Veterinary antibiotic usage in the Netherlands in 2010

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This is a publication of LEI, part of Wageningen UR.

The information presented on the MARAN website www.maran.wur.nl is based on a collation of data from on-going surveillance systems on the sales and use of antimicrobial agents in animal husbandry in the Netherlands. The website also provides more detailed data about the usage of antibiotics.

LEI project team

Nico Bondt (project leader)
Linda Puister
Hennie van der Veen
Ron Bergevoet
Bernard Douma
Arno van Vliet
Klaus Wehling

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Contents

Summary

In the years 2007-2010 the total sales of antibiotics decreased by 23%. Sample data about the antibiotic use in specific animal species in the Netherlands also indicate a substantial decrease in antibiotic use in three out of four animal production sectors examined in 2010.

Trends in total sales
Sales data reveal that the total amount of antibiotics sold by the pharmaceutical industry (FIDIN members) in the Netherlands for therapeutic veterinary use, has increased by 83% in the period 1999-2007. In the last three years the antibiotic sales in the Dutch animal production decreased by 23%, to a total of 455 tonnes in 2010. This downward trend of veterinary antibiotic sales is in line with the policy objective of 20% reduction in 2011, compared with 2009.

Trends in exposure
The figures on exposure to antibiotics in the sample surveys reveal the following tendencies for the years 2005-2010, indicating a substantial decrease in antibiotic use in most animal production sectors in the Netherlands in 2010:

- sow/piglet farms: annual variation, decrease in 2010;
- fattening pig farms: decrease in 2009 and 2010;
- broiler farms: increased usage from 2005 to 2009, decrease in 2010;
- dairy farms: decrease in 2009, increase in 2010.

1. Introduction

Aim

The objective of this study is to obtain detailed insight into the exposure of farm animals to antibiotics, by monitoring both sales data at the national level and more specifically data per animal species. The results of the study can be used by the Ministry of Economic Affairs, Agriculture and Innovation for policy evaluation. In addition, the usage data might play a role in explaining trends in resistance that have become apparent. Moreover, these data might be used to inform the European Commission.

Monitoring in the Netherlands

Monitoring of antibiotic usages in the Netherlands is done in two ways. Since 1998 FIDIN, the federation of the Dutch veterinary pharmaceutical industry, annually reports antibiotic sales figures in the Netherlands (FIDIN, 2011). The sales figures stated in these reports give an impression of the total amount of active substances used in the Netherlands at the level of pharmacotherapeutic groups. LEI, part of Wageningen UR, monitors the antibiotic use on a stratified sample of Dutch farms. This provides information about the true exposure of farm animals to antibiotics, and gives insight into the underlying factors that could explain changes in antibiotic use. In cooperation with the veal calf sector the use in veal calves is monitored in an additional sample.

Monitoring in Europe

All EU member states are required to monitor antimicrobial resistance in food producing animals of public health concern (Zoonosis Directive 2003/99/EC). Within this context, monitoring of antibiotic usage is equally important. Therefore the European Medicines Agency (EMA) is carrying out the ESVAC project to establish national systems for the collection of data on sales of veterinary antimicrobial agents in Europe, in a standardized way (EMA, 2010). ESVAC stands for European Surveillance of Veterinary Antimicrobial Consumption. The project was set up in April 2010 to collect information on how antimicrobial medicines are used in animals across the European Union. The EMA started this project following a request from the European Commission for the Agency to develop a harmonised approach for the collection and reporting of data on the use of antimicrobial agents in animals from the EU Member States. EC Directive 2001/82/EC and Regulation 726/2004 provide a legal basis for national authorities to request the pharmaceutical industry to provide data on sales of antimicrobial agents. However, member states are not yet obliged to provide data about the use of veterinary antibiotics to the EC.

2. Materials and methods

2.1 Analysis of sales data

FIDIN reports the total number of kilograms of antibiotics (active ingredient) sold in the Netherlands at the level of pharmacotherapeutic groups**.** The data about use of active substances are based on sales data of members of FIDIN and are estimated to cover about 98% of all sales. Actual use can be different from the amounts sold as a result of stock piling and cross border use. The figures give information about the total sales for all animals, not per individual animal species**.**

Table 2.1. Trends in livestock in the Netherlands in numbers (thousands)

Number of animals * 1.000	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Piglets (less than 20 kg)	4,791	4,935	4,422	4,225	3,896	4,300	4,170	4,470	4,680	4,555	4,809	4,649
Sows	1,320	1,272	1,161	1,140	1,052	1,125	1,100	1,050	1,060	1,025	1,100	1,098
Fattening pigs (of at least 50 kg)	4,668	4,560	5,911	5,772	5,807	5,705	5,715	5,880	5,960	6,135	6,192	6,450
Other pigs 1)	2,360	2,055	20	17	11	10	15	-180	10	20	7	9
Turkeys 2)	1,523	1,523	1,523	1,451	1,112	1,238	1,250	1,200	1,232	1,222	1,336	1,336
Other poultry 2)	48,642	48,642	48,642	48,714	43,168	44,427	45,800	45,475	45,068	46,976	48,885	48,885
Veal calves	800	756	676	692	748	775	813	824	860	913	886	921
Cattle (excl. veal calves)	3,297	3,134	3,166	3,088	2,986	2,984	2,933	2,849	2,960	3,083	3,112	3,039
Sheep	1,152	1,250	1,250	1,300	1,476	1,700	1,725	1,755	1,715	1,545	1,091	1,211

