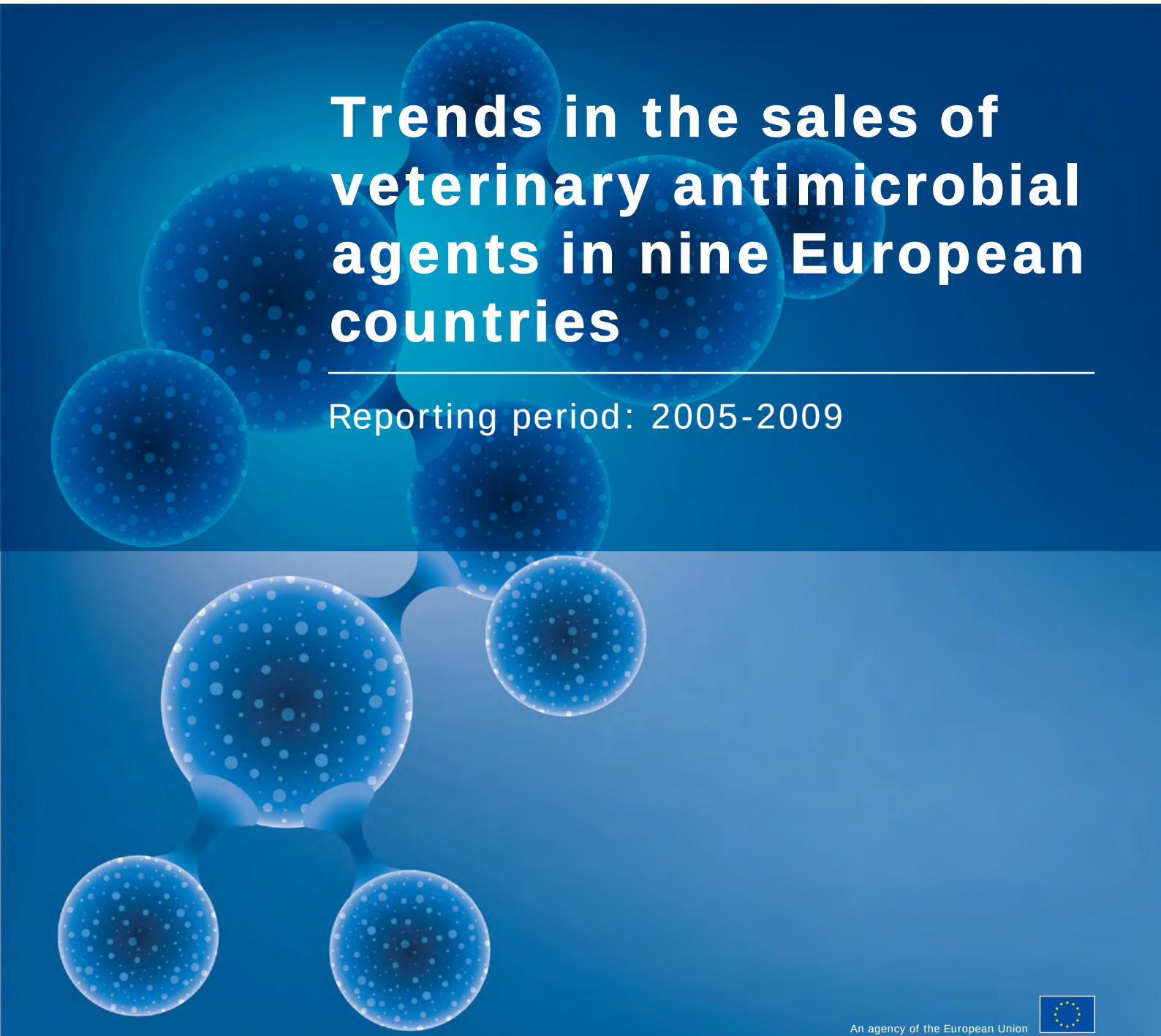
EUROPEAN MEDICINES AGENCY
SCIENCE MEDICINES HEALTH

# Trends in the sales of veterinary antimicrobial agents in nine European countries

Reporting period: 2005-2009



An agency of the European Union

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 is the European Union 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 the best-possible scientific advice on any question 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.

**Principal activities**

Working with the Member States and the European Commission as partners in a European medicines network, the European Medicines 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 European Commission;
- 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 European Commission;
- 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 European Commission 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.

# Trends in the sales of veterinary antimicrobial agents in nine European countries

Reporting period: 2005-2009

15 September 2011
EMA/238630/2011
Veterinary Medicines and Product Data Management

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## About the European Medicines Agency

The European Medicines Agency (EMA) is a decentralised body of the European Union, 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 European Commission, a centralised marketing authorisation is valid in all European Union (EU) and EEA-EFTA states (Iceland, Liechtenstein and Norway).

The Agency, with the help of the Committee for Medicinal Products for Veterinary Use (CVMP) and its Scientific Advisory Group on Antimicrobials (SAGAM), has produced a strong body of scientific advice[1] in relation to use of antimicrobials and the risk of antimicrobial resistance, with the intention to promote the continued availability of effective antimicrobials for use in animals, while at the same time acting to minimise risks to animals or man arising from their use.

The European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) project was launched by the European Medicines Agency in September 2009, following a request from the European Commission to develop a harmonised approach for the collection and reporting of data on the use of antimicrobial agents in animals from the Member States. In order to get experience on how to analyse and report such data at the Community level, already existing data on the sales of veterinary antimicrobial agents have been collected and reported in a harmonised manner from those countries that had already established surveillance programs.

## About the report

The present report analyses aggregated data from nine European countries that have for several years had surveillance programs on sales of antimicrobial agents in place and published data annually.

**It should be emphasised that aggregated data such as those presented in this report should not be used alone as a basis for setting management priorities, but should always be complemented by data from other sources.**

The ESVAC is currently collecting harmonised and detailed data on sales of veterinary antimicrobial agents at package level for 2010 from European countries according to a standardised template[2]. In contrast to the aggregated data, the data collected according to the template will for example give information on administration form and differ between herd and individual treatment; these data will allow for a more in-depth analysis of the use of veterinary antimicrobial agents in the EU.

1 See details on the EMA website here.
2 Available from the EMA website here.

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# Summary

The use of antimicrobial agents is the key risk factor for the development and spread of antimicrobial resistance. It is therefore generally recognised that data on the usage of antimicrobial agents in food-producing animals (and companion animals) are essential for identifying and quantifying the risk of developing and spreading antibiotic resistance in the food-chain.

The European Commission has asked the European Medicines Agency (EMA) to take the lead in the collection of harmonised data on overall sales, as well as per animal species, of veterinary antimicrobial agents. The European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) project was launched by the Agency in September 2009. To ensure that the data provided by the Member States are harmonised, an ESVAC Data Collection Protocol (ESVAC template) has been developed and a call for data for 2010 has been launched.

In this study, existing data on sales of veterinary antimicrobial agents were collected in a standardised manner from nine European countries that had established surveillance programs and had published data annually for several years. The aim was to gain experience on how to analyse and report the data in a standardised manner so that trends in sales over time could be assessed and prescribing patterns identified for the nine countries, as well as for each country individually. The data were analysed mainly by the EMA but with assistance from the participating countries.

Eight of the countries provided aggregated data on sales, in tonnes of active ingredient, of veterinary antimicrobial agents for 2005-2009, namely the Czech Republic, Denmark, Finland, France, the Netherlands, Norway, Sweden and the United Kingdom, while Switzerland provided sales data for the years 2006-2009. Only two countries, the Czech Republic and Finland, deviated from the inclusion criteria by including dermatological preparations and preparations for sensory organs; however, the contribution from these groups to the total amounts is minimal and, therefore, the effect of the deviation is negligible. Furthermore, sales for use in farmed fish were not included in the data from Norway and Sweden.

To normalise the sales data over time within each country by animal population, the annual sales figure in each country was divided by the estimated weight at treatment of livestock and of slaughter animals in the corresponding year. In this report, the population correction unit (PCU) is used as the term for the estimated weight of both livestock and slaughtered animals. For Norway and Sweden farmed fish have not been included in the PCU. The PCU is a purely technical unit of measurement. The estimation of the PCU takes into account that animals transported for slaughter or fattening in another Member State are likely to have been treated in the country of origin. The countries with the highest net export of animals for fattening or slaughter in another Member State are Denmark, the Czech Republic, the Netherlands and France; the estimated weight of animals transported to other countries accounts for approximately 7-10%, 4-6%, 5% and 2-3% respectively of the total estimated weight, while for the other countries this was negligible. The total sales, in tonnes of active ingredient, for the eight countries for which data were available for the years 2005-2009, decreased by 11.2%, while the PCU for the corresponding countries decreased by 3.1% (Switzerland not included). When sales data are expressed as mg/PCU, the decrease in total sales for the eight countries providing data for all the years is 8.3%. This shows the importance of taking into account the animal demographics when assessing trends in the sales of veterinary antimicrobial agents. For some countries a decrease in the sales in mg/PCU is observed, whereas for other countries an increase is observed.

A major finding is the substantial difference in the prescribing patterns of veterinary antimicrobial agents between the countries. Generally, these variations may be due to differences between the countries in the availability of veterinary antibacterial products on the market in those countries, prices, risk-management measures implemented, the veterinarians' prescribing behaviour, animal production systems (e.g. veal as opposed to beef cattle on pasture) and the general situation with regard to infectious diseases.

There are significant differences in the sales, in mg/PCU, between the nine countries. These differences are likely to be due in part to differences between countries in the composition of the animal population, the selection of antimicrobial agents, and the dosing regimen. It should be emphasised that sales in mg per PCU are not indicators for the level of exposure. The main goal of calculating the amount of mg sold per PCU is to adjust trends in the sales within a country for possible changes in the size of animal livestock population and number of slaughtered animals.

A positive correlation was shown between the total PCU (by country and year) with tetracyclines and macrolides sales (tonnes of active ingredient); a similar correlation was found for the PCU for each species individually (cattle, pigs and poultry) with tetracyclines and macrolides sales. In contrast, negative correlations were shown between the total PCU (by country and year) with penicillins sales (tonnes of active ingredient) and the PCU for each of the individual species (cattle, pigs and poultry).

Antimicrobial class repartition and prescribing patterns vary importantly between species; therefore, the variation in the animal demographics between countries may partly explain the observed correlations, but other factors also need to be considered.

While the differences in animal demographics, antimicrobial class repartition between species and prescribing patterns may explain to some extent the variation in the sales observed in the different countries, other factors also need to be considered.

As the data presented in this report are aggregated per antimicrobial class, they do not allow for more in-depth analysis. To identify the factors underlying the differences observed, there is a need for more detailed sales data. As a first step, the use of the standardised ESVAC template for the collection of data will provide detailed data at package level, including information on administration form and herd treatment versus individual treatment, allowing for more detailed analysis than can be done using the aggregated data. The next steps should be to collect data per animal species and to analyse the data taking into account variance in the dosing of the various agents. As some agents are administered in much higher dosages than others (e.g. tetracyclines versus cephalosporins), there is a need to continue to refine the tools for analysing the data on sales of antimicrobial agents.

# 1. Introduction

The use of antimicrobial agents is an important risk factor for the development of antimicrobial resistance. Any use – in people, animals or plants – anywhere in the world can potentially affect everyone. Use in one individual can promote the local survival of resistant strains that can subsequently spread from that individual to others and potentially, over time, to any community in the world. Consequently, antimicrobial agents have been described as societal drugs, in recognition of the possible global impact of their use. It is therefore generally recognised that data on the usage of antimicrobial agents in food-producing animals are essential for identifying and quantifying the risk of developing and spreading antibiotic resistance in the food-chain. This was also acknowledged by the European Council in 2008 through the Council Conclusions on Antimicrobial Resistance (Council of the European Union, 2008), which called upon the Member States to strengthen surveillance systems and improve data quality on antimicrobial resistance and on use of antimicrobial agents within both human and veterinary sectors.

In response to the Council Conclusion, the European Commission requested the European Medicines Agency (EMA) to take the lead in the collection of data on sales of veterinary antimicrobial agents in the Member States. 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 Commission, the EMA is 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 (poultry, pigs, veal calves, other ruminants, pets and fish);
- to collect the data from Member States and manage the database;
- to draft a summary annual report with the data from Member States and publish it before the end of November of the year following the year of monitoring.

With regard to the data collection:

- comparability with the sale/use of antimicrobials in humans should be ensured;
- a multi-annual approach should be anticipated, to allow for the evaluation of trends. The execution may be limited in time, including at least one year of monitoring, but integration of the data in a follow-up request should be foreseen.

An appendix to the terms of reference sets out the following intended uses for the collected data on usage of veterinary antimicrobial agents:

- To aid interpretation of patterns and trends regarding antibacterial resistance.
- To serve as a basis for risk profiling and risk assessment regarding antibacterial drug resistance.
- To serve as a basis for setting risk-management priorities.
- To serve as a basis for evaluating the effectiveness of control measures being implemented.
- To aid in identifying emerging use of antibacterial drugs, e.g. of specific drug classes such as critically important antibiotics.
- To aid in comparing usage of antibacterial drugs between and within countries, and between time periods, etc.
- To assess the spread and effects of environmental pollution through use of antibacterial drugs.
- To serve as a basis for focused and targeted research and development.

## 1.1. Approach to obtaining harmonised data

Following the request, the Agency, together with experts from countries that had published data on veterinary antimicrobial agents, developed the ESVAC protocol (EMA/76066/2010) which describes the classes of antimicrobials to be included in the material, as well as the variables to be reported for each package, in addition to the number of packages sold. Furthermore, to ensure that the data provided by the Member States are harmonised, the ESVAC Data Collection Form (ESVAC template) has been developed (EMA/790974/2010). A call for data for 2010 has been sent to 22 European countries, of which 20 are Member States willing to participate in the first pilot phase of the implementation of the ESVAC project. The deadline for submission of the data is 1 September 2011.

## 1.2. Identification of the existing data/surveillance systems established

A total of nine European countries – the Czech Republic (CZ), Denmark (DK), Finland (FI), France (FR), the Netherlands (NL), Norway (NO), Sweden (SE), Switzerland (CH) and the United Kingdom (UK) – were identified as having established surveillance programs on sales of antimicrobial agents, and had published data annually for several years, some of these having been operational for more than 10 years. The data were, however, reported in different ways by the various countries, and for some countries it was not possible to identify which antimicrobial agents had been included in the surveillance program.

To make use of the existing data obtained through these surveillance programs, and to gain experience on how to analyse and report such data, the nine countries agreed to participate in a pilot study, with the aim of collecting standardised, aggregated sales data on veterinary antimicrobial agents for the years 2005-2009. Furthermore, the aim was to report the data in a standardised manner, to allow trends in sales over time to be assessed and prescribing patterns to be identified, aggregated for the nine countries, as well as for each country individually.

# 2. Material and methods

## 2.1. Veterinary antimicrobial classes included in the material

To harmonise the veterinary antimicrobial agents to be included in the material, the Anatomical Therapeutic Chemical classification system for veterinary medicinal products (ATCvet[1]) was applied. Each country was asked to provide data on the overall sales (not by animal species), in tonnes of active ingredient, of the groups of veterinary antimicrobial agents in the ATCvet groups described, for the years 2005-2009 (Table 1). As data for Switzerland do not cover 2005, this country is excluded from some of the analysis.

For some of the countries, dermatological preparations (ATCvet code QD) and preparations for sensory organs (ATCvet code QS) were included in the original data. In such cases, deviations from Table 1 were accepted, to avoid having to recalculate the data; any such deviations are described in the respective country-specific sections of this report.

To harmonise with the presentation of data on use of antimicrobial agents in human medicine, the data are presented according to the ATCvet system (same order) and ATCvet names, usually WHO international non-proprietary names (INN names), where available. If INN names are not assigned, the ATCvet system applies either USAN (United States Adopted Names) or BAN (British Approved Names).

**Table 1.** Categories and ATCvet codes of veterinary antimicrobial agents included in the data

| Categories of veterinary antimicrobial agents | ATCvet codes |
|---|---|
| Antimicrobial agents for intestinal use | QA07AA; QA07AB |
| Antimicrobial agents for intrauterine use | QG51AA; QG51AC; QG51AE; QG51AX<br>QG51BA; QG51BC; QG51BE |
| Antimicrobial agents for systemic use | QJ01 |
| Antimicrobial agents for intramammary use | QJ51 |
| Antimicrobial agents used as antiparasitic agents | QP51AG |

To express antimicrobial prodrugs as active ingredient in a standardised manner, the countries were asked to apply the same conversion factor when calculating weight of active ingredient, i.e. 0.39 for benzathine benzylpenicillin, 0.38 for benzathine phenoxymethylpenicillin, 0.63 for penethamate hydriodide and 0.61 for procaine penicillin. For antimicrobial agents for which the strength is given in international units (IU), the conversion factors shown in Table 2 were used to calculate the amounts sold in weight of active substance.

**Table 2.** Conversion factors[1,2] from international units (IU) to weight (mg) of active ingredient

| Active ingredient | IU/mg | Conversion factor (mg/IU) |
|---|---|---|
| Bacitracin | 74 | 0.013514 |
| Colistin sulphate | 20,500 | 0.000049 |
| Colistin methane sulphonate | 12,700 | 0.000079 |
| Dihydrostreptomycin sulphate | 820 | 0.001220 |
| Erythromycin | 920 | 0.001087 |
| Gentamicin | 620 | 0.001613 |
| Gramicidin | 1,070 | 0.000935 |
| Kanamycin sulphate | 796 | 0.001256 |

1 ATCvet system for classification of veterinary medicines: www.whocc.no/atcvet/

| Active ingredient | IU/mg | Conversion factor (mg/IU) |
|---|---|---|
| Neomycin sulphate | 755 | 0.001325 |
| Nystatin | 5,710 | 0.000175 |
| Polymyxin B sulphate | 8,403 | 0.000119 |
| Rifamycin | 887 | 0.001127 |
| Spiramycin | 3,200 | 0.000313 |
| Streptomycin | 785 | 0.001274 |
| Tobramycin | 875 | 0.001143 |

[1] International Standards for Antibiotics: http://crs.pheur.org/db/4DCGI/search?vSelectName=4&vContains=1&vtUserName=ISA&OK=Search
[2] Colistin methane sulphonate: http://www.who.int/bloodproducts/catalogue/AntiJan10.pdf

Furthermore, each country provided information on the systems for distribution of antimicrobial veterinary medicinal products in their country, as well as on the sources from which the data were obtained, the legal basis for the collection of the data, and the assumed data coverage.

## 2.2. Population correction factor

The amounts of veterinary antimicrobial agents sold in the different countries are, among others, linked to the animal demographics in each country, which may vary over time. In this report, the annual sales figures in each country were divided by the estimated weight at treatment of livestock and of slaughtered animals in the corresponding year. In this report, the population correction unit (PCU) is used as the term for the estimated weight; the PCU is purely a technical unit of measurement, used only to estimate temporal trends in individual countries and across countries. In this report, 1 PCU = 1 kg of different categories of livestock and slaughtered animals.

## 2.3. Animal species and categories included; selection of data sources

The selection of animal species and data sources for the estimation of PCU was made to fulfil the following objectives:

1. The collection of data should be harmonised between countries.
2. The methodology for collection and reporting of data should be transparent.
3. The data should be validated at regular intervals.
4. The data should be made available for the included species for all Member States.

Eurostat, the Statistical Office of the European Union, covers data on numbers and biomass of food-producing animals slaughtered, as well as data on livestock food-producing animals, and Eurostat data comply with of the abovementioned criteria. Therefore, Eurostat was selected as the data source for data on this animal category.

For livestock horses, national statistics were used (see Appendix 2). As data on dogs and cats are not available in all participating countries, these species were not included in the PCU, in order to have standardised data.

For Norway and Sweden, data on sales of antimicrobial agents for farmed fish are not included, as these are collected separately in these countries. Consequently, farmed fish is not included in the calculation of PCU for Norway and Sweden.

Animals exported for fattening or slaughter in another Member State are likely to have been treated with antimicrobial agents in the country of origin, but would be included in the Eurostat data. It was decided to correct for this for the major species (cattle, pigs, poultry and sheep). However, the Eurostat data on number of animals exported or imported for fattening or slaughter are not valid, as these are reported only when above a certain limit (personal communication, Michael Goll), which implies that the Eurostat data represent an underestimate of these for most species and countries. These data were therefore obtained from TRACES (DG SANCO, European Commission), and as these are based on health certificates, which are obligatory for all animals passing any border, they are considered reliable. However, data were only available from 2006, therefore exported and imported animals have not been taken into account for

2005. TRACES is not a public data source, as the application is designed for online certification. For data-protection reasons, access to the application is restricted to veterinary authorities and to economic users validated by the relevant veterinary authority.

## 2.4. Calculation of PCU

Essentially, the PCU for each animal category was calculated by multiplying numbers of livestock animals (dairy cows, sheep, sows and horses) and slaughtered animals (cattle, pigs, lambs, poultry and turkeys) by the theoretical weight at the time most likely for treatment. For animals exported or imported for fattening or slaughter (cattle, pigs and poultry), the PCU was calculated by multiplying the number of animals with a standardised weight. The detailed calculations, including the standardised weights of the PCU, are given in Appendix 2, method I. For farmed fish, Eurostat data are given only as live-weight slaughtered, as information on weight at treatment was not identified; for fish, the PCU is taken as biomass live-weight slaughtered in each country. For Switzerland, the PCU was calculated by a different method, as some data on numbers of slaughtered animals were not available (see Appendix 2, method II).

In a study by Grave et al (2010), a slightly different method was used to estimate PCU. The values for PCU for 2007 calculated by the methods described in Appendix 2 were compared against the values obtained for the same year by Grave et al (2010) using the Pearson correlation test, to identify whether the data correlated.

## 2.5. Examination of possible correlation between animal demographics and prescribing patterns

The types and incidences of infectious diseases vary considerably between animal species and production category (e.g. veal versus dairy cattle), and consequently the sales of veterinary antibacterial agents are thought to be influenced by animal species demographics.

The correlation between the PCU for the major species (cattle, pigs and poultry) and the sales of the three major antimicrobial classes (macrolides, penicillins and tetracyclines) was studied using the Spearman correlation test.

# 3. Results

## 3.1. Overall results for the nine countries

### 3.1.1. Summary of data sources, legal bases and data coverage

**Table 3.** Summary table of data on sales of veterinary antimicrobial agents for therapeutic use, legal basis, data provider, data source and data coverage, by country

| Country | Legal basis | Data provider | Data sources (approx. no) | Data coverage | Antimicrobials included | Species covered |
|---|---|---|---|---|---|---|
| Czech Republic (CZ) | Mandatory to report | Institute for State Control of Veterinary Biologicals and Medicaments | Wholesalers (76); feed mills (79) | Assumed to be 98% | Table 1 + QD + QS | Terrestrial and aquatic species |
| Denmark (DK) | Mandatory to report | VetStat, Technological University of Denmark | Pharmacies; wholesalers; veterinarians; feed mills | Assumed to be 100% | Table 1 | Terrestrial and aquatic species |
| Finland (FI) | Mandatory to report | Finnish Medicines Agency | Wholesalers (5); feed mills and importers of medicated feed (2) | Assumed to be 100% | Table 1 + QD + QS | Terrestrial and aquatic species |
| France (FR) | Not mandatory | French Agency for Veterinary Medicinal Products (ANSES) | Marketing authorisation holders (31) | Assumed to be 100% | Table 1 | Terrestrial and aquatic species |
| Netherlands (NL) | Not mandatory | Federation of the Dutch Veterinary Pharmaceutical Industry (FIDIN) | Marketing authorisation holders (69) | Assumed to be about 98% | Table 1 | Terrestrial and aquatic species |
| Norway (NO) | Mandatory to report | Norwegian Veterinary Institute | Wholesalers (5) | Assumed to be 100% | Table 1 | Terrestrial species only |
| Sweden (SE) | Mandatory to report | National Veterinary Institute | Pharmacies (Apotekens Service AB) | Assumed to be close to 100% | Table 1 | Terrestrial species only |
| Switzerland (CH) | Mandatory to report | Swiss Agency for Therapeutic Products (Swissmedic) | Marketing authorisation holders (20) | Assumed to be 100% | Table 1 | Terrestrial species only |
| United Kingdom (UK) | Mandatory to report | Veterinary Medicines Directorate | Marketing authorisation holders (47) | Assumed to be 100% | Table 1 | Terrestrial and aquatic species |

## 3.1.2. Sales during the reporting period (2005-2009)

**Table 4.** Sales of active ingredient, in tonnes, by country, during the reporting period (2005-2009)

| Country | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Czech Republic (CZ) | 91 | 100 | 88 | 95 | 82 |
| Denmark (DK) | 111 | 114 | 119 | 117 | 130 |
| Finland (FI) | 14 | 14 | 15 | 17 | 17 |
| France (FR) | 1,322 | 1,260 | 1,346 | 1,188 | 1,064 |
| Netherlands (NL) | 508 | 544 | 589 | 526 | 514 |
| Norway (NO) | 6 | 6 | 6 | 6 | 6 |
| Sweden (SE) | 16 | 17 | 17 | 16 | 15 |
| Switzerland (CH)[1] | - | 68 | 72 | 73 | 70 |
| United Kingdom (UK) | 445 | 403 | 395 | 381 | 403 |
| **Total** | **2,514** | **2,527** | **2,649** | **2,420** | **2,301** |
| **Total (without CH)** | **2,514** | **2,459** | **2,577** | **2,347** | **2,231** |

[1] Not available for 2005.

The total sales, in tonnes of active ingredient, for the eight countries for which data were available for the years 2005-2009, decreased by 11.2% (Table 4) (CH not included).

