685	398	94	62	1	33	3,446
Norway	214	130	68	108	1,326	0	50	1,896
Poland	1,547	1,453	1,266	18	0	2	121	4,407
Portugal	228	359	220	174	10	6	18	1,014
Romania	929	553	453	1,001	7	0.002	173	3,116
Slovakia	93	55	56	31	2	0	4	242
Slovenia	98	19	40	9	2	0.02	11	178
Spain	918	3,738	834	1,437	308	68	216	7,518
Sweden	298	198	105	48	13	0	142	805
Switzerland	477	203	70	34	0	1	22	806
United Kingdom	1,792	789	1,151	2,845	187	0	378	7,142
Total 30 countries	**19,685**	**20,165**	**8,860**	**8,701**	**2,438**	**186**	**2,486**	**62,521**

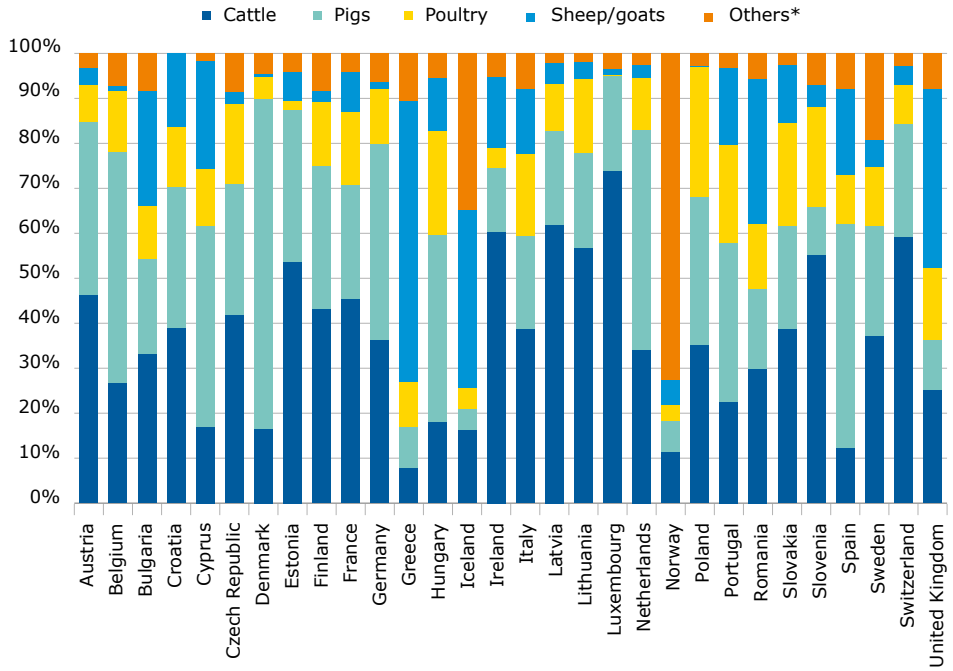
1 See Annex 3 for animal categories included in the calculation of the PCU.
2 When PCU is given as zero it indicates zero or insignificant production.

Figure 27. The denominator (PCU) and its distribution by the food-producing animal species, including horses, (1 PCU = 1 kg), by country, in 2016



*Others include horses and, for some countries, fish and/or rabbits.

Figure 28. Distribution of the denominator (PCU) in weight by food-producing animal species, including horses, by country, in 2016



*Includes horses and, for some countries, fish and/or rabbits.

In 2016, of the 30 countries, 13 had a net export of animals for slaughter and/or fattening to other Member States that accounted for ≥5% of the total denominator (PCU), whilst 11 countries had a net import accounting for ≥5% of the total denominator.

Table 7. PCU domestic, net export and net import (1000 tonnes) of animals for fattening or slaughter, respectively, in another Member State and PCU (net balance) in 2016

Country	PCU – domestic	PCU – export	Proportion, export	PCU – import	Proportion, import	PCU
Austria	1,034	15	2%	-93	-10%	957
Belgium	1,805	144	8%	-233	-14%	1,715
Bulgaria	396	0.1	0.03%	-3	-1%	393
Croatia	308	13	5%	-35	-12%	286
Cyprus	102	0.4	0.4%	-0.02	-0.02%	102
Czech Republic	632	85	12%	-12	-2%	705
Denmark	2,042	377	16%	-0	0%	2,420
Estonia	105	11	10%	-3	-3%	113
Finland	516	5	1%	<-0.01	< -0.01%	521
France	6,866	309	4%	-33	-0.5%	7,143
Germany	8,959	443	5%	-668	-8%	8,734
Greece	1,269	0.01	<0.01%	-11	-1%	1,258
Hungary	852	46	5%	-66	-8%	832
Iceland	120	0	0%	0	0%	120
Ireland	1,935	45	2%	-17	-1%	1,963
Italy	4,350	6	0.1%	-240	-6%	4,116
Latvia	165	22	12%	-7	-4%	180
Lithuania	319	28	8%	-10	-3%	338
Luxembourg	47	13	23%	-5	-9%	55
Netherlands	3,302	571	17%	-428	-12%	3,446
Norway	1,896	0	0%	0	0%	1,896
Poland	4,639	16	0.4%	-248	-6%	4,407
Portugal	1,065	34	3%	-85	-8%	1,014
Romania	3,103	43	1%	-30	-1%	3,116
Slovakia	190	69	29%	-17	-7%	242
Slovenia	168	17	10%	-7	-4%	178
Spain	7,527	130	2%	-139	-2%	7,518
Sweden	805	0.0001	<0.01%	<-0.01	<-0.01%	805
Switzerland	806	2	0.2%	-1	-0.2%	806
United Kingdom	7,155	21	0.3%	-33	-0.5%	7,142

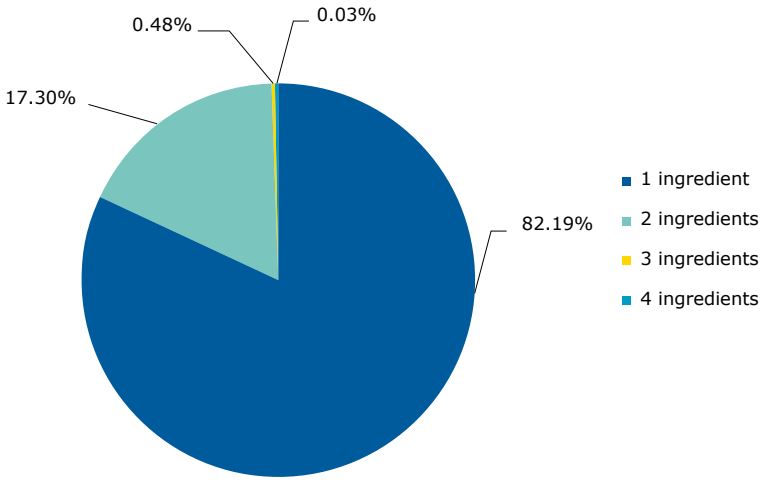
2.6. Distribution of single- and multiple-ingredient products of veterinary antimicrobial agents

Of the 9,205 product presentations (tablets excluded) for which sales were reported, 81.5% (n=7,504) contained only one active ingredient, 16.2% (n=1,487) contained two active ingredients, and 2.1% (n=193) contained three active ingredients (Annex 1, Table A7). In addition, 0.2% (n=21) of the product presentations contained four active ingredients. Sales of products with three active ingredients were accounted for almost solely by products for individual treatment (injections, intramammary and intrauterine preparations).

For all 30 countries, 43.0% of the product presentations of antimicrobial VMPs were for group treatment, i.e. premixes, oral powders and oral solutions. Of these, 84.2% contained one active ingredient, 14.5% two active ingredients, and 1.2% contained three active ingredients (Annex 1, Table A8).

Across the 30 countries, of the total sales of premixes, oral powders and oral solutions, in tonnes of active ingredient, 82.2%, 17.3% and 0.5% were accounted for by products containing 1, 2 and 3 active ingredients, respectively (Figure 29).

Figure 29. Percentage of sales, in tonnes of active ingredient, of premixes, oral powders and oral solutions containing 1, 2, 3 and 4 antimicrobial agents, in 2016

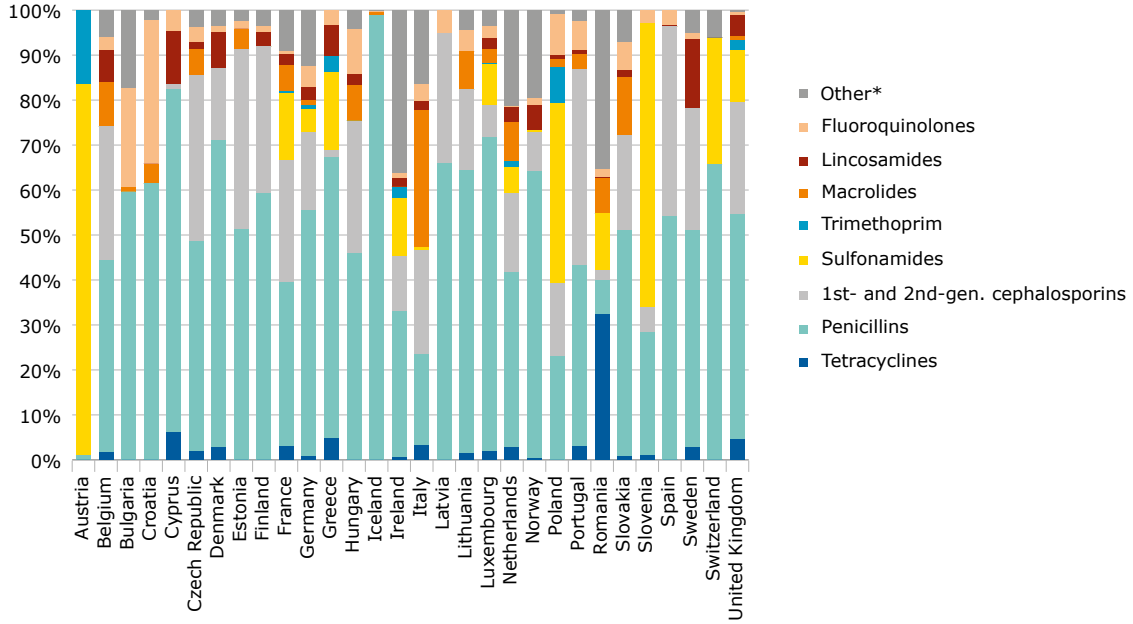


2.7. Sales of tablets by veterinary antimicrobial class for companion animals

Tablets are excluded from the dataset used to report sales for food-producing animals based on the assumption that tablets are used almost solely for companion animals. Figure 30 shows the distribution of sales of tablets, in tonnes of active ingredient, by antimicrobial class and country, for 2016. The sales patterns for tablets varied substantially between countries, but in general the most-sold tablets contained penicillins (mainly in combination with a beta-lactamase inhibitor, see Figure 31).

Data presented in Figure 30 covers only sales of tablets containing antimicrobials marketed for veterinary use and should be interpreted as such. In the current report, all injectable veterinary antimicrobial products are included in the sales data for food-producing animals, but some of the injectable preparations are also used in companion animals and a few are only marketed for companion animals. Similarly, some tablet formulations could also be authorised for use in food-producing or fur animals (e.g. foxes, nutria, minks), and their use is not necessarily exclusive for use in companion animals.

Figure 30. Distribution of sales of tablets, in tonnes of active ingredient, by antimicrobial class (reported according to the ATCvet hierarchical system), by country, for 2016[1,2]

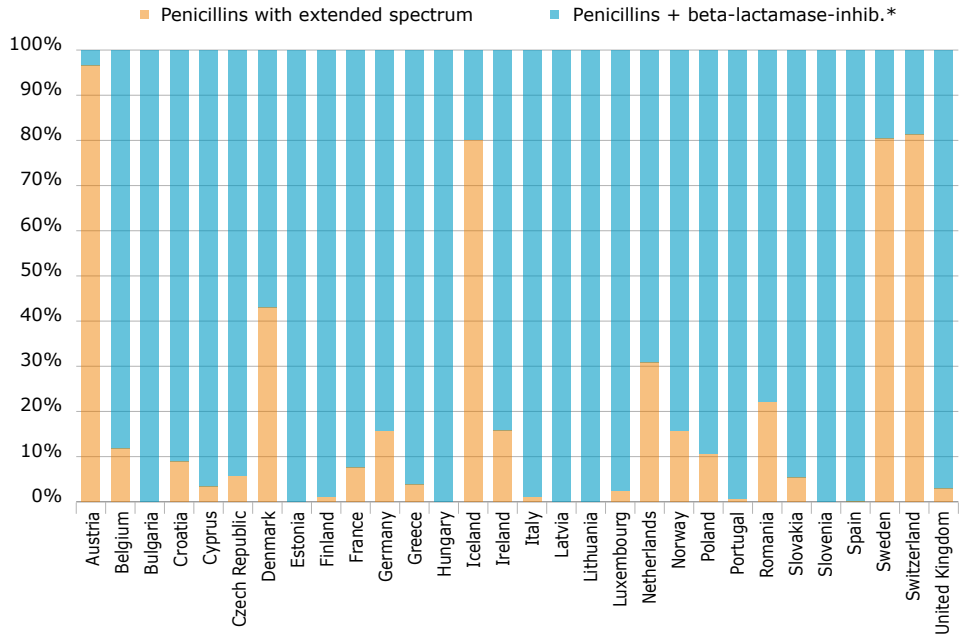


[1] Some tablet formulations are authorised for use in food-producing, fur and companion animals.
[2] In Romania, 45% (1.5 tonnes) of tablets sold were indicated for poultry and/or cage birds.
*Small amount of aminoglycosides, amphenicols, polymyxins, 3rd- and 4th-gen. cephalosporins and other antibacterials (classified as such in the ATCvet system) were sold in some countries.

Aggregated by the 30 countries, penicillins (40%), 1st- and 2nd-generation cephalosporins (23%), sulfonamides (10%) and macrolides (7%) were the most-sold antimicrobial classes of tablets.

The sales (tonnes active substance) of penicillin tablets varied significantly in terms of distribution by penicillin subclasses in the 30 countries (Figure 31). Combinations of penicillins with beta-lactamase inhibitors represented from 3% to 100% (in six countries) of the total sales of penicillin tablets (sales of clavulanic acid inhibitors as such are not included in the data).

Figure 31. Distribution of sales (by weight of active ingredient) of tablets containing penicillins by subclass, by country, in 2016[1]



[1] Some tablet formulations are authorised for use in food-producing, fur and companion animals.
*Note: In the ATCvet system, classified as combinations of penicillins which include penicillins + beta-lactamase inhibitors.

2.8. Changes across time

Throughout the report, there is a special focus either on those antimicrobials that belong to the high-selling classes, or are among those considered of the highest importance in the AMEG categorisation, or are included in the WHO list of the highest priority CIAs. Following the ECDC/EFSA/EMA jointly established list of harmonised outcome indicators to assist EU Member States in assessing their progress in reducing the use of antimicrobials and AMR in both humans and food-producing animals, the emphasis in this report also lies on overall sales (mg/PCU) of antimicrobials (primary indicator) and sales of 3rd- and 4th-generation cephalosporins, quinolones and polymyxins (secondary indicators).

Chapter 2.8.1 presents the changes across time for all participating countries for the most-sold classes (tetracyclines, penicillins and sulfonamides) and the antimicrobials belonging to AMEG Category 2 as well as those additional classes classified by the WHO as the highest priority CIAs for human medicine (Table A16). These are quinolones (fluoroquinolones and other quinolones), 3rd- and 4th-generation cephalosporins, macrolides and polymyxins (glycopeptides and carbapenems are not authorised for use in food-producing animals in the ESVAC participating countries).

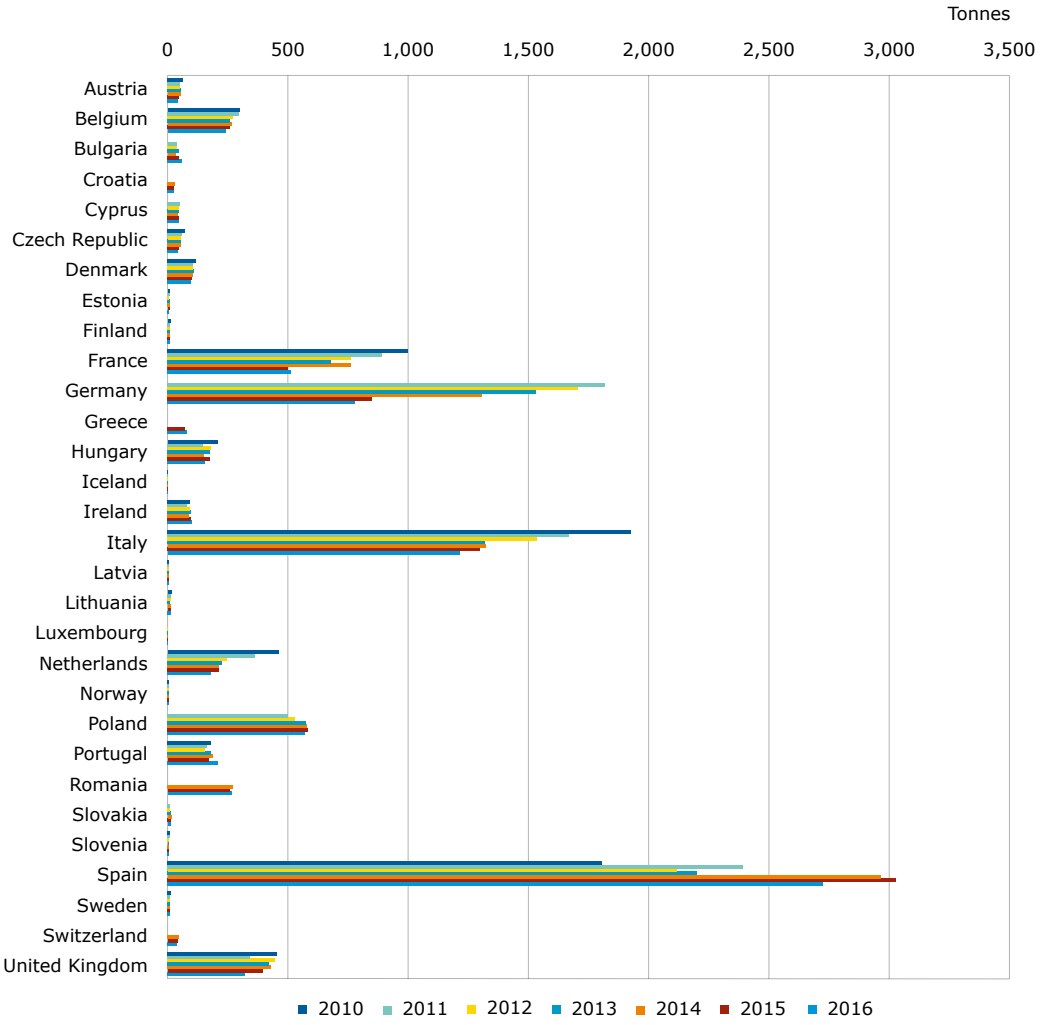
Chapter 2.8.2 focuses on some of the antimicrobial classes that are included in the categorisation of antimicrobial agents made by the EMA AMEG, in terms of their public health importance in Europe[24] (Annex 5, Table A16).

[24] Available on the EMA website (www.ema.europa.eu): via Home > Veterinary regulatory > Overview > Antimicrobial resistance > Use of antibiotics in animals (http://www.ema.europa.eu/docs/en_GB/document_library/Other/2014/07/WC500170253.pdf)

2.8.1. Overall changes in the ESVAC participating countries

2.8.1.1. Changes in sales of tonnes of active ingredients, by country

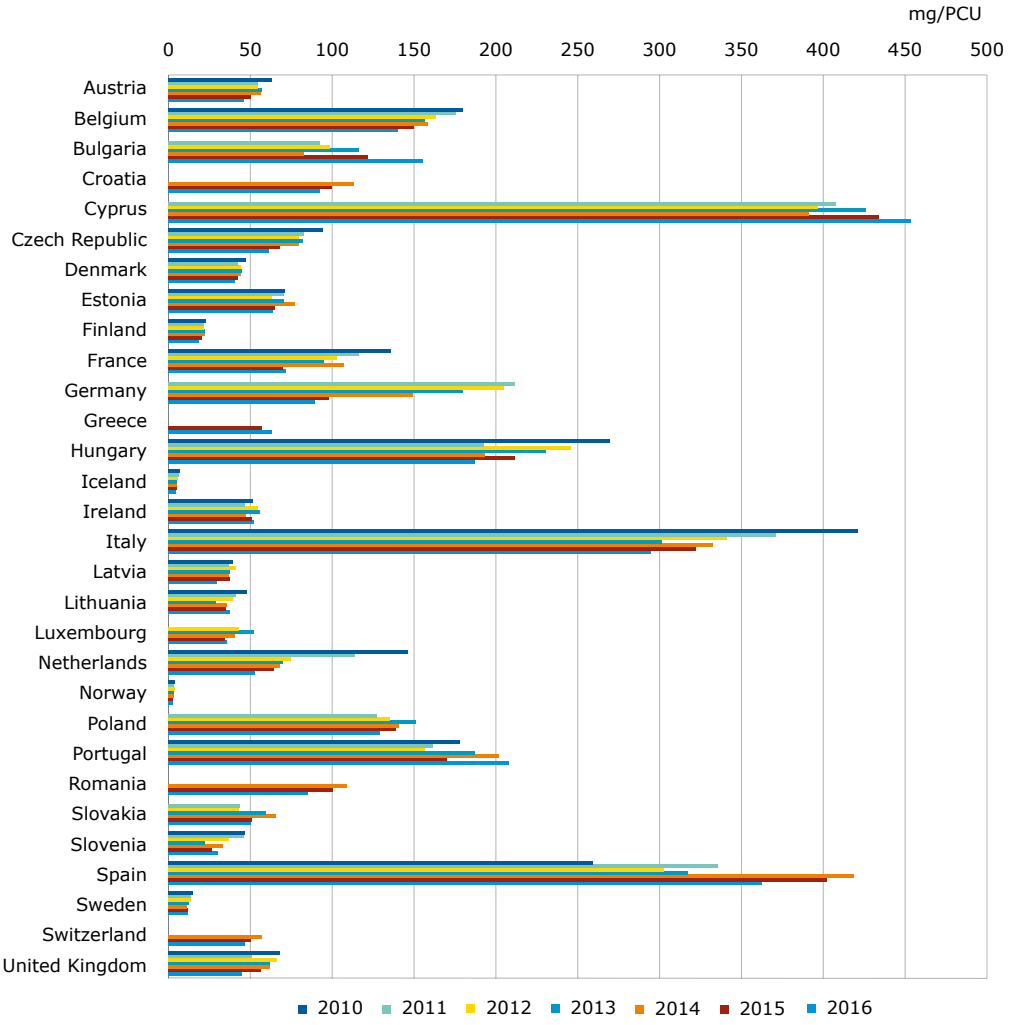
Figure 32. Sales, in tonnes of active ingredients, of veterinary antimicrobials for food-producing animals, between 2010 to 2016, in 30 European countries[1-9]



[1] Correction of sales data published in the ESVAC 2016 report is described in Chapter 1.5.
[2] Under-reported for Bulgaria for 2011, 2012 and 2014 as several wholesalers failed to report data.
[3] Strength reported as the base for most VMPs for 2011-2012 for the Czech Republic; for 2013-2016, strength reported as in the VMPs' label.
[4] Strength reported as the base for some VMPs for 2011–2012 for the Netherlands; for 2013-2016, strength reported as in the label of the VMPs.
[5] For Romania, 2014 data was updated, as wholesalers initially failed to deliver all sales data.
[6] For Slovakia, for 2011 and 2012, the data only represents antimicrobial VMPs imported by wholesalers; from 2013, data represents all sales from wholesalers to end-users (veterinarians, pharmacies, producers of medicated feeding stuffs and farmers, obtained by import and from national manufacturers).
[7] For Spain, under-reporting has been identified for 2010 to 2013 (underestimates).
[8] For the UK, high sales of certain products containing tetracyclines late in 2010 were probably used in 2011 and thus their use has been underestimated for 2011. For more details, see Chapter 2.8.2.
[9] For Portugal, under-reporting has been identified for 2010-2014.

2.8.1.2. Changes in overall sales in mg/PCU, by country

Figure 33. Total sales of veterinary antimicrobial agents for food-producing species, in mg/PCU, from 2010 to 2016, for 30 European countries[1-8]



[1] Corrections to sales data and/or PCU data published in the ESVAC 2016 report are described in Chapter 1.5.
[2] Under-reported for Bulgaria for 2011, 2012 and 2014 as several wholesalers failed to report data.
[3] Strength reported as the base for most VMPs for 2011–2012 for the Czech Republic; for 2013–2016, strength reported as in the label of the VMPs.
[4] Strength reported as the base for some VMPs for 2011–2012 for the Netherlands; for 2013–2016, strength reported as in the VMPs' label.
[5] For Romania, 2014 data was updated, as wholesalers initially failed to deliver all sales data.
[6] For Slovakia, for 2011 and 2012, the data represent antimicrobial VMPs imported by wholesalers; from 2013 data represent all sales from wholesalers to end-users (veterinarians, pharmacies, producers of medicated feeding stuffs and farmers, obtained by import and from national manufacturers).
[7] For Spain, under-reporting for the years 2010 to 2013 has been identified (underestimated).
[8] For the UK, high sales of certain tetracycline-containing products late in 2010 were probably used in 2011 and thus their use has been underestimated for 2011. For more details, see Chapter 2.8.2.

For the 25 countries that reported data for all years from 2011 to 2016, a drop of more than 5% (range 8.7% to 57.8%) in sales (mg/PCU) was observed for 16 countries (Table 8). For six countries, an increase of more than 5% was noted (range 7.9% to 67.7%).

Table 8. Annual sales of veterinary antimicrobial agents for food-producing species, in mg/PCU, for 30 European countries[1], from 2010 to 2016

Country	2010	2011	2012	2013	2014	2015	2016	Trends 2010-2016
Austria	62.9	54.5	54.9	57.2	56.3	50.7	46.1	
Belgium	180.1	175.3	163.1	156.6	158.3	150.1	140.1	
Bulgaria[2]		92.6	98.9	116.1	82.9	121.9	155.3	
Croatia					113.2	100.0	92.9	
Cyprus		407.6	396.5	425.8	391.5	434.2	453.4	
Czech Republic[3]	94.3	83.0	79.8	82.2	79.5	68.1	61.2	
Denmark	47.5	42.6	44.1	44.9	44.2	42.2	40.8	
Estonia	70.9	70.7	62.9	70.4	77.1	65.2	64.0	
Finland	22.7	21.9	21.8	22.4	22.3	20.4	18.6	
France	136.0	116.5	102.7	95.0	107.0	70.2	71.9	
Germany		211.5	204.8	179.7	149.3	97.9	89.2	
Greece						57.2	63.5	
Hungary	269.9	192.5	245.8	230.7	193.1	211.4	187.1	
Iceland	7.3	6.6	5.9	5.3	5.2	5.0	4.7	
Ireland	51.5	46.5	55.0	55.9	47.6	51.0	52.1	
Italy	421.1	371.0	341.0	301.6	332.4	322.0	294.8	

Country	2010	2011	2012	2013	2014	2015	2016	Trends 2010-2016
Latvia	39.5	36.7	41.5	37.7	36.7	37.6	29.9	
Lithuania	48.2	41.3	39.2	29.1	35.5	35.1	37.7	
Luxembourg			43.2	52.1	40.9	34.6	35.5	
Netherlands[4]	146.1	113.8	74.9	69.9	68.4	64.4	52.7	
Norway	4.0	3.6	3.8	3.6	3.1	2.9	2.9	
Poland		127.3	135.2	151.5	140.8	138.9	129.4	
Portugal[5]	177.9	161.8	156.9	187.2	201.6	170.2	208.0	
Romania[6]					109.0	100.5	85.2	
Slovakia[7]		43.7	43.3	59.3	65.9	51.0	50.4	
Slovenia	46.9	46.1	37.0	22.4	33.4	26.4	30.3	
Spain[8]	259.5	335.8	302.4	317.1	418.8	402.0	362.5	
Sweden	15.2	13.6	13.5	12.7	11.5	11.8	12.1	
Switzerland					56.9	50.6	46.6	
United Kingdom[9]	67.9	51.1	66.3	62.1	62.1	56.7	45.0	

1 Corrections to sales data and/or PCU data published in the ESVAC 2015 report are described in Chapter 1.5.
2 Under-reported for Bulgaria for 2011, 2012 and 2014 as several wholesalers failed to report data.
3 Strength reported as the base for most VMPs for 2011–2012 for the Czech Republic; for 2013–2016, strength reported as in the label of the VMPs.
4 Strength reported as base for some VMPs for 2011–2012 for the Netherlands; for 2013–2016, strength reported as in the label of the VMPs.
5 For Portugal, under-reporting has been identified for the years 2010 to 2014.
6 For Romania, 2014 data was updated as wholesalers initially failed to deliver all sales data.
7 For Slovakia, the data for 2011 and 2012 represent only imported antimicrobial VMPs by wholesalers; from 2013, data represent all sales from wholesalers to end-users (veterinarians, pharmacies, producers of medicated feeding stuffs and farmers, obtained by import and from national manufacturers).
8 For Spain, under-reporting has been identified for the years 2010 to 2013.
9 For the UK, high sales of certain tetracycline-containing products late in 2010 were probably used in 2011 and thus their use has been underestimated for 2011. For more details, see Chapter 2.8.2.

Spain changed its system for collecting sales data in 2014, and it was noted that some of the highest selling VMPs in 2014 had not been reported by MAHs between 2011 and 2013, even though these VMPs had been marketed during that period. Thus, sales data for Spain for 2011 to 2013 has most likely been underestimated. Consumption of antimicrobials in Spain is one of the highest among those European countries participating in the ESVAC and the biomass of animals (PCU) is among the largest. Therefore, the observed changes in sales for these 25 countries from 2011 to 2014 should be interpreted with great care.

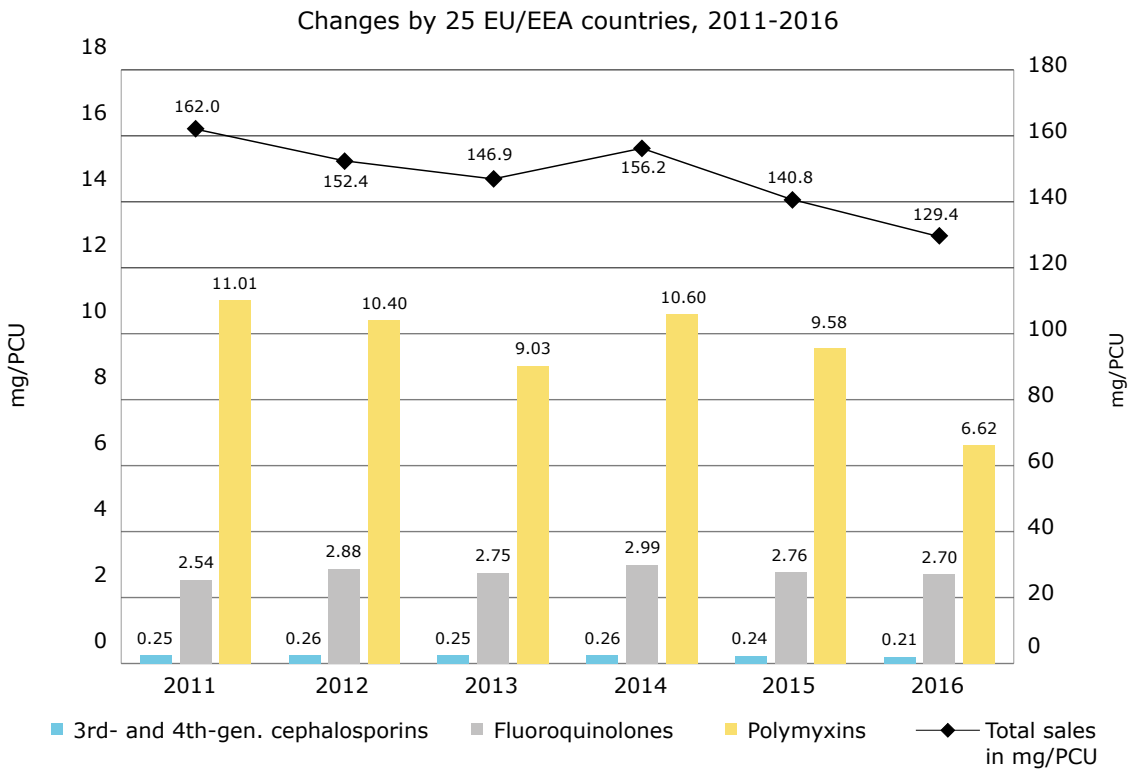
Changes in sales (mg/PCU) across 2011-2016 aggregated by 25 countries

For the 25 countries reporting sales data to the ESVAC for all the years from 2011 to 2016, an overall decrease of 20 % in sales (mg/PCU) was observed (Figure 34).

For the period 2011 to 2016, a drop in sales (in mg/PCU) of more than 5 % was observed for 16 of the 25 countries. For the same period, there was an increase in sales of over 5 % in six of the 25 countries (Table 8).

During 2011-2016, the sales (mg/PCU) of 3rd- and 4th-generation cephalosporins decreased by 15 %, and sales of polymyxins decreased by 40 %. From 2011 to 2016 the consumption of fluoroquinolones increased by 6 %, but in comparison to 2014, sales of fluoroquinolones decreased by 9.8 %.

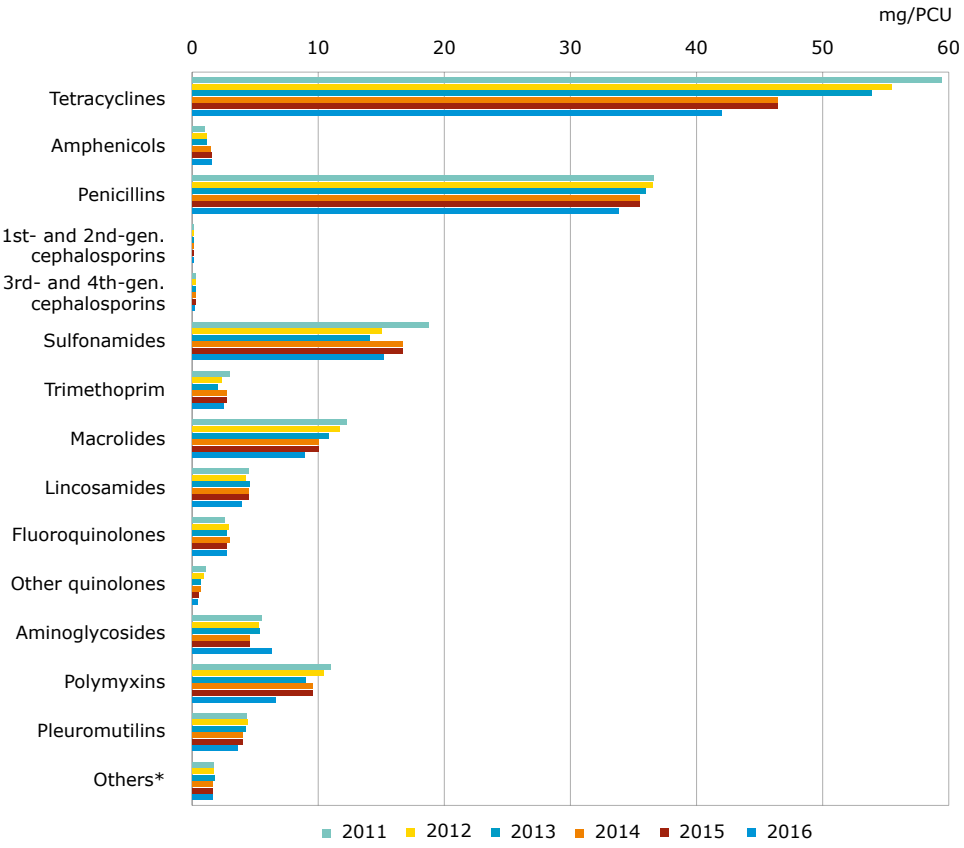
Figure 34. Changes in aggregated overall sales and sales of fluoroquinolones, 3rd- and 4th-generation cephalosporins and polymyxins, for 25 EU/EEA countries[1], from 2011 to 2016 (note the differences in the scales of the Y axes)



[1] Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

In 2016, tetracyclines, penicillins and sulfonamides were the most-sold classes accounting for 32 %, 26 % and 12 %, respectively, of aggregated sales of antimicrobials (mg/PCU) for food-producing species for those 25 countries delivering data from 2011 to 2016.

Figure 35. Changes in aggregated sales (mg/PCU) by antimicrobial class in 25 EU/EEA countries, from 2011 to 2016



*Other antibacterials (classified as such in the ATCvet system).

Total antimicrobial consumption has declined from 2011 to 2016. A decrease in sales of all antimicrobial classes has been observed, with the exception of amphenicols, aminoglycosides and fluoroquinolones.

The sales of fluoroquinolones fluctuated slightly during the period 2011 to 2016, with an increase of 17.8 % from 2011 to 2014 and a decrease of 9.8 % from 2014 to 2016.

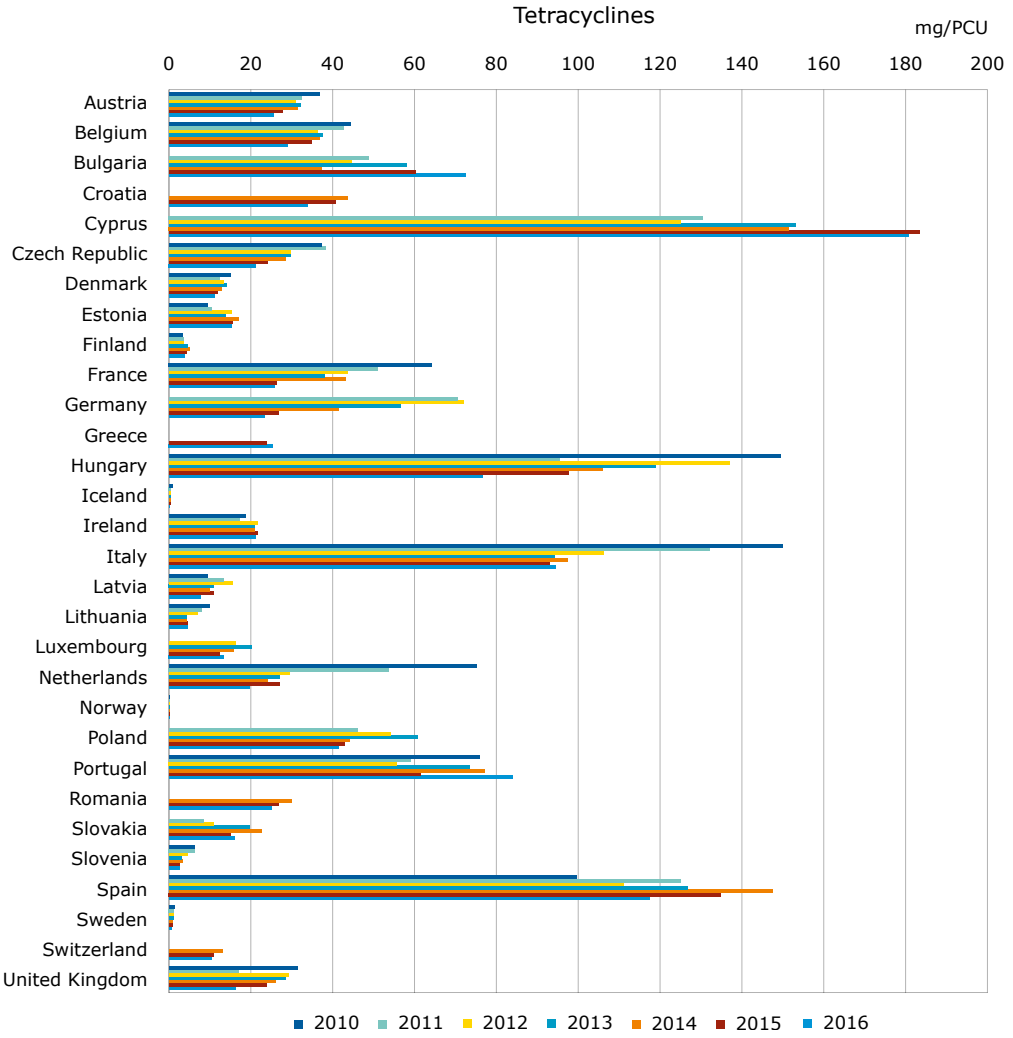
Sales of polymyxins fluctuated during the period 2011 to 2016, however a decline from 11.01 mg/PCU to 6.62 mg/PCU was observed in this timeframe.

The proportion of 3rd- and 4th-generation cephalosporins of the aggregated sales among 25 countries stayed at 0.2 % for each reference year.

2.8.1.3. Changes in sales by antimicrobial class in mg/PCU, by country

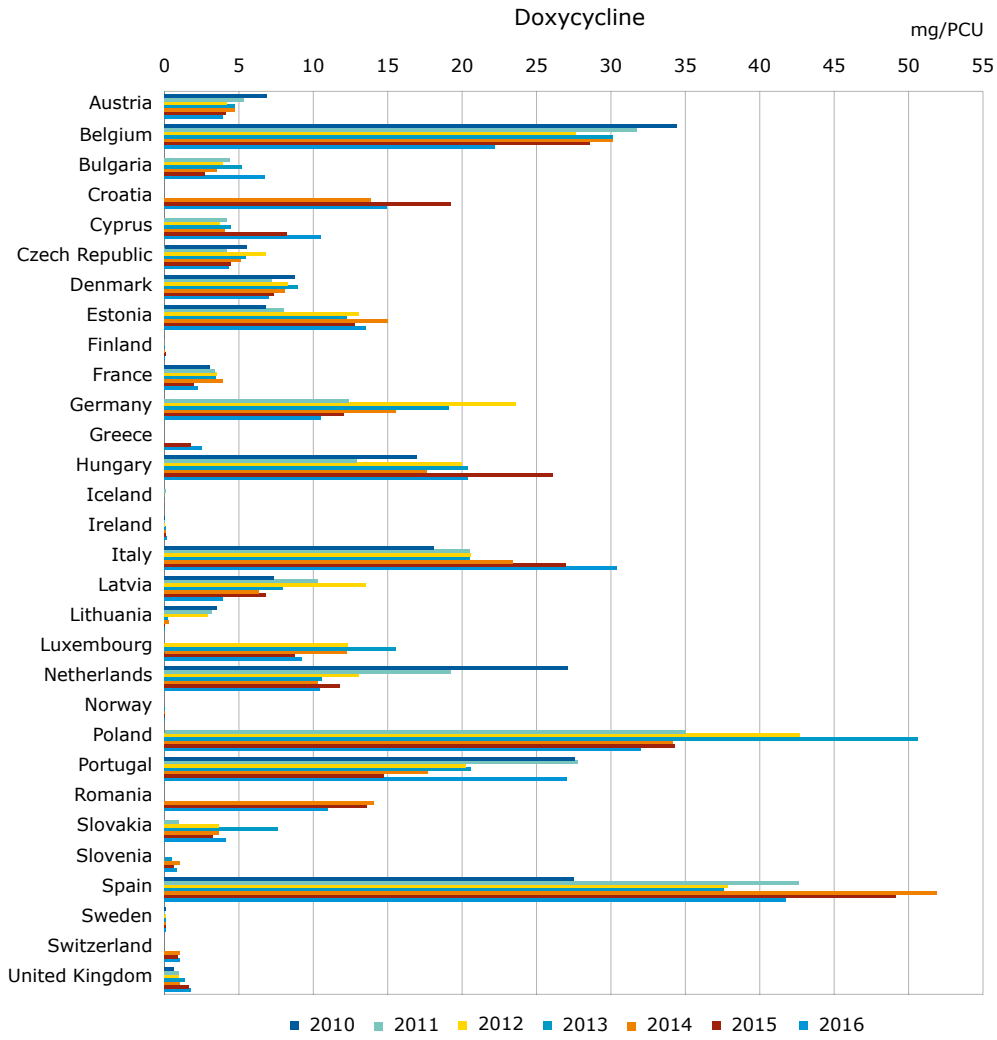
Sales of tetracyclines are shown in Figure 36. The sales of doxycycline are also presented separately because of the lower dosing used in the treatment of animals compared to other tetracyclines and the high volume of sales attributed to this class of antimicrobials (Figure 37). Therefore, an increase in the sales of doxycycline could be associated with a reduction in total sales of tetracyclines.

Figure 36. Changes in sales of tetracyclines for food-producing species, in mg/PCU, by 30 European countries, from 2010 to 2016[1]



[1] Sales in Iceland, Norway and Sweden ≤1 mg/PCU in any of the years.

Figure 37. Changes in sales of doxycycline for food-producing species, in mg/PCU, by 30 European countries, from 2010 to 2016[1]



[1] No sales in Iceland since 2012, negligible amount sold only in 2011; in Finland, Ireland, Norway and Sweden, no sales reported for some of the years or sales were very low (≤0.14 mg/PCU).

In some countries, it can be observed that overall sales of tetracyclines have decreased while sales of doxycycline have either increased or remained stable.

Figure 38. Changes in sales of penicillins for food-producing species, in mg/PCU, by 30 European countries, from 2010 to 2016

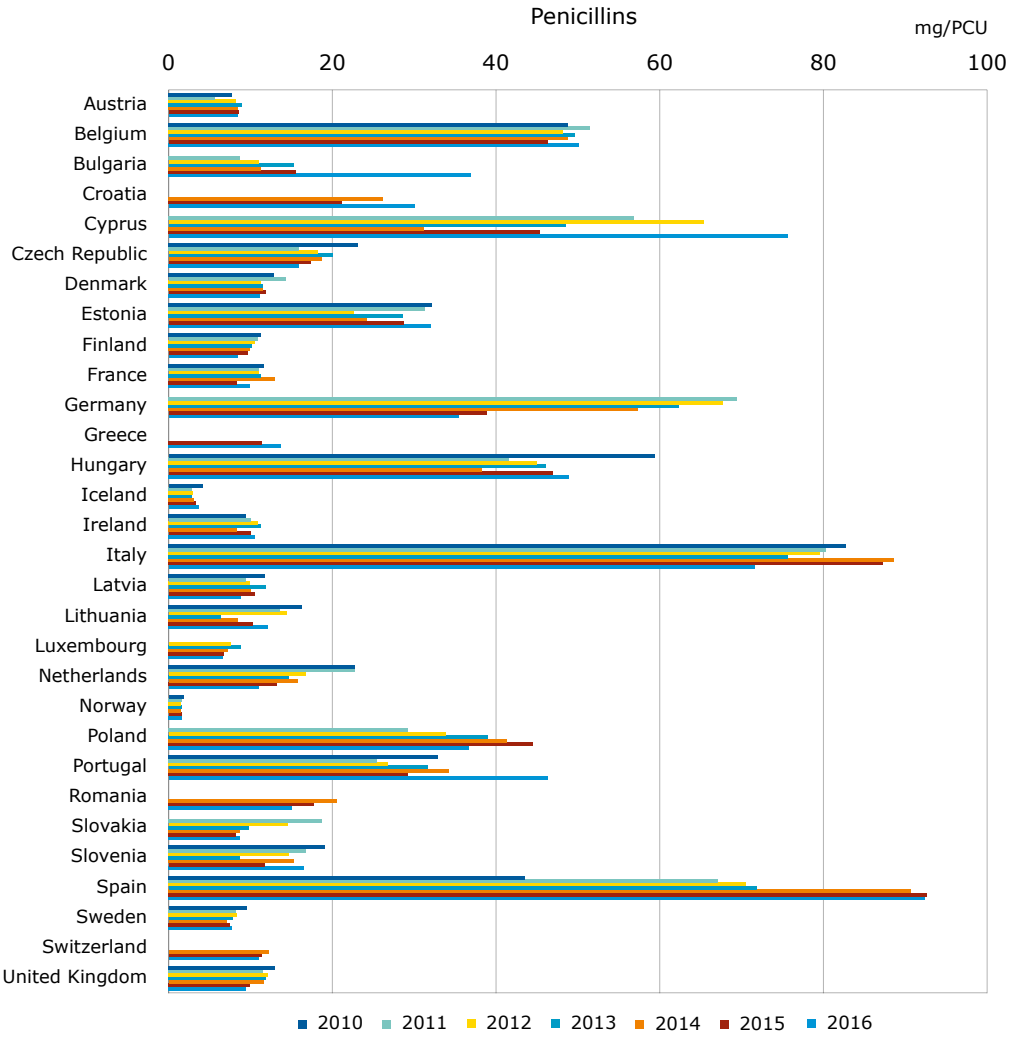
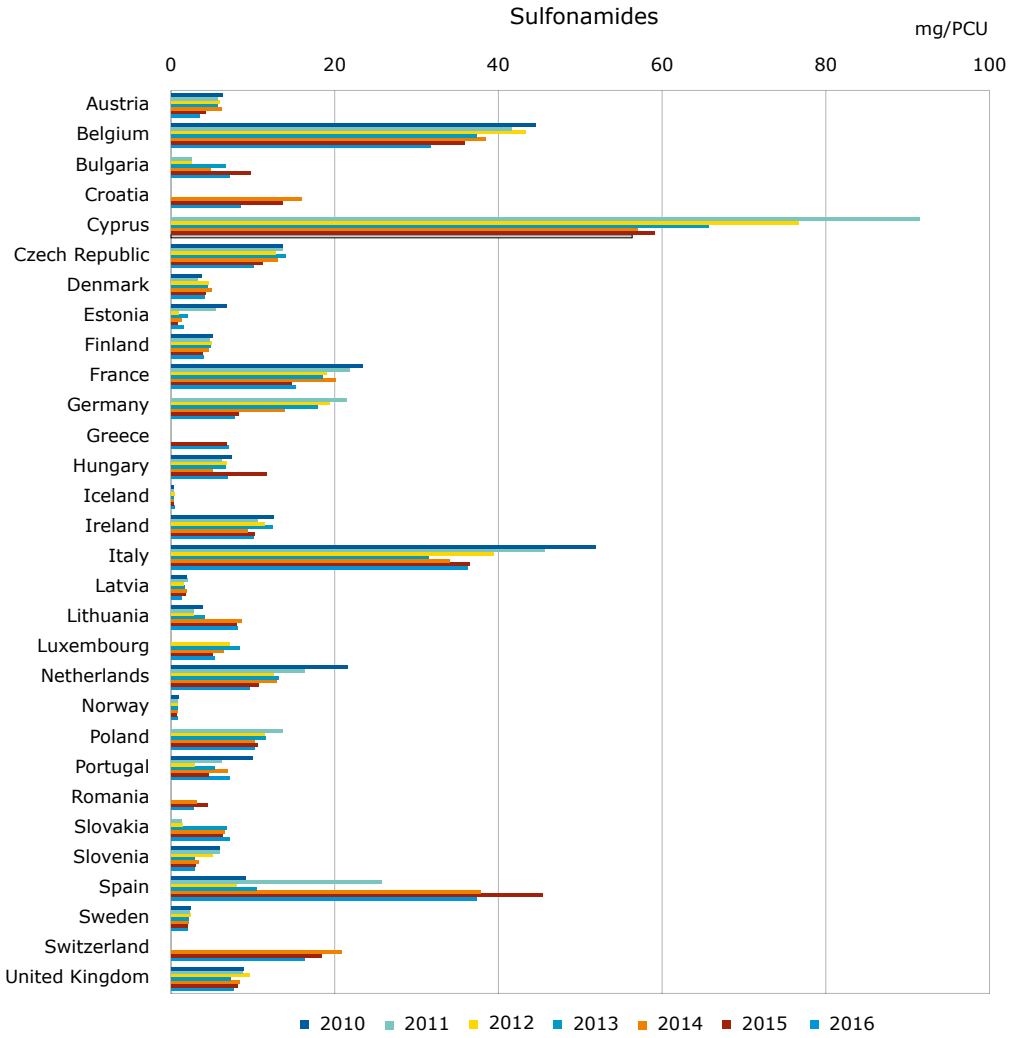


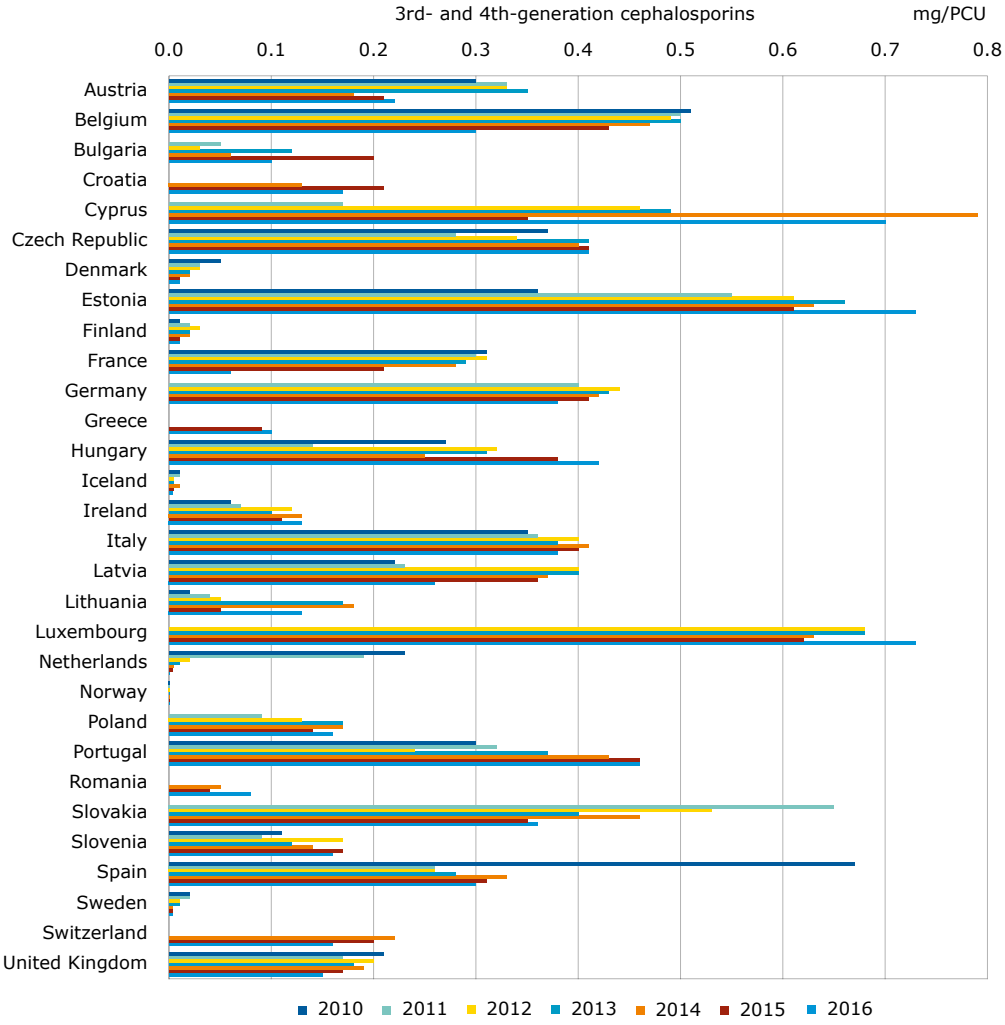
Figure 39. Changes in sales of sulfonamides for food-producing species, in mg/PCU, by 30 European countries, from 2010 to 2016[1]



[1] Negligible sales in Iceland (<1mg/PCU) in each of the years.