Source: Eurostat 2010

1) Other pigs is a calculated number

2) Poultry 2010 is not yet available; poultry numbers 2009 are used

Table 2.2. Trends in livestock in the Netherlands in live weight (tonnes)

kg live weight *1.000	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
pigs	831,204	793,152	715,992	699,434	678,786	691,691	685,943	675,876	699,092	703,127	725,258	741,470
Turkeys	9,138	9,138	9,138	8,706	6,672	7,428	7,500	7,200	7,392	7,332	8,018	8,018
Other poultry	48,642	48,642	48,642	48,714	43,168	44,427	45,800	45,475	45,068	46,976	48,885	48,885
Veal calves	141,040	133,283	119,179	122,000	131,943	136,633	143,332	145,271	151,618	160,962	156,202	162,372
Cattle (excl. veal calves)	1,648,500	1,567,000	1,583,000	1,544,000	1,493,150	1,492,000	1,466,500	1,424,500	1,480,000	1,541,500	1,556,000	1,519,500
Sheep	69,120	75,000	75,000	78,000	88,560	102,000	103,500	105,300	102,900	92,700	65,460	72,660
total	**2,747,644**	**2,626,215**	**2,550,951**	**2,500,854**	**2,442,279**	**2,474,179**	**2,452,575**	**2,403,622**	**2,486,070**	**2,552,597**	**2,559,823**	**2,552,905**

To adjust for trends in the size of the animal population the sales of antibiotics in grams per kilogram of live animal weight are determined. For this the annual total sales figures published by FIDIN have been related to the total live weight of animals in the Dutch livestock farming sector (pigs, poultry, veal calves, other cattle and sheep). For this analysis the following average weights have been used: veal calves (weighted average of white and rosé) 176 kg, other cattle 500 kg, turkeys 6 kg, other poultry 1 kg, fattening pig 70 kg, sow 220 kg, other pigs 70 kg, piglets (< 20 kg) 10 kg, sheep 60 kg. This yields information about the trend in the sales of antibiotics in grams per kilogram of live animal weight over the years, thus taking yearly fluctuations in the size of the animal population into account.

The yearly average numbers of animals and its conversion into live weight are given in Table 2.1 and 2.2.

2.2 Analysis of sample data

The Farm Accountancy Data Network (FADN) contains a representative, stratified sample of around 1,500 agricultural and horticultural farms in the Netherlands (Vrolijk et al., 2009). Records are made of the economic data and technical key figures of these farms. Every year a number of farms are replaced by other farms to ensure that the database of the Data Network remains representative for Dutch livestock farming. On these farms all animal-medicine data and veterinary services are recorded. The data for the veal calves originate from an additional random sample of all veal calf farms. On these farms detailed data were collected on number of animals present and the amount of antibiotics used.

These data are available on the LEI websites (www.lei.wur.nl and www.maran.wur.nl). Data of 214 pig, broiler and dairy cattle farms in the FADN were used to estimate the antibiotic usage in 2010. Data from veal calf farms were collected in an additional sample. See Table 2.3 for details.

The use of antibiotics is expressed as the number of daily dosages per animal year and about the use in grams of active ingredients per animal year. The aggregated usage data are considered to be representative for the total exposure of Dutch food-producing animals to antibiotics. The 95% confidence intervals (CI) indicate that with 95% certainty, the average antibiotic use per animal on a national level, expressed in the number of daily dosages per animal year, will lie within the upper and lower limits given. The confidence interval also indicates the variation in antibiotic usage amongst farms.

Table 2.3. Number of sample farms taking part each year and the associated number of animals

	Type of holding	2005	2006	2007	2008	2009	2010
Number of animals	Sows /piglets	16,790	12,155	17,949	18,767	20,806	24,593
	Fattening pigs	54,788	55,970	119,922	156,098	159,104	153,887
	Broilers	2,367,623	2,315,882	2,197,716	2,508,103	2,530,313	2,244,706
	Veal calves	n.a.	n.a.	124,115	134,437	134,446	n.a.
	Dairy cows	2,875	2,818	2,850	7,274	7,382	7,020
Number of farms	Sows /piglets	46	32	39	45	48	48
	Fattening pigs	40	31	49	77	72	64
	Broilers	29	28	29	29	28	25
	Veal calves	n.a.	n.a.	185	199	193	n.a.
	Dairy cows	35	34	34	82	83	77
	Total	150	125	336	432	424	214

n.a. = no data available

2.3 Daily doses

To provide insight into the true exposure of animals to antibiotics, the use is expressed in the number of daily doses per animal year: ADD (Jensen et al., 2004). Antibiotics vary in their potency and pharmacokinetic properties[1], and this results in different dosages per kilogram of body weight between and within antibiotic classes. Because of these differences the unit "grams per kg live weight", as calculated from total sales figures, is a less accurate indicator for the use of antibiotics. The unit "daily dosage" is more suitable for calculating the exposure of animals to antibiotics. Adopting this approach offers an opportunity to obtain more insight into the relationship with the occurrence and trends in resistance. Moreover, this unit conforms to international developments in this field and developments in the human health sector. The broader implementation of records of this nature will also improve the feasibility to compare for example the antibiotic use in different EU member states in similar livestock systems.

The number of daily dosages per animal year was determined by calculating the total number of kilograms of animal that can be treated with each active ingredient: the treatable weight. This was then divided by the total weight of the average present livestock on the farm[2]. This assumes that the average treatment is administered to animals with an average weight. With this approach the calculation and comparison of the total antibiotic use on farms is possible, even when different active ingredients are involved. Expressing the use per animal year enables comparisons of farms with different vacancy periods. However, especially in some sectors (e.g. veal calves) differences in length of production periods should also be taken into account.

[1]Differences in dosage are determined by differences in potency, differences in bioavailability and distribution throughout the body.

[2]This is the average weight of the animals (in kg per animal) multiplied by the average number of animals present on the farm per year. Note that on dairy farms only the weight of the dairy cows has been taken into account.

This information is used to obtain insight into the total antibiotic use for specific animal species and categories of animal species (for example, fattening pigs) on a specific group of farms (for example, all pig farms with fattening pigs). This is expressed in terms of an average number of daily dosages per animal year for fattening pigs. More information about this unit of measurement is given in the following daily dosages box, which also includes an example of a calculation. The use of antibiotics in spray containers is not included.

