Usage of Antibiotics in Agricultural Livestock in the Netherlands in 2013

Trends and benchmarking of livestock farms and veterinarians

September 2014




Preface

This is your copy of the SDa report 'Usage of Antibiotics in Agricultural Livestock in the Netherlands in 2013'. The purpose of this report is to provide insight into the usage of antibiotics at Dutch livestock farms. The efforts of livestock farmers and their quality assurance systems and veterinarians enabled the SDa to report on the usage levels of more than 41,000 livestock farms over several years. This report also contains information on veterinarians' prescription patterns over a two-year period. The SDa's analysis is based on veterinarians' and livestock farmers' benchmarking results and on the improvement measures they initiated. Its objective is reduced and prudent usage of antibiotics in the Dutch livestock sector.

The amount of data available to the SDa expert panel has increased over the last few years. The SDa board feels the expert panel succeeded in distilling key information out of this increasing amount of data and did so in a way that will continue to prove the value of the data in the years to come. The SDA board would like to express its appreciation for the way in which the expert panel, comprising Prof. D.J.J. Heederik (chair), I.M. van Geijlswijk, Prof. J.W. Mouton, Prof. J.A. Wagenaar and the researchers J.H. Jacobs and F.J. Taverne, MSc, performed the data analyses.

On behalf of the SDa board,

Utrecht, June 2014

F.J.M. Werner
Chair

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Conclusions and recommendations

In the 2012-2013 period, usage of antibiotics continued to decline in three of the four main livestock sectors in the Netherlands. This is shown by the delivery lines in the sector-specific databases and the sector-specific $DDDA_{NAT}$ calculated, based on this information. The pig and broiler farming sectors recorded the most substantial decreases, 30% and 29%, respectively. Usage in the veal farming sector decreased by 22%. Although the usage level in the cattle farming sector did not change between 2012 and 2013, it was lowest in absolute terms. Together, the four main livestock sectors (pig, veal, broiler and cattle farming) achieved a 20.5% reduction compared to 2012 (weighted based on animal weight per livestock sector).

These reductions are also reflected in the sales figures, although the decrease in the amount of antibiotics sold seems to have leveled off somewhat compared to previous years. The number of kilograms of antibiotics sold decreased by 15.9% compared to the 2012 level. Compared to 2009, total sales decreased by 57.7%. In the previous period (2011-2012), the decrease in the amount of antibiotics sold still exceeded 25%.

The 2012-2013 period also showed a further decrease in the usage in agricultural livestock of antibiotics that are of critical importance for public health. Looking at the number of kilograms of active substances sold, the most striking development in 2013 was a substantial decrease in sales of all third-choice antibiotics. Third- and fourth-generation cephalosporins showed a 76% decrease in sales, and sales of fluoroquinolones dropped by 50%. Of the antibiotics also considered to be of critical importance for human health and the veterinary prescription drugs that are to be phased out, aminoglycosides and colistin were the ones showing the most prominent decreases in sales (40% and 35%, respectively). Sales of first-choice antibiotics went up in the case of florfenicol (by 18%) and combinations containing both sulphonamides and trimethoprim (by 9%).

The decrease in mean usage of antibiotics was associated with a substantial number of livestock farms moving from the action zone to lower usage level zones. In the pig and broiler farming sectors, over two-thirds of the livestock farms currently fall within the target zone. The shift in the veal farming sector was more modest. Generally speaking, more attention is required for the livestock farms in the signaling zone, in order to reduce their usage to a level that is closer to the target zone. This requires further investigation into how the number of livestock farms in the signaling zone can be reduced. Although the cattle farming sector is characterized by low usage levels, the number of cattle farms in the signaling zone is relatively high. This is mostly the result of how benchmark thresholds for the cattle farming sector have been determined. The benchmark thresholds for the cattle farming sector, and the dairy farming sector in particular, will have to be adjusted in the near future. However, the expert panel first wants to see the effect of new guidelines on selective application of dry-cow therapy on the usage of antibiotics in this livestock sector.