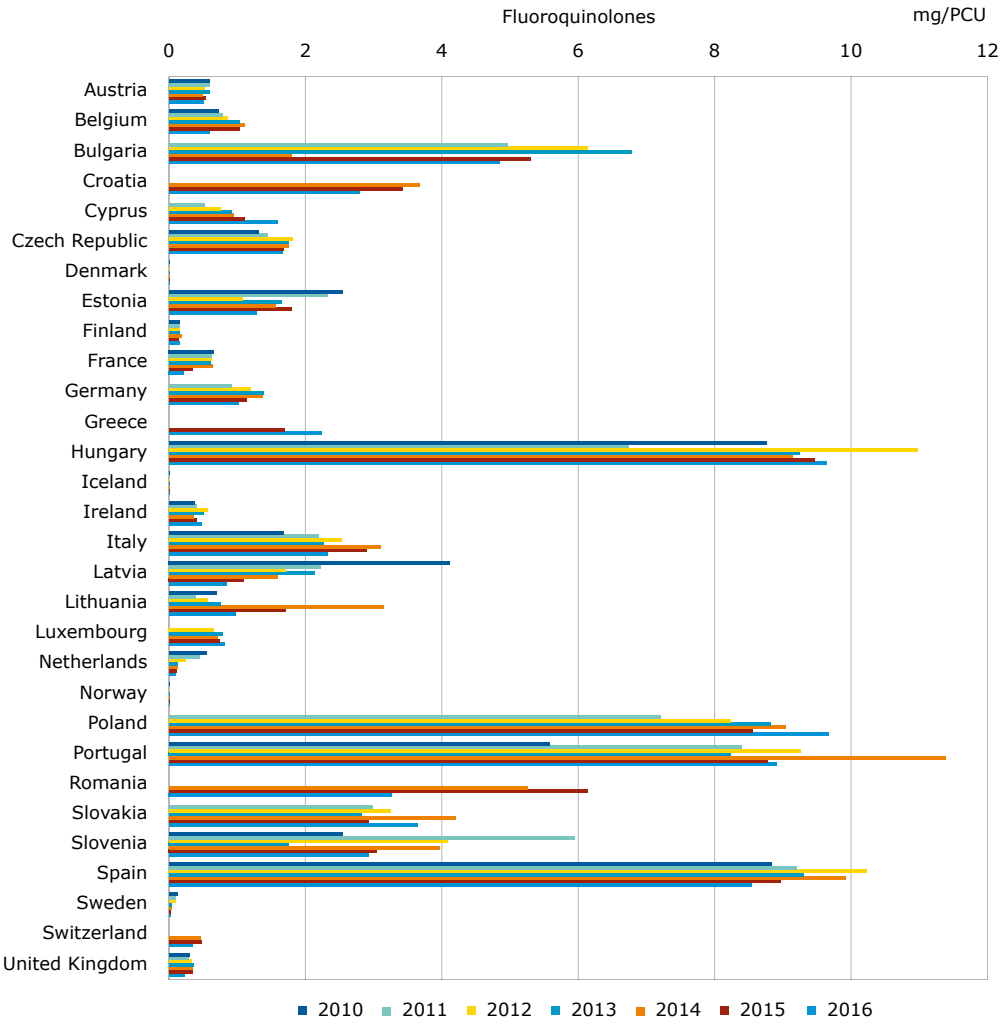
In Figures 40-44, critically important antimicrobials with the highest priority for humans, as defined by WHO, and antimicrobial classes belonging to the AMEG Category 2 are highlighted. For more details, see Annex 5, Table A16.

Figure 40. Changes in sales of 3rd- and 4th-generation cephalosporins for food-producing species, in mg/PCU, by 30 European countries, from 2010 to 2016[1]



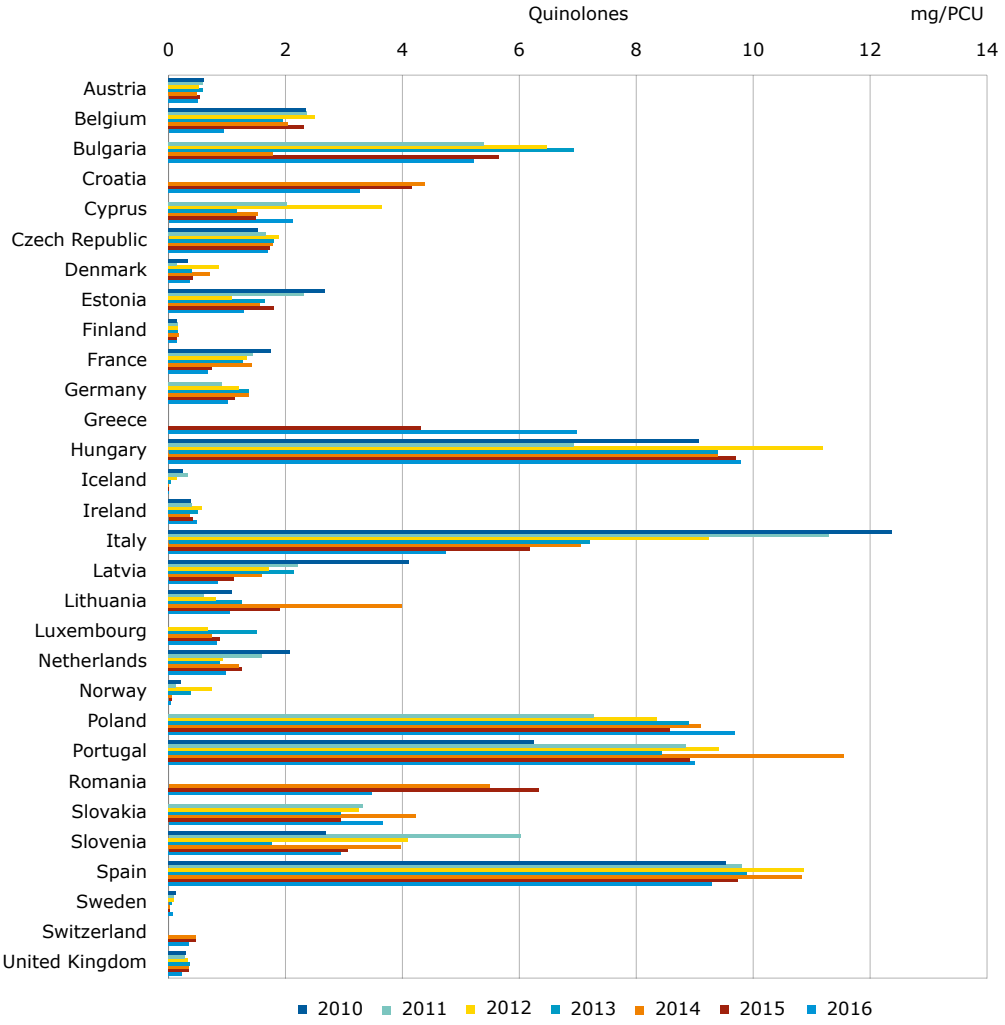
[1] For countries where the injectable 3rd- and 4th-generation cephalosporins are almost solely marketed for dogs and cats, the data provide a considerable overestimate for food-producing animals.

Figure 41. Changes in sales of fluoroquinolones for food-producing species, in mg/PCU, by 30 European countries, from 2010 to 2016[1]



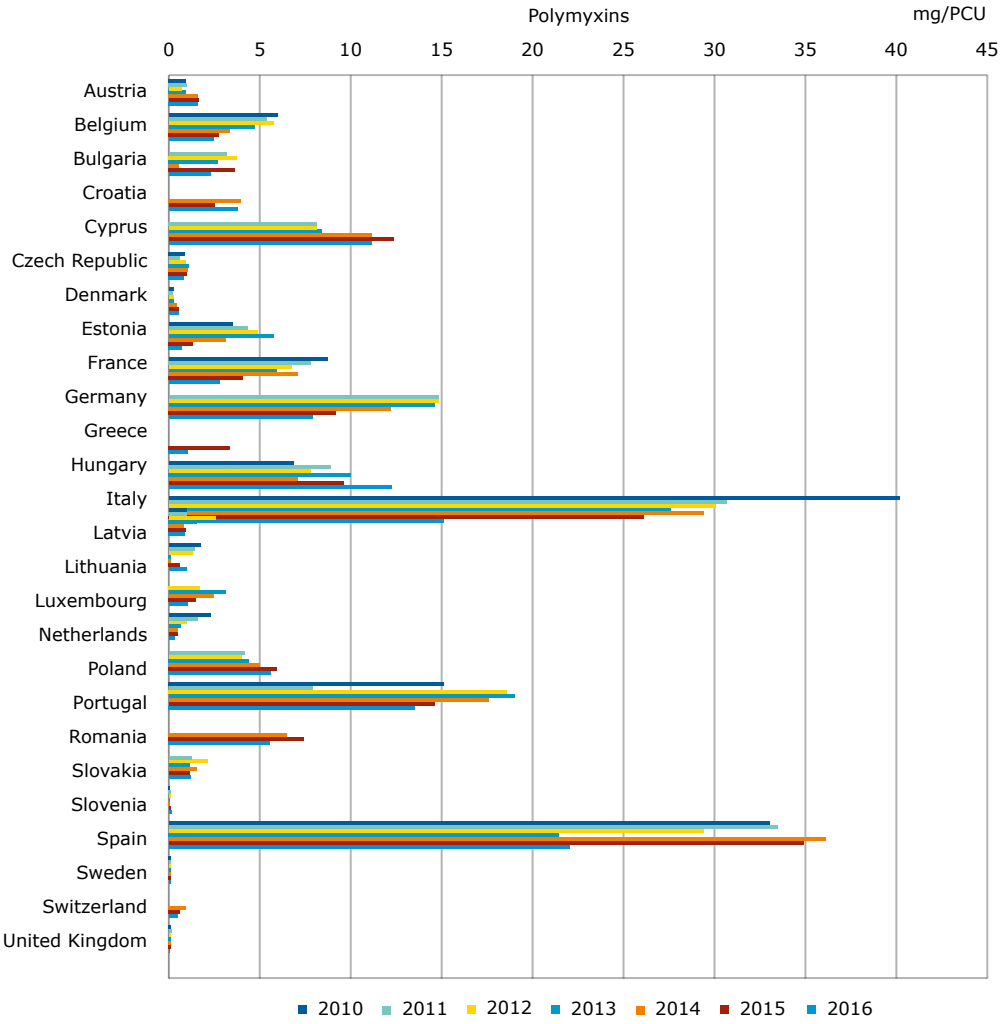
[1] Negligible amounts sold in Denmark, Iceland, Norway and Sweden.

Figure 42. Changes in sales of quinolones (fluoroquinolones and other quinolones) for food-producing species, in mg/PCU, by 30 European countries, from 2010 to 2016[1]



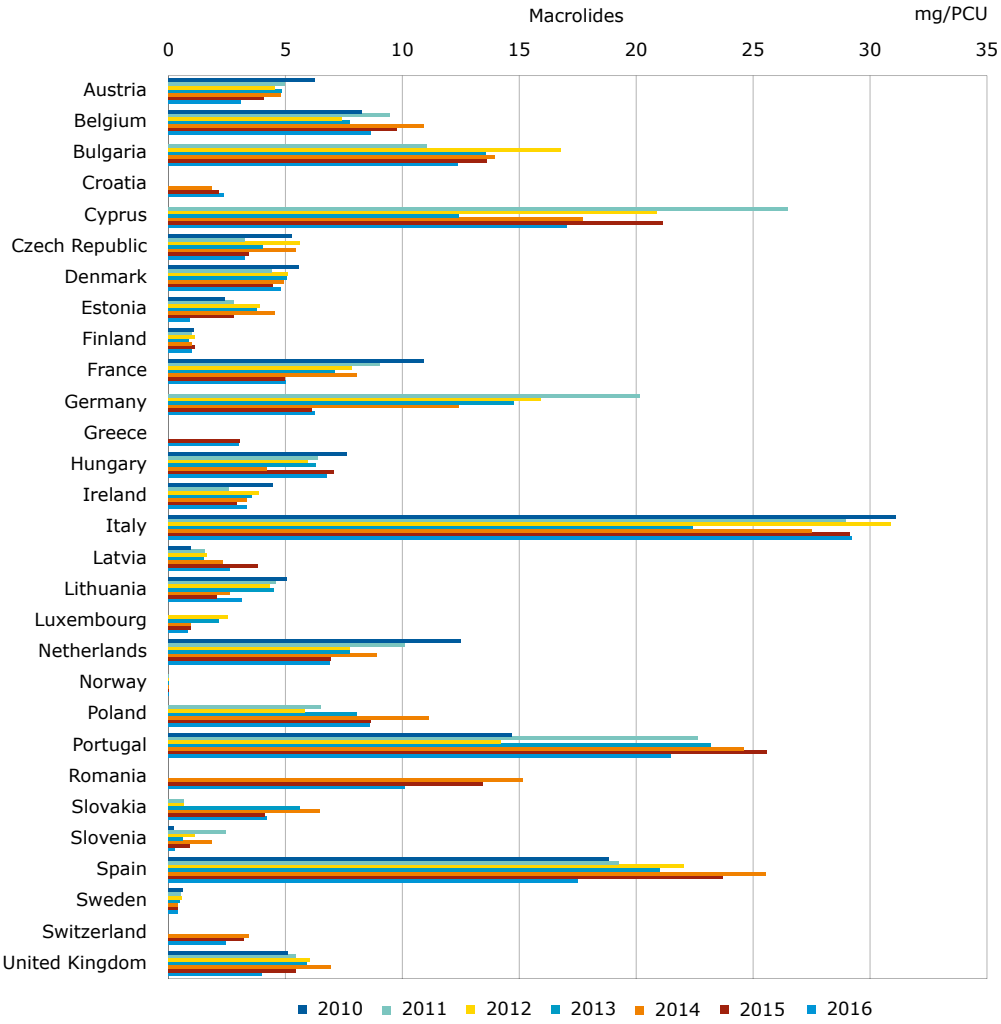
[1] In Austria, Denmark, Finland, Iceland, Ireland, Norway, Sweden, Switzerland and United Kingdom, combined sales of fluoroquinolones and other quinolones were <1mg/PCU in any of the years.

Figure 43. Changes in sales of polymyxins for food-producing species, in mg/PCU, by 30 European countries, from 2010 to 2016[1,2]



[1] No sales of polymyxins in Finland, Iceland and Norway for any of the years.
[2] For reasons of commercial confidentiality, sales of polymyxins in Ireland (≤0.1 mg/PCU) are not included in this graph.

Figure 44. Changes in sales of macrolides for food-producing species, in mg/PCU, by 30 European countries, from 2010 to 2016[1]



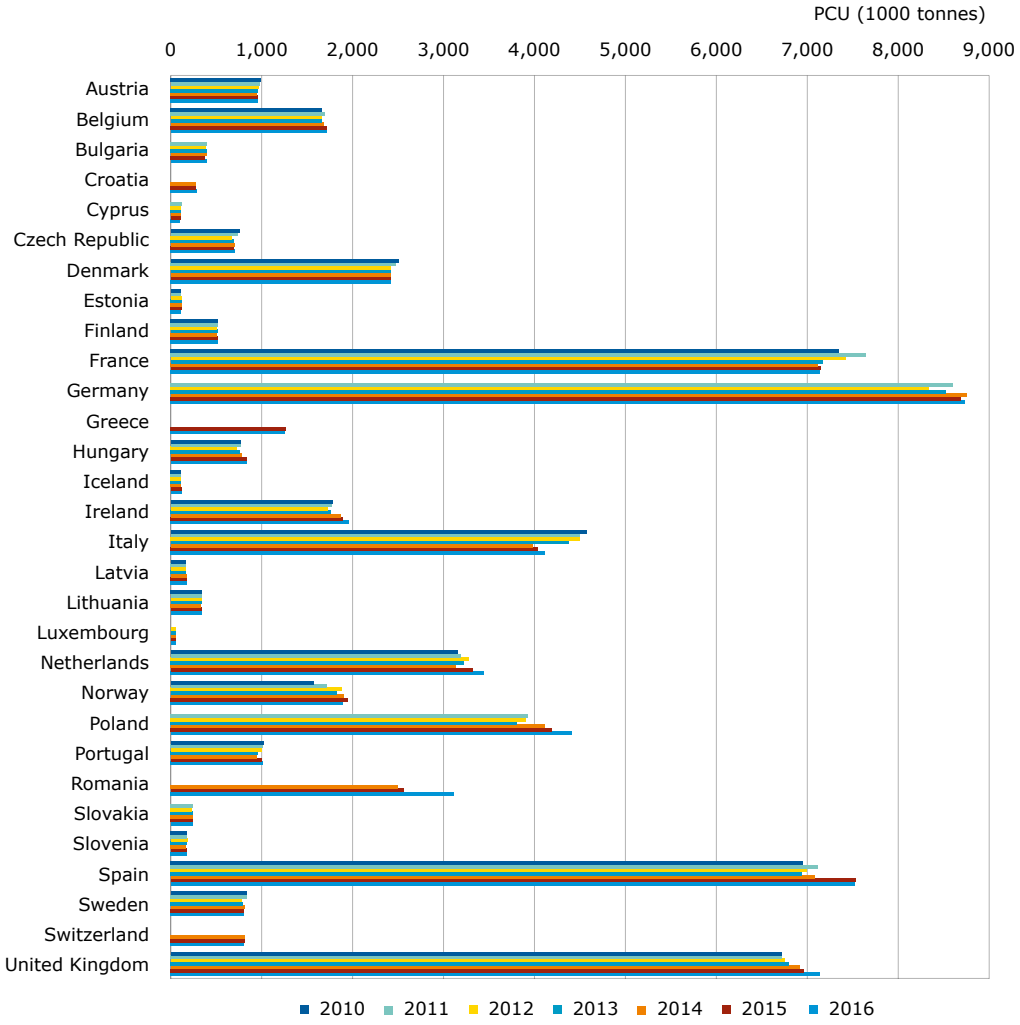
[1] No sales in Iceland; negligible sales in Norway.

2.8.1.4. Changes in the denominator (PCU) by country

From 2010 to 2016, the PCU (estimated weight at treatment of livestock and slaughtered animals) was relatively stable for most countries (Figure 45).

For three of the 25 countries (Ireland, Norway and Poland) that delivered data for five years (2011-2016), an increase of more than 10 % was observed in the PCU, while a decrease of more than 10 % was seen in Cyprus (see Chapter 2.8.2 for more detailed information).

Figure 45. Changes in the denominator (PCU) for food-producing animals, in 1000 tonnes, by country, between 2010 to 2016, in 30 European countries

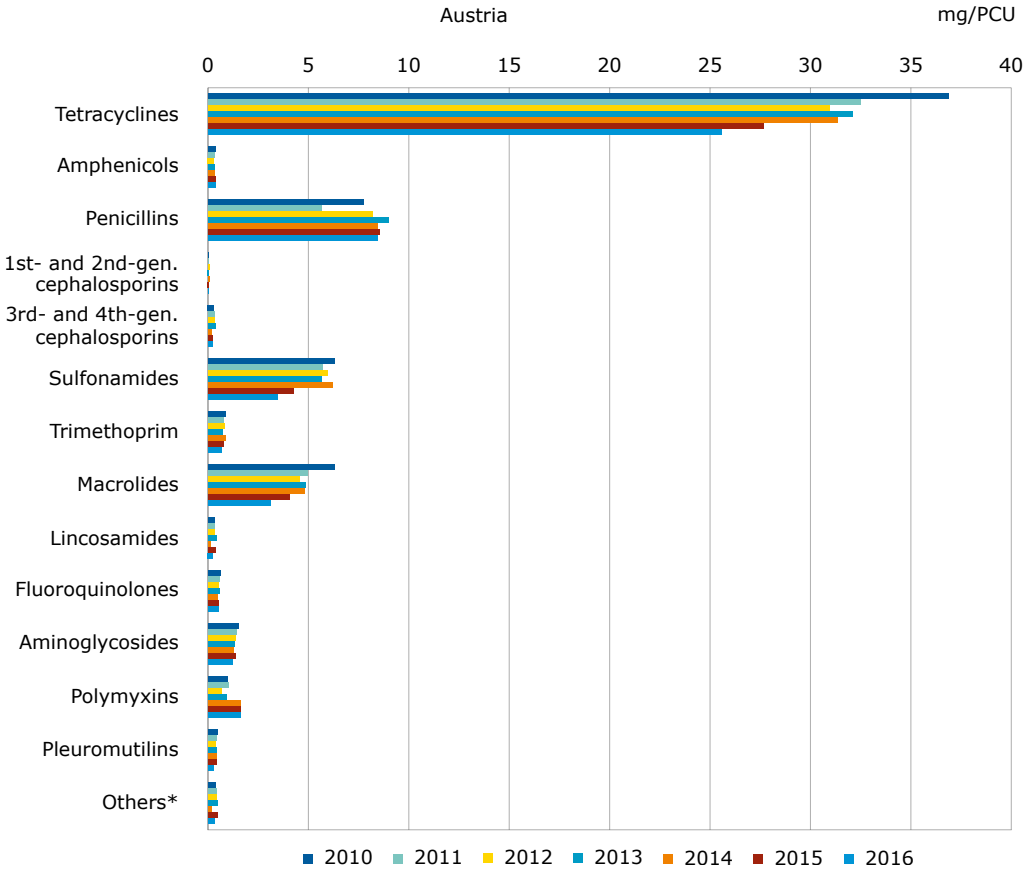


2.8.2. Changes in sales (mg/PCU) across years, by country

This chapter addresses sales per country per antimicrobial class over the period 2010–2016 (first figure). The second figure highlights, for each country, only the antimicrobial classes included under AMEG Category 2 which are common to the highest priority WHO CIAs (Annex 5, Table A16).

Austria

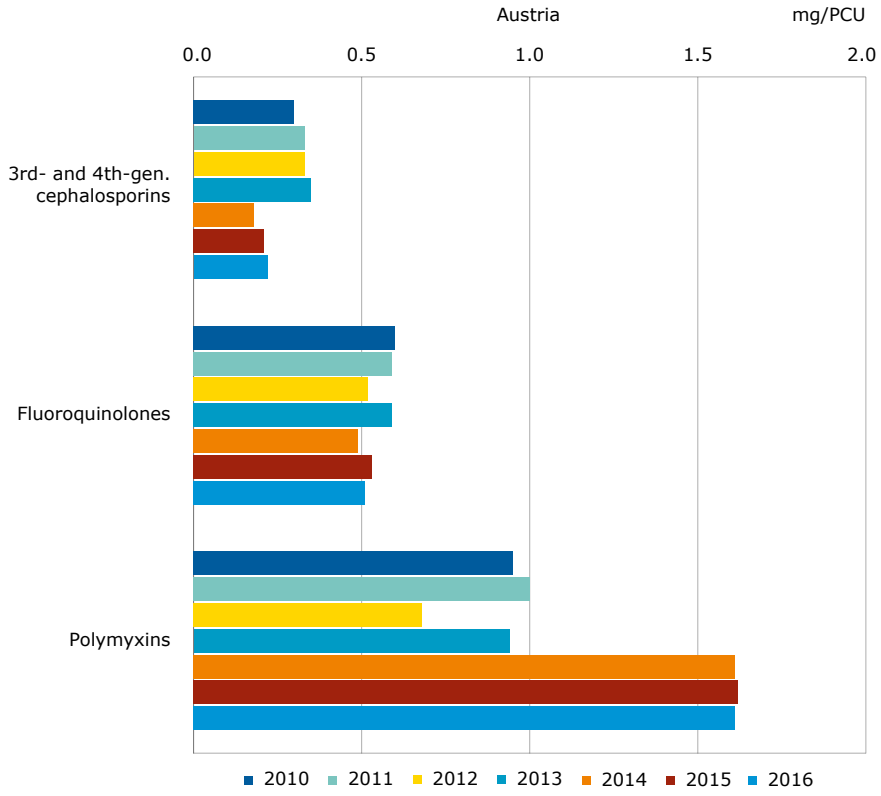
Figure 46. Changes in sales (mg/PCU) by antimicrobial class in Austria, from 2010 to 2016[1]



[1] No sales of other quinolones during any of the years.
*Other antibacterials (classified as such in the ATCvet system).

Overall, a drop of 27% was observed in the total annual sales, in mg/PCU, between 2010 and 2016. This reduction is mainly due to a decrease in absolute sales, as there were only minor changes in the PCU over the last years (Figure 45). The sales were dominated by tetracyclines, which accounted for 55% of the total sales in 2016. Penicillins had the second highest sales figures, and sales of this antimicrobial class were relatively stable over the last years. However, as the total amount decreased, the proportion of penicillins increased from 12% to 18% during the period 2010 to 2016. The overall reduction is mainly due to the withdrawal of tetracycline-sulfonamide combination products (the data did not show any compensation by other products).

Figure 47. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in Austria, from 2010 to 2016



From 2010 to 2016, a drop in the sales (mg/PCU) of 3rd- and 4th-generation cephalosporins was observed. In 2016, the sales of 3rd- and 4th-generation cephalosporins were 0.22 mg/PCU, and aggregated sales across the 25 countries were 0.21 mg/PCU (Figure 34).

The sales of fluoroquinolones were relatively stable over the years with a reduction of 15% in 2016 compared to 2010. In 2016, the sales of fluoroquinolones in Austria were 0.51 mg/PCU, and the aggregated sales for the countries were 2.70 mg/PCU (Figure 34).

Sales of polymyxins increased in 2016 by 69% compared to the year 2010; and have been stable for the last three years. In 2016, sales of polymyxins in Austria were 1.61 mg/PCU and the aggregated sales of polymyxins for the 25 countries were 6.62 mg/PCU (Figure 34).

In Austria, a national action plan for the reduction of antimicrobial resistance was implemented in 2013 and is updated regularly. One of the main goals was to improve the monitoring system of antimicrobial consumption in veterinary medicines. Therefore, a new method for sales data collection was implemented in 2014. Wholesalers and MAHs are required to upload their sales data directly into a database, which led to an improvement in data quality. In addition, VET-pharmacies must also report their sales to livestock holdings (including species information). First results for the main food-producing species have been published in the national report.

Furthermore, different research projects concerning antimicrobial usage in poultry, pigs and cattle are in progress and prudent use campaigns were implemented together with the animal health services.

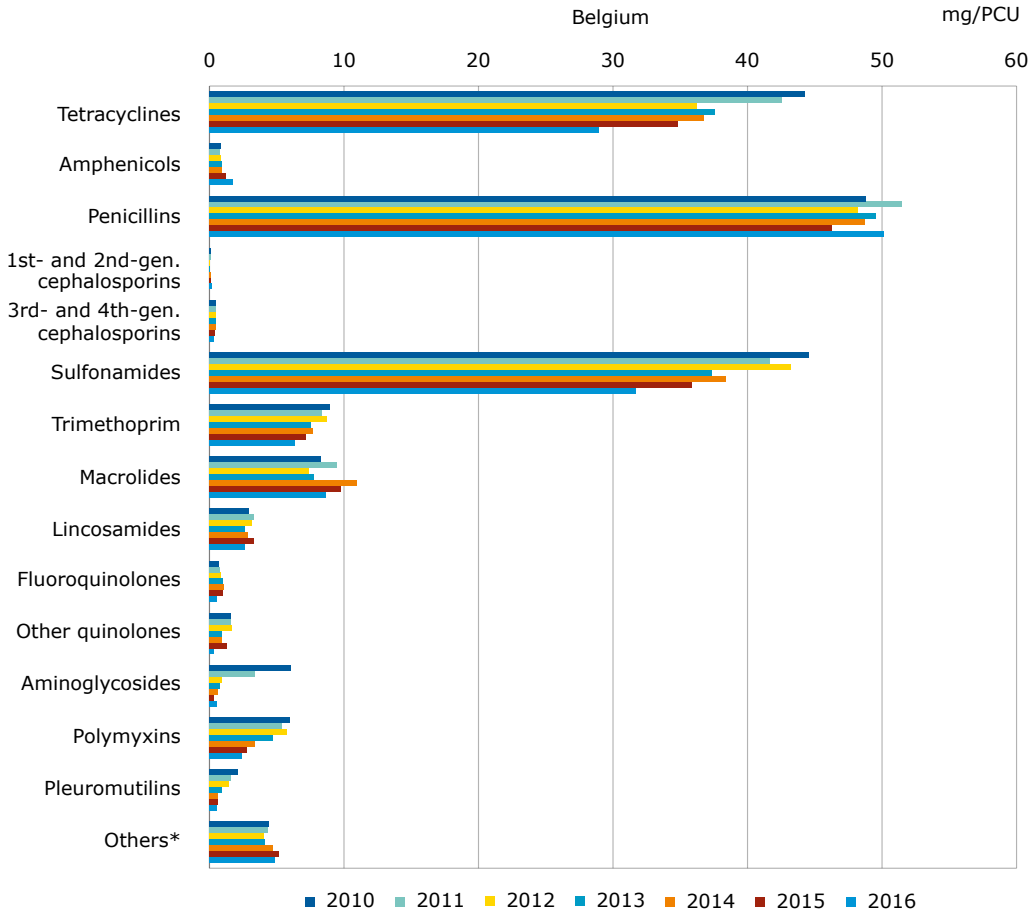
Belgium

After a decrease in antibiotic sales in Belgium in 2015 (-5.2% from 2014), overall sales dropped again in 2016 by -6.7% from 2015. Cumulatively, use of veterinary antimicrobial agents in Belgium decreased by 22% from 2010 (180 mg/PCU) to 2016 (140 mg/PCU).

The reduction in 2016 from the previous year is observed for the classes of most used substances as sulphonamides and tetracyclines. Use of penicillins (mainly amoxicillin and ampicillin) increased by 8%. The proportion in use of the different antibiotic classes is relatively stable, however.

Use of macrolides in 2016 (8.66 mg/PCU) is still 5% higher compared to 2010 (8.3 mg/PCU) but decreased from 2015 (9.79 mg/PCU). A quite substantial decrease (-72%) could be observed for other quinolones like flumequine (0.36 mg/PCU) vs 2015 (1.3 mg/PCU). These products were mainly authorised for use in poultry.

Figure 48. Changes in sales (mg/PCU) by antimicrobial class in Belgium, from 2010 to 2016



*Other antibacterials (classified as such in the ATCvet system).

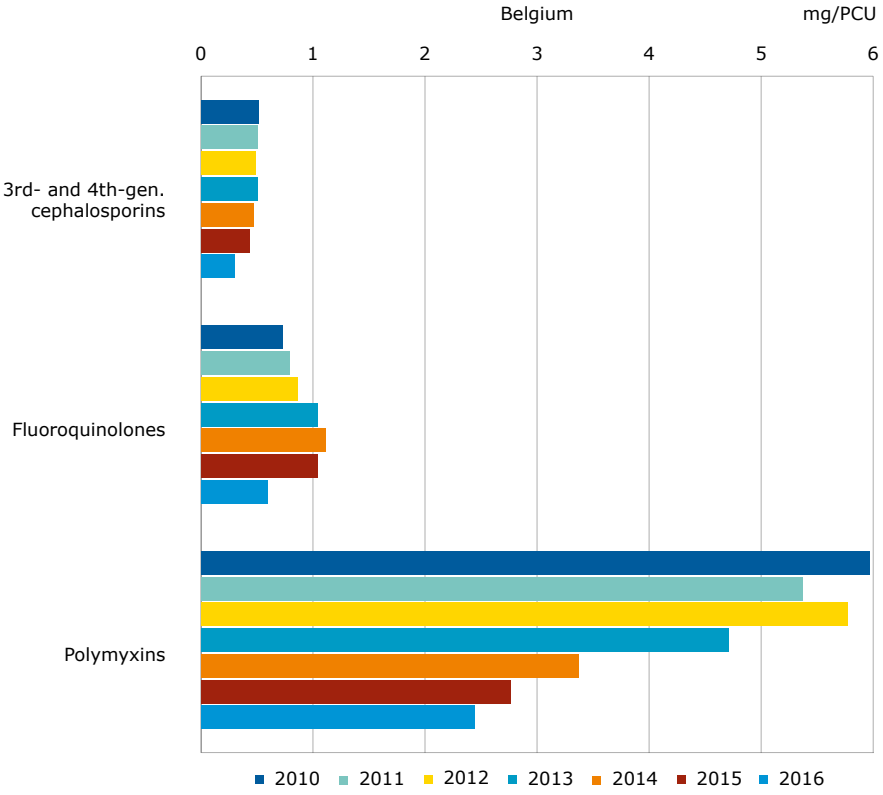
The sales accounted for by 3rd- and 4th-generation cephalosporins decreased sharply in 2016, representing just 0.2% of total sales (0.30 mg/PCU) while the use of fluoroquinolones was reduced to 0.4% (0.59 mg/PCU). It has to be highlighted, that the increasing sales of fluoroquinolones since 2010 was reversed for the first time in 2015 and dropped substantially in 2016 (-43%).

In Belgium, sales of 3rd- and 4th-generation cephalosporins (0.30 mg/PCU) are up against the aggregated sales of 0.21 mg/PCU of 25 European countries, while sales of fluoroquinolones in Belgium (0.59 mg/PCU) are up against aggregated sales of 2.70 mg/PCU (Figure 34).

Since September 2013, ZnO premixes are authorised to be applied in therapeutic doses in weaned piglets. Their use decreased for the first time in 2016 to 74.4 tonnes (-14.7% from 2015), still corresponding with treatment of approximately 6.2 million piglets. ZnO primarily replaces colistin. Despite this reduction in use of ZnO, also sales of polymyxins decreased in 2016 (2.44 mg/PCU) compared to 2015 (2.8 mg/PCU). Since 2012, the year before ZnO premixes became available, sales of polymyxins decreased by 60%.

To note that on 26 June 2017, the EC adopted a decision to withdraw all marketing authorisations for veterinary medicinal products containing ZnO administered orally to food-producing species[25].

Figure 49. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in Belgium, from 2010 to 2016



Awareness campaigns on antibiotic use and emergence of resistance are primarily based on the national monitoring programme 'BelVet-Sac' for which the Federal Agency for Medicines and Health Products (FAMHP)[26] collaborates with the Faculty of Veterinary Medicine in Ghent to collect and analyse data.

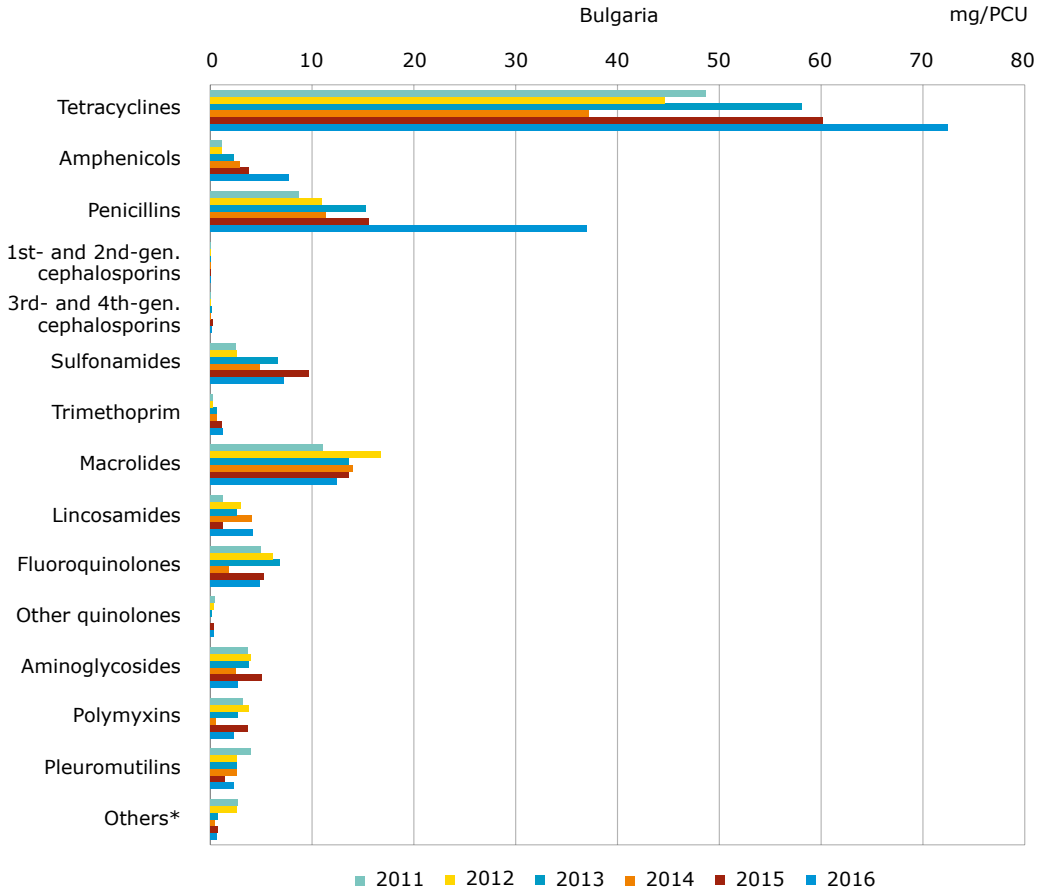
Because of a rather slow decreasing trend in overall antimicrobial use since 2011 (reference year) and the disappointing figures of 2014, the competent authority decided in 2015 to prepare co-regulation measures to complement the sensitisation activities of the Centre of Expertise on Antimicrobial Consumption and Resistance in Animals (AMCRA), and its partners. Additional legal measures were implemented and a centralised data collection system was installed as restrictions on use of critically important antibiotics for human medicine, requiring obligatory sampling and sensitivity testing before use. The Royal Decree came into force in mid-2016 and had an almost immediate effect.

Since 2016, main activities include further sensitisation initiatives (AMCRA), enforcement activities by the competent authority regarding the new legislation, and the preparation of individual analysis reports (benchmarking).

[25] http://ec.europa.eu/health/documents/community-register/2017/20170626136754/dec_136754_en.pdf
[26] https://www.fagg-afmps.be/nl/DIERGENEESKUNDIG_gebruik/geneesmiddelen/geneesmiddelen/goed_gebruik/Antibiotica_0

Bulgaria

Figure 50. Changes in sales (mg/PCU) by antimicrobial class in Bulgaria, from 2011 to 2016



*Other antibacterials (classified as such in the ATCvet system).

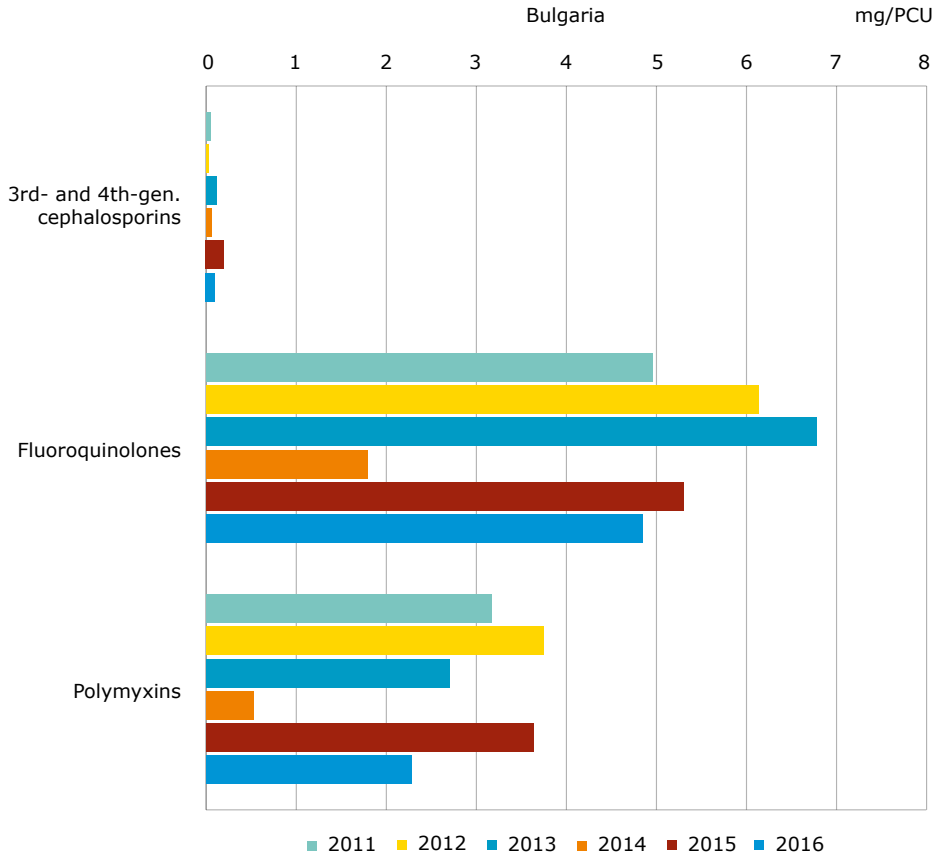
Following the patterns already observed in the period 2011-2015, tetracyclines (46.5 %) and penicillins (23.9 %) were the most sold antimicrobial veterinary medicinal products in Bulgaria in 2016, followed by macrolides (8 %), sulphonamides (5.4 %), amphenicols (5 %), fluoroquinolones (3.2 %), lincosamides (2.6 %) and aminoglycosides (2.1 %).

An overall increase of 27 % in the total consumption of antimicrobial VMPs in 2016 was observed with reference to 2015 sales in mg/PCU. This increase is mostly due to the rise in sales of tetracyclines (20 %), penicillins (138 %), amphenicols (105 %) and lincosamides (245 %). The sales of polymyxins decreased by 37 %.

In reference to 2011 the increase in sales in 2016 reached 68 %; this difference in sales can be partially explained by significant underreporting in sales for previous years, particularly for water soluble VMPs and premixes.

Sales of antimicrobial agents, in tonnes, have increased by 65 %, while the PCU (expressed in 1000 tonnes) has remained relatively stable (-1 %), in reference to 2011.

Figure 51. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in Bulgaria, from 2011 to 2016



In 2016, 3rd- and 4th-generation cephalosporins were sold in larger quantities than cephalosporins of the 1st- and 2nd-generation, but sales of this class of antimicrobials were still relatively low during the study period, representing 0.1 % of total sales (mg/PCU) in 2016.

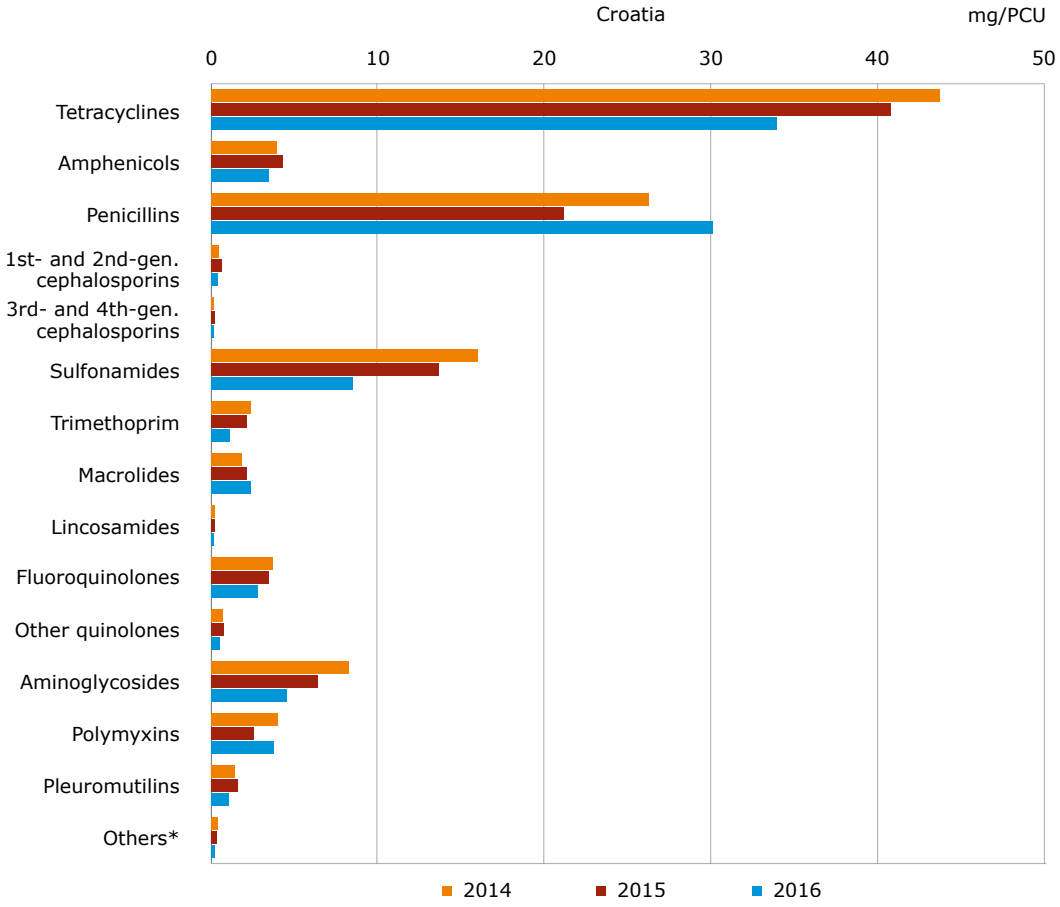
Last year (2017) Bulgaria introduced a national data collection system for sales of antimicrobial VMPs, supported by the introduction of national legislation. The new system requires veterinarians to report any prescription and administration of medicines to animals and also includes data provided by wholesalers and retailers. Until now, it was only possible to obtain data from some Marketing Authorisation Holders (MAHs), therefore an underreporting of sales in 2015 and previous years cannot be excluded. The new system will also allow for the collection of data at sites where antimicrobials are used (reporting by registered veterinarians and animal owners).

The Bulgarian Food Safety Authority (BFSA) has established an Expert Council on Antimicrobial Resistance which includes all directorates of the Agency and whose main activities are:

- to develop and implement policy and legislation with regard to the AMR;
- to develop objective and measurable criteria for assessing the results of the implementation of the guidance for prudent use of antimicrobials in veterinary activity;
- to enhance collaboration of BFSA Directorates in the development of good practices in relation to AMR, for example in the prevention and control of infections to improve animal health and welfare.

Croatia

Figure 52. Changes in sales (mg/PCU) by antimicrobial class in Croatia, from 2014 to 2016

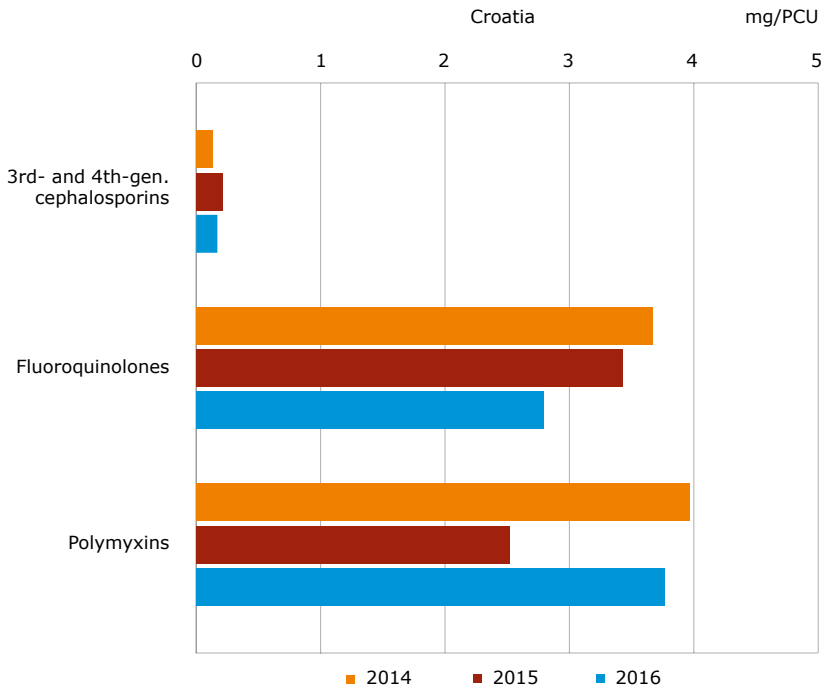


*Other antibacterials (classified as such in the ATCvet system).

In 2016, tetracyclines, penicillins and sulfonamides were the most-sold classes accounting for 36 %, 32 % and 9 %, respectively, of the total sales of antimicrobials (mg/PCU) for food-producing species, including horses.

A 7 % decrease in sales (mg/PCU) was observed in Croatia from 2015 to 2016. This decline should be interpreted with caution, as it was the result of the first three years of collecting data using the ESVAC common template, and bearing in mind that overall sales, in tonnes, can fluctuate from year to year. The denominator (PCU) for Croatia remained relatively stable (+3 %) across the three years of observation.

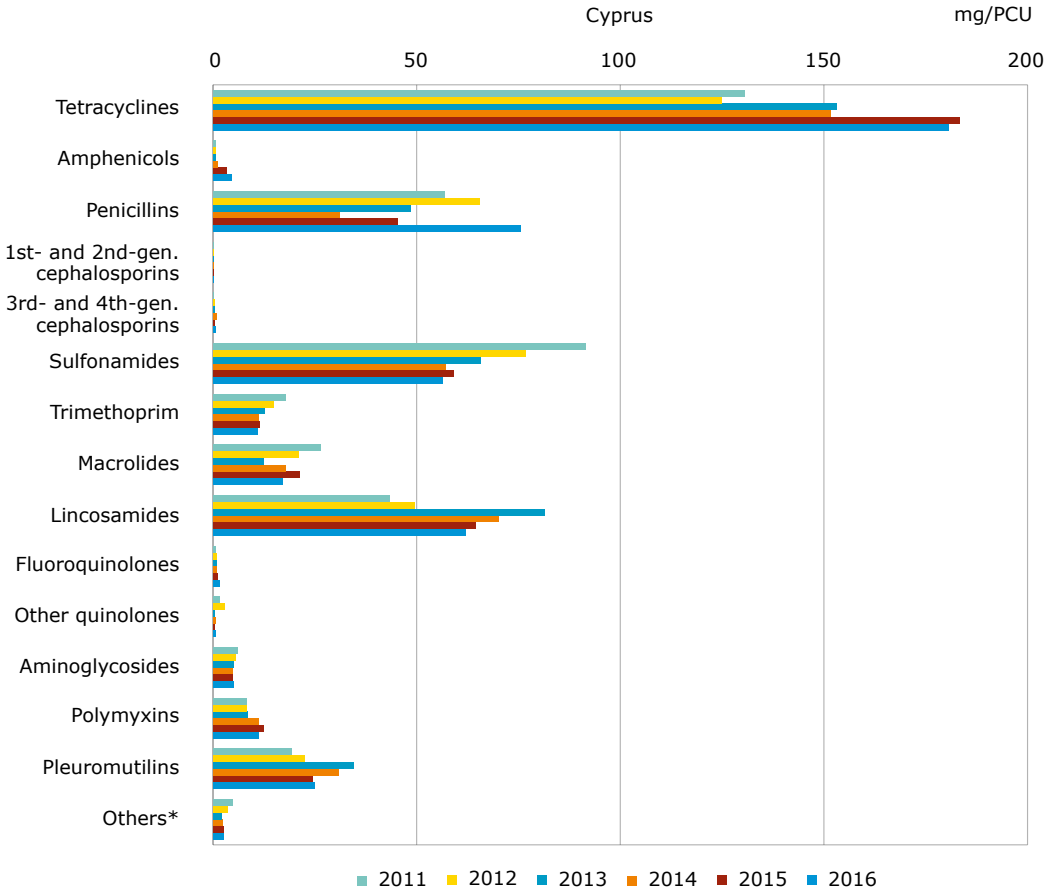
Figure 53. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in Croatia, from 2014 to 2016



In Croatia, sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins represented 0.2%, 3.0% and 4.1%, respectively, of total sales in 2016. In the same year, sales of 3rd- and 4th-generation cephalosporins were 0.17 mg/PCU; the aggregated sales for 25 countries were 0.21 mg/PCU (Figure 34).
Sales of fluoroquinolones were 2.79 mg/PCU; the aggregated sales for 25 countries were 2.70 mg/PCU (Figure 34).
Sales of polymyxins were 3.77 mg/PCU; the aggregated sales for 25 countries were 6.62 mg/PCU (Figure 34).

Cyprus

Figure 54. Changes in sales (mg/PCU) by antimicrobial class in Cyprus, from 2011 to 2016



*Other antibacterials (classified as such in the ATCvet system).