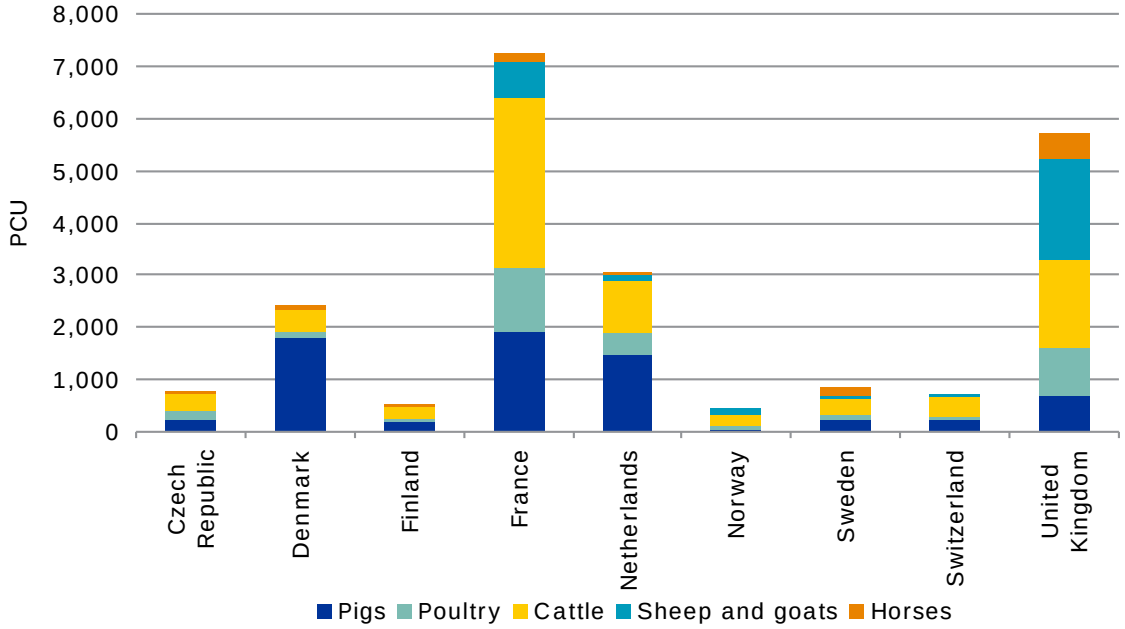
**Table 5.** Estimated PCU (in 1,000 tonnes) of the animal population, by country, during the reporting period (2005-2009)

| Country | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Czech Republic (CZ) | 888 | 887 | 875 | 840 | 771 |
| Denmark (DK) | 2,443 | 2,543 | 2,537 | 2,523 | 2,447 |
| Finland (FI) | 562 | 558 | 554 | 541 | 524 |
| France (FR) | 7,801 | 7,666 | 7,789 | 7,707 | 7,539 |
| Netherlands (NL) | 3,170 | 3,214 | 3,288 | 3,133 | 3,109 |
| Norway (NO) | 436 | 437 | 429 | 438 | 440 |
| Sweden (SE) | 837 | 828 | 819 | 819 | 825 |
| Switzerland (CH)[1] | - | 729 | 731 | 734 | 743 |
| United Kingdom (UK) | 6,142 | 6,190 | 6,202 | 6,018 | 5,925 |
| **Total** | **22,280** | **23,052** | **23,224** | **22,754** | **22,322** |
| **Total (without CH)** | **22,280** | **22,323** | **22,493** | **22,020** | **21,579** |

[1] Not relevant for 2005.

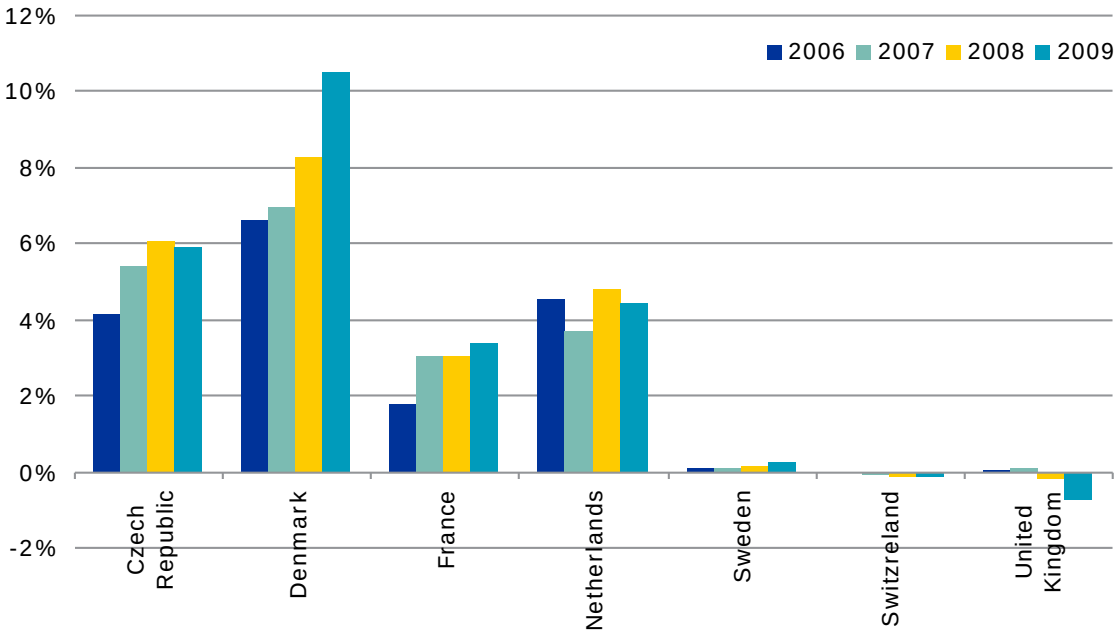
The estimated PCU of the animal population decreased by 3.1% (Table 5) from 2005 to 2009 in the eight countries that provided sales data for the same years (CH not included). It should be noted that the PCU for the Netherlands is slightly underestimated for 2008 and 2009, due to under-reporting of numbers of slaughtered broilers in Eurostat. The PCU accounted for by the various animal species in the nine countries for 2009 is shown in Figure 1.

**Figure 1.** PCU (in 1,000 tonnes) of the major animal species in 2009, by country




The countries with the highest net export of animals for fattening or slaughter in another Member State are Denmark, the Czech Republic, the Netherlands and France; the estimated weight of animals transported to other countries accounts for approximately 7-10%, 4-6%, 5% and 2-3% respectively of the total estimated weight (see the detailed data in Appendix 2).

**Figure 2.** Percentage of the total PCU of animals exported or imported[1] for fattening or slaughter in another Member State for 2006-2009. TRACES data not valid for 2005




[1] Data represent the net balance between export and import, i.e. a negative value means a net import.

A comparison between PCU values for 2007 used in this study and a similar unit used in the paper by Grave et al (2010) is shown in Figure 3. The correlation coefficient between the data is r=0.974. The deviation observed for the UK is due to inclusion of livestock sheep in the PCU in the current report, and reflects the high number of sheep in the UK as compared to the other eight countries.

**Figure 3.** Comparison between the population correction unit (PCU) calculated for 2007 in the current report and a similar unit applied by Grave et al (2010) for 2007, by country

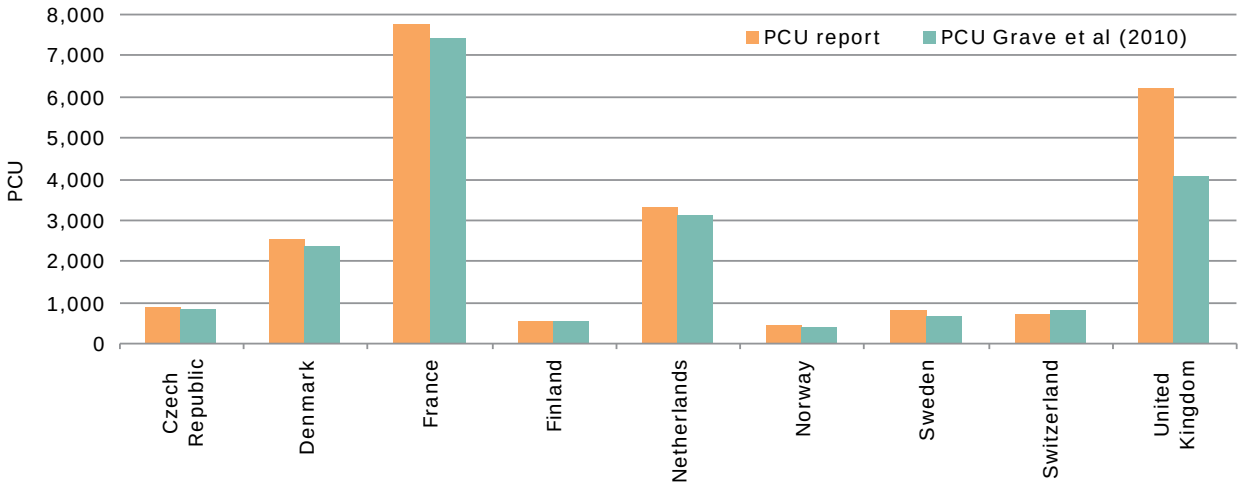


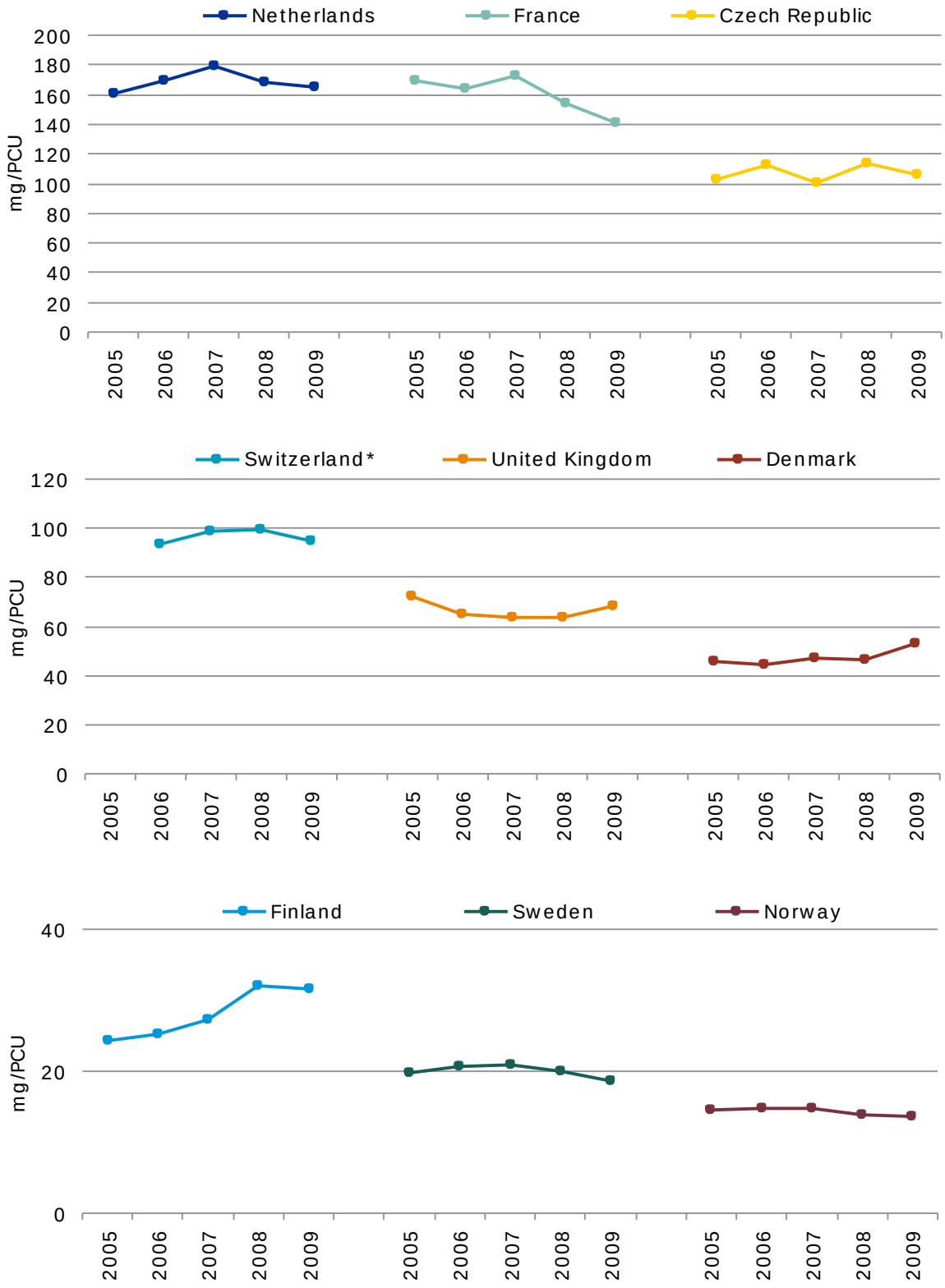

**Table 6.** Sales normalised by population correction unit (PCU) for the years 2005-2009. Data are expressed as mg/PCU

| Country | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Czech Republic (CZ) | 103 | 113 | 101 | 114 | 106 |
| Denmark (DK) | 46 | 45 | 47 | 46 | 53 |
| Finland (FI) | 24 | 25 | 27 | 32 | 32 |
| France (FR) | 169 | 164 | 173 | 154 | 141 |
| Netherlands (NL) | 160 | 169 | 179 | 168 | 165 |
| Norway (NO) | 14 | 15 | 15 | 14 | 14 |
| Sweden (SE) | 20 | 21 | 21 | 20 | 19 |
| Switzerland (CH)[1] | - | 93 | 99 | 99 | 95 |
| United Kingdom (UK) | 72 | 65 | 64 | 63 | 68 |

[1] Data on sales not available for 2005; PCU is calculated by a method slightly different from that used for the other eight countries (see Appendix 2, method II). Differences between countries are probably caused in part by differences in animal demographics, in the selection of antimicrobial agents and in dosage regimes, among other factors.

As the PCU for the Netherlands is slightly underestimated for 2008 and 2009, due to under-reporting of numbers of slaughtered broilers in Eurostat, the value for the mg/PCU is slightly overestimated for these years. The temporal trends in sales by country are shown in Figure 4. Detailed comments on the country data are available in Section 3.2.

**Figure 4.** Temporal trends in the sales, expressed in mg per population correction unit (mg/PCU), of veterinary antimicrobial agents in nine European countries. Note the differences in the scales




* Data on sales not available for 2005; PCU is calculated by a method slightly different from that used for the other eight countries (see Appendix 2, method II). Differences between countries are probably caused in part by differences in animal demographics, in the selection of antimicrobial agents and in dosage regimes, among other factors.

**Table 7.** Total sales of veterinary antimicrobial agents (active ingredient), total population correction unit (PCU) and mean mg/PCU in eight European countries (Switzerland not included)

| | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Total sales (tonnes) | 2,513 | 2,459 | 2,576 | 2,348 | 2,232 |
| Total PCU (1,000 tonnes) | 22,288 | 22,323 | 22,493 | 22,020 | 21,579 |
| Mean mg/PCU | 112.8 | 110.2 | 114.5 | 106.6 | 103.4 |

When sales results are expressed as mg/PCU, the decrease in total sales for the eight countries providing data for all years is 8.3% (Table 7).

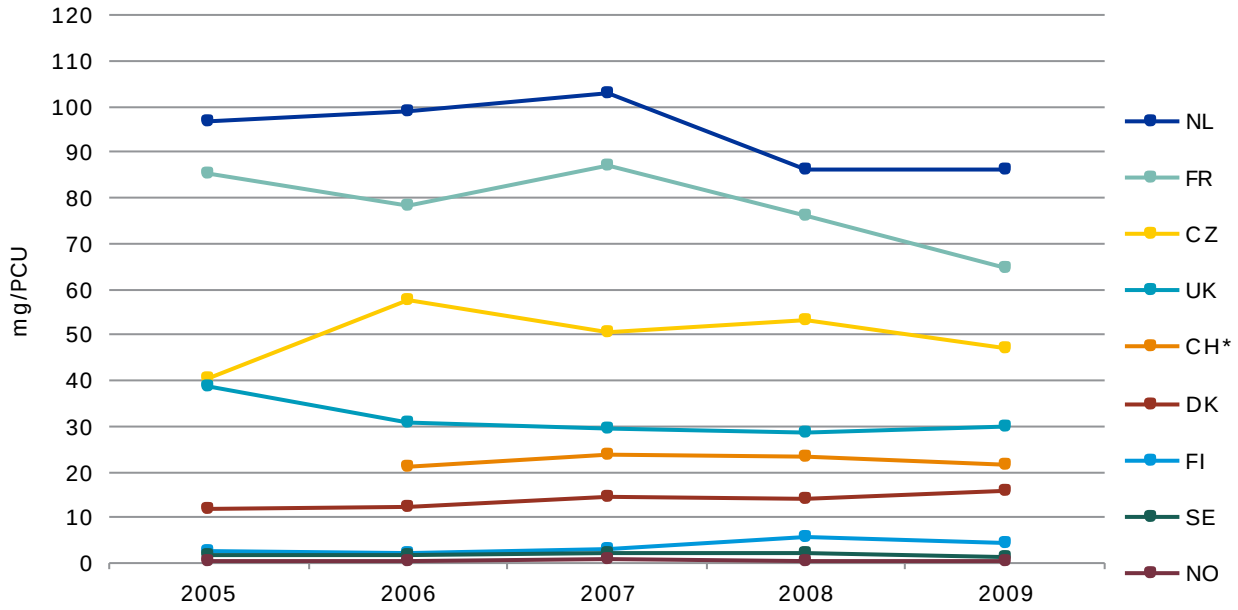
From 2005 to 2009, a decrease in the sales of veterinary antimicrobial agents for the eight countries (Switzerland not included) was observed; this decrease is mainly due to a decrease in sales of tetracyclines and, to a lesser extent, of sulfonamides (Table 8).

**Table 8.** Difference between 2009 and 2005 in sales, expressed as tonnes active ingredient and as mg/PCU (population correction unit), for eight European countries (Switzerland not included)

| Antimicrobial class | Tonnes | Tonnes (%) | mg/PCU | mg/PCU (%) |
|---|---|---|---|---|
| Tetracyclines | -268.2 | -21.0% | -10.6 | -18.4% |
| Amphenicols | -2.5 | -18.4% | -0.1 | -15.7% |
| Penicillins | 32.7 | 11.0% | 1.9 | 14.6% |
| Cephalosporins (total) | 3.1 | 19.2% | 0.2 | 23.0% |
| *1st and 2nd gen. cephalosporins* | 2.5 | 21.6% | 0.1 | 25.5% |
| *3rd and 4th gen. cephalosporins* | 0.5 | 15.1% | 0.03 | 18.8% |
| Sulfonamides and trimethoprim (total) | -38.2 | -8.5% | -1.1 | -5.5% |
| *Sulfonamides* | -31.0 | -8.0% | -0.9 | -5.1% |
| *Trimethoprim* | -7.2 | -10.8% | -0.2 | -7.9% |
| Macrolides | -1.2 | -0.6% | 0.2 | 2.6% |
| Lincosamides | -3.0 | -13.8% | -0.1 | -11.0% |
| Aminoglycosides | -14.5 | -12.6% | -0.5 | -9.7% |
| Quinolones (total) | -8.8 | -26.4% | -0.4 | -24.0% |
| *Fluoroquinolones* | 1.9 | 27.8% | 0.1 | 31.9% |
| *Other quinolones* | -10.7 | -42.0% | -0.5 | -40.1% |
| Polymyxins | 1.1 | 1.6% | 0.2 | 4.9% |
| Pleuromutilins | 9.7 | 43.3% | 0.5 | 48.0% |
| Others | 3.5 | 32.3% | 0.2 | 36.6% |
| **Difference all classes** | **-281** | **-11.2%** | **-9.4** | **-8.3%** |

The sales in mg/PCU of tetracyclines by country are shown in Figure 5. Similar to the overall use (see comments to Table 6), the value for the mg/PCU for tetracyclines is slightly overestimated for the Netherlands for 2008 and 2009.

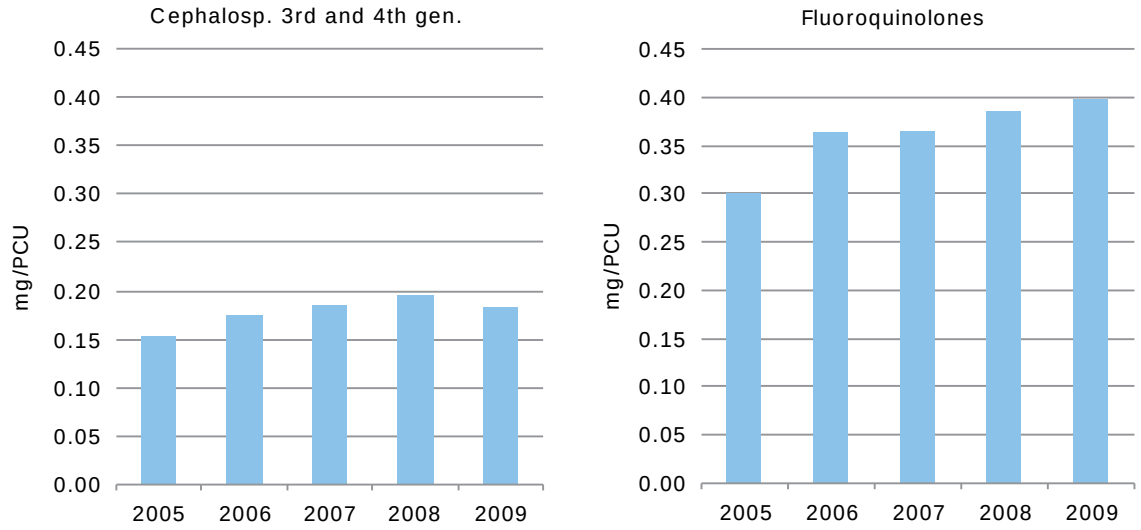
**Figure 5.** Temporal trends in the sales, expressed in mg per population correction unit (mg/PCU), of tetracyclines as veterinary medicinal products in nine European countries




* Sales data not available for Switzerland for 2005.

For antimicrobial agents considered to be critically important antimicrobials in human medicine, such as the 3rd and 4th-generation cephalosporins and the fluoroquinolones, an overall increase in sales is observed. It should be noted that some countries report 3rd and 4th-generation cephalosporins aggregated as cephalosporins, and fluoroquinolones aggregated at the level of quinolones, and data from these countries are not included in Figure 6.

**Figure 6.** Sales in mg/PCU of 3rd and 4th-generation cephalosporins (in DK, FR, NL, SE, UK) and of fluoroquinolones (in DK, FI, FR, NL, NO, SE, UK), 2005-2009



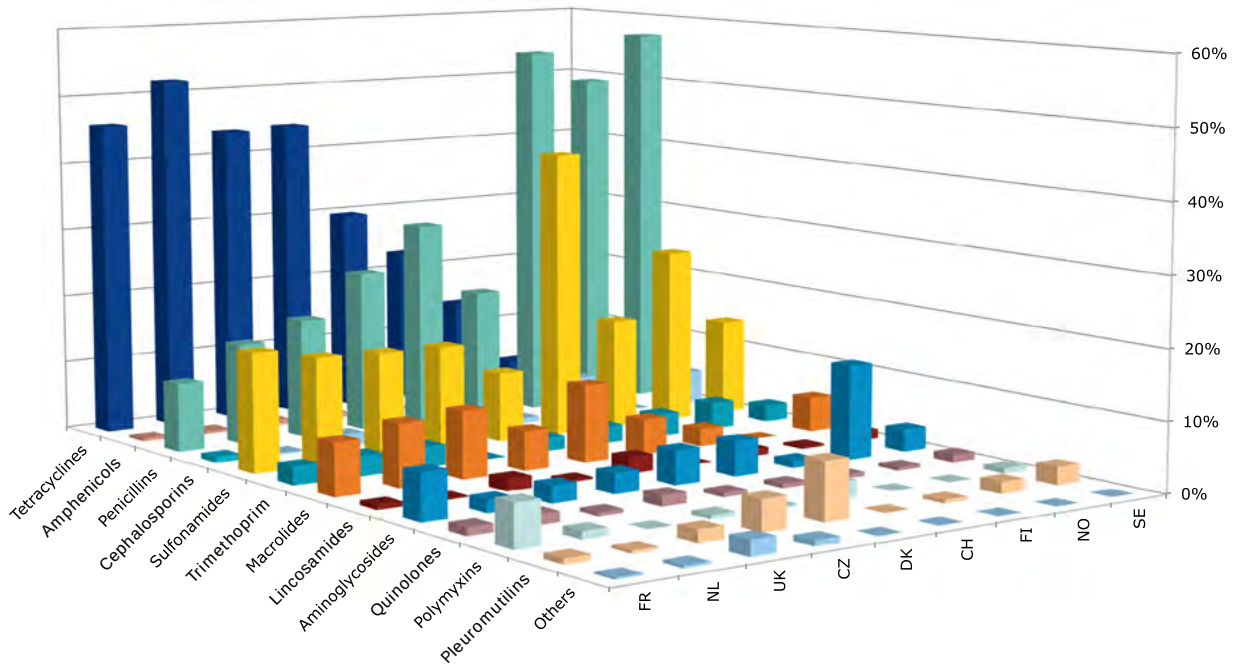
## 3.1.3. Sales patterns in the reporting countries in 2009

**Table 9.** Sales in 2009 of the various antimicrobial classes, as a percentage of total tonnes of veterinary antimicrobial agents sold, by country

| | CZ | FI | DK | FR | NL | NO | SE | CH | UK |
|---|---|---|---|---|---|---|---|---|---|
| Tetracyclines | 44.1% | 13.8% | 29.6% | 45.8% | 52.0% | 3.6% | 7.6% | 22.7% | 43.8% |
| Amphenicols | 0.6% | - | 0.5% | 0.5% | 0.4% | 0.4% | - | 0.3% | 0.7% |
| Penicillins | 23.4% | 55.2% | 29.8% | 9.9% | 14.7% | 50.5% | 57.1% | 18.8% | 17.3% |
| Cephalosporins | 0.6% | 6.0% | 0.5% | 0.8% | 0.2% | 0.02% | 4.8% | 0.7% | 1.7% |
| Sulfonamides | 15.0% | 16.0% | 10.1% | 17.1% | 15.4% | 25.5% | 14.0% | 41.7% | 15.1% |
| Trimethoprim | 0.00% | 3.2% | 2.0% | 2.6% | 3.0% | 3.9% | 2.5% | 2.5% | 3.0% |
| Macrolides | 5.7% | 2.6% | 11.1% | 7.6% | 9.0% | - | 5.0% | 5.0% | 9.7% |
| Lincosamides | 0.3% | 1.0% | 2.4% | 0.7% | 0.2% | 0.4% | 1.4% | 0.1% | 1.7% |
| Aminoglycosides | 2.9% | 1.1% | 4.9% | 6.7% | 1.8% | 13.6% | 3.3% | 5.0% | 2.5% |
| Quinolones | 1.5% | 0.6% | 0.6% | 1.2% | 1.5% | 0.5% | 1.1% | 0.6% | 0.5% |
| Polymyxins | 0.6% | - | 0.3% | 6.1% | 1.1% | 0% | 0.7% | 2.4% | - |
| Pleuromutilins | 4.4% | 0.5% | 8.2% | 0.8% | 0.4% | 1.7% | 2.6% | - | 1.7% |
| Others | 0.8% | - | - | 0.3% | 0.4% | - | - | - | 2.2% |
| **Total** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** |

- Value <0.05%.

**Figure 7.** Sales in 2009 of the various antimicrobial classes, as a percentage of total tonnes of veterinary antimicrobial agents sold, by country



Generally, tetracyclines and/or penicillins accounted for the highest proportion of the sales (in tonnes) in the reporting countries in 2009, except in Switzerland (CH), where sulfonamides accounted for the highest proportion (Table 9, Figure 7). A similar picture is also shown for the other years (see Section 3.2 — Country-specific results).