In the livestock sectors for which longer-term data are available, persistently high usage levels (defined as falling within the action zone for three consecutive years) are currently not considered a substantial problem. In the pig and veal farming sectors, the numbers of persistent high users amount to 4.1% and 2.8%, respectively.

In short, the expert panel concludes that the benchmarking of livestock farms and, if necessary, the immediate application of improvement measures for quickly reducing the usage levels have shown to be effective. Livestock farms within the signaling zone demand further attention.

In 2013, the veterinary benchmark could be applied to a larger number of veterinarians (9% more) than was the case in 2012. In the pig farming sector, the degree of coverage for registered one-to-one relationships between veterinarians and pig farms should soon be increased to 100%. The number of veterinarians within the action zone decreased from 9.6% in 2012 to 3.4% in 2013. This was a direct result of the decrease in the number of farms within the action zone due to mutual efforts of the livestock farmers and veterinarians concerned. The number of veterinarians in the signaling zone increased between 2012 and 2013, which was consistent with the developments at the livestock farm-level.

In 2013, the SDa was asked to look at any discrepancies between the amounts of antibiotics used according to actual usage data (delivery lines) and the amounts of antibiotics sold according to sales figures. Delivery lines are registered by veterinarians. Based on this analysis, the expert panel concluded that the registered delivery line data and the registered sales figures were largely consistent. Any discrepancies could be attributed to antibiotics sold being used within animal husbandry sectors not subject to monitoring (horse, companion animal and rabbit farming sectors), decisions to increase stock levels and changes in stock levels. In 2012, registration errors regarding the number of packages delivered initially were the main cause of the discrepancies found before. However, following rectification of the delivery lines concerned, such errors could have only marginally attributed to discrepancies between the two reporting methods.

The four animal production sectors subject to monitoring turned out to be responsible for about 10% of total usage of third- and fourth-generation cephalosporins. Usage of these agents mainly takes place in other animal husbandry sectors, probably in particular in the companion animal sector and horse sector. In the case of fluoroquinolones, about 45% of the amount sold (in kilograms) could not be traced back to the livestock sectors for which delivery lines are available. Presumably, a substantial proportion of these antibiotics, too, is used in unmonitored animal husbandry sectors. The expert panel therefore wants animal husbandry sectors within which a relevant amount of use is expected (i.e. the rabbit farming, goat farming, horse and possibly companion animal sectors) to be subjected to monitoring as well, to enable better assessment of the usage of antibiotics. In these animal husbandry sectors, veterinarians' prescription patterns regarding these antibiotics that are of critical importance for public health also require further attention.

For the year 2014, the SDa expert panel will continue to apply the current benchmarking method, but it is discussing further refinements with the pig, veal and cattle farming sectors. The consultation processes will be completed before the end of 2014. 2013 was the first year for which the SDa analyzed delivery lines for turkey farms. The degree of coverage was almost 100% and of sufficient quality for inclusion in this report. The SDa used these data to determine provisional 2014 benchmark thresholds for turkey farms.

It is clear that monitoring and benchmarking are beginning to pay off. In light of all the changes that have occurred in the usage of antibiotics over the past few years, it is crucial to find out whether they have had an effect on the occurrence of resistant micro-organisms. The results of this analysis may show that the benchmark thresholds require updating. The SDa expert panel wants to explore this during the following period. In the course of 2015, this should lead to a monitoring and benchmarking system capable of further reducing the usage of antibiotics over the next few years. It is possible that sector-specific benchmarking methods will be introduced in the near future, in order to further reduce the public health risk of antibiotic resistance. The SDa expert panel intends to present its recommendations on this matter in late 2015.