Animal weights

In general, younger animals are more likely to encounter health problems than older animals, while animals no longer receive antibiotics in the last period before slaughter, primarily because of less health problems and also to ensure that the meat is free of antibiotic residues. The best estimation of the total treatment duration per year would be obtained by calculating the number of daily dosages on the basis of the best possible estimate of the average weight at the time of treatment. However, the information currently available is not sufficient to determine the exact weight of the animals at the time of the administration of the medicine. For this reason the calculations in this report are still based on the average weight per animal during the animals' presence on the farm. The calculated number of defined daily dosages is therefore expected to be an underestimation of the true exposure, especially for piglets, fattening pigs and veal calves.

In the sample survey the following average weights have been used: dairy cows 600 kg, veal calves 172 kg (i.e. the weighted average of white veal calf 164 kg and rosé veal calf 192 kg), broilers 1 kg, fattening pigs 70 kg, sows 220 kg, maiden gilts 107.5 kg, piglets (< 25 kg) 12.5 kg, breeding boars 350 kg (ASG, 2010). On dairy farms the number of daily dosages is based on the weight of the dairy cows only, because this category of the animals gets almost all of the antibiotics. On sow farms the size of the 'population at risk' is based on the weight of all present animals (including piglets, gilts, breeding boars). For an illustrative calculation of the number of daily dosages for young calves on dairy farms (from birth to weaning at 56 days of age) the average weight of 56.5 kg has been used.

Daily dosages

The amounts of different active ingredients cannot simply be totalled since the antimicrobial potency and pharmacokinetics (and, consequently, the dosage prescription) varies between active ingredients. However, active ingredients can be compared and totalled once the active ingredient in each antibiotic preparation is expressed in terms of the daily dosage. The daily dosage is a measure of the number of milligrams of a specific active ingredient required to treat one kilogram of animal in one day with that antibiotic preparation, and is based on the recorded average dosage of a medicine for a specific type of animal[3]. These daily dosages can be totalled to determine the total exposure to antibiotics. The daily dosages are specific to the type of animal, and have been defined for dairy cattle, veal calves, pigs and poultry. Consequently, antibiotic preparations may have been assigned multiple daily dosages, according to the type of animal the preparations are administered to, i.e. the daily dosage for each type of animal.

Example of a calculation of the daily dosage

For example, a farm with 150 fattening pigs with an average weight of 70.2 kg used 2 litres of antibiotic preparation X during the course of one year (X contains 40% = 400 mg/ml active ingredient a) and 20 kg of antibiotic preparation Y (Y contains 25% = 250 mg/g active ingredient b). Antibiotic preparation X: the defined daily dosage of active ingredient a is 10 mg per kg animal weight per day. Antibiotic preparation Y:the defined daily dosage of active ingredient b is 50 mg per kg animal weight per day.

Antibiotic X can be used to treat (2,000 * 400)/10 = 80,000 kg animal weight. Antibiotic Y can be used to treat (20,000 * 250)/50 = 100,000 kg animal weight. Consequently, the farm has used antibiotics for treatment of a total of 180,000 kg animal weight. The farm has an average of 150 fattening pigs per year, with a total weight of 10,530 kg. 180,000 kg were treated in that year, equivalent to 180,000/10,530 = 17.1 daily dosages. Consequently, an average fattening pig[4] on the farm in that year was administered a prescribed dosage of antibiotics on 17.1 days. In this example the farm uses 17.1 daily dosages per animal year of antibiotic preparation X plus Y.

[3] For veal calves the calculated daily dosages are based on the highest allowed dosage instead of the average dosage. This is according to daily practice, where usually the highest recorded dosage is administered. The use per average veal calf is calculated on the basis of the composition of the veal calf sector in the Netherlands: 70% white veal calves and 30% rosé veal calves.

[4]This refers to a pig on the farm throughout the year: however, there is no such pig. This is a method which can be used to provide for comparisons of farms with different vacancy rates. For example, a farm has 2 herds of animals a year, both of which comprise 200 animals that remain on the farm for 5.5 months. The farm is vacant during the first and last week of the year, and for 2 weeks between the two herds. The calculations for this farm are based on an average of 183 animals present on the farm. When a farm is vacant for six months and has a herd of 200 animals for six months then the calculations are based on an average of 100 animals on the farm.

2.4 Statistical analysis

To obtain insight into the amount of and trends in antibiotic use on the national level, the sample of farms in FADN and the additional sample for veal calves are used to estimate the usage in the whole population, expressed in average use per average animal present on an average farm.

This rather limited number of farms used may affect the validity of the conclusions drawn for the whole population. However, the selection of farms in the sample is representative for the different animal production sectors. In this way the sample can provide adequate information (Vrolijk et al., 2009). Because of the observed large variation in use of antibiotics between individual farms in the sample relatively large sample sizes are necessary to make accurate estimates for the whole population.

To ensure that the farms that are included in the sample are representative of the whole population and to make the sampling as efficient as possible a disproportional stratified random sampling strategy is used. A stratified sample implies that the population is divided into a number of homogeneous groups. Subsequently farms are selected from each of the groups. For strata with larger variation in the use of antibiotics, relatively more sample farms are selected. In the FADN sample the strata are based on both farm size and animal category. The additional sample of veal calf farms is additionally stratified for 'large integration' versus 'small integration or non-contracted farms'.
Since the stratification is disproportional, the results have to be weighted to be representative. For each stratum the average daily dosages per animal year is determined. Then the weighted average for an animal category is calculated, based on the number of farms in the population in each stratum.

In this report the usage data of all sample farms are used to present the findings about the use of antibiotics and also for further statistical analysis about decrease of increase of antibiotic use over a period of two or more years. Comparing means between two years can be done in two ways, either by only using farms that are in the sample for both years[5] or by comparing the means independently, using all sample farms in both years. The first method usually gives better results if the number of sample farms available in both periods is not much smaller that the number of farms in the separate years. This usually is the case in subsequent years. However, if the years of comparison are further apart, the number of sample farms available in both years will be more limited. Additionally, the direction of the change might even be different from the direction in the total sample. In that case, testing for significant differences can better be done by using the means and standard errors of the separate years instead of using a subsample.[6]

[5]See Appendix 3 in Vrolijk et al. (2008) for more detail about the statistics.