In four of the countries (CZ, FR, NL, UK), tetracyclines accounted for the highest percentage of veterinary antimicrobial agents sold in 2009, ranging from 44% to 52% of total sales, while penicillins accounted for between 10% and 23%. For three of the countries (FI, NO, SE), penicillins represented the highest percentage of antimicrobial agents sold (range 50-57% of total sales), while for these countries the sales of tetracyclines varied between 4% and 14% (Table 9).

In Denmark and Switzerland, tetracyclines and penicillins represent approximately the same percentage of total veterinary antimicrobial agents sold annually.

### 3.1.4. Correlation between animal demographics and prescribing patterns

A positive correlation was shown between the total PCU (by country and year) with tetracyclines and macrolides sales (tonnes of active ingredient); a similar correlation was found for the PCU for each species individually (cattle, pigs and poultry) with tetracyclines and macrolides sales.

In contrast, negative correlations were shown between the total PCU (by country and year) with penicillins sales (tonnes of active ingredient) and the PCU for each of the individual species (cattle, pigs and poultry).

**Table 10.** The Spearman correlation coefficient (SpC) between the population correction unit (PCU) of cattle (Ca-PCU), pigs (Pi-PCU) and poultry (Po-PCU) and the proportion sold of tetracyclines, penicillins and macrolides of the total amounts of veterinary antimicrobial agents sold per PCU (mg/PCU) in each of the eight countries (Switzerland not included) in 2009; (P = p-value) (S = significant)

| | Total PCU | | | Ca-PCU | | | Pi-PCU | | | Po-PCU | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SpC | P | S | SpC | P | S | SpC | P | S | SpC | P | S |
| Tetracyclines | 0.73 | 0.031 | S | 0.68 | 0.050 | S | 0.78 | 0.0172 | S | 0.78 | 0.0172 | S |
| Penicillins | -0.80 | 0.014 | S | -0.85 | 0.006 | S | -0.76 | 0.0213 | S | -0.75 | 0.0254 | S |
| Macrolides | 0.80 | 0.014 | S | 0.70 | 0.043 | S | 0.86 | 0.0045 | S | 0.70 | 0.0432 | S |

## 3.2. Country-specific data

### 3.2.1. Czech Republic

#### *3.2.1.1 Distribution of veterinary medicines*

In the Czech Republic, all veterinary medicinal products (VMPs) containing antimicrobial agents are prescription-only medicines. This includes medicated feeding stuffs manufactured from medicated premixes containing antimicrobials by authorised feed mills in accordance with Directive 90/167/EEC. There are five categories of receiver of antimicrobial VMPs from wholesalers: wholesalers (when selling to each other), veterinarians, pharmacies, farmers and feed mills, while from feed mills only farmers are receivers.

#### *3.2.1.2 Veterinary antimicrobial agents included in the material*

In addition to the groups of antimicrobial agents given in Table 1, products for dermatological use belonging to the ATC groups QD06AA02, QD06AA03 and QD06AA52 (included in tetracyclines), QD06AX (included in others), and otologic and ophthalmologic VMPs belonging to ATC QS01A and QS03A (included in relevant antimicrobial classes) are included in the data in Table 11. The two latter groups account for negligible amounts of the total consumption of antimicrobial agents. For more details, see the footnotes to Table 11. Antimicrobial VMPs for both terrestrial and aquatic species are included in the material.

#### *3.2.1.3 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., which includes these provisions:

- Section 16: (3) In the sphere of veterinary pharmaceuticals, the Veterinary Institute furthermore shall: b) manage and maintain the database of expert information on pharmaceuticals, including data on the consumption of medicinal products.
- Section 23: (1) An operator is obliged: d) to provide, free of charge, the Veterinary Institute as requester thereby, with any data and information necessary for the conduct of their tasks as stipulated by Section 16, paragraph 3.

There are stipulated sanctions of up to 100,000 CZK for cases of not following the law. Further details on how to fulfil the obligations are described in Guidance of the Veterinary Institute No. DIS-01/2006, which is publicly available on the website of the Institute for State Control of Veterinary Biologicals and Medicaments.

#### *3.2.1.4 Data sources*

Sales data were collected from all wholesalers (n=76) and feed mills (n=79) licensed in the Czech Republic, and from one wholesaler from another Member State, that deliver VMPs directly to final customers (veterinarians, pharmacies or farmers) in the Czech Republic.

Manufacturers (distributing their own products) and wholesalers are obliged to fill in the template quarterly with their sales of all VMPs (including antimicrobial VMPs); the template is divided into five categories of final receiver in the Czech Republic: other wholesalers; veterinarians, pharmacies, farmers and feed mills. Only data on distribution to veterinarians, pharmacies and farmers are used to calculate consumption, to avoid double reporting. Feed mills are also obliged to report data on production quarterly, including detailed data on use of medicated premixes (which medicated premix, which amount was used in kg). These data are used for calculation of medicated premixes consumption.

Data reported by wholesalers on distribution to other wholesalers or to feed mills are used only for cross-control of reports. These data are not used for consumption calculations.

#### *3.2.1.5 Data coverage*

Data coverage is assumed to be more than 98%. Imports by veterinarians from another Member State licensed to provide veterinary services within the Czech Republic are not included.

### 3.2.1.6 Analysis of the data

The sales data (package level) were processed, analysed and validated by the Institute for State Control of Veterinary Biologicals and Medicaments as the national authority responsible for this task according to the national law (Anonymous, 2009).

### 3.2.1.7 Results

**Table 11.** Sales, in tonnes of active ingredients, of veterinary antimicrobial agents in the Czech Republic, 2005-2009

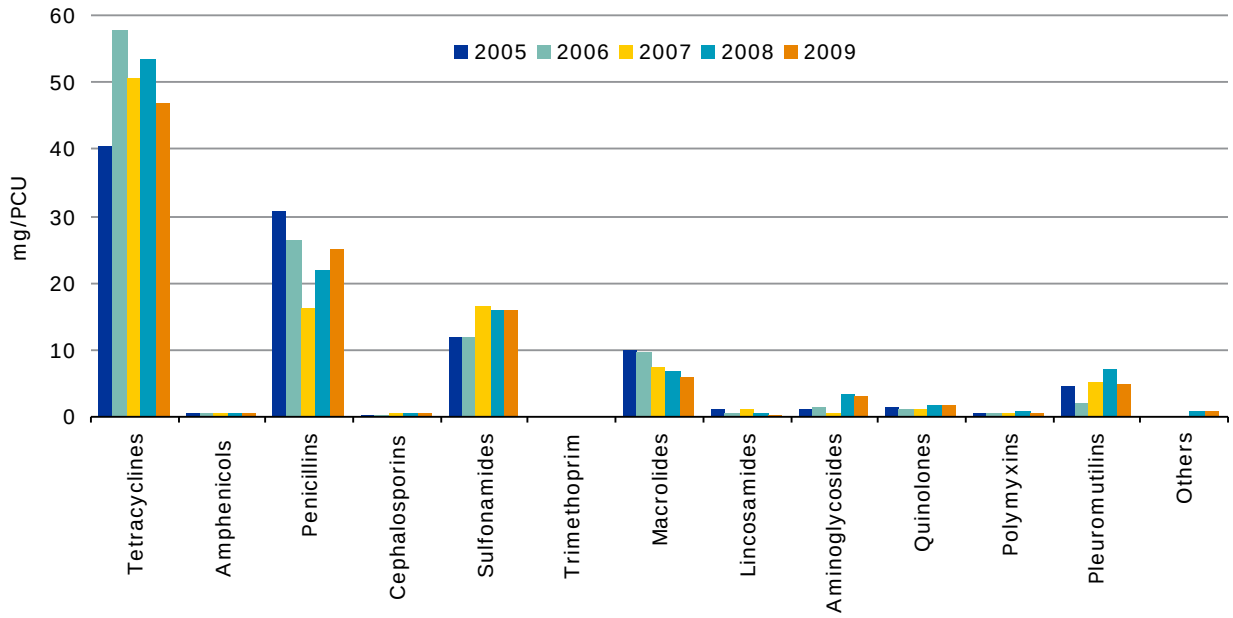
| Antimicrobial class | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Tetracyclines[1] | 35.87 | 51.24 | 44.30 | 44.86 | 36.17 |
| Amphenicols | 0.44 | 0.41 | 0.53 | 0.36 | 0.52 |
| Penicillins | 27.20 | 23.51 | 14.13 | 18.50 | 19.23 |
| Cephalosporins (total) | 0.34 | 0.29 | 0.42 | 0.55 | 0.47 |
| *1st and 2nd gen. cephalosporins* | [a] | [a] | 0.29 | 0.37 | 0.31 |
| *3rd and 4th gen. cephalosporins* | [a] | [a] | 0.13 | 0.18 | 0.17 |
| Sulfonamides and trimethoprim (total)[2] | 10.62 | 10.67 | 14.49 | 13.34 | 12.28 |
| *Sulfonamides* | 10.62 | 10.67 | 14.49 | 13.34 | 12.28 |
| *Trimethoprim* | [b] | [b] | [b] | [b] | [b] |
| Macrolides | 8.87 | 8.55 | 6.51 | 5.76 | 4.67 |
| Lincosamides | 1.14 | 0.49 | 1.01 | 0.46 | 0.25 |
| Aminoglycosides | 0.90 | 1.35 | 0.49 | 2.91 | 2.42 |
| Quinolones (total) | 1.27 | 1.12 | 1.07 | 1.41 | 1.26 |
| *Fluoroquinolones* | [a] | [a] | 0.55 | 1.27 | 1.09 |
| *Other quinolones* | [a] | [a] | 0.52 | 0.14 | 0.17 |
| Polymyxins | 0.54 | 0.48 | 0.44 | 0.64 | 0.47 |
| Pleuromutilins | 4.07 | 1.69 | 4.55 | 6.00 | 3.62 |
| Others | 0.05 | 0.05 | 0.03 | 0.68 | 0.65 |
| **Total** | **91.33** | **99.86** | **87.97** | **95.47** | **82.02** |

[1] Also includes QD06AA02, QD06AA03 and QD06AA52. [2] Does not include QP51AG.
[a] Only aggregated data available. [b] Not available in raw data for these years.

**Table 12.** Population correction unit (PCU) (in 1,000 tonnes), Czech Republic

| Animal species | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Cattle | 297 | 307 | 311 | 316 | 307 |
| Pigs | 359 | 346 | 334 | 294 | 245 |
| Poultry | 169 | 170 | 165 | 164 | 154 |
| Sheep and goats | 14 | 15 | 16 | 16 | 15 |
| Horses | 29 | 29 | 29 | 29 | 29 |
| Fish | 20 | 20 | 20 | 20 | 20 |
| **Total** | **888** | **887** | **875** | **840** | **771** |

**Figure 8.** Sales, in mg active ingredient per population correction unit (mg/PCU), of veterinary antimicrobial agents in the Czech Republic for the years 2005-2009




### *3.2.1.8 Comments on the data*

Tetracyclines, penicillins, and sulfonamides are the top three antimicrobial classes sold, accounting for more than 80% of the total sales, in tonnes. The majority of the products within the tetracycline and sulfonamide groups are products for mass medication. In the case of penicillins, a large number of products are included: both injectable and intramammary products, and also (especially in the amino-penicillin group) products for mass medication.

In the case of tetracyclines, the consumption peaked in 2006, while from 2006 to 2009 a decline of 29% was observed. For penicillins, the highest consumption was in 2005, the lowest in 2007; thereafter the consumption increased. The sulphonamide consumption was relatively stable for the last three years of the study period.

Third and fourth-generation cephalosporins and fluoroquinolones are the antimicrobial classes which are the main focus of antimicrobial policy. There is a slight upward trend in sales of 3rd and 4th-generation cephalosporins during the last three years (2007-2009), while quinolones consumption was relatively stable (1.45 ± 0.18 mg/PCU) during the study period. There is a significant decrease in the consumption of premixes, which are in most cases replaced by VMPs used for drinking-water medication.

Generally, it can be summarised that the data provided have particular value with regard to assessing total consumption trends. Such data should be interpreted with caution, and further analysis is needed to assess trends of exposure and the effect of prudent-use policy measures.

## 3.2.2. Denmark

### *3.2.2.1 Distribution of veterinary medicines*

In Denmark, all veterinary medicinal products (VMPs) are prescription-only, and can only be dispensed either through pharmacies or through a small number of dispensing companies approved by the Danish Medicines Agency to dispense VMPs on legal terms equal to 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. In Denmark, medicated feeds produced and supplied by feed mills are used for farmed fish and pigs, but comprise presently only a few percent (1-2%) of the total veterinary consumption of antimicrobial agents. However, herd/flock treatment of livestock with antimicrobial agents, administered through drinking water or as a top-dressing on feed dispensed on veterinary prescription through pharmacies or dispensing companies, is common.

### *3.2.2.2 Veterinary antimicrobial agents included in the material*

The data in Table 13 include antimicrobial VMPs authorised in Denmark or the European Union that have been prescribed for use in animals. In addition, a few VMPs sold on special exemption by the Danish Medicines Agency (following a case-by-case assessment) have been included. Antimicrobial VMPs for both terrestrial and aquatic species are included in the material.

### *3.2.2.3 Legal basis for the monitoring of sales*

All sales of antimicrobial VMPs for therapeutic use are mandatorily to be reported by pharmacies, dispensing companies and feed mills to the VetStat database, owned by the Ministry of Food, Agriculture and Fisheries. The pharmacy/ dispensing company sales records also include all purchases by veterinary practitioners of medicines for use in their practice.

The Veterinary Institute (from 2011, the Veterinary and Food Administration) publishes statistics on overall antimicrobial consumption, on a monthly basis. The National Food Institute, Technical University of Denmark, is responsible for reporting the usage of antimicrobial agents at species level through DANMAP (the national program for surveillance of usage of antimicrobial agents and occurrence of antimicrobial resistance for the veterinary, food and human sectors; see www.danmap.org).

### *3.2.2.4 Data sources*

Data on dispensing of antimicrobial VMPs from pharmacies, dispensing companies and feed mills were retrieved from the VetStat database.

### *3.2.2.5 Data coverage*

The data coverage is assumed to be 100%. Data from the pharmacies and dispensing companies approved by the Danish Medicines Agency are registered electronically in the billing process, providing a high accuracy of amounts and drug identity because this information determines the payment from the customer. Furthermore, the assumption is based on a comparison in 2001 (see DANMAP 2001 at www.danmap.org) of VetStat data with data on the sales of veterinary antimicrobial agents in Denmark, collected from the pharmaceutical industry by the Danish Medicines Agency, showing a 99% agreement. Part of the discrepancy was due to erroneous reporting from marketing authorisation holders of medicines exported, i.e. a bias from over-reporting. A minor part of the discrepancy arises because the consumption is registered at different distribution levels.

### *3.2.2.6 Analysis of the data*

The sales data at prescription level were processed, analysed and validated by the National Food Institute, Technological University of Denmark. Records from the feed mills contain identity of package, amounts dispensed (given as concentration of the medical product in the feed) and feed amounts. In records from pharmacies and companies approved by the Danish Medicines Agency, amounts are given as number of packages. All amounts were turned into kg antimicrobial agent.

### *3.2.2.7 Results*

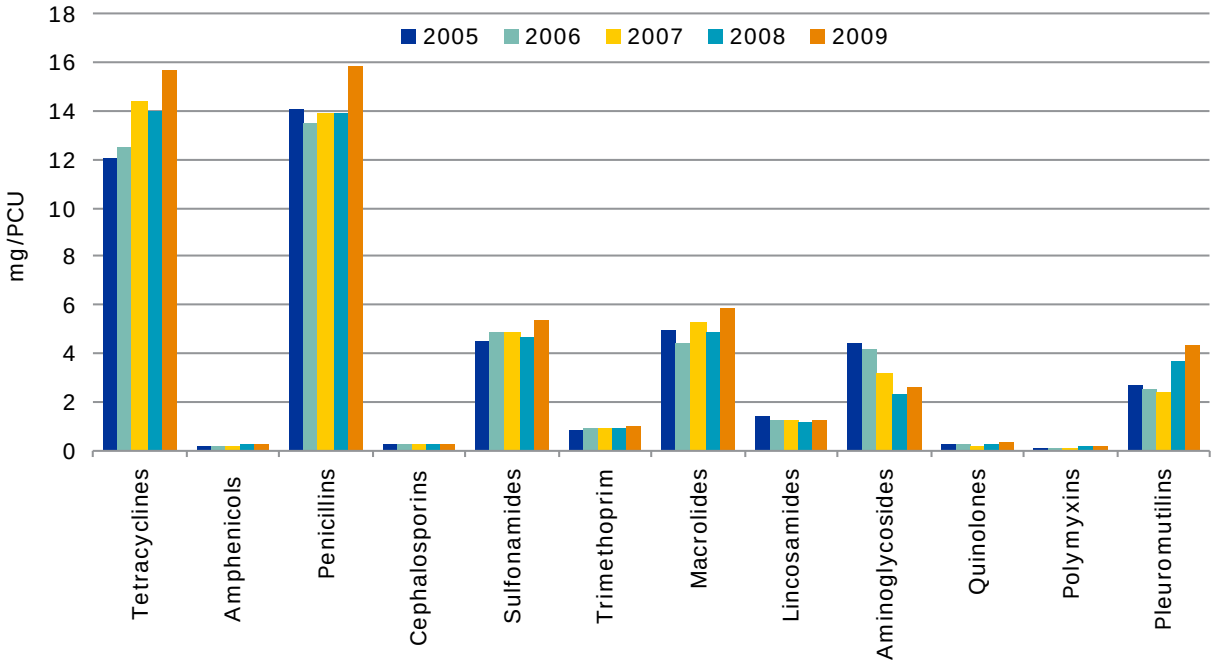
**Table 13.** Sales, in tonnes of active ingredients, of veterinary antimicrobial agents in Denmark, 2005-2009

| Antimicrobial class | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Tetracyclines | 29.51 | 31.76 | 36.55 | 35.31 | 38.35 |
| Amphenicols | 0.37 | 0.40 | 0.47 | 0.59 | 0.69 |
| Penicillins | 34.41 | 34.21 | 35.35 | 35.15 | 38.64 |
| Cephalosporins (total) | 0.57 | 0.64 | 0.66 | 0.64 | 0.59 |
| *1st and 2nd gen. cephalosporins* | 0.40 | 0.45 | 0.44 | 0.41 | 0.41 |
| *3rd and 4th gen. cephalosporins* | 0.17 | 0.19 | 0.23 | 0.23 | 0.18 |
| Sulfonamides and trimethoprim (total) | 13.08 | 14.61 | 14.65 | 14.06 | 15.65 |
| *Sulfonamides* | 11.03 | 12.30 | 12.33 | 11.81 | 13.12 |
| *Trimethoprim* | 2.05 | 2.31 | 2.32 | 2.25 | 2.53 |
| Macrolides | 11.97 | 11.22 | 13.30 | 12.32 | 14.39 |
| Lincosamides | 3.41 | 3.21 | 3.24 | 3.01 | 3.05 |
| Aminoglycosides | 10.82 | 10.59 | 8.13 | 6.00 | 6.33 |
| Quinolones (total) | 0.58 | 0.58 | 0.38 | 0.67 | 0.79 |
| *Fluoroquinolones* | 0.05 | 0.05 | 0.05 | 0.02 | 0.02 |
| *Other quinolones* | 0.53 | 0.53 | 0.33 | 0.65 | 0.77 |
| Polymyxins | 0.24 | 0.25 | 0.31 | 0.39 | 0.41 |
| Pleuromutilins | 6.51 | 6.34 | 6.07 | 9.19 | 10.65 |
| Others | - | - | 0.001 | 0.002 | 0.002 |
| **Total** | **111.47** | **113.81** | **119.11** | **117.31** | **129.53** |

**Table 14.** Population correction unit (PCU) (in 1,000 tonnes), Denmark

| Animal species | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Cattle | 447 | 436 | 436 | 440 | 402 |
| Pigs | 1,759 | 1,892 | 1,880 | 1,857 | 1,820 |
| Poultry | 122 | 109 | 111 | 112 | 112 |
| Sheep and goats | 8 | 9 | 9 | 9 | 9 |
| Horses | 70 | 70 | 70 | 70 | 70 |
| Fish | 39 | 28 | 31 | 37 | 34 |
| **Total** | **2,443** | **2,543** | **2,537** | **2,523** | **2,447** |

**Figure 9.** Sales in mg active ingredient per population correction unit (mg/PCU) of veterinary antimicrobial agents in Denmark, 2005-2009




### *3.2.2.8 Comments on the data*

During the study period, the total sales in Denmark of veterinary antimicrobial agents for terrestrial animals expressed as mg/PCU increased by 16%. The increase over the years is almost entirely due to increasing consumption in pigs. Denmark has one of the world's largest exports of pigs and pork, and around 80% of veterinary antimicrobials are used in pig production. Because the increase was mainly seen in tetracyclines that are used in high dosage (13–25 mg/kg/day), the increase in the exposure is less than what is indicated by the increase in tonnage (DANMAP 2009). In pig production, the consumption increased by 20% in mg meat produced (including pigs exported for fattening and slaughter), corresponding to 31% in Defined Animal Daily Doses (ADD)/kg meat produced. Correcting for a change in production (steep increase in export of fatteners at 30 kg), the consumption for pigs increased by 22% in ADD/animal produced (to slaughter weight) between 2005 and 2009 (DANMAP 2009).

The major classes prescribed are the tetracyclines and penicillins, when measured in tonnes; however, measured in ADD, macrolides and pleuromutilins are used almost to the same extent. Tetracyclines, macrolides and pleuromutilins are mainly used for oral treatment, mainly in pigs. Regarding penicillins, 70% are betalactamase-sensitive penicillins, which are only administered parenterally, mainly in sows or cows.

The cattle population is almost entirely dairy cattle. The consumption in cattle varies between 14 tonnes and 15 tonnes annually, and the majority of these antimicrobials are used as intramammaries or parenterally, mainly for mastitis. Narrow-spectrum penicillins account for approximately half of this consumption, in accordance with the official guidelines. Antimicrobial use in calves is very different from the use in cows, with tetracyclines and macrolides being the major antimicrobial groups, mostly for treatment of respiratory disease.

The use of antimicrobial agents in poultry (mainly broilers) is very little, amounting to 200-300 kg annually, except for 2009, when 450 kg were used in broiler production. In poultry production, amoxicillin is a major drug (87% of the consumption for broilers during 2005-2008). In recent years, the use of fluoroquinolones has decreased to almost zero, while use of tetracyclines has increased.

The patterns of sales of antimicrobial agents for use in dogs and cats are very different from the sales profile of antimicrobial agents in food-producing animals, with amoxicillin (including in combination with clavulanic acid), sulphonamide/trimethoprim and cephalosporin being the major groups. While consumption in companion animals

amounted to 2-3% of the total veterinary sales annually, a large part of the sales of veterinary fluoroquinolones and cephalosporins were used in companion animals (DANMAP 2009). However, more than 99% of the cephalosporin use in companion animals involves 1st-generation cephalosporins, while in production animals, all systemic use of cephalosporin is of 3rd or 4th generation. In 2009, the use of 3rd and 4th-generation cephalosporins in production animals reached a maximum of 129 kg in total. In 2010, the pig industry imposed a voluntary ban on cephalosporin use in pigs.

There has been a lot of political and public focus on the use of antimicrobial agents in Danish animal production since the mid 1990s. This led to interventions regulating the use of prescription medicines. Examples include limitation of veterinarians' profit from distributing medicines (1994), limitation of use of extemporaneously prepared medicines (1994) (the cascade rule), limitation of the use of fluoroquinolones (2002), regulation of use of antimicrobials for mastitis (towards using penicillins), and official guidelines on choice of antimicrobial agents in pigs and cattle (www.fvst.dk). It is likely that the public focus and some of these interventions have contributed to lowering the use of antimicrobials in production animals and affected prescription patterns, e.g. high consumption of penicillins in cattle, low consumption of fluoroquinolones. However, apart from the low consumption in broilers, other factors are also responsible for the seemingly overall low level of consumption in Denmark.

Firstly, compared to other countries, veal and beef production in Denmark is very low, relative to pig production and also to broiler production. As lifespan is not taken into account, the chosen denominator (PCU) overestimates the population at risk in Denmark, as opposed to countries with a large cattle population, in particular countries with large young-beef, beef or dairy productions. Overestimating the population at risk leads to underestimating the usage, particularly in broilers and pigs.

Secondly, the use of tetracyclines comprises a smaller proportion of the consumption than in many other countries (outside Scandinavia). As tetracyclines are generally used at very high dosages, the exposure is underestimated when measured in grams in countries using fewer tetracycline products, such as Denmark.

## 3.2.3. Finland

### *3.2.3.1 Distribution of veterinary medicines*

In Finland, all veterinary medicinal products (VMPs) that contain antimicrobials are prescription-only medicines. All VMPs have to be dispensed through pharmacies, which are supplied by wholesalers only. Veterinarians are allowed to sell medicines but are not allowed to obtain economic benefit from the sales. An exemption from the pharmacy/ wholesaler monopoly has been granted for medicated feeds (i.e. feeds into which drugs for therapeutic use are mixed prior to sale). Medicated feeds have to be prescribed by veterinarians and produced by feed mills authorised by the Finnish Food Safety Authority. Another exemption is that medicated feeds may be imported to Finland, but require a prescription by a veterinarian, just like other medicated feeds. Importation of medicated feeds is supervised by the Finnish Food Safety Authority, which approves importers and distributors. Currently, only medicated feed for fish is imported to Finland.

### *3.2.3.2 Veterinary antimicrobial agents included in the material*

Antimicrobials obtained on special licence (exemption from marketing authorisation) are included in the material. In addition to the antimicrobial groups given in Table 1, the 2005-2008 data include sales of antibacterial VMPs administered locally (products for dermatological use and for ears and eyes, i.e. ATCvet codes QD and QS) for which the sales have been less than 200 kg/year. Antimicrobial VMPs for both terrestrial and aquatic species are included in the material. There are no veterinary antimicrobials authorised in Finland with the following ATCvet codes: QA07AB; QG51AA; QG51AC; QG51AE; QG51AX; QG51BA; QG51BC; QG51BE; QP51AG.

### *3.2.3.3 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). Importation of medicated feeds has to be reported to the Finnish Food Safety Authority Evira in accordance with the Decree on Medicated Feeds (10/EEO/2008).

### *3.2.3.4 Data source*

The Finnish Medicines Agency monitors sales of VMPs. Information on sales is obtained at package level from the wholesalers (5). Importation of antimicrobials in medicated feed is monitored by the Finnish Food Authority, which collects data from feed mills (1) and other importers (1).

### *3.2.3.5 Data coverage*

Sales data has been obtained from all wholesalers, thus the coverage is assumed to be 100%. Importation of medicated feed has to be reported to the Finnish Food Safety Authority, thus it is assumed that the coverage is also 100%.

### *3.2.3.6 Analysis of the data*

The Finnish Medicines Agency processes and analyses the raw data, and the results are published on the agency's website (www.fimea.fi/elainlaakkeet/mikrobilaakkeiden_kulutus_elaimilla). In the original data published on the agency's website, penicillin prodrugs are reported in tonnes of prodrugs and not of active ingredient. Due to time constraints, it was not possible to recalculate these data to express the sales in tonnes of active ingredient; this implies that the sales figures for penicillins for Finland are overestimated as compared to the other countries.