Terms and definitions

Treatable kilograms	The number of kilograms of a particular type of livestock that, according to the package leaflet information, can be treated with a single mass unit of the antibiotic concerned.
$DDDA_{NAT}$	The 'Defined Daily Dose Animal' based on national antibiotic usage data. It is determined by first calculating the total number of treatable kilograms within a particular livestock sector for a specific year, and then dividing this number by the average number of kilograms of animal present within the livestock sector concerned. This measure is used to determine the amount of antibiotics used within a particular livestock sector, irrespective of the various types of livestock farms within the livestock sector concerned and any differences between these livestock farms. The $DDDA_{NAT}$ is used in other countries as well. It is similar to the parameter DDD per 1000 patient days used for people when multiplied by 1000/365. The $DDDA_{NAT}$ is expressed in DDDA/animal year (or DDDA/1000 animal days).
$DDDA_F$	The 'Defined Daily Dose Animal' based on the antibiotic usage data of a particular livestock farm. It is determined by first calculating the total number of treatable kilograms at a particular livestock farm for a specific year, and then dividing this number by the average number of kilograms of animal present at the livestock farm concerned. It reflects the amount of antibiotics used at a particular livestock farm level, and is used for benchmarking individual livestock farms. This is the measure used by the SDa since 2011 (see the Standard Operational Procedure for 'Calculation of ADDD/Y for antimicrobials'). The $DDDA_F$ data of all individual livestock farms within a particular livestock sector are used to determine the mean and the median (*unweighted*, all livestock farms contribute equally). The weighted mean of the $DDDA_F$ (weighted based on the value of the denominator, i.e. the number of kilograms of animal) is equall to the $DDDA_{NAT}$ based on all livestock farms within the livestock sector considered. The $DDDA_F$ is expressed in DDDA/animal year. In previous publications, this parameter was expressed in ADDD/Y.
ESVAC	European Surveillance of Veterinary Antimicrobial Consumption.
Mass balance	An equation for comparing the amount (in kilograms, kg) of an active substance sold as reported by the pharmaceutical industry with the reported used (in kg) of the active substance according to deliverance reports of veterinarians.
VBI	Veterinary Benchmark Indicator. The VBI is based on the distribution of the relative prescription ratio's. The Relative Prescription Ratio (RPR) is the animal-defined daily dosage of a livestock farm DDDAF divided by the corresponding action threshold for that livestock type

Introduction

The SDa has been monitoring the usage of antibiotics at livestock farms since 2011, by assessing the farms based on benchmark thresholds. Specific benchmark thresholds have been defined for the various livestock sectors and types of livestock farms. In the spring of 2014, the SDa also published a benchmarking method to be used for veterinarians. The data provided by the various livestock sectors enable the SDa to:

- provide extensive reports on developments in the usage of antibiotics in the Dutch livestock sector;
- define benchmark thresholds;
- compare collected data with the sales figures for antibiotics provided by the federation of the Dutch veterinary pharmaceutical industry (FIDIN);
- benchmark livestock farms and veterinarians.

Once analyzed, the data will also show whether a livestock farm's or veterinarian's usage of antibiotics has been persistently high for several years in a row.

This is the third year for which the SDa publishes usage data. Due to the increased amount of data available compared to previous years, a larger number of analyses and more informative analyses could be performed. The current report is therefore structured differently from previous reports.

- The main focus of the initial two reports was to provide information on the usage of antibiotics at the livestock farm level. At the time, not much was known about average usage and about how the usage data were distributed over the individual livestock farms within a particular livestock sector. In the previous reports, this information was illustrated by many tables and figures. As our insight into the subject matter has improved, other choices have now been made regarding the way in which the results should be presented in the report.
- As a result, the current report provides more information on developments in the usage of antibiotics over several years, and on analysis regarding persistently high usage. The report now also includes benchmarking of veterinarians. In short, the report now addresses a more diverse range of topics regarding the usage of antibiotics. In order for this not to affect the readability of the report, the presentation of key results had to be more concise than in previous years.
- Over the last few years, consultations with several livestock sectors were held to discuss changes to the livestock sector classification. It was proposed to make more or less homogenous groups of certain types of livestock farms, since this would result in more specific benchmark thresholds. The consultation process is still ongoing and will be concluded in 2014. It will lead to improved applicability of the benchmarking method, and will ensure that livestock farmers can no longer be assigned to the wrong benchmark zone. It will, however, complicate multi-year trend analysis. In light of this, a new measure was introduced that should facilitate better monitoring of trends at both the national and the livestock sector level.