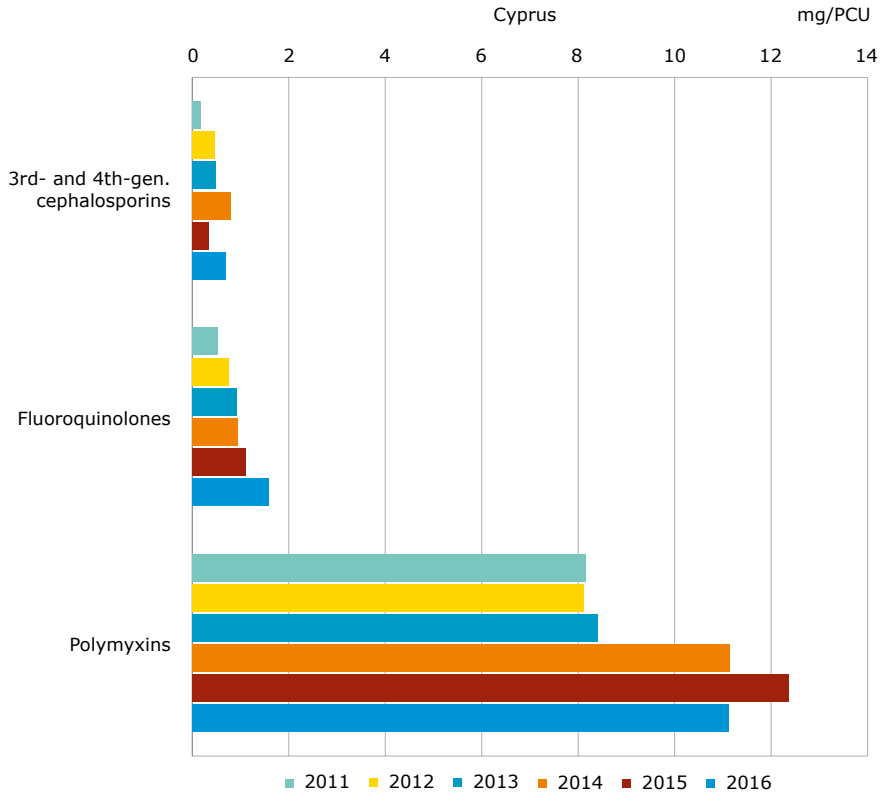
The annual sales, in mg/PCU, of veterinary antimicrobials in Cyprus fluctuated during the period 2011 to 2016, with an increase of 11% being observed. Note that the proportion of goats in Cyprus is relatively high compared to other countries participating in the ESVAC. This has a significant effect on the magnitude of PCU for Cyprus since living goats are not included in the PCU calculation for the ESVAC. Based on national statistics for the number of goats in Cyprus and an average treatment weight of about 45 kg, the living goat PCU would have added 11.6 thousand tonnes to the PCU. If goats had been included in the PCU, the total annual sales, in mg/PCU, would have been approximately 10% lower.

Prescribing patterns have changed considerably from 2011 to 2016; in particular, sales of other quinolones and sulfonamides have decreased while a substantial increase has been observed for tetracyclines (Figure 54). Sales of lincosamides also increased during this period, although a decline can be seen from 2013 to 2016.

A National Strategic Plan to combat AMR was published in December 2012 by the Ministry of Health under the "One Health" approach. This plan is managed by the National Committee on Antibiotics, which includes representatives from both the human and veterinary medicine fields. Activities introduced with the National Strategic Plan focus mainly on human health although there are some actions in the veterinary field such as, improving diagnosis and the use of antibiotics in animals and specifying measures to encourage the prudent use of antimicrobials.

Moreover, a separate and specific action plan was considered necessary to address the high level of veterinary antimicrobial sales in Cyprus over the last few years. To that end, a five-year action plan to combat AMR was prepared by the veterinary services and approved during the first half of 2018 by the Ministry of Agriculture, Rural Development and Environment. This plan contains several types of measures including: awareness-raising campaigns; strengthening the prevention of infections in food-producing animals; controls on the use of highest priority CIAs for human medicine; and recommendations on the prudent use of antimicrobials which are in line with EC published guidance.

Figure 55. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in Cyprus, from 2011 to 2016



In 2011, the 3rd- and 4th-generation cephalosporins accounted for 0.04% of total sales; in 2016, this figure was 0.2%. In the same year (2016), sales of 3rd- and 4th-generation cephalosporins were 0.70 mg/PCU, while the aggregated sales for 25 countries were 0.21 mg/PCU (Figure 34).

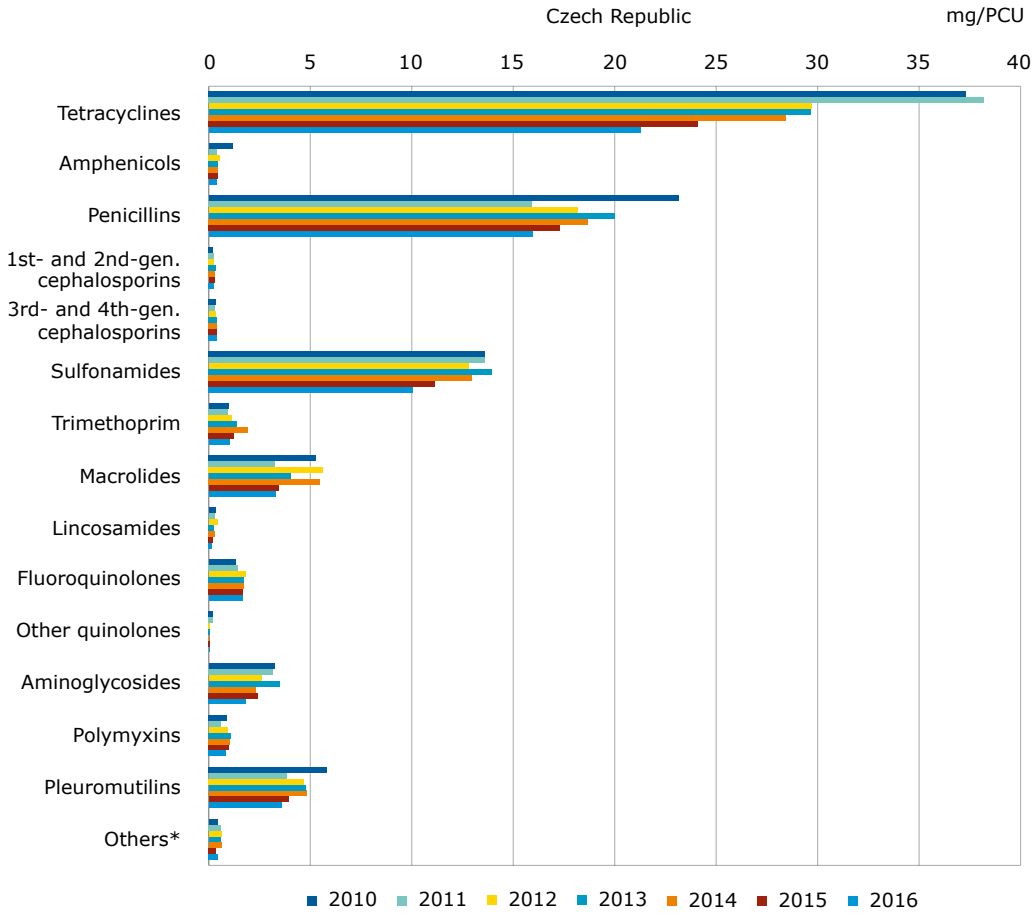
For fluoroquinolones, sales accounted for 0.13% and 0.35% of total sales in 2011 and 2016, respectively. In 2016, sales of fluoroquinolones were 1.59 mg/PCU, while the aggregated sales for 25 countries were 2.70 mg/PCU (Figure 34).

Sales of polymyxins increased from 2.0% of total sales in 2011 to 2.5% in 2016. In 2016, sales of polymyxins, particularly colistin, were 11.13 mg/PCU, while the aggregated sales for 25 countries were 6.62 mg/PCU (Figure 34).

Czech Republic

From 2010 to 2016, total sales (mg/PCU) fell by 35 % in the Czech Republic (in tonnes, by 39 %). The largest decreases (in mg/PCU) were observed for tetracyclines (by 43 %) as the most-sold class; however, also for further most frequently used classes - penicillins, sulphonamides, pleuromutilins and macrolides, decrease was quite significant (31 %, 26 %, 39 % and 38 %, respectively).

Figure 56. Changes in sales (mg/PCU) by antimicrobial class in the Czech Republic, from 2010 to 2016

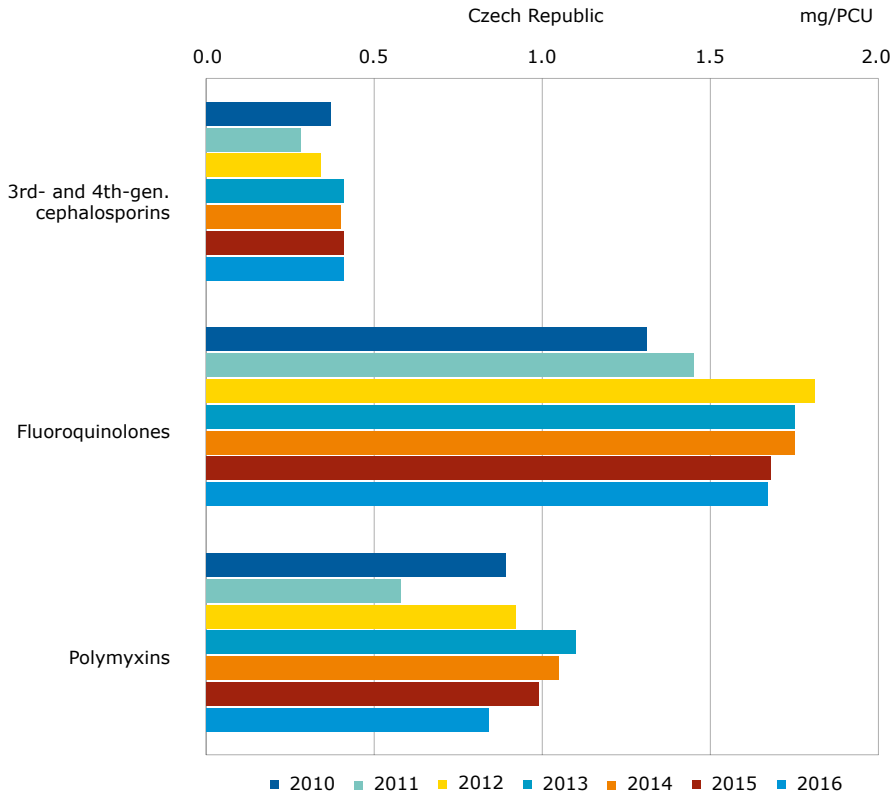


*Other antibacterials (classified as such in the ATCvet system).

For 3rd- and 4th-generation cephalosporins, there were slight fluctuations in consumption during the period 2010–2016 (mean = 0.37 mg/PCU, min = 0.28 mg/PCU, max = 0.41 mg/PCU). For fluoroquinolones (mean = 1.63 mg/PCU), a decreasing trend started in 2012 (down by 8 % from 2012 to 2016). For polymyxins, where consumption has traditionally been low in the Czech Republic (mean = 0.91 mg/PCU), the decreasing trend started in 2013 (down by 24 % from 2013 to 2016).

The above-mentioned total consumption data show some remarkable decreases in sales. The data for groups of critically important antimicrobials show either decrease (colistin since 2013 and fluoroquinolones, especially enrofloxacin, since 2012) or fluctuation (3rd- and 4th-generation cephalosporins). More in-depth analysis of the reasons of antimicrobial use in individual groups/VMPs and species and categories of animals has been done in cooperation with different stakeholders in animal health services to indicate further space for improvement under forthcoming activities in the Czech National Action Plan against AMR.

Figure 57. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in the Czech Republic, from 2010 to 2016



It should be also noted that for 2011 and 2012 the amount of active ingredients for the major part of the antimicrobial VMPs were provided as the base. To ensure complete harmonisation with the data from the other countries participating in the ESVAC, which typically provide the strength of active ingredients as they appear on the VMP label, the strength of active ingredients of the VMP presentations for the Czech Republic has been reported to the ESVAC according to the label since 2013.

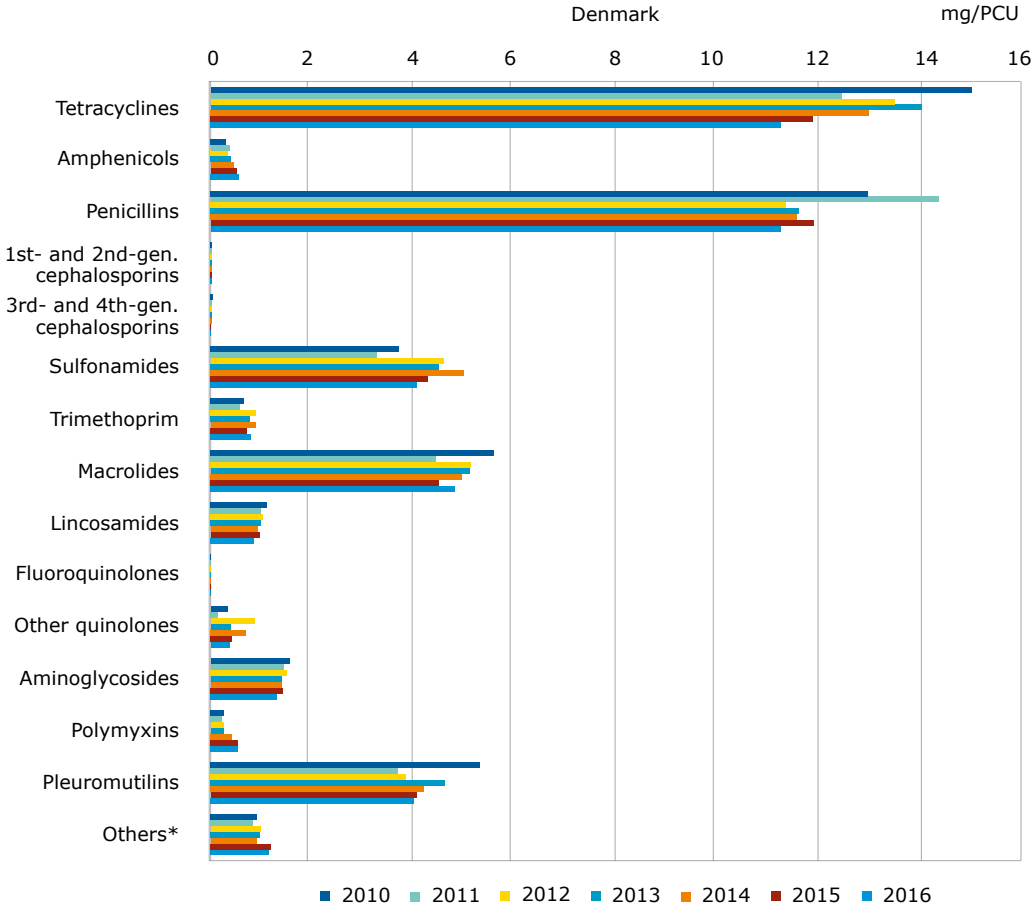
The decrease in total sales could be partly due to a reduction in the use of herd/flock medication (with a significant decrease (approx. 70 %) in use within the group of medicated premixes from 2010 to 2016). The decrease in sales of premixes was also caused by the switch to the use of medicines administered in drinking water, a shift towards treatment of limited groups/individual animals, and targeted treatment whenever possible. All these changes are connected with the gradual but continuous improvement of herd/flock management measures, leading to better animal health. This is especially the case in farms introducing new technologies and repopulation (pigs). Other measures include: improvement of animal care (especially piglets at weaning); in-house microbiological tests; selective use of antimicrobials at drying off (dairy cows); improving biosecurity and care for parent flocks and one-day-old chicks; and use of other tools to prevent disease, tailored to flock conditions (vaccination, fyto, enzymes, vitamins) that possibly influenced the decrease in sales of fluoroquinolones.

Responsible and more targeted use of antimicrobials can also be linked to the monitoring of susceptibility/resistance of target veterinary pathogens that started in 2015. This project was initiated by a working group on antimicrobials led by the Ministry of Agriculture. Monitoring results, as well as results of MICs are made available to veterinarians and trainings to raise awareness of antimicrobial resistance are organised for veterinary practitioners. The focus of recent activities has been on identifying tools for improvement that can be effectively implemented to achieve minimum necessary use of antimicrobials under the National Action Plan.

Denmark

Prudent use of antimicrobials has been a very high priority in Denmark since 2010, particularly in the Danish pig production sector, where the 'Yellow card' initiative has been implemented, targeting the 5-10 % of pig producers with the highest consumption of antimicrobial agents for veterinary use. A new political target for reducing antimicrobial consumption in pigs was set in 2015, aiming for a 15 % reduction by the end of 2018 compared to 2014. To reach this goal the new 'Yellow card' initiative was launched in 2016. The initiative divides antimicrobials for pigs into three categories with different multiplication factors: fluoroquinolones, 3rd- and 4th-generation cephalosporins and colistin (polymyxins) are multiplied by a factor of 10; tetracyclines are multiplied by a factor of 1.5; and others are assigned a factor of one. Furthermore, the thresholds for use in pigs were lowered, supporting the aim of a 15 % reduction in pigs by the end of 2018.

Figure 58. Changes in sales (mg/PCU) by antimicrobial class in Denmark, from 2010 to 2016



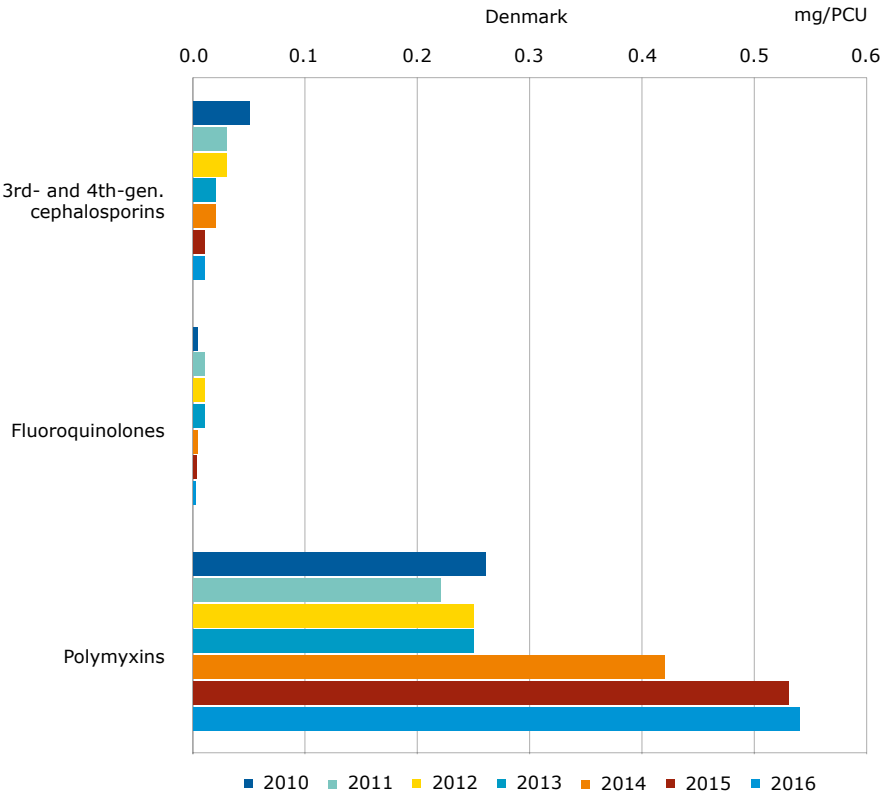
*Other antibacterials (classified as such in the ATCvet system).

From 2010 to 2016, overall sales (mg/PCU) of veterinary antimicrobial agents fell by 14 %. After the introduction of the 'Yellow card' initiative in 2010, sales fell 10 % during the first year. The following years, from 2011 to 2016, sales fell by 4 %.

The most-sold classes of antimicrobial VMPs in Denmark were tetracyclines and penicillins; in 2016, these classes each accounted for 27 % of total sales. The proportion of tetracyclines is expected to decrease during the next years, due to the new 'Yellow card' initiative introduced in 2016. The average daily dose (ADD) for tetracycline is now multiplied by a factor of 1.5.

The sales of macrolides accounted for 12 % of total sales in 2016. From 2010 to 2016, sales of macrolides decreased by 14 %. Approximately 90 % of the macrolides (mostly tylosin) were used in pigs. The proportion of macrolides may increase during the next years, due to the new 'Yellow card' initiative. Macrolides are used as a substitute for tetracycline, and this class of antimicrobials has been assigned a factor of one.

Figure 59. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in Denmark, from 2010 to 2016



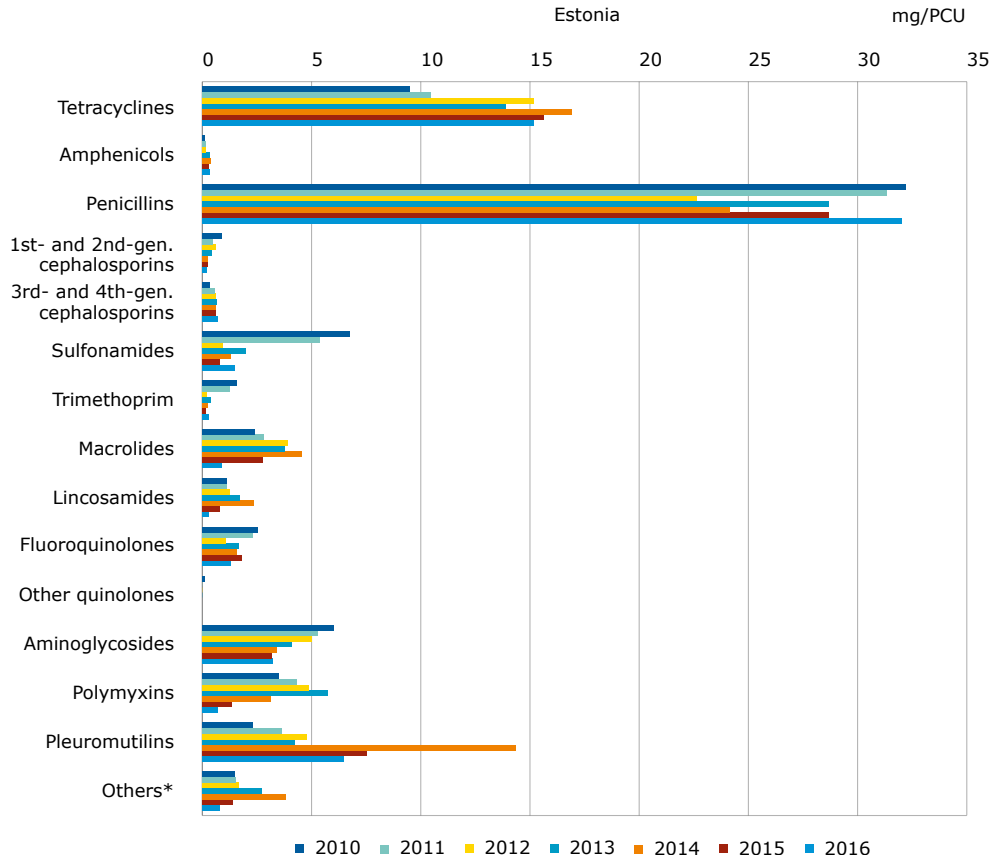
In 2010 and 2011, the 3rd- and 4th-generation cephalosporins accounted for 0.1 % of total sales; in 2016, this figure was 0.02 %, which is relatively low. From 2010 to 2016, the total sales (mg/PCU) of 3rd- and 4th-generations fell by 86 %, mainly due to a voluntary initiative by the pig industry in 2010 to cease the use of 3rd- and 4th-generation cephalosporins.

Sales of fluoroquinolones for food-producing animals are generally low in Denmark, accounting for just 0.006 % of total sales in 2016. From 2010 to 2016, total sales (mg/PCU) of fluoroquinolones fell by approximately 36 %. The reason for these rather low figures is strict regulation on the prescription of fluoroquinolones in food-producing animals, in force since 2002.

Sales of polymyxins for food-producing animals are generally low in Denmark, accounting for just 1.3 % of total sales in 2016. From 2010 to 2016, the total sales (mg/PCU) of polymyxins increased by approximately 106 %. The reason for this development has been increasing use of polymyxins (colistin) in pigs. The proportion of polymyxins expects to decrease significantly, due to the new 'Yellow card' initiative, whereby colistin is multiplied to a factor of 10. This factor was implemented in 2017.

Estonia

Figure 60. Changes in sales (mg/PCU) by antimicrobial class in Estonia, from 2010 to 2016[1]



[1] Since 2011, no sales of other quinolones have been reported.
*Other antibacterials (classified as such in the ATCvet system).

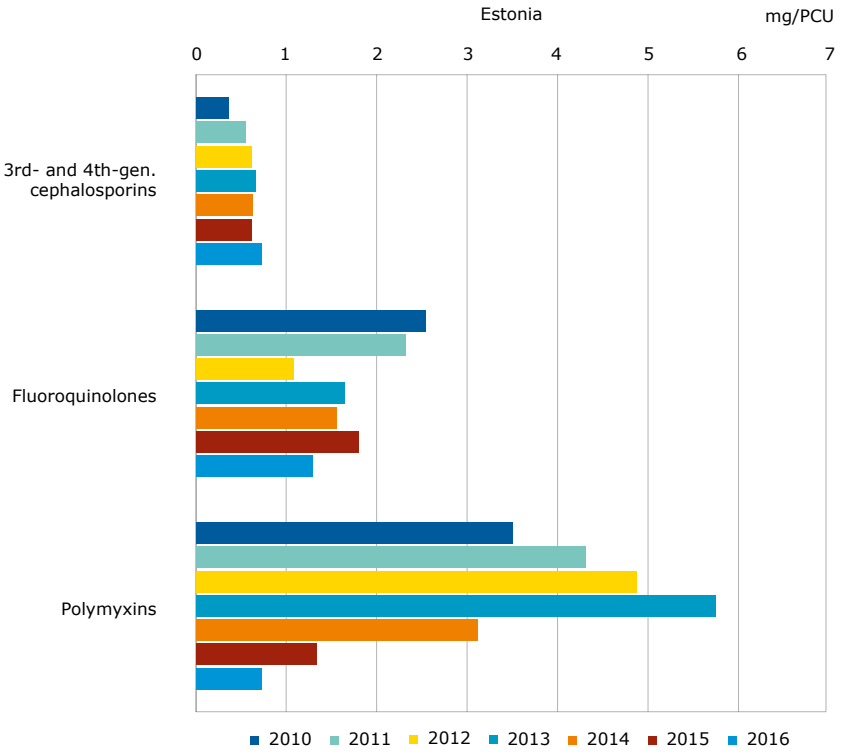
The sales of veterinary antimicrobial agents (mg/PCU) in Estonia fluctuated slightly from 2010 to 2016, with an increase of 9 % from 2010 to 2014 and a decrease of 17 % from 2014 to 2016. The main reason for the decrease in 2015 and 2016 is that there were notable changes in the total population of some food-producing animal species. In 2015 and 2016, the total number of pigs decreased significantly: 15 % and 13 % respectively compared to the previous year. The number of sows fell by 26 % in 2015 compared to 2014. The number of dairy cows decreased by 10 % in 2016 compared to 2014.

The most-sold classes in Estonia were penicillins and tetracyclines. The proportion accounted for by penicillins in 2010 and 2016 was 45 % and 50 %, respectively. An increase in the proportion, from 13 % to 24 %, was also observed for tetracyclines. The fall in sales of sulfonamides combined with trimethoprim may be related to the increase in sales of tetracyclines, which are all authorised products, during this period. Sulfonamides and trimethoprim combination products for oral use are not authorised, so special permission is required for their use. The sales of macrolides decreased by 67 % in 2016 compared to 2015.

In 2014, the sales of pleuromutilins (mg/PCU) increased almost sixfold compared to 2010. The observed increase in sales of pleuromutilins in 2014 compared to previous years is explained by extensive outbreaks of swine dysentery and higher morbidity of unknown aetiology in many large pig farms in Estonia during that year. Notably, since the second quarter of 2015, sales of tiamulin have stayed almost at the same level as in 2012.

As Estonia is a small country, changes in the treatment strategy on one or two major farms or outbreaks such as that described above may significantly influence sales patterns.

Figure 61. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in Estonia, from 2010 to 2016



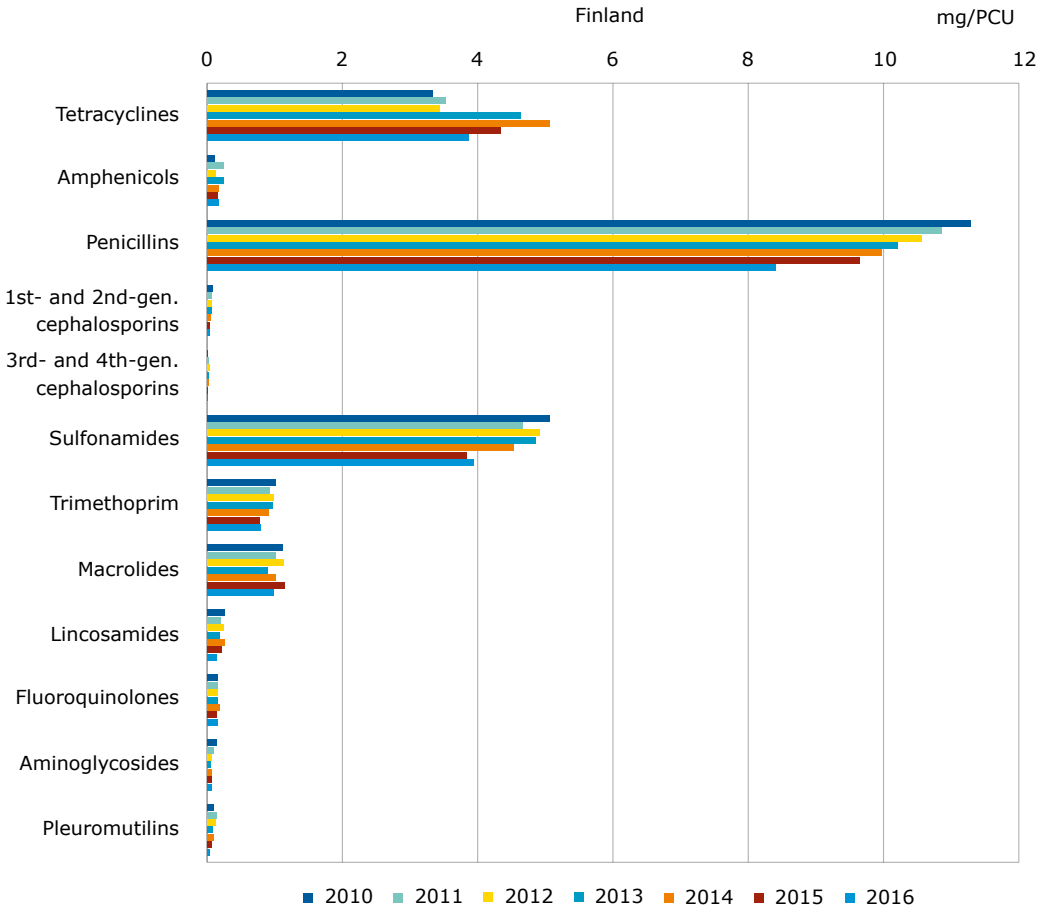
From 2010 to 2016, overall sales (mg/PCU) of 3rd- and 4th-generation cephalosporins show a slow increasing trend. In 2010 and 2016, the 3rd- and 4th-generation cephalosporins accounted for 0.5 % and 1.1 %, respectively, of total sales. In 2016, sales of 3rd- and 4th-generation cephalosporins were 0.73 mg/PCU, while in 2010 they were 0.36 mg/PCU.

Sales of fluoroquinolones decreased between 2010 and 2016, although fluctuations in sales were also observed. In 2010, fluoroquinolones accounted for 3.6 % of the total sales; in 2016, this figure was 2.0 %. In 2016, sales of fluoroquinolones were 1.29 mg/PCU.

Sales of polymyxins fluctuated significantly from 2010 to 2016, with a total decrease of 79 %. They rose by 64 % from 2010 to 2013, then fell considerably from 2013 to 2016.

Finland

Figure 62. Changes in sales (mg/PCU) by antimicrobial class in Finland, from 2010 to 2016[1]



[1] No sales of other quinolones, polymyxins and other antibacterials in any of the years.

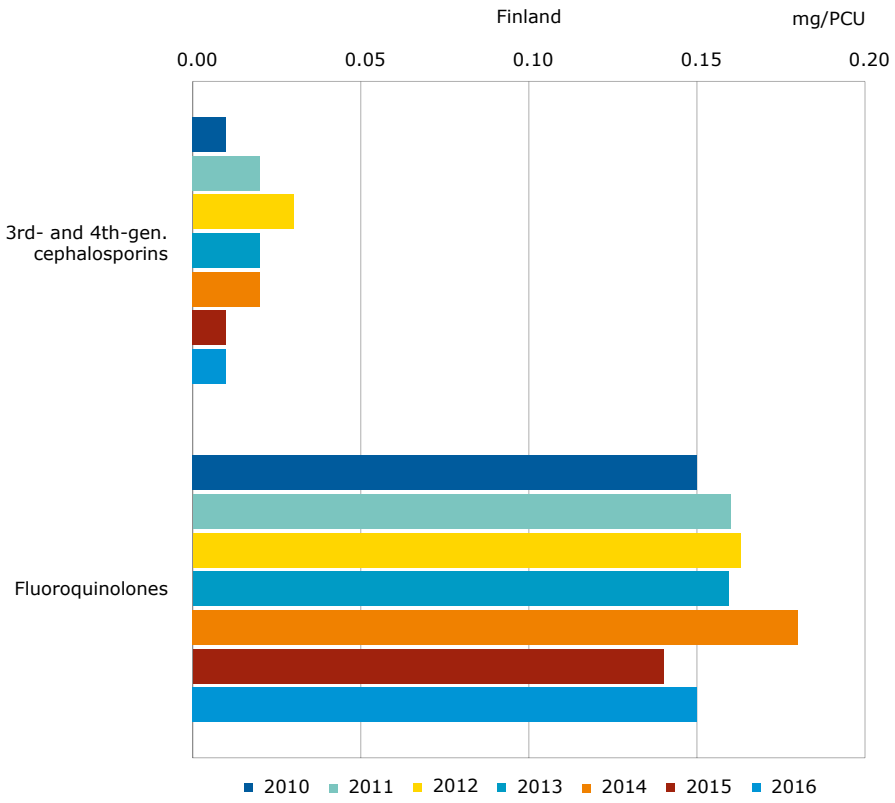
Overall sales of veterinary antimicrobials in Finland continued to be low: approximately 19 mg/PCU in 2016. A marked decrease in overall sales has been seen in recent years with sales falling by 3.7 mg/PCU (-17%) from 2014 to 2016. The highest decrease in mg/PCU was for penicillins and tetracyclines, but proportionally the highest decrease was for 3rd generation cephalosporins (-60% from 2014).

Penicillins continued to be the most-sold antimicrobial class (45% in 2016), followed by tetracyclines (21%) and sulfonamides (21%). Beta-lactamase-sensitive penicillins accounted for slightly more than 86% of the sales of all penicillins (Figure 5) and 89% of penicillins sold were injectable preparations (Figure 14). In the long term (from 2010), the most significant changes in mg/PCU were the decreases in sales of penicillins and the sulfonamide-trimethoprim combination. Sales of tetracyclines in 2016 were higher than in 2010 but a decreasing trend has been observed in recent years.

The reasons for decreased sales since 2014 are unknown. The next years will tell whether this trend continues. The total population of food-producing animals (measured as PCU) has been relatively stable. Finland has a long history of promoting the health and welfare of food-producing animals and is free of several strategically important animal diseases. Prudent use guidelines[27] have been available since 1996 and have been updated three times, most recently in spring 2016.

[27] https://www.evira.fi/sv/om-evira/publikationer/djur/guider/rekommendationer-for-anvandning-av-antimikrobiella-lakemedel-mot-de-vanligaste-infektionssjukdomarna-och-smittsamma-sjukdomarna-hos-djur/

Figure 63. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in Finland, from 2010 to 2016[1]



[1] No sales of polymyxins in any of the years.

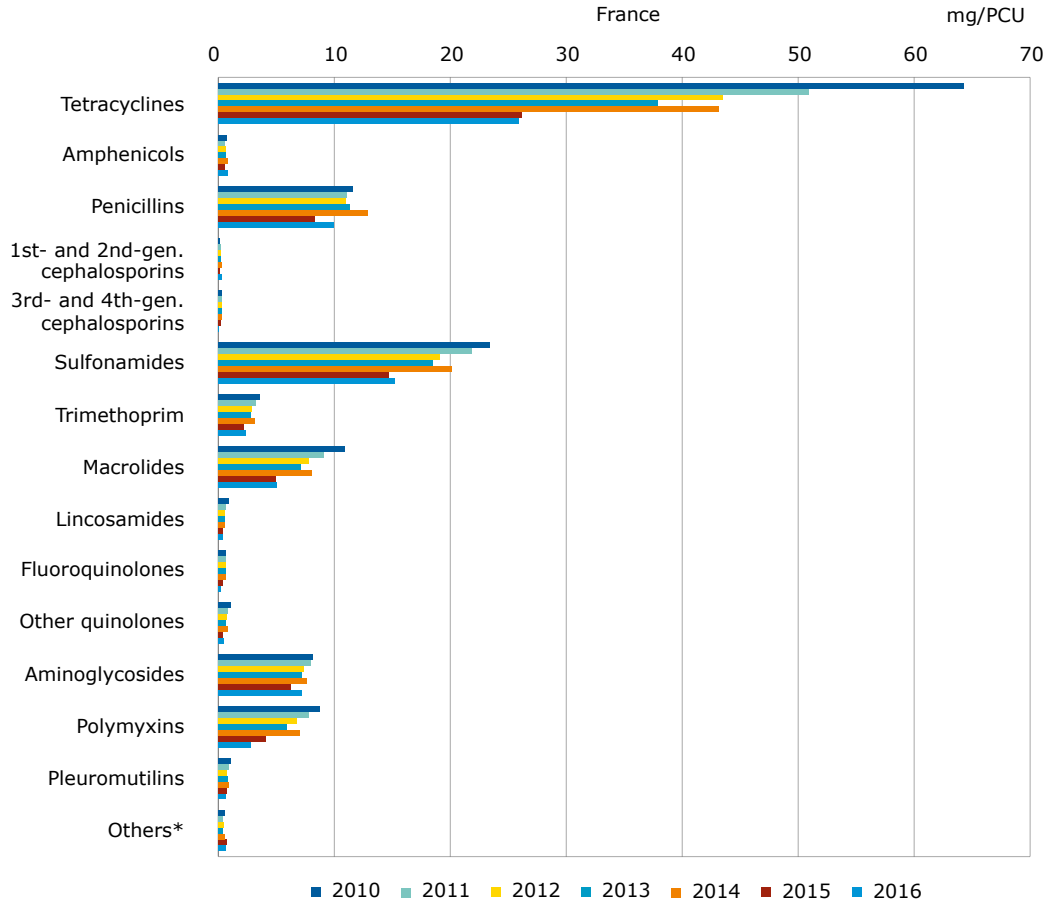
Sales of 3rd-generation cephalosporins and fluoroquinolones (in mg/PCU) in Finland were low. Both classes are only available as injections. Polymyxins have never been used in food-producing animals in Finland.

Sales of 3rd-generation cephalosporins decreased by 56 % from 2015 to 2016. The decrease may partially be explained by the control measures targeting high-using veterinarians and partially by changes in national law (e.g. the requirement for susceptibility testing before using highest priority CIAs). Sales of injectable fluoroquinolones have remained relatively stable since 2010.

Prudent use guidance has traditionally targeted treatment of food-producing animals but in recent years more attention has been directed to veterinarians treating companion animals. Sales of tablets have been relatively high in Finland (approximately 2 tonnes between 2010 and 2013) but since the peak year 2011 a decreasing trend (-27 %) has been observed. During the period the number of dogs has been estimated to have increased somewhat while the number of cats has remained stable. Human medicinal products containing antimicrobial agents may also be used in companion animals, but the amounts and trends are not known.

France

Figure 64. Changes in sales (mg/PCU) by antimicrobial class in France, from 2010 to 2016



*Other antibacterials (classified as such in the ATCvet system).

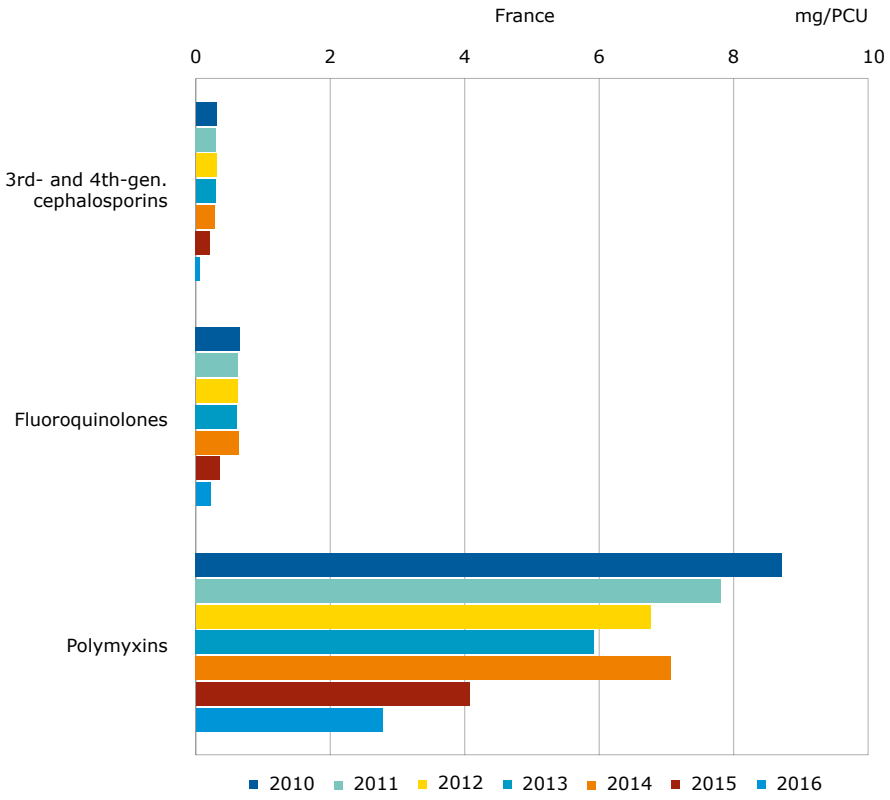
In France, the total sales (mg/PCU) of antimicrobial agents fell by 47% between 2010 and 2016.

The declining trends were observed for nearly all antimicrobial classes.

The important decrease in antimicrobials used in animals in France is the result of collective action by all stakeholders to implement the French Action Plan 'EcoAntibio' 2012-2017.

Over the last five years, overall exposure to antimicrobials has decreased by 36.6%. The objective of the first EcoAntibio plan to reduce the use of antimicrobials by 25% in five years has therefore been significantly exceeded.

Figure 65. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in France, from 2010 to 2016



Sales of 3rd- and 4th-generation cephalosporins (mg/PCU) fell by 82 % between 2010 and 2016. Sales (mg/PCU) of fluoroquinolones fell by 66 % between 2010 and 2016. Sales (mg/PCU) of polymyxins fell by 68 % between 2010 and 2016.

The observed decrease can be linked to the publication of a new law in 2014 on the future of agriculture, food and forestry, which includes a number of measures on antimicrobials.

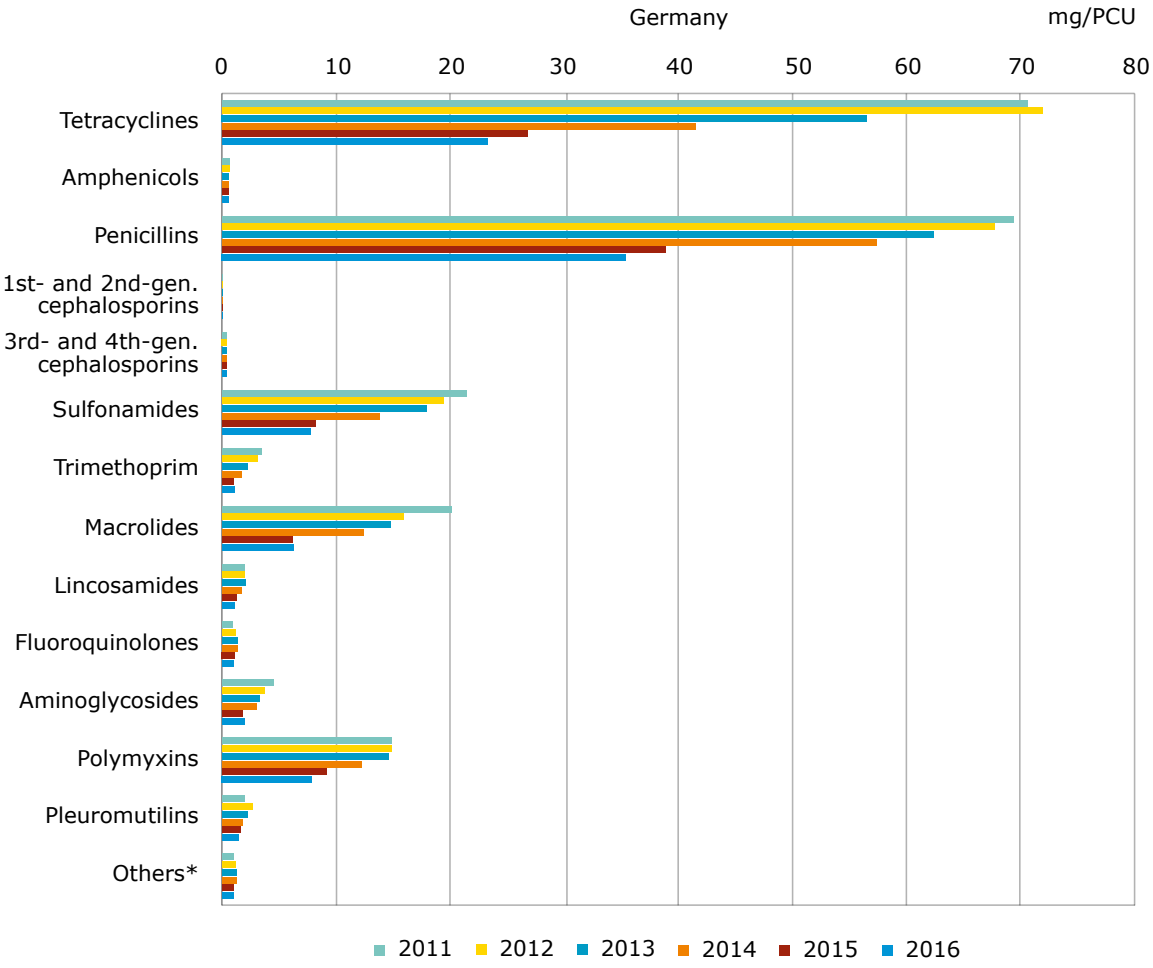
Specific measures have been undertaken on critically important antimicrobials through a decree limiting the use of 3rd- and 4th-generation cephalosporins and fluoroquinolones.

The objective (included in the law) to reduce the use of fluoroquinolones and third- and fourth-generation cephalosporins by 25 % has been exceeded.

The EcoAntibio2 plan set the goal of a 50 % reduction in five years in exposure to colistin in the cattle, pig and poultry sectors, with as reference the average exposure for 2014-2015. Between 2015 and 2016, sales of colistin decreased by 32 %.

Germany

Figure 66. Changes in sales (mg/PCU) by antimicrobial class in Germany, from 2011 to 2016[1]



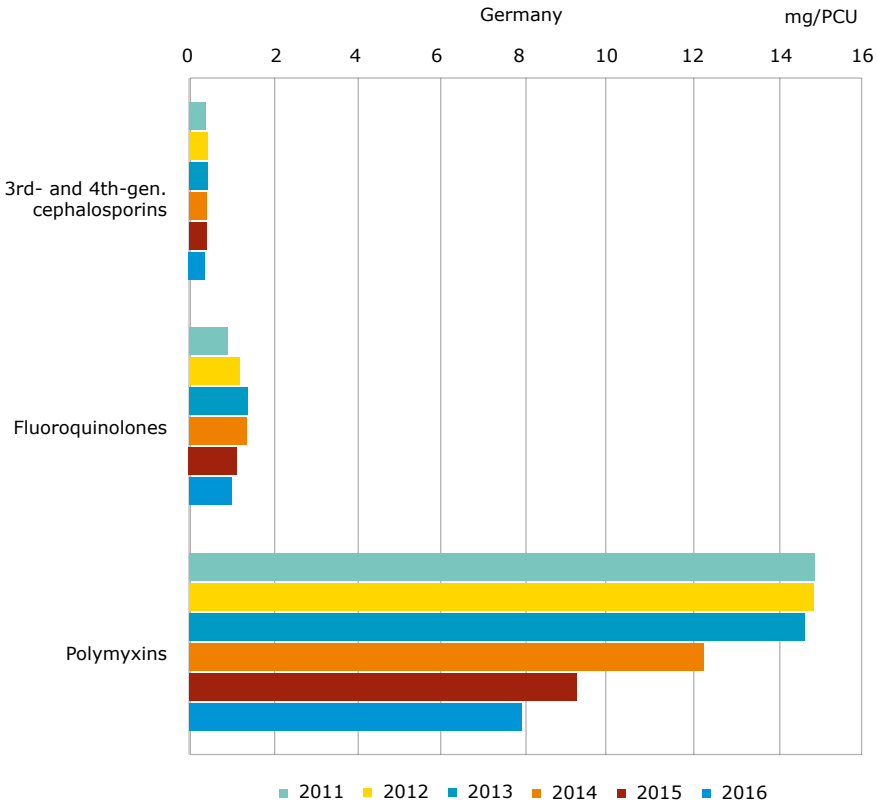
[1] No sales of other quinolones in any of the years.
*Other antibacterials (classified as such in the ATCvet system).

In Germany, a 58 % decrease in the overall sales (mg/PCU) of veterinary antimicrobial agents was observed between 2011 and 2016. The greatest relative reduction was noted for trimethoprim (-68 %), macrolides (-69 %), tetracyclines (-67 %), sulphonamides (-64 %), and aminoglycosides (-57 %).

Overall sales (mg/PCU) decreased every year, with the largest fall observed from 2014 to 2015 (-34 %). The decrease from 2015 to 2016 was 9 %.

The antibiotic-minimising concept in the 16th amendment to the Medicines Act came into force in the second half of 2014. Farmers who keep cattle, pigs, chicken or turkeys for fattening purposes have to report the frequency of antimicrobial treatment on their farm every six months. If the treatment frequency of a single farm is above the median of all farms, the farm has to evaluate its antimicrobial usage together with a veterinarian. If the frequency of therapy is above the third quartile, a management plan is issued and sent to the supervisory authority. This antibiotic minimising concept cannot be set in direct numeric relation to the decrease in sales for veterinary antimicrobial agents, but it appears to be having an effect.

Figure 67. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in Germany, from 2011 to 2016



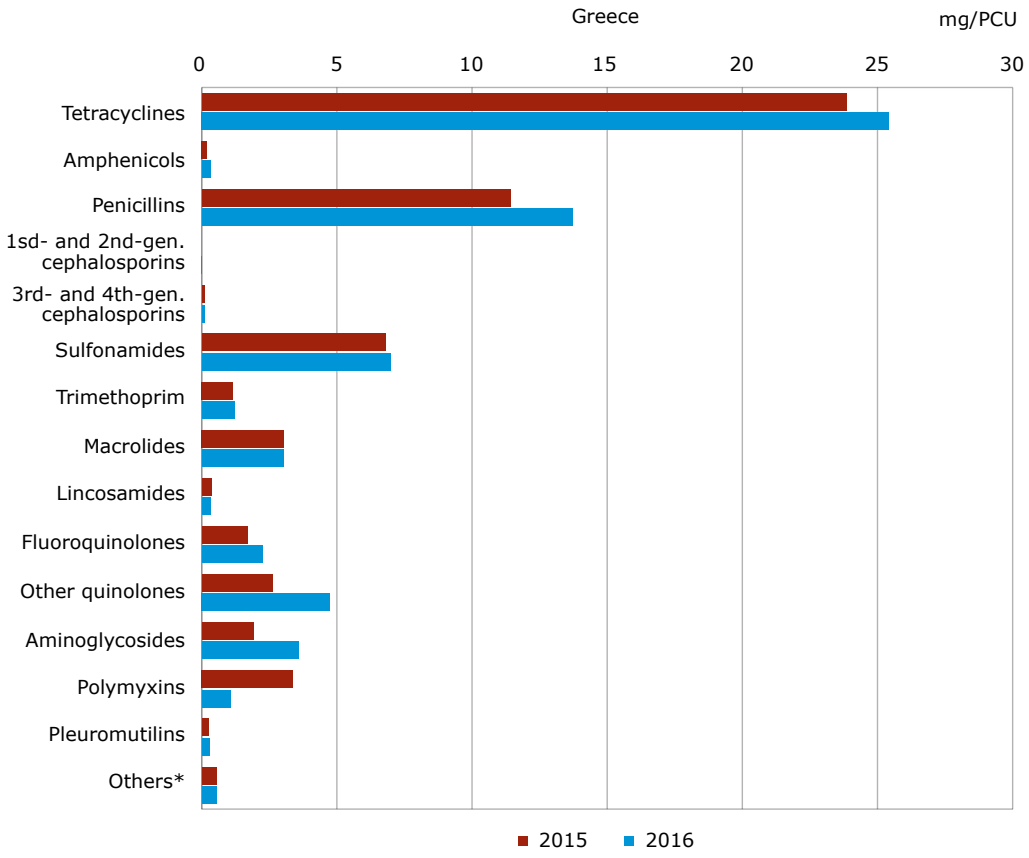
Sales, in mg/PCU, of 3rd- and 4th-generation cephalosporins were relatively stable during the period 2011 to 2016. In 2011, sales of 3rd- and 4th-generation cephalosporins were 0.40 mg/PCU, while in 2015, they were 0.38 mg/PCU.

Sales of fluoroquinolones rose by around 50% from 2011 to 2014, but decreased by 25% from 2014 to 2016. In 2011, sales of fluoroquinolones were 0.91 mg/PCU, in 2014 sales were 1.38 mg/PCU and in 2016, they were 1.02 mg/PCU.

Sales of polymyxins were 14.84 mg/PCU in 2011 and 7.89 mg/PCU in 2016: a decrease of 47%.