Joint reports with the Finnish Food Safety Authority on veterinary antimicrobial resistance and sales of veterinary antimicrobial products have been published within the FINRES-Vet program (last report for the years 2007-2009, see www.evira.fi/portal/en/evira/publications?a=category&cid=28).

### *3.2.3.7 Results*

**Table 15.** Sales, in tonnes of active ingredients, of veterinary antimicrobial agents in Finland, 2005-2009

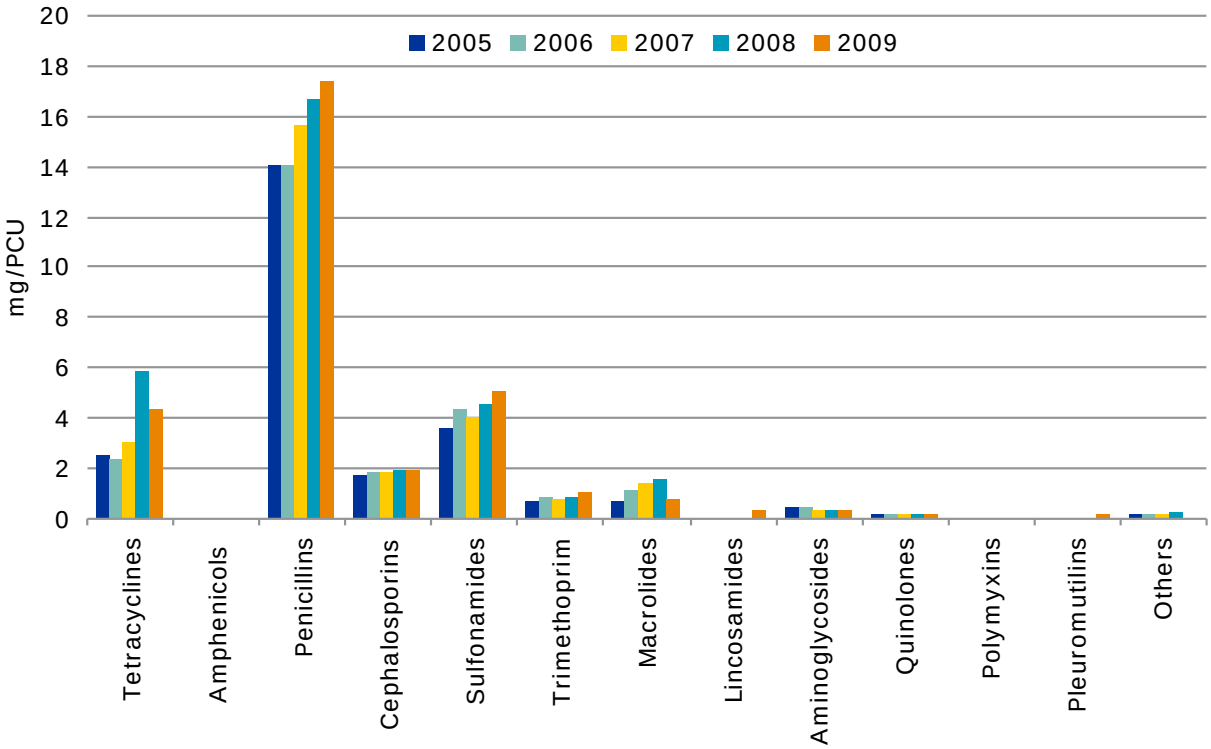
| Antimicrobial class | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Tetracyclines | 1.45 | 1.32 | 1.71 | 3.14 | 2.28 |
| Amphenicols[1] | - | - | - | - | 0.01 |
| Penicillins[2] | 7.89 | 7.86 | 8.67 | 9.02 | 9.12 |
| Cephalosporins (total)[3] | 1.00 | 1.00 | 1.03 | 1.03 | 0.99 |
| *1st and 2nd gen. cephalosporins[3]* | - | - | - | - | 0.99 |
| *3rd and 4th gen. cephalosporins[3]* | - | - | - | - | 0.002 |
| Sulfonamides and trimethoprim (total) | 2.44 | 2.95 | 2.66 | 2.93 | 3.17 |
| *Sulfonamides[4]* | 2.03 | 2.46 | 2.22 | 2.44 | 2.64 |
| *Trimethoprim[4]* | 0.41 | 0.49 | 0.44 | 0.49 | 0.53 |
| Macrolides[5] | 0.39 | 0.62 | 0.75 | 0.85 | 0.43 |
| Lincosamides[5] | | | | | 0.17 |
| Aminoglycosides | 0.24 | 0.23 | 0.18 | 0.17 | 0.18 |
| Quinolones (total) | 0.09 | 0.08 | 0.09 | 0.09 | 0.10 |
| *Fluoroquinolones* | 0.09 | 0.08 | 0.09 | 0.09 | 0.10 |
| *Other quinolones* | - | - | - | - | - |
| Pleuromutilins[1] | - | - | - | - | 0.08 |
| Others[6] | 0.11 | 0.07 | 0.08 | 0.12 | 0 |
| **Total** | **13.61** | **14.13** | **15.16** | **17.34** | **16.51** |

[1] 2005-2008 sales reported in 'Others'. [2] Figures are for sales of penicillin prodrugs, not active ingredient. [3] Only aggregated data available for 2005-2008. [4] Calculated figures in 2005-2007. [5] 2005-2008 sales of macrolides reported together with lincosamides. [6] 2005-2008 includes amphenicols, polymyxins and pleuromutilins. Sales of products for dermatological use and for ears and eyes are included in overall sales for 2005-2008 (<0.2 tonnes/year).

**Table 16.** Population correction unit (PCU) (in 1,000 tonnes), Finland

| Animal species | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Cattle | 252 | 250 | 243 | 230 | 226 |
| Pigs | 201 | 199 | 202 | 200 | 190 |
| Poultry | 62 | 63 | 62 | 62 | 57 |
| Sheep and goats | 7 | 7 | 8 | 8 | 8 |
| Horses | 26 | 26 | 27 | 28 | 29 |
| Fish | 14 | 13 | 13 | 13 | 14 |
| Total | 562 | 558 | 554 | 541 | 524 |

**Figure 10.** Sales, in mg active ingredient per population correction unit (mg/PCU), of veterinary antimicrobial agents in Finland, 2005-2009 (see footnotes below Table 15)




### *3.2.3.8 Comments on the data*

Penicillins are the most used antimicrobials for animals in Finland, followed by sulfonamide-trimethoprim combinations and tetracyclines. In 2009, the sales of penicillins accounted for 55% (corresponding to 17 mg/PCU) of the total sales.

A marked increase of 32% (corresponding to 8 mg/PCU) was seen in total sales during the first four years of the observation period; this was followed by a decrease of 2% (0.5 mg/PCU) in 2009. For tetracyclines, the sales more than doubled (3 mg/PCU) from 2005 to 2008, followed by a decline in 2009 (1.5 mg/PCU). Macrolide-lincosamides were reported together until 2009 (see Table 15); their sales doubled from 2005 to 2008 (0.9 mg/PCU), followed by a decline in 2009 (0.4 mg/PCU). Sulfonamides and trimethoprim are available only as combination products, and their sales in 2009 were 39% (2 mg/PCU) higher than in 2005. The sales of penicillins have increased during the whole study period (24%, 3 mg/PCU).

Separate sales data for all agents considered as critically important antimicrobials (CIA) in human medicine covering the study period are not available. However the sales of macrolides, fluoroquinolones and 3rd and 4th-generation cephalosporins together accounted for 3.2% of the overall sales in 2009. For fluoroquinolones, sales increased by 19% (corresponding to 0.03 mg/PCU) during the observation period. For macrolides and 3rd and 4th-generation cephalosporins, class-specific data are available only since 2009.

The sales of veterinary antimicrobials in Finland have clearly increased during the observation period. As the data are based on the information obtained from wholesalers, and most VMPs have several target species and indications, it is not possible to identify the reasons for the increased use. It can be speculated whether the increase would reflect an increased impact of infectious diseases. Data on lung rejections at slaughter show, for instance, that the incidence of swine pleuropneumonia (*Actinobacillus pleuropneumoniae*) increased in 2008. This is largely attributed to previous exposure of the animals to outbreaks of swine influenza which entered Finland in 2008. The first cases of PWMS (Post Weaning Multisystemic Wasting Syndrome) on pig farms were detected in 2007. The predisposing effects of swine influenza and porcine circovirus have now been curtailed by vaccinations and other improvements in herd-management systems. The favourable trend is seen already in the decreasing sales of tetracyclines and macrolides-lincosamides in

2009 (FINRES-Vet 2007-2009, 2011).

According to Table 16, estimated weights of cattle and pig populations that could potentially have been treated have decreased during the study period (-10% and -5%). However, production has moved towards larger animal units and more intensive production systems; the number of dairy farms in Finland decreased by 26% between 2005 and 2009. The respective decrease in the number of pig farms was 53% (MTT Economydoctor, 2011). This, together with movement of animals between farms, may also have an impact on the prevalence of infections. These factors are thought to be associated with the increased incidence of contagious hoof infections of cattle and pneumonia of calves, which require intensive antibiotic treatment. According to the national prudent use guidelines (Evira publications 3/2009), penicillin is the antimicrobial of choice for both indications, as well as for the treatment of porcine *A. pleuropneumoniae* infections. Continuous surveillance of disease situations, as a collaboration between the animal industry and veterinary experts, is necessary, as are reinforcing the importance of the prudent use guidelines and good management skills, which are the cornerstones of responsible use of antimicrobials in the treatment of animal diseases.

## 3.2.4. France

### *3.2.4.1 Distribution of veterinary medicines in France*

In France, all veterinary medicinal products (VMPs) are on prescription only, except for some VMPs for local use in limited quantities. VMPs are distributed mainly through wholesalers to veterinarians and farmers.

### *3.2.4.2 Veterinary antimicrobial agents included in the material*

All antimicrobial classes referred to in Table 1 have been included, i.e. antimicrobial VMPs for dermatological use or use in sensory organs (eyes and ears) have not been included in this material but are included in the data published in the French annual report. The data covered all animal species, including cats, dogs and fish.

### *3.2.4.3 Legal basis for the monitoring of sales*

There is no specific national legal framework for monitoring the sales of veterinary antimicrobial VMPs in France. Reports are published annually (www.anses.fr/PND301.htm). Every second year, a publication (Farm) is produced, integrating results of sales monitoring and antimicrobial resistance surveys (www.anses.fr/cgi-bin/countdocs.cgi?Documents/SANT-Ra-FARM2008.pdf).

### *3.2.4.4 Data sources*

The sales monitoring programme is coordinated on a voluntary basis by ANMV/Anses (French Agency for Veterinary Medicinal Products), in collaboration with the French Veterinary Medicine Industry association. It is based on declarations of marketing authorisation holders, and started in 1999. The methodology is based on a questionnaire sent to every applicant who has registered a VMP containing antimicrobial agents. Every year, a letter is sent by ANMV/Anses to the marketing authorisation holders, requesting details of the number of units of each VMP sold. These figures must be supplied for the period between 1 January and 31 December of the actual year. The sales of each formulation are cross-referenced with data from ANMV/Anses (qualitative and quantitative composition, pharmaceutical form and target species). In 2009, it was requested to provide, in addition, a species repartition for each antimicrobial VMP.

### *3.2.4.5 Data coverage*

The data coverage is assumed to be 100%.

### *3.2.4.6 Analysis of the data*

The sales data are processed, analysed and validated by the French Agency for Veterinary Medicinal Products.

### *3.2.4.7 Results*

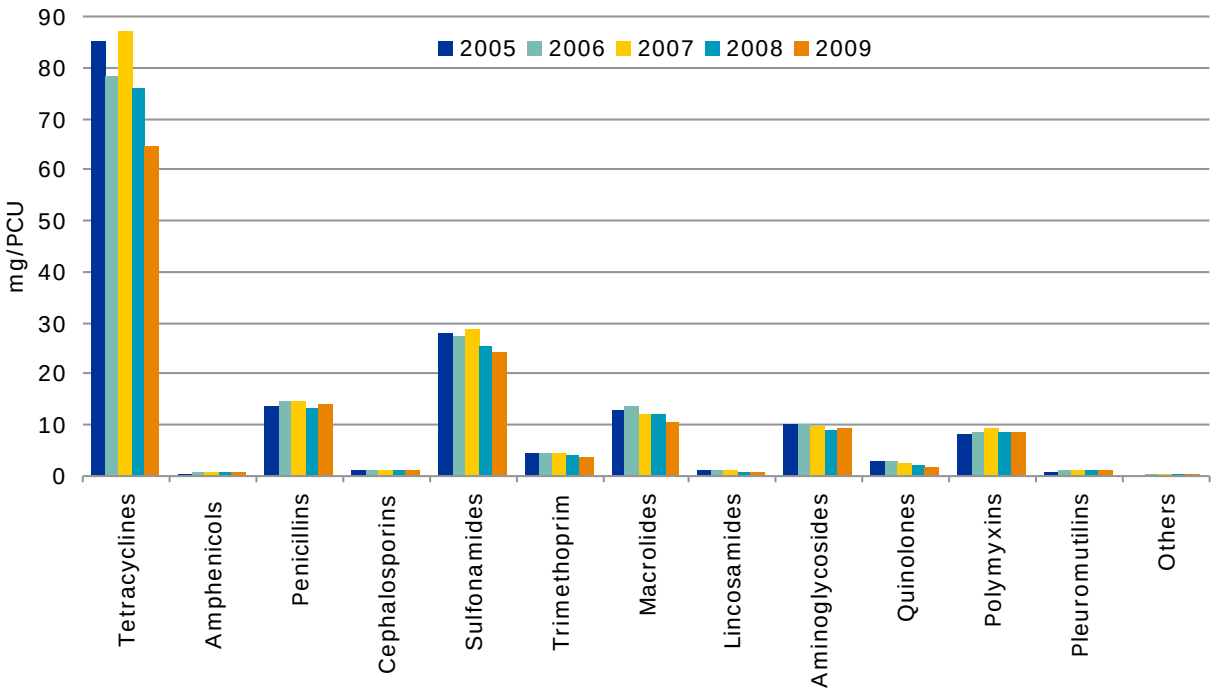
**Table 17.** Sales, in tonnes of active ingredients, of veterinary antimicrobial agents in France, 2005-2009

| Antimicrobial class | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Tetracyclines | 664.69 | 601.50 | 679.49 | 584.96 | 487.28 |
| Amphenicols | 4.69 | 6.08 | 5.88 | 5.02 | 4.79 |
| Penicillins | 108.30 | 112.81 | 112.53 | 103.94 | 105.89 |
| Cephalosporins (total) | 8.51 | 8.86 | 9.25 | 8.81 | 8.47 |
| *1st and 2nd gen. cephalosporins* | 6.91 | 6.99 | 7.25 | 6.69 | 6.64 |
| *3rd and 4th gen. cephalosporins* | 1.60 | 1.87 | 2.00 | 2.12 | 1.83 |
| Sulfonamides and trimethoprim (total) | 251.85 | 244.44 | 258.47 | 224.58 | 210.71 |
| *Sulfonamides* | 216.35 | 211.31 | 224.62 | 195.02 | 182.51 |
| *Trimethoprim* | 35.50 | 33.13 | 33.85 | 29.56 | 28.20 |
| Macrolides | 100.82 | 104.11 | 94.87 | 92.30 | 80.43 |
| Lincosamides | 9.96 | 8.88 | 8.94 | 7.67 | 7.07 |
| Aminoglycosides | 77.52 | 75.90 | 74.55 | 69.81 | 71.23 |
| Quinolones (total) | 21.94 | 22.76 | 19.80 | 16.91 | 12.43 |
| *Fluoroquinolones* | 4.35 | 4.81 | 4.68 | 4.89 | 4.89 |
| *Other quinolones* | 17.59 | 17.95 | 15.12 | 12.02 | 7.54 |
| Polymyxins | 64.51 | 65.11 | 72.12 | 64.15 | 64.96 |
| Pleuromutilins | 7.78 | 8.25 | 8.81 | 7.91 | 8.19 |
| Others | 1.44 | 1.66 | 1.78 | 1.87 | 2.86 |
| **Total** | **1,322.01** | **1,260.36** | **1,346.49** | **1,187.93** | **1,064.31** |

**Table 18.** Population correction unit (PCU) (in 1,000 tonnes), France

| Animal species | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Cattle | 3,302 | 3,285 | 3,349 | 3,365 | 3,288 |
| Pigs | 1,975 | 1,983 | 2,006 | 1,993 | 1,941 |
| Poultry | 1,250 | 1,149 | 1,199 | 1,168 | 1,179 |
| Sheep and goats | 806 | 792 | 775 | 722 | 677 |
| Horses | 168 | 168 | 168 | 168 | 168 |
| Fish | 245 | 238 | 237 | 238 | 234 |
| Rabbits | 55 | 53 | 55 | 52 | 52 |
| **Total** | **7,801** | **7,666** | **7,789** | **7,707** | **7,539** |

**Figure 11.** Sales, in mg active ingredient per population correction unit (mg/PCU), of veterinary antimicrobial agents in France, 2005-2009




### *3.2.4.8 Comments on the data*

During the reporting period, the total sales of antimicrobials for animals expressed as mg/PCU increased by 2% between 2005 and 2007, and then decreased by 18% until 2009. These trends are partly explained by changes in the sales of tetracyclines, sulfonamides and macrolides.

The sales in mg/PCU are dominated by tetracyclines, which in 2009 represented about 46% of total sales. Tetracyclines are sold mainly as oral formulations for food-producing animals. The second-largest class sold is sulphonamides, which in 2009 represented about 17% of total sales. Sulfonamides are also sold mainly as oral formulations for food-producing animals.

The profile of antimicrobials sold and dispensed for use in dogs and cats is very different from the antimicrobial sales profile in food-producing animals (Moulin, G & Chevance, A, 2010). In cats and dogs, the antimicrobial classes sold that predominate are penicillins (32%) and cephalosporins (27%), followed by sulfonamides (16%). Fluoroquinolones sales account for 2% in cats and dogs. The weight of cats and dogs accounts for approximately 198,000 kg body weight.

Interpretation of sales data and sales trends should be made with caution, as they may not necessarily represent the evolution of exposure. Species repartition should also be taken into account.

To estimate the exposure, it is necessary to take into account the dose and the duration of the treatment. A first step consists in calculating the weight of animals that can be treated. This value (weight of animal treated = WAT) is obtained by dividing the sales (in weight of active substance) by the (dose (mg/kg) * treatment duration) (this indicator is also known as Defined Cure Dose kg = DCDkg). By thereafter dividing the WAT by the weight of the animal population (PCU) in question, the results can be defined as an exposure index (ALEA). This index is directly correlated to the percentage of animals treated, and is a meaningful indicator of exposure of animals to antimicrobial agents.

As an example, when comparing 2009 results with 1999 results, the sales volume decreases by 19.3%; however, when taking into account the weight of animals potentially treated, the decrease is only of 11.8% (Moulin, G & Chevance, A, 2010). When expressing results in WAT representing the number of treatments, an increase of 3.1% is seen. The ALEA index representing the animal exposure shows an increase of 12.6%. This shows that a decrease in sales or in sales corrected by PCU may not be always be interpreted as a decrease in use/exposure. When comparing 2009 data to

1999 data, a decrease in sales is observed but an increase in use/exposure is seen.

This can be explained by a switch from 'old' antimicrobial classes to 'new' classes that require a lower weight of active ingredient to treat one animal.

When comparing 2009 results to 2008 results, the sales volume decreases by 12.9% (Moulin, G & Chevance, A, 2010). When taking into account the weight of animals potentially treated, the decrease is 11.8%. When expressing results in WAT representing the number of treatments, the decrease is 5.1%. The ALEA index representing the animal exposure shows a decrease of 3.9%. In 2009, compared to 2008, the sales decrease by 12.9% and the use/exposure decreases by 3.9%.

In France, an estimation of sales and exposure is performed by animal species. These data interpretations show that a high tonnage or a high tonnage corrected by PCU attributed to a specific species does not mean that this species would have a high use/exposure to antimicrobials.

## 3.2.5. The Netherlands

### *3.2.5.1 Distribution of veterinary medicines*

In the Netherlands, antimicrobial veterinary medicinal products (VMPs) are available on prescription only. Veterinarians purchase them mainly from the Dutch federation of the veterinary pharmaceutical industry (FIDIN); veterinarians sell the products to animal owners.

FIDIN members dispense 98% of the total volume of antimicrobial VMPs in the Netherlands. Pharmacies dispense only minor amounts of VMPs in the Netherlands, and obtain their data from the pharmaceutical industry.

### *3.2.5.2 Veterinary antimicrobial agents included in the material*

All authorised VMPs from the antimicrobial classes referred to in Table 1 are included in the material. This includes antimicrobial VMPs for cats, dogs and fish.

### *3.2.5.3 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.

### *3.2.5.4 Data sources*

FIDIN obtained data on sales of the included veterinary antimicrobial agents at package level from the marketing authorisation holders that are members of FIDIN.

### *3.2.5.5 Data coverage*

The data coverage is assumed to be about 98%. An estimated 2% is sold by non-FIDIN members.

### *3.2.5.6 Analysis of the data*

FIDIN reports the total amounts in kilograms active ingredient of veterinary antimicrobial agents sold in the Netherlands per class of antimicrobial agents.

### *3.2.5.7 Results*

**Table 19.** Sales, in tonnes of active ingredients, of veterinary antimicrobial agents in the Netherlands, 2005-2009[1]

| Antimicrobial class | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Tetracyclines | 306.59 | 318.05 | 338.11 | 270.57 | 267.26 |
| Amphenicols | 1.22 | 1.39 | 1.85 | 1.85 | 2.01 |
| Penicillins | 53.36 | 59.76 | 63.24 | 71.15 | 75.53 |
| Cephalosporins (total) | 0.76 | 0.97 | 1.01 | 1.07 | 1.04 |
| *1st and 2nd gen. cephalosporins* | 0.13 | 0.13 | 0.11 | 0.13 | 0.13 |
| *3rd and 4th gen. cephalosporins* | 0.63 | 0.84 | 0.90 | 0.94 | 0.91 |
| Sulfonamides and trimethoprim (total) | 93.02 | 95.40 | 100.53 | 101.65 | 94.45 |
| *Sulfonamides* | 77.39 | 79.48 | 84.00 | 85.26 | 79.26 |
| *Trimethoprim* | 15.63 | 15.92 | 16.53 | 16.39 | 15.19 |
| Macrolides | 26.27 | 41.99 | 54.31 | 50.92 | 46.37 |
| Lincosamides | 0.94 | 0.95 | 0.84 | 0.72 | 1.04 |
| Aminoglycosides | 10.88 | 10.92 | 11.57 | 11.16 | 9.22 |
| Quinolones (total) | 8.27 | 7.42 | 9.42 | 8.25 | 7.79 |
| *Fluoroquinolones* | 1.02 | 0.96 | 1.19 | 1.27 | 1.38 |
| *Other quinolones* | 7.25 | 6.46 | 8.23 | 6.98 | 6.41 |
| Polymyxins | 5.02 | 5.38 | 5.95 | 6.05 | 5.57 |
| Pleuromutilins | 0.49 | 0.89 | 0.97 | 1.24 | 2.05 |
| Others | 1.22 | 1.36 | 1.20 | 1.12 | 1.81 |
| **Total** | **508.04** | **544.48** | **589.00** | **525.75** | **514.14** |

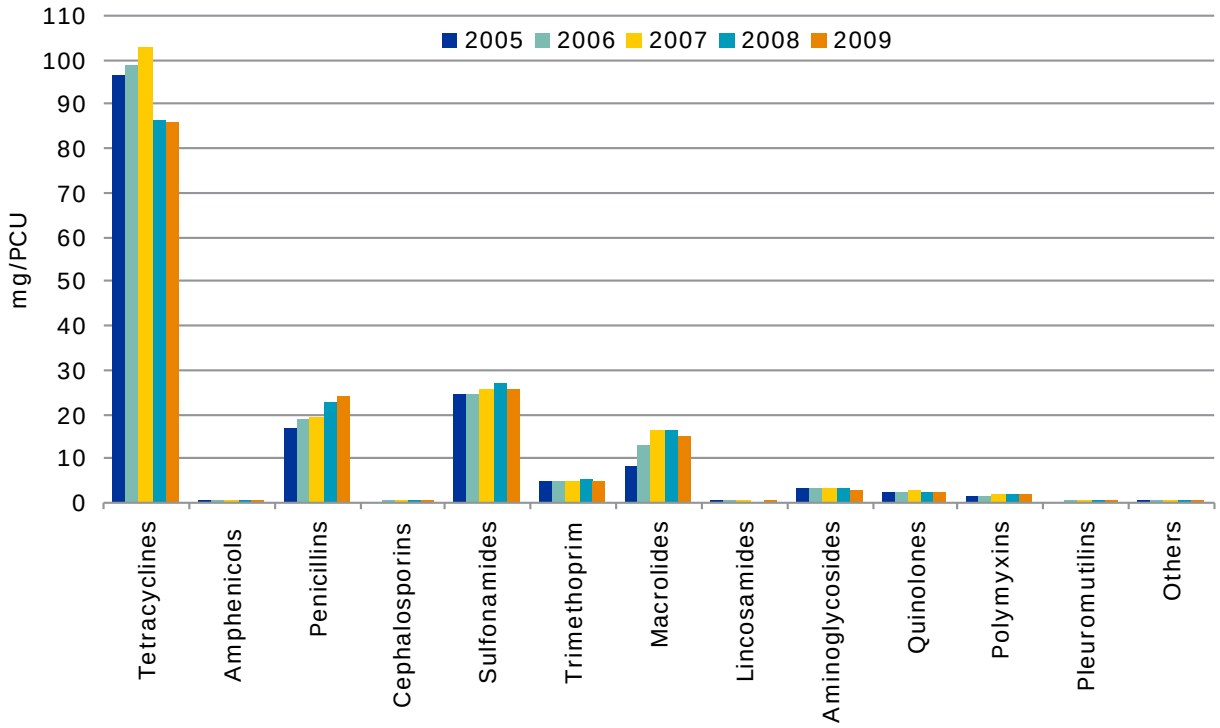
[1] Note that there are minor differences between the NL sales data used for this report and previously published data.

**Table 20.** Population correction unit (PCU) (in 1,000 tonnes), the Netherlands

| Animal species | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Cattle | 1,073 | 1,006 | 952 | 1,006 | 1,009 |
| Pigs | 1,198 | 1,389 | 1,461 | 1,491 | 1,484 |
| Poultry[1] | 628 | 567 | 610 | 395 | 400 |
| Sheep and goats | 142 | 153 | 153 | 138 | 103 |
| Horses | 58 | 58 | 58 | 58 | 58 |
| Fish | 71 | 42 | 53 | 47 | 56 |
| **Total** | **3,170** | **3,214** | **3,288** | **3,133** | **3,109** |

[1] Numbers of slaughtered poultry seems to be under-reported to Eurostat for 2008 and 2009, as weight of carcass poultry reported to Eurostat increases from 2007 to 2009.