- This report also looks at discrepancies between reported sales of antibiotics and usage of antibiotics according to delivery lines.

Trend analysis and benchmarking topics are addressed separately in this report. In addition, Dutch sales figures are now included in an analysis of the usage of antibiotics in kilograms and the number of treatable kilograms for the main livestock sectors. Furthermore, the appendices pertaining to individual livestock sectors have been scrutinized and simplified, and updated in accordance with the latest developments if necessary.

In 2013, the poultry farming sector switched from registering just the number of treatment days to registering and reporting of delivery lines. This means the DDDA can now be calculated, as was already common practice in the other livestock sectors. For 2013, both measures have been calculated and included, in order to facilitate comparisons over several years.

2013 was the first year for which turkey farming sector data were obtained. The expert panel also gained access to inventories regarding the usage of antibiotics at supply chain links supplying the broiler farming and laying farmer sectors. Given their low level of antibiotic use and the very limited usage of antibiotics that are of critical importance for public health, the expert panel suggests not to subject these types of livestock farms to detailed monitoring and reporting of usage data. The expert panel deems regular reporting (e.g. once every three years) by the sector itself to be sufficient.

In the final chapter of this report, the expert panel addresses future developments. The continued decrease in the usage of antibiotics means a fundamentally revised benchmarking method is needed from 2015 onwards. The new approach should be able to be used for the next four to five years without requiring too many adjustments.

Trends in the usage and sales of antibiotics

Two reporting methods are used to analyze trends in the usage and sales of antibiotics. Usage of antimicrobial agents is assessed based on all delivery lines for antimicrobial agents at livestock farms. These data are recorded by veterinarians and included in the database of the livestock sector concerned.

Sales figures are provided by the federation of the Dutch veterinary pharmaceutical industry (FIDIN). Differentiation of sales figures according to livestock sector is only possible to a very limited extent, while the delivery lines are of course differentiated according to livestock sector.

The Defined Daily Dose per Animal for an entire livestock sector in a particular year can be calculated by converting all deliveries within the livestock sector concerned to the number of kilograms of animal that can be treated with these deliveries, and by subsequently dividing this number of treatable kilograms by the average number of kilograms of animal present within that livestock sector in the year concerned. This parameter is called $DDDA_{NAT}$. It differs from the parameter $DDDA_{F}$, since the latter represents the DDDA for a particular farm (in previous reports referred to as ADDD/Y). $DDDA_{NAT}$ was selected as the general trend indicator for antibiotic consumption within the various Dutch livestock sectors over several years, and will be used in the next few years as well. This parameter is similar to the ones suggested by the European Medicines Agency as part of the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) project, and is in line with the MARAN data previously reported by LEI. From 2012 onwards, the livestock sectors (except for the broiler farming sector) have reported all delivery lines to the SDa. The broiler farming sector only reported part of the delivery lines in 2012, but it did report all delivery lines in 2013. This means that $DDDA_{NAT}$ trends for these livestock sectors can be analyzed from 2012 onwards. 2013 is the first year for which turkey farming sector usage data have been included. Trends for this livestock sector can be determined from next year onwards.

Number of animals and number of kilograms of animal present in the Netherlands

Data on the number of animals and animal weights in the Netherlands were provided by the Dutch Agricultural Economics Institute foundation (LEI). The broiler population was estimated based on data provided by Statistics Netherlands and on an average animal weight of 1 kg. Based on the average number of kilograms of animal present in the Netherlands, the $DDDA_{NAT}$/Y for the individual livestock sectors could be calculated.