Greece

Figure 68. Changes in sales (mg/PCU) by antimicrobial class in Greece, in 2016



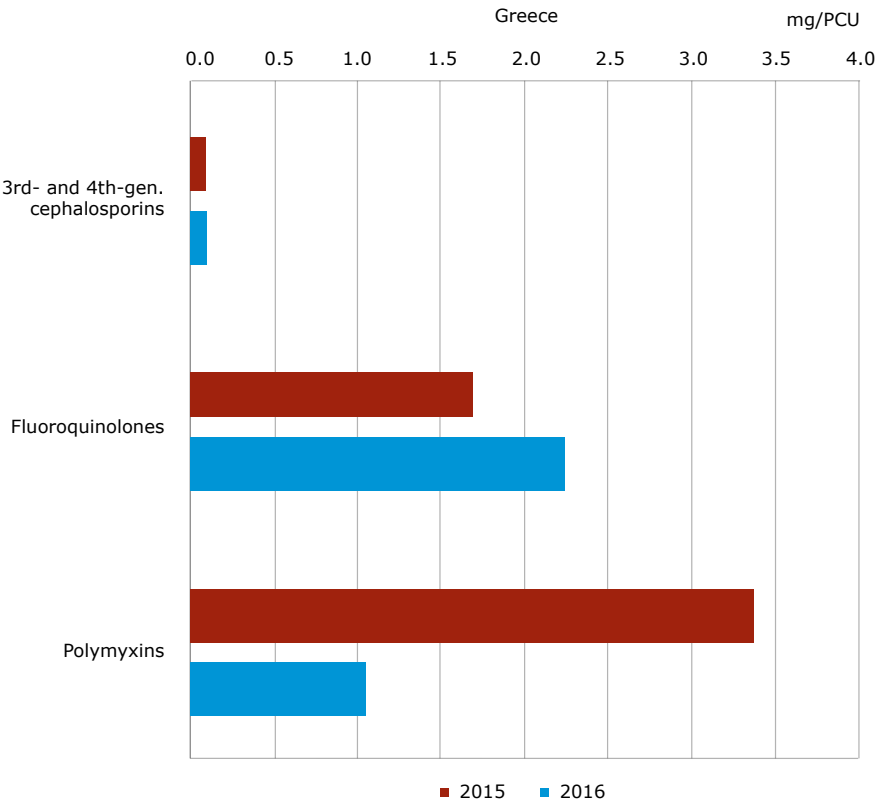
In 2016, sales for veterinary antimicrobial agents were reported to the ESVAC for the second time. Data were provided by 75 MAHs. Negligible sales from a few MAHs with a very small market share, and who do not have local representatives in the country, were not included in the 2015 or 2016 datasets.

An apparent 11 % increase in sales (mg/PCU) was observed in Greece from 2015 to 2016. This increase should be interpreted with caution as it was the result of the first two years of collecting data using the ESVAC template, bearing in mind that the overall sales, in tonnes, can fluctuate from year to year.

In 2016, the total sales of antimicrobial VMPs in Greece were 63.5 mg/PCU. Tetracyclines, penicillins and sulfonamides were the most-sold classes accounting for 40 %, 22 % and 11 %, respectively, of the total sales of antimicrobials (mg/PCU) for food-producing species, including horses.

The vast majority of the denominator (PCU) for Greece was accounted for by caprine animals (62 %), which is currently the highest proportion of overall PCU among other ESVAC participating countries. The denominator (PCU) for Greece remained relatively stable (-0.8 %) across the two years of observation.

Figure 69. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in Greece, in 2016

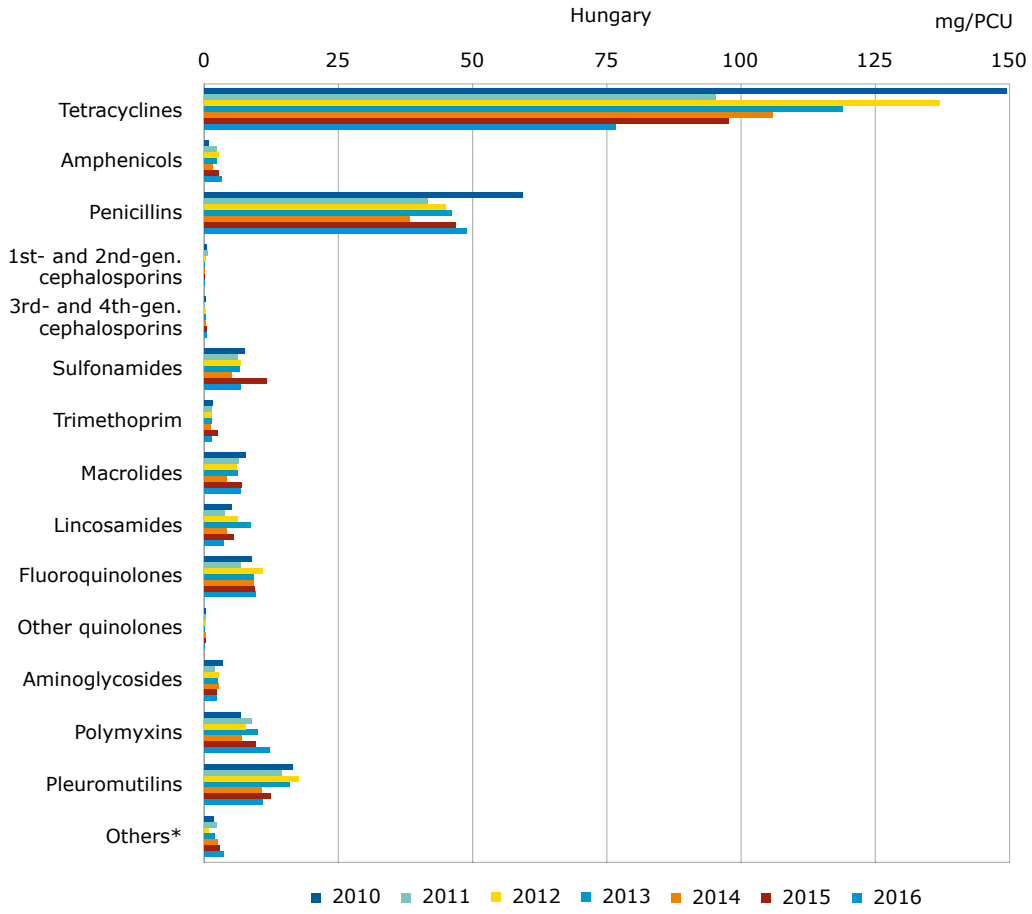


In Greece, the sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins represented 0.2 %, 4 % and 2 %, respectively, of total sales in 2016. In the same year, the sales of 3rd- and 4th-generation cephalosporins were 0.10 mg/PCU, while the aggregated figure for 25 countries was 0.21 mg/PCU in 2016 (Figure 34). Sales of fluoroquinolones were 2.24 mg/PCU, while the aggregated sales for 25 countries in 2016 accounted for 2.70 mg/PCU (Figure 34). In the same year sales of polymyxins were 1.05 mg/PCU, while the aggregated figure for 25 countries was 6.62 mg/PCU (Figure 34).

The work on establishing an inter-ministerial committee that will handle 'One Health' approach related matters and implement the requirements of the WHO, focusing on assessment and control of the consumption of antimicrobial agents and antimicrobial resistance for both human and animal sectors, is currently ongoing.

Hungary

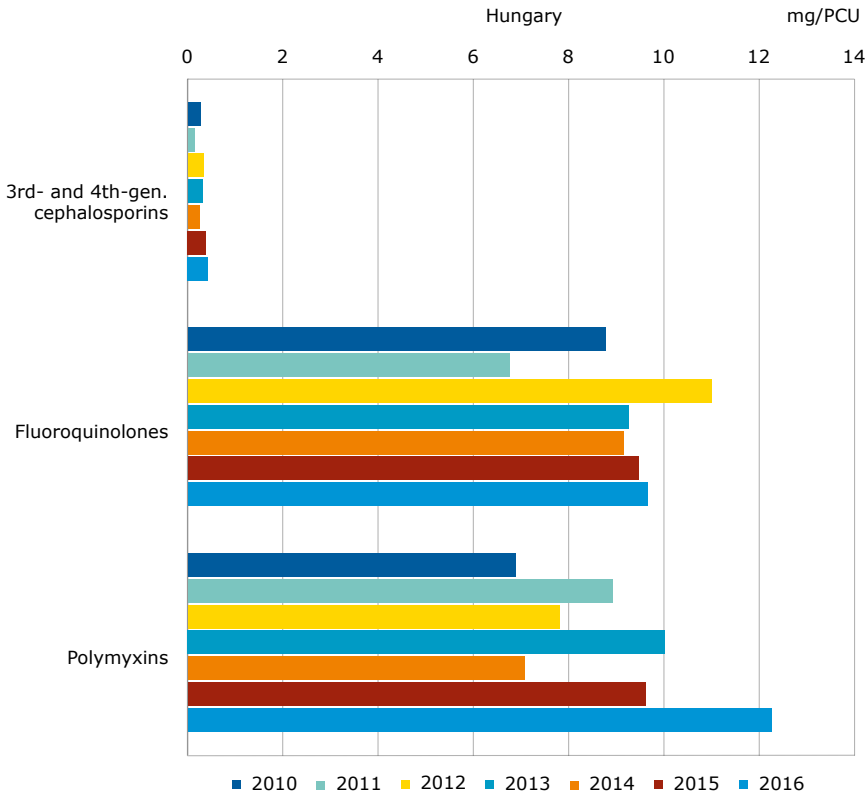
Figure 70. Changes in sales (mg/PCU) by antimicrobial class for Hungary, from 2010 to 2016



*Other antibacterials (classified as such in the ATCvet system).

Total sales (mg/PCU) fluctuated during the period 2010 to 2016; the observed sales were 269.9 mg/PCU, 192.5 mg/PCU, 245.8 mg/PCU, 230.7 mg/PCU, 193.1 mg/PCU, 211.4 mg/PCU and 187.1 mg/PCU, for each year respectively. In 2010, the system for collecting data was different: wholesalers reported the amounts sold to each other as well, so the 2010 data have probably been overestimated. From 2011 to 2016 a 2.8% total decrease was observed. The most-sold classes were tetracyclines and penicillins across all five years. From 2011 to 2016, the proportion of tetracycline sales decreased but the penicillin sales slightly increased. The annual sale of macrolides remained stable, with a transient decrease in 2014. The proportion accounted for by sulphonamides increased from 2011 to 2015 but remains below average.

Figure 71. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in Hungary, from 2010 to 2016

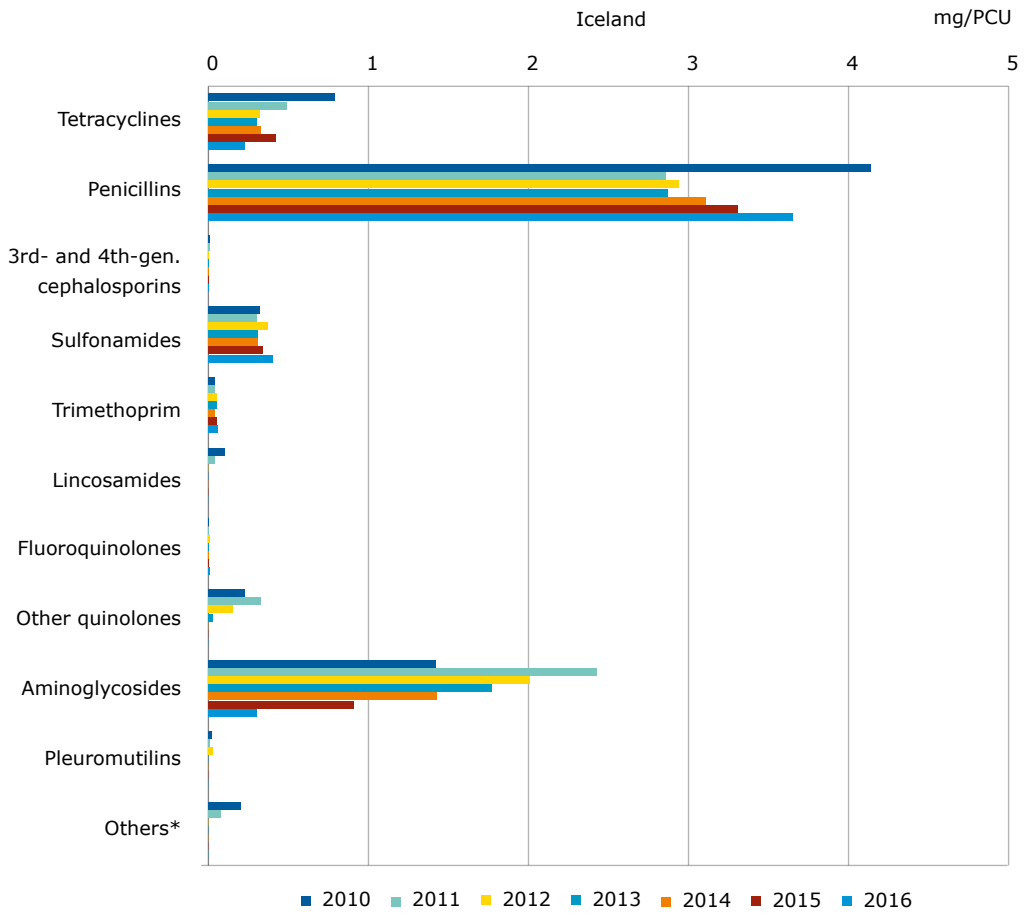


Sales (mg/PCU) of 3rd- and 4th-generation cephalosporins increased during the period 2011 to 2016, from 0.14 mg/PCU (2011) to 0.42 mg/PCU (2016). Sales of fluoroquinolones fluctuated during this period, between 6.74 mg/PCU (2011) and 10.98 mg/PCU (2012). In 2016, sales of fluoroquinolones were 9.64 mg/PCU, while aggregated sales for 25 countries were 2.70 mg/PCU (Figure 34).

Sales (mg/PCU) of polymyxins also fluctuated, with a slight increase in 2013. In 2016, sales of polymyxins were 12.25 mg/PCU, while the aggregated sales for the 25 countries, which delivered data from 2011 to 2016, were 6.62 mg/PCU (Figure 34).

Iceland

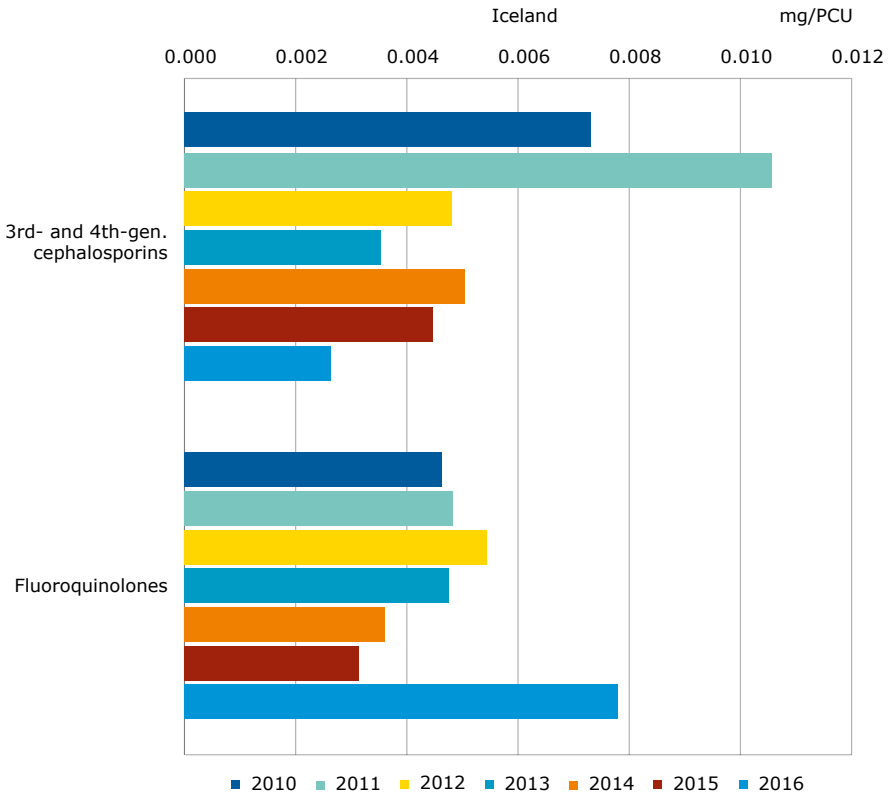
Figure 72. Changes in sales (mg/PCU) by antimicrobial class in Iceland, from 2010 to 2016[1,2]



[1] No sales of amphenicols, 1st- and 2nd-gen. cephalosporins, macrolides and polymyxins in any of the years.
[2] From 2012 no sales of other antibacterials and lincosamides, and from 2013 no sales of pleuromutilins have been reported.
*Other antibacterials (classified as such in the ATCvet system).

A gradual decline of 36% in sales, in mg/PCU, was observed from 2010 to 2016 (Table 8). The decrease from 2010 was caused by a reduction in sales of several products, in particular aminoglycosides and tetracyclines. However, no definite conclusion can be reached for the time being as to what caused these changes, although there has been increased general awareness of the importance of the responsible use of antimicrobials.

Figure 73. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins and fluoroquinolones in Iceland, from 2010 to 2016[1]



[1] No sales of polymyxins in any of the years.

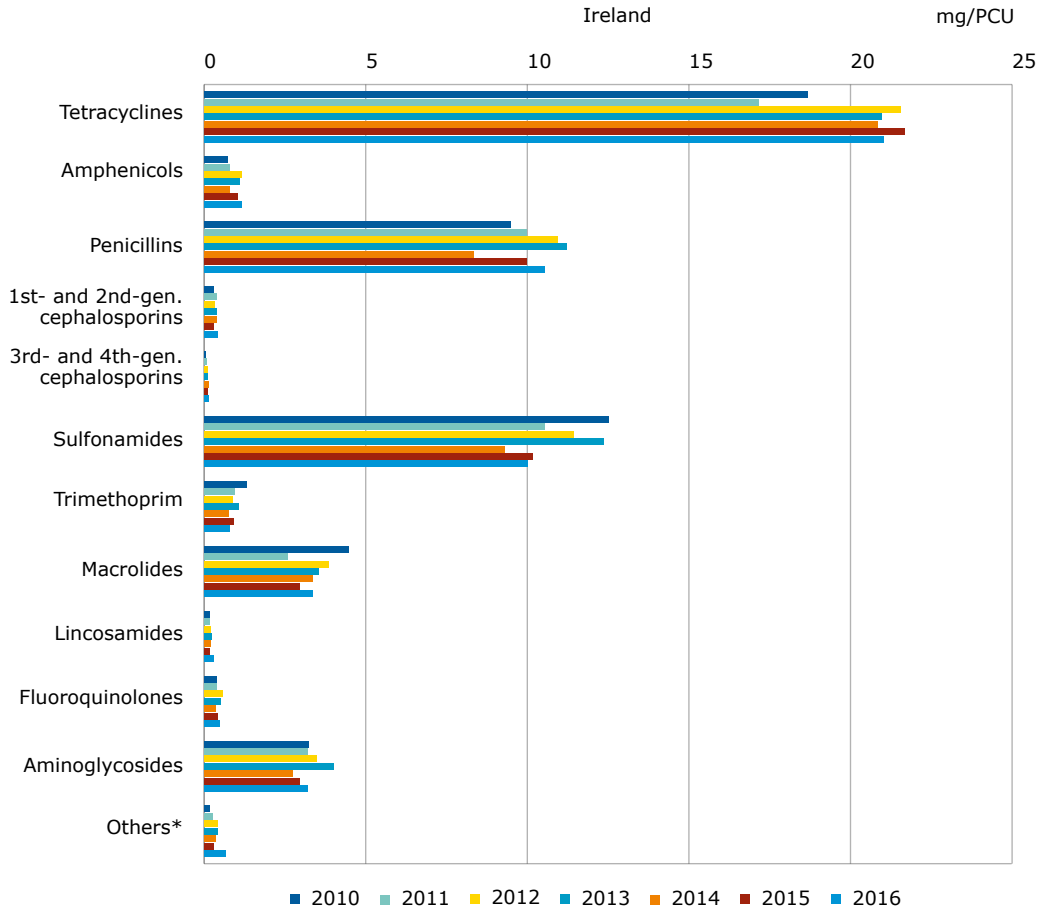
Sales (mg/PCU) of 3rd- and 4th-generation cephalosporins and fluoroquinolones in Iceland are very low.

The sales, in mg/PCU, of 3rd- and 4th-generation cephalosporins declined by 65% from 2010 to 2016. In 2010, the 3rd- and 4th-generation cephalosporins accounted for 0.1% of total sales; for 2016, this figure was also 0.1%. In 2016, sales of 3rd- and 4th-generation cephalosporins were 0.003 mg/PCU, while aggregated sales for 25 countries were 0.21 mg/PCU (Figure 34).

Sales of fluoroquinolones fell by 68% from 2010 to 2016. Fluoroquinolones accounted for 0.06% of total sales in 2010 and for 0.17% in 2016. In 2016, sales of fluoroquinolones were 0.01 mg/PCU, while the aggregated sales for 25 countries were 2.70 mg/PCU (Figure 34).

Ireland

Figure 74. Changes in sales (mg/PCU) by antimicrobial class in Ireland, from 2010 to 2016[1,2]

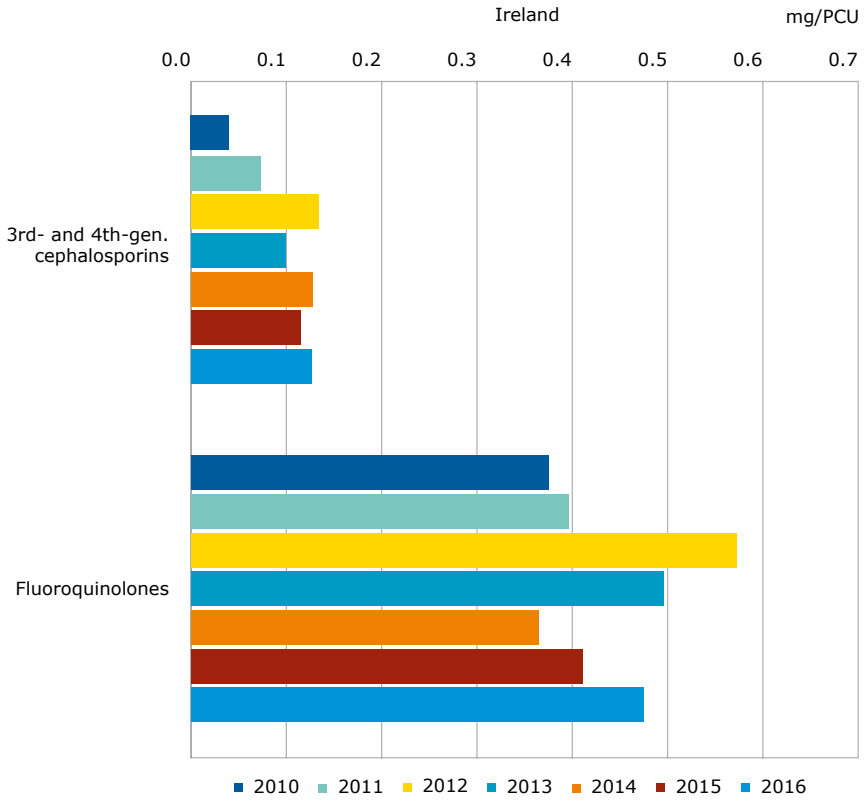


[1] For reasons of commercial confidentiality, polymyxins and pleuromutilins are aggregated with 'others'.
[2] No sales of other quinolones in any of the years.
*Other antibacterials (classified as such in the ATCvet system).

Total sales of veterinary antimicrobial agents for food-producing species (mg/PCU) in Ireland have fluctuated marginally from year to year. Between 2015 and 2016, a minor change from 50.9 mg/PCU to 52.1 mg/PCU was recorded, compared to a low of 46.5 mg/PCU in 2011 and a high of 55.9 mg/PCU in 2013. A slight increase of 2.3% in tonnes of active ingredients sold was observed between 2015 and 2016.

Sales of tetracyclines, penicillins and sulphonamides (in mg/PCU) were the largest contributors to the increases observed, accounting for approximately 40%, 20% and 19%, respectively, of all sales in 2016.

Figure 75. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins and fluoroquinolones in Ireland, from 2010 to 2016[1]



[1] For reasons of commercial confidentiality, polymyxins are not included in this graph.

In 2016, sales of 3rd- and 4th-generation cephalosporins were 0.13 mg/PCU. Sales of 3rd- and 4th-generation cephalosporins varied over the period 2010 to 2016, with an increasing trend observed. In 2010, this subclass accounted for 0.1% of the total sales (mg/PCU), while in 2016, this figure was 0.2%.

Sales of fluoroquinolones were 0.48 mg/PCU in 2016, while the total sales figure for 25 EU/EEA countries was 2.70 mg/PCU (Figure 34). Sales figures of fluoroquinolones have ranged from 0.36 mg/PCU (2014) to 0.57 mg/PCU (2012) since 2010.

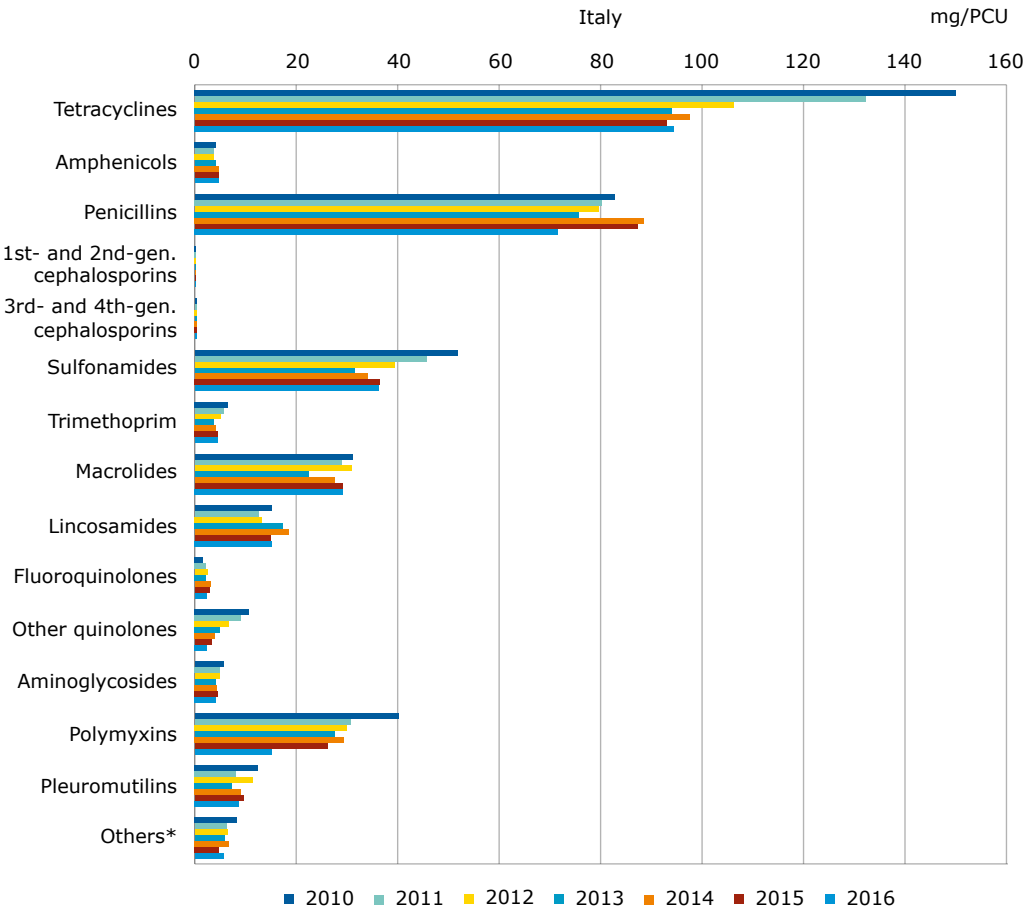
Sales of polymyxins cannot be reported for reasons of commercial confidentiality, due to the low number of products authorised on the market in Ireland. However, it should be noted that sales of colistin are below 1 mg/PCU.

Ireland's national action plan on antimicrobial resistance 2017-2020 (iNAP) was published in 2017. This plan sets out a range of strategic objectives with targeted interventions and activities to address AMR. As part of the objectives, the Department of Agriculture, Food and the Marine (DAFM) carried out education and awareness training on AMR and disease prevention through the knowledge transfer programme to participants from the farming sector. An animal sector implementation committee involving key stakeholders from industry was established to oversee the animal sector actions detailed in iNAP.

In conclusion, compared to 2015, a minor increase in the overall sales of veterinary antibiotics was recorded for 2016. A review of the previous year's sales indicates that the overall trends are generally consistent between the years with small fluctuations. Many factors can play a role in these fluctuations, such as seasonal disease and product availability from year to year.

Italy

Figure 76. Changes in sales (mg/PCU) by antimicrobial class in Italy, from 2010 to 2016



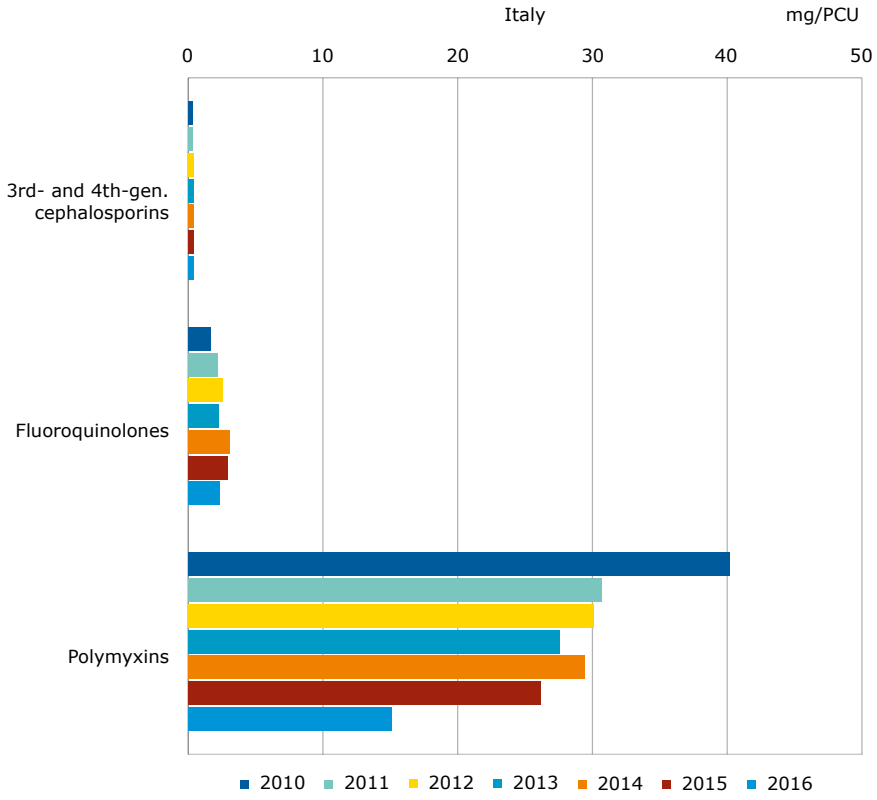
*Other antibacterials (classified as such in the ATCvet system).

A reduction in the consumption of antimicrobials was observed in 2016, with a 30 % drop in sales (mg/PCU) during the period 2010-2016. This fall appears to be mainly correlated with a reduction in sales of tetracyclines, sulphonamides and polymyxins. The most-sold antimicrobial classes were tetracyclines and penicillins, accounting for 32 % and 24 % of total sales in 2016.

Italy has initiated complete digitalisation of data collection for veterinary medicines sales and use, including data on prescription, distribution and administration. The pilot project was launched in 2015 in three of 20 Italian regions. As part of the experiment, training was provided for veterinarians, farmers and pharmacists. Trained professionals helped to disseminate knowledge and put the digitalisation of monitoring veterinary drugs sales and use into practice nationwide. The system is based on the direct collection of sales and use data which enables improvements in data quality. It came into force since 1 September 2018.

Furthermore, the development of a separate computerised and integrated monitoring system of veterinary data collection is ongoing. This system allows various aspects of the veterinary data to be collected and analysed, such as animal health and welfare, injuries and diseases at slaughterhouses, as well as various levels of veterinary medicine consumption (per animal category, active ingredient, therapy target). The system enables the identification of those farms which may be exposed to the risk of developing and spreading resistant bacteria. Consequently, farms can be classified according to the level of risk. Such an approach represents a starting point for producing a manual with instructions on how to improve antimicrobial use and thus how to improve animal health, taking into consideration as many particularities and needs as possible.

Figure 77. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in Italy, from 2010 to 2016



Sales of 3rd- and 4th-generation cephalosporins were relatively stable during the period 2010 to 2016, accounting for approximately 0.1 % of total sales each year. In 2016, the sales of 3rd- and 4th-generation cephalosporins were 0.38 mg/PCU, while the total sales figure for 25 countries was 0.21 mg/PCU in the same year (Figure 34).

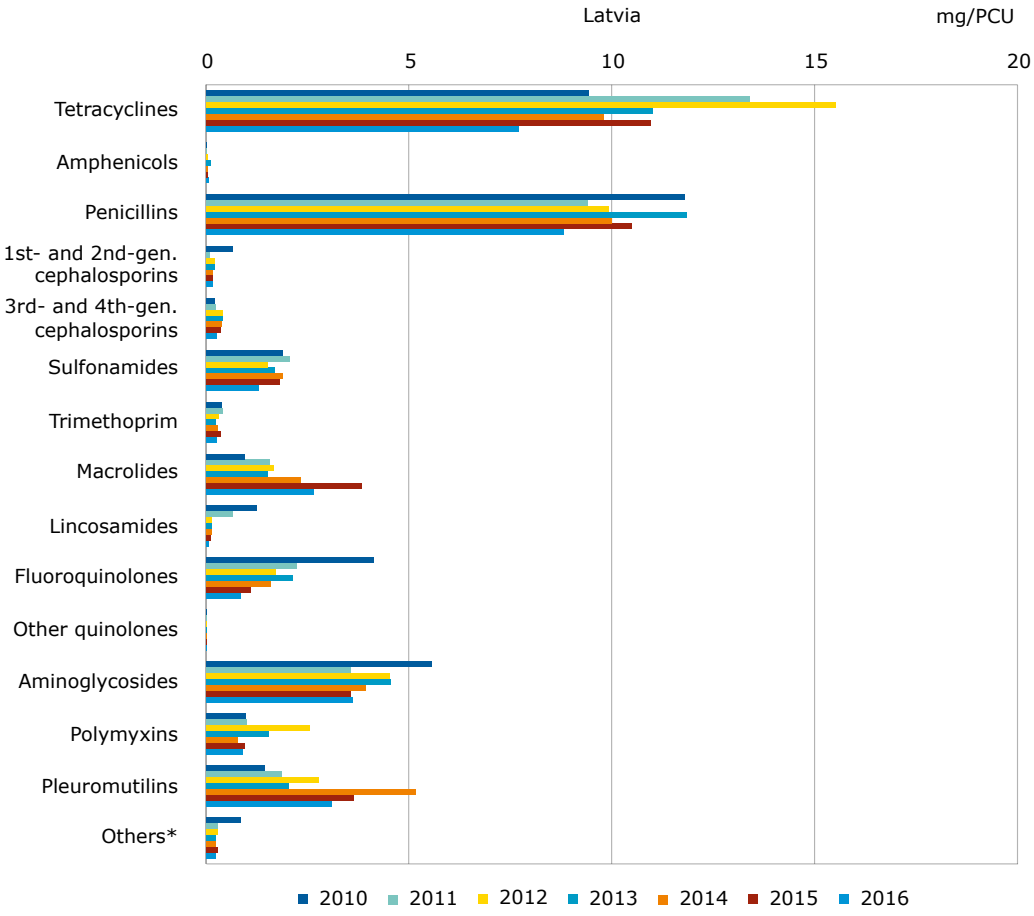
In 2016, sales of fluoroquinolones were 2.33 mg/PCU which is close to the aggregated sales for the 25 countries in that year (2.70 mg/PCU). This sub-class accounted for 0.4 % of total sales in 2010, while in 2016, the corresponding figure was 0.8 %.

Sales of polymyxins fell by 62 % in 2016 compared to sales in 2010. In 2016, sales of polymyxins in Italy were 15.10 mg/PCU, while aggregated sales for the 25 countries were 6.62 mg/PCU in the same year (Figure 34). This sub-class represented 5 % of total sales in 2016.

The National Action Plan against Antimicrobial Resistance, launched on 2 November 2017, sets a target of 10 % reduction in three years (compared to 2016) in the use of critically important antimicrobials and reducing the sales of colistin to the recommended target of 5 mg/PCU.

Latvia

Figure 78. Changes in sales (mg/PCU) by antimicrobial class in Latvia, from 2010 to 2016



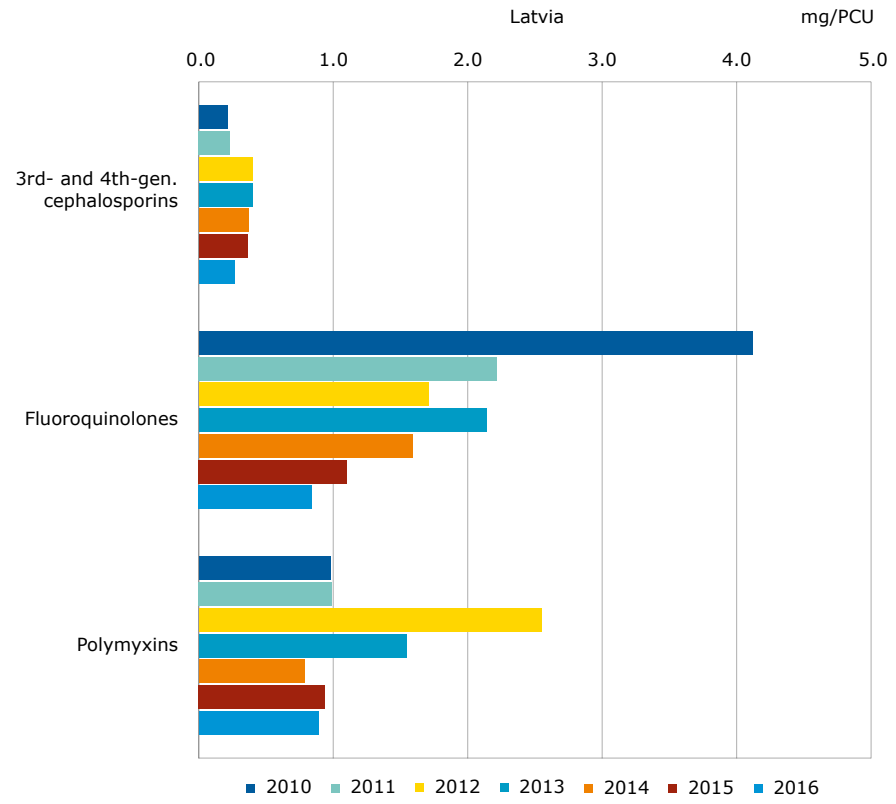
*Other antibacterials (classified as such in the ATCvet system).

Annual sales (mg/PCU) of antimicrobial VMPs were stable during the period 2010 to 2016. Overall sales declined by 24% from 2010 to 2016, while the proportion accounted for by most of the various antimicrobial classes fluctuated.

Tetracyclines and penicillins are the most-sold classes for all the study years. A peak in sales of tetracyclines was observed for 2012; overall, a drop of 18% in sales of this class is observed from 2010 to 2016. The most-sold VMPs in tetracycline class were oral solution presentations with doxycycline. Sales of penicillin VMPs were relatively stable in Latvia, except for in 2010 and 2013, when peaks were noted.

Sales of macrolides increased from 0.95 mg/PCU to 2.64 mg/PCU from 2010 to 2016, which is double the sales of this class during the period.

Figure 79. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in Latvia, from 2010 to 2016



The sales of 3rd- and 4th-generation cephalosporins rose from 0.22 mg/PCU in 2010 to 0.26 mg/PCU in 2016; the total sales figure for 25 countries was 0.21 mg/PCU in 2016 (Figure 34).

In Latvia, sales of fluoroquinolones fluctuated during the period 2010 to 2016; however, a decline from 4.12 mg/PCU to 0.84 mg/PCU is evident during this period. In comparison, aggregated sales in 25 countries were 2.70 mg/PCU in 2016 (Figure 34).

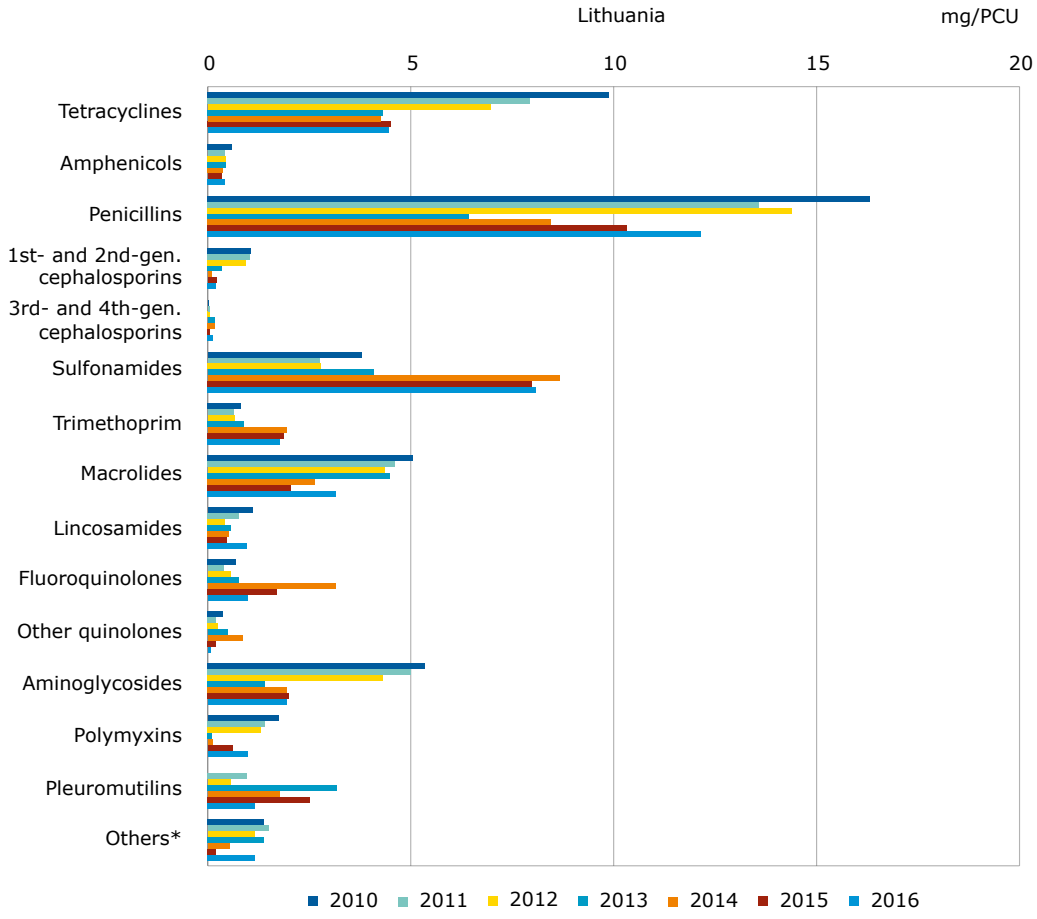
Sales of polymyxins fluctuated during the period 2010 to 2016. A peak in these sales was observed for 2012. Overall, a decrease of 9% in sales of this class was observed from 2010 to 2016. In 2016, sales of polymyxins were 0.89 mg/PCU, while aggregated sales in 25 countries were 6.62 mg/PCU in 2016 (Figure 34).

During 2016 several awareness campaigns on the use of antimicrobials were carried out. For example, seminars devoted to the prudent use of highest priority CIAs for human medicine were held for veterinarians. Particular attention was paid to responsible use of colistin.

Collection of sales data by animal species started in mid-2016. In the coming years it will allow for more detailed analysis of antimicrobial use in veterinary medicine in Latvia.

Lithuania

Figure 80. Changes in sales (mg/PCU) by antimicrobial class in Lithuania, from 2010 to 2016



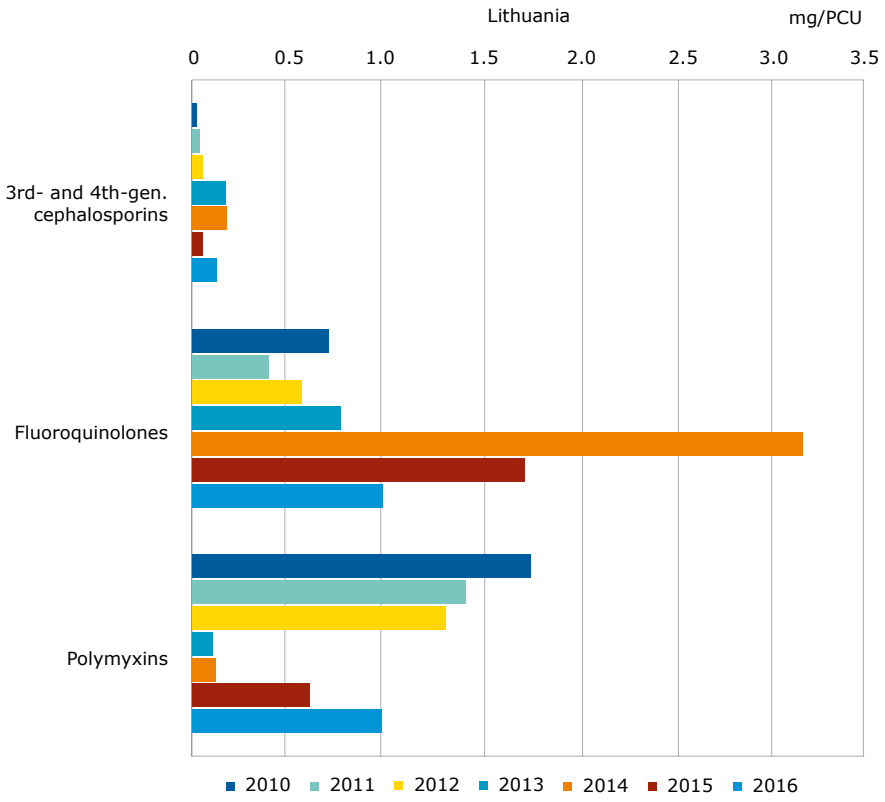
*Other antibacterials (classified as such in the ATCvet system).

From 2010 to 2016, a 22% drop in sales (in mg/PCU) was seen in Lithuania, accounted for by almost all antimicrobial classes. The exceptions are sulfonamides and trimethoprim, 3rd- and 4th-generation cephalosporins and fluoroquinolones for which a substantial increase was observed. Currently, there is no precise data available that can explain the observed changes in the sales patterns of veterinary antimicrobial agents in Lithuania.

The State Food and Veterinary Service (SFVS) together with the Ministry of Health developed the 2017-2020 national action plan against AMR. Moreover, SFVS adopted its own 2015-2020 action plan against AMR in the veterinary and agriculture sectors. Key elements of the AMR action plan are: prudent use of antibiotics in animals; restricting off-label use; reducing overall antibiotics sales for use in animals; and organising training for veterinarians, farmers, animal owners and feed manufacturers on the prudent use of antimicrobial agents in animals.

The decline from 2010 to 2016 is mainly accounted for by a reduction in the reported sales of tetracyclines and penicillins. In 2010, sales of penicillins accounted for 34% of the total sales of antimicrobial VMPs while this figure was 32% in 2016. The corresponding figures for tetracyclines were 20% and 12%.

Figure 81. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in Lithuania, from 2010 to 2016



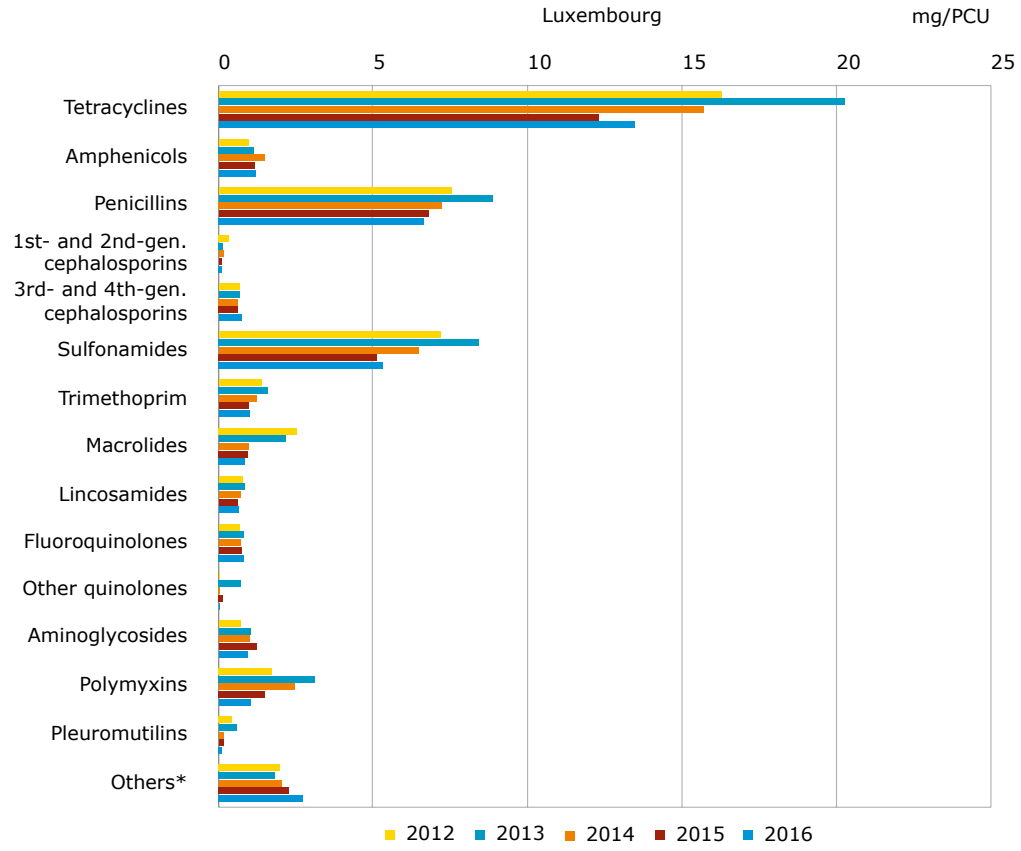
Sales (mg/PCU) of 3rd- and 4th-generation cephalosporins increased from 0.02 mg/PCU to 0.13 mg/PCU from 2010 to 2016. In 2016, aggregated sales of 3rd- and 4th-generation cephalosporins VMPs were 0.21 mg/PCU across 25 countries (Figure 34). In 2010, sales of this subclass accounted for 0.05% of total sales, while in 2016, this figure was 0.34%.

Sales of fluoroquinolones rose during the study period, in particular in 2014. In 2016, sales of fluoroquinolones in Lithuania were 0.98 mg/PCU, while aggregated sales in 25 countries were 2.70 mg/PCU in 2016 (Figure 34).

Sales of polymyxins accounted for 3.6% and 2.6% of total sales in 2010 and 2016, respectively. In 2016, sales of polymyxins were 0.98 mg/PCU, while aggregated sales for 25 countries were 6.62 mg/PCU (Figure 34).

Luxembourg

Figure 82. Changes in sales (mg/PCU) by antimicrobial class in Luxembourg, from 2012 to 2016



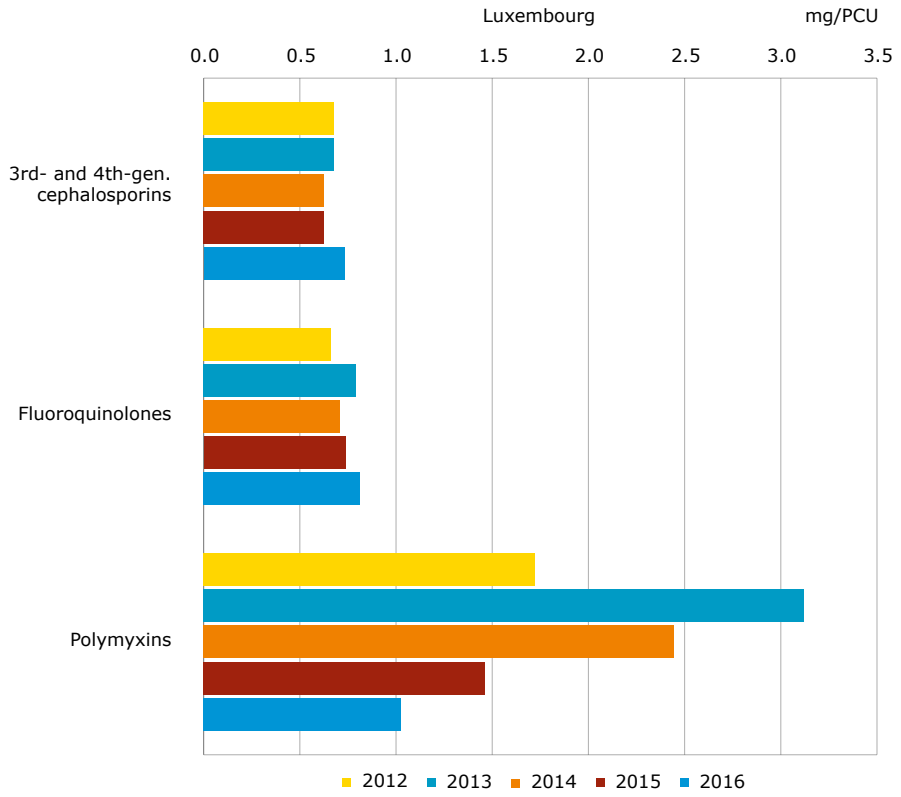
*Other antibacterials (classified as such in the ATCvet system).

From 2015 to 2016, a 3% increase in reported sales (mg/PCU) of antimicrobial VMPs was observed in Luxembourg. The proportion of the most-sold classes — tetracyclines, penicillins and sulfonamides — accounted for 38%, 19% and 15%, respectively, of total sales in 2016.

Tetracyclines are the most sold class for all study years. A peak in sales of tetracyclines was observed in 2013, while a gradual drop was observed from 2014 to 2016. There was an overall drop of 17% in sales of this class from 2012 to 2016. The reasons for lower sales are not known and the coming years will indicate whether the trend is sustainable.

Compared to 2012, the overall sales of antimicrobial VMPs (in mg/PCU) declined by 18% in 2016. The fall during 2012 to 2016 is mainly accounted for by a reduction in the reported sales of tetracyclines, penicillins and sulfonamides. However, the data must be interpreted with caution as Luxembourg is a small country with a small animal population where sales may fluctuate due to external reasons.