**Figure 12.** Sales, in mg active ingredient per population correction unit (mg/PCU), of veterinary antimicrobial agents in the Netherlands, 2005-2009




### *3.2.5.8 Comments on the data*

#### Trends

After almost ten years of continuous increase in the total sales of therapeutic antimicrobial agents for animals, sales in the Netherlands expressed as mg/PCU decreased by 8% from 2007 to 2009. This decrease is mainly the result of a reduction in the sales of tetracyclines that are used in relatively large amounts for oral medication. It should be noted that numbers of slaughtered poultry seem to be under-reported to Eurostat for 2008 and 2009, as weight of carcass poultry reported to Eurostat increases in the same period by 5%. Consequently, the PCU for poultry for 2008 and 2009 is slightly underestimated, and thus the value for the total mg/PCU in the Netherlands is slightly overestimated for these years. Recent data indicate a further decrease of 12% in 2010.

A substantial decrease in total sales does not necessarily mean that the exposure to antimicrobial agents also declined. For instance, in 2009 a clear shift was seen within the group of tetracyclines from oxytetracycline to the more powerful doxycycline. Nevertheless, the annual sample survey on the use in specific animal species did show a decrease in exposure in 2009 in three out of five animal-production sectors, including fattening pigs and veal calves (MARAN-2009, 2011).

#### Use per animal species

FIDIN roughly estimates that, in the Netherlands, 95.5% of the antimicrobial agents for animals were for cattle, pigs and poultry, only 0.5% for dogs and cats, and another 4% for 'other animals', such as sheep, goats, horses and ponies. There is no insight into the off-label use, for example in rodents, songbirds and aquarium fish.

Exploratory calculations indicate that the most-sold antibiotics by far were those for use in the pig and veal-calf sectors, and that the proportion of sales for use in cattle and poultry was relatively small. In the Netherlands, there are only small numbers of species that usually get very limited amounts of antimicrobial agents, such as extensively held beef cattle and sheep.

### Prescribing patterns

The figures show that the treatment strategy in the Netherlands is primarily based on tetracyclines.

The sample survey showed that, in 2009, 70% of the use of antimicrobial agents in fattening pigs originated from the administration of tetracyclines, and 13% from macrolides/lincosamides. On veal-calf farms, 49% of the antimicrobial use originated from tetracyclines, 20% from intestinal anti-infectives (e.g. neomycin, colistin) and 10% from trimethoprim/sulfonamides. The applied dosage of tetracyclines in veal calves is especially high, compared to pigs and other species. In most sectors, the use of fluoroquinolones and 3rd and 4th-generation cephalosporins is limited. There seems to be a tendency to reintroduce conservative therapy with traditional antibiotic groups, instead of introducing newer antibiotics like cephalosporins, fluoroquinolones and macrolides (MARAN-2009, 2011).

## 3.2.6. Norway

### *3.2.6.1 Distribution of veterinary medicines*

In Norway, all veterinary medicinal products (VMPs) are prescription-only, and have to be dispensed through pharmacies, which are supplied by drug wholesalers only. An exemption from the pharmacy/wholesaler monopoly has been granted for medicated feeds (i.e. feeds into which drugs for therapeutic use are mixed prior to sale). Medicated feeds have to be prescribed by veterinarians and produced by feed mills authorised by the Norwegian Medicines Agency. In Norway, medicated feeds produced and supplied by feed mills are only used for farmed fish. Medicated feeds for livestock are not produced in feed mills, due to the small size of livestock herds compared to most other European countries. However, herd/flock treatment of livestock with antimicrobial agents is possible, again subject to veterinary prescription, through drinking water or as a top-dressing on feed.

### *3.2.6.2 Veterinary antimicrobial agents included in the material*

The data include approved products, except for a few antimicrobials sold on special exemption from marketing authorisation, which have been included following a case-by-case assessment. Only veterinary antimicrobial agents used in terrestrial animals are included in the data in Table 21, as in Norway, data on sales in farmed fish are collected separately.

### *3.2.6.3 Legal basis for the monitoring of sales*

The wholesalers and feed mills in Norway are mandated to provide sales statistics for both human and veterinary medicinal products, as well as for medicated feeding stuffs, to the Norwegian Institute of Public Health. The Norwegian Veterinary Institute (NVI) is responsible (on request from the Norwegian Food Safety Authority) for the surveillance and reporting of the usage of antimicrobial agents in animals. It does this through the national surveillance program on usage of antimicrobial agents and occurrence of antimicrobial resistance (NORM/NORM-VET, 2009), which covers veterinary, food and human sectors.

### *3.2.6.4 Data sources*

NVI obtained data on sales of the included veterinary antimicrobial agents at package level from the Norwegian Institute of Public Health, which collects its data from authorised wholesalers and feed mills.

### *3.2.6.5 Data coverage*

The data coverage is assumed to be 100%, as the sales of veterinary antimicrobial agents, in packages, collected from wholesalers in Norway (dispensing to pharmacies and animal owners), are shown to be identical to the corresponding sales calculated from prescription data obtained from the Norwegian Prescription Database (NorPD) for the years 2005 to 2009 (Kvaale MK, personal communication).

### *3.2.6.6 Analysis of the data*

The sales data (package level) were processed, analysed and validated by the Norwegian Veterinary Institute, in cooperation with the Norwegian School of Veterinary Science.

### *3.2.6.7 Results*

**Table 21.** Sales, in tonnes of active ingredients, of veterinary antimicrobial agents in Norway, 2005-2009

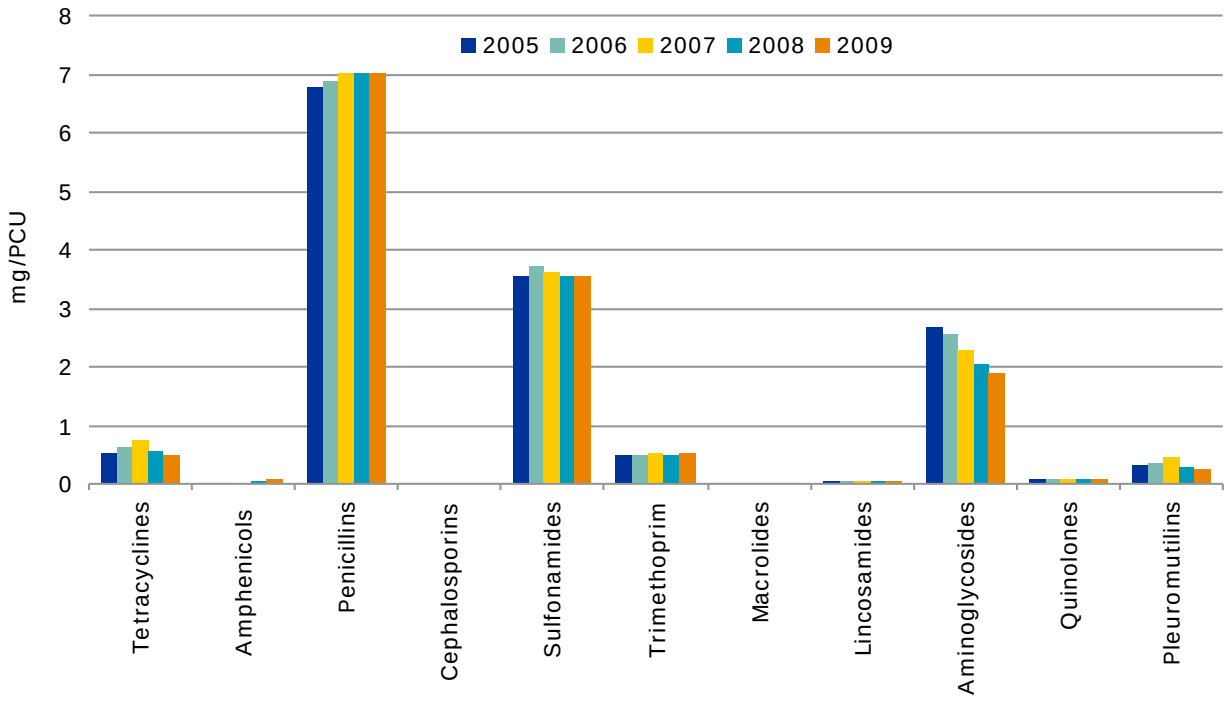
| Antimicrobial class | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Tetracyclines | 0.23 | 0.28 | 0.32 | 0.25 | 0.22 |
| Amphenicols | - | - | - | 0.019 | 0.024 |
| Penicillins | 2.96 | 3.00 | 3.01 | 3.07 | 3.09 |
| Cephalosporins (total) | - | - | - | 0.001 | 0.001 |
| *1st and 2nd gen. cephalosporins*[1] | - | - | - | - | - |
| *3rd and 4th gen. cephalosporins*[2] | - | - | - | 0.001 | 0.001 |
| Sulfonamides and trimethoprim (total) | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 |
| *Sulfonamides* | 1.5 | 1.6 | 1.6 | 1.5 | 1.6 |
| *Trimethoprim* | 0.2. | 0.2 | 0.2 | 0.2 | 0.2 |
| Macrolides | 0.002 | 0.002 | 0.000 | 0.000 | 0.000 |
| Lincosamides | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| Aminoglycosides | 1.16 | 1.11 | 0.99 | 0.89 | 0.83 |
| Quinolones (total) | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| *Fluoroquinolones* | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| *Other quinolones* | - | - | - | - | - |
| Polymyxins[1] | - | - | - | - | - |
| Pleuromutilins | 0.14 | 0.15 | 0.20 | 0.13 | 0.10 |
| **Total** | **6.30** | **6.44** | **6.34** | **6.18** | **6.13** |

[1] Not approved in Norway. [2] Marketing approval in 2008.

**Table 22.** Population correction unit (PCU) (in 1,000 tonnes), Norway

| Animal species | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Cattle | 249 | 247 | 239 | 239 | 231 |
| Pigs | 32 | 33 | 31 | 32 | 32 |
| Poultry | 47 | 51 | 55 | 63 | 71 |
| Sheep and goats | 97 | 94 | 90 | 91 | 92 |
| Horses | 12 | 12 | 13 | 14 | 14 |
| **Total** | **436** | **437** | **429** | **438** | **440** |

**Figure 13.** Sales, in mg active ingredient per population correction unit (mg/PCU), of veterinary antimicrobial agents in Norway, 2005-2009




### *3.2.6.8 Comments on the data*

For Norway, data for VMPs used in farmed fish are not included in the material, and thus not in the PCU. During 2005 to 2009, the annual sales of antimicrobials for farmed fish was on average 1.12 tonnes (1.12, 1.48, 0.65, 0.94 and 1.31 tonnes, respectively) (NORM-VET, 2009), while the biomass slaughtered fish (live weight) increased from approximately 560,000 tonnes to 960,000 tonnes in this period. The mg/PCU for farmed fish varies from 0.8 to 1.9 in the study period. If fish had been included in the material, mg/PCU for all species, including fish, would have been 5.2 mg/PCU.

Antimicrobial VMPs (mainly tablets) approved solely for companion animals accounted for 0.6 tonnes to 0.7 tonnes of the total sales annually (K. Grave, unpublished data). This implies that, if VMPs for companion animals had been excluded from the material, the mg/PCU estimated for terrestrial food-producing animals would have been 12, or approximately 14% lower than found in the current study.

During the study period, the total sales in Norway of veterinary antimicrobial agents for terrestrial animals expressed both as mg/PCU and in tonnes of active ingredient decreased by 6%. The major classes prescribed are the penicillins, sulfonamides and aminoglycosides.

In Norway, a large proportion of antimicrobial agents administered to food animals are injection preparations, mainly penicillins or penicillins in combination with aminoglycosides (dihydrostreptomycin); in 2009, the amount of injectable antimicrobial agents sold was 3.1 tonnes (K. Grave, unpublished data). In the second part of 1990, a campaign on prudent use of antimicrobial agents was conducted by Norwegian husbandry organisations and the Norwegian Medicines Agency; this included, among others, a plan to reduce the overall use of antimicrobial agents, but also to reduce the use of combinations of penicillins and aminoglycosides, as the added therapeutic value of aminoglycosides was considered insignificant. This campaign was very successful, and explains why penicillins account for the major proportion of the sales of antimicrobial VMPs in Norway today, contributing close to half of total sales (mg/PCU), while sales of aminoglycosides declined from 18% (2005) to 14% (2009). The decrease in sales of aminoglycosides is caused by a decrease in sales of combination preparations of penicillins + dihydrostreptomycin, which have been partly replaced with pure penicillin preparations. Parallel to this, there has been a gradual increase in the proportion accounted for by pure penicillin preparations since 1995, when the sales (in tonnes) contributed to 24% of total sales

(NORM-VET, 2009). From 1995, a 40% decrease in the sales of veterinary antimicrobial agents, in tonnes of active ingredients, is observed in Norway (NORM-VET, 2009).

Sulfonamides accounted for approximately 25% of the sales of veterinary VMPs in Norway; 99% of the sulfonamides were sold in combination with trimethoprim (NORM-VET, 2009).

## 3.2.7. Sweden

### *3.2.7.1 Distribution of veterinary medicines*

In Sweden, antimicrobial veterinary medicinal products (VMPs) may only be sold on prescription. VMPs have to be dispensed through pharmacies, which are supplied by drug wholesalers or marketing authorisation holders. Pharmacies are authorised by the Medical Products Agency, and they operate according to specified guidelines. Feed mills may only mix antimicrobials in feed if they are controlled and authorised by the 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 Board of Agriculture has controlled and authorised the establishment for the purpose. In such cases, the premix is purchased on prescription and dispensed by a pharmacy.

### *3.2.7.2 Veterinary antimicrobial agents included in the material*

The material includes all antimicrobial VMPs marketed in Sweden and sold for use in terrestrial animals in classes of antimicrobial agents as per Table 1. In addition, products sold with a special-licence prescription (exemption from general Swedish marketing authorisation) are included. However, due to changes in the retrieval system, it is possible that data for 2005 are not entirely complete with respect to the latter category.

### *3.2.7.3 Legal basis for the monitoring of sales*

All pharmacies in Sweden are required to provide sales statistics on a daily basis to an infrastructure company owned by the state, Apotekens Service AB, which maintains a database and provides statistics to the competent national and regional authorities and to others on a commercial basis. All feed mills and farms authorised to mix medicated feed are requested to report their purchases and sales on a yearly basis to the Board of Agriculture.

Use of antimicrobials for animals has been monitored on the initiative of and by the National Veterinary Institute (SVA) since 1980. SVA is responsible for monitoring antimicrobial resistance, and statistics on usage are published in English in the yearly reports of the Swedish Veterinary Antimicrobial Resistance Monitoring programme (SVARM, 2009). Since 2005, the Board of Agriculture has been responsible for statistics on use of certain pharmaceuticals for animals, including antimicrobials. Data are reported in Swedish in an electronic report on sales of certain drugs for animals (www.jordbruksverket.se). Data are given by companion or production animals – and to the extent possible, also by specific animal species.

### *3.2.7.4 Data sources*

The data in Table 23 have been extracted from the monitoring performed by SVA (including data published in SVARM), with the exception of data for QP51AG. For the latter class, data has been taken from the reports of the Board of Agriculture. All raw data on sales were originally obtained from Apotekens Service AB.

### *3.2.7.5 Data coverage*

The data coverage is assumed to be close to 100%. In rare cases, premixes mixed in medicated feed may be delivered from feed mills without the sales being recorded by a pharmacy. Examination of the reports by all feed mills to the Board of Agriculture shows that this happened only once during the study period (a total quantity of 40 kg active substance). Also, it is possible that not all products sold with a special licence during year 2005 were captured.

### 3.2.7.6 Analysis of the data

Sales data were obtained as number of packages and as quantity of active substance sold per year. Data were validated, adjusted and further processed by SVA.

### 3.2.7.7 Results

**Table 23.** Sales, in tonnes of active ingredients, of veterinary antimicrobial agents in Sweden, 2005-2009

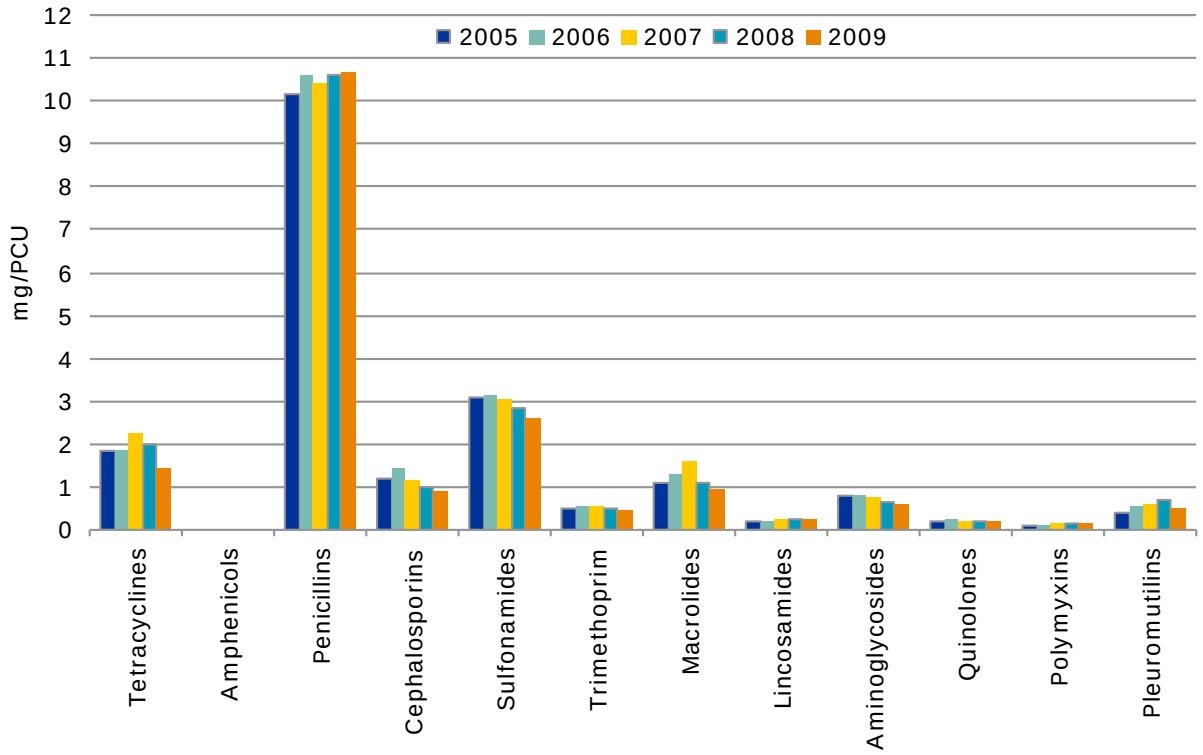
| Antimicrobial class | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Tetracyclines | 1.56 | 1.52 | 1.85 | 1.65 | 1.17 |
| Amphenicols | - | - | - | - | - |
| Penicillins | 8.48 | 8.78 | 8.51 | 8.70 | 8.79 |
| Cephalosporins (total) | 1.01 | 1.21 | 0.95 | 0.82 | 0.74 |
| *1st gen. cephalosporins*[1] | 0.98 | 1.19 | 0.92 | 0.79 | 0.71 |
| *3rd gen. cephalosporins*[1] | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 |
| Sulfonamides and trimethoprim (total) | 3.03 | 3.04 | 2.91 | 2.74 | 2.53 |
| *Sulfonamides* | 2.59 | 2.59 | 2.47 | 2.33 | 2.15 |
| *Trimethoprim* | 0.44 | 0.45 | 0.44 | 0.42 | 0.38 |
| Macrolides | 0.91 | 1.08 | 1.33 | 0.88 | 0.77 |
| Lincosamides | 0.18 | 0.18 | 0.19 | 0.22 | 0.21 |
| Aminoglycosides | 0.67 | 0.66 | 0.61 | 0.54 | 0.50 |
| Quinolones (total) | 0.18 | 0.20 | 0.18 | 0.17 | 0.16 |
| *Fluoroquinolones* | 0.18 | 0.20 | 0.18 | 0.17 | 0.16 |
| *Other quinolones* | - | - | - | - | - |
| Polymyxins | 0.10 | 0.09 | 0.11 | 0.11 | 0.11 |
| Pleuromutilins | 0.34 | 0.46 | 0.51 | 0.57 | 0.40 |
| Others | 0.004 | 0.004 | 0.004 | 0.003 | 0.003 |
| **Total** | **16.45** | **17.21** | **17.15** | **16.39** | **15.39** |

[1] No 2nd or 4th-generation cephalosporins authorised.

**Table 24.** Population correction unit (PCU) (in 1,000 tonnes), Sweden

| Animal species | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Cattle | 345 | 342 | 328 | 320 | 331 |
| Pigs | 251 | 240 | 238 | 241 | 231 |
| Poultry | 77 | 76 | 78 | 78 | 76 |
| Sheep and goats | 40 | 42 | 44 | 44 | 46 |
| Horses | 123 | 128 | 132 | 136 | 141 |
| **Total** | **837** | **828** | **819** | **819** | **825** |

**Figure 14.** Sales, in mg active ingredient per population correction unit (mg/PCU), of veterinary antimicrobial agents in Sweden, 2005-2009




### *3.2.7.8 Comments on the data*

During the reporting period, the total sales of antimicrobials for animals expressed as mg/PCU increased by 8% between 2005 and 2007, and then decreased by 10% until 2009. These trends are partly explained by changes in the sales of tetracyclines, macrolides and pleuromutilins, mostly for medication in feed or in water. Consequently, sales of products for medication in feed or in water as a proportion of the total sales varied between 13% and 17% during the study period.

The sales in mg/PCU are dominated by penicillins (50-57%). Of that group, 87-89% was injectable benzylpenicillin. Benzylpenicillin is the first-line treatment for mastitis, mostly applied as injection. Estimates based on various sources indicate that at least 40% of the volume of benzylpenicillin was sold for use in dairy cows, at least 20% for pigs, and the remainder for non-dairy cattle, horses and other animals. It should be noted that the equine population has increased notably and today exceeds the population of dairy cows. The second-largest class is sulphonamides and trimethoprim in combination, of which about two thirds are products formulated for oral use in horses.

The proportion of total sales of antimicrobials that was dispensed for use in dogs and cats, expressed as mg/PCU, was 11% to 13% during the study period (calculated from data in SVARM 2009). Sales for use in these species have decreased by 24% since 2006. Since 2005, a decrease of first-generation cephalosporins by 25% and a corresponding increase by 26% in the sales of lincosamides is almost entirely explained by sales for dogs. The sales of fluoroquinolones for all species, expressed as mg/PCU, decreased by 8% from 2005 to 2009, but when sales for dogs and cats are subtracted, the decrease is only 4%. This shows that, in Sweden, trends in sales for dogs and cats can noticeably influence the overall sales for certain classes.

## 3.2.8. Switzerland

### *3.2.8.1 Distribution of veterinary medicines in Switzerland*

All antimicrobial veterinary medicinal products (VMPs) authorised for use in veterinary medicine in Switzerland are prescription only. The majority are dispensed directly from the veterinarians (especially in the food-producing animals sector) and a small percentage are dispensed by pharmacies. Medicated premixes are intended for direct application (top dressing) or on-site incorporation into feed. They are also prescription-only medicines and may be dispensed either by veterinarians or by wholesalers to feed mills for incorporation, in which case they are delivered by the feed mill as medicated feed. The definition of premixes is different in Switzerland to in the EU: premixes are VMPs to be added to feed or water and applied to groups of animals. They are not distinguished from oral powders. The prescription of medicated feed or premix requires the use of a specific form for groups larger that 10 calves, 20 pigs or 50 chickens.

All antimicrobials are distributed by wholesalers to veterinarians or pharmacies, and premixes only to feed mills. In most cases, wholesalers and marketing authorisation holders are the same entity.

### *3.2.8.2 Veterinary antimicrobial agents included in the material*

Antimicrobial VMPs according to Table 1 for both terrestrial and aquatic species are included in the material. However, the sale quantities of products for use in aquatic species are negligible. Note that 2005 data are not included, since they have been obtained from a different source and are therefore not comparable with following years.

### *3.2.8.3 Legal basis for the monitoring of sales*

The legal basis for data collection is Art. 36 of the Federal Ordinance on Veterinary Medicines, enacted in September 2004. It requests the Swiss Agency for Therapeutic Products (Swissmedic) to "specifically establish a statistic about usage of veterinary antimicrobials for the purpose of monitoring resistances". The data are therefore requested, processed and analysed by Swissmedic. Sales of veterinary antimicrobials are published yearly in the ARCH-VET report (ARCH-VET, 2009) covering sales and resistances to veterinary antimicrobials.

Note that figures published in the ARCH-VET differ from figures below, since all ATCvet groups are included in the national report.

### *3.2.8.4 Data sources*

Data were obtained at package level from the marketing authorisation holders.

### *3.2.8.5 Data coverage*

Coverage is assumed to be 100% for the sales of authorised antimicrobials. No prescription figures are currently available at national level, which means 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 delivered by Swissmedic. As they 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 can not be monitored and are therefore not included in the statistics.

### *3.2.8.6 Analysis of the data*

Data are entered in a database at package level and processed by Swissmedic. The plausibility of data is checked by comparison with previous years (evolution of sales figures), other sources (e.g. PSURs) or in relation to other substance groups (e.g. if new products are placed on the market).