[6] If the difference between the two means is larger than twice the square root of sum of both squares of the standard errors then there is a significant difference.

3. Trends in antibiotic usage

3.1 Trends in total sales

Figure 3.1 shows the trends in the total sales of therapeutic antibiotics in the Netherlands, also expressed in grams of active substance per kg of live weight**.** The figure was prepared from total sales figures presented by FIDIN (FIDIN, 2011).

Figure 3.1. Therapeutic antibiotic sales 1999-2010

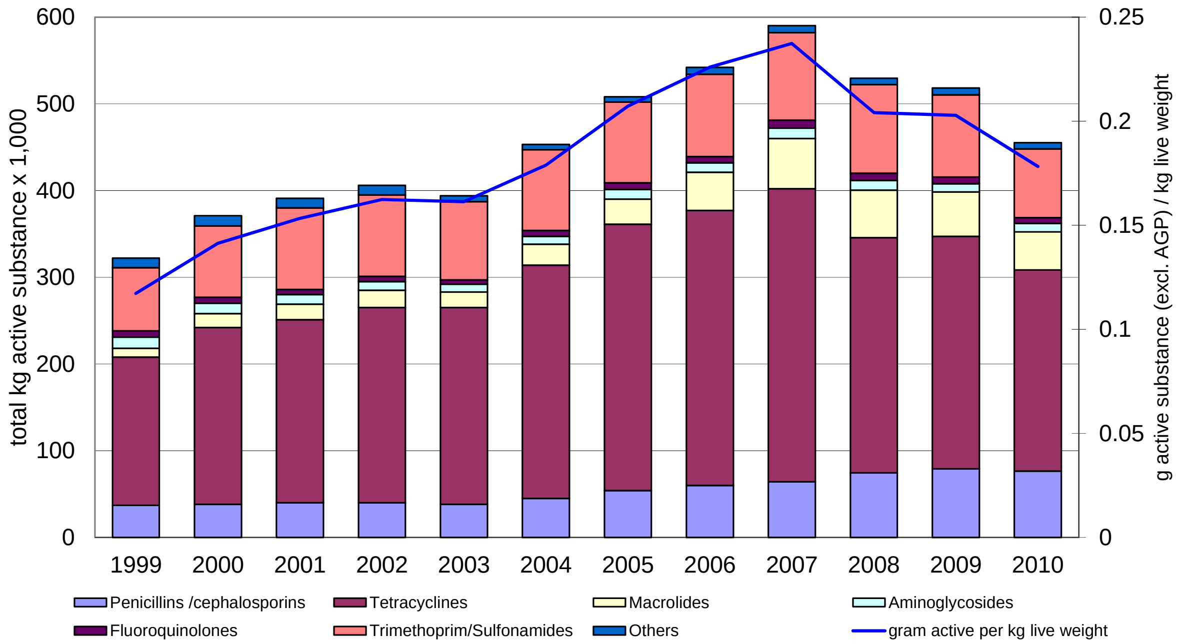


Figure 3.1 reveals that the total amount of antibiotics sold by the pharmaceutical industry (FIDIN members) in the Netherlands for therapeutic veterinary use has increased by 83% in the period 1999-2007 from 322 to 590 tonnes. After that the antibiotic sales in the Dutch animal production decreased by 23%, to a total of 455 tonnes in 2010. Compared with 2009, in 2010 the sales decreased by more than 12%. Because the livestock numbers remained stable, the sales in grams per kg of live weight also decreased by 12%.

Discussion
This downward trend of veterinary antibiotic sales is in line with the policy objective of 20% reduction in 2011, compared with 2009.

The total sales volume amounted to 455 tonnes in 2010, which is more or less the 2004 level. However, at that time an additional 80 tonnes of antimicrobial growth promoters were used (see Table 3.1). Almost all classes of antibiotics showed a decrease.

Tetracyclines
The sales data show a decrease of tetracyclines from 338 tonnes in 2007 to 232 tonnes in 2010 (-31%), of which 149 tonnes of oxytetracyclines (-40%) and 81 tonnes of doxycyclines (-8%). The true exposure to tetracyclines did not decrease by 31%, but by an estimated 25%, roughly assuming a constant livestock population and an average dosage of 30 mg per kg of animal for oxytetracyclines and 10 mg per kg for doxycyclines.

Fluoroquinolones
In 2010 the fluoroquinolones represented 1.44% of the total veterinary antibiotic sales in the Netherlands, of which 0.38% 'newer' fluoroquinolones (danofloxacin, difloxacin, enrofloxacin and marbofloxacin). In the years 2007-2010 the sales of fluoroquinolones decreased substantially, by 30%. The sales of the newer fluoroquinolones showed an increase of 49%.

Cephalosporins
The cephalosporins represented 0.20% of the total sales, of which 0.16% third and fourth generation cephalosporins (cefoperazon, cefovecin, cefquinome, ceftiofur, cefuroxim). In 2007-2010 the sales of third and fourth generation cephalosporins decreased by 22%.

Table 3.1. Antibiotic sales from 1999-2010 in tonnes (FIDIN, 2011)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Penicillins /cephalosporins	37	38	40	40	38	45	54	60	64	74	79	76.5
Tetracyclines	171	204	211	225	227	269	307	317	338	271	268	232
Macrolides	10	16	18	20	18	24	29	44	58	55	51	43.8
Aminoglycosides	13	12	11	10	9	9	11	11	12	11	10	9.75
Fluoroquinolones	7	7	6	6	5	7	8	7	9	8	8	6.55
Trimethoprim/Sulfonamides	73	82	94	94	90	93	93	95	101	102	95	79.3
Others	11	12	11	11	7	6	6	8	8	7	8	7.2
Total therapeutic sales	322	371	391	406	394	453	508	542	590	529	518	455
Antimicrobial growth promoters (AGP)	250	205	180	140	120	80	40	0	0	0	0	0
Total sales including AGP	572	576	571	546	514	533	548	542	590	529	518	455

3.2 Trends in exposure

Figure 3.2 shows the trends in exposure to antibiotics in defined daily dosages per average animal present per year (ADD) in the five livestock sectors examined in this study. The outcome of the calculations is indexed, using 2009 as baseline year. The continuous line represents the estimated average use. The 95% confidence intervals are indicated by the dotted lines shown in Figure 3.2.