Figure 83. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins and fluoroquinolones in Luxembourg, from 2012 to 2016



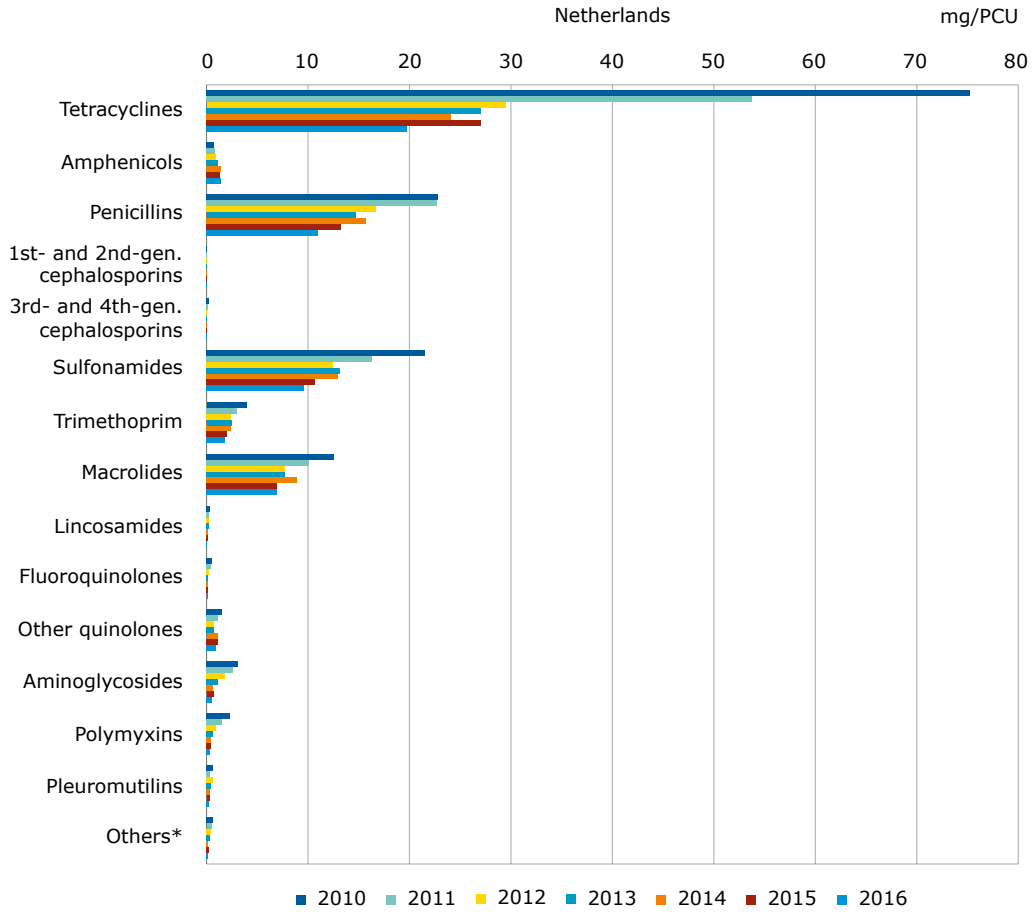
Sales (mg/PCU) of 3rd- and 4th-generation cephalosporins were stable over the period 2012 to 2016. In 2012, this subclass accounted for 1.6 % of total sales, while in 2016, this figure was 2.1 %. In 2016, the sales of 3rd- and 4th-generation cephalosporins were 0.73 mg/PCU, while aggregated sales for 25 countries in that year were 0.21 mg/PCU (Figure 34).

Sales of fluoroquinolones fluctuated during the study years. A slight drop was observed in 2014 when sales of this class were 0.71 mg/PCU and accounted for 1.7 % of total sales.

A peak in sales of polymyxins was observed in 2013, at 3.1 mg/PCU. A gradual decline was observed from 2013 to 2016, when sales of polymyxins in 2016 fell to 1.0 mg/PCU.

Netherlands

Figure 84. Changes in sales (mg/PCU) by antimicrobial class for food-producing species, in the Netherlands, from 2010 to 2016



*Other antibacterials (classified as such in the ATCvet system).

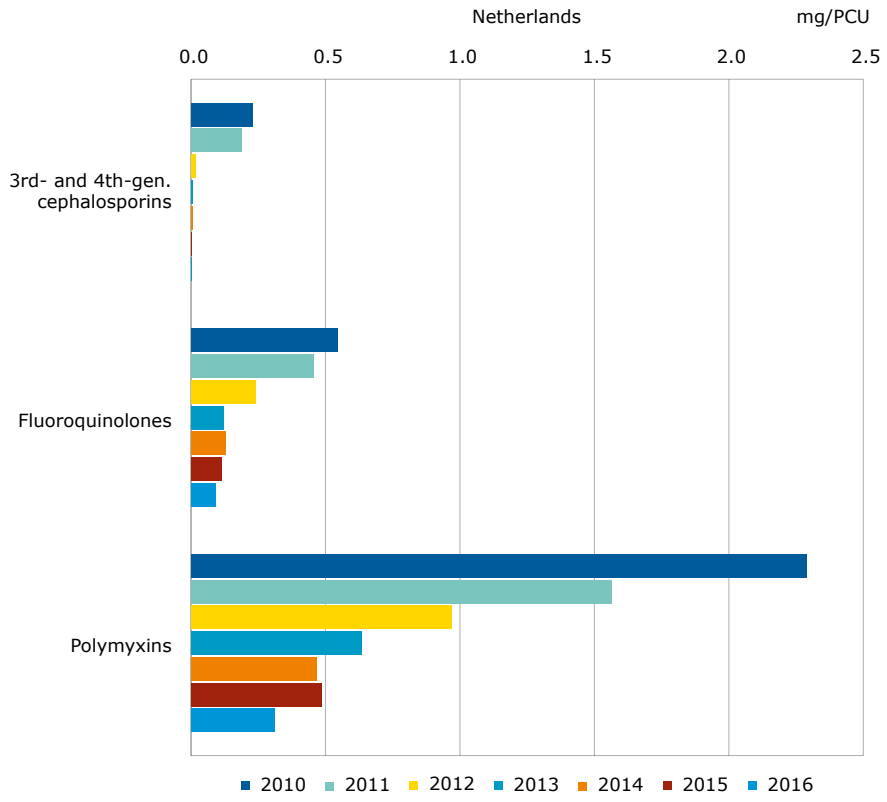
A 54% drop in sales (in mg/PCU) of veterinary antimicrobial agents was observed from 2011 to 2016; compared to 2010, sales declined by 64% in 2016. This is the result of efforts by the major production sectors and veterinarians which agreed with the government to set reduction targets in 2010 for the use of antimicrobial agents in food-producing animals.

Relatively speaking, the reduction in sales of 3rd- and 4th-generation cephalosporins (-100%), fluoroquinolones (-80%) and colistin (-80%) are the biggest, while the major decline in total sales is accounted for by tetracyclines, with a 63% reduction in sales (mg/PCU) since 2011.

Sales (mg/PCU) of 3rd- and 4th-generation cephalosporins fell by 100% from 2011 to 2016; in 2011, this subclass accounted for 0.16% of total sales, while for 2016, the figure was 0.001%. This result was achieved thanks to efforts within private quality-production systems. Private quality systems in pig and dairy cows banned most use of 3rd- and 4th-generation cephalosporins. In 2016, the sales of 3rd- and 4th-generation cephalosporins VMPs were 0.0005 mg/PCU, while the aggregated sales for 25 countries in 2016 were 0.21 mg/PCU (Figure 34).

Sales (mg/PCU) of fluoroquinolones fell by 80% from 2011 to 2016; in 2011, this subclass accounted for 0.4% of the total sales, while in 2016 this figure was 0.18%. In 2016, sales of fluoroquinolones were 0.09 mg/PCU, while the aggregated sales for 25 countries in that year were 2.70 mg/PCU (Figure 34).

Figure 85. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in the Netherlands, from 2010 to 2016



Sales (mg/PCU) of polymyxins (>99% colistin) also decreased by 80% from 2011 to 2016; in 2011, this subclass accounted for 1.4% of the total sales, in 2016 0.59%. In 2016, sales of polymyxins were 0.31 mg/PCU, while the aggregated sales for 25 countries in that year were 6.62 mg/PCU (Figure 34).

The sales (mg/PCU) of aminoglycosides also fell by 80% from 2011 to 2016. In the Netherlands, antibiotic policy focused on the use of 3rd- and 4th-generation cephalosporins, fluoroquinolones, polymyxins and aminoglycosides, while the use of macrolides was only restricted in poultry. Amphenicols is a preferred class, with sales increasing by 73% between 2011 and 2016.

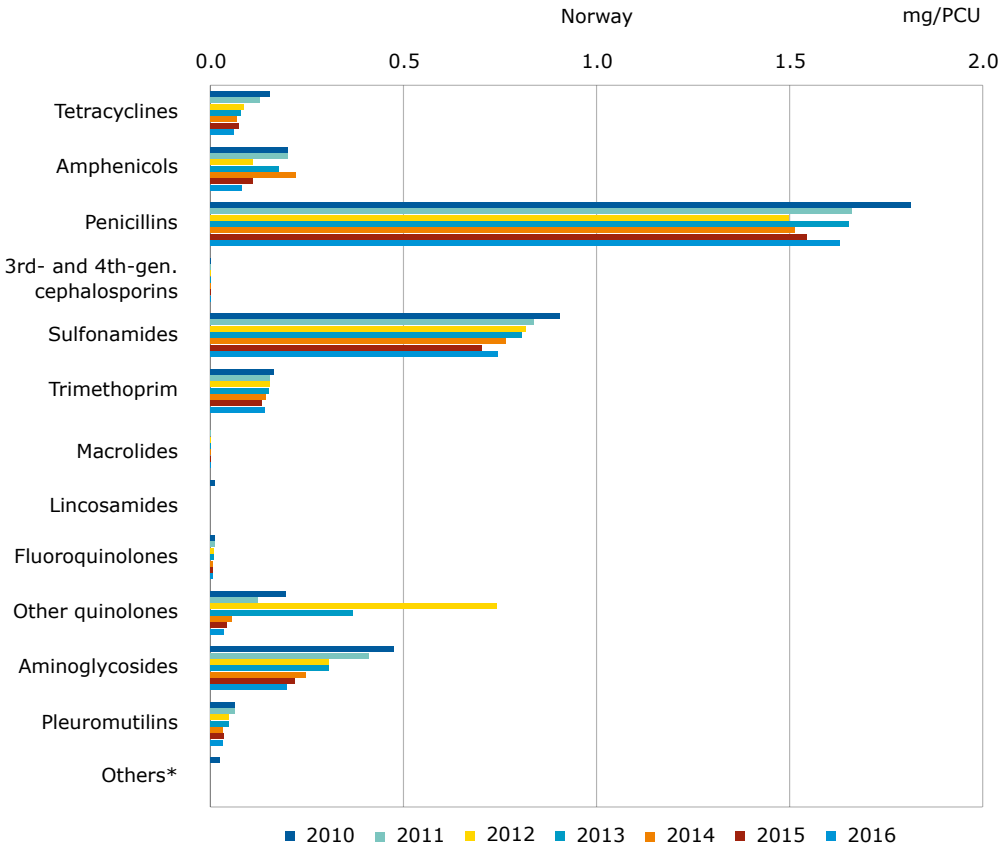
As from 2013, antimicrobial susceptibility testing is mandatory for veterinarians before using 3rd- and 4th-generation cephalosporins and fluoroquinolones. Since 2015, this obligation is also monitored for companion animals. For cattle veterinarians, a guideline for dry cow treatment was introduced in 2014, which resulted in a change in antimicrobials applied and an overall reduction in dry cow treatment.

Since 2011, antibiotic use by livestock farms in the Netherlands has been monitored by benchmark indicators. In addition, in 2013, the Netherlands Veterinary Medicines Institute (SDa) developed a framework for monitoring antibiotic prescription patterns of veterinarians and defined associated benchmark values. This benchmark method for veterinarians was introduced in 2014. Since 2015, veterinarians working in every livestock sector monitored have had access to their Veterinary Benchmark Indicator (VBI). Veterinarians with a high VBI have to take action to change their prescription patterns.

From 2009 to 2016, sales of veterinary antimicrobials (in total mass of active substances) were reduced by 64.4%; the Dutch government is maintaining the reduction target of 70% which was set in 2012. To explore possibilities to increase awareness and responsible use in the various animal sectors, four programmes named 'Critical success factors' were launched in 2016, investigating relevant specific factors per sector (poultry, pigs, veal calves and veterinarians) that are influencing prescription and use of antimicrobials.

Norway

Figure 86. Changes in sales (mg/PCU) by antimicrobial class in Norway, from 2010 to 2016[1]



[1] No sales of 1st- and 2nd-generation cephalosporins or polymyxins in any of the years; minor amounts of macrolides sold in 2011-2013 (< 0.002 mg/PCU).
*Other antibacterials (classified as such in the ATCvet system).

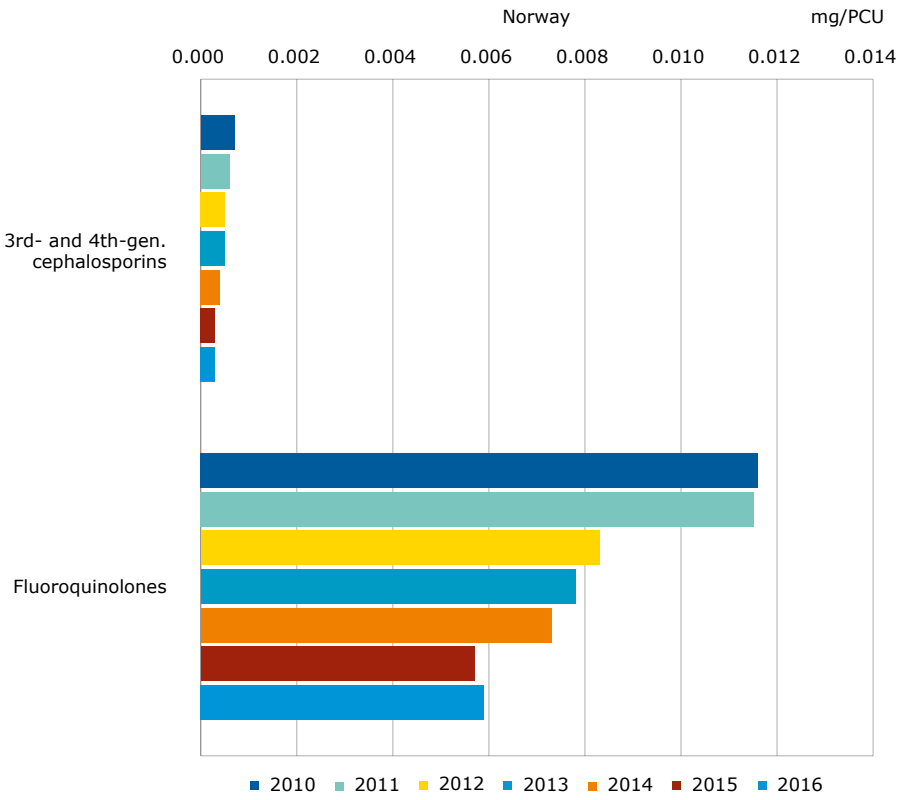
From 2010 to 2016, total sales of antimicrobials for food-producing animals fell from 4.0 mg/PCU to 2.9 mg/PCU (-27%). Decreases were noted for all classes. Some fluctuations were observed for amphenicols, which are used almost solely for farmed fish, and for other quinolones that are used in farmed fish only.

The overall reduction in sales from 2010-2016 is mainly accounted for by lower sales of VMPs containing penicillins, aminoglycosides, and sulfonamides combined with trimethoprim used for terrestrial food-producing animals.

In 1996, the Norwegian Livestock Industry (NLI) agreed a target for a 25% reduction in the consumption of antimicrobial VMPs for terrestrial food-producing animals over five years, with 1995 as the reference year. In parallel, the NLI initiated a responsible-use campaign, among other initiatives, by implementing the therapeutic guidelines the NLI published in connection with the campaign. More comprehensive therapeutic guidelines were published by the Norwegian Medicines Authority in the late 1990s and have recently been revised. From 1995 to 1999, a reduction of approximately 40% in the sale of antimicrobials for terrestrial food-producing animals was achieved. Since then, sales of antimicrobial agents for use in terrestrial food-producing animals have been relatively stable, showing only minor fluctuations (http://www.vetinst.no/overvaking/antibiotikaresistens-norm-vet). Since 1981, sales of antimicrobials for use in farmed fish have declined by 99%, while during the same period, the production of farmed fish increased more than 100-fold.

The National Strategy against Antibiotic Resistance (2015–2020) sets a target to reduce the usage of antimicrobials for terrestrial food-producing animals by 10% by 2020, with 2013 as the reference year. In the period 2013–2016, sales for this animal category were reduced by 4% when measured in kg, while the reduction was 2% when measured in mg/PCU (NORM/NORM-VET2016). If oral paste approved for horses and PCU horses are excluded, the corresponding figures were 7% and 5%, respectively (unpublished data).

Figure 87. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins and fluoroquinolones in Norway, from 2010 to 2016[1]



[1] No sales of polymyxins in any of the years.

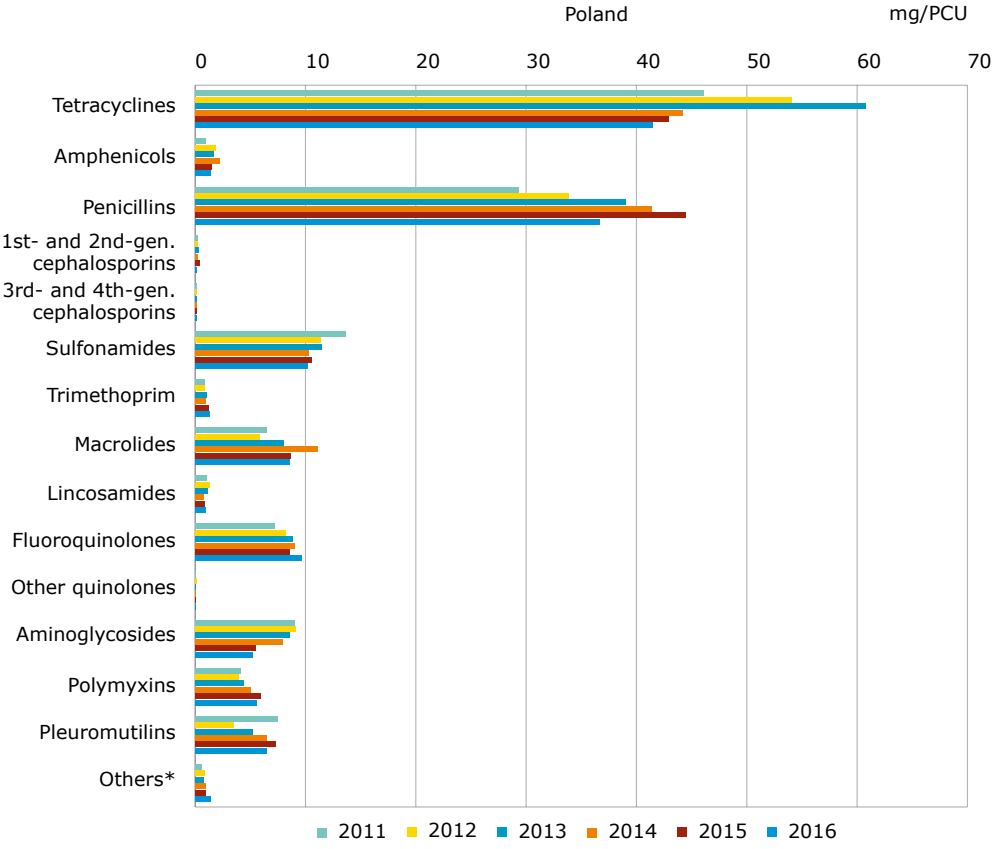
Since 2010, sales of 3rd- and 4th-generation cephalosporins and fluoroquinolones have decreased by 54 % and 49 %, respectively.

In 2016, the sales of fluoroquinolones were 0.006 mg/PCU; the aggregated sales for 25 countries in 2016 were 2.70 mg/PCU (Figure 34).

Sales of 3rd- and 4th-generation cephalosporins were negligible – i.e. such sales were 0.0003 mg/PCU in 2016; the total sales for 25 countries were 0.21 mg/PCU. Note that sales of this antimicrobial sub-class could be for use in non-food-producing animals. The Norwegian prudent use guidelines for antibacterial treatment of food-producing animals state that the highest priority CIAs should be last choice antibiotics. During 1993-2017 no VMPs containing 3rd and higher generations of cephalosporins have been approved for food-producing animals in Norway via national procedures. Two 3rd-generation products have been approved via community procedures, but these are not marketed in Norway. Applications for special permits to use such VMPs marketed in other EEA countries for food-producing animals are normally not approved. Approval would only be given for specific animals if sensitivity testing precluded all other options (Tonje Høy, Norwegian Medicines Authority, personal communication).

Poland

Figure 88. Changes in sales (mg/PCU) by antimicrobial class in Poland, from 2011 to 2016



*Other antibacterials (classified as such in the ATCvet system).

From 2011 to 2016 a slight increase of 2 % in overall sales (mg/PCU) of veterinary antimicrobial agents was noted in Poland.

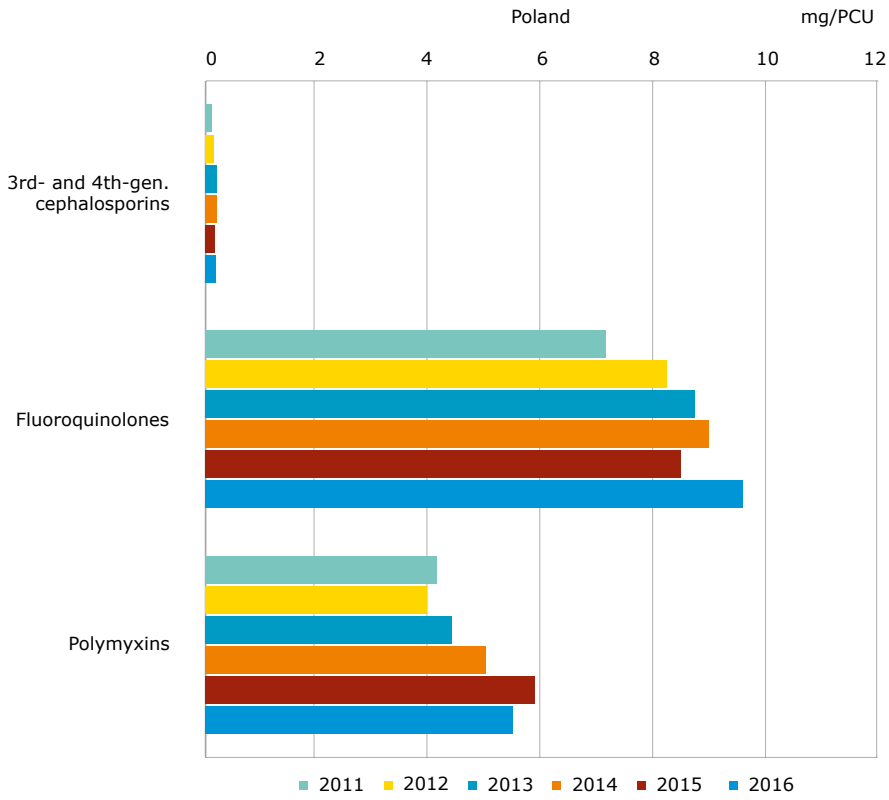
The two most-sold classes were tetracyclines and penicillins. Sales of tetracyclines accounted for 36 % of total sales in 2011, whereas in 2016 this figure was 32 %. The corresponding figures for penicillins were 23 % and 28 %, indicating a shift in prescribing from tetracyclines to penicillins.

Currently, there is no data available that can explain the observed increase in sales or changes in the sales patterns of veterinary antimicrobial agents in Poland.

In 2015, the Ministry of Agriculture and Rural Development of the Republic of Poland developed a strategy to combat antimicrobial resistance. The implementation of the strategy involved five different parties covering different areas of responsibility, ranging from the prudent use of VMPs by veterinarians, to conducting research on monitoring the rise of antimicrobial resistance.

To improve the system for collecting data on sales of veterinary medicines, the Ministry of Agriculture and Rural Development initiated work on amending corresponding regulations, to specify the scope and process for gathering sales details.

Figure 89. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in Poland, from 2011 to 2016



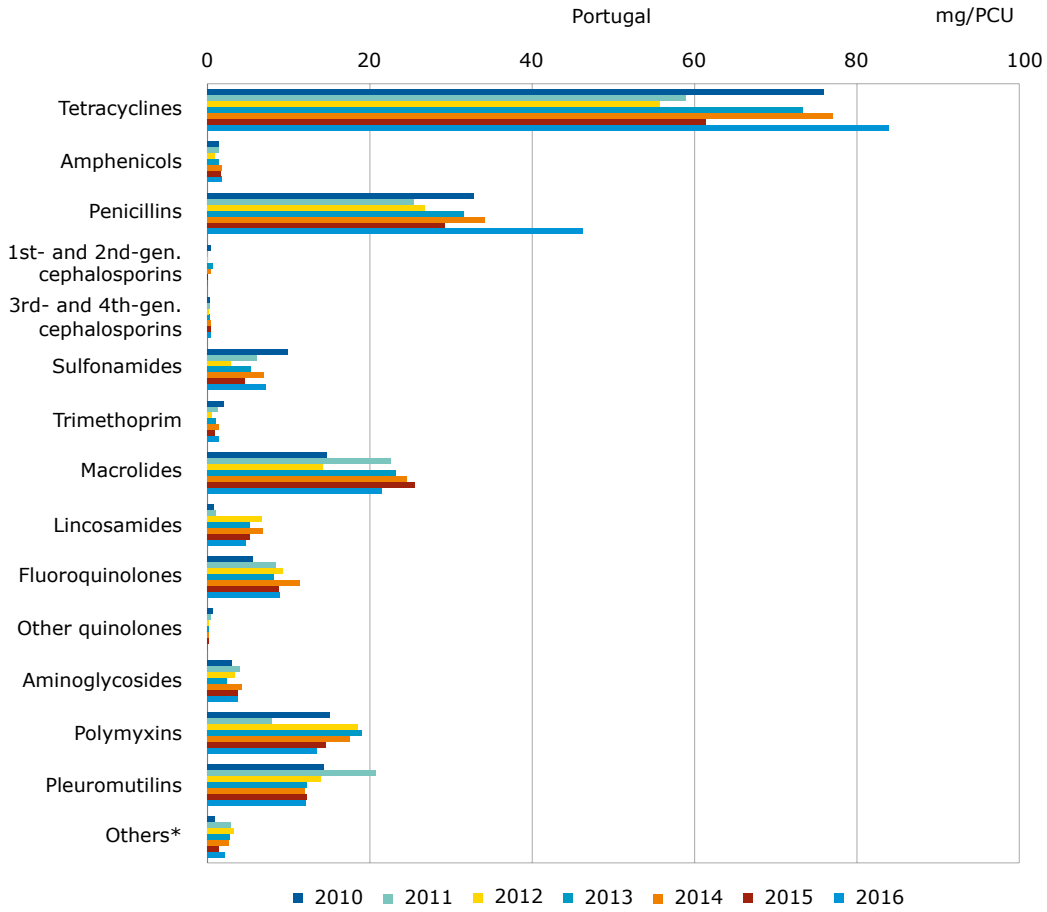
Sales (mg/PCU) of 3rd- and 4th-generation cephalosporins increased slightly from 2011 to 2016; in 2011, this subclass accounted for 0.07 % of total sales, while in 2016, this figure was 0.12 %. In 2016, sales of 3rd- and 4th-generation cephalosporins VMPs were 0.16 mg/PCU, while aggregated sales for 25 countries in that year were 0.21 mg/PCU (Figure 34).

From 2011 to 2016, an increase was observed in sales (mg/PCU) of fluoroquinolones. In 2011, the proportion of total sales for fluoroquinolones was 5.7 %, and in 2016, this figure was 7.5 %. In 2016, sales of fluoroquinolones were 9.67 mg/PCU, while aggregated sales for 25 countries in that year were 2.70 mg/PCU (Figure 34).

Sales (mg/PCU) of polymyxins increased by 35 % from 2011 to 2016; in 2011, this class accounted for 3.3 % of total sales; in 2016, this figure was 4.3 %. In the same year, sales of polymyxins were 5.62 mg/PCU, while the aggregated sales for 25 countries in 2015 were 6.62 mg/PCU (Figure 34).

Portugal

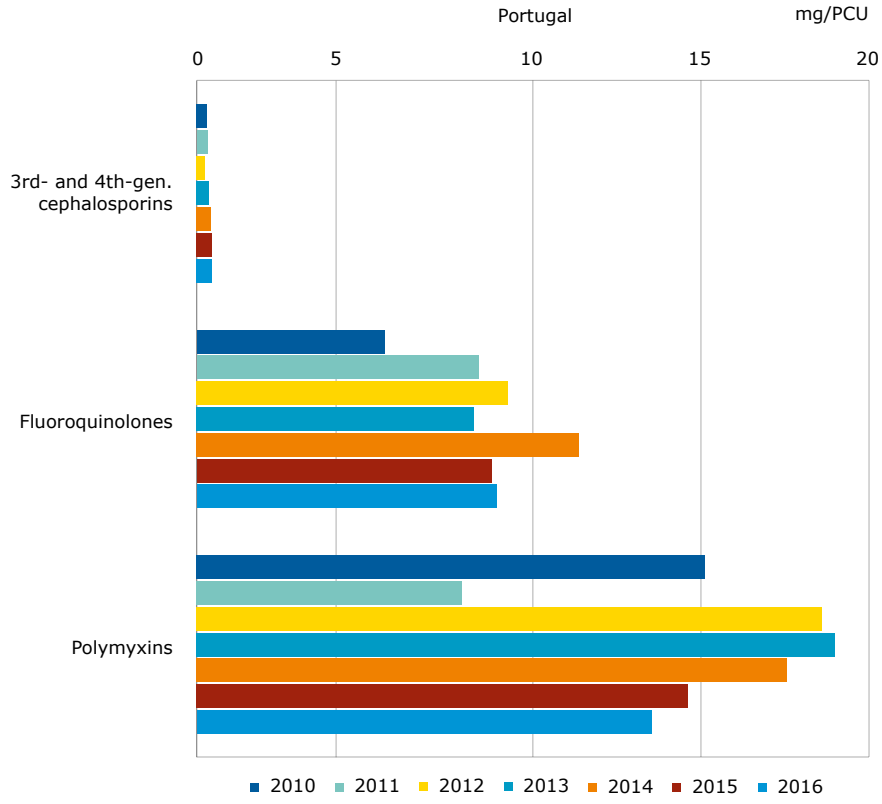
Figure 90. Changes in sales (mg/PCU) by antimicrobial class in Portugal, from 2010 to 2016



*Other antibacterials (classified as such in the ATCvet system).

In Portugal, overall sales (mg/PCU) fluctuated during the period 2010 to 2016, with an increase of 17 %. In reference to 2014, following the implementation of the National Action Plan for the Reduction of Use of Antibiotics in Animals, which put an emphasis on the need for the reduction of highest priority critically important antimicrobials for human medicine, 2016 data show a decrease in consumption (mg/PCU), among others, for macrolides, quinolones, aminoglycosides and polymyxins. In 2016 the autonomous regions initiated the reporting of sales of antimicrobial agents for veterinary use to support accurate data collection.

Figure 91. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in Portugal, from 2010 to 2016



Sales (in mg/PCU) of 3rd- and 4th-generation cephalosporins remained relatively stable from 2010 to 2016. In 2016, sales of 3rd- and 4th-generation cephalosporin VMPs were 0.46 mg/PCU, while the aggregated sales for 25 countries in that year were 0.21 mg/PCU (Figure 34).

From 2010 to 2016, an increase was observed in sales (mg/PCU) of fluoroquinolones, peaking in 2014. This was mainly attributed to the availability of several wide-spectrum generic VMPs, particularly those containing enrofloxacin. In 2014, sales of fluoroquinolones were 11.38 mg/PCU, while aggregated sales for 25 countries in that year were 2.99 mg/PCU (Figure 34). In 2016, sales of fluoroquinolones dropped to 8.91 mg/PCU, while aggregated sales for 25 countries in that year were 2.70 mg/PCU (Figure 34).

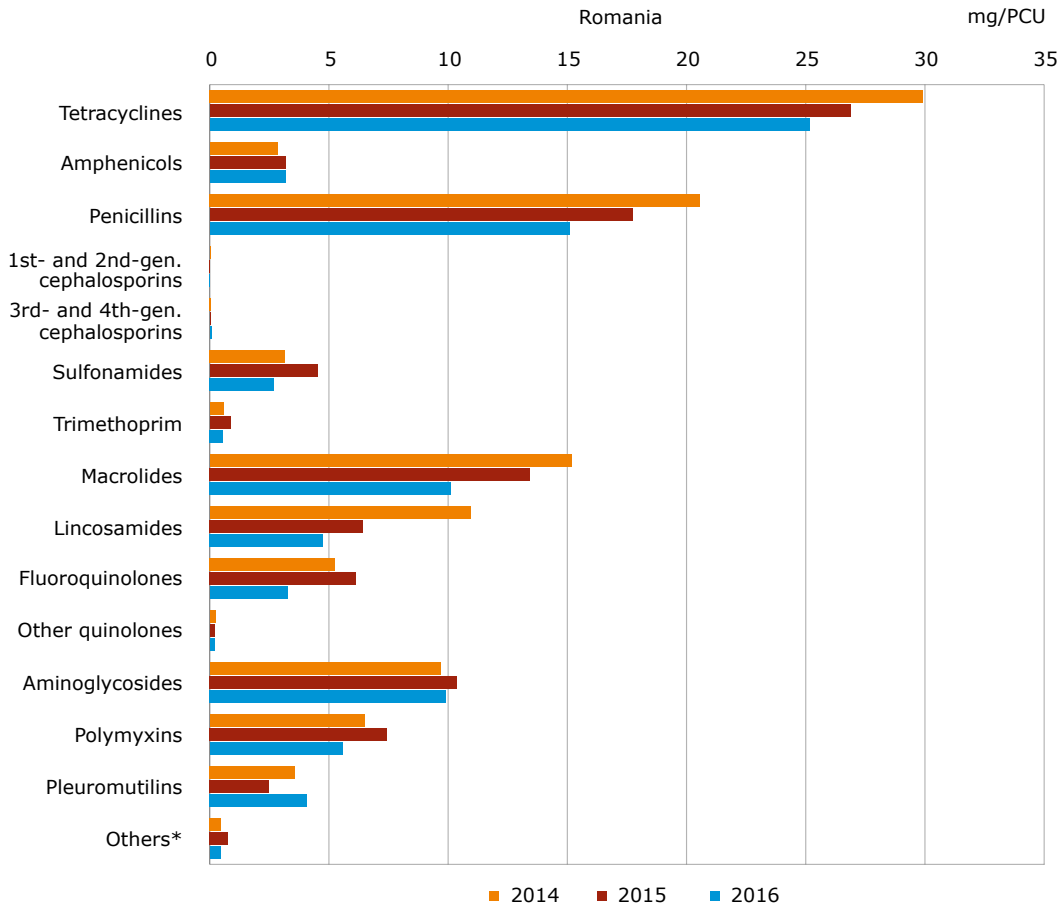
Since 2013, there has been a decrease in sales (mg/PCU) of polymyxins, namely colistin. Polymyxins are last-resort antimicrobials for use in humans, which means that sales of VMPs containing antimicrobial agents of this class require further attention. In 2016, sales of polymyxins dropped to 13.53 mg/PCU (-7% compared to the previous year).

A new strategic national plan under the 'One health' approach involving the human, veterinary and environment sectors, with an operational plan and measurable objectives based on previous results, will be implemented during 2018.

Meanwhile, new initiatives have already been taken, namely voluntary programmes for the reduction of the use of antimicrobials in rabbits and poultry and for the use of colistin in pigs.

Romania

Figure 92. Changes in sales (mg/PCU) by antimicrobial class in Romania, from 2014 to 2016

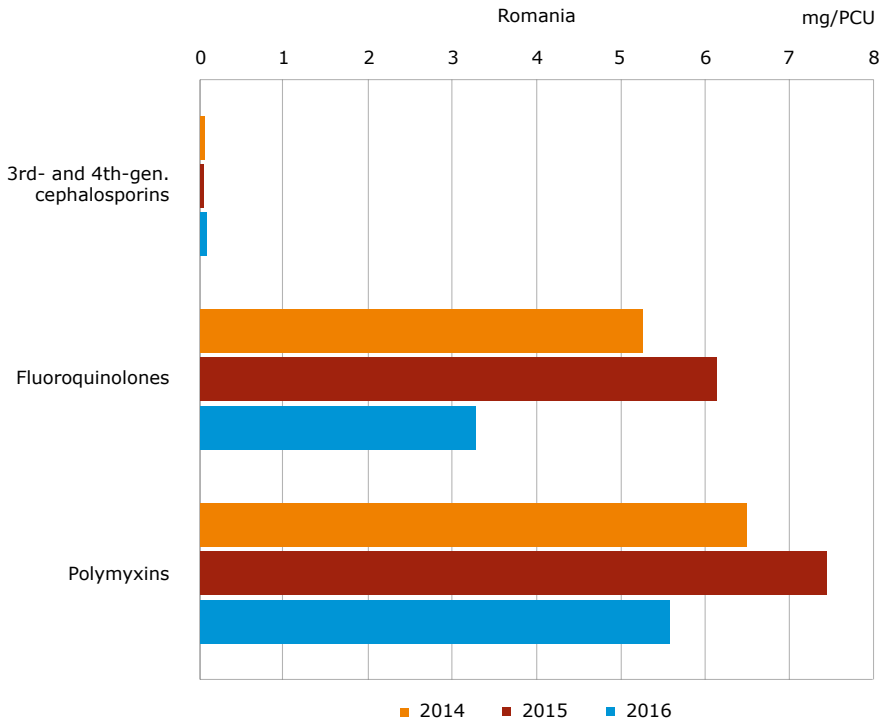


*Other antibacterials (classified as such in the ATCvet system).

Data provided by MAHs include sales to distributors, veterinarians, farms and pharmacies.

In 2016, the most-sold classes for food-producing animals expressed in mg/PCU were tetracyclines (30 %), penicillins (18 %), macrolides (12 %) and aminoglycosides (12 %).

Figure 93. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in Romania, from 2014 to 2016



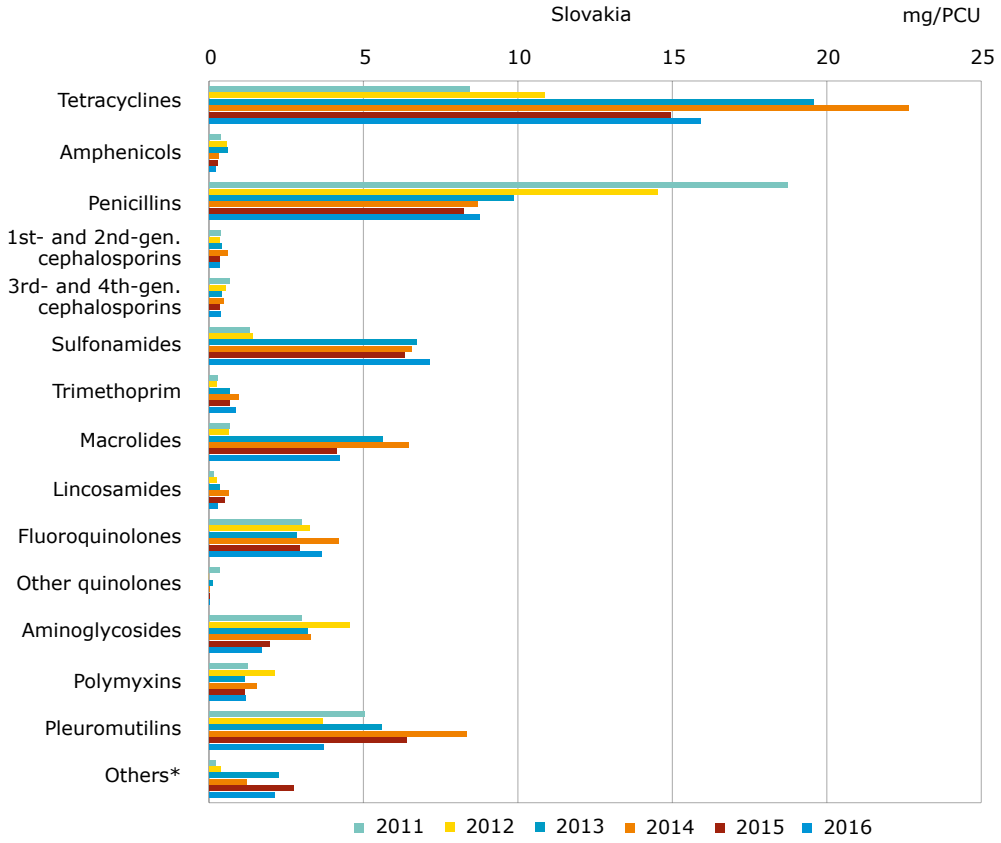
Sales of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in tonnes of active ingredient, of veterinary antimicrobial agents applicable mainly for food-producing animals, accounted for 0.09%, 3.8% and 6.5%, respectively, of total sales.

In 2016, sales of 3rd- and 4th-generation cephalosporins were 0.08 mg/PCU; aggregated sales for 25 countries in that year were 0.21 mg/PCU (Figure 34). Sales of fluoroquinolones in Romania were 3.27 mg/PCU, while aggregated sales for 25 countries in that year were 2.70 mg/PCU (Figure 34). Sales of polymyxin VMPs were 5.57 mg/PCU, while aggregated sales for 25 countries in 2016 were 6.62 mg/PCU (Figure 34).

In 2016, to reduce the consumption of antimicrobials and prevent antimicrobial resistance, the National Sanitary Veterinary and Food Safety Authority developed a strategy plan and supporting guidelines.

Slovakia

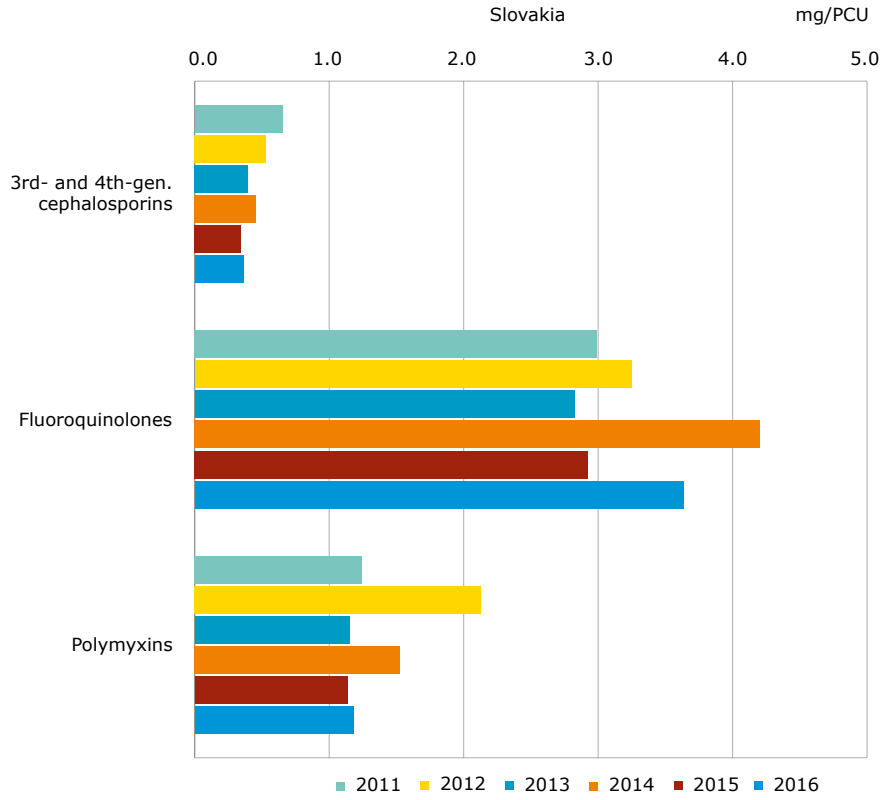
Figure 94. Changes in import data by wholesalers (2011 and 2012) and sales to end-users (2013-2016) (mg/PCU) by antimicrobial class for food-producing species, in Slovakia



*Other antibacterials (classified as such in the ATCvet system).

Datasets for 2011 and 2012 only included data for antimicrobial VMPs imported by wholesalers, so sales of antimicrobial VMPs to end-users by national manufacturers were not accounted for. Since 2013, antimicrobial VMPs produced by national manufacturers have also been dispensed by wholesalers. Thus, for the years 2013 to 2016, the data include sales from wholesalers to end-users (veterinarians, pharmacies, producers of medicated feeding stuffs and farmers) — covering both import data and antimicrobial VMPs produced by national manufacturers. This difference in coverage is thought to be the main explanation for differences in sales between 2011 and 2012, and 2013 and 2016. Thus, data for the period 2012-2013 are not comparable with data for 2013-2016. For the period 2013-2016, which has the same data coverage, a 15 % reduction in sales can be seen. Slovak manufacturers of veterinary medicinal products mainly produce products with tetracyclines, pleuromutilins, macrolides and sulphonamides, which are the most-selling classes. Thus, as is apparent from Figure 94, sales of these classes account for the largest difference in consumption data for the years 2013 to 2016, when compared to previous years.

Figure 95. Changes in import data by wholesalers (2011 and 2012) and sales to end-users (2013-2016) (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins for food-producing species, in Slovakia



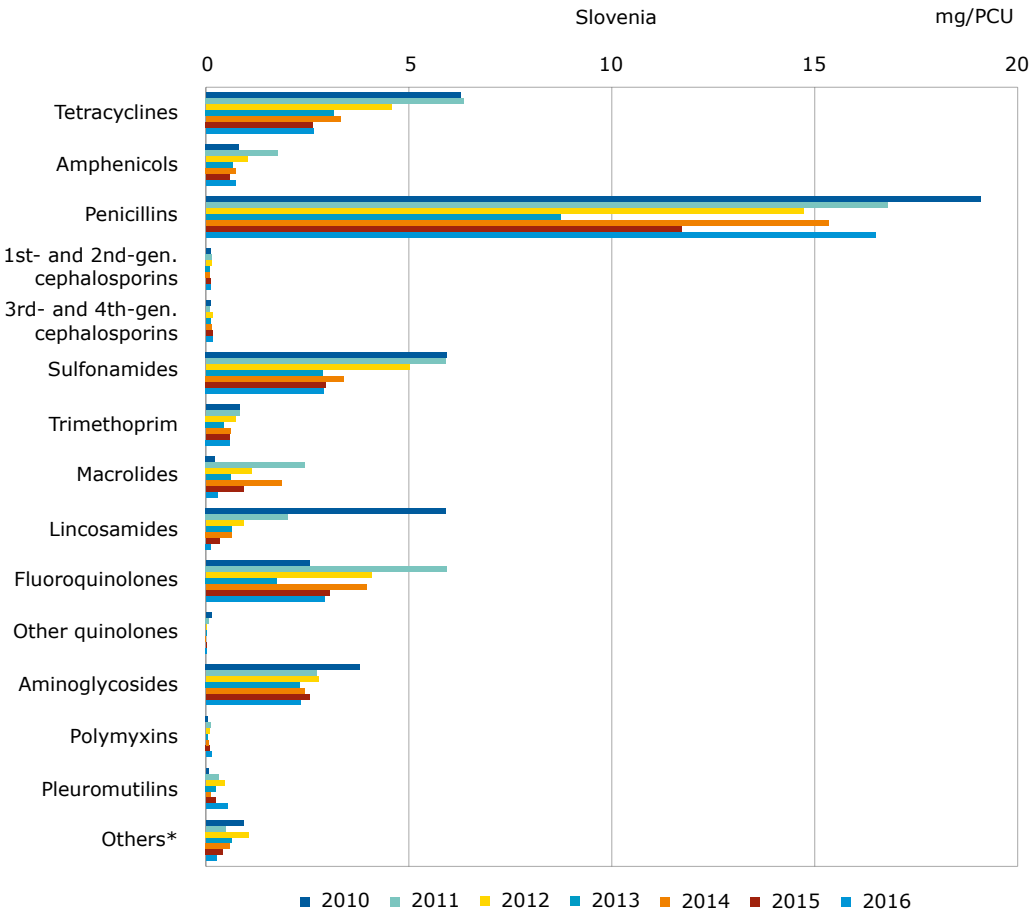
Sales (imports in 2011 and 2012), in mg/PCU, of 3rd- and 4th-generation cephalosporins declined from 2011 to 2016; in 2011, this subclass accounted for 1.5% of total sales; in 2016, the figure was 0.7%. In 2016, sales of 3rd- and 4th-generation cephalosporins were 0.36 mg/PCU, while aggregated sales for 25 countries in that year were 0.21 mg/PCU (Figure 34).

In Slovakia, sales of fluoroquinolones fluctuated from 2011 to 2016. In 2011 and 2016, the proportion of the total sales for this subclass accounted for 6.8% and 7.2%, respectively. In 2016, sales of fluoroquinolone VMPs were 3.64 mg/PCU; aggregated sales for 25 countries in that year were 2.70 mg/PCU (Figure 34).

Sales (mg/PCU) of polymyxins fluctuated during the study period. In 2016, they were 1.18 mg/PCU, while aggregated sales for 25 countries in that year were 6.62 mg/PCU (Figure 34).

Slovenia

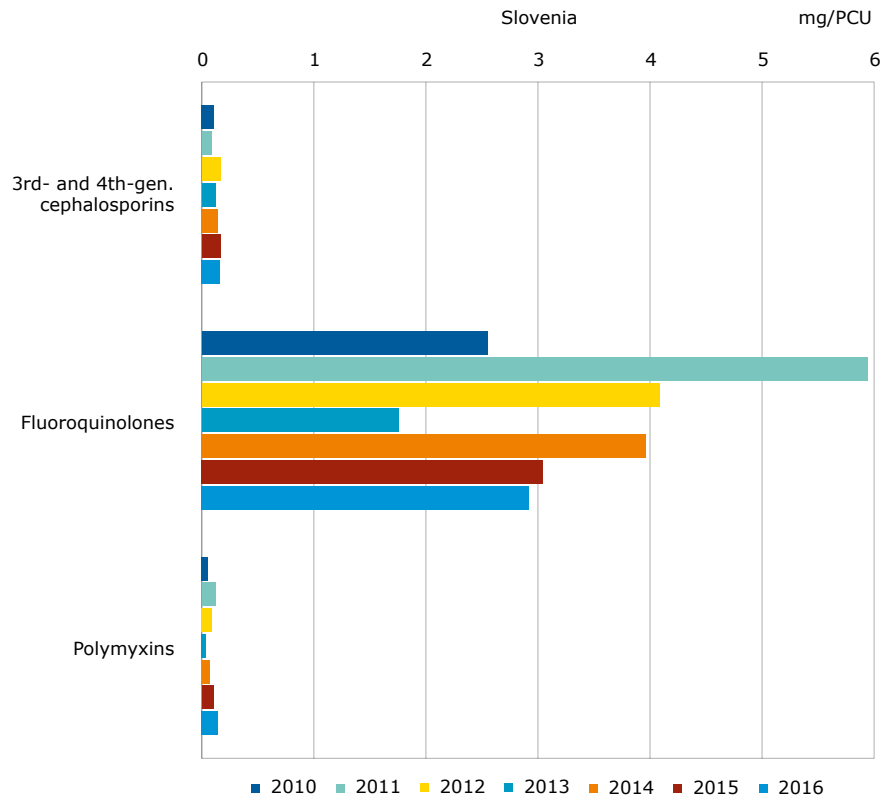
Figure 96. Changes in sales (mg/PCU) by antimicrobial class for food-producing species, in Slovenia, from 2010 to 2016



*Other antibacterials (classified as such in the ATCvet system).

From 2010 to 2016, there was an overall drop in sales (mg/PCU) of veterinary antimicrobials, from 46.9 mg/PCU to 30.3 mg/PCU. This implies a 35 % decrease in sales of antimicrobials from 2010 to 2016. The reduction in sales across the study period was accounted for by almost all classes.

Figure 97. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins for food-producing species, in Slovenia, from 2010 to 2016



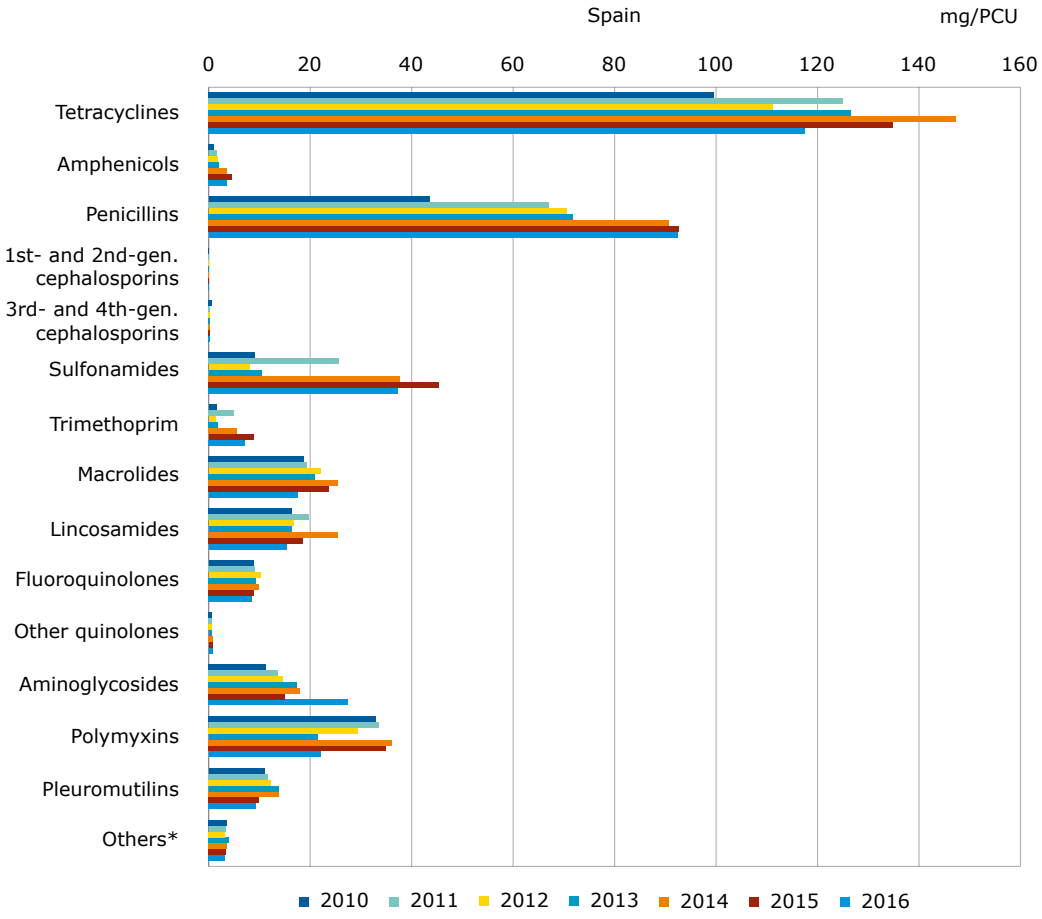
Sales (mg/PCU) of 3rd- and 4th-generation cephalosporins were relatively stable from 2010 to 2016. In 2010, this subclass accounted for 0.2 % of total sales, while for 2016, this figure was 0.5 %. In 2016, sales of 3rd- and 4th-generation cephalosporins VMPs were 0.16 mg/PCU, while total sales for 25 countries in that year were 0.21 mg/PCU (Figure 34).