### *3.2.8.7 Results*

**Table 25.** Sales, in tonnes of active ingredients, of veterinary antimicrobial agents in Switzerland, 2006-2009

| Antimicrobial class | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|
| Tetracyclines | 15.49 | 17.21 | 17.19 | 16.04 |
| Amphenicols | 0.14 | 0.17 | 0.19 | 0.21 |
| Penicillins | 13.16 | 13.18 | 13.87 | 13.26 |
| Cephalosporins (total) | 0.45 | 0.48 | 0.50 | 0.51 |
| *1st and 2nd gen. cephalosporins* | 0.36 | 0.37 | 0.37 | 0.35 |
| *3rd and 4th gen. cephalosporins* | 0.09 | 0.11 | 0.13 | 0.16 |
| Sulfonamides and trimethoprim (total) | 29.31 | 31.38 | 31.29 | 31.15 |
| *Sulfonamides* | 27.23 | 29.36 | 29.43 | 29.40 |
| *Trimethoprim* | 2.08 | 2.02 | 1.86 | 1.75 |
| Macrolides | 3.24 | 3.55 | 3.78 | 3.56 |
| Lincosamides | 0.10 | 0.11 | 0.10 | 0.08 |
| Aminoglycosides | 3.72 | 3.71 | 3.71 | 3.54 |
| Quinolones (total) | 0.35 | 0.39 | 0.44 | 0.43 |
| *Fluoroquinolones* | 0.34 | 0.38 | 0.43 | 0.43 |
| *Other quinolones* | 0.01 | 0.01 | 0.00 | 0.00 |
| Polymyxins | 1.99 | 1.81 | 1.71 | 1.68 |
| Pleuromutilins[1] | 0.01 | 0.15[1] | 0.02 | 0.03 |
| Others | 0.02 | 0.02 | 0.02 | 0.02 |
| **Total** | **67.96** | **72.17** | **72.81** | **70.50** |

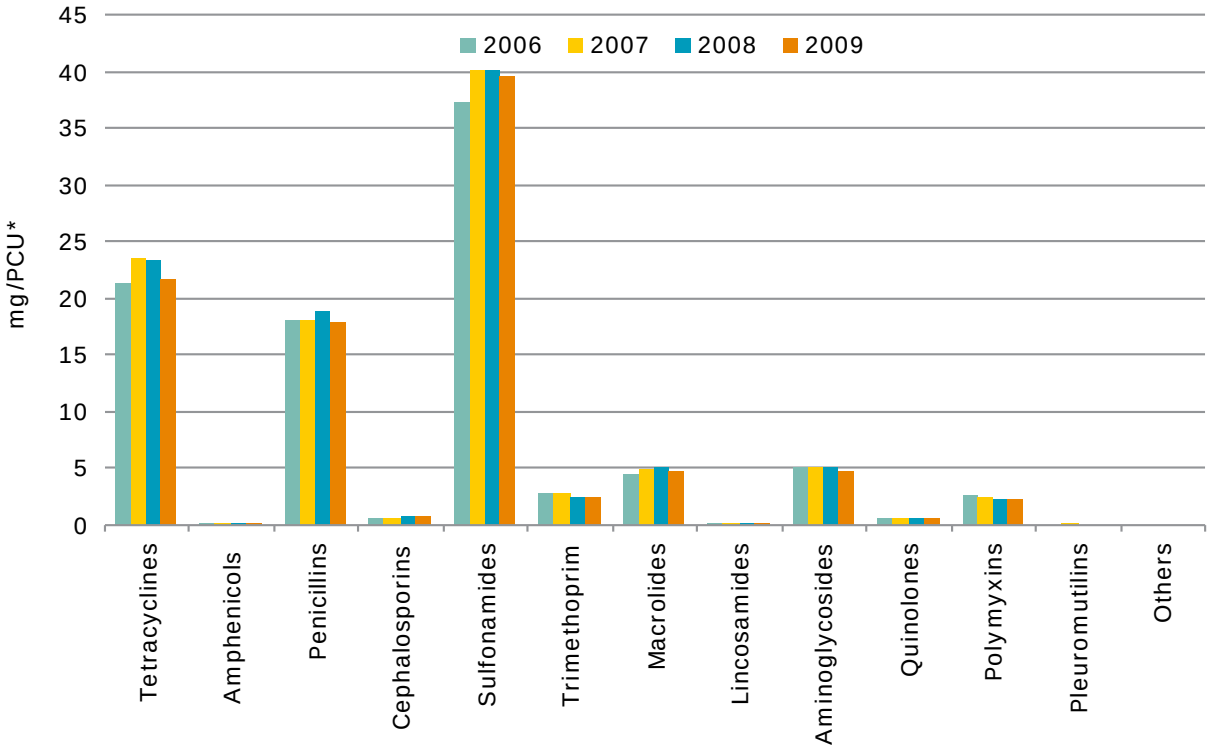
[1] The major part used in a clinical field study.

**Table 26.** Population correction unit (PCU*) (in 1,000 tonnes), Switzerland

| Animal species | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|
| Cattle | 391 | 389 | 398 | 400 |
| Pigs | 239 | 235 | 225 | 231 |
| Poultry | 48 | 56 | 60 | 61 |
| Sheep and goats | 32 | 32 | 32 | 31 |
| Horses | 16 | 16 | 17 | 17 |
| Rabbits | 2 | 2 | 2 | 2 |
| **Total** | **728** | **730** | **733** | **742** |

* PCU is calculated by a method slightly different to that for the other eight countries (see Appendix 2, method II).

**Figure 15.** Sales, in mg active ingredients per population correction unit (mg/PCU*), of veterinary antimicrobial agents in Switzerland, 2006-2009




* PCU is calculated by a method slightly different to that for the other eight countries (see Appendix 2, method II).

### *3.2.8.8 Comments on the data*

The total sales of veterinary antimicrobial agents in Switzerland remained relatively stable during the years 2006 to 2009. The sales in tonnes of active ingredients showed a 7.1% increase from 2006 to 2008, followed by a drop of about 3.2% in 2009. Over all four years, sulfonamides represent the highest part of the sales, in tonnes of active ingredients as well as in mg/PCU, followed by tetracyclines and penicillins.

The highly fragmented structures of pig and calf production encountered in Switzerland are leading to frequent grouping of young animals, which favours the appearance of crowding symptoms, such as respiratory disorders in calves and diarrhoea in pigs. A high percentage of the premixes authorised for such indications and sold in the four years under consideration contain a combination of one sulfonamide, one tetracycline and one macrolide (mainly tylosin). This explains the high importance and high sales volume of the first two substance groups. Amino-penicillins are also frequently found in premixes, and are mainly used in calves.

Antimicrobial agents contained in oral preparations for food-producing animals therefore represent the biggest part (around 75%) of the Swiss sales for the years under consideration, followed by antimicrobial agents for intramammary application, at 7% of the sales in tonnes of active ingredients (2009). Within the latter, 28% originated from products used at drying-off (2009), whereas 72% were sold in products to treat mastitis during lactation.

Among the different classes of antimicrobial agents, the sales of cephalosporins expressed as mg/PCU increased slightly, but continuously, during the four years under review. This is particularly the case for substances of the newer 3rd and 4th generations, and concerns both food-producing and companion-animal sectors. Part of this growth is attributable to the launch of newly licensed preparations during the years 2006 to 2009.

In companion animals, beta-lactams represented 74% of the active ingredients marketed exclusively for this sector (2009). The proportion in preparations for oral application was even greater, at 80%, with 42% of these being cephalosporins of the 1st generation.

## 3.2.9. United Kingdom

### *3.2.9.1 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, these can only be supplied by a wholesale dealer authorised by the UK 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.

Use of the veterinary prescribing cascade is permitted if there is no suitable authorised veterinary medicinal product available. Should the prescribing cascade be used in treating farmed animals, then only products authorised for use in food-producing animal species may be prescribed, and then specific withdrawal periods, which are dependent on the animal product, have to be observed.

### *3.2.9.2 Veterinary antimicrobial agents included in the material*

The material includes veterinary antimicrobial agents as given in Table 1, used for both farmed animals, including fish, and animals kept as pets. The data from the UK do not include some products such as those applied as topical creams, which are reported in the UK's national report on sales of veterinary antimicrobial agents (VMD, 2009).

### *3.2.9.3 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.

### *3.2.9.4 Data sources*

The UK Veterinary Medicines Directorate collects data from veterinary pharmaceutical manufacturers that hold current UK marketing authorisations. During the first half of the calendar year, letters are sent to manufacturers to ask for their sales data from the previous full calendar year.

### *3.2.9.5 Data coverage*

The data coverage is assumed to be 100% of all products with a UK marketing authorisation. The VMD holds information on all new, current and past authorisations, and carries out an annual search of these data prior to writing. The manufacturers are asked to confirm that the VMD's list is correct when they supply their data.

### *3.2.9.6 Analysis of the data*

Sales data are analysed according to package size and numbers sold, and validated as far as possible by the UK Veterinary Medicines Directorate.

### *3.2.9.7 Results*

**Table 27.** Sales, in tonnes of active ingredients, of veterinary antimicrobial agents in the United Kingdom, 2005-2009

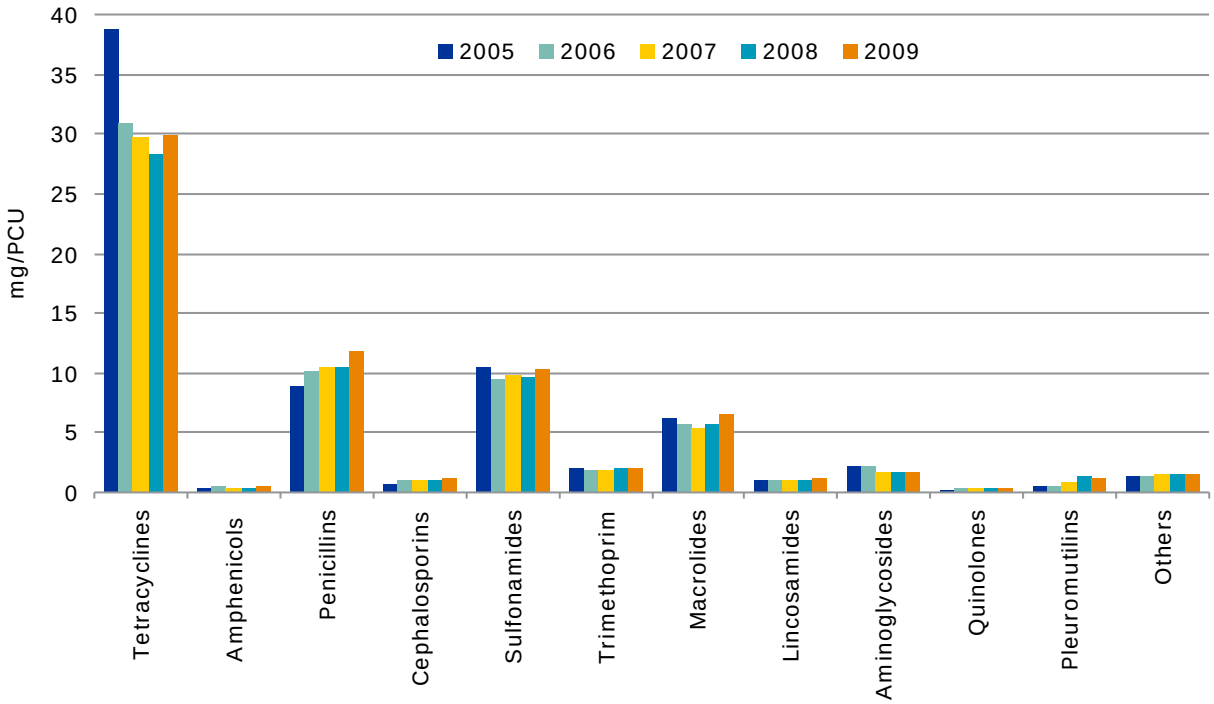
| Antimicrobial class | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Tetracyclines | 238.33 | 190.66 | 183.45 | 171.09 | 176.89 |
| Amphenicols | 1.88 | 2.90 | 2.21 | 2.28 | 2.74 |
| Penicillins[1] | 55.48 | 63.43 | 65.06 | 62.54 | 70.21 |
| Cephalosporins (total) | 3.97 | 5.69 | 6.22 | 6.24 | 6.60 |
| *1st and 2nd gen. cephalosporins[2]* | 3.30 | 4.95 | 5.37 | 5.36 | 5.62 |
| *3rd and 4th gen. cephalosporins* | 0.67 | 0.74 | 0.85 | 0.88 | 0.98 |
| Sulfonamides and trimethoprim (total) | 75.77 | 71.05 | 72.87 | 69.61 | 73.04 |
| *Sulfonamides[3]* | 64.21 | 59.37 | 60.84 | 58.16 | 61.03 |
| *Trimethoprim* | 11.56 | 11.68 | 12.03 | 11.45 | 12.01 |
| Macrolides | 37.45 | 36.13 | 32.93 | 35.42 | 38.53 |
| Lincosamides | 6.25 | 6.14 | 6.11 | 5.94 | 6.52 |
| Aminoglycosides | 13.26 | 13.68 | 9.85 | 9.86 | 10.00 |
| Quinolones (total) | 1.42 | 1.61 | 1.94 | 1.92 | 1.78 |
| *Fluoroquinolones* | 1.42 | 1.61 | 1.94 | 1.92 | 1.78 |
| *Other quinolones* | - | - | - | - | - |
| Pleuromutilins | 2.91 | 2.90 | 4.77 | 7.54 | 6.65 |
| Others[4] | 7.87 | 8.31 | 9.78 | 9.05 | 9.63 |
| **Total** | **445** | **403** | **395** | **381** | **403** |

[1] Does not include clavulanic acid, which is in 1:4 ratios to amoxicillin (QJ01CR). This would have been an additional 1.51, 1.48, 1.59, 1.76 and 1.79 tonnes in 2005, 2006, 2007, 2008 and 2009, respectively. [2] No 2nd-generation cephalosporins are available as authorised veterinary medicines in the UK. [3] Also includes 0.067 tonnes and 0.1445 tonnes "sulphonamides, plain and in combinations" in 2005 and 2007, respectively. [4] Includes spectinomycin and polymyxins.

**Table 28.** Population correction unit (PCU) (in 1,000 tonnes), United Kingdom

| Animal species | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Cattle | 1,674 | 1,793 | 1,803 | 1,757 | 1,678 |
| Pigs | 717 | 693 | 709 | 698 | 674 |
| Poultry | 952 | 924 | 901 | 886 | 942 |
| Sheep and goats | 2,106 | 2,088 | 2,095 | 1,978 | 1,915 |
| Horses | 520 | 520 | 520 | 520 | 520 |
| Fish | 173 | 172 | 174 | 180 | 197 |
| **Total** | **6,142** | **6,190** | **6,202** | **6,018** | **5,925** |

**Figure 16.** Sales, in mg active ingredient per population correction unit (mg/PCU), of veterinary antimicrobial agents in the United Kingdom, 2005-2009




### *3.2.9.8 Comments on the data*

Over the reporting period, there was a decrease in total sales of veterinary antimicrobials in the UK from 444 tonnes to 404 tonnes. The highest-selling three antimicrobial classes were tetracyclines, sulfonamides and penicillins, which contributed between 76% and 81% of total sales in each of the five reporting years. Tetracycline sales have generally decreased, while penicillin sales have increased and sulphonamide sales remained constant. The majority of the products with these active ingredients are used for herd treatment.

Total sales of antimicrobials expressed as mg/PCU have remained constant over the reporting period, varying between 63 mg/PCU and 72 mg/PCU per year. In the UK, it is estimated that about 85-90% of all antimicrobial agents sold for use in the veterinary sector are for food-producing animals, the majority being used for pigs and poultry.

Sales of fluoroquinolones peaked in 2007 and have been declining since this time. Conversely, cephalosporin sales increased each year over the five-year reporting period. Sales of 1st, 3rd and 4th-generation cephalosporins are noted (the UK has no 2nd-generation cephalosporins authorised). During the study years, the sales of 1st and 2nd-generation cephalosporins accounted for approximately 83-87% of total cephalosporin sales, most of which are used in companion animals.

Medicated feeding-stuffs account for the largest proportion of total sales of veterinary antimicrobial agents in the UK, followed by oral and water-administered products. The medicated feeding-stuffs account for approximately 60-70% of total sales each year.

# 4. Discussion

## 4.1. Material and methods

### 4.1.1. Sales data for veterinary antimicrobial agents

It is important to note that the results presented in this report may differ from those presented in the national reports because of, for example, differences in inclusion criteria and conversion factors used for veterinary antimicrobial agents.

Two countries, the Czech Republic and Finland, deviated from the inclusion criteria (Table 1) by including dermatological preparations (ATCvet group QD) and preparations for sensory organs (ATCvet group QS) (Table 3). The contribution from these groups of antimicrobial agents, in tonnes of active ingredient, to the total amounts is minimal, and therefore the effect of the deviation is negligible. Furthermore, sales for fish are not included in the data from Norway and Sweden.

In some countries, subclasses of quinolones and cephalosporins, e.g. fluoroquinolones and 3rd and 4th-generation cephalosporins, were not reported as such before 2009. There may also be some differences in the reporting of other antimicrobial agents; in the UK, for example, polymyxins are not given separately (included in 'other'), due to confidentiality issues. Generally, deviations are minor and, whenever possible, were taken into account in the data analysis. Furthermore, use of human antimicrobial agents is not captured in the data, as the data only cover veterinary antimicrobial agents. Also, in some countries veterinary antimicrobials obtained on special licence (exemption from marketing authorisation) are included in the material, while not in others. The impact of these deviations is considered less important and does not influence the general results.

As the data provided are aggregated per class, it is not possible to analyse, for example, trends in the sales of antimicrobials applied for herd treatment. In the future, the implementation of the ESVAC template will provide detailed data at package level, give information on administration form, and differentiate between herd treatments versus individual treatment. This will allow for more detailed analysis of data than can be done using the aggregated data.

### 4.1.2. Reporting of the data by use of mg/PCU

An apparent 12-fold difference in sales, in mg/PCU, is observed between the most- and least-selling countries. This is likely to be due in part to differences in the composition of the animal population (e.g. more pigs than cattle) in the various countries. There may also be considerable variation in terms of dosage, length of treatment period and formulation of the various antimicrobial agents used. For example, the dose for a whole treatment with a fluoroquinolone is typically 2-5 mg/kg (for terrestrial animals), while with a tetracycline this is typically 140 mg/kg, or up to 70 times higher. This implies that a given weight of active ingredient of fluoroquinolone sold can be used to treat 70 times as many animals as the same weight of active ingredient of tetracycline. Another consideration is that the treatment dosage may differ significantly according to species; for fish, the typical tetracycline dosage for the whole treatment is 800 mg/kg, or some six times higher than that for terrestrial animals. Furthermore, within a class there may be different dosages for different substances; for example, the dosage of doxycycline is about one quarter of the dosage of oxytetracycline.

In human medicine, defined daily doses (DDDs) have been assigned for antimicrobial agents at international level, allowing for standardised reporting of usage of antimicrobial agents by class, time period and country. DDDs are assigned by the WHO International Working Group for Drug Statistics Methodology (WHO Collaborating Centre for Drug Statistics Methodology, 2011), and are defined as "the assumed average maintenance dose per day for a drug used for its main indication in adults". A similar unit of measurement, for example DDDkg animal, has not yet been developed at the global level for veterinary antimicrobial agents. An option to correct for differences in dosing could be to use information available in the summary of product characteristics (SPC), as data in ESVAC will be collected at package level. But the dosages as given in the SPCs may vary between countries, especially for older products, for the same antimicrobial agent and formulation, and even animal species may also be given as a range (e.g. 10-40 mg/kg for 3-4 days), and thus need to be standardised at EU level.

Furthermore, the PCU only represents a technical unit of measurement and not a real value for the animal population that could potentially be treated by antimicrobial agents. Thus, reporting the data as mg/PCU does not provide information on real exposure to antimicrobial agents, but may be an indicator for development of trends in use ('frequency'), as well as

for changes in prescribing patterns. Such data should never be used alone as the basis for setting management priorities, but should always be complemented by data from other sources.

The sales data on veterinary antimicrobial agents (numerator) cover all species, while the population correction factor (denominator) does not include companion animals or minor species such as reindeer. Thus, in this report the use of the measure mg per PCU results in an overestimate of antimicrobial agents sold.

The observed 12-fold difference in sales, in mg/PCU, between the most- and least-selling countries is slightly above the value found by Grave et al (2010). However, the correlation between the PCU used in this report for 2007 and the corresponding unit used by Grave et al (2010) for the 2007 data is very high (r=0.974). The probable explanation for the discrepancy is that the methodology used in this report to estimate the weight of livestock and slaughtered animals was different to that used by Grave et al (2010), resulting in a lower PCU and thus higher value of the mg/PCU.

The PCU values for 2007 applied in the present report are highly correlated with a similar unit used in the paper by Grave et al (2010) to normalise sales data of veterinary antimicrobial agents against animal demographics. As opposed to the study by Grave et al (2010), the PCU calculated for the current study also includes livestock sheep, and as the UK has a very high population of sheep, this explains the deviation between the values seen for the UK and those for the other countries.

To adjust for differences in dosage and length of treatment periods for the various antimicrobial agents and formulations, a technical unit of measurement, such as defined daily dose ($DDD_{animal}$) or defined cure dose ($DCD_{animal}$), or estimates of the percentage of the population treated, should be developed. It is further recognised that the PCU (denominator) used may not be optimal, and may therefore need to be refined in the future.

### 4.1.3. Trends in sales and sales patterns

For eight countries (Switzerland not included), the sales, in tonnes, of all veterinary antimicrobial agents included in the material decreased by 11.2% in the period 2005 to 2009. When data are corrected using the population correction factor and expressed as mg/PCU, the observed decrease is 8.2%. This shows that it is important to take into account the animal population when assessing trends in the sales of veterinary antimicrobial agents.

The decrease in total sales of veterinary antimicrobial agents, expressed in tonnes or as mg/PCU, does not necessarily imply that the numbers of animals treated have decreased. The dosages of the antimicrobial agents responsible for the major part of the overall decrease (especially tetracyclines) are substantially higher than the dosages of the antimicrobial agents increasing in sales, e.g. fluoroquinolones, cephalosporins, pleuromutilins and penicillins.

The decrease in total sales in the eight countries is mainly due to a decrease in the sales of tetracyclines, both in tonnes and in mg/PCU. The total sales of antimicrobial agents classified by the WHO as critically important for humans – 3rd and 4th-generation cephalosporins, and fluoroquinolones – in the countries reporting such sales increased, both in tonnes and in mg/PCU. As the data are aggregated by class, it is not possible to identify whether the increased sales of these agents can be attributed to an increase in their use for food-producing animals or for companion animals. Data at package level currently being collected from the Member States will allow for more in-depth analysis of the sales of critically important antimicrobials for use in food-producing animals, as products used only in companion animals, such as tablets, can then be excluded.

One of the main findings of the present study is that the prescribing patterns of veterinary antimicrobial agents during the five-year period differ substantially between countries. Generally, these variations may be due to differences between the countries in the relative proportion of the various animal species, the availability of veterinary antibacterial products on the market, prices, risk-management measures implemented, veterinarians' prescribing behaviour, animal production systems (e.g. veal as opposed to beef cattle on pasture) and the general situation with regard to infectious diseases.

A positive correlation was shown between the total PCU (by country and year) with tetracyclines and macrolides sales (tonnes of active ingredient); a similar correlation was found for the PCU for each species individually (cattle, pigs and poultry) with the tetracyclines and macrolides sales. In contrast, a negative correlation was shown between the total PCU (by country and year) with sales of penicillins (tonnes of active ingredient); similarly, a negative correlation was shown for the PCU for each of the individual species (cattle, pigs and poultry).

Antimicrobial class repartition and prescribing patterns vary significantly for the various species; therefore, the variation in the animal demographics between countries may partly explain the observed correlations, but other factors also need to be considered. Further in-depth analyses are required to be able to identify with greater precision the factors underlying these observed differences.

# 5. Conclusion

This report presents, for the first time, harmonised data on sales of veterinary antimicrobial agents in nine European countries that have a sales-monitoring system in place; it covers the period 2005-2009 (Switzerland 2006-2009).

The analysis performed for this report was of existing data that were re-analysed using a harmonised approach. Even if full harmonisation was not achieved, the results obtained give an overall picture of trends in the sales of veterinary antimicrobial agents in the nine countries. To establish a more accurate picture of antimicrobial use across the EU, it is important to obtain detailed data from all EU Member States. This report provides a methodology that can be applied by other countries.

The first step towards obtaining a more detailed analysis of the data is to obtain detailed data at package level of each antimicrobial veterinary medicinal product, but the ultimate goal is to collect usage data per animal species and per production category, and to take into account the dosage and the treatment duration for each antimicrobial product.

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# Appendix 2: Calculation of population correction unit (PCU)

## Definition

The population correction unit (PCU) is used for estimated weight at treatment of livestock and of slaughter animals, and is purely a technical unit of measurement; 1 PCU = 1 kg.

## Animal species and categories included; selection of data sources

The selection of animal species and data sources for the estimation of PCU was made to fulfil the following objectives:

1. Collection of the data should be harmonised between countries.
2. The methodology for collection and reporting of the data should be transparent.
3. The data should be validated at regular intervals.
4. The data should be made available for the included species for all Member States.

Eurostat, the Statistical Office of the European Union, covers data on numbers and biomass of food-producing animals slaughtered, as well as data on livestock food-producing animals, and these data comply with the abovementioned criteria. Therefore, Eurostat was selected as the data source for data on this animal category. For livestock horses, national statistics were used. Data on dogs and cats are not available in all Member States, so to have harmonised data, these species were not included in PCU. For Norway and Sweden, data on sales of antimicrobial agents for farmed fish are not included, as these data are collected separately in these countries. Consequently, farmed fish were not included in the calculation of PCU for Norway and Sweden.

Animals exported for fattening or slaughter in another Member State are likely to have been treated with antimicrobial agents in the country of origin, but are included in the Eurostat data on number of animals slaughtered and biomass slaughtered (carcass weight). It was decided to correct for this for the major species (cattle, pigs, poultry, and sheep). However, the Eurostat data on numbers of animals exported or imported for fattening or slaughter to other countries are not valid, as these are reported only when above a certain limit (personal communication, Michael Goll), which implies that the Eurostat data represent an underestimate of these for most species and countries. These data were therefore obtained from TRACES (DG SANCO, European Commission), and as these are based on health certificates, which are obligatory for all animals passing any border, they are considered reliable, albeit only since 2006. TRACES is not a public data source. The application is designed for online certification, so for reasons of data protection, access to it is limited to veterinary authorities and economic users validated by a relevant veterinary authority. It should be noted that TRACES data do not include data on number of animals transported to non-EU countries.

## Calculation of PCU

### *Method I*

PCU per country, year and animal category was calculated by multiplying the numbers of the various animal categories per year and country by average weight (AW) at treatment (Montforts, 1999).

1. Number of animals slaughtered multiplied by AW at treatment.
2. Number of livestock (dairy cows, sows, sheep, horses) multiplied by AW at treatment.
3. Number of animals imported/exported for fattening/slaughter multiplied by AW.

**Table 1.** Data sources used in calculation of the population correction unit (PCU)

| Data | Units in data source | Data source |
|---|---|---|
| Number of animals slaughtered | 1,000 heads | Eurostat[1] |
| Number of livestock (dairy cows, sows, sheep, horses) | 1,000 heads | Eurostat (December census)[1] |
| Number of animals imported or exported for fattening or slaughter (net balance) | Heads | TRACES (DG SANCO); Data for 2005 not used as not valid[2] |
| Number of livestock horses | 1,000 heads | National statistics |
| Fish slaughtered (as live weight) | 1,000 tonnes | Eurostat[3] |

[1] http://epp.eurostat.ec.europa.eu/portal/page/portal/agriculture/data/database
[2] sanco-traces@ec.europa.eu
[3] http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=fish_aq_q&lang=en.

### *Method II – applied for Switzerland*

Data on numbers of animals slaughtered are not available for Switzerland; therefore, the data in point 1 of method I are replaced by slaughtered biomass (carcass weight), multiplied by a conversion factor (CF) to express biomass live weight at slaughter, while the other data (points 2 and 3) are calculated in the same way for all countries.