For all sectors except the veal calf sector results are presented from 2005 to 2010. For veal calves data are available as from 2007 to 2009; data on the usage in veal calves in 2010 are not yet available.

Figure 3.2 Tendencies in antibiotic usage 2005-2010

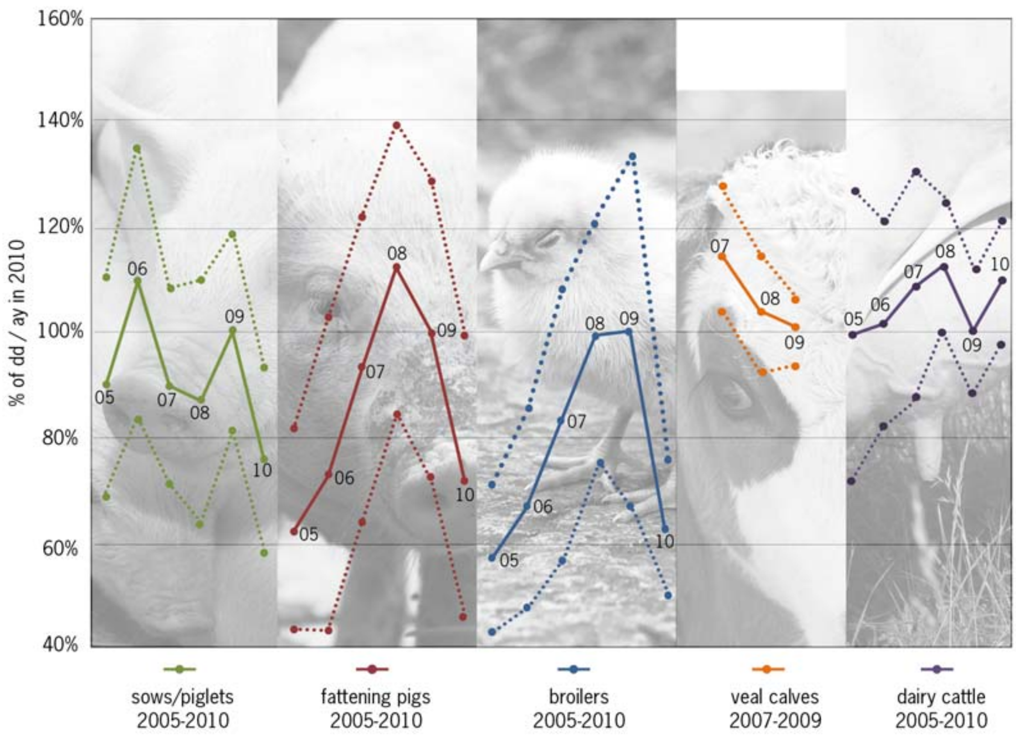


Figure 3.2 shows different trends in exposure to antibiotics in the different animal species. The results indicate a substantial decrease in antibiotic use in most animal production sectors in 2010[7]:

- sow/piglet farms: annual variation, decrease in 2010;
- fattening pig farms: decrease in 2009 and 2010;
- broiler farms: increased usage from 2005 to 2009, decrease in 2010;
- dairy farms: decrease in 2009, increase in 2010.

For broilers the decrease in 2010 was statistically significant, and also the comparison of the pig farms that participated in the survey in 2009 and in 2010 reveals statistically significant decreases, both in sows and in fattening pigs.

The results do not permit a distinct conclusion that the antibiotic usage in the dairy cattle sector in the Netherlands has increased.

[7] veal calf farms: data 2010 not yet available

4. Antibiotic use per species

In this chapter the usage of the different types of antibiotics per livestock species is addressed into detail.

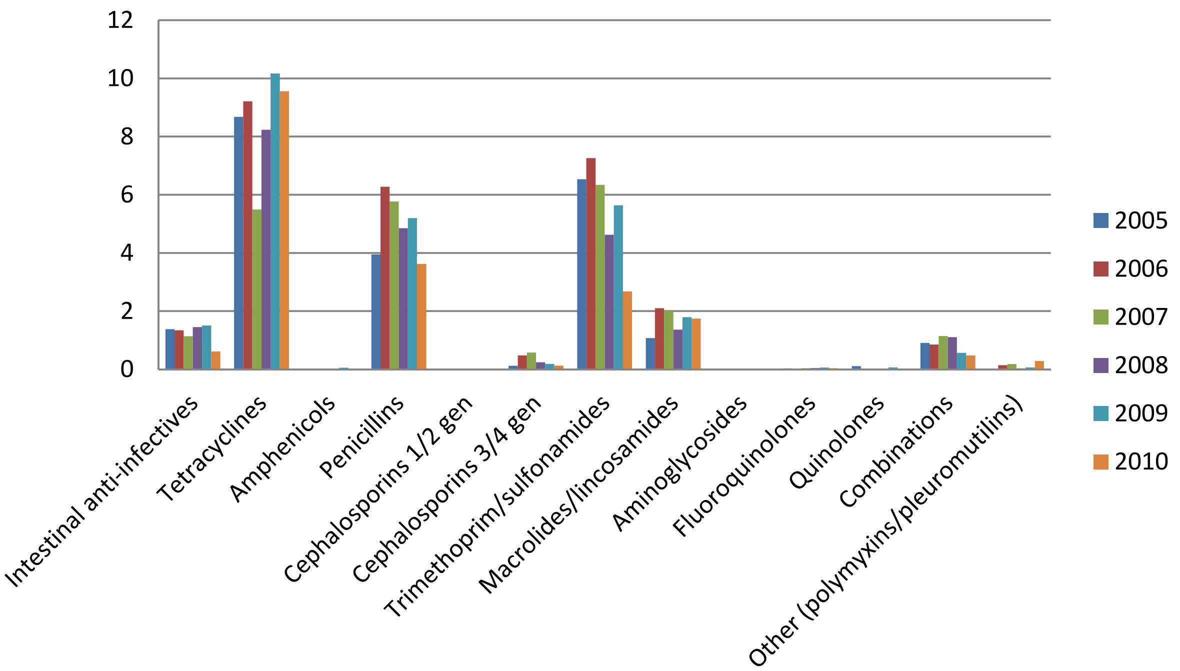
4.1 Pigs

Sows and piglets

In 2010, the average animal on sow/piglet production farms in this survey received approximately 19 daily dosages per year (95% Confidence Interval: 15-24 dd/ay). In 2009 the use was 25 daily dosages per year (95% CI: 21-30 dd/ay). The large confidence intervals are mainly caused by the large variation in use that exists between different farms. 83% of the antibiotics were orally administered, probably predominantly in piglets.