Table 1. Live weight (x 1,000 kg) of agricultural livestock in the Netherlands from 2012 to 2013[*]

Livestock sector	2012	2013
Pig farming sector	710,688	710,802
Turkey farming sector	4,962	5,046
Broiler farming sector	43,846	44,242
Veal farming sector	162,056	176,882
Other cattle farming sectors	1,522,500	1,532,000

[*]Provided by LEI

The Statistics Netherlands data were compared to information on the numbers of animals provided by the livestock sectors. This information was then used to calculate the average live weight present (in kilograms). For none of the livestock sectors does the difference exceed 7%. With benchmarking within the livestock sectors becoming more specific year after year, in 2013 several livestock sectors were requested to supply data on the number of animals belonging to specific age groups. Such a change to the reporting method affects the animal weight calculated for the population. This is one of the reasons for using Eurostat/Statistics Netherlands data in multi-year trend analyses. The numbers of kilograms of animal calculated based on data from sector-specific databases closely resemble the Eurostat/Statistics Netherlands data. The $DDDA_{NAT}$ data calculated will therefore not be affected too much by discrepancies between animal weights according to Eurostat/Statistic Netherlands data on the one hand and animal weights based on data from sector-specific databases on the other.

Distribution of the usage of antibiotics over the various livestock sectors, total usage, and sales figures

Usage data were provided by the various livestock sectors. The delivery lines registered by the livestock sectors were used to calculate the total number of kilograms of active substances used within the individual livestock sectors, to enable completion of the mass balance (an equation for comparing the number of kilograms of an active substance sold with the reported number of kilograms of the active substance used). Reported use according to delivery lines amounted to 198,628 kg, while sales amounted to 209,420 kg.

Table 2. Distribution of the usage of antibiotics in kg over the various livestock sectors, total usage and sales figures in 2013, by group of antibiotics. [1]*Sales figures were provided by FIDIN*

	Usage according to delivery lines						Sales figures[1]
Group	Pig	Veal	Cattle	Broiler	Turkey	Total	
Amphenicols	484	1,967	1,122	0	1	3,575	3,616
Aminoglycosides	15	563	130	83	46	836	1,634
1st- and 2nd-gen. cephalosporins	0	0	26	0	0	26	87
3rd- and 4th-gen. cephalosporins	0	0	1	0	0	1	13
Quinolones	306	861	123	733	0	2,035	2,433
Fluoroquinolones	1	12	15	108	89	225	406
Macrolides/lincosamides	6,964	13,524	2,940	1,007	833	25,267	24,093
Penicillins	16,710	7,410	5,638	6,618	1,011	37,387	42,147
Pleuromutilins	446	0	0	3	0	449	1,153
Polymyxins	1,384	274	107	14	3	1,781	1,990
Tetracyclines	38,690	31,405	9,142	2,295	1,032	82,564	72,350
Trimethoprim/sulphonamides	20,715	8,995	6,038	2,821	332	38,902	53,019
Combinations of antibiotics	1,312	171	2,483	1,613	0	5,579	6,161
Other	0	0	0	0	0	0	137
Total	**87,029**	**65,181**	**27,763**	**15,294**	**3,360**	**198,628**	**209,240**

This highly specified division of antibiotics into pharmaco-therapeutic groups is also used when reporting on usage in terms of treatable kilograms. It is a more detailed specification than the one used for sales figures reporting. According to the sector-specific databases, the number of times an antibiotic was prescribed in 2013 amounted to a total of 802,379. These antibiotics were prescribed for 41,180 livestock farms in total. According to the delivery lines, the total number of kilograms of antibiotics prescribed amounted to 198,628. These delivery lines were associated with 6,588 pig farms, 2,125 veal farms, 770 broiler farms, 48 turkey farms, and 31,650 cattle farms. Of the delivery lines recorded, 19 resulted in an unlikely DDDA. Of those, 17 could be corrected (factor 100-1000 errors (see below)), en the 2 remaining delivery lines (0.00025%) were associated with two livestock farms. These livestock farms, together were responsible for 22 delivery lines, were excluded and their data were not used in the calculations.