1. Carcass weight of cattle, pigs, poultry, sheep and goats multiplied by CF.
2. Number of livestock (dairy cows, sows, sheep, horses) multiplied by AW.
3. Number of animals imported/exported for fattening/slaughter multiplied by AW.

Because data obtained from the calculations using method II, point 1 represent the estimated weight at slaughter (PCU), while the data obtained by use of method I, point 1 represent the estimated weight at treatment (PCU), and are thus lower values, the data are not comparable. To adjust for this, the PCU for each of the seven EU Member States and Norway was calculated using method II. It was found that the PCU obtained for these countries using method I was approximately 70% lower for each country than when using method II. Therefore, the data obtained for Switzerland by method II have been multiplied by a factor of 0.7. The correlation factor between the PCU obtained through the two methods for the eight countries was found to be high (Table 2). The correlation factor for the Netherlands is lower than for the other countries. This is due to under-reporting in Eurostat of numbers of broilers slaughtered (used in method I) for 2008-2009, compared to slaughtered biomass broilers for these years (used in method II).

**Table 2.** Correlation between PCU obtained through method I and method II for the years 2005-2009

| Country | Correlation factor |
|---|---|
| Czech Republic | 0.985 |
| Denmark | 0.990 |
| Finland | 0.999 |
| France | 0.993 |
| Netherlands | 0.833 |
| Norway | 0.984 |
| Sweden | 0.976 |
| United Kingdom | 0.999 |

## Average weights and carcass-to-live-weight conversion factors

**Table 3.** Average weight (AW), in kilos, used in calculating the population correction unit (PCU)

| Animal category | AW at treatment (kilos) | Source |
|---|---|---|
| **Cattle** | | |
| Slaughter cows | 425 | Montforts (1999)[1] |
| Slaughter heifers | 200 | EMA[2] |
| Slaughter bullocks and bulls | 425 | Montforts (1999)[1] |
| Slaughter calves and young cattle | 140 | Montforts (1999)[1]; EMA[2] |
| Imported/exported cattle for slaughter | 425 | Montforts (1999)[1] |
| Imported/exported cattle for fattening | 140 | Montforts (1999)[1] |
| Livestock dairy cows | 425 | Montforts (1999)[1]; EMA[2] |
| **Pigs** | | |
| Slaughter pigs | 65 | Montforts (1999)[1]; EMA[2] |
| Imported/exported pigs for slaughter | 65 | Montforts (1999)[1]; EMA[2] |
| Imported/exported pigs for fattening | 25 | M. Goll (Eurostat, personal comm.) |
| Livestock sows | 240 | Montforts (1999)[1]; EMA[2] |
| **Poultry** | | |
| Slaughter broilers | 1 | Montforts (1999)[1]; EMA[2] |
| Slaughter turkeys | 6.5 | Montforts (1999)[1]; EMA[2] |
| Imported/exported poultry for slaughter[3] | 1 | Montforts (1999)[1]; EMA[2] |
| **Sheep and goats** | | |
| Slaughter sheep and goats | 20 | Montforts (1999)[1] |
| Imported/exported sheep and goats for slaughter[4] | 20 | Montforts (1999)[1] |
| Livestock sheep | 75 | Montforts (1999)[1] |
| **Horses** | | |
| Living horses | 400 | Montforts (1999)[1]; EMA[2] |
| **Fish**[5] | | |
| **Rabbits** | | |
| Slaughter rabbits | 1.4 | EMA[2] |

[1] M.H.M.M. Montforts 1999. Environmental risk assessment for veterinary medicinal products. Part 1. Other than GMO-containing and immunological products. First update.
[2] European Medicines Agency (EMA). Revised guideline on environmental impact assessment for veterinary medicinal products in support of the VICH guidelines GL6 and GL 38 (EMEA/CVMP/ERA/418282/2005-Rev.1).
[3] Assume broilers.
[4] Assume lambs.
[5] Data from Eurostat is given as 1,000 tonnes slaughtered fish (as live weight).

**Table 4.** Data source used in calculation of the population correction unit (PCU) for Switzerland

| Data | Units in data source | Data source |
|---|---|---|
| Carcass weight slaughtered | 1,000 tonnes | Eurostat[1] |

[1] http://epp.eurostat.ec.europa.eu/portal/page/portal/agriculture/data/database

**Table 5.** Conversion factors (CF) for converting from carcass to live weight biomass, used in the calculation of population correction unit (PCU) – Method II

| Animal carcass category | Conversion factor (CF) carcass to live weight | Source |
|---|---|---|
| Cattle (medium fat) | 2 | FAO |
| Calves | 1.67 | Eurostat[1] |
| Pigs | 1.35 | FAO |
| Poultry | 1.3 | Eurostat[1] |
| Sheep and goats | 2 | FAO |
| Rabbits | 1.6 | FAO[2] |

[1] Michael Goll, personal communication. [2] Carcass dry weight 1.2, live weight 1.9.

# Czech Republic

**Table 6.** Raw data used for calculation of population correction unit (PCU)

| | Data source | 2005[1] | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| **Cattle** | | | | | | |
| Number of slaughtered (1,000 heads) cows | Eurostat | 121 | 120 | 111 | 113 | 122 |
| Number of slaughtered (1,000 heads) heifers | Eurostat | 26 | 24 | 22 | 23 | 26 |
| Number of slaughtered (1,000 heads) bullocks and bulls | Eurostat | 125 | 122 | 129 | 129 | 110 |
| Number of slaughtered (1,000 heads) calves and young cattle | Eurostat | 9 | 8 | 8 | 9 | 12 |
| Number of net exported cattle for slaughter | TRACES | | 44 | 53,361 | 65,776 | 70,988 |
| Number of net exported cattle for fattening | TRACES | | 17,425 | 51,189 | 70,835 | 62,149 |
| Number of livestock (1,000 heads) dairy cows | Eurostat | 437 | 417 | 407 | 400 | 384 |
| **Pigs** | | | | | | |
| Number of slaughtered (1,000 heads) pigs | Eurostat | 4,278 | 4,039 | 4,066 | 3,804 | 3,243 |
| Number of net imported pigs for slaughter | TRACES | | | | | 44,548 |
| Number of net exported pigs for slaughter | TRACES | | 134,008 | 124,778 | 18,981 | |
| Number of net imported pigs for fattening | TRACES | | 59,982 | 147,663 | 210,277 | 363,840 |
| Number of livestock (1,000 heads) sows | Eurostat | 338 | 317 | 273 | 212 | 194 |
| **Poultry**[2] | | | | | | |
| Number of slaughtered (1,000 heads) broilers[3] | Eurostat | 169,287 | 161,811 | 152,052 | 147,542 | 136,128 |
| Number of net exported broilers for slaughter | TRACES | | 8,139,688 | 13,140,743 | 16,877,706 | 18,371,597 |
| **Sheep and goats** | | | | | | |
| Number of slaughtered (1,000 heads) sheep and goats | Eurostat | 93 | 103 | 113 | 127 | 10 |
| Number of net exported sheep for slaughter | TRACES | | 5,447 | 5,016 | 7,573 | 7,081 |
| Number of livestock (1,000 heads) sheep | Eurostat | 163 | 169 | 184 | 183 | 197 |
| **Horses** | | | | | | |
| Number of livestock (1,000 heads) horses | National Register of Horses[4] | 71 | 71 | 71 | 71 | 71 |
| **Fish** | | | | | | |
| Biomass (1,000 tonnes) live weight fish slaughtered | Eurostat | 20 | 20 | 20 | 20 | 20 |

[1] TRACES data not used as not valid. [2] No data reported for turkeys. [3] Reported as chickens for 2009; no data available for 2005-2008, but calculated from biomass slaughter by dividing by a factor of 1.85 (2009 data). [4] Situační a výhledová zpráva - koně, Ministerstvo zemědělství, prosinec 2010, p. 14 ISBN 80-7084-914-9 (http://eagri.cz/public/web/file/100000/KONE_12_2010.pdf).

# Czech Republic

**Table 7.** Population correction unit (PCU) in 1,000 tonnes, calculated by multiplying numbers of animals from Table 6 for the various categories by average weight (AW)

| | AW in kilos | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| **Cattle** | | | | | | |
| Number of slaughtered (1,000 heads) cows × AW | 425 | 51.33 | 51.10 | 47.08 | 47.85 | 51.87 |
| Number of slaughtered (1,000 heads) heifers × AW | 200 | 5.24 | 4.80 | 4.37 | 4.61 | 5.12 |
| Number of slaughtered (1,000 heads) bullocks and bulls × AW | 425 | 53.23 | 51.65 | 55.02 | 54.70 | 46.81 |
| Number of slaughtered (1,000 heads) calves and young cattle × AW | 140 | 1.24 | 1.09 | 1.06 | 1.31 | 1.62 |
| Number of net exported cattle for slaughter (+) × AW | 425 | | 18.83 | 22.68 | 27.95 | 30.17 |
| Number of net exported cattle for fattening (+) × AW | 140 | | 2.44 | 7.17 | 9.92 | 8.70 |
| Number of livestock (1,000 heads) dairy cows × AW | 425 | 185.77 | 177.35 | 173.15 | 169.87 | 163.12 |
| **Pigs** | | | | | | |
| Number of slaughtered (1,000 heads) pigs × AW | 65 | 278.04 | 262.56 | 264.30 | 247.27 | 210.78 |
| Number of net imported pigs for slaughter (-) × AW | 65 | | 0.00 | 0.00 | 0.00 | -2.90 |
| Number of net exported pigs for slaughter (+) × AW | 65 | | 8.71 | 8.11 | 1.23 | 0.00 |
| Number of net imported pigs for fattening (-) × AW | 25 | | -1.50 | -3.69 | -5.26 | -9.10 |
| Number of livestock (1,000 heads) sows × AW | 240 | 81.12 | 75.98 | 65.47 | 50.88 | 46.35 |
| **Poultry** | | | | | | |
| Number of slaughtered (1,000 heads) broilers × AW | 1 | 169.29 | 161.81 | 152.05 | 147.54 | 136.13 |
| Number of net exported broilers for slaughter (+) × AW | 1 | | 8.14 | 13.14 | 16.88 | 18.37 |
| **Sheep and goats** | | | | | | |
| Number of slaughtered (1,000 heads) sheep and goats × AW | 20 | 1.87 | 2.06 | 2.26 | 2.55 | 0.20 |
| Number of net exported sheep for slaughter (+) × AW | 20 | | 0.11 | 0.10 | 0.15 | 0.14 |
| Number of livestock (1,000 heads) sheep × AW | 75 | 12.26 | 12.67 | 13.77 | 13.73 | 14.77 |
| **Horses** | | | | | | |
| Number of livestock (1,000 heads) horses × AW | 400 | 28.54 | 28.54 | 28.54 | 28.54 | 28.54 |
| **Fish**[1] | | | | | | |
| Biomass (1,000 tonnes) live weight fish slaughtered | | 20.46 | 20.43 | 20.45 | 20.40 | 20.07 |
| **Total** | | **888.37** | **886.78** | **875.02** | **840.11** | **770.76** |

[1] Data from Eurostat given as 1,000 tonnes slaughtered fish (as live weight).

# Denmark

**Table 8.** Raw data used for calculation of population correction unit (PCU)

| | Data source | 2005[1] | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| **Cattle** | | | | | | |
| Number of slaughtered (1,000 heads) cows | Eurostat | 211 | 195 | 184 | 183 | 189 |
| Number of slaughtered (1,000 heads) heifers | Eurostat | 58 | 50 | 45 | 44 | 45 |
| Number of slaughtered (1,000 heads) bullocks and bulls | Eurostat | 251 | 238 | 259 | 257 | 111 |
| Number of slaughtered (1,000 heads) calves and young cattle | Eurostat | 12 | 10 | 10 | 11 | 137 |
| Number of net exported cattle for slaughter | TRACES | | 10,830 | 6,028 | 362 | 1,096 |
| Number of net exported cattle for fattening | TRACES | | 243 | 3,038 | 12,217 | 18,983 |
| Number of livestock (1,000 heads) dairy cows | Eurostat | 558 | 555 | 551 | 566 | 574 |
| **Pigs** | | | | | | |
| Number of slaughtered (1,000 heads) pigs | Eurostat | 22,109 | 21,419 | 21,385 | 20,790 | 19,308 |
| Number of net exported pigs for slaughter | TRACES | | 1,895,586 | 1,065,617 | 1,055,580 | 1,225,059 |
| Number of net exported pigs for fattening | TRACES | | 1,474,806 | 3,855,839 | 5,091,053 | 6,492,879 |
| Number of livestock (1,000 heads) sows | Eurostat | 1,340 | 1,414 | 1,353 | 1,289 | 1,346 |
| **Poultry** | | | | | | |
| Number of slaughtered (1,000 heads) broilers[2] | Eurostat | 120,498 | 105,888 | 103,237 | 101,107 | 100,132 |
| Number of slaughtered (1,000 heads) turkeys | Eurostat | 158 | 32 | 0 | 0 | 0 |
| Number of net exported broilers for slaughter | TRACES | | 2,765,532 | 7,450,452 | 10,609,113 | 11,947,784 |
| **Sheep and goats** | | | | | | |
| Number of slaughtered (1,000 heads) sheep and goats | Eurostat | 85 | 84 | 88 | 90 | 90 |
| Number of net exported sheep for slaughter | | | 13,973 | 7,685 | 7,132 | 3,684 |
| Number of livestock (1,000 heads) sheep[3] | Eurostat | 84 | 98 | 98 | 90 | 90 |
| **Horses** | | | | | | |
| Number of livestock (1,000 heads) horses | SD[4] | 174 | 174 | 174 | 174 | 174 |
| **Fish** | | | | | | |
| Biomass (1,000 tonnes) live weight fish slaughtered | | 39 | 28 | 31 | 37 | 34 |

[1] TRACES data not used as not valid. [2] Broilers reported as chickens for 2009. [3] No data available for 2009; used 2008 data. [4] SD = Statistics Denmark: www.dst.dk/pukora/epub/Nyt/2000/NR499.pdf

# Denmark

**Table 9.** Population correction unit (PCU) in 1,000 tonnes, calculated by multiplying numbers of animals from Table 8 for the various categories by average weight (AW)

| | AW in kilos | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| **Cattle** | | | | | | |
| Number of slaughtered (1,000 heads) cows × AW | 425 | 89.53 | 82.79 | 78.14 | 77.82 | 80.16 |
| Number of slaughtered (1,000 heads) heifers × AW | 200 | 11.67 | 9.97 | 9.08 | 8.80 | 8.90 |
| Number of slaughtered (1,000 heads) bullocks and bulls × AW | 425 | 106.61 | 101.35 | 110.08 | 109.14 | 47.01 |
| Number of slaughtered (1,000 heads) calves and young cattle × AW | 140 | 1.67 | 1.37 | 1.37 | 1.47 | 19.21 |
| Number of net exported cattle for slaughter (+) × AW | 425 | | 4.60 | 2.56 | 0.15 | 0.47 |
| Number of net exported pigs for fattening (+) × AW | 140 | | 0.03 | 0.43 | 1.71 | 2.66 |
| Number of livestock (1,000 heads) dairy cows × AW | 425 | 237.15 | 235.88 | 234.18 | 240.55 | 243.95 |
| **Pigs** | | | | | | |
| Number of slaughtered (1,000 heads) pigs × AW | 65 | 1,437.10 | 1,392.22 | 1,390.00 | 1,351.32 | 1,254.99 |
| Number of net export pigs for slaughter (+) × AW | 65 | | 123.21 | 69.27 | 68.61 | 79.63 |
| Number of net export pigs for fattening (+) × AW | 25 | | 36.87 | 96.40 | 127.28 | 162.32 |
| Number of livestock (1,000 heads) sows × AW | 240 | 321.60 | 339.36 | 324.72 | 309.36 | 323.04 |
| **Poultry** | | | | | | |
| Number of slaughtered (1,000 heads) broilers × AW | 1 | 120.50 | 105.89 | 103.24 | 101.11 | 100.13 |
| Number of slaughtered (1,000 heads) turkeys × AW | 6.5 | 1.03 | 0.21 | 0.00 | 0.00 | 0.00 |
| Number of net exported broilers for slaughter (+) × AW | 1 | | 2.77 | 7.45 | 10.61 | 11.95 |
| **Sheep and goats** | | | | | | |
| Number of slaughtered (1,000 heads) sheep and goats × AW | 20 | 1.70 | 1.69 | 1.75 | 1.80 | 1.80 |
| Number of net exported sheep for slaughter (+) × AW | 20 | | 0.28 | 0.15 | 0.14 | 0.07 |
| Number of livestock (1,000 heads) sheep × AW | 75 | 6.30 | 7.35 | 7.35 | 6.75 | 6.75 |
| **Horses** | | | | | | |
| Number of livestock (1,000 heads) horses × AW | 400 | 69.60 | 69.60 | 69.60 | 69.60 | 69.60 |
| **Fish**[1] | | | | | | |
| Biomass (1,000 tonnes) live weight fish slaughtered | | 39.01 | 27.91 | 31.17 | 37.22 | 34.13 |
| **Total** | | **2,443.46** | **2,543.34** | **2,536.92** | **2,523.44** | **2,446.75** |

[1] Data from Eurostat given as 1,000 tonnes slaughtered fish (as live weight).

# Finland

**Table 10.** Raw data used for calculation of population correction unit (PCU)

| | Data source | 2005[1] | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| **Cattle**[2] | | | | | | |
| Number of slaughtered (1,000 heads) cows | Eurostat | 100 | 106 | 98 | 88 | 85 |
| Number of slaughtered (1,000 heads) heifers | Eurostat | 37 | 36 | 38 | 34 | 35 |
| Number of slaughtered (1,000 heads) bullocks and bulls | Eurostat | 160 | 152 | 156 | 145 | 145 |
| Number of slaughtered (1,000 heads) calves and young cattle | Eurostat | 9 | 9 | 9 | 7 | 3 |
| Number of livestock (1,000 heads) dairy cows | Eurostat | 313 | 309 | 296 | 288 | 286 |
| **Pigs** | | | | | | |
| Number of slaughtered (1,000 heads) pigs | Eurostat | 2,403 | 2,391 | 2,446 | 2,459 | 2,343 |
| Number of net exported pigs for fattening | TRACES | | 90 | | | |
| Number of livestock (1,000 heads) sows | Eurostat | 186 | 183 | 177 | 167 | 156 |
| **Poultry**[2] | | | | | | |
| Number of slaughtered (1,000 heads) broilers[3] | Eurostat | 52,348 | 52,997 | 53,321 | 54,402 | 50,935 |
| Number of slaughtered (1,000 heads) turkeys | Eurostat | 1,502 | 1,478 | 1,333 | 1,156 | 937 |
| **Sheep and goats**[2] | | | | | | |
| Number of slaughtered (1,000 heads) sheep and goats | Eurostat | 34 | 34 | 39 | 42 | 37 |
| Number of livestock (1,000 heads) sheep[4] | Eurostat | 84 | 88 | 90 | 94 | 96 |
| **Horses** | | | | | | |
| Number of livestock (1,000 heads) horses | SHO[5] | 64 | 66 | 68 | 69 | 72 |
| **Fish** | | | | | | |
| Biomass (1,000 tonnes) live weight fish slaughtered | Eurostat | 14 | 13 | 13 | 13 | 14 |

[1] TRACES data not used as not valid. [2] No data in TRACES. [3] Broilers reported as chickens for 2009. [4] Source 2009 data: Statistics Finland. [5] SHO = Suomen Hippos Oy: www.hippos.fi

# Finland

**Table 11.** Population correction unit (PCU) in 1,000 tonnes, calculated by multiplying numbers of animals from Table 10 for the various categories by average weight (AW)

| | AW in kilos | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| **Cattle** | | | | | | |
| Number of slaughtered (1,000 heads) cows × AW | 425 | 42.57 | 45.09 | 41.78 | 37.41 | 36.08 |
| Number of slaughtered (1,000 heads) heifers × AW | 200 | 7.35 | 7.19 | 7.53 | 6.86 | 7.06 |
| Number of slaughtered (1,000 heads) bullocks and bulls × AW | 425 | 68.02 | 64.65 | 66.35 | 61.78 | 61.41 |
| Number of slaughtered (1,000 heads) calves and young cattle × AW | 140 | 1.30 | 1.32 | 1.25 | 1.03 | 0.36 |
| Number of livestock (1,000 heads) dairy cows × AW | 425 | 132.98 | 131.50 | 125.84 | 122.57 | 121.47 |
| **Pigs** | | | | | | |
| Number of slaughtered (1,000 heads) pigs × AW | 65 | 156.17 | 155.43 | 159.01 | 159.81 | 152.28 |
| Number of net exported pigs for fattening (+) × AW | 25 | | 0.00225 | 0.00 | 0.00 | 0.00 |
| Number of livestock (1,000 heads) sows × AW | 240 | 44.66 | 43.80 | 42.55 | 40.10 | 37.42 |
| **Poultry** | | | | | | |
| Number of slaughtered (1,000 heads) broilers × AW | 1 | 52.35 | 53.00 | 53.32 | 54.40 | 50.94 |
| Number of slaughtered (1,000 heads) turkeys × AW | 6.5 | 9.76 | 9.60 | 8.66 | 7.52 | 6.09 |
| **Sheep and goats** | | | | | | |
| Number of slaughtered (1,000 heads) sheep and goats × AW | 20 | 0.69 | 0.69 | 0.78 | 0.84 | 0.74 |
| Number of livestock (1,000 heads) sheep × AW | 75 | 6.31 | 6.62 | 6.77 | 7.06 | 7.22 |
| **Horses** | | | | | | |
| Number of livestock (1,000 heads) horses × AW | 400 | 25.51 | 26.42 | 27.20 | 27.74 | 28.92 |
| **Fish**[1] | | | | | | |
| Biomass (1,000 tonnes) live weight fish slaughtered | | 14.355 | 12.891 | 13.03 | 13.439 | 13.627 |
| **Total** | | **562.02** | **558.19** | **554.08** | **540.55** | **523.61** |

[1] Data from Eurostat given as 1,000 tonnes slaughtered fish (as live weight).

# France

**Table 12.** Raw data used for calculation of population correction unit (PCU)

| | Data source | 2005[1] | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| **Cattle** | | | | | | |
| Number of slaughtered (1,000 heads) cows | Eurostat | 1,827 | 1,781 | 1,701 | 1,715 | 1,778 |
| Number of slaughtered (1,000 heads) heifers | Eurostat | 487 | 437 | 435 | 424 | 426 |
| Number of slaughtered (1,000 heads) bullocks and bulls | Eurostat | 1,227 | 1,203 | 1,342 | 1,313 | 1,177 |
| Number of slaughtered (1,000 heads) calves and young cattle | Eurostat | 1,797 | 1,744 | 1,606 | 1,630 | 1,573 |
| Number of net exported cattle for slaughter | TRACES | | 14,557 | 18,804 | 32,797 | 42,415 |
| Number of net exported cattle for fattening | TRACES | | 457,596 | 991,703 | 986,194 | 1,058,658 |
| Number of livestock (1,000 heads) dairy cows | Eurostat | 3,895 | 3,799 | 3,759 | 3,794 | 3,673 |
| **Pigs** | | | | | | |
| Number of slaughtered (1,000 heads) pigs | Eurostat | 25,681 | 25,484 | 25,730 | 25,735 | 24,908 |
| Number of net exported pigs for slaughter | TRACES | | 358,194 | 578,662 | 498,068 | 573,356 |
| Number of net imported pigs for fattening | TRACES | | 18,530 | 27,421 | 1,343 | |
| Number of net exported pigs for fattening | TRACES | | | | | 10,596 |
| Number of livestock (1,000 heads) sows | Eurostat | 1,274 | 1,264 | 1,234 | 1,200 | 1,185 |
| **Poultry** | | | | | | |
| Number of slaughtered (1,000 heads) broilers[2] | Eurostat | 720,720 | 636,859 | 699,478 | 713,461 | 759,189 |
| Number of slaughtered (1,000 heads) turkeys | Eurostat | 81,379 | 72,944 | 70,072 | 63,367 | 58,029 |
| Number of net exported broilers for slaughter | TRACES | | 37,945,293 | 44,043,345 | 43,097,321 | 42,597,705 |
| **Sheep and goats** | | | | | | |
| Number of slaughtered (1,000 heads) sheep and goats | Eurostat | 7,455 | 7,379 | 7,238 | 6,822 | 5,231 |
| Number of net exported sheep for slaughter | | | 355,016 | 457,417 | 354,295 | 398,883 |
| Number of livestock (1,000 heads) sheep | Eurostat | 8,760 | 8,494 | 8,285 | 7,715 | 7,528 |
| **Horses** | | | | | | |
| Number of livestock (1,000 heads) horses | Agreste[3] | 420 | 420 | 420 | 420 | 420 |
| **Fish** | | | | | | |
| Biomass (1,000 tonnes) live weight fish slaughtered | Eurostat | 245 | 238 | 237 | 238 | 234 |
| **Rabbits** | | | | | | |
| Number of slaughtered (1,000 heads) rabbits[4] | Eurostat | 39,174 | 37,519 | 39,198 | 37,199 | 37,199 |

[1] TRACES data not used as not valid. [2] Broilers reported as chickens for 2009. [3] www.agreste.agriculture.gouv.fr [4] No data available in 2009; used 2008 data.