Figure 4.1 provides insight into the trends in the relative use of the various groups of antibiotics on the sample farms.

Figure 4.1. Antibiotic use in sows/piglets in daily dosages per sow per year in 2005-2010



In 2010 50% of the total antibiotic use in sows/piglets consisted of tetracyclines, 14% of trimethoprim/sulfonamides and another 19% of penicillins. 0.6% of the total usage consisted of 3rd and 4th generation cephalosporins and 0.2% consisted of fluoroquinolones, which are likely to have been administered to young piglets before weaning.

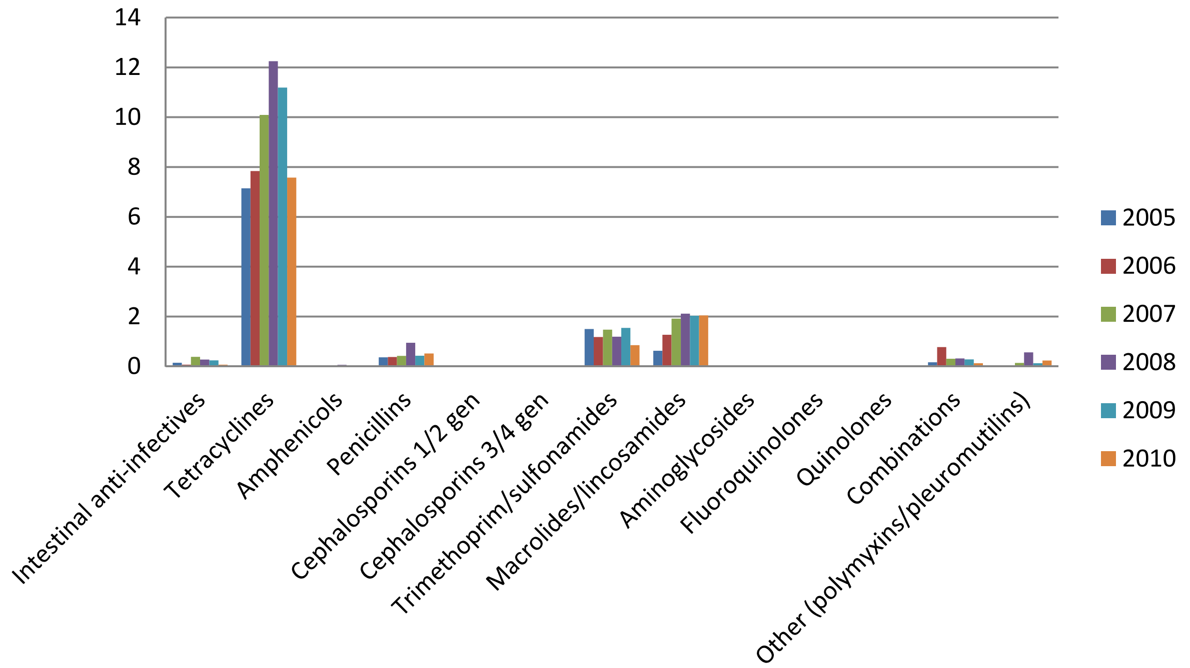
Discussion
For sows/piglets in the sample the average use in 2010 was 19 daily dosages per year. However, in practice almost all of the antibiotics are likely used for the treatment of the piglets, and only incidentally for the sows. If it is assumed that 100% of the antibiotics are administered to the piglets, with an average weight of 12.5 kg, this would mean that an average piglet is treated with antibiotics during 19 days in the period from birth to the age of 74 days (at delivering to the fattening farm, at 25 kg).

Fattening pigs

The average fattening pig in the sample received 11 daily dosages per year in 2010, of which 95% orally administered (95% Confidence Interval: 7-16 dd/ay). In 2009 the average use was 16 daily dosages per year (CI: 11-20 dd/ay).

Figure 4.2 provides insight into the trends in the relative use of the various groups of antibiotics on the sample farms.

Figure 4.2. Antibiotic use in fattening pigs in daily dosages per animal year in 2005-2010



In 2010 66% of the total antibiotic use in fattening pigs originated from the administration of tetracyclines and 18% from macrolides/lincosamides. Cephalosporins and (fluoro)quinolones were not applied.

Discussion

The average fattening pig in the sample was treated with antibiotics 11 days per year. Assuming a production period of 117 days, 4 daily dosages (= 11 x (117/365) are administered to each fattening pig during its production period from 25 kg to slaughter weight. This average fattening pig has also received antibiotics at the breeding farm (during 19 days), which brings the total exposure to antibiotics per average fattening pig to approximately 23 days during its whole life from birth to slaughter at the average age of 191 days.