Comparison of sales figures en veterinarians' delivery lines

In order to explain discrepancies between the amount of antibiotic consumed according to delivery lines and the sales figures for antibiotics (provided by FIDIN), both data sources were inspected. For the 2013 data, the differences between the registered number of kilograms of active substances sold and the registered number of kilograms consumed could be attributed to:

1. Antibiotics that stopped being marketed in the 2012-2013 period and were sold out in 2013 (the number of packages consumed exceeded the number of packages sold by approximately 100, resulting in approximately -26,000 kg for sales figures).
2. Antibiotics registered for use in companion animals and horses (resulting in approximately +6,300 kg for sales figures). For these antibiotics, the expert panel estimated the $DDDA_{NAT}$ for usage in companion animals. Usage in 2012 was estimated at 4 $DDDA_{NAT}$, which was quite similar to results from a sample survey of companion animal practices published at an earlier date (3.2 $DDDA_{NAT}$, based on a sample survey of 10% of veterinarian practices, Van Geijlswijk et al. 2013). For companion animal practices, this study found a substantial reduction to 2.7 $DDDA_{NAT}$ in 2013.
3. Products like dermal sprays and eye ointments, which are not included in DDDA calculations and are therefore not or no longer reported by most livestock sectors (resulting in +540 kg for sales figures).
4. Antibiotics that are also registered for use in rabbits (premix), sheep, goats and horses, which means that not all of these antibiotics sold are included in the delivery lines of the monitored livestock sectors (estimated to result in +30,000 kg for sales figures).
5. Decisions to increase or reduce stock levels (also at the wholesale level) affecting (to some extent) the mass balance.
6. Incorrect registration of the packs of antibiotics delivered. Such incorrect registrations were discovered and corrected 12 times for 2012 (2 livestock farms; 36 delivery lines in the cattle farming sector), and 17 times for 2013. As a result of factor 1000 errors (deliveries being expressed in grams, i.e. 3000, while the pack size was in fact 1 kg) occurring several times, differences due to these errors could easily have huge effects (+10.000 kg, now corrected). Furthermore, injection vials were sometimes prescribed in the number of milliliters the vials

contained (i.e. 100, 250; resulting in factor 100-250 errors). Delivery lines that clearly contained such errors were corrected. The same analysis was performed with the 2012 data. Incorrect registrations turned out to have caused the overestimation of antibiotic use observed last year (+5%). Following recalculation, it now is deemed to have been -9%, with consumption by agricultural livestock amounting to 226,588 kg and sales figures amounting to 248,531 kg.

7. So-called "spillage" due to damaged vials and packaging materials. For pricing purposes, an amount equal to 5% of costs is generally used to take account of this. It is not possible to simply calculate the corresponding number of kilograms of antibiotics based on this percentage, but it does give an idea of what is considered to be an acceptable damage-related margin.

The SDa expert panel is of the opinion that sales figures registration and delivery lines registration both have benefits as well as shortcomings as a method for monitoring usage of antibiotics at a national and livestock sector level. For the four main livestock sectors, the two registration methods (taking their shortcomings into account) are largely consistent.

Based on veterinary prescription drugs registrations, several products can be linked to a particular type of livestock. When comparing reported deliveries and sales of third- and fourth-generation cephalosporins, the first thing to notice is that a large proportion (90%) cannot be attributed to the four main livestock sectors. This is mainly due to usage of these agents in companion animals and horses, and maybe also to a minor extent to usage in other sectors not subject to monitoring. A very different picture emerges for fluoroquinolones: usage in companion animals is responsible for just 4% of the number of kilograms sold, and 45% cannot be attributed to the monitored livestock sectors and is likely to have been used in sectors not subject to monitoring, such as the rabbit farming sector, goat farming sector and horse sector. The expert panel therefore wants animal husbandry sectors within which a relevant amount of use is expected (the rabbit farming sector, goat farming sector, horse sector and possibly the companion animal sector) to be subjected to monitoring as well. Within these animal husbandry sectors, prescription patterns of veterinarians prescribing antibiotics that are of critical importance for public health should be assessed as well.

Trend analysis based on 2012-2013 delivery lines

First, the number of treatable kilograms of animal was calculated, based on the delivery lines. The results were then linked to the average number of kilograms of animal present in 2013, using LEI data. This was done for each type of livestock within the various livestock sectors in the Netherlands. This resulted in the livestock sector-specific $DDDA_{NAT}$ data included in the table below for 2012 and 2013.