In Slovenia, throughout the observation period, greater fluctuations were noted for sales of fluoroquinolones, ranging between 1.8 and 5.9 mg/PCU, compared to the other classes presented in Figure 97. In 2013, sales of fluoroquinolones were significantly lower compared to the other years. In 2010, fluoroquinolones accounted for 5.4 % of total sales; the corresponding figure for 2016 was 9.6 %. In 2016, sales of fluoroquinolone VMPs were 2.9 mg/PCU, while aggregated sales for 25 countries in that year were 2.70 mg/PCU (Figure 34).

Sales (mg/PCU) of polymyxins were relatively stable from 2010 to 2016. In 2010, this subclass accounted for 0.1 % of total sales, while for 2016, this figure was 0.5 %. In 2016, sales of polymyxin VMPs were 0.1 mg/PCU, while aggregated sales for 25 countries in that year were 6.62 mg/PCU (Figure 34).

Spain

Figure 98. Changes in sales (mg/PCU) by antimicrobial class in Spain, from 2010 to 2016[1]



[1] Sales of 1st- and 2nd-generation cephalosporins were low each year (<0.05% of total sales).
*Other antibacterials (classified as such in the ATCvet system).

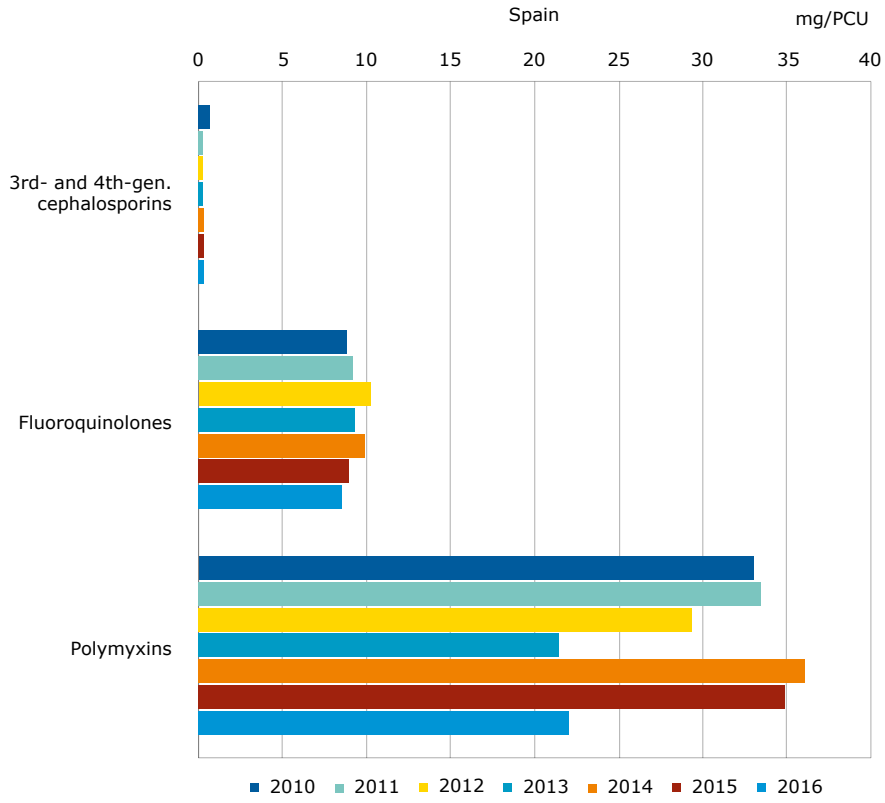
For the period 2010 to 2016, sales (mg/PCU) and sales patterns in Spain varied. From 2010 to 2014, an overall increase in sales of 61% was observed, while a reduction of 13% can be seen from 2014 to 2016. Spain changed its system for collecting sales data as from 2014. Under-reporting was identified for the years 2010 to 2013, which (among other reasons) means the data for these years represent underestimates. Therefore, data for 2010-2013 are not directly comparable with data for the years 2014 to 2016.

In general terms, there is a decrease of 10% compared to the reported data in 2015 and since 2014 sales have decreased by 13%, this decline is attributed to the adoption of the Spanish National Plan against Antibiotic Resistance[28] in June 2014. Six strategies are included in this common plan for the veterinary and human sectors, aimed at promoting appropriate use, ensuring effective surveillance systems, promoting research and innovation, and developing a communication and education plan.

Different activities have been carried out focusing on prudent use of antimicrobials in animals, including a plan to voluntarily reduce the use of colistin in porcine species and to organise training courses for veterinarians. Similar initiatives to reduce the use of antibiotics in sectors such as poultry, ruminants and rabbit breeding are being carried out. It is expected that these initiatives will contribute to the reduction of overall consumption of antimicrobial agents for veterinary use in Spain. Although the results of the national action plan cannot be assessed completely at the current time, data reported in 2016 showed a change in the sales (mg/PCU) trend.

[28] http://www.aemps.gob.es/publicaciones/publica/home.htm

Figure 99. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in Spain, from 2010 to 2016



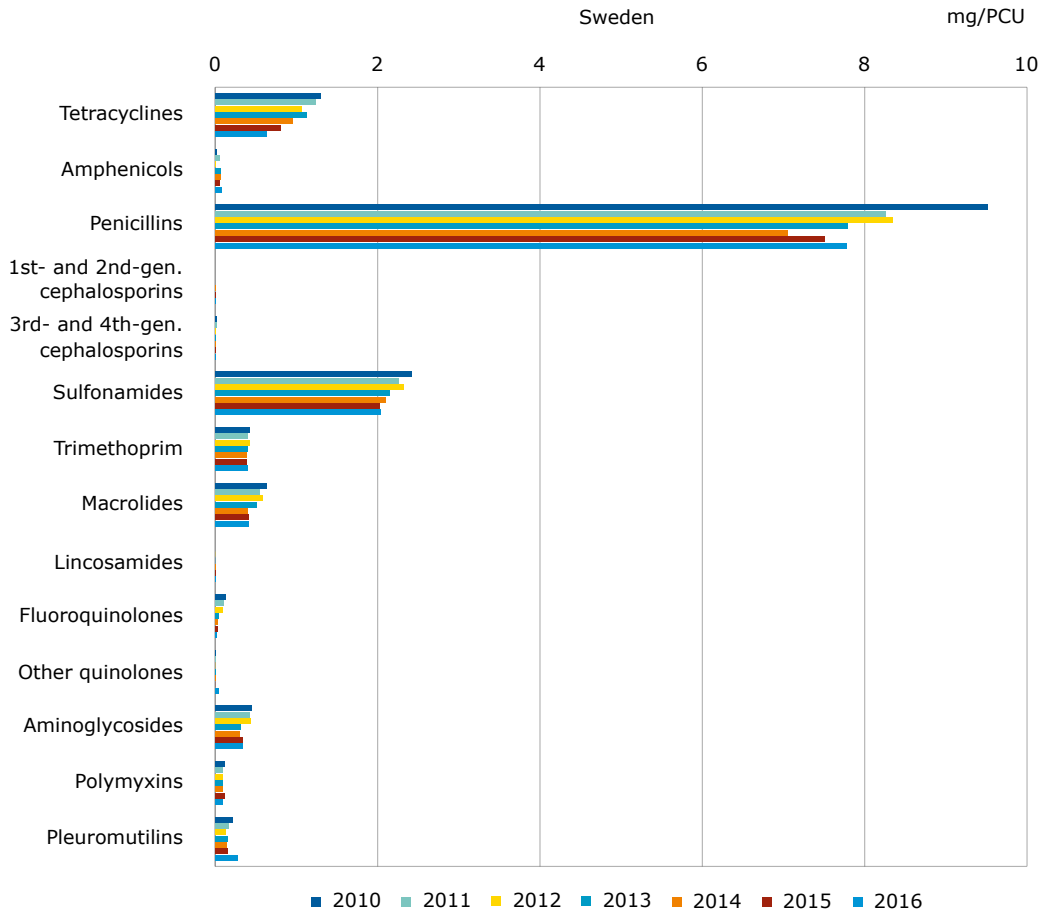
Sales (mg/PCU) of 3rd- and 4th-generation cephalosporins were stable from 2011 to 2016, with considerably higher sales in 2010 accounting for 0.3 % of the total sales, but for just 0.1 % in any other year. In 2016, sales of 3rd- and 4th-generation cephalosporin VMPs were 0.30 mg/PCU, while aggregated sales for 25 countries in that year were 0.21 mg/PCU (Figure 34).

Sales of fluoroquinolones were relatively stable from 2010 to 2016. In 2010, sales of fluoroquinolones accounted for 3.4 % of total sales, while in 2016, this figure was 2.4 %. In 2016, sales of fluoroquinolone VMPs were 8.54 mg/PCU, while aggregated sales for 25 countries in that year were 2.70 mg/PCU (Figure 34).

Sales of polymyxins decreased by 37 % from 2015 to 2016. In 2016, sales of polymyxins were 22.0 mg/PCU, while aggregated sales for 25 countries in that year were 6.62 mg/PCU (Figure 34). Activities within the plan to voluntarily reduce the use of colistin in pigs have likely contributed to the decline in sales of colistin.

Sweden

Figure 100. Changes in sales (mg/PCU) by antimicrobial class in Sweden, from 2010 to 2016[1]

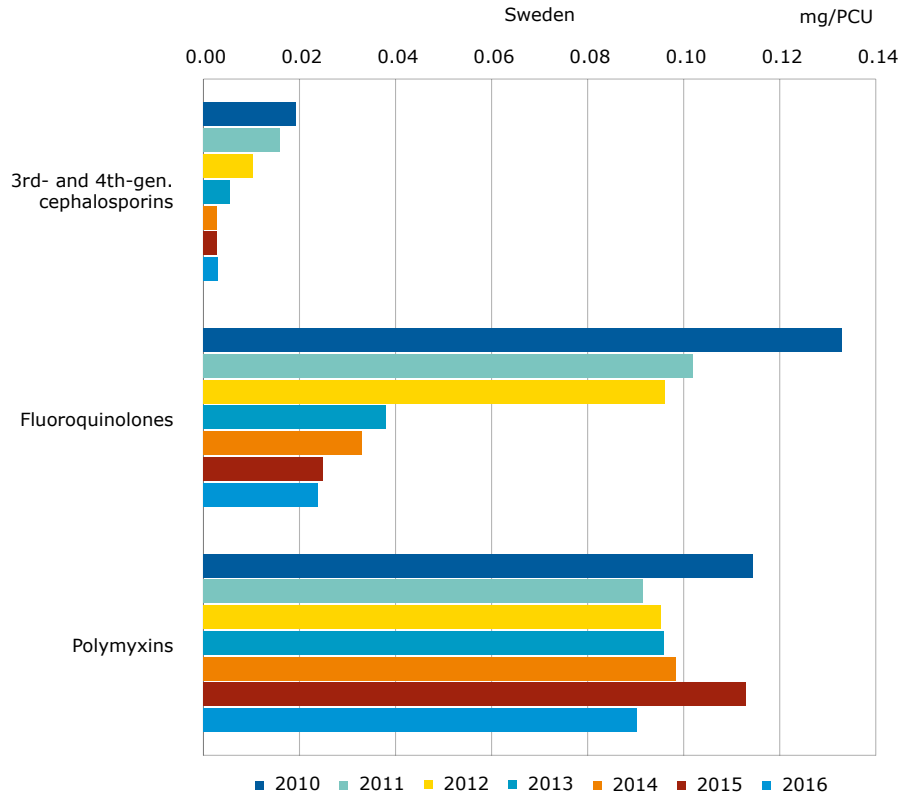


[1] No sales of 1st- and 2nd-generation cephalosporins from 2010 to 2013, and minor amounts sold in 2014, 2015 and 2016 (<0.01 mg/PCU); sales of lincosamides were low each year (<0.01 mg/PCU); no sales of other quinolones in 2012 because sales for fish were not available; no sales of other antibacterials in any of the years.

From 2010 to 2016, total sales of antimicrobials for food-producing animals fell from 15.2 mg/PCU to 12.1 mg/PCU (-20 %). Decreases were noted for most classes. In 2016, sales of 3rd- and 4th-generation cephalosporins and fluoroquinolones were 0.003 and 0.02 mg/PCU, respectively. The corresponding aggregated values for 25 countries reporting data since 2010 in 2016 were 0.21 and 2.70 mg/PCU, respectively (Figure 34). Since 2010, Swedish sales of these two classes have decreased by 84 % and 82 %, respectively. Sales of polymyxins have remained relatively unchanged at 0.09–0.11 mg/PCU; aggregated sales for the 25 countries were 6.62 mg/PCU.

In 2011, products sold under special licence were not fully captured, leading to a slight underestimate. Furthermore, concerns have been raised about a lack of completeness in the statistics on sales of products with marketing authorisation from 2010 to 2015. Taken together, the reported sales for 2010-2015 may be slightly underestimated. From 2016, this problem has been solved and data are likely to be complete (see Swedres-Svarm 2015 for more information: www.sva.se).

Figure 101. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in Sweden, from 2010 to 2016



The decrease in overall sales (mg/PCU) from 2010 to 2016 was 20 %. During the same period, sales of products for the medication of individual animals fell by 18 % and products for group medication by 30 %.

The notable decreases in sales of 3rd- and 4th-generation cephalosporins and fluoroquinolones can probably be explained by increased adherence to the guidance for prudent use of antibiotics in the treatment of animals and by a regulation limiting veterinarians' rights to prescribe this type of antimicrobials (SJVFS 2013:42), which came into force on 1 January 2013.

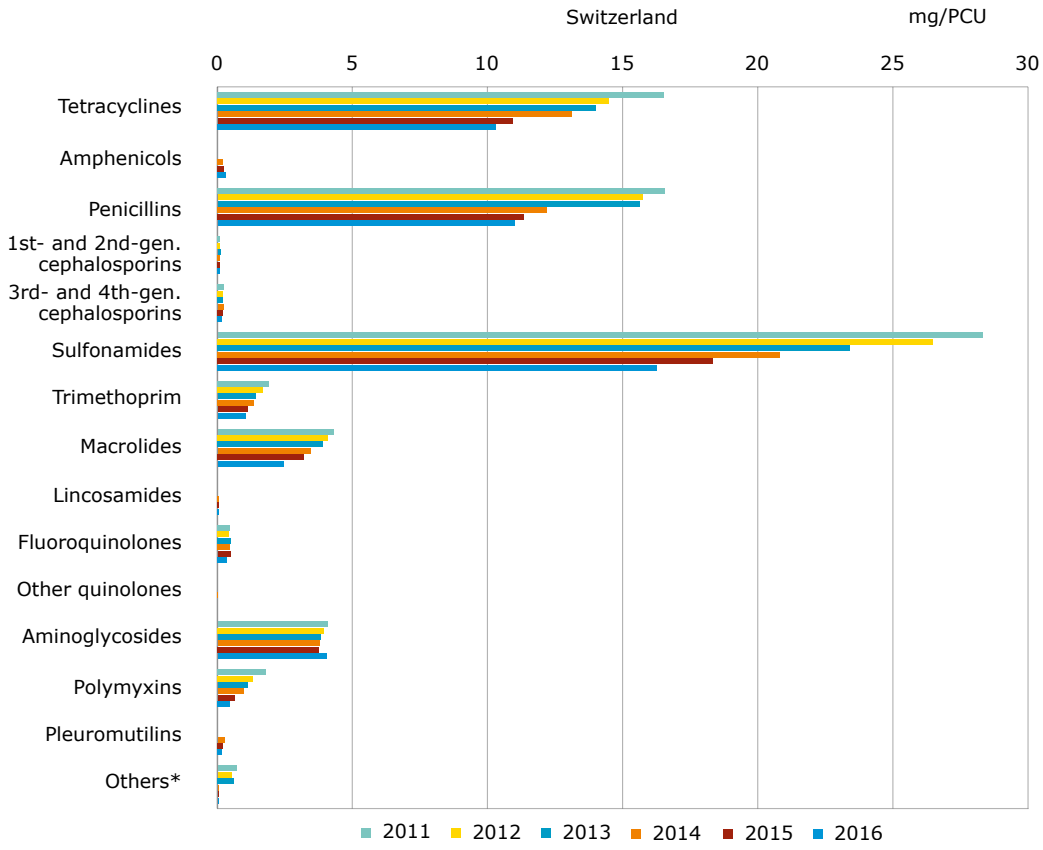
In Sweden polymyxins (colistin) are only authorised for use in pigs, with weaning diarrhoea as the sole indication. The pig population has decreased during the study period. During 2016, recent findings of transferrable resistance to colistin were communicated to stakeholders, such as organisations working with prevention of contagious diseases and animal health. In 2016, sales of polymyxins were 20 % lower than in 2015, but it is yet too early to assess trends.

The downward trends reflect a long-term strategy where the core element is to reduce the need for antimicrobials through, for example, biosecurity, disease-control programmes, and optimised management and husbandry. When antimicrobials are needed, guidance on their prudent use is available and should be followed. Authorities, academia, professional advisors, veterinarians and farmers all collaborate with the aim of continuous improvement of animal health and the prudent use of antimicrobials.

In 2016, the Swedish government updated the strategy on antimicrobial resistance. An inter-sectorial collaborative group, mainly including national authorities, was initiated in 2012. The group includes representatives from the public health, animal, food and environmental sectors. In 2017, an updated joint action plan based on the Government's objectives was adopted by the collaborative group. Among the activities of relevance for the ESVAC is development of an existing data warehouse with records of treatments reported by veterinarians to provide data on use at farm level.

Switzerland

Figure 102. Changes in sales (mg/PCU) by antimicrobial class in Switzerland, from 2011 to 2016[1,2]

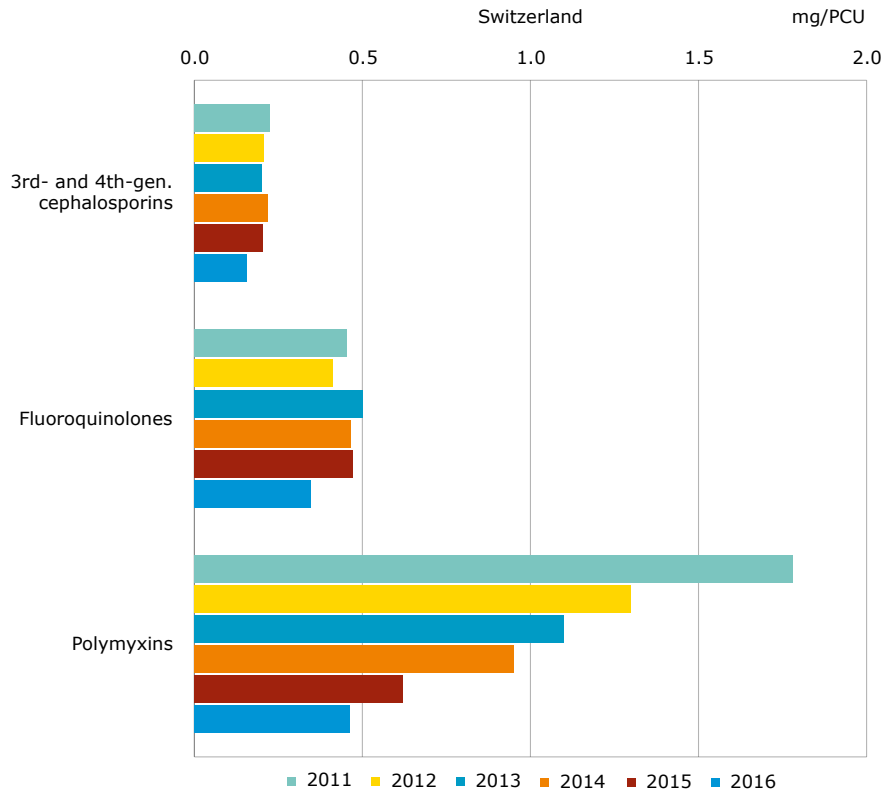


[1] From 2011 to 2013, for reasons of confidentiality, amphenicols, other quinolones and pleuromutilins are grouped with 'Others' and lincosamides are grouped with macrolides.
[2] Data for 2011–2013 have not been submitted to the ESVAC database but have been retrieved from Annex 9 in previous ESVAC reports.
*Other antimicrobials (classified as such in the ATCvet system).

From 2011 to 2016, total sales in mg/PCU fell by 38 %. This is due to decreases in the top three sellers sulfonamides (-43 %), penicillins (-34 %) and tetracyclines (-38 %).

Total PCU shows a decreasing trend in the years under investigation, but the decrease in sales is mainly correlated with a reduction of use, mainly in pigs and calves treated as a group. As expected, two of the three top sellers (tetracyclines and sulfonamides) are mainly used in the form of premixes, very often in combination with a macrolide. In the context of the national strategy of antimicrobial resistance (StAR), vaccination campaigns, strengthened continuing education and management measures are being promoted and new restrictions implemented (see comments to Figure 103, sales of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins). These measures, strongly contributed to decreased sales of premixes and hence, the overall decrease in sales.

Figure 103. Changes in sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in Switzerland, from 2011 to 2016[1]



[1] Data for 2011–2013 were not submitted at package level but have been retrieved from Annex 9 in previous ESVAC reports.

Sales of 3rd- and 4th-generation cephalosporins decreased from 0.23 mg/PCU in 2011 to 0.16 mg/PCU in 2016. The strongest decrease (-0.04 mg/PCU) was registered between 2015 and 2016. This might be attributed to a change in the Swiss legislation forbidding stock delivery of products containing highest priority critically important antimicrobials (HPCIAs). Since 1 April 2016, such products may only be applied by the treating veterinarian but not delivered in stock to the animal owner. The same restriction applies to products containing macrolides, very often contained in premixes, leading to a strong reduction of 43% (4.29 mg/PCU in 2011 to 2.44 mg/PCU in 2016) in sales of this class.

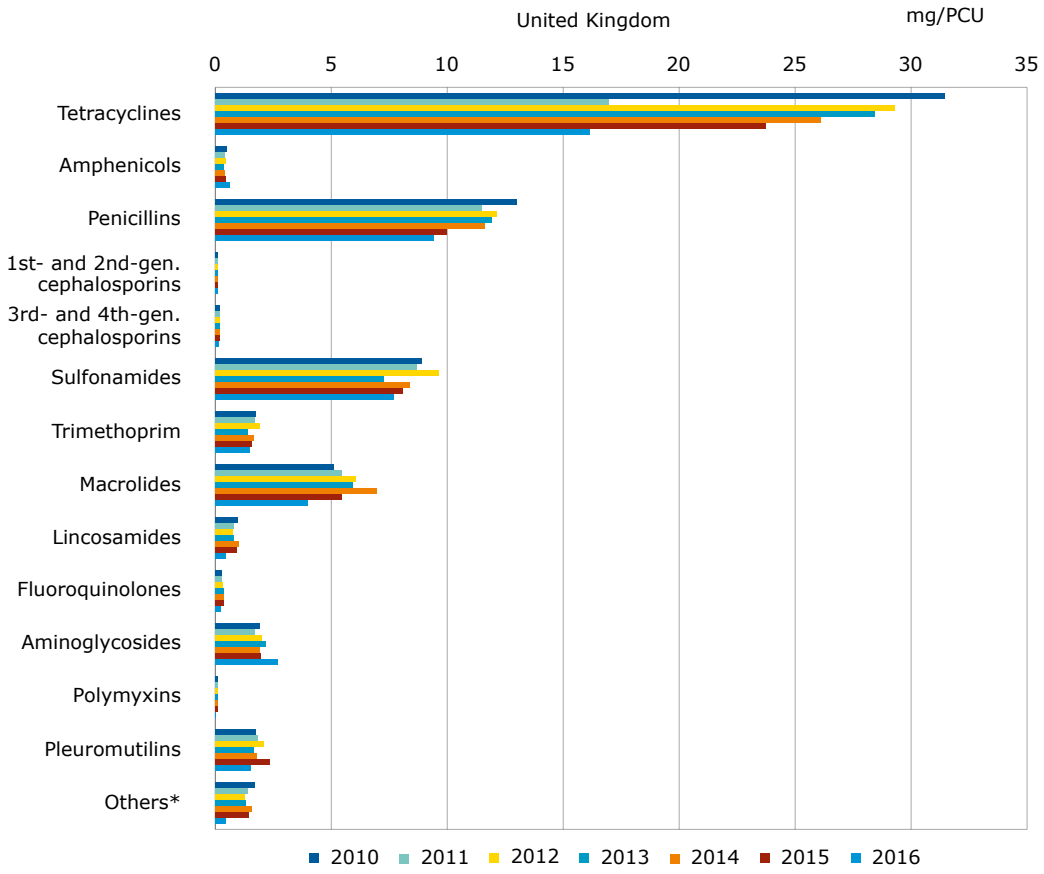
The restriction also applies to fluoroquinolones, with sales decreasing in absolute numbers from 0.45 mg/PCU in 2011 to 0.35 mg/PCU in 2016. The same effect as described for 3rd- and 4th-generation cephalosporins is seen, with the biggest decrease (-0.12 mg/PCU) taking place between 2015 and 2016.

Polymyxins, exclusively sold and used as colistin in food-producing animals, achieved the highest reduction in critical antimicrobials with a decrease in absolute numbers from 1.78 mg/PCU in 2011 to 0.46 mg/PCU in 2016. Under current Swiss legislation, colistin is not subject to the same restrictions as 3rd- and 4th-generation cephalosporins and fluoroquinolones and can still be stock-delivered to (mainly pig) farmers. The strong reduction in colistin sales therefore might be linked to the aforementioned measures and also to the introduction and extensive use of vaccines against both porcine circovirus and Lawsonia infections, thereby reducing the occurrence of diarrhoea and hence the need to treat for bacterial secondary infections.

Of note, sales of antimicrobials for veterinary use reported by Switzerland are considered to be slightly overestimated, as data also contain trade in Liechtenstein, although no animal data characterising Liechtenstein are covered in the denominator currently used for analysis. Consumption of antimicrobials for veterinary use in Lichtenstein is considered to be very low.

United Kingdom

Figure 104. Changes in sales (mg/PCU) by antimicrobial class in the United Kingdom, from 2010 to 2016[1]



[1] No sales of other quinolones in any of the years.
*Other antimicrobials (classified as such in the ATCvet system).

Overall sales of antibiotics for use in food-producing species in 2016 declined by 34 % when compared to 2010 and were the second-lowest figure reported over this six year period. Sales were at their lowest level in 2011, although this is thought to be artificially low (and 2010 sales artificially high) due to altered product-purchasing behaviour in anticipation of a change in marketing authorisation holder(s) for certain tetracycline-containing products between 2010 and 2011. However, it should be noted that over the period 2012 to 2016, a 32 % decline in sales was observed.

Between 2012 and 2016 there was a decrease in most of the antimicrobial classes although this was particularly substantial for tetracyclines (45 %). Despite this reduction, tetracyclines remain the most-sold class, accounting for 36 % of total sales in 2016.

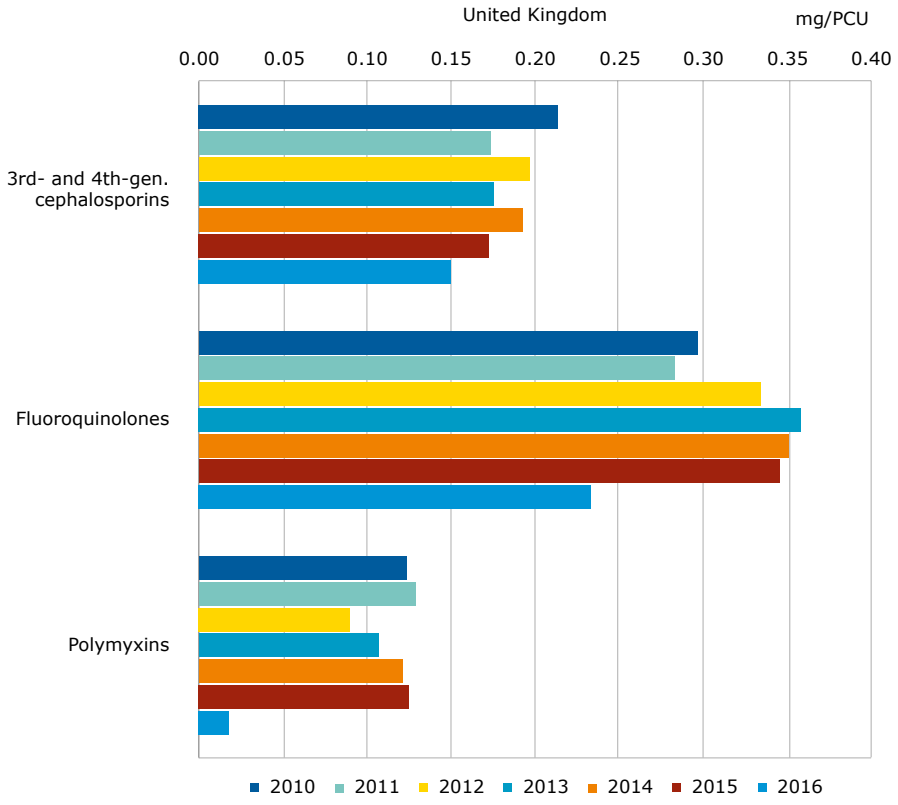
A programme for the surveillance of antibiotic use continues to be developed in the UK. For the first time, the UK-VARSS 2016 report[29] included antibiotic use data from the pig, gamebird, egg and dairy sectors. Data from meat poultry (which was first presented in UK-VARSS 2014) was broken down by species (broilers, turkeys and ducks).

Antibiotic use data in pigs were extracted from the electronic Medicines Book for Pigs (eMB-Pigs), software launched by the Agriculture and Horticulture Development Board for pigs (AHDB Pork) in April 2016. At the time of extraction (14 September 2017), the eMB data covered 56 % UK pig production for 2015 and 62 % pig production for 2016. These data showed that between 2015 and 2016, using ESVAC PCU weights as the denominator, antibiotic use decreased by 34 %, from 278 mg/kg in 2015 to 183 mg/kg in 2016.

[29] https://www.gov.uk/government/collections/veterinary-antimicrobial-resistance-and-sales-surveillance

For a third year, the British Poultry Council (BPC) provided data collected from their members, representing 90 % of the commercial meat poultry industry. These data showed that between 2014 and 2016, again using ESVAC PCU weights as the denominator, antibiotic use in the chicken sector decreased by 65 % from 48.8 mg/kg to 17.1 mg/kg and in the turkey sector decreased by 61 % from 219.5 mg/kg to 86.4 mg/kg.

Figure 105. Sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones and polymyxins in the United Kingdom, from 2010 to 2016



Sales of highest priority CIAs represented <1 % of antibiotics sold in 2016.

Sales of 3rd- and 4th-generation cephalosporins and fluoroquinolones were relatively stable from 2010 to 2015, but decreased by 13 % and 30 % respectively between 2015 and 2016.

Sales of polymyxins remained below 0.15 mg/PCU over the six year reporting period, and reduced by 86 % between 2015 and 2016.

3. Discussion

3.1. Materials and methods

In the EU, the use of antimicrobials for growth promotion has been banned since 2006, therefore the data sets provided for the ESVAC represent exclusively sales of antimicrobial agents sold as veterinary medicinal products.

Depending on the source of the data, countries requested data on sales to end-users, or asked the national data providers to exclude sales among data sources (for example, between wholesalers) and consequently it is assumed that double reporting has been avoided.

In 2016, all countries provided sales data except for Denmark and Sweden which submitted prescription data.

As regards the material and methods, it should be noted that in all the participating countries, antimicrobial agents have a 'prescription only' status. According to Directive 2001/82/EC of the European Parliament and of the Council of 6 November 2001 on the Community code relating to veterinary medicinal products[30], all veterinary medicinal products, including veterinary antimicrobial agents, have to be sold through distributors authorised by the competent authority in each country. This made it possible for all the participating countries to identify all distributors of antimicrobial VMPs in their country, and consequently 100 % data-source coverage could be obtained. It is therefore reasonable to assume that the data presented in this report provide a good overview of the total sales of antimicrobial agents in the 30 countries.

The national sales data (numerator) cover all food-producing species, including horses, which are considered as food-producing species according to EU legislation. Thus, the animal population 'at risk' of being treated with antimicrobial agents (denominator) includes all food-producing species. However, as the use of antimicrobial agents in the various animal species varies considerably, interpretation of the data should take into account distribution of the PCU value between the species in the various countries. It should also be emphasised that the PCU only represents a technical unit of measurement and not a real value for the animal population that could potentially be treated with antimicrobial agents.

In the current report, data presented on sales of veterinary antimicrobial agents for companion animals are based solely on the sales of tablets. For countries with a relatively low number of dogs and cats, the market for antimicrobial VMPs as tablets is typically low, and thus the proportion of human antimicrobial agents used according to the cascade could account for a higher proportion than in those countries with a high number of dogs and cats. Furthermore, injectable antimicrobial VMPs are used in both food-producing animals, including horses, and companion animals. Therefore, the data on sales of veterinary antimicrobial agents for companion animals presented in this report are likely to represent an underestimate, while data on sales for food-producing animals are likely to be slightly overestimated.

Dosing of the various antimicrobial agents between and within classes, as well as between animal species, varies substantially, sometimes by several orders, as reflected by the DDDvet and DCDvet values published by EMA in 2016[31]. For example, the dose for a whole treatment (DCDvet) with an oral fluoroquinolone VMP may vary between 10 and 40 mg/kg, differing between cattle, pigs and poultry, while with an oral tetracycline VMP this may vary between 110 and 280 mg/kg. This implies that a given weight of active ingredient of fluoroquinolone sold can be used to treat several times as many animals as the same weight of active ingredient of a tetracycline. Furthermore, within an antimicrobial class there may be different dosages for different substances; for example, the dosage of doxycycline is about one-quarter of that of oxytetracycline. The daily dose can also vary within one antimicrobial class and among oral and parenteral forms. Another consideration is that the treatment dosage may differ significantly according to species; for fish, a typical tetracycline dosage for the whole treatment is 800 mg/kg, or some six times higher than that for terrestrial animals. The data in this report cover all food-producing animals together; therefore it was not possible to take into account differences in dosing when reporting the data. Considering all above-mentioned factors, sales data do not reflect the exposure of the animals and frequency of treatment. Since sales patterns and animal demographics vary substantially between countries, comparison of the sales data across the countries should be done with great care.

[30] OJ L 311, 28.11.2001, p. 1.
[31] Available on the European Medicines Agency website (www.ema.europa.eu) via Home > Veterinary regulatory >Antimicrobial resistance (http://www.ema.europa.eu/ema/index.jsp?curl=pages/regulation/general/general_content_001493.jsp&mid=WC0b01ac0580a2fcf5)

The proportion of sales of small packages of oral powders and oral solutions sufficient for treatment of only a single or a few animals is very low compared to those applicable for group treatment, and oral solutions and oral powders are typically used for group treatment. Thus, the data presented in this report on sales of oral powder and oral solutions are considered to be a reasonable estimate of sales of these forms for group treatment.

In Member States, antimicrobial medicinal products non-authorised in veterinary medicine may be used in companion animals, based on the cascade principle described in Article 10 of Directive 2001/82/EC of the European Parliament and of the Council of 6 November 2001 on the Community code relating to veterinary medicinal products[32]. Such sales are not included in this report.

Dermatological preparations (ATCvet group QD) and preparations for sensory organs (ATCvet group QS) were not included in the data sets. In 2016, these pharmaceutical forms represented, for example, only 0.2% in Denmark, (L. Mie Jensen, unpublished data), 0.4% in the Czech Republic (L. Pokludová, unpublished data), 0.52% in France (A. Chevance, unpublished data), 0.002% in Norway (https://www.vetinst.no/en/surveillance-programmes/norm-norm-vet-report) and 0.7% in the United Kingdom (S. Brown, unpublished data) of the total tonnes sold. The annual contribution from these groups of antimicrobial agents, in tonnes of active ingredients, to the total amounts is thought to be minimal, and therefore the effect of the deviation is negligible.

Injectable antimicrobial agents are used both in food-producing and companion animals. With the exception of some long-acting products, injection of antimicrobial agents in companion animals is generally limited to hospitalised animals or perioperative treatments. Data from Denmark and France for 2016 showed that approximately 1.1% and 0.8%, respectively, of the injectable antimicrobial VMPs sold were used for dogs and cats (L. Mie Jensen and A. Chevance, unpublished data). Therefore, sales of injectable antimicrobials are assumed to be for use in food-producing species. For countries where the injectable 3rd- and 4th-generation cephalosporins are almost solely marketed for dogs and cats, the data provide a considerable overestimate for food-producing animals.

For 2016, nine countries (Table 2) included veterinary antimicrobial agents obtained on special licence (use on exemption from marketing authorisation, i.e. obtained from another Member State and permitted to be marketed for specific animal species, although this type of procedure might differ among Member States) in the data sets; these are all countries with a comparatively low number of antimicrobial veterinary medicinal products (VMPs) on the market (Annex 1, Table A7). Seven of these countries – Czech Republic, Denmark, Estonia, Finland, Norway, Slovenia and Sweden — reported that the proportion of sales of antimicrobial VMPs on special licence accounted for approximately <0.01%, 0.1%, 1%, 5.5%, 0.7%, 7.5% and 5-6%, of the total sales, respectively.

It is important to note that the results presented in this report may differ from those presented in national reports because of differences, for example, in inclusion criteria for veterinary antimicrobial products or in the reporting of data in the national surveillance systems. For instance, reporting concentration as the moiety of a chemical compound in the national database, while for the ESVAC the strength of an ingredient is reported as given in the summary of product characteristics/labelling of the VMP, which typically is the salt (see references to national reports in Annex 7).

Despite different factors noted above, ESVAC sales data can be considered as valid and important from the perspective of following trends in individual countries, especially those with well-established and stable systems of data collection.

3.2. Results

In 25 countries reporting sales data to the ESVAC for the years 2011–2016, there was an overall decrease in sales (mg/PCU) of 20%. Aggregated sales were 162 mg/PCU, 152 mg/PCU, 147 mg/PCU, 156 mg/PCU, 141 mg/PCU and 129 mg/PCU in 2011, 2012, 2013, 2014, 2015 and 2016, respectively (Figure 34). The PCU was stable over these years; only a 2% increase of PCU was observed for 25 countries, while the reduction in tonnes sold was 18.5%.

From 2011 to 2016, a drop of more than 5% (range 9% to 58%) in sales (mg/PCU) was observed for 16 countries (Table 8). An increase of more than 5% was observed (range 8% to 68%) for six countries.

[32] OJ L 311, 28.11.2001, p. 1

Sales (mg/PCU) of 3rd- and 4th-generation cephalosporins in those 25 countries that provided data for the years 2011 to 2016 decreased by 15% during the study period. An increase of 6% was observed for the fluoroquinolones, however, in comparison to 2014 when sales of fluoroquinolones peaked at 2.99 mg/PCU, the consumption of this class decreased by 9.8%. The sales (mg/PCU) of polymyxins (mostly colistin; from 2013 no sales of polymyxin B reported) in these 25 countries decreased by 40% (Figure 34).

A large difference in sales, expressed as mg/PCU, was observed between the most- and least-selling countries. This is partially due to differences in the composition of the animal population in the various countries (e.g. more pigs than cattle). Furthermore, differences in the production system may play an important role. Among other factors, there is also considerable variation in terms of daily dosage and length of treatment between the various antimicrobial agents and formulations used. Differences in data source selection — i.e. prescriptions, sales data or purchase data — may have an impact, although the effect of this is considered to be minor.

In 2016, prescribing patterns for the various veterinary antimicrobial classes, expressed as mg/PCU, varied substantially between the countries. Notable variations were observed between different countries in the proportion of sales accounted for by the CIAs with the highest priority for human medicine — 3rd- and 4th-generation cephalosporins, fluoroquinolones, other quinolones, polymyxins and macrolides.

Overall, in the 30 countries, the sales (mg/PCU) of 3rd- and 4th-generation cephalosporins, fluoroquinolones, other quinolones, polymyxins (only colistin) and macrolides accounted for 0.2%, 2.2%, 0.4%, 5.1% and 7.0%, respectively, of the total sales of antimicrobial VMPs in 2016.

Another important finding was that total sales, both in tonnes and in mg/PCU, of veterinary antimicrobial agents in the 30 European countries were mainly accounted for by pharmaceutical forms that can be used for mass treatment (premixes) or group treatment (oral powder and oral solution). However, this varies significantly between the countries.

Of the total number of product presentations (i.e. product name, form, strength and pack size) of antimicrobial VMPs applicable to food-producing animals (tablets excluded) sold in 2016, 81.5% contained only one active ingredient, 16.1% contained two active ingredients, and 2.1% contained three active ingredients; in addition, 0.2% (n=21) of the product presentations contained four active ingredients. Sales of products with three active ingredients were almost solely accounted for by products for individual treatment (intramammary and intrauterine preparations), and sales of products containing four ingredients were solely accounted for by intramammary preparations.

Considerable variations were observed between the sales and sales patterns, expressed in tonnes, of veterinary antimicrobial agents as tablets assigned as sold for use in companion animals. This is particularly the case for the sales of tablets containing combinations of penicillins + beta-lactamase inhibitors (sales of clavulanic acid are not included in the data), which varied between 0% and 100% of the total sales of penicillin tablets. It must be noted that human medicinal products and injectable veterinary products can also be used in companion animals, thus the data on sales of tablets should be interpreted with great care.

4. Concluding remarks

Variations between the 30 countries on reported sales (mg/PCU) and on sales patterns for 2016 are likely to be partly due to differences in the composition of the animal population and in the production systems in various countries. There are considerable variations in terms of daily dose used for the various antimicrobial agents and pharmaceutical forms, and duration of treatment. In addition, differences in the selection of sales data providers among countries may have an impact, although the effect of this is thought to be minor. These factors, however, can only partly explain the differences in the sales observed between the 30 countries, so other factors must also be considered.

The sales data (numerator) for antimicrobial agents cover all food-producing species (including horses), thus the animal population 'at risk' of being treated with antimicrobial agents (denominator) includes most of the food-producing species. However, the use of antimicrobial agents in the various animal species varies considerably: for example, the use of antimicrobial agents in extensive production systems is generally relatively low. Therefore, interpretation of the data should take into account the distribution of the PCU value between the species in the various countries.

Tentative explanations provided by some of the countries for the decline in sales include, among others, the implementation of responsible-use campaigns, restrictions on use, increased awareness of the threat of antimicrobial resistance, setting of targets and/or changes in animal demographics. The reduced sales of veterinary antimicrobials in some countries indicate that there is potential for a reduction in other countries, too.

Variations in both the sales patterns and magnitudes of sales may be due to differences between the countries in the relative proportion of the various food-producing animal species, the availability of veterinary antimicrobial products on the market, prices, animal-production systems, and the general situation with regard to infectious diseases. However, these factors cannot fully explain the differences. Other influences, such as the focus on disease prevention by management, vaccination programmes, or implementation of responsible-use campaigns in some countries may also have impacted sales patterns.

Annex 1. Additional tables and charts

Table A1. Sales, in tonnes of active ingredient, of veterinary antimicrobial agents applicable mainly for food-producing animals by antimicrobial class (presented according to the ATCvet hierarchical system) by country, for 2016 (tablets not included)

Country	Tetracyclines	Amphenicols	Penicillins	1st- and 2nd-gen. cephalosporins	3rd- and 4th-gen. cephalosporins[1]	Sulfonamides	Trimethoprim	Macrolides	Lincosamides	Fluoroquinolones	Other quinolones	Aminoglycosides	Polymyxins	Pleuromutilins	Others[2]	Total tonnes
Austria	24.5	0.4	8.1	0.04	0.2	3.3	0.7	3.0	0.2	0.5	0	1.2	1.5	0.3	0.3	44.1
Belgium	49.7	3.0	86.0	0.3	0.5	54.4	10.9	14.8	4.6	1.0	0.6	0.9	4.2	1.0	8.4	240.4
Bulgaria	28.5	3.0	14.5	0.01	0.04	2.8	0.5	4.9	1.6	1.9	0.1	1.1	0.9	0.9	0.2	61.1
Croatia	9.7	1.0	8.6	0.1	0.0	2.4	0.3	0.7	0.03	0.8	0.1	1.3	1.1	0.3	0.1	26.6
Cyprus	18.5	0.5	7.7	0.01	0.1	5.8	1.1	1.7	6.3	0.2	0.1	0.5	1.1	2.5	0.3	46.3
Czech Republic	15.0	0.3	11.2	0.2	0.3	7.1	0.7	2.3	0.1	1.2	0.02	1.3	0.6	2.5	0.3	43.2
Denmark	27.1	1.4	27.1	0.1	0.02	9.8	1.9	11.6	2.1	0.01	0.9	3.1	1.3	9.7	2.7	98.7
Estonia	1.7	0.04	3.6	0.02	0.1	0.2	0.03	0.1	0.03	0.1	0	0.4	0.1	0.7	0.1	7.2
Finland	2.0	0.1	4.4	0.02	0.003	2.0	0.4	0.5	0.1	0.1	0	0.03	0	0.02	0	9.7
France	184.9	5.6	71.1	2.2	0.4	108.8	17.2	35.9	2.7	1.6	3.2	51.2	19.9	4.5	4.7	513.9
Germany	203.6	5.0	309.3	0.5	3.4	67.5	9.7	54.6	9.9	8.9	0	17.0	68.9	12.4	8.6	779.2
Greece	32.0	0.4	17.2	0.001	0.1	8.8	1.5	3.8	0.4	2.8	6.0	4.5	1.3	0.3	0.7	79.9
Hungary	63.8	2.7	40.7	0.1	0.3	5.7	1.2	5.6	3.0	8.0	0.1	1.9	10.2	9.1	3.1	155.6
Iceland	0.03	0	0.4	0	<0.001	0.05	0.01	0	0	0.001	0	0.04	0	0	0	0.6
Ireland[3]	41.3	2.3	20.7	0.8	0.2	19.7	1.6	6.6	0.6	0.9	0	6.3			1.3	102.3
Italy	388.9	19.4	294.7	0.5	1.6	149.0	18.3	120.3	62.5	9.6	9.9	17.2	62.1	35.7	23.4	1,213.2
Latvia	1.4	0.01	1.6	0.03	0.05	0.2	0.05	0.5	0.01	0.2	0.001	0.6	0.2	0.6	0.04	5.4
Lithuania	1.5	0.1	4.1	0.1	0.04	2.7	0.6	1.1	0.3	0.3	0.02	0.7	0.3	0.4	0.4	12.7
Luxembourg	0.7	0.1	0.4	0.01	0.04	0.3	0.1	0.05	0.03	0.04	0.001	0.1	0.1	0.01	0.1	1.9
Netherlands	68.1	4.9	37.8	0.1	0.002	33.2	6.2	23.8	0.1	0.3	3.1	1.8	1.1	0.8	0.6	181.7
Norway	0.1	0.2	3.1	0	0.001	1.4	0.3	0.002	0	0.01	0.1	0.4	0	0.1	0	5.6
Poland	182.8	6.3	161.6	0.8	0.7	44.8	5.7	37.9	4.2	42.6	0.1	23.1	24.8	28.6	6.3	570.2
Portugal	85.1	1.8	46.9	0.1	0.5	7.3	1.4	21.8	4.8	9.0	0.1	3.8	13.7	12.4	2.2	210.9
Romania	78.4	9.9	47.0	0.03	0.2	8.4	1.7	31.5	14.8	10.2	0.6	30.9	17.4	12.7	1.5	265.4
Slovakia	3.8	0.1	2.1	0.1	0.1	1.7	0.2	1.0	0.1	0.9	0.01	0.4	0.3	0.9	0.5	12.2
Slovenia	0.5	0.1	2.9	0.02	0.03	0.5	0.1	0.1	0.02	0.5	0.01	0.4	0.03	0.1	0.05	5.4
Spain	883.3	26.7	694.6	0.4	2.3	280.3	54.1	131.7	115.5	64.2	5.7	206.5	165.6	70.0	24.2	2,724.9
Sweden	0.5	0.1	6.3	0.01	0.002	1.6	0.3	0.3	0.01	0.02	0.04	0.3	0.1	0.2	0	9.8
Switzerland[4]	8.3	0.2	8.9	0.1	0.1	13.1	0.8	2.0		0.3	0	3.2	0.4		0.1	37.6
United Kingdom	115.4	4.3	67.2	0.7	1.1	54.9	10.8	28.5	3.4	1.7	0	19.3	0.1	11.0	3.4	321.7
Total 30 countries	**2,521.0**	**99.7**	**2,009.8**	**7.3**	**12.4**	**897.9**	**148.3**	**546.6**	**237.5**	**167.9**	**30.9**	**399.3**	**397.2**	**218.3**	**93.1**	**7,787.1**

[1] For the countries where injectable 3rd- and 4th-gen. cephalosporins are almost solely marketed for dogs and cats, the data provides a considerable overestimate for food-producing animals.
[2] Bacitracin, fosfomycin, furaltadone, metronidazole, novobiocin, paromomycin, rifaximin and spectinomycin (classified as 'Other antibacterials' in the ATCvet system).
[3] Polymyxins and pleuromutilins are aggregated with 'Others' for commercial confidentiality reasons.
[4] For reasons of confidentiality, pleuromutilins are grouped with others and lincosamides are grouped with macrolides.

Table A2. Distribution of sales, in mg/PCU, of veterinary antimicrobial agents applicable mainly for food-producing animals[1], by administration route/form and country, for 2016

Country	Premix	Oral powder	Oral solution	Injectable prep.	Oral paste	Bolus	Intramammary prep.	Intrauterine prep.	Total mg/PCU
Austria	2.0	35.6	1.0	5.9	0.3	0	1.2	0.1	46.1
Belgium	21.0	101.1	3.7	13.7	0	0.1	0.4	0.2	140.1
Bulgaria	65.6	14.6	64.4	9.9	0	0	0.8	0.1	155.3
Croatia	9.3	33.7	28.8	19.1	0	0.92	0.7	0.37	92.9
Cyprus	358.7	58.3	16.4	19.1	0.1	0.2	0.7	0.01	453.4
Czech Republic	9.3	14.7	27.4	8.3	0.02	0.05	1.1	0.5	61.2
Denmark	0.6	4.2	20.0	15.2	0.5	0.01	0.2	0.1	40.8
Estonia	0	42.8	1.4	18.1	0	0	1.5	0.2	64.0
Finland	2.9	4.4	0.02	9.7	1.1	0	0.5	0	18.6
France	27.9	1.0	28.9	12.9	0.1	0.1	1.0	0.1	71.9
Germany	0.1	42.0	39.4	6.2	0.2	0.01	0.7	0.6	89.2
Greece	33.3	0	21.3	8.8	0.001	0	0.1	0	63.5
Hungary	96.1	39.7	44.4	6.4	0.005	0	0.2	0.2	187.1
Iceland	0.01	0.1	0.1	4.0	0.1	0	0.3	0.1	4.7
Ireland	17.6	7.7	9.8	14.2	0.03	0.3	2.5	0.01	52.1
Italy	116.8	43.7	116.3	17.1	0.2	<0.001	0.5	0.2	294.8
Latvia	0.002	6.4	9.6	11.2	0.003	0	1.3	1.4	29.9
Lithuania	0.2	20.3	5.9	7.7	0	1.3	2.1	0.2	37.7
Luxembourg	0.01	15.0	6.9	12.2	0.2	0.1	0.9	0.3	35.5
Netherlands	0.4	2.7	40.6	8.1	0.3	0.04	0.5	0.1	52.7
Norway	0.1	0.1	0.1	1.8	0.7	0	0.1	0.1	2.9
Poland	8.4	0.5	105.9	11.9	0	0	2.5	0.2	129.4
Portugal	123.3	10.1	62.7	11.3	0.005	0	0.5	0.04	208.0
Romania	7.8	0.6	63.9	12.7	0	0.1	0.1	0.1	85.2
Slovakia	9.9	2.6	28.6	8.5	0.01		0.7	0.1	50.4
Slovenia	0.3	10.7	9.3	8.7	0	0	1.0	0.4	30.3
Spain	248.2	0	98.5	15.6	0.01	<0.001	0.1	0.01	362.5
Sweden	0.3	0.1	0.9	9.2	1.5	0	0.2	0.001	12.1
Switzerland	26.0	5.6	0.1	10.3	0.5	0	3.2	0.9	46.6
United Kingdom[2]	20.7	4.5	9.0	10.0	0.1	0.2	0.5		45.0

[1] Injectable antimicrobial VMPs included are also used in companion animals; tablets not included.
[2] For commercial confidentiality reasons intrauterine prep. are aggregated with intramammary prep.