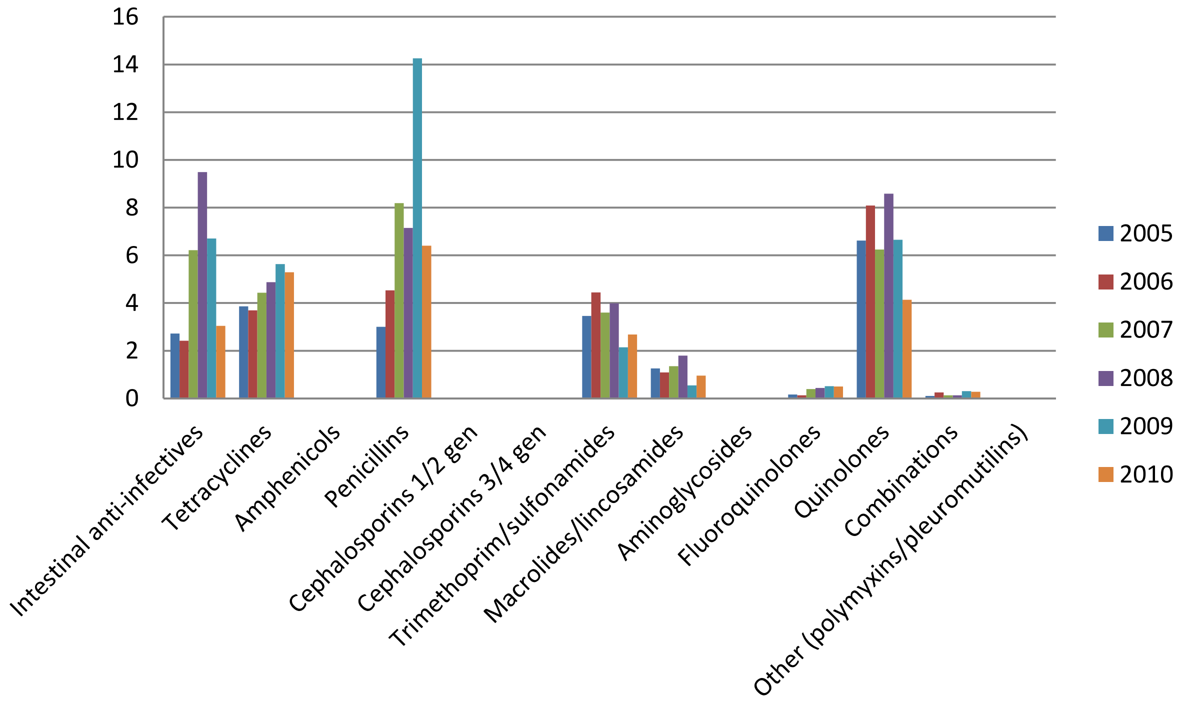
If it is assumed that the average treatment weight of fattening pigs will be 30% lower than their average live weight, since younger animals are more likely to receive antibiotics than older animals, the estimation of the total life time true exposure increases from 23 days to a total of 25 days. Compared to 2009 this is a decrease of 22%.

4.2 Broilers

The average boiler chicken in the sample received 23 daily dosages per year in 2010, administered orally, mainly through the drinking water (95% Confidence Interval: 18-28 dd/ay). In 2009 the usage was 37 daily dosages per year (CI: 24-49 dd/ay).

Figure 4.3 provides insight into the trends in the relative use of the various groups of antibiotics on the sample farms.

Figure 4.3. Antibiotic use in broilers in daily dosages per animal year in 2005-2010



In 2010 administration of penicillines accounted for 28% of the total antibiotic use on broiler farms, intestinal anti-infectives for 13%, quinolones for 18% and tetracyclines for 23%. Fluoroquinolones use was 2.2% of the total use. The use of intestinal anti-infectives (e.g. orally administered neomycin, colistin) decreased from 6.7 dd/ay in 2009 to 3.0 dd/ay in 2010.

Discussion

On the average broiler farm in the sample 23 daily dosages of antibiotics are administered per year. This means that an individual broiler is treated with antibiotics during 3 days (= 23 x 42/365) in the 42 days from day one to slaughter.

Data on the time of prescription reveal that the average weight on which broilers receive treatment equals the average live weight of 1.0 kg. Therefore the calculated exposure of approximately 3 days per broiler can be considered as an adequate estimation of the true exposure (i.e. 2 to 3 treatment days per broiler, considering the 95% confidence interval).

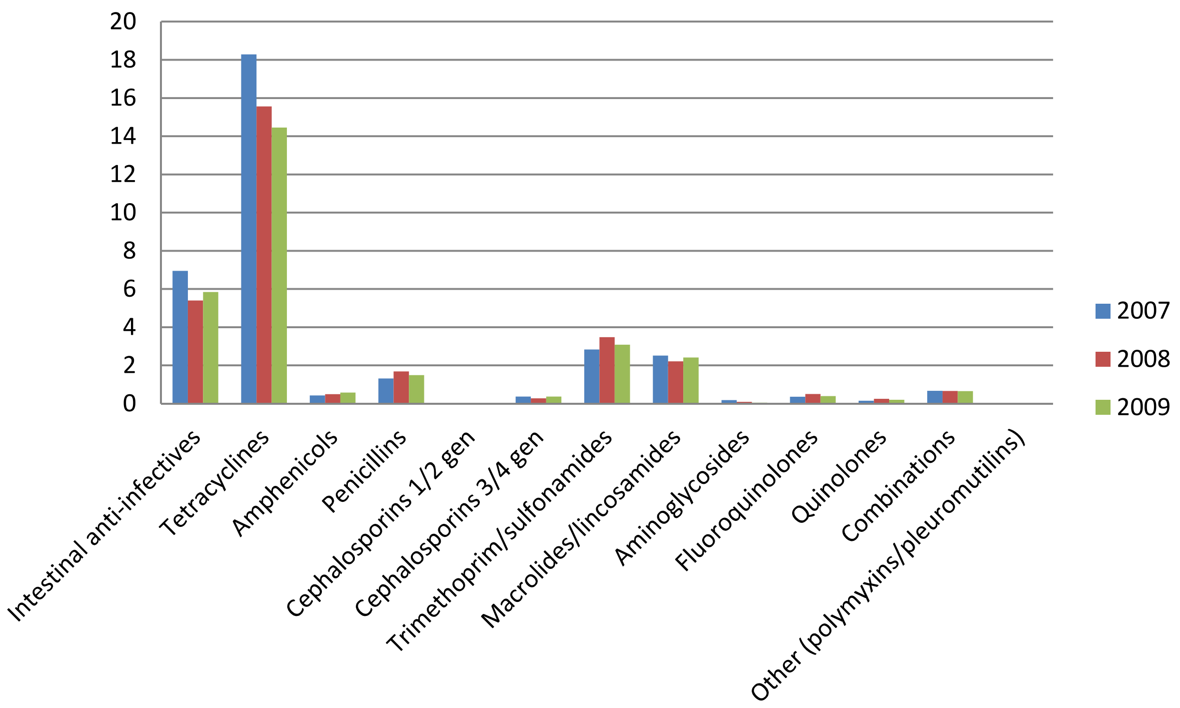
4.3 Veal calves (2009)

In this paragraph the results from 2007-2009 are presented, because for veal calves the 2010 data are not yet available.