# France

**Table 13.** Population correction unit (PCU) in 1,000 tonnes, calculated by multiplying numbers of animals from Table 12 for the various categories by average weight (AW)

| | AW in kilos | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| **Cattle** | | | | | | |
| Number of slaughtered (1,000 heads) cows × AW | 425 | 776.44 | 757.00 | 722.80 | 729.08 | 755.44 |
| Number of slaughtered (1,000 heads) heifers × AW | 200 | 97.36 | 87.48 | 86.95 | 84.90 | 85.14 |
| Number of slaughtered (1,000 heads) bullocks and bulls × AW | 425 | 521.28 | 511.24 | 570.22 | 558.11 | 500.29 |
| Number of slaughtered (1,000 heads) calves and young cattle × AW | 140 | 251.51 | 244.21 | 224.80 | 228.19 | 220.22 |
| Number of net exported cattle for slaughter (+) × AW | 425 | | 6.19 | 7.99 | 13.94 | 18.03 |
| Number of net exported cattle for fattening (+) × AW | 140 | | 64.06 | 138.84 | 138.07 | 148.21 |
| Number of livestock (1,000 heads) dairy cows × AW | 425 | 1,655.55 | 1,614.58 | 1,597.36 | 1,612.28 | 1,560.81 |
| **Pigs** | | | | | | |
| Number of slaughtered (1,000 heads) pigs × AW | 65 | 1,669.28 | 1,656.49 | 1,672.47 | 1,672.80 | 1,619.04 |
| Number of net exported pigs for slaughter (+) × AW | 65 | | 23.28 | 37.61 | 32.37 | 37.27 |
| Number of net imported pigs for fattening (-) × AW | 25 | | -0.46 | -0.69 | -0.03 | 0.00 |
| Number of net exported pigs for fattening (+) × AW | 25 | | 0.00 | 0.00 | 0.00 | 0.26 |
| Number of livestock (1,000 heads) sows × AW | 240 | 305.76 | 303.36 | 296.16 | 288.00 | 284.40 |
| **Poultry** | | | | | | |
| Number of slaughtered (1,000 heads) broilers × AW | 1 | 720.72 | 636.86 | 699.48 | 713.46 | 759.19 |
| Number of slaughtered (1,000 heads) turkeys × AW | 6.5 | 528.96 | 474.14 | 455.47 | 411.89 | 377.19 |
| Number of net exported broilers for slaughter (+) × AW | 1 | | 37.95 | 44.04 | 43.10 | 42.60 |
| **Sheep and goats** | | | | | | |
| Number of slaughtered (1,000 heads) sheep and goats × AW | 20 | 149.10 | 147.59 | 144.76 | 136.43 | 104.62 |
| Number of net exported sheep for slaughter (+) × AW | 20 | | 7.10 | 9.15 | 7.09 | 7.98 |
| Number of livestock (1,000 heads) sheep × AW | 75 | 656.99 | 637.07 | 621.34 | 578.64 | 564.62 |
| **Horses** | | | | | | |
| Number of livestock (1,000 heads) horses × AW | 400 | 168.10 | 168.10 | 168.10 | 168.10 | 168.10 |
| **Fish**[1] | | | | | | |
| Biomass (1,000 tonnes) live weight fish slaughtered | | 245.16 | 237.61 | 237.45 | 238.25 | 234.00 |
| **Rabbits** | | | | | | |
| Number of slaughtered (1,000 heads) rabbits × AW | 1.4 | 54.84 | 52.53 | 54.88 | 52.08 | 52.08 |
| **Total** | | **7,801.06** | **7,666.33** | **7,789.17** | **7,706.73** | **7,539.48** |

[1] Data from Eurostat given as 1,000 tonnes slaughtered fish (as live weight).

# The Netherlands

**Table 14.** Raw data used for calculation of population correction unit (PCU)

| | Data source | 2005[1] | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| **Cattle** | | | | | | |
| Number of slaughtered (1,000 heads) cows | Eurostat | 510 | 501 | 470 | 424 | 509 |
| Number of slaughtered (1,000 heads) heifers | Eurostat | 14 | 14 | 13 | 12 | 14 |
| Number of slaughtered (1,000 heads) bullocks and bulls | Eurostat | 70 | 66 | 77 | 68 | 61 |
| Number of slaughtered (1,000 heads) calves and young cattle | Eurostat | 1,376 | 1,334 | 1,345 | 1,419 | 1,484 |
| Number of net imported cattle for slaughter | TRACES | | 21,792 | 22,778 | | |
| Number of net exported cattle for slaughter | TRACES | | | | 66,664 | 1,556 |
| Number of net imported cattle for fattening | TRACES | | 207,592 | 676,301 | 765,582 | 776,870 |
| Number of livestock (1,000 heads) dairy cows | Eurostat | 1,486 | 1,443 | 1,490 | 1,587 | 1,562 |
| **Pigs** | | | | | | |
| Number of slaughtered (1,000 heads) pigs | Eurostat | 14,377 | 14,027 | 14,187 | 14,505 | 13,816 |
| Number of net exported pigs for slaughter | TRACES | | 2,989,382 | 3,738,339 | 4,483,486 | 4,843,683 |
| Number of net exported pigs for fattening | TRACES | | 1,252,408 | 1,676,069 | 421,309 | 275,067 |
| Number of livestock (1,000 heads) sows | Eurostat | 1,100 | 1,050 | 1,060 | 1,025 | 1,100 |
| **Poultry**[2] | | | | | | |
| Number of slaughtered (1,000 heads) broilers[3] | Eurostat | 627,579 | 615,519 | 675,104 | 473,018 | 481,401 |
| Number of net imported broilers for slaughter | TRACES | | 48,769,388 | 64,671,769 | 78,335,267 | 81,386,487 |
| **Sheep and goats** | | | | | | |
| Number of slaughtered (1,000 heads) sheep and goats | Eurostat | 634 | 726 | 877 | 758 | 752 |
| Number of net exported sheep for slaughter | | | 320,248 | 337,333 | 335,242 | 287,883 |
| Number of livestock (1,000 heads) sheep | Eurostat | 1,725 | 1,755 | 1,715 | 1,545 | 1,099 |
| **Horses** | | | | | | |
| Number of livestock (1,000 heads) horses | DMEAAI[4] | 144 | 144 | 144 | 144 | 144 |
| **Fish** | | | | | | |
| Biomass (1,000 tonnes) live weight fish slaughtered | Eurostat | 71 | 42 | 53 | 47 | 56 |

[1] TRACES data not used as not valid. [2] No data reported for turkeys. [3] Data in Eurostat changed from reporting broilers to chickens for 2008 and 2009. [4] DMEAAI = Dutch Ministry of Economic Affairs, Agriculture and Innovation.

# The Netherlands

**Table 15.** Population correction unit (PCU) in 1,000 tonnes, calculated by multiplying numbers of animals from Table 14 for the various categories by average weight (AW)

| | AW in kilos | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| **Cattle** | | | | | | |
| Number of slaughtered (1,000 heads) cows × AW | 425 | 216.55 | 212.92 | 199.75 | 180.31 | 216.44 |
| Number of slaughtered (1,000 heads) heifers × AW | 200 | 2.77 | 2.71 | 2.60 | 2.35 | 2.72 |
| Number of slaughtered (1,000 heads) bullocks and bulls × AW | 425 | 29.73 | 28.25 | 32.73 | 28.87 | 25.98 |
| Number of slaughtered (1,000 heads) calves and young cattle × AW | 140 | 192.63 | 186.76 | 188.30 | 198.67 | 207.79 |
| Number of net imported cattle for slaughter (-) × AW | 425 | | -9.26 | -9.68 | 0.00 | 0.00 |
| Number of net exported cattle for slaughter (+) × AW | 425 | | 0.00 | 0.00 | 28.33 | 0.66 |
| Number of net imported cattle for fattening (-) × AW | 140 | | -29.06 | -94.68 | -107.18 | -108.76 |
| Number of livestock (1,000 heads) dairy cows × AW | 425 | 631.55 | 613.28 | 633.25 | 674.48 | 663.85 |
| **Pigs** | | | | | | |
| Number of slaughtered (1,000 heads) pigs × AW | 65 | 934.49 | 911.76 | 922.16 | 942.83 | 898.02 |
| Number of net exported pigs for slaughter (+) × AW | 65 | | 194.31 | 242.99 | 291.43 | 314.84 |
| Number of net exported pigs for fattening (+) × AW | 25 | | 31.31 | 41.90 | 10.53 | 6.88 |
| Number of livestock (1,000 heads) sows × AW | 240 | 264.00 | 252.00 | 254.40 | 246.00 | 264.00 |
| **Poultry** | | | | | | |
| Number of slaughtered (1,000 heads) broilers × AW | 1 | 627.58 | 615.52 | 675.10 | 473.02 | 481.40 |
| Number of net imported broilers for slaughter (-) × AW | 1 | | -48.77 | -64.67 | -78.34 | -81.39 |
| **Sheep and goats** | | | | | | |
| Number of slaughtered (1,000 heads) sheep and goats × AW | 20 | 12.68 | 14.52 | 17.53 | 15.16 | 15.04 |
| Number of net exported sheep for slaughter (+) × AW | 20 | | 6.40 | 6.75 | 6.70 | 5.76 |
| Number of livestock (1,000 heads) sheep × AW | 75 | 129.38 | 131.63 | 128.63 | 115.88 | 82.43 |
| **Horses** | | | | | | |
| Number of livestock (1,000 heads) horses × AW | 400 | 57.60 | 57.60 | 57.60 | 57.60 | 57.60 |
| **Fish**[1] | | | | | | |
| Biomass (1,000 tonnes) live weight fish slaughtered | | 71.37 | 42.20 | 53.37 | 46.62 | 55.56 |
| **Total** | | **3,170.32** | **3,214.06** | **3,288.02** | **3,133.26** | **3,108.81** |

[1] Data from Eurostat given as 1,000 tonnes slaughtered fish (as live weight).

# Norway

**Table 16.** Raw data used for calculation of population correction unit (PCU)

| | Data source | 2005[1] | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| **Cattle**[2] | | | | | | |
| Number of slaughtered (heads) cows | Statistics Norway | 124,574 | 127,349 | 117,172 | 128,262 | 118,890 |
| Number of slaughtered (heads) heifers[3] | Statistics Norway | | | | | |
| Number of slaughtered (heads) bullocks and bulls[3] | Statistics Norway | 189,809 | 187,518 | 185,065 | 179,072 | 179,511 |
| Number of slaughtered (heads) calves and young cattle[4] | Statistics Norway | 18,613 | 19,025 | 18,648 | 17,651 | 14,918 |
| Number of livestock (heads) dairy cows | | 265,201 | 259,084 | 253,364 | 248,283 | 239,637 |
| **Pigs** | | | | | | |
| Number of slaughtered (heads) pigs | Statistics Norway | 124,574 | 127,349 | 117,172 | 128,262 | 118,890 |
| Number of net exported pigs for slaughter | TRACES | | 249 | 0 | 0 | 0 |
| Number of livestock (heads) sows | Statistics Norway | 98,597 | 101,184 | 97,985 | 98,902 | 100,328 |
| **Poultry** | | | | | | |
| Number of slaughtered (1,000 heads) poultry[5] | Statistics Norway | 46,730 | 51,029 | 55,499 | 63,332 | 71,080 |
| Number of net imported broilers for slaughter | TRACES | | 0 | 0 | 0 | 2,288 |
| **Sheep and goats**[2] | | | | | | |
| Number of slaughtered (heads) sheep and goats | Statistics Norway | 1,296,809 | 1,260,525 | 1,186,263 | 1,188,434 | 1,188,534 |
| Number of livestock (heads) sheep | Statistics Norway | 946,752 | 920,101 | 887,090 | 892,701 | 905,629 |
| **Horses** | | | | | | |
| Number of livestock (heads) horses | Statistics Norway | 29,329 | 30,662 | 32,790 | 34,298 | 35,537 |

[1] TRACES data not used as not valid. [2] No data in TRACES. [3] In Norway, the categories heifers and bullocks and bulls are merged into one category: heifers/bulls. [4] Only calves. [5] Data subdivided into turkeys and broilers not available (majority broilers).

# Norway

**Table 17.** Population correction unit (PCU) in 1,000 tonnes, calculated by multiplying numbers of animals from Table 16 for the various categories by average weight (AW)

| | AW in kilos | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| **Cattle** | | | | | | |
| Number of slaughtered (heads) cows × AW | 425 | 52.94 | 54.12 | 49.80 | 54.51 | 50.53 |
| Number of slaughtered (heads) heifers × AW | 200 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Number of slaughtered (heads) bullocks and bulls × AW | 425 | 80.67 | 79.70 | 78.65 | 76.11 | 76.29 |
| Number of slaughtered (heads) calves and young cattle × AW | 140 | 2.61 | 2.66 | 2.61 | 2.47 | 2.09 |
| Number of livestock (heads) dairy cows × AW | 425 | 112.71 | 110.11 | 107.68 | 105.52 | 101.85 |
| **Pigs** | | | | | | |
| Number of slaughtered (1,000 heads) pigs × AW | 65 | 8.10 | 8.28 | 7.62 | 8.34 | 7.73 |
| Number of net exported pigs for slaughter (+) × AW | 65 | | 0.02 | 0.00 | 0.00 | 0.00 |
| Number of livestock (heads) sows × AW | 240 | 23.66 | 24.28 | 23.52 | 23.74 | 24.08 |
| **Poultry** | | | | | | |
| Number of slaughtered (1,000 heads) poultry | 1 | 46.73 | 51.03 | 55.50 | 63.33 | 71.08 |
| Number of net imported broilers for slaughter (-) × AW | 1 | | 0.00 | 0.00 | 0.00 | -0.002 |
| **Sheep and goats** | | | | | | |
| Number of slaughtered (heads) sheep and goats × AW | 20 | 25.94 | 25.21 | 23.73 | 23.77 | 23.77 |
| Number of livestock (heads) sheep × AW | 75 | 71.01 | 69.01 | 66.53 | 66.95 | 67.92 |
| **Horses** | | | | | | |
| Number of livestock (heads) horses × AW | 400 | 11.73 | 12.26 | 13.12 | 13.72 | 14.21 |
| **Total** | | **436.09** | **436.68** | **428.75** | **438.45** | **439.55** |

# Sweden

**Table 18.** Raw data used for calculation of population correction unit (PCU)

| | Data source | 2005[1] | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| **Cattle** | | | | | | |
| Number of slaughtered (1,000 heads) cows | Eurostat | 159 | 157 | 152 | 139 | 152 |
| Number of slaughtered (1,000 heads) heifers | Eurostat | 45 | 46 | 46 | 43 | 53 |
| Number of slaughtered (1,000 heads) bullocks and bulls | Eurostat | 229 | 231 | 222 | 219 | 225 |
| Number of slaughtered (1,000 heads) calves and young cattle | Eurostat | 33 | 32 | 30 | 29 | 68 |
| Number of net exported cattle for slaughter | TRACES | | 25 | 0 | 0 | 219 |
| Number of livestock (1,000 heads) dairy cows | Eurostat | 391 | 385 | 366 | 366 | 354 |
| **Pigs** | | | | | | |
| Number of slaughtered (1,000 heads) pigs | Eurostat | 3,160 | 3,022 | 3,004 | 3,073 | 2,956 |
| Number of net exported pigs for slaughter | TRACES | | 12,296 | 12,204 | 16,636 | 14,607 |
| Number of net imported pigs for fattening | TRACES | | 90 | 0 | 0 | 1,760 |
| Number of livestock (1,000 heads) sows | Eurostat | 192 | 177 | 175 | 168 | 159 |
| **Poultry** | | | | | | |
| Number of slaughtered (1,000 heads) broilers | Eurostat | 73,458 | 72,906 | 74,666 | 75,031 | 73,160 |
| Number of slaughtered (1,000 heads) turkeys | Eurostat | 565 | 490 | 430 | 471 | 477 |
| Number of net exported broilers for slaughter | TRACES | | 0 | 47,270 | 45,140 | 34,450 |
| **Sheep and goats** | | | | | | |
| Number of slaughtered (1,000 heads) sheep and goats | Eurostat | 206 | 213 | 232 | 236 | 256 |
| Number of net exported sheep for slaughter | | | 0 | 390 | 80 | 56 |
| Number of livestock (1,000 heads) sheep | Eurostat | 480 | 506 | 521 | 521 | 541 |
| **Horses** | | | | | | |
| Number of livestock (1,000 heads) horses | Statistics Sweden | 308 | 319 | 330 | 340 | 352 |

[1] TRACES data not used as not valid.

# Sweden

**Table 19.** Population correction unit (PCU) in 1,000 tonnes, calculated by multiplying numbers of animals from Table 18 for the various categories by average weight (AW)

| | AW in kilos | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| **Cattle** | | | | | | |
| Number of slaughtered (1,000 heads) cows × AW | 425 | 67.72 | 66.56 | 64.67 | 59.22 | 64.67 |
| Number of slaughtered (1,000 heads) heifers × AW | 200 | 8.92 | 9.22 | 9.11 | 8.65 | 10.58 |
| Number of slaughtered (1,000 heads) bullocks and bulls × AW | 425 | 97.38 | 98.17 | 94.30 | 93.02 | 95.62 |
| Number of slaughtered (1,000 heads) calves and young cattle × AW | 140 | 4.63 | 4.54 | 4.22 | 4.01 | 9.45 |
| Number of net exported cattle for slaughter (+) × AW | 425 | | 0.01 | 0.00 | 0.00 | 0.09 |
| Number of livestock (1,000 heads) dairy cows × AW | 425 | 166.05 | 163.50 | 155.42 | 155.38 | 150.54 |
| **Pigs** | | | | | | |
| Number of slaughtered (1,000 heads) pigs × AW | 65 | 205.40 | 196.45 | 195.27 | 199.74 | 192.17 |
| Number of net exported pigs for slaughter (+) × AW | 65 | | 0.80 | 0.79 | 1.08 | 0.95 |
| Number of net imported pigs for fattening (-) × AW | 25 | | 0.00 | 0.00 | 0.00 | -0.04 |
| Number of livestock (1,000 heads) sows × AW | 240 | 46.06 | 42.55 | 41.95 | 40.32 | 38.16 |
| **Poultry** | | | | | | |
| Number of slaughtered (1,000 heads) broilers × AW | 1 | 73.46 | 72.91 | 74.67 | 75.03 | 73.16 |
| Number of slaughtered (1,000 heads) turkeys × AW | 6.5 | 3.67 | 3.18 | 2.79 | 3.06 | 3.10 |
| Number of net exported broilers for slaughter (+) × AW | 1 | | 0.00 | 0.05 | 0.05 | 0.03 |
| **Sheep and goats** | | | | | | |
| Number of slaughtered (1,000 heads) sheep and goats × AW | 20 | 4.12 | 4.27 | 4.63 | 4.71 | 5.12 |
| Number of net exported sheep for slaughter (+) × AW | 20 | | 0.00 | 0.01 | 0.00 | 0.00 |
| Number of livestock (1,000 heads) sheep × AW | 75 | 35.98 | 37.91 | 39.07 | 39.07 | 40.54 |
| **Horses** | | | | | | |
| Number of livestock (1,000 heads) horses × AW | 400 | 123.20 | 127.60 | 132.00 | 136.00 | 140.80 |
| **Total** | | **836.57** | **827.67** | **818.94** | **819.34** | **824.93** |

# United Kingdom

**Table 20.** Raw data used for calculation of population correction unit (PCU)

| | Data source | 2005[1] | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| **Cattle** | | | | | | |
| Number of slaughtered (1,000 heads) cows | Eurostat | 19 | 364 | 435 | 541 | 480 |
| Number of slaughtered (1,000 heads) heifers | Eurostat | 771 | 828 | 793 | 759 | 780 |
| Number of slaughtered (1,000 heads) bullocks and bulls | Eurostat | 1,513 | 1,401 | 1,387 | 1,287 | 1,263 |
| Number of slaughtered (1,000 heads) calves and young cattle | Eurostat | 111 | 51 | 46 | 44 | 43 |
| Number of net imported cattle for slaughter | TRACES | | | | | 32,338 |
| Number of net exported cattle for slaughter | TRACES | | 4,045 | 8,373 | 4,946 | |
| Number of net imported cattle for fattening | TRACES | | | | | 20,999 |
| Number of net exported cattle for fattening | TRACES | | 116,450 | 137,903 | 75,296 | |
| Number of livestock (1,000 heads) dairy cows | Eurostat | 2,007 | 2,005 | 1,977 | 1,903 | 1,864 |
| **Pigs** | | | | | | |
| Number of slaughtered (1,000 heads) pigs | Eurostat | 9,173 | 9,097 | 9,484 | 9,427 | 9,031 |
| Number of net imported pigs for slaughter | TRACES | | 356,150 | 382,487 | 448,149 | 495,943 |
| Number of net imported pigs for fattening | TRACES | | 39,138 | 70,303 | 83,971 | 87,087 |
| Number of livestock (1,000 heads) sows | Eurostat | 505 | 524 | 498 | 487 | 504 |
| **Poultry** | | | | | | |
| Number of slaughtered (1,000 heads) broilers[2] | Eurostat | 826,308 | 806,922 | 798,485 | 784,393 | 838,883 |
| Number of slaughtered (1,000 heads) turkeys | Eurostat | 19,363 | 17,232 | 14,880 | 14,910 | 15,482 |
| Number of net export broilers for slaughter | TRACES | | 5,174,277 | 5,706,221 | 4,564,850 | 2,041,275 |
| **Sheep and goats** | | | | | | |
| Number of slaughtered (1,000 heads) sheep and goats | Eurostat | 16,292 | 16,420 | 15,811 | 16,705 | 15,391 |
| Number of net exported sheep for slaughter | | | 98,193 | 148,561 | 214,387 | 318,076 |
| Number of livestock (1,000 heads) sheep | Eurostat | 23,730 | 23,429 | 23,676 | 21,856 | 21,343 |
| **Horses** | | | | | | |
| Number of livestock (1,000 heads) horses | See link[3] | 1,300 | 1,300 | 1,300 | 1,300 | 1,300 |
| **Fish** | | | | | | |
| Biomass (1,000 tonnes) live weight fish slaughtered | Eurostat | 173 | 172 | 174 | 180 | 197 |

[1] TRACES data not used as not valid. [2] Broilers reported as chickens for 2009. [3] 30 March 2011: 342W (www.publications.parliament.uk/pa/cm201011/cmhansrd/cm110330/text/110330w0001.htm).

# United Kingdom

**Table 21.** Population correction unit (PCU) in 1,000 tonnes, calculated by multiplying numbers of animals from Table 20 for the various categories by average weight (AW)

| | AW in kilos | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| **Cattle** | | | | | | |
| Number of slaughtered (1,000 heads) cows × AW | 425 | 8.04 | 154.89 | 184.84 | 230.09 | 204.01 |
| Number of slaughtered (1,000 heads) heifers × AW | 200 | 154.23 | 165.61 | 158.63 | 151.79 | 156.10 |
| Number of slaughtered (1,000 heads) bullocks and bulls × AW | 425 | 642.93 | 595.34 | 589.64 | 547.09 | 536.70 |
| Number of slaughtered (1,000 heads) calves and young cattle × AW | 140 | 15.48 | 7.17 | 6.40 | 6.19 | 5.96 |
| Number of net imported cattle for slaughter (-) × AW | 425 | | 0.00 | 0.00 | 0.00 | -13.74 |
| Number of net exported cattle for slaughter (+) × AW | 425 | | 1.72 | 3.56 | 2.10 | 0.00 |
| Number of net imported cattle for fattening (-) × AW | 140 | | 0.00 | 0.00 | 0.00 | -2.94 |
| Number of net exported cattle for fattening (+) × AW | 140 | | 16.30 | 19.31 | 10.54 | 0.00 |
| Number of livestock (1,000 heads) dairy cows × AW | 425 | 852.98 | 852.13 | 840.23 | 808.78 | 792.20 |
| **Pigs** | | | | | | |
| Number of slaughtered (1,000 heads) pigs × AW | 65 | 596.25 | 591.28 | 616.44 | 612.74 | 587.00 |
| Number of net imported pigs for slaughter (-) × AW | 65 | | -23.15 | -24.86 | -29.13 | -32.24 |
| Number of net imported pigs for fattening (-) × AW | 25 | | -0.98 | -1.76 | -2.10 | -2.18 |
| Number of livestock (1,000 heads) sows × AW | 240 | 121.08 | 125.76 | 119.52 | 116.88 | 120.96 |
| **Poultry** | | | | | | |
| Number of slaughtered (1,000 heads) broilers × AW | 1 | 826.31 | 806.92 | 798.49 | 784.39 | 838.88 |
| Number of slaughtered (1,000 heads) turkeys × AW | 6.5 | 125.86 | 112.01 | 96.72 | 96.92 | 100.64 |
| Number of net exported broilers for slaughter (+) × AW | 1 | | 5.17 | 5.71 | 4.56 | 2.04 |
| **Sheep and goats** | | | | | | |
| Number of slaughtered (1,000 heads) sheep and goats × AW | 20 | 325.84 | 328.41 | 316.23 | 334.11 | 307.81 |
| Number of net exported sheep for slaughter (+) × AW | 20 | | 1.96 | 2.97 | 4.29 | 6.36 |
| Number of livestock (1,000 heads) sheep × AW | 75 | 1,779.77 | 1,757.14 | 1,775.70 | 1,639.20 | 1,600.73 |
| **Horses** | | | | | | |
| Number of livestock (1,000 heads) horses × AW | 400 | 520.00 | 520.00 | 520.00 | 520.00 | 520.00 |
| **Fish** | | | | | | |
| Biomass (1,000 tonnes) live weight fish slaughtered[1] | | 172.81 | 171.85 | 174.20 | 179.84 | 196.60 |
| **Total** | | **6,141.57** | **6,189.53** | **6,201.95** | **6,018.28** | **5,924.89** |

[1] Data from Eurostat given as 1,000 tonnes slaughtered fish (as live weight).

# Switzerland

**Table 22.** Data on slaughtered animals as carcass weights, in 1,000 tonnes, from Swiss statistics

| Animal carcass category | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|
| Carcass bovines | 102.91 | 102.12 | 105.12 | 109.34 |
| Carcass calves | 32.03 | 30.82 | 30.25 | 32.23 |
| Carcass pigs | 243.55 | 241.99 | 230.96 | 237.82 |
| Carcass poultry | 51.69 | 60.42 | 63.83 | 65.16 |
| Carcass sheep and goats | 6.30 | 5.94 | 5.93 | 5.84 |
| Carcass rabbits | 1.59 | 1.50 | 1.54 | 1.50 |

**Table 23.** Population correction unit (PCU) in 1,000 tonnes, calculated using method II[1]

| Category | CF | Average weight in kilos[2] | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| **Cattle** | | | | | | |
| Carcass bovines x CF | 2 | | 144.08 | 142.96 | 147.17 | 153.07 |
| Carcass calves x CF | 1.67[3] | | 37.44 | 36.03 | 35.36 | 37.68 |
| Number of net imported cattle for slaughter × AW | | 425 | -0.19 | -0.74 | -0.84 | -0.92 |
| Number of livestock dairy cows × AW | | 425 | 209.86 | 210.73 | 216.25 | 210.55 |
| **Pigs** | | | | | | |
| Carcass pigs x CF | 1.35 | | 213.10 | 211.74 | 202.09 | 208.10 |
| Number of net imported pigs for slaughter × AW | | 65 | -0.04 | -0.05 | -0.05 | -0.05 |
| Number of livestock sows × AW | | 240 | 25.49 | 23.61 | 23.19 | 23.15 |
| **Poultry** | | | | | | |
| Carcass poultry x CF | 1.33[3] | | 48.23 | 56.38 | 59.56 | 60.80 |
| Number of net exported broilers for slaughter × AW | | | 0.03 | 0.05 | 0.05 | 0.11 |
| **Sheep and goats** | | | | | | |
| Carcass sheep and goats x CF | 2 | | 8.82 | 8.31 | 8.30 | 8.18 |
| Number of livestock sheep × AW | | | 23.67 | 23.29 | 23.42 | 22.67 |
| **Horses** | | | | | | |
| Number of livestock horses × AW | | 400 | 15.79 | 16.16 | 16.51 | 16.84 |
| **Rabbits** | | | | | | |
| Carcass rabbits x CF | 1.6 | | 1.78 | 1.68 | 1.72 | 1.68 |
| **Total** | | | **728.08** | **730.16** | **732.74** | **741.87** |

[1] Note that all data are multiplied by 0.7. [2] From Montforts (1999). [3] Eurostat, Michael Goll, personal communication.

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