Table A3. Percentage of sales, in mg/PCU, of premixes by veterinary antimicrobial class (according to ATCvet system) by country, for 2016[1,2]

Country	Tetracyclines	Amphenicols	Penicillins	Sulfonamides	Trimethoprim	Macrolides	Lincosamides	Quinolones	Aminoglycosides	Polymyxins	Pleuromutilins	Others[3]	Total mg/PCU premixes
Austria	33%	0%	0%	0%	0%	43%	10%	0%	0%	1%	3%	10%	2.0
Belgium	14%	1%	29%	40%	8%	4%	0.3%	0%	0.1%	1%	1%	0.3%	21.0
Bulgaria	78%	6%	0%	2%	0%	10%	0%	0%	0%	3%	1%	0%	65.6
Croatia	50%	6%	0%	25%	0%	5%	0.4%	0.02%	12%	0%	0%	0.2%	9.3
Cyprus	36%	1%	17%	13%	3%	4%	17%	0%	0%	3%	7%	0.05%	358.7
Czech Republic	33%	0.05%	17%	14%	3%	20%	0.5%	0%	0%	2%	9%	3%	9.3
Denmark	0%	0%	2%	55%	11%	0%	1%	31%	0%	0%	0%	0.1%	0.6
Finland	57%	5%	0%	11%	2%	22%	3%	0%	0%	0%	0%	0%	2.9
France	50%	0%	4%	26%	4%	4%	0.4%	0.1%	7%	2%	1%	0.1%	27.9
Germany	72%	0%	7%	0%	0%	0.1%	0%	0%	0%	2%	19%	0%	0.1
Greece	58%	0.5%	20%	14%	2%	1%	0.2%	2%	0.1%	1%	1%	0.1%	33.3
Hungary	60%	0.5%	11%	2%	0.4%	4%	2%	0%	0%	10%	6%	3%	96.1
Iceland	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.01
Ireland[4]	73%	0.01%	0.3%	16%	3%	7%	0.2%	0%	0.5%			0.6%	17.6
Italy	43%	1%	20%	13%	1%	5%	6%	1%	1%	5%	5%	1%	116.8
Latvia	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0.002
Lithuania	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0.2
Luxembourg	0%	0%	0%	0%	0%	0%	50%	0%	0%	0%	0%	50%	0.01
Netherlands	76%	0%	0%	15%	3%	6%	0%	0%	0%	0%	0%	0%	0.4
Norway	0%	67%	0%	0%	0%	0%	0%	33%	0%	0%	0%	0%	0.1
Poland	25%	0.1%	13%	44%	0%	11%	1%	0%	0%	2%	5%	0%	8.4
Portugal	50%	0.4%	13%	4%	1%	12%	0.4%	0%	1%	9%	9%	1%	123.3
Romania	40%	3%	6%	1%	0.3%	2%	0.3%	2%	2%	2%	40%	1%	7.8
Slovakia	77%	0.1%	1%	0.3%	0.05%	5%	0.1%	0%	0%	2%	14%	0.1%	9.9
Slovenia	7%	11%	0%	4%	0%	15%	31%	0%	0%	0%	0%	31%	0.3
Spain	37%	0.2%	24%	13%	2%	5%	3%	0.01%	7%	6%	3%	1%	248.2
Sweden	7%	13%	0%	0%	0%	48%	0%	16%	0%	0%	16%	0%	0.3
Switzerland[5]	32%	0%	16%	39%	2%	8.1%		0%	0%	2%		0.5%	26.0
United Kingdom	51%	0.4%	9%	16%	3%	13%	0.5%	0%	1%	0%	5%	0.3%	20.7

[1] Negligible amount of fluoroquinolones is included in the table together with other quinolones.
[2] No sales of premixes were reported in Estonia.
[3] Bacitracin, metronidazole, paromomycin and spectinomycin (classified as 'Other antibacterials' in the ATCvet system).
[4] Polymyxins and pleuromutilins are aggregated with 'Others' for commercial confidentiality reasons.
[5] For reasons of confidentiality, pleuromutilins are grouped with others and lincosamides are grouped with macrolides.

Table A4. Percentages of sales, in mg/PCU, of oral powders by antimicrobial class (according to ATCvet system) by country, for 2016[1,2]

Country	Tetracyclines	Penicillins	Sulfonamides	Trimethoprim	Macrolides	Lincosamides	Quinolones	Aminoglycosides	Polymyxins	Pleuromutilins	Others[3]	Total mg/PCU oral powders
Austria	68%	14%	7%	1%	5%	0%	0%	0.3%	4%	1%	0.1%	35.6
Belgium	25%	35%	21%	4%	6%	2%	0.4%	0.02%	2%	0.4%	4%	101.1
Bulgaria	56%	32%	7%	0.1%	<0.001%	0.02%	3%	1%	1%	0.03%	0.005%	14.6
Croatia	60%	29%	3%	2%	0%	0%	1%	0%	5%	0%	0%	33.7
Cyprus	78%	13%	0%	0%	4%	1%	1%	0%	2%	0%	3%	58.3
Czech Republic	77%	2%	10%	1%	3%	0%	0%	2%	0.1%	5%	0%	14.7
Denmark	54%	0.4%	18%	4%	11%	0%	5%	0.3%	0%	7%	1%	4.2
Estonia	31%	50%	2%	0.3%	1%	0.1%	0%	0%	2%	14%	0.2%	42.8
Finland	20%	12%	50%	10%	7%	0%	0%	0%	0%	1%	0.1%	4.4
France	49%	25%	0%	0%	0%	0%	0%	0%	0%	0%	26%	1.0
Germany	24%	54%	14%	2%	1%	0.5%	0%	0.02%	2%	2%	0.04%	42.0
Hungary	42%	36%	2%	0.3%	5%	3%	0.4%	2%	1%	9%	1%	39.7
Iceland	10%	60%	0%	0%	0%	0%	0%	30%	0%	0%	0%	0.1
Ireland	66%	7%	24%	1%	0%	1%	0%	<0.001%	0%	0%	0%	7.7
Italy	28%	18%	3%	0%	41%	4%	0.1%	0.3%	3%	2%	1%	43.7
Latvia	25%	52%	5%	1%	12%	0%	0%	0%	5%	0.4%	0%	6.4
Lithuania	18%	36%	26%	6%	0%	4%	0%	0%	5%	0.2%	5%	20.3
Luxembourg	78%	2%	9%	2%	0.1%	1%	0.1%	0.2%	6%	1%	1%	15.0
Netherlands	31%	30%	30%	6%	2%	0.4%	0%	0%	2%	0%	0%	2.7
Norway	37%	0%	53%	11%	0%	0%	0%	0%	0%	0%	0%	0.1
Poland	0.02%	0%	75%	15%	9%	0%	0%	0%	0%	0%	0%	0.5
Portugal	17%	71%	9%	2%	1%	0%	0%	0%	0%	0.1%	0%	10.1
Romania	26%	21%	0%	0%	0.001%	0%	0%	6%	0%	0%	47%	0.6
Slovakia	49%	0.1%	21%	1%	0%	0%	0%	24%	5%	0%	0%	2.6
Slovenia	4%	85%	8%	2%	0%	0%	0%	0%	0%	0%	1%	10.7
Sweden	45%	0%	45%	9%	0%	0%	0%	0%	0%	0%	0%	0.1
Switzerland	0.05%	0%	85%	7%	0%	0%	0%	8%	0%	0%	0%	5.6
United Kingdom	12%	1%	72%	14%	0%	0%	0%	0%	0%	0%	<0.001%	4.5

[1] Negligible amount of amphenicols, fluoroquinolones and 1st- and 2nd-gen. cephalosporins sold is included with other antibacterials.
[2] No sales of oral powders were reported in Greece and Spain.
[3] Bacitracin, furaltadone, metronidazole, paromomycin and spectinomycin (classified as 'Other antibacterials' in the ATCvet system).

Table A5. Percentage of sales, in mg/PCU, of oral solutions by antimicrobial class (according to ATCvet system) by country, for 2016

Country	Tetracyclines	Amphenicols	Penicillins	Sulfonamides	Trimethoprim	Macrolides	Lincosamides	Fluoroquinolones	Other quinolones	Aminoglycosides	Polymyxins	Pleuromutilins	Others[1]	Total mg/PCU oral solutions
Austria	23%	1%	0%	36%	7%	0%	2%	16%	0%	0%	5%	5%	4%	1.0
Belgium	3%	0%	0.1%	47%	9%	32%	0.04%	7%	0%	0%	0.3%	0%	0.3%	3.7
Bulgaria	15%	5%	47%	7%	2%	8%	6%	7%	0.003%	0.5%	1%	2%	1%	64.4
Croatia	25%	2%	51%	5%	1%	3%	0.09%	3%	0%	0%	7%	4%	0.2%	28.8
Cyprus	11%	0.2%	8%	52%	9%	6%	0%	7%	1%	0%	2%	3%	0%	16.4
Czech Republic	18%	0.4%	36%	25%	2%	3%	0.2%	5%	0.1%	0.05%	2%	7%	0.4%	27.4
Denmark	35%	0.1%	15%	2%	0.4%	20%	2%	0.01%	0%	1%	3%	17%	5%	20.0
Estonia	36%	14%	0%	0.1%	0.02%	7%	0%	23%	0%	0%	0%	0%	19%	1.4
Finland	13%	0%	0%	8%	2%	0%	0%	1%	0%	0%	0%	76%	0%	0.02
France	34%	0.2%	14%	24%	4%	9%	1%	1%	1%	4%	7%	1%	1%	28.9
Germany	32%	0.1%	24%	2%	0.2%	14%	2%	1%	0%	4%	18%	1%	2%	39.4
Greece	12%	0.2%	23%	8%	2%	11%	1%	10%	20%	8%	4%	0.1%	1%	21.3
Hungary	3%	5%	49%	9%	2%	2%	1%	21%	0%	0%	5%	3%	0.1%	44.4
Iceland	0%	0%	100%	0%	0%	0%	0%	0.3%	0%	0%	0%	0%	0%	0.1
Ireland[2]	3%	0.5%	31%	48%	0.2%	7%	2%	1%	0%	3%			4.9%	9.8
Italy	26%	2%	31%	15%	3%	4%	5%	1%	1%	0.3%	7%	1%	3%	116.3
Latvia	41%	0.2%	0%	1%	0.1%	16%	0%	5%	0.1%	0.3%	6%	31%	0%	9.6
Lithuania	0%	0.5%	5%	19%	5%	46%	0%	13%	1%	0%	0.03%	10%	0%	5.9
Luxembourg	1%	0.1%	5%	39%	7%	8%	6%	1%	0.1%	0.002%	0.1%	0%	34%	6.9
Netherlands	42%	0.01%	16%	17%	3%	16%	0.04%	0.2%	2%	0.5%	1%	1%	0.4%	40.6
Norway	2%	0%	57%	0%	0%	0%	0%	0.2%	0%	15%	0%	26%	0%	0.1
Poland	36%	0.4%	29%	5%	1%	7%	1%	8%	0.03%	1%	5%	6%	1%	105.9
Portugal	30%	0.2%	31%	2%	0.2%	10%	7%	13%	0.1%	0.1%	4%	2%	2%	62.7
Romania	31%	2%	18%	3%	1%	15%	7%	4%	0.3%	10%	9%	1%	0.2%	63.9
Slovakia	20%	0.1%	17%	19%	2%	12%	1%	12%	0.1%	0%	3%	8%	7%	28.6
Slovenia	9%	2%	44%	10%	2%	0%	0.2%	23%	0.3%	0%	1%	6%	0.4%	9.3
Spain	26%	0.5%	30%	6%	1%	4%	8%	6%	1%	9%	7%	1%	1%	98.5
Sweden	27%	0%	15%	0.5%	0.1%	17%	0.2%	0.2%	0%	7%	10%	23%	0%	0.9
Switzerland	0%	0%	0%	0%	0%	0%	0%	98%	0%	0%	2%	0%	0%	0.1
United Kingdom	25%	1%	46%	4%	1%	8%	4%	1%	0%	2%	0.2%	5%	4%	9.0

[1] Bacitracin, fosfomycin, furaltadone, metronidazole, paromomycin and spectinomycin (classified as 'Other antibacterials' in the ATCvet system).
[2] Polymyxins and pleuromutilins are aggregated with 'Others' for reasons of commercial confidentiality.

Table A6. Percentage of sales, in mg/PCU, of injection preparations by antimicrobial class (according to ATCvet system) by country, for 2016

Country	Tetracyclines	Amphenicols	Penicillins	1st- and 2nd-gen. cephalosporins	3rd- and 4th-gen. cephalosporins[1]	Sulfonamides	Trimethoprim	Macrolides	Lincosamides	Quinolones[2]	Aminoglycosides	Polymyxins	Pleuromutilins	Others[3]	Total mg/PCU injection prep.
Austria	9%	6%	39%	0%	3%	9%	2%	7%	1%	6%	18%	0%	0.03%	1%	5.9
Belgium	4%	10%	59%	1%	2%	4%	1%	4%	3%	2%	3%	0.1%	0.02%	6%	13.7
Bulgaria	33%	5%	15%	0.1%	1%	5%	1%	12%	2%	4%	20%	0.02%	0.4%	2%	9.9
Croatia	8%	12%	27%	2%	1%	15%	2%	5%	0.3%	10%	17%	0.001%	0.2%	0.6%	19.1
Cyprus	14%	6%	33%	0%	2%	8%	1%	1%	1%	3%	27%	0.2%	1%	3%	19.1
Czech Republic	18%	3%	43%	2%	5%	4%	1%	3%	0.3%	3%	17%	0%	1%	0.1%	8.3
Denmark	13%	3%	52%	0%	0.04%	13%	3%	2%	3%	0.01%	7%	0%	2%	1%	15.2
Estonia	8%	1%	52%	0.5%	4%	4%	1%	1%	1%	5%	17%	0%	4%	2%	18.1
Finland	14%	0.3%	77%	<0.001%	0.06%	5%	1%	0.4%	0.5%	2%	0.3%	0%	0%	0%	9.7
France	11%	6%	33%	0.1%	0.4%	6%	1%	10%	1%	1%	30%	1%	0.02%	1%	12.9
Germany	4%	8%	43%	0%	5%	11%	2%	5%	2%	10%	7%	0.02%	0.2%	2%	6.2
Greece	37%	1%	22%	0%	1%	7%	1%	4%	1%	2%	21%	0.03%	0%	3%	8.8
Hungary	8%	9%	40%	1%	6%	2%	0.5%	4%	1%	8%	19%	0.2%	1%	1%	6.4
Iceland	5%	0%	81%	0%	0.03%	7%	1%	0%	0%	0.2%	5%	0%	0%	0%	4.0
Ireland[4]	20%	8%	34%	0.4%	1%	4%	1%	10%	0.3%	3%	18%			0.3%	14.2
Italy	12%	10%	24%	0%	2%	11%	1%	8%	3%	4%	18%	0.5%	1%	7%	17.1
Latvia	7%	0.4%	43%	0.3%	2%	8%	2%	3%	0.3%	3%	29%	0%	1%	1%	11.2
Lithuania	9%	5%	40%	1%	2%	9%	1%	6%	2%	3%	18%	0%	4%	1%	7.7
Luxembourg	10%	10%	46%	0.004%	5%	10%	2%	2%	1%	6%	6%	0.2%	0%	2%	12.2
Netherlands	17%	17%	38%	0%	0.01%	18%	4%	2%	0%	0.1%	4%	0.1%	0.1%	0%	8.1
Norway	2%	1%	84%	0%	0.02%	6%	1%	0.1%	0%	0.3%	5%	0%	0.1%	0%	1.8
Poland	9%	9%	32%	0.4%	1%	2%	0.3%	2%	2%	10%	29%	0.1%	1%	1%	11.9
Portugal	22%	10%	24%	1%	3%	4%	1%	6%	1%	7%	19%	0.1%	1%	2%	11.3
Romania	18%	14%	24%	0.1%	1%	3%	1%	3%	3%	6%	27%	0.1%	0.2%	1%	12.7
Slovakia	16%	2%	41%	3%	4%	12%	2%	2%	0.3%	4%	12%	0%	2%	1%	8.5
Slovenia	9%	5%	33%	1%	2%	13%	2%	3%	0.1%	9%	24%	0.1%	0%	0.1%	8.7
Spain	5%	16%	24%	0.1%	2%	2%	0.4%	10%	3%	18%	16%	0.2%	0.3%	3%	15.6
Sweden	3%	0.5%	82%	0.1%	0.03%	9%	2%	1%	0.1%	0.2%	2%	0%	0.2%	0%	9.2
Switzerland[5]	10%	3%	42%	0%	1%	8%	1%	3%		3%	29%	0.01%		0.5%	10.3
United Kingdom	26%	5%	31%	0.2%	1%	5%	1%	5%	0.5%	1%	23%	0%	0.1%	0.03%	10.0

[1] For the countries where the injectable 3rd- and 4th-gen. cephalosporins are almost solely marketed for dogs and cats the data provide a considerable overestimate for food-producing animals.
[2] Negligible amount of other quinolones is included together with fluoroquinolones.
[3] Spectinomycin (classified as 'Other antibacterials' in the ATCvet system).
[4] Polymyxins and pleuromutilins are aggregated with 'Others' for reasons of commercial confidentiality.
[5] For reasons of confidentiality, pleuromutilins are grouped with others and lincosamides are grouped with macrolides

Table A7. Number of product presentations (product name, form, strength and pack size) containing 1, 2 and 3 antimicrobial agents sold, by country, for 2016 (tablets excluded from the data)

Country	1 ingredient	2 ingredients	3 ingredients	Total number[1]
Austria	210	31	5	246
Belgium	307	44	5	356
Bulgaria	197	41	4	242
Croatia	126	28	3	162
Cyprus	123	31	3	157
Czech Republic	367	69	10	450
Denmark	211	53	6	270
Estonia	113	23	5	141
Finland	74	17	1	92
France	537	151	8	696
Germany	503	74	5	582
Greece	198	57	1	256
Hungary	330	50	7	388
Iceland	27	5	2	34
Ireland	241	47	7	296
Italy	597	114	11	723
Latvia	139	33	9	182
Lithuania	97	30	5	132
Luxembourg	216	55	7	278
Netherlands	183	43	3	229
Norway	47	17	2	66
Poland	378	65	9	453
Portugal	469	73	9	551
Romania	413	91	8	515
Slovakia	290	49	9	350
Slovenia	99	28	3	131
Spain	489	69	4	562
Sweden	90	22	1	113
Switzerland	128	41	37	206
United Kingdom	304	36	4	345
Total 30 countries	**7,504**	**1,487**	**193**	**9,205**

[1] In addition, 21 presentations contained 4 active ingredients (these are included in the total number), accounting for 0.2% of the product presentations in the 30 countries.

Table A8. Number of product presentations (product name, form, strength and pack size) of premixes, oral powders and oral solutions sold containing 1, 2 and 3 antimicrobial agents sold, by country, for 2016[1]

Country	1 ingredient	2 ingredients	3 ingredients	Total number of product presentations for premixes, oral powders and oral solutions
Austria	70	10	2	82
Belgium	113	21		134
Bulgaria	113	14		127
Croatia	46	11		60
Cyprus	51	15		66
Czech Republic	177	37	2	216
Denmark	86	11		97
Estonia	25	3		28
Finland	21	5		26
France	291	77		368
Germany	223	32		255
Greece	95	24		119
Hungary	189	23		212
Iceland	6			6
Ireland	74	12		86
Italy	316	61	6	384
Latvia	33	4		37
Lithuania	32	6		38
Luxembourg	71	23		94
Netherlands	78	16		94
Norway	12	2		14
Poland	197	25		222
Portugal	187	23		210
Romania	233	37	4	276
Slovakia	112	23	5	140
Slovenia	32	13		45
Spain	260	18		278
Sweden	24	2		26
Switzerland	41	12	28	81
United Kingdom	126	13		139
Total 30 countries	**3,334**	**573**	**47**	**3,960**

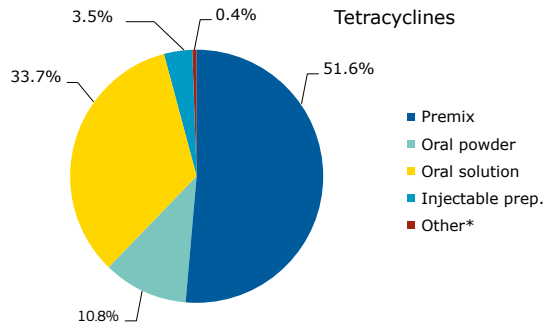
[1] In addition, 6 preparations contained 4 active ingredients (these are included in the total number), accounting for 0.2% of the product presentations for premixes, oral powders and oral solutions in the 30 countries.

Table A9. Sales, in tonnes of active ingredient, of antimicrobial agents sold as premixes, oral powders and oral solutions containing 1, 2 and 3 active ingredients, by country, for 2016[1]

Country	Presentations with 1 ingredient		Presentations with 2 ingredients		Presentations with 3 ingredients		Tonnes (premixes, oral powders and oral solutions)
	Tonnes	%	Tonnes	%	Tonnes	%	
Austria	33.3	90%	3.5	9%	0.1	0.3%	36.9
Belgium	143.7	67%	72.0	33%	0	0%	215.7
Bulgaria	51.8	91%	5.0	9%	0	0%	56.8
Croatia	17.5	85%	1.5	7%	0	0%	20.5
Cyprus	34.0	77%	10.2	23%	0	0%	44.3
Czech Republic	29.7	82%	6.0	17%	0.4	1%	36.2
Denmark	52.9	88%	7.0	12%	0	0%	59.8
Estonia	4.9	98%	0.1	2%	0	0%	5.0
Finland	2.2	59%	1.6	41%	0	0%	3.8
France	302.7	73%	110.0	27%	0	0%	412.6
Germany	651.5	92%	60.2	8%	0	0%	711.8
Greece	58.6	85%	10.1	15%	0	0%	68.7
Hungary	137.9	92%	11.9	8%	0	0%	149.9
Iceland	0.03	100%	0	0%	0	0%	0.03
Ireland	57.5	84%	11.3	16%	0	0%	68.8
Italy	802.3	70%	317.6	28%	19.3	2%	1,139.4
Latvia	2.8	97%	0.1	3%	0	0%	2.9
Lithuania	5.8	65%	3.1	35%	0	0%	8.9
Luxembourg	0.9	78%	0.3	22%	0	0%	1.2
Netherlands	121.0	80%	29.6	20%	0	0%	150.6
Norway	0.5	88%	0.1	12%	0	0%	0.5
Poland	456.3	90%	49.4	10%	0	0%	505.7
Portugal	175.7	88%	23.2	12%	0	0%	198.9
Romania	212.0	94%	12.3	5%	0.8	0.4%	225.1
Slovakia	7.4	74%	2.3	23%	0.3	3%	9.9
Slovenia	3.1	85%	0.5	15%	0	0%	3.6
Spain	2,211.9	85%	394.5	15%	0	0%	2,606.4
Sweden	1.0	97%	0.04	3%	0	0%	1.1
Switzerland	6.4	25%	6.2	24%	13.0	51%	25.6
United Kingdom	179.7	74%	64.1	26%	0	0%	243.7
Total 30 countries	**5,765.1**	**82.19%**	**1,213.7**	**17.30%**	**33.9**	**0.48%**	**7,014.5**

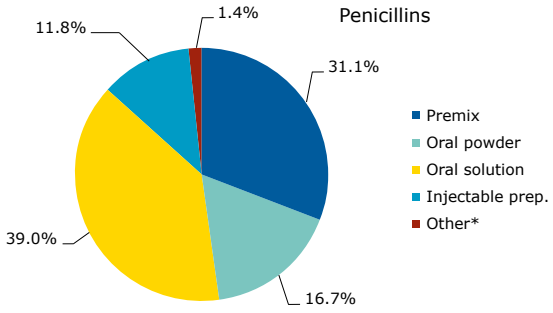
[1] In addition, 0.03% of the total sales of premixes, oral powders and oral solutions preparations contained 4 active ingredients, accounting for 1.8 tonnes (which is included in the total tonnes of premixes, oral powders and oral solutions).

Figure A1. Distribution of sales of tetracyclines for food-producing animals, in mg/PCU, by the major pharmaceutical forms sold, aggregated by the 30 European countries, for 2016



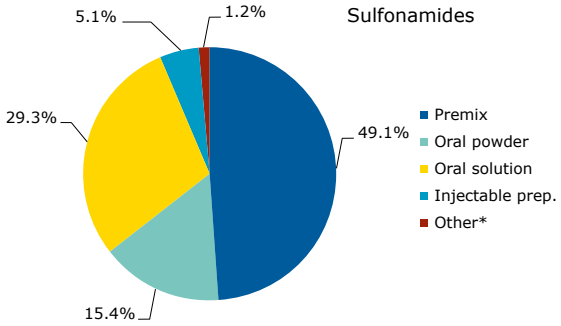
*Other forms include boluses, oral pastes, intramammary and intrauterine preparations.

Figure A2. Distribution of sales of penicillins for food-producing animals, in mg/PCU, by the major pharmaceutical forms sold, aggregated by the 30 European countries, for 2016



*Other forms include boluses, oral pastes, intramammary and intrauterine preparations.

Figure A3. Distribution of sales of sulfonamides for food-producing animals, in mg/PCU, by the major pharmaceutical forms sold, aggregated by the 30 European countries, for 2016



*Other forms include boluses, oral pastes, intramammary and intrauterine preparations.

Figure A4. Distribution of sales of 3rd- and 4th-generation cephalosporins for food-producing animals, in mg/PCU, by the major pharmaceutical forms sold, aggregated by the 30 European countries, for 2016

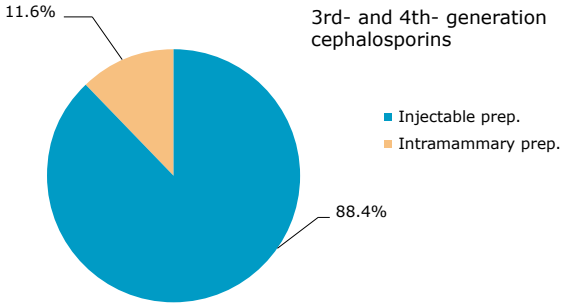
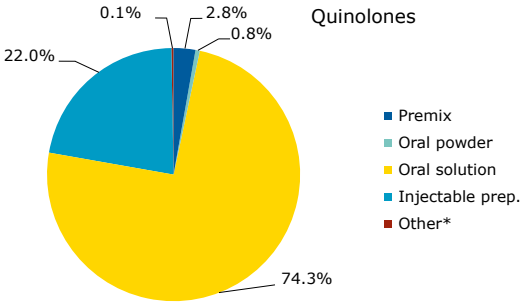
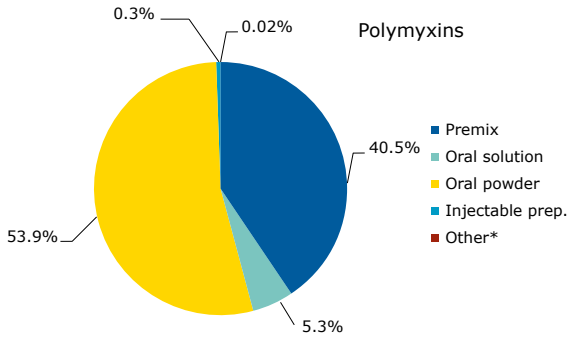


Figure A5. Distribution of sales of quinolones for food-producing animals, in mg/PCU, by the major pharmaceutical forms sold, aggregated by the 30 European countries, for 2016



*Other forms include boluses, oral pastes, intramammary and intrauterine preparations.

Figure A6. Distribution of sales of polymyxins for food-producing animals, in mg/PCU, by the major pharmaceutical forms sold, aggregated by the 30 European countries, for 2016



*Other forms include boluses and intramammary preparations.

Figure A7. Distribution of sales of macrolides for food-producing animals, in mg/PCU, by the major pharmaceutical forms sold, aggregated by the 30 European countries, for 2016

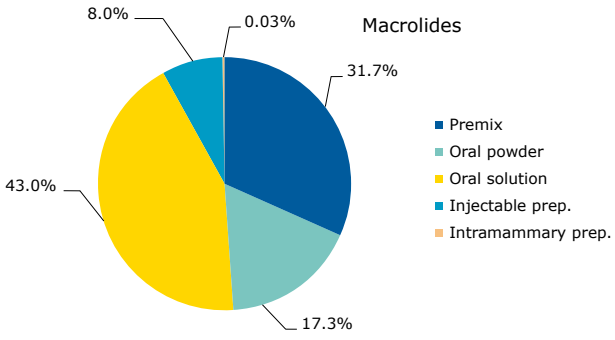
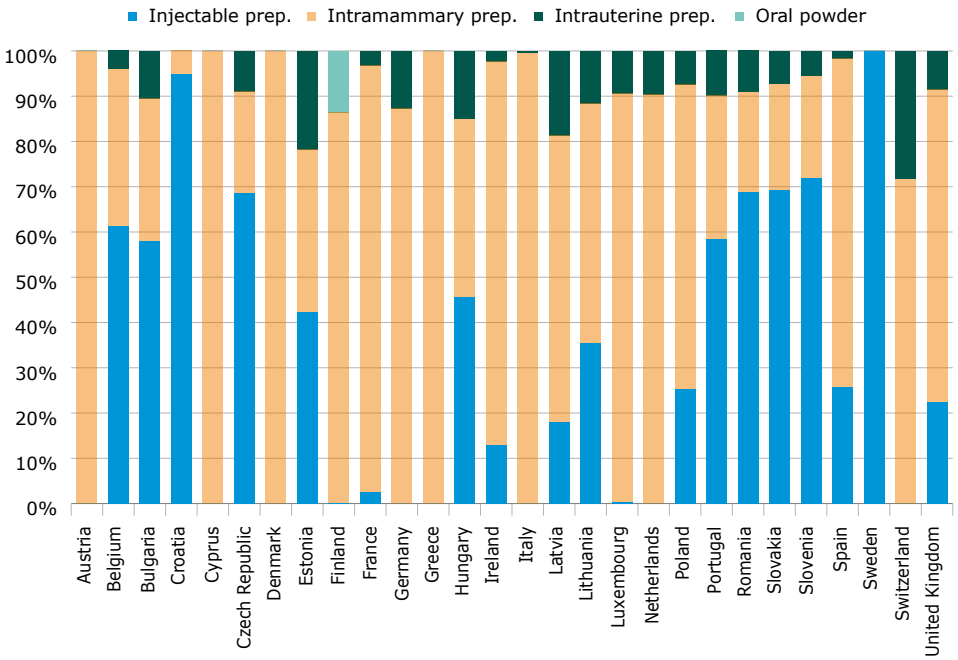


Figure A8. Spatial distribution of sales of 1st- and 2nd-generation cephalosporins, in mg/PCU, by country, for 2016[1]

[1] No sales in Iceland and Norway; negligible amounts (≤1 kg) were sold in Greece.

Figure A9. Distribution of sales by pharmaceutical form for 1st- and 2nd-generation cephalosporins, in mg/PCU, by country, for 2016[1,2]



[1] No sales in Iceland and Norway; negligible amounts (≤1 kg) were sold in Greece.
[2] For countries where the oral forms of 1st- and 2nd-generation cephalosporins are only marketed for dogs and cats, the data provide a considerable overestimate for food-producing animals.

Figure A10. Spatial distribution of sales of aminoglycosides, in mg/PCU, by country, for 2016

Figure A11. Distribution of sales by pharmaceutical form for aminoglycosides, in mg/PCU, by country, for 2016

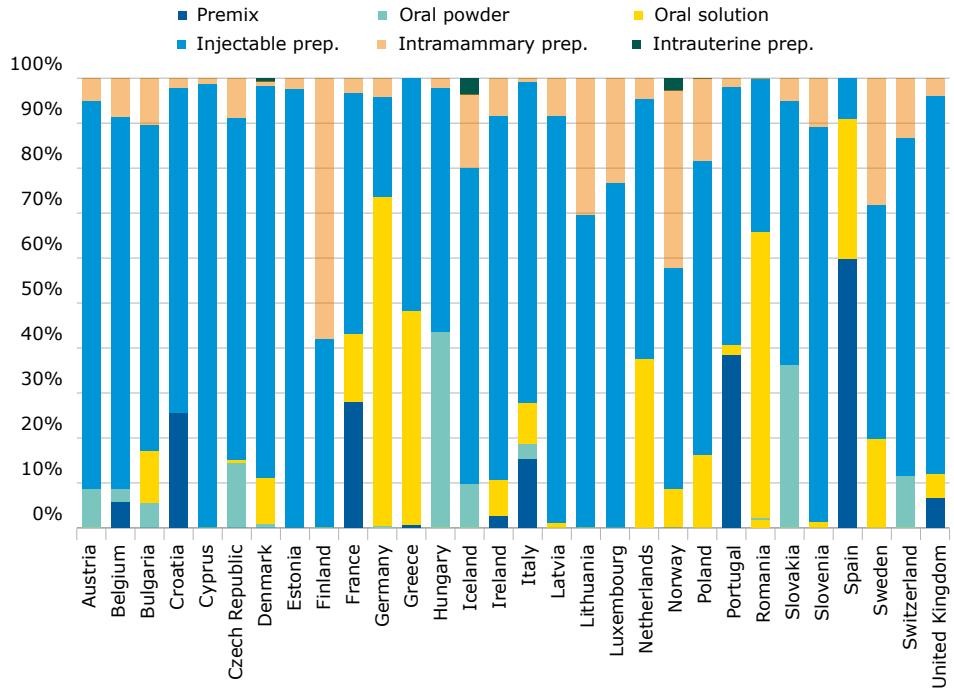
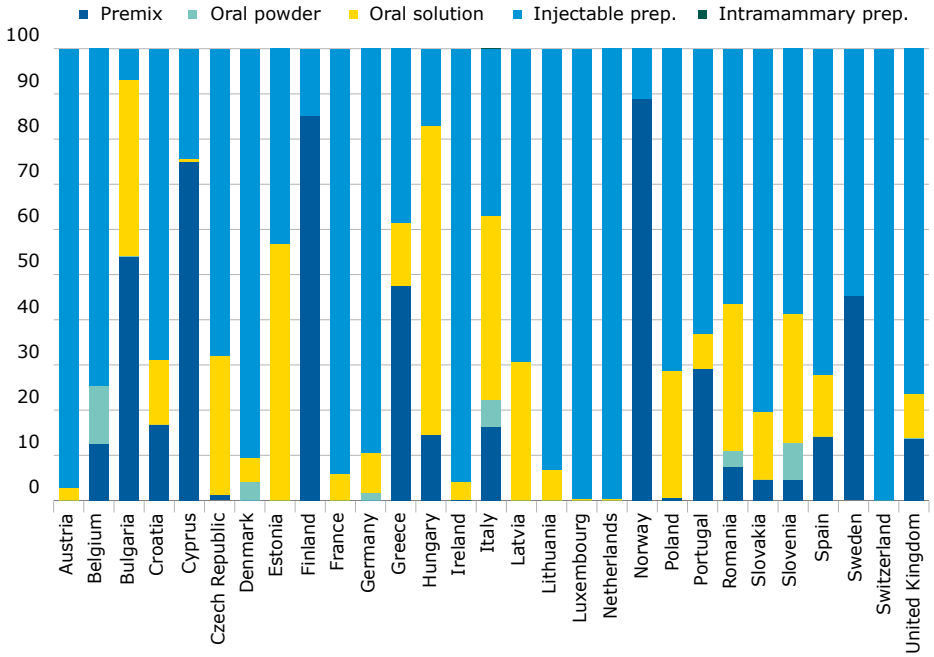


Figure A12. Spatial distribution of sales of amphenicols, in mg/PCU, by country, for 2016[1]

[1] No sales in Iceland.

Figure A13. Distribution of sales by pharmaceutical form of amphenicols, in mg/PCU, by country, for 2016[1]

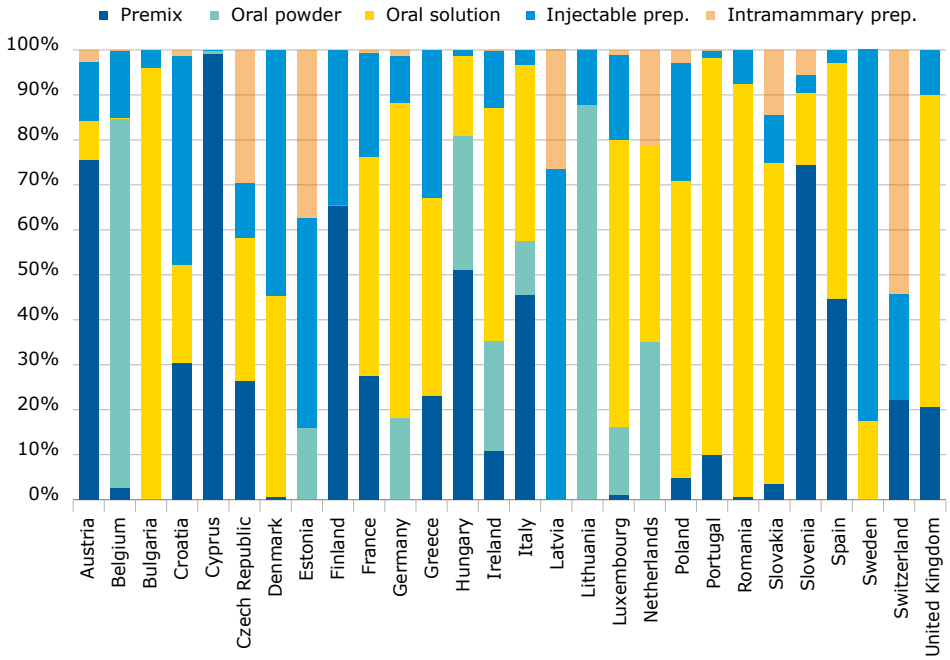


[1] No sales in Iceland.

Figure A14. Spatial distribution of sales of lincosamides, in mg/PCU, by country, for 2016[1]

[1] No sales in Iceland and Norway.

Figure A15. Distribution of sales by pharmaceutical form for lincosamides, in mg/PCU, by country, for 2016[1]

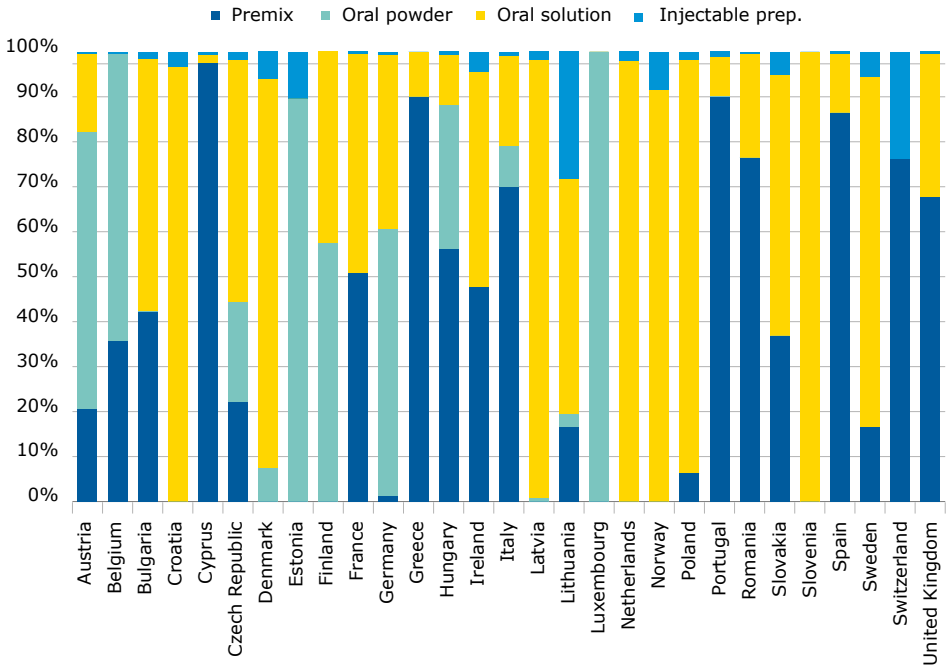


[1] No sales in Iceland and Norway.

Figure A16. Spatial distribution of sales of pleuromutilins, in mg/PCU, by country, for 2016[1]

[1] No sales in Iceland.

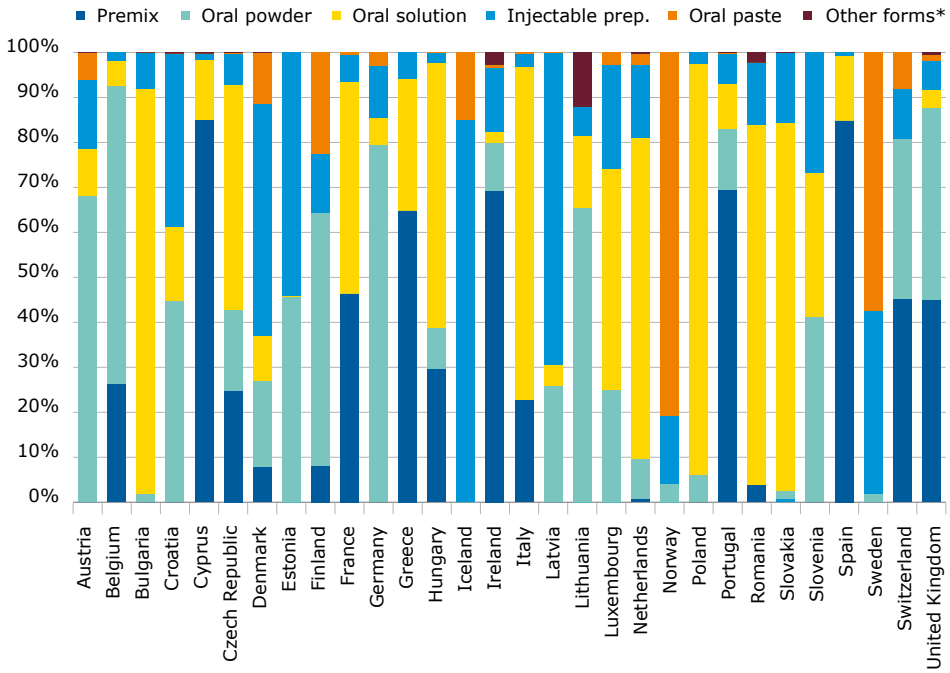
Figure A17. Distribution of sales by pharmaceutical form for pleuromutilins, in mg/PCU, by country, for 2016[1]



[1] No sales in Iceland.

Figure A18. Spatial distribution of sales of trimethoprim, in mg/PCU, by country, for 2016

Figure A19. Distribution of sales by pharmaceutical form for trimethoprim, in mg/PCU, by country, for 2016



*Other forms include negligible amounts sold as intramammary preparations and/or boluses in some countries.

Annex 2. Variables to be reported or used for calculation of active ingredient for each antimicrobial veterinary medicinal product; standardisation of the data

Table A10. Variables reported to the ESVAC for each antimicrobial veterinary medicinal product, for 2016

	Variable	Description of variable	Justification
	COUNTRY	**ISO code** (http://www.iso.org/iso/country_codes)	To identify place of collected sales data.
	YEAR		To identify time period for collected sales data.
	MA	**Marketing authorisation number**	To allow for the unique identification of the veterinary medicinal product (VMP) and enable a link with other databases. To allow for market analysis if all the products are available.
PRODUCT INFORMATION	**ID**	**Medicinal product package code value** Digit code is a unique identifier for each package size, strength and formulation of the VMP. Because it is a key variable in many databases, it must be stable over time, so that VMPs no longer available on the market or that are no longer registered can still be identified to allow for analysis of historical data.	To allow for analysis of historical data. To allow for identification of duplicate reporting of sales.
	NAME	**Medicinal product name (in national language)** e.g. Harmony vet tablets 2 × 30; Harmony vet long-acting injection 10 ml.	For validation purposes. To allow, for example, for analysis of use of, for example, long-acting preparations and antimicrobial resistance.
	FORM	**Pharmaceutical form** Bolus (BOLUS), Injection (INJ), Intramammary preparation (INTRAMAM), Intramammary preparation dry cow (INTRAMAM-DC), Oral solution (ORAL SOLU), Oral paste (ORAL PASTE), Oral powder (ORAL POWD), Premix (PREMIX), Capsules and Tablets, etc. (TABL), Intrauterine preparation (INTRAUT).	Important to avoid misinterpretation of pharmaceutical form if given in a language other than English. Allows for reporting of data as individual or group treatment.
	LONG ACTING	**Long-acting injectable preparations** This refers to injectable preparations that, once injected, maintain their antimicrobial activity over a long period of time.	Optional.
	PACKSIZE	**Content quantity in package: pack size (numerical only)** e.g. 100 for 100 tablets or 100 intramammary prep.; 10 for 10 ml injection; Package of 2 kg premix: 2; Box of 10 blisters of 30 tablets: 300; Box of 12 injectors: 12.	To allow for calculation of the amount of active ingredient in each package/product.
	PACKSIZEU	**Content unit of measurement** e.g. ML, L, G, KG, PIECE (for example, for tablets, capsules, boluses and intramammary prep.).	To allow for calculation of amount of active ingredient in each package/product.
	ATCvet – 5th LEVEL	**ATCvet: Anatomical Therapeutic Chemical (Classification) Veterinary** WHO ATCvet code last version to be used.	Generally, a classification system needs to have a common language when reporting use and analysing data with data on AMR, e.g. for 3rd- and 4th-generation cephalosporins. To have a common language for defining confidentiality of the data (can be converted into ATCvet 3rd level).

	Variable	Description of variable	Justification
	SPECIES	**Animal species** All the animal species for which the VMP is approved, e.g. cattle (CA), poultry (POU).	Optional.
	NO SOLD	**Number of packages sold/year/country**	To calculate weight of active ingredient sold.
INGREDIENT	**INGR**	**Active ingredient name (ATCvet name)** In case of multi-ingredient VMP, the ATCvet names of all the ingredients must be given.	Important to avoid misinterpretation of ingredient name if given in a language other than English. Use of ATCvet names facilitates the identification of active ingredients as well as standardised reporting.
	SALT	**Salt of active ingredient** E.g. colistin sulfate and colistin methanesulfonate.	Only in cases when the strength is given in IU, IU/ML or IU/UNIT and when different salts exist, to allow for conversion to weight of active ingredient.
	PRODRUG	**Prodrug name (ATCvet name)** E.g. procaine penicillin which is prodrug for benzylpenicillin.	Only in cases when a product contains a prodrug.
	STRENGTH	**Quantity of the active ingredient in each unit as declared in SPC/label: strength (numerical only)** e.g. 10 for 10 MG/TABLET, 10 IU/TABLET, 10 MG/ML, 10 IU/ML, 10 MG/PIECE or 10 IU/PIECE. In case of a multi-ingredient VMP, strength must be given for each ingredient separately.	To allow for calculation of amount of active ingredient in each package/product and to validate INGR CONTENT.
	STRENGTHU	**Unit of measurement for strength** E.g. IU, IU/G, IU/ML, IU/PIECE, G, G/KG, G/L, MG, MG/ML, MG/PIECE. In case of a multi-ingredient VMP, unit of measurement strength has to be given for each ingredient on a separate line.	To allow for calculation of the amount of active ingredient in each package/product and to validate INGR CONTENT.
	CONV FACT IU	**Conversion factor IU** When strength is given in IU, IU/ML or IU/PIECE.	When strength is only given as IU, IU/ML or IU/PIECE. To allow for calculation of weight of the active ingredient in the package.
	CONV FACT PRODR	**Conversion factor prodrug** Used when strength is given for the prodrug and not for the active ingredient (e.g. procaine penicillin that is prodrug for benzylpenicillin).	To allow for calculation of weight of the active ingredient in the package.
	INGR CONTENT	**Content of active ingredient in package** In case of a multi-ingredient VMP, the content in the package has to be given separately for each ingredient on a separate line.	Optional: to allow for validation of the ESVAC calculations.
	CONT UNIT (G)	**Unit of active ingredient in package** To be given in grams (g) for all substances. In case of a multi-ingredient VMP, the content unit has to be given separately for each ingredient on a separate line.	Optional: to allow for validation of the ESVAC calculations.
	TONNES SOLD	**Tonnes sold of active ingredient**	

For antimicrobial veterinary medicinal products containing more than one active ingredient, information on the active ingredient name, strength and strength unit must be given for each ingredient separately.

Table A11. Conversion factors used to convert from International Units (IU) to weight (mg) of active ingredient, based on WHO international standards for antibiotics[1]

Active ingredient	IU/mg	Conversion factor (mg/IU)
Bacitracin	74	0.01351
Benzylpenicillin (and prodrugs to benzylpenicillin)[2]	1,667	0.00060
Chlortetracycline[3]	900	0.00111
Colistin sulphate	20,500	0.00005
Colistin methane sulphonate[4]	12,700	0.00008
Dihydrostreptomycin	820	0.00122
Erythromycin	920	0.00109
Gentamicin	620	0.00161
Kanamycin	796	0.00126
Neomycin	755	0.00133
Framycetin	670	0.00149
Oxytetracycline	870	0.00115
Paromomycin[2]	675	0.00148
Polymyxin B	8,403	0.00012
Spiramycin	3,200	0.00031
Streptomycin	785	0.00127
Tetracycline	982	0.00102
Tobramycin	875	0.00114
Tylosin	1,000	0.00100

[1] WHO ISA (https://crs.edqm.eu/db/4DCGI/search?vSelectName=4&vContains=1&vtUserName=ISA&OK=Search).
[2] Martindale (http://www.medicinescomplete.com/mc/martindale/current/141-b.htm?q=procain%20penicillin&t=search&ss=text&p=2#_hit).
[3] WHO Pharmacopoeia (http://apps.who.int/phint/en/p/docf/).
[4] WHO International Biological Reference Preparations (http://www.who.int/bloodproducts/catalogue/AntiJan10.pdf).

Table A12. Conversion factors used to convert from prodrug content to content of active ingredient[1]

Prodrug	Conversion factor	Active ingredient
Benethamine benzylpenicillin	0.65	Benzylpenicillin
Benzathine benzylpenicillin[2]	0.74	Benzylpenicillin
Cefapirin benzathine	0.41	Cefapirin
Cefalexin benzathine	0.36	Cefalexin
Cloxacillin benzathine	0.43	Cloxacillin
Oxacillin benzathine	0.69	Oxacilline
Penethamate hydriodide	0.63	Benzylpenicillin
Procaine penicillin	0.61	Benzylpenicillin

[1] Martindale (http://www.medicinescomplete.com/mc/martindale/current/141-b.htm?q=procain%20penicillin&t=search&ss=text&p=2#_hit).
[2] Revised (previously 0.39) as an error was identified.

Annex 3. Population correction unit (PCU)

Table A13. Animal categories included in the calculation of the population correction unit (PCU) and data types to be reported

Animal category
Cattle (heads/number of animals)
Slaughtered cows
Slaughtered heifers
Slaughtered bullocks and bulls
Slaughtered calves and young cattle
Slaughtered bovine - Import
Slaughtered bovine - Export
Fattening bovine - Import
Fattening bovine - Export
Living dairy cows
Pigs (heads/number of animals)
Slaughtered pigs
Slaughtered pigs - Import
Slaughtered pigs - Export
Fattening pigs - Import
Fattening pigs - Export
Living sows
Poultry (heads/number of birds)
Slaughtered broilers
Slaughtered turkeys
Slaughtered poultry - Import
Slaughtered poultry - Export
Caprinae (heads/number of animals)
Slaughtered sheep and goats
Slaughtered sheep - Import
Slaughtered sheep - Export
Fattening sheep - Import
Fattening sheep - Export
Living sheep
Slaughtered goats - Import
Slaughtered goats - Export
Fattening goats - Import
Fattening goats - Export
Equidae (heads/number of animals)
Living horses
Rabbits (heads/number of animals)
Slaughtered rabbits
Fish (tonnes)
Biomass fish live weight

Table A14. Weights used to calculate the population correction unit (PCU)

Animal category	Weight in kg
Slaughtered or livestock (Eurostat)	
Slaughtered cows	425
Slaughtered heifers	200
Slaughtered bullocks and bulls	425
Slaughtered calves and young cattle	140
Dairy cows	425
Slaughtered pigs	65
Living sows	240
Broilers	1
Turkeys	6.5
Slaughtered sheep and goats	20
Living sheep	75
Horses	400
Rabbits	1.4
Imported/exported for fattening or slaughter (TRACES data)	
Slaughtered bovine	425
Fattening bovine	140
Slaughtered pigs	65
Fattening pigs	25
Slaughtered poultry	1
Slaughtered sheep	20
Fattening sheep	20
Slaughtered goats	20
Fattening goats	20

Annex 4. List of antimicrobial classes/ active ingredients reported in the ESVAC

Table A15 includes all the substances for which sales have been reported, divided by class or subclass. Note that in the ESVAC, sales are reported by classes/subclasses independent of whether or not this refers to a single or a combination product — i.e. not by ATCvet classes. An exception to this is combinations of penicillins, including beta-lactamase inhibitors, which are included as the combination penicillins + beta-lactamase inhibitors reported as such in Figure 5 and Figure 31.

Pharmacologically active substances that may be used in food-producing animals must be listed in Table 1 of the Annex to Commission Regulation (EU) No 37/2010. The table details, among others, the food-producing animal species for which those substances can be used. Table 2 of that annex contains substances that are prohibited for use in any food-producing species; some of these are included in Table A15 below, because they are used in companion animals for which no maximum residue limits (MRLs) are required.

Table A15. List of substances reported sold in the ESVAC 2010-2016

Class/subclass	Substances		
Tetracyclines			
	Chlortetracycline	Doxycycline	Oxytetracycline
	Tetracycline		
Amphenicols			
	Chloramphenicol[1]	Florfenicol	Thiamphenicol
Penicillins			
Beta-lactamase-sensitive penicillins			
	Benzathine benzylpenicillin	Benzathine phenoxymethylpenicillin	Benzylpenicillin
	Penethamate hydriodide	Phenoxymethylpenicillin	Pheneticillin
	Procaine benzylpenicillin		
Beta-lactamase-resistant penicillins			
	Cloxacillin	Dicloxacillin	Nafcillin
	Oxacillin		
Penicillins with extended spectrum			
	Amoxicillin	Ampicillin	Metampicillin[2]
Combinations of penicillins with beta-lactamase inhibitors			
	Amoxicillin	Ampicillin	
Cephalosporins			
First-generation cephalosporins			
	Cefacetrile	Cefadroxil[2]	Cefalexin
	Cefalonium	Cefapirin	Cefazolin
	Cefalotin		

Class/subclass	Substances		
Third-generation cephalosporins			
	Cefoperazone	Cefovecin[2]	Ceftiofur
Fourth-generation cephalosporins			
	Cefquinome		
Sulfonamides and trimethoprim			
Sulfonamides			
	Formosulfathiazole	Phthalylsulfathiazole	Sulfacetamide
	Sulfachlorpyridazine	Sulfaclozine	Sulfadiazine
	Sulfamonomethoxine	Sulfadimethoxine	Sulfadimidine
	Sulfadoxine	Sulfafurazole	Sulfaguanidine
	Sulfalene	Sulfamerazine	Sulfamethizole
	Sulfamethoxazole	Sulfamethoxypyridazine	Sulfanilamide
	Sulfapyridine	Sulfaquinoxaline	Sulfathiazole
	Sulfazuinoxaline		
Trimethoprim and derivatives			
	Trimethoprim		
Macrolides and lincosamides			
Macrolides			
	Erythromycin	Gamithromycin	Oleandomycin
	Spiramycin	Tildipirosin	Tilmicosin
	Tulathromycin	Tylosin	Tylvalosin
Lincosamides			
	Clindamycin[2]	Lincomycin	Pirlimycin
Aminoglycosides			
	Amikacin[2]	Apramycin	Dihydrostreptomycin
	Framycetin	Gentamicin	Kanamycin
	Neomycin	Streptomycin	
Quinolones			
Fluoroquinolones			
	Danofloxacin	Difloxacin	Enrofloxacin
	Ibafloxacin[2]	Marbofloxacin	Norfloxacin[2]
	Orbifloxacin[2]	Pradofloxacin[2]	
Other quinolones			
	Cinoxacin[2]	Flumequine	Oxolinic acid
Imidazole derivatives			
	Metronidazole[1]		

Class/subclass	Substances		
Pleuromutilins			
	Tiamulin	Valnemulin	
Polymyxins			
	Colistin	Polymyxin B[2]	
Nitrofuran derivatives			
	Furazolidone[1]		
Other antibacterials			
	Bacitracin	Fosfomycin	Furaltadone[1]
	Natamycin	Nitroxoline	Novobiocin
	Paromomycin	Rifaximin	Spectinomycin

[1] Included in Table 2 (prohibited substances) of the Annex to Commission Regulation (EU) No 37/2010.
[2] MRLs not established for any food-producing species.
[3] MRLs not established for poultry (not allowed to be used).