In 2009 the average veal calf in the sample received 30 daily dosages per animal year, of which more than 90% was orally administered (95% Confidence Interval: 28-31dd/ay).

Figure 4.4 provides insight into the trends in the relative use of the various groups of antibiotics on the sample farms.

Figure 4.4. Antibiotic use in veal calves in daily dosages per animal year in 2007-2009



In 2009 49% of the total antibiotic use on veal calf farms originated from the administration of tetracyclines, 20% from intestinal anti-infectives (e.g. neomycin, colistin) and 10% from trimethoprim/sulfonamides. Fluoroquinolones and 3rd and 4th generation cephalosporin use were both 1.3% of the total use.

Discussion
The overall use decreased, mainly as a result of less traditional antibiotic therapy with tetracyclines. The application of the newer antibiotics like cephalosporins, fluoroquinolones and macrolides seems to be unchanged, whereas a decrease was expected.

On the average veal calf farm in the sample in 2009 30 daily dosages of antibiotics were administered per year. This means that the individual average veal calf was treated with antibiotics during 18 days (= 30 x 222/365) in the period from birth to the average slaughter age of 222 days (white and rosé).

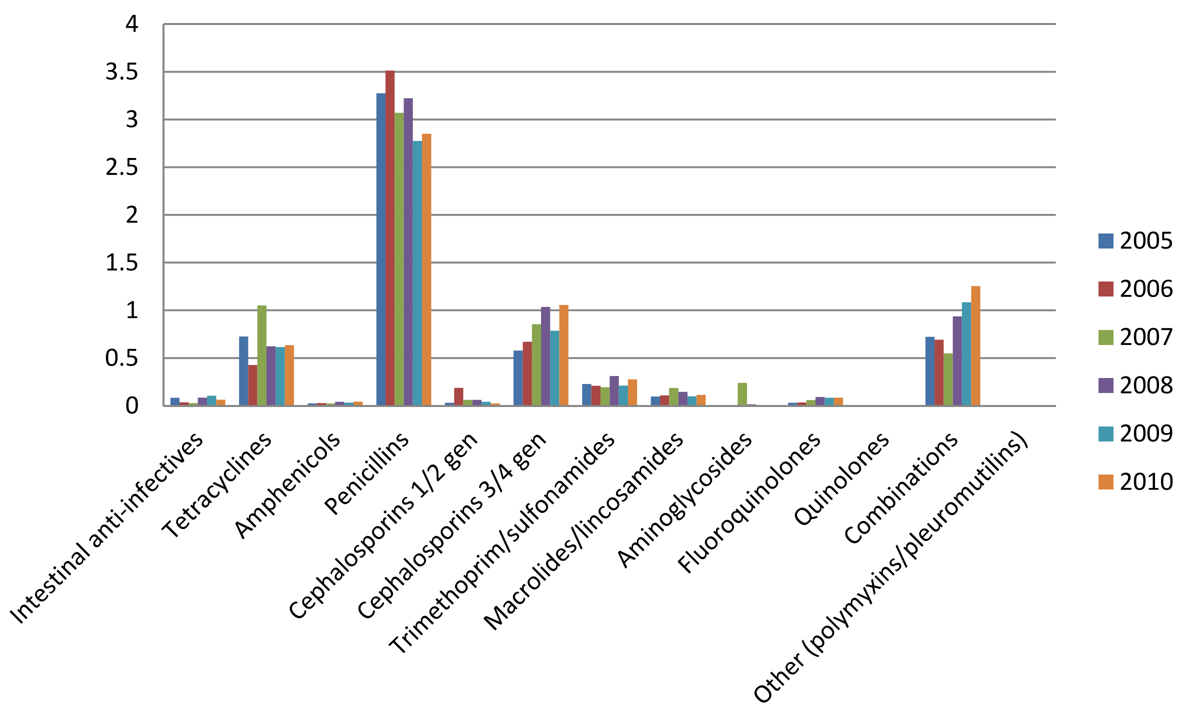
If it is assumed that the average treatment weight of veal calves is about 50% lower than the average live weight, since younger animals are more likely to receive antibiotics than older animals, the estimation of the total life time true exposure increases from 18 days to a total of 36 days.

4.4 Dairy cows

The average dairy cow in the sample received 6.4 daily dosages per year in 2010, including the use in young stock (95% Confidence Interval: 5.7-7.1 dd/ay). In 2009 the usage was 5.8 daily dosages per year (CI: 5.1-6.5 dd/ay).

Figure 4.5 provides insight into the trends in the relative use of the various groups of antibiotics on the sample farms.

Figure 4.5. Antibiotic use in dairy cattle in daily dosages per animal year in 2005-2010



In 2010 44% of the total antibiotic use on dairy farms originated from the administration of penicillins and 20% from combinations, which were mainly applications for intramammary treatment. Also 16% third/fourth generation cephalosporins were used. Use of fluoroquinolones in dairy cattle is only 1.3%.

Discussion
On the average dairy farm in the sample in 2010 6.4 daily dosages of antibiotics were administered per year, of which 0.2 for oral use. If it is assumed that the oral use is only applied in young calves, an average calf is exposed to antibiotics during 7 days of the 56 day weaning period. Note that part of the antibiotics that are registered for oral treatment may have been used off-label in footbaths for disinfection of cattle feet instead of for treating sick calves.

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