Annex 5. Criteria to select the classes of antimicrobials highlighted in the main ESVAC report of WHO CIAs and AMEG Category 2

The WHO list of critically important antimicrobials for human medicine[33] and the list of the EU Antimicrobial Advice ad hoc Expert Group (AMEG)[34,35], were used as a basis to select the classes of antimicrobials that are highlighted in this report. The classes/subclasses highlighted are those antimicrobials used in veterinary medicine that are categorised as highest priority in the WHO list of CIAs for human medicine and also belong to AMEG Category 1 or 2: 3rd- and 4th-generation cephalosporins, macrolides[36], polymyxins and fluoroquinolones (Table A16).

Table A16. Antimicrobial classes highlighted in the report and their classification

Antimicrobial class	AMEG classification	WHO classification
3rd- and 4th-generation cephalosporins	Category 2	Highest priority CIAs (3rd- and higher-generation cephalosporins)
Fluoroquinolones and other quinolones	Category 2 (other quinolones not included)	Highest priority CIAs
Macrolides	Category 1	Highest priority CIAs
Polymyxins	Category 2	Highest priority CIAs
Aminoglycosides	Provisionally included in Category 2 (but no risk profiling has been provided)	CIAs
Certain penicillins (amoxicillin, ampicillin, metampicillin)	Provisionally included in Category 2 (but no risk profiling has been provided)	CIAs

[33] WHO Critically important antimicrobials for human medicine. 5th revision. (http://www.who.int/foodsafety/publications/antimicrobials-fifth/en/)
[34] EMA/AMEG 2014. Answers to the request for scientific advice on the impact on public health and animal health of the use of antibiotics in animals (http://www.ema.europa.eu/docs/en_GB/document_library/Other/2014/07/WC500170253.pdf)
[35] EMA/AMEG 2016. Updated advice on the use of colistin products in animals within the European Union: development of resistance and possible impact on human and animal health (http://www.ema.europa.eu/docs/en_GB/document_library/Scientific_guideline/2016/07/WC500211080.pdf)
[36] According to the WHO classification, macrolides include also ketolides, which are not marketed in the EU/EEA countries for veterinary use.

Annex 6. Distribution of veterinary medicines; legal framework and data sources by country

Austria

Distribution of veterinary medicines

In Austria, all veterinary medicinal products (VMPs) are prescription-only medicines. VMPs are dispensed by pharmaceutical companies or wholesalers to veterinarians. Only veterinarians are allowed to sell VMPs to farmers. Veterinarians have to confirm the distribution of veterinary drugs to owners of food-producing animals and horses if used for food production. Distribution of VMPs to farmers is restricted to VMPs registered for topical or oral use. Distribution of VMPs for intramammary use or for systemic use (injection) and premixes is restricted to farms that are members of the Austrian Animal Health Service. Sales of VMPs by public pharmacies must be prescribed by a veterinarian; such sales account for a negligible amount of sales for farm animals.

Legal basis for the monitoring of sales

The collection of sales data by pharmaceutical companies and wholesalers is based on the national law on animal drug control: BGBl. II Nr. 83/2014 Veterinär-Antibiotika-MengenströmeVO.

Data sources

Sales data have to be uploaded into the national database by pharmaceutical companies either producing or importing VMPs, and by wholesalers which are assigned by the industry to distribute a product.

Belgium

Distribution of veterinary medicines

In Belgium, all VMPs containing antimicrobial agents are prescription-only medicines. This includes medicated premixes containing antimicrobial agents as pharmaceutically active substances.

VMPs (pharmaceutical formulation) are distributed through wholesaler-distributors to veterinarians and pharmacists; the wholesaler-distributor obtains the VMPs from a wholesaler or the authorised producer. Antimicrobial VMPs are only available to animal owners via delivery from a pharmacy, on veterinary prescription, or directly from the veterinarian.

Premixes are distributed through wholesalers or wholesaler-distributors directly to feed mills. Only farmers are receivers from feed mills. Medicated feed is always on veterinary prescription.

Note: since 1 June 2014, the Federal Agency of Medicines and Health Products (FAHMP) has imposed a fee per package, according to the active ingredient content, for all veterinary antibiotics on the Belgian market on behalf of the MAHs. A higher fee is imposed if it concerns critically important antibiotics such as cephalosporins, quinolones or macrolides. Since 1 April 2018 the fees have been increased (+75%).

Legal basis for the monitoring of sales

The collection of sales data is based on the national law on medicines of 25 March 1964 (Art. 12) and on the Royal Decree of 14 December 2006 on medicines for human and veterinary use (Arts. 221 and 228). Wholesaler-distributors and feed mills are obliged to keep records of all sales and to deliver these records to the FAHMP on a yearly basis.

Data sources

To avoid double counting, all wholesaler-distributors are asked to provide sales data for the antimicrobial VMPs delivered to pharmacies and veterinarians, while sales data for antimicrobial premixes are provided by the Belgian feed mills licensed to produce medicated feed and to deliver it to Belgian farmers.

Data collection for both concerned parties is organised via a secure web application with a login and password delivered by letter.

Import data on medicated feed produced in another EU country and delivered to Belgian farmers are not included in the material.

Bulgaria

Distribution of veterinary medicines

In Bulgaria, all VMPs containing antimicrobial agents are prescription-only medicines. This includes medicated premixes containing pharmaceutically active substances like antimicrobial agents. VMPs are distributed through wholesalers to veterinarians, farms and pharmacists; the wholesalers acquire the VMPs from another wholesaler or the authorised manufacturer. Antimicrobial VMPs are only available to animal owners by delivery from a pharmacy or wholesaler, on veterinary prescription, or directly from the veterinarian. Premixes are distributed through wholesalers directly to feed mills. Only farmers receive feed from feed mills. Medicated feed is always on veterinary prescription.

Legal basis for the monitoring of sales

The collection of sales data is based on the national law on veterinary activities, promulgated in the State Gazette (SG), Issue №7/25.01.2013. At the request of the Executive Director of BFSA, in view of pharmacovigilance, the holder of a marketing authorisation for VMPs shall provide data on the volume of sales of VMPs. Wholesalers, pharmacies and farmers are obliged to keep records of all sales and purchases, and to deliver these records to the Bulgarian Food Safety Agency on request.

Data sources

Sales data are collected from all manufacturers, importers and wholesalers, which are also either MAHs or official representatives of MAHs in Bulgaria (to avoid double counting, sales of other wholesalers are excluded). The data include the sales to veterinarians, farms and pharmacies.

Croatia

Distribution of veterinary medicines

In Croatia, all antimicrobial veterinary medicinal products (VMPs) are prescription-only medicines. VMPs are dispensed by pharmaceutical companies or wholesalers of VMPs to veterinary practices (surgery, station, and hospital), veterinary pharmacies and feed mills. Animal owners can only buy antimicrobial VMPs on veterinary prescription in a veterinary pharmacy.

Large farms have authorised their own veterinary practices for their animals and they can buy premixes on veterinary prescription from a veterinary pharmacy and use them in feed mills. Feed mills should have a record of veterinary prescriptions covering each amount of antimicrobial VMP used.

Legal basis for the monitoring of sales

The collection of sales data by wholesalers is based on the national law, published in the Official Gazette of the Republic of Croatia No: 84/08, 56/13, 94/13 & 15/15.

Data sources

The veterinary antimicrobial agents' sales data are obtained each year from the authorised wholesalers.

Cyprus

Distribution of veterinary medicines

In Cyprus, all VMPs containing antimicrobials are prescription-only medicines. They are dispensed either by pharmacies or veterinary clinics. Veterinarians are only allowed to administer VMPs to animals under their direct personal responsibility. The supply of VMPs to pharmacies and veterinary clinics is conducted by authorised wholesalers.

Medicated feeding stuffs containing antimicrobials are manufactured on a prescription basis, and only by authorised feed mills. Feeding stuffs manufactured in or imported into Cyprus are distributed by authorised suppliers, and only administered on prescription by a veterinarian.

Legal basis for the monitoring of sales

The data are provided under legal requirements for the wholesaler/veterinarian/pharmacist to give any information requested.

Data sources

The data on sales of the veterinary antimicrobial agents included are collected each year from all authorised wholesalers and licensed feed mills in Cyprus.

Czech Republic

Distribution of veterinary medicines

In the Czech Republic, all VMPs containing antimicrobial agents are prescription-only medicines. This includes medicated feeding stuffs manufactured from medicated premixes containing antimicrobials. There are five categories of receiver of antimicrobial VMPs from wholesalers: wholesalers (when selling to each other), veterinarians, pharmacies, farmers and feed mills, while only farmers are receivers from feed mills. Medicated feed has to be prescribed by veterinarians and produced by feed mills authorised by the Institute for State Control of Veterinary Biologicals and Medicaments.

Legal basis for the monitoring of sales

The collection of sales data is based on a national law on pharmaceuticals, Act No. 378/2007 Coll.

Data sources

Sales data are collected from all wholesalers and feed mills licensed in the Czech Republic.

Brief description of data collection

Manufacturers/wholesalers fill in the template with their quarterly sales data, divided into five categories (no data about customers); only sales for veterinarians, pharmacies and farmers are used to calculate consumption.

In the case of medicated premixes, the data reported by manufacturers of medicated feeding stuffs are used for calculation. Sales to wholesalers and manufacturers of medicated feeding stuffs are used for the verification of VMP sales.

Denmark

Distribution of veterinary medicines

In Denmark, all VMPs are prescription-only medicines, and can only be dispensed either through pharmacies or via a small number of dispensing companies approved by the Danish Medicines Agency to dispense VMPs on the same legal terms as those to which the pharmacies are subject. Both pharmacies and dispensing companies are supplied by pharmaceutical companies and wholesalers. An exemption from the pharmacy/dispensing-company monopoly has been granted for medicated feeds, i.e. feeds into which VMPs formulated as premix are mixed prior to sale. Medicated feed has to be prescribed by veterinarians and produced by feed mills authorised by the Danish Medicines Agency.

Legal basis for the monitoring of sales

All sales of prescription medicines by pharmacies, dispensing companies and feed mills are mandated to be reported to the VetStat database, owned by the Ministry of Environment and Food of Denmark. The pharmacy/dispensing-company sales records include sales of all prescription medicines to animal owners, as well as medicines purchased by veterinary practitioners for use in their practice. Furthermore, it is mandatory for the veterinarians to report to the VetStat medicines used in their own practices for food-production animals. Antimicrobial sales for companion animals are gathered from sales reported by pharmacies to veterinarians.

Data sources

Data on sales of all prescription medicines at package level from pharmacies, dispensing companies, veterinarians and feed mills are retrieved from the VetStat database.

Estonia

Distribution of veterinary medicines

In Estonia, antimicrobial VMPs are prescription-only medicines. VMPs have to be dispensed through pharmacies (general and veterinary) and veterinarians, who are supplied by wholesalers.

Legal basis for the monitoring of sales

Wholesalers are obliged to report the sales of VMPs to the State Agency of Medicines under the Medicinal Products Act of 2005.

Data source

The State Agency of Medicines collects sales data at package level from wholesalers. Only sales to pharmacies (general and veterinary) and veterinarians are accounted for, to avoid double reporting by including sales to other wholesalers.

Finland

Distribution of veterinary medicines

In Finland, all VMPs that contain antimicrobials are prescription-only medicines. They are available either from pharmacies on veterinarian prescription or directly from veterinarians. Veterinarians are allowed to dispense medicines for the treatment of animals under their care, but are not allowed to profit from the sales. Pharmacies and veterinarians are supplied by wholesalers. Medicated feeds may either be produced by feed mills or imported to Finland, but always require a prescription from a veterinarian.

Legal basis for the monitoring of sales

Wholesalers are obliged to provide information on the sales of VMPs to the Finnish Medicines Agency in accordance with the Medicines Act (375/1987). Production and imports of medicated feeds have to be reported to the Finnish Food Safety Authority in accordance with the Decree on Medicated Feeds (10/EEO/2008).

Data source

The sales data are obtained at package level from wholesalers by the Finnish Medicines Agency, which monitors the sales of VMPs. Sales of antimicrobial agents in medicated feed are monitored by the Finnish Food Authority which collects data from feed mills and other importers.

France

Distribution of veterinary medicines

In France, all VMPs are available on prescription only. VMPs are distributed mainly through wholesalers to veterinarians and pharmacists; wholesalers obtain the VMPs from marketing authorisation holders.

Legal basis for the monitoring of sales

A new law published at the end of 2014 makes the provision of data on antimicrobial sales to the competent authority mandatory.

Data sources

The sales data are collected from marketing authorisation holders at package level by Anses-ANMV (French Agency for Veterinary Medicinal Products), in collaboration with the French Veterinary Medicine Industry Association. Double reporting is avoided because the data are not provided by the wholesalers but directly by the MAHs, which do not trade among one another.

Germany

Distribution of veterinary medicines

In Germany, all VMPs containing antimicrobial agents are prescription-only medicines. Veterinarians are allowed to dispense drugs directly to the farmer for the treatment of animals in their care. Veterinarians are supplied with VMPs directly from pharmaceutical companies or wholesalers. Very few animal owners acquire VMPs from pharmacies.

Premixes have to be prescribed by veterinarians, and medicated feed is produced by officially authorised feed mills thereafter.

Legal basis for the monitoring of sales

The collection of sales data from pharmaceutical companies and wholesalers is based on German medicines law. This is further specified in a specific regulation.

Data sources

Data on sales to veterinarians are collected by pharmaceutical companies and wholesalers which dispense antimicrobial agents to veterinarians located in Germany. In the case of premixes, sales data are taken from periodic safety update reports (PSURs), because premixes are provided to feed mills on prescription and thus are not included in the data on sales to veterinarians.

Greece

Distribution of veterinary medicines

In Greece, all antimicrobial veterinary medicinal products are prescription-only medicines. MAHs or local representatives provide VMPs to wholesalers and retailers. Wholesalers can also provide VMPs to retailers. Only retailers can provide VMPs to the customer with a valid prescription.

Legal basis for the monitoring of sales

The collection of sales data by MAHs is based on the joint ministerial law: KYA 282371/16-06-2006.

Data sources

In 2016, sales for veterinary antimicrobial agents were reported to the ESVAC for the second time. Data were provided by 75 marketing authorisation holders. Negligible sales from a few MAHs with a very small market share, and who do not have local representatives in the country, were not included in the 2015 and 2016 datasets.

Hungary

Distribution of veterinary medicines

In Hungary, all VMPs that contain antimicrobials are prescription-only medicines. All VMPs have to be dispensed through authorised retailers, which are only supplied by authorised wholesalers. Wholesalers are authorised by the National Food Chain Safety Office, and the retailers are authorised by the local government office.

Antimicrobial VMPs can be bought from a wholesaler by other wholesalers, retailers, veterinarians, farmers or feed mills. The route of VMPs must be documented as it must be possible to control the journey of each batch from the manufacturer to the farmer.

According to EU rules, medicated feeds are classified as feed and not as VMPs. They have to be prescribed by veterinarians, and produced by feed mills authorised by the government office. Medicated feeds may be imported into Hungary, but require a prescription by a veterinarian, like other medicated feeds. Importation of medicated feeds is supervised by the office which authorises importers and distributors.

Legal basis for the monitoring of sales

There is no legal basis for mandatory reporting of sales data; monitoring of sales takes place voluntarily.

Data sources

Data are collected from wholesalers in Hungary. These wholesalers only submit data for those products they have sold to veterinarians, feed mills, farmers and retailers, but not to other wholesalers (i.e. there is no double reporting).

Iceland

Distribution of veterinary medicines

In Iceland, all antimicrobial VMPs and almost all other VMPs are prescription-only medicines. They have to be dispensed to animal owners by veterinarians (or used by the veterinarians in their practices), or pharmacies, i.e. veterinarians are allowed to dispense VMPs in the same way as pharmacies. Veterinarians and pharmacies can only purchase VMPs from licensed wholesalers. No medicated feeding stuffs for livestock are produced by feed mills in Iceland.

Legal basis for the monitoring of sales

Wholesalers in Iceland are mandated to provide sales statistics for both human and veterinary medicinal products, as well as for medicated feeding stuffs, to the Icelandic Medicines Agency.

Data sources

The data on sales of the included veterinary antimicrobial agents at package level are provided by wholesalers in Iceland, of which there are only two.

Ireland

Distribution of veterinary medicines

In Ireland, antimicrobial veterinary medicinal products may only be supplied on prescription. The products are supplied to the trade by wholesalers authorised by the Department of Agriculture, Food and the Marine. In accordance with the prescription of the prescribing veterinarian, the prescribed products can be dispensed either by the veterinarian or by a pharmacist. By way of exception to this rule, intramammary antimicrobial substances can also be dispensed by licensed agricultural merchants. Medicated feeds containing antimicrobials are prepared from authorised premixes, again under veterinary prescription. They are incorporated into the feed under a special authorisation granted by the Department of Agriculture, Food and the Marine. The licences for incorporation are granted either to feed mills or to farms that have the appropriate facilities for inclusion. It should be noted that the sale, supply, or possession of any unauthorised veterinary medicine in Ireland is a criminal offence.

Legal basis for the monitoring of sales

There is currently no legal basis requiring wholesalers to supply data relating to the volume of sales of authorised veterinary medicinal products. However, marketing authorisation holders are obliged to report sales data.

Data sources

Each year, the Health Products Regulatory Authority (HPRA) collects data from veterinary pharmaceutical manufacturers holding current Irish marketing authorisations. These holders are requested by the HPRA to only report sales in Ireland. The HPRA checks the information provided against data collected for previous years. Fluctuations in the data from year to year are followed up with the individual company to guard against data errors. The importation of medicated feed is permitted. However, in practice, given the logistics involved, this is not seen as a major route of supply into the country.

Italy

Distribution of veterinary medicines

In Italy, antimicrobial agents for use in animals are prescription-only medicines. Therefore, their sale to the end-user can only take place upon presentation of a veterinary prescription. The sale of veterinary medicines (including antimicrobial agents) on Italian territory may take place as described below:

Wholesale of veterinary medicines

This type of sale includes all forms of business transaction except sales to the end-user. It can only be done on storage premises authorised for the purpose by the local competent authority.

Wholesale of veterinary medicinal products includes transactions between:

- marketing authorisation holders or their representatives and wholesalers;
- marketing authorisation holders or their representatives and pharmacies;
- wholesalers;
- wholesalers and pharmacies;
- wholesalers and feed mills authorised to produce medicated feeds (premixes for medicated feed).

Direct sale of veterinary medicinal products

Holders of authorised wholesale veterinary medicines storage premises may, as a result of further authorisation by the local competent authority, also make direct sales of such products to breeders, pet owners, veterinarians and veterinary care facilities. This type of transaction also includes the sale of premixes for medicated feed by wholesalers, pharmacies and manufacturers to farms authorised to produce medicated feed for self-consumption. Such sales may take place only in the presence of a pharmacist and, in the case of antimicrobial agents, only under veterinary prescription.

Retail veterinary medicinal products

The retail sale of veterinary medicinal products containing antibiotics can only take place at pharmacies, under veterinary prescription, and only in the presence of a pharmacist.

Farmers, veterinarians, breeding and healthcare facilities may, on request, be authorised by the local competent authority to hold stocks of veterinary medicinal products. Stocks of veterinary drugs, including antibiotics, can only be purchased under veterinary prescription. Farms cannot hold stocks of antibiotics in the form of medicated feed or veterinary drugs administered in feed, water or liquid feed. Only small quantities can be held, not exceeding a treatment period of seven days.

Veterinarians cannot sell veterinary drugs (including antibiotics). When it is required by professional intervention, veterinarians are allowed to deliver open packages of veterinary medicines from their stocks to the breeder or the animal owner to start the therapy. For companion animals, the veterinarian may also deliver unopened packages.

Legal basis for the monitoring of sales

The collection of sales data by pharmaceutical companies is based on the national law 193/2006 (art. 32(3)) transposing EC Directive 2004/28.

Data sources

Sales data are collected from pharmaceutical companies producing or importing VMPs.

Latvia

Distribution of veterinary medicines

In Latvia, all VMPs containing antimicrobial agents are prescription-only medicines. This includes medicated feed manufactured from medicated premixes containing antimicrobial agents. VMPs are distributed through wholesalers to pharmacies, veterinarians and licensed farms. VMPs for licensed farms have been ordered by the veterinarian contracted to provide routine healthcare services. Animal owners without the license can only purchase VMPs containing antibiotics on veterinary prescription in pharmacies.

Legal basis for the monitoring of sales

Sales data are collected by the Food and Veterinary Service. This task is mandated by the Law of Pharmacy and the related Regulation of the Cabinet of Ministers.

Data sources

Sales data are collected from all wholesalers in Latvia at package level by the Food and Veterinary Service. The wholesalers are asked to report in detail what medicines are sold, to determine real consumption of VMPs and avoid double reporting or export of VMPs.

Lithuania

Distribution of veterinary medicines

In Lithuania, all VMPs that contain antimicrobial agents are prescription-only medicines. All VMPs have to be dispensed to veterinarians or farmers through wholesalers or pharmacies. Medicated feed is also subject to prescription by a veterinarian.

Legal basis for the monitoring of sales

Wholesalers are obliged to provide information on sales of VMPs to the State Food and Veterinary Service of the Republic of Lithuania, in accordance with national law.

Data sources

Data on sales of antimicrobial VMPs at package level are obtained from wholesalers by the State Food and Veterinary Service of the Republic of Lithuania.

Luxembourg

Distribution of veterinary medicines

In Luxembourg, all veterinary medicinal products (VMPs) containing antimicrobial agents are prescription-only medicines. This includes medicated premixes containing pharmaceutical agents.

VMPs containing antimicrobial agents are distributed through wholesalers to pharmacies or to veterinarians (via pharmacies' records). Veterinarians are allowed to keep VMPs in stock and to dispense them to the farmer for the treatment of animals in their care.

Legal basis for monitoring

Wholesalers, pharmacies, veterinarians and farmers are legally obliged to keep records of all sales. They are legally bound to provide any data or information they are asked for.

Data sources

The data on sales of veterinary antimicrobial agents at package level are obtained from the authorised wholesalers on a yearly basis.

Netherlands

Distribution of veterinary medicines

In the Netherlands, antimicrobial VMPs are available on prescription only. Veterinarians purchase approximately 40 % of their VMPs directly from the manufacturers and approximately 60 % through wholesalers. About 98 % of the total volume of antimicrobial VMPs is dispensed by marketing authorisation holders who are either direct members of the Dutch federation of the veterinary pharmaceutical industry (FIDIN) or represented by members of the FIDIN. An estimated 2 % are sold by authorisation holders not associated with FIDIN. Veterinarians sell the products directly to animal owners. Pharmacies dispense only minor quantities of VMPs.

Legal basis for the monitoring of sales

Currently, there is no legal basis for mandatory reporting of sales data; monitoring of sales takes place voluntarily.

Data sources

The sales data are obtained at package level from the MAHs who are (represented by) members of FIDIN. Since sales data are obtained from marketing authorisation holders only, including both their sales to wholesalers and their direct sales to veterinarians, there is no double reporting of wholesalers' sales.

Norway

Distribution of veterinary medicines

In Norway, all VMPs are prescription-only medicines, and are generally dispensed through pharmacies, which are supplied by drug wholesalers. Veterinarians are not allowed to dispense VMPs except in emergency situations in the field, in which case they have to be sold at cost price. Medicated feeds are not used for food-producing animals except for farmed fish; this is due to the small size of livestock herds compared to those in most other European countries. However, group/flock treatment of livestock with antimicrobial agents is possible, again subject to veterinary prescription, through drinking water or as top dressing on feed by use of oral solution or oral powder, respectively.

Legal basis for the monitoring of sales

Wholesalers and feed mills in Norway are mandated to provide sales statistics for both human and veterinary medicinal products, as well as for medicated feedstuffs, to the Norwegian Institute of Public Health (NIPH).

Data sources

Data on the sales of the included veterinary antimicrobial agents at package level are obtained from the NIPH, which collects its data from authorised wholesalers and feed mills (only relevant for aquaculture). To avoid double reporting by including sales among the wholesalers, the wholesalers and feed mills are asked by the NIPH to only report sales to pharmacies and animal owners in Norway.

Poland

Distribution of veterinary medicines

Most VMPs, including antimicrobial VMPs, are prescription-only medicines. VMPs are distributed by wholesalers to veterinarians. Antimicrobial VMPs are available to animal owners only if the veterinarian delivers them. Veterinarians and medicated-feed producers are allowed to buy medicated premixes from wholesalers. However, before purchase, medicated-feed producers need to obtain the district veterinary officer's confirmation.

Legal basis for the monitoring of sales

In accordance with national pharmaceutical law, wholesalers are obliged to provide data on sales of VMPs.

Data sources

Sales data are collected from wholesalers who deliver VMPs directly to veterinarians. Wholesalers fill in the template with their quarterly sales data.

Portugal

Distribution of veterinary medicines

In Portugal, all VMPs containing antimicrobial agents are prescription-only medicines. This includes medicated premixes containing pharmaceutically active substances, like antimicrobial agents. VMPs containing antimicrobial agents are provided by wholesaler-distributors to retailers of veterinary medicinal products (both human and animal pharmacies), farmers, veterinarians, producers' organisations, veterinary clinics and hospitals, and feed mills.

Wholesaler-distributors obtain the VMPs from a wholesaler or from the MAH/manufacturer. Antimicrobial VMPs are only available to animal owners/farmers by means of an official veterinary prescription. Veterinarians do not sell VMPs, and they may only charge for those they use for treatment of animals in their care. Premixes are distributed through wholesalers or wholesaler-distributors directly to feed mills. Only farmers are receivers from feed mills. Medicated feeds containing antimicrobial premixes also have to be prescribed by a veterinarian and can only be manufactured by officially authorised feed mills.

Legal basis for the monitoring of sales

The collection of sales data is based on the national law no. 148/2008, dated 29 July (Art. 120), amended and reprinted by national law no. 314/2009, dated 28 October.

Data sources

Data are provided by wholesalers who are authorised to sell veterinary medicinal products containing antibiotics.

Romania

Distribution of veterinary medicines

In Romania, all VMPs containing antimicrobial agents are prescription-only medicines.

Wholesalers must supply medicinal products only to those authorised to provide retail activities or those who are legally allowed to purchase medicinal products from wholesalers. Retail distribution of the veterinary medicinal products is performed only by those authorised to carry out such operations in accordance with the national legislation.

Marketing of veterinary medicinal products is carried out according to the veterinary legislation in force, i.e. only through veterinary pharmaceutical establishments which are authorised by the National Sanitary Veterinary and Food Safety Directorate.

Legal basis for the monitoring of sales

The collection of sales data is based on the national law on veterinary activities - Order of the National Sanitary Veterinary and Food Safety President - promulgated in the Official Monitor from 15 October 2015.

The MAHs are obliged to report the sales of the antimicrobials each year before 15 March, and to deliver these records to the Institute for Control of Biological Products and Veterinary Medicines, which reports the data to the ESVAC.

Data sources

For 2014, the sales data were collected from 37 wholesalers and those 11 MAHs which distributed their own products. The data include the sales to veterinarians, farmers and pharmacies. From 2015, according to the updated veterinary law, the sales data are collected from MAHs only.

Slovakia

Distribution of veterinary medicines

In Slovakia, all VMPs containing antimicrobial agents are prescription-only medicines. This includes medicated feeding stuffs manufactured from medicated premixes containing antimicrobial agents. There are four categories of receiver of antimicrobial VMPs from wholesalers to wholesalers (when selling to each other), veterinarians, pharmacies and feed mills, while from feed mills, farmers and wholesalers (very seldom) are receivers. Medicated feed has to be prescribed by veterinarians and produced by feed mills authorised by the Institute for State Control of Veterinary Biologicals and Medicaments.

Legal basis for the monitoring of sales

The collection of import data is based on a national law on pharmaceuticals, Act No. 362/2011 Coll.

Data sources

For 2011 and 2012, import data were collected from all wholesalers licensed in the Slovak Republic; from 2013, data represent sales from wholesalers to end-users.

Brief description of data collection

Wholesalers send their quarterly import data (number of packs, name of the product, batch number, etc.) and manufacturers send their quarterly production data to the Institute for State Control of Veterinary Biologicals and Medicaments.

Slovenia

Distribution of veterinary medicines

In accordance with applicable legislation, antimicrobial VMPs are dispensed in the Republic of Slovenia on the basis of a veterinary prescription only. Wholesalers deliver antimicrobial VMPs to retailers, i.e. pharmacies and veterinary organisations, and to approved medicated-feed mills.

Legal basis for the monitoring of sales

Wholesalers are required by law to report to the competent authority on the turnover (sales) of all medicinal products.

Data sources

Data on sales of veterinary antimicrobial agents at package level were obtained from the wholesalers.

Spain

Distribution of veterinary medicines

In Spain, all VMPs that contain antimicrobials are prescription-only medicines, so they can only be dispensed under veterinary prescription. All suppliers to final users of VMPs (wholesalers, retailers, pharmacies and farmers' co-operatives) are authorised according to national law and have a mandatory pharmacist control service. Dispensing is most frequently done by retailers. Veterinarians in Spain are allowed to use VMPs in their daily practice, but they cannot sell VMPs to animal owners.

Medicated feeds containing antimicrobial premixes also have to be prescribed by a veterinarian, and can only be manufactured by feed mills authorised by regional competent authorities according to the specific legislation and to the feed hygiene regulation (Hazard Analysis and Critical Control Point principles).

Legal basis for the monitoring of sales

There is a legal basis for mandatory reporting of sales data from the distributors of such products, while monitoring of sales from the MAHs takes place voluntarily.

Data sources

The sales data are collected from MAHs at package level by the Spanish Agency for Veterinary Medicinal Products (AEMPS), in collaboration with the Spanish veterinary medicine industry association (Veterindustria) and the Spanish business association of additives and premixes for animal health and nutrition (Adiprem).

Sweden

Distribution of veterinary medicines

In Sweden, antimicrobial VMPs may only be sold on prescription. VMPs have to be dispensed through pharmacies, which are supplied by drug wholesalers or MAHs. Feed mills may only mix antimicrobial VMPs in feed if they are controlled and authorised by the Swedish Board of Agriculture. Sales of medicated feed to farmers are only allowed on prescription (i.e. the farmer presents the prescription to the feed mill). Mixing of antimicrobials in feed may also take place on farms, provided that the Swedish Board of Agriculture has controlled and authorised the establishment for this purpose. In such cases, the premix is purchased on prescription and dispensed by a pharmacy.

Legal basis for the monitoring of sales

All pharmacies in Sweden are required to provide sales statistics on a daily basis to a central database. Until and including 2013, this was an infrastructure company owned by the state, Apotekens Service AB. From 1 January 2014, all activities within that company have been transferred to the Swedish eHealth Agency. All feed mills and farms authorised to mix medicated feed are requested to report their purchases and sales on a yearly basis to the Swedish Board of Agriculture.

Data sources

Pharmacy data on dispensation of prescriptions to animal owners or requisitions by a veterinarian (e.g. sales from pharmacies to animal owners or to veterinarians for use in practice) at package level have been obtained from Apotekens Service AB/the Swedish eHealth Agency.

Switzerland

Distribution of veterinary medicines

In Switzerland, all VMPs are prescription-only medicines, and have to be dispensed by either the treating veterinarian or a pharmacy. Medicated feeds for livestock (terrestrial animals) are either produced in feed mills using authorised premixes, or incorporated on-site following prescription and dispensing by veterinarians. Group treatment of livestock with antimicrobial agents is possible, subject to veterinary prescription and supervision, through medicated feed, drinking water or as top dressing.

Legal basis for the monitoring of sales

The legal basis for data collection is Art. 35 of the Federal Ordinance on Veterinary Medicines, enacted in September 2004. Art. 36 requests the Federal Office of Food Safety and Veterinary Affairs to "specifically establish a statistic about usage of veterinary antimicrobials for the purpose of monitoring resistances". Sales of veterinary antimicrobials are published yearly in the ARCH-VET report, covering sales and resistances to veterinary antimicrobials. Note that figures published in the national ARCH-VET report differ from figures in the present report since all ATCvet groups are included in the national report.

Data sources

Data are obtained at package level from the MAHs. They are requested, processed and analysed by the Federal Office of Food Safety and Veterinary Affairs.

Data coverage

Coverage is assumed to be nearly 100 % for the sales of authorised antimicrobial agents. No prescription figures are currently available at national level, meaning that sales figures cannot be further validated. Veterinarians may import VMPs for companion and food-producing animals, including products containing antimicrobial agents, based on a single authorisation valid for one year and delivered by Swissmedic, the Swiss Agency for Therapeutic Products. As these products are not sold by marketing authorisation holders or wholesalers in Switzerland, and since these single authorisations are not delivered for a defined quantity, these products cannot be monitored and are therefore not included in the statistics.

United Kingdom

Distribution of veterinary medicines

In the United Kingdom, antimicrobial veterinary medicinal products may only be supplied on prescription. The products can be dispensed either by the veterinarian or by a veterinary pharmacist and, in turn, can only be supplied by a wholesale dealer authorised by the United Kingdom Veterinary Medicines Directorate. Medicated feeds have to be prescribed by veterinarians, and manufactured either by authorised feed mills or by authorised farms. Medicated feeds are used primarily for pig and poultry production.

Legal basis for the monitoring of sales

Manufacturers are legally required to supply data relating to the volume of sales of authorised veterinary medicinal products at the request of the Veterinary Medicines Directorate.

Data sources

The United Kingdom Veterinary Medicines Directorate collects data from those veterinary pharmaceutical manufacturers that hold current United Kingdom marketing authorisations.

Annex 7. References to national reports

Austria. European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) — the Austrian Results. Resistenzbericht Österreich — AURES 2016 (https://www.ages.at/download/0/0/dbc0e4bd9fbe48b96ce6ffe2f81a3bc83a964252/fileadmin/AGES2015/Themen/Arzneimittel_Medizinprodukte_Dateien/AURES/aures_2016.pdf, pp.347-353, in German).

Belgium. Belgian Veterinary Surveillance of Antimicrobial Consumption. National Consumption Report 2016 (http://www.fagg-afmps.be/nl/DIERGENEESKUNDIG_gebruik/geneesmiddelen/geneesmiddelen/goed_gebruik/Antibiotica_0).

Czech Republic. Spotřeba antibiotik ve veterinární medicíně v ČR (www.uskvbl.cz/cs/informace/tiskove-centrum/tiskprohl, in Czech).

Cyprus. Sales of veterinary antimicrobial products in Cyprus (http://www.moa.gov.cy/moa/vs/vs.nsf/vs74_gr/vs74_gr?OpenDocument).

Denmark. DANMAP 2016. Use of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from food animals, food and humans in Denmark. ISSN 1600-2032 (www.danmap.org).

Estonia An overview of the consumption of antibiotics for veterinary use 2006-2016 (http://www.ravimiamet.ee/sites/default/files/antibiootikumide_kasutamine_loomadel_2006-2016.pdf, in Estonian).

Finland. FINRES-Vet 2010-2012. Finnish Veterinary Antimicrobial Resistance Monitoring and Consumption of Antimicrobial Agents, Evira publications 2/2015 (http://www.evira.fi/portal/en/about+evira/publications/?a=view&productId=412).

France. Moulin, G., Chevance, A., Meheust, D., 2017. Sales Survey of Veterinary Medicinal Products Containing Antimicrobials in France — 2016, October 2017, Anses-ANMV, Fougères (https://www.anses.fr/en/system/files/ANMV-Ra-Antibiotiques2016EN.pdf).

Germany. Wallmann, J., Bender, A., Bode, C., Köper, L., Heberer, T., Abgabemengenerfassung antimikrobiell wirksamer Stoffe in Deutschland 2016 (Sales data of antimicrobial substances in Germany in 2016), Deutsches Tierärzteblatt Dezember 2017 (https://www.deutsches-tieraerzteblatt.de/artikel/abgabemengenerfassung-antimikrobiell-wirksamer-stoffe-in-deutschland-2016.html, in German).

Iceland. Sýklalyfjanotkun og sýklalyfjanæmi baktería í mönnum og dýrum á Íslandi 2016 (https://www.landlaeknir.is/utgefid-efni/skjal/item32860/, in Icelandic).

Ireland. Health Products Regulatory Authority, 2018. Report on consumption of veterinary antibiotics in Ireland during 2016 (http://www.hpra.ie/docs/default-source/default-document-library/report-on-consumption-of-veterinary-antibiotics-in-ireland-during-2016367b0a2697826eee9b55ff00008c97d0.pdf?sfvrsn=0).

Netherlands. Monitoring of Antimicrobial Resistance and Antibiotic Usage in Animals in the Netherlands in 2017, NETHMAP-MARAN 2018 (http://www.wur.nl/nl/Expertises-Dienstverlening/Onderzoeksinstituten/Bioveterinary-Research/Publicaties/MARAN-Rapporten.htm).

Netherlands. SDa, Veterinary Medicines Authority, Usage of antibiotics in agricultural livestock in the Netherlands in 2016 (http://www.autoriteitdiergeneesmiddelen.nl/en/publications).

Norway. NORM/NORM-VET, 2016. Usage of Antimicrobial Agents and Occurrence of Antimicrobial Resistance in Norway. ISSN 1502-2307 (http://www.vetinst.no/overvaking/antibiotikaresistens-norm-vet).

Romania. Raport privind consumul de produse medicinale veterinare antimicrobiene in Romania (http://www.icbmv.ro/ro/informatii-utile/raport-privind-consumul-de-produse-medicinale-veterinare-antimicrobiene, in Romanian).

Spain. News of veterinary medicines (http://www.resistenciaantibioticos.es/es).

Sweden. Swedres-Svarm 2016. Use of antimicrobials and occurrence of antimicrobial resistance in Sweden. Solna/Uppsala ISSN 1650-6332 (www.sva.se/en/Antibiotika/SVARM-reports/).

Switzerland. Swiss Antibiotic Resistance Report 2016 (https://www.blv.admin.ch/dam/blv/de/dokumente/tiere/tierkrankheiten-und-arzneimittel/tierarzneimittel/swiss-antibiotic-resistance-report.pdf.download.pdf/swiss-antibiotic-resistance-report-2017.pdf)

United Kingdom. VMD 2017. UK - Veterinary Antimicrobial Resistance and Sales Surveillance Report 2016 (https://www.gov.uk/government/collections/veterinary-antimicrobial-resistance-and-sales-surveillance).

Annex 8. Country and affiliation of the ESVAC national contact points/alternates

Table A17. List of ESVAC national contact points/alternates 2018

Country	Name and affiliation
Austria	**Reinhard Fuchs** Austrian Agency for Health and Food Safety Betriebsstätte Graz Zinzendorfgasse 27/1 8010 Graz AUSTRIA E-mail: reinhard.fuchs@ages.at **Klemens Fuchs (*Alternate*)** Austrian Agency for Health and Food Safety Betriebsstätte Graz Zinzendorfgasse 27/1 8010 Graz AUSTRIA E-mail: klemens.fuchs@ages.at
Belgium	**Bart Hoet** Federaal Agentschap voor Geneesmiddelen en Gezondheidsproducten - Agence Fédérale des Médicaments et des Produits de Santé Bâtiment Eurostation, bloc 2 place Victor Horta, 40 / 40 B-1060 Brussel - Bruxelles BELGIUM E-mail: bart.hoet@fagg.be **Dries Minne (*Alternate*)** Federaal Agentschap voor Geneesmiddelen en Gezondheidsproducten - Agence Fédérale des Médicaments et des Produits de Santé Eurostation gebouw, blok 2 Victor Hortaplein 40 / 40 B-1060 Brussel - Bruxelles BELGIUM E-mail: dries.minne@fagg.be
Bulgaria	**Ivaylo Ivanov** Bulgarian Food Safety Agency Българска агенция по безопасност на храните Directorate for control of veterinary medicinal products Shose Bankya 7 1331 Sofia BULGARIA E-Mail: iivanov@itp.bg **Antonio Radoev (*Alternate*)** Bulgarian Food Safety Agency Българска агенция по безопасност на храните Directorate for control of veterinary medicinal products Shose Bankya 7 1331 Sofia BULGARIA E-mail: a_radoev@nvms.government.bg

Country	Name and affiliation
Croatia	**Iva Gruden Zdunić** Ministarstvo Poljoprivrede Uprava za veterinarstvo i sigurnost hrane Planinska ulica 2a 10000 Zagreb CROATIA Email: iva.g-zdunic@mps.hr **Bernard Jendrašinkin (*Alternate*)** Service for VMP, feed and animal by products Ministarstvo Poljoprivrede Uprava za veterinarstvo i sigurnost hrane Planinska ulica 2a 10000 Zagreb CROATIA E-mail: bernard.jendrasinkin@mps.hr
Cyprus	**Marios Genakritis** Veterinary Services 1417 Athalassa Nicosia CYPRUS E-mail: mgenakritis@vs.moa.gov.cy
Czech Republic	**Lucie Pokludová** Ústav pro státní kontrolu veterinárních biopreparátů a léčiv Hudcova 56a 621 00 Brno - Medlánky CZECH REPUBLIC E-mail: pokludova@uskvbl.cz **Jana Wojtylová (*Alternate*)** Ústav pro státní kontrolu veterinárních biopreparátů a léčiv Hudcova 56a 621 00 Brno – Medlánky CZECH REPUBLIC E-mail: wojtylova@uskvbl.cz
Denmark	**Laura Mie Jensen** Danish Veterinary and Food Administration Stationsparken 31-33 2600 Glostrup DENMARK E-mail: lauje@fvst.dk
Estonia	**Marju Sammul** State Agency of Medicines 1, Nooruse Street 50411 Tartu ESTONIA E-mail: marju.sammul@ravimiamet.ee
Finland	**Katariina Kivilahti-Mäntylä** Finnish Medicines Agency Mannerheimintie 103B 00280 Helsinki FINLAND E-mail: katariina.kivilahti-mantyla@fimea.fi

Country	Name and affiliation
France	**Gérard Moulin** Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail 8 rue Claude Bourgelat, Parc d'activité de la Grande Marche CS 70611 Javené, F-35306 Fougères Cedex FRANCE E-mail: gerard.moulin@anses.fr **Claire Chauvin (*Alternate*)** Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail Anses - Laboratoire de Ploufragan-Plouzané Unité d'épidémiologie BP 53 - 22440 Ploufragan FRANCE E-mail: claire.chauvin@anses.fr
Germany	**Inke Reimer** Bundesamt für Verbraucherschutz und Lebensmittelsicherheit Mauerstraße 39-42 10117 Berlin GERMANY E-mail: inke.reimer@bvl.bund.de **Christoph Bode (*Alternate*)** Bundesamt für Verbraucherschutz und Lebensmittelsicherheit Mauerstraße 39-42 10117 Berlin GERMANY E-mail: christoph.bode@bvl.bund.de
Greece	**Farlopoulos Spyridon** EOF, Greek National Organization for Medicines Veterinary Medicines Assessment Section 284, Mesogeion Ave. 155 62 Cholargos, Athens GREECE E-mail: sfarlopoulos@eof.gr **Ioannis Malemis (*Alternate*)** EOF, Greek National Organization for Medicines Veterinary Medicines Assessment Section 284, Mesogeion Ave. 155 62 Cholargos, Athens GREECE E-Mail: malemisj@eof.gr
Hungary	**Edit Nagy** Nemzeti Élelmiszerlánc-biztonsági Hivatal Állatgyógyászati Termékek Igazgatósága Szállás utca 8 1107 Budapest HUNGARY E-mail: nagye@nebih.gov.hu **Ernő Horváth (*Alternate*)** Nemzeti Élelmiszerlánc-biztonsági Hivatal Állatgyógyászati Termékek Igazgatósága Szállás utca 8 1107 Budapest HUNGARY E-mail: horvathern@nebih.gov.hu

Country	Name and affiliation
Iceland	**Jóhann M. Lenharðsson** Lyfjastofnun Vínlandsleið 14 IS-113 Reykjavík ICELAND E-mail: johann.m.lenhardsson@lyfjastofnun.is
Ireland	**Jeremiah Gabriel Beechinor** An tÚdarás Rialála Táirgí Sláinte Kevin O'Malley House The Earlsfort Centre Earlsfort Terrace Dublin 2 IRELAND E-mail: jgb@hpra.ie **Gavin Ryan (*Alternate*)** An tÚdarás Rialála Táirgí Sláinte Kevin O'Malley House The Earlsfort Centre Earlsfort Terrace Dublin 2 IRELAND E-mail: gavin.ryan@hpra.ie
Italy	**Loredana Candela** Ministero della Salute Direzione generale della sanità animale e dei farmaci veterinari Viale Giorgio Ribotta, 5 00144 Roma ITALY E-mail: l.candela@sanita.it
Latvia	**Inese Pereverteņa** - until June 2018 Pārtikas un Veterinārais Dienests Peldu iela 30 LV-1050 Rīga LATVIA E-mail: inese.perevertena@pvd.gov.lv **Dagnija Brensone** Pārtikas un Veterinārais Dienests Peldu iela 30 LV-1050 Rīga LATVIA E-mail: dagnija.brensone@pvd.gov.lv
Lithuania	**Sigitas Siriukaitis** Animal Health and Welfare Department Valstybinė maisto ir veterinarijos tarnyba Siesiku str. 19 LT-07170 Vilnius LITHUANIA E-mail: sigitas.siriukaitis@vmvt.lt
Luxembourg	**Marcel Bruch** Ministère de la Santé - Direction de la Santé Allée Marconi L-2120 LUXEMBOURG E-mail: marcel.bruch@ms.etat.lu

Country	Name and affiliation
Netherlands	**Bart van den Assum** Ministry of Agriculture, Nature and Food Quality Directorate-General for Agro and Nature Postbus 20401 2500 EK Den Haag THE NETHERLANDS E-mail: j.b.f.c.vandenassum@minez.nl **Inge van Geijlswijk (*Alternate*)** On behalf of the Netherlands Veterinary Medicines Institute (SDa), Faculty of Veterinary Medicine, Utrecht University PO Box 80155 3508 TD Utrecht THE NETHERLANDS E-mail: i.m.vangeijlswijk@uu.nl
Norway	**Kari Grave** Norwegian Veterinary Institute P.O. Box 750, 0106 Oslo NORWAY E-mail: kari.grave@vetinst.no **Kari Olli Helgesen (*Alternate*)** Norwegian Veterinary Institute P.O. Box 750, 0106 Oslo NORWAY E-mail: kari.helgesen@vetinst.no
Poland	**Nina Pora** - until April 2018 Ministerstwo Rolnictwa i Rozwoju Wsi ul. Wspólna 30 00-930 Warsaw POLAND E-mail: nina.pora@minrol.gov.pl **Dorota Żaboklicka-Bodzioch** Ministerstwo Rolnictwa i Rozwoju Wsi ul. Wspólna 30 00-930 Warsaw POLAND E-mail: Dorota.Zaboklicka-Bodzioch@minrol.gov.pl **Katarzyna Szymanek (*Alternate*)** PAŃSTWOWY INSTYTUT WETERYNARYJNY al. Partyzantow 57 24-100 Pulawy POLAND E-mail: katarzyna.szymanek@piwet.pulawy.pl
Portugal	**Maria Azevedo Mendes** Divisão de Gestão e Autorização de Medicamentos Veterinários Direção-Geral de Alimentação e Veterinária Campo Grande, n.º 50 1700-093 Lisboa PORTUGAL E-mail: maria.mendes@dgav.pt **Joao Pedro Duarte de Silva (*Alternate*)** Divisão de Gestão e Autorização de Medicamentos Veterinários Direção-Geral de Alimentação e Veterinária Campo Grande, n.º 50 1700-093 Lisboa PORTUGAL Email: jpsilva@dgav.pt

Country	Name and affiliation
Romania	**Camelia Voicu** Institutul pentru Controlul Produselor Biologice si Medicamentelor de Uz Veterinar 39 Dudului Street Sector 6 060603 Bucharest ROMANIA E-mail: camelia.vitan@icbmv.ro
Slovakia	**Judita Hederová** Institute for State Control of Veterinary Biologicals and Medicaments Ústav štátnej kontroly veterinárnych biopreparátov a liečiv Biovetská 34 949 01 Nitra SLOVAKIA E-mail: hederova@uskvbl.sk **Martina Ihnátová (*Alternate*)** Institute for State Control of Veterinary Biologicals and Medicaments Štátna veterinárna a potravinová správa Slovenskej republiky Botanická 17 842 13 Bratislava SLOVAKIA E-mail: ihnatova@svps.sk
Slovenia	**Anton Svetlin** Uprava Republike Slovenije za varno hrano, veterinarstvo in varstvo rastlin Administration of the Republic of Slovenia for Food Safety, Veterinary Sector and Plant Protection (AFSVSPP) Dunajska 22 SI-1000 Ljubljana SLOVENIA E-mail: anton.svetlin@gov.si
Spain	**Cristina Muñoz Madero** Spanish Agency of Medicines and Medical Devices Veterinary Department Parque Empresarial Las Mercedes Edificio 8 C/Campezo 1 28022 Madrid SPAIN E-mail: cmunoz@aemps.es **Sara Sacristán Álvarez (*Alternate*)** Spanish Agency of Medicines and Medical Devices Veterinary Department Parque Empresarial Las Mercedes Edificio 8 C/Campezo 1 28022 Madrid SPAIN E-mail: ssacristan@aemps.es

Country	Name and affiliation
Sweden	**Kinfe Girma** Department for Animal Welfare and Health, Division for International Affairs and Animal Health, Staff Unit Swedish Board of Agriculture SE-551 82 Jönköping SWEDEN E-mail: kinfe.girma@jordbruksverket.se **Christina Greko (*Alternate*)** Department of Animal Health and Antimicrobial Strategies, Strama VL Statens Veterinärmedicinska Anstalt, SVA (National Veterinary Institute) SE-751 89 Uppsala SWEDEN E-mail: christina.greko@sva.se
Switzerland	**Cedric Müntener** Institute of veterinary pharmacology and toxicology Winterthurerstrasse 260 8057 Zürich SWITZERLAND E-mail: cedric.muentener@vetpharm.uzh.ch
United Kingdom	**Ana Vidal** Veterinary Medicines Directorate Woodham Lane New Haw, Addlestone KT15 3LS Surrey UNITED KINGDOM E-mail: a.vidal@vmd.defra.gsi.gov.uk **Alexandra Pickering (*Alternate*)** Veterinary Medicines Directorate Woodham Lane New Haw, Addlestone KT15 3LS Surrey UNITED KINGDOM E-mail: a.pickering@vmd.defra.gsi.gov.uk

Annex 9. ESVAC sales advisory expert group members and observers

Table A18. List of ESVAC sales advisory expert group members

Name	Address	Country
Kari Grave (chair)	Norwegian Veterinary Institute P.O. Box 750, 0106 Oslo NORWAY E-mail: kari.grave@vetinst.no	Norway
Christina Greko	Department of Animal Health and Antimicrobial Strategies, Strama VL Statens Veterinärmedicinska Anstalt SE-751 89 Uppsala SWEDEN E-mail: christina.greko@sva.se	Sweden
Katariina Kivilahti-Mäntylä	Finnish Medicines Agency Mannerheimintie 103B 00280 Helsinki FINLAND E-mail: katariina.kivilahti-mantyla@fimea.fi	Finland
Laura Mie Jensen	Danish Veterinary and Food Administration Stationsparken 31-33 2600 Glostrup DENMARK E-mail: lauje@fvst.dk	Denmark
Gérard Moulin	Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail 8 rue Claude Bourgelat, Parc d'activité de la Grande Marche CS 70611 Javené, F-35306 Fougères Cedex FRANCE E-mail: gerard.moulin@anses.fr	France
Lucie Pokludová	Ústav pro státní kontrolu veterinárních biopreparátů a léčiv Hudcova 56a 621 00 Brno - Medlánky CZECH REPUBLIC E-mail: pokludova@uskvbl.cz	Czech Republic

Table A19. List of ESVAC sales advisory expert group observers from the European Commission, ECDC and EFSA

Name	Address	Representing institution
Dean Bosnjak – until June 2018	DG SANTE D6 – Medicinal Products – quality, safety and efficacy Rue de Mot 24 1040 Brussels BELGIUM E-mail: dean.bosnjak@ec.europa.eu	European Commission
Julie Sainz	DG SANTE E5 – Animal nutrition, veterinary medicines Rue Breydel 4 1040 Brussels BELGIUM E-mail: julie.sainz@ec.europa.eu	European Commission
Klaus Weist	European Centre for Disease Prevention and Control Tomtebodavägen 11 A 171 83 Stockholm SWEDEN E-mail: klaus.weist@ecdc.europa.eu	European Centre for Disease Prevention and Control (ECDC)
Pierre-Alexandre Beloeil	European Food Safety Authority Largo N. Palli 5/A I-43121 Parma ITALY E-mail: pierre-alexandre.beloeil@efsa.europa.eu	European Food Safety Authority (EFSA)

European Medicines Agency

30 Churchill Place
Canary Wharf
London E14 5EU
United Kingdom

Telephone +44 (0)20 3660 6000
Facsimile +44 (0)20 3660 5555
Send a question www.ema.europa.eu/contact

www.ema.europa.eu

Sales of veterinary antimicrobial agents in 30 European countries in 2016
Trends from 2010 to 2016
Eighth ESVAC report
EMA/275982/2018

TC-AE-18-001-EN-N
ISBN 978-92-9155-059-3
ISSN 2315-1455
DOI 10.2809/807372