The $DDDA_{NAT}$ table shows that in the pig farming sector, usage of antibiotics declined by about 30% compared to the 2012 level. Sow/piglet farms recorded a more pronounced reduction (37%) than pig fattening farms (23%) (see Table B1 in the appendices). The veal farming sector experienced a 15% reduction. Within the cattle farming sector, usage remained consistent. This was the case for both dairy cattle farms (with a $DDDA_{NAT}$ of 4.09 for 2012 and 2013, see appendices) and non-dairy cattle farms (with a $DDDA_{NAT}$ of 1.23 and 1.26 for 2012 and 2013, respectively). The broiler farming sector delivery lines for 2012 were incomplete.

Table 3. $DDDA_{NAT}$ data for 2012 and 2013, by livestock sector and group of antibiotics.

	Livestock sector							
	Pig farming sector		Veal farming sector		Cattle farming sector		Broiler farming sector	
	2012	2013	2012	2013	2012	2013	2012*	2013
Number of livestock farms with delivery lines	6,425	6,588	2,175	2,125	32,254	31,650	732	770
Amphenicols	0.06	0.09	1.19	1.11	0.05	0.07	-	-
Aminoglycosides	-	-	0.78	0.48	0.01	0.01	1.91	0.03
1st and 2nd generation cephalosporins	-	-	-	-	0.02	0.02	-	-
3rd and 4th generation cephalosporins	-	-	-	-	0.03	-	-	-
Quinolones	0.03	0.03	0.26	0.27	-	-	0.55	1.65
Combinations of multiple antibiotics	0.27	0.10	0.42	0.08	0.84	0.67	0.81	0.37
Fluoroquinolones	-	-	0.22	0.01	0.01	-	1.16	0.24
Macrolides/lincosamides	1.39	1.02	3.54	3.26	0.08	0.11	-	0.31
Penicillins	2.91	2.18	2.16	1.57	1.20	1.45	7.97	6.34
Pleuromutilins	0.35	0.12	-	-	-	-	-	-
Polymyxins	0.58	0.44	0.69	0.32	0.05	0.02	0.88	0.08
Tetracyclines	6.79	4.58	10.45	8.64	0.47	0.50	2.52	2.52
Trimethoprim/sulphonamides	1.92	1.40	2.67	1.68	0.19	0.19	2.02	1.46
Other	-	-	-	-	-	-	-	-
Total	**14.32**	**9.96**	**22.40**	**17.43**	**2.97**	**3.04**	**18.40**	**13.01**

**The 2012 broiler farming sector data are estimates based on the delivery lines available (about 60% of broiler farms had delivery line data for part of 2012), and on the 2012/2013 treatment days ratio. Differences in usage data between 2012 and 2013 may be somewhat confounded by a shift in treatment ages.*

In 2012, following recommendations by the SDa, the broiler farming sector was transitioning from a system based on treatment days to the ADDD/Y system. Based on the delivery lines available, 2012 usage was estimated at 18.4 $DDDA_{NAT}$, and based on treatment days, usage of antibiotics (in $DDDA_{NAT}$) decreased by 29.2%. The number of treatment days showed a 28.6% reduction. The weighted mean $DDDA_{NAT}$ for the four livestock sectors (pig, veal, broiler and cattle farming sectors) turned out to be 7.85 and 6.24 for 2012 and 2013, respectively (weighted based on animal weight per livestock sector). This corresponds to a 20.5% reduction between 2012 and 2013 for all four livestock sectors together.

Trend analysis and comparison to MARAN data

LEI used to publish reports on trends in the usage of antibiotics, and LEI's trend analyses were based on data from sample surveys of livestock farms within the individual livestock sectors (MARAN, 2013). The percentage change in antibiotic usage found for each of the samples was then translated into a value for the livestock sector as a whole by calculating a weighted mean. It was expressed in ADDD/Y. This parameter corresponds to the $DDDA_{NAT}$, as the two parameters are the result of similar calculation methods. We do, however, want to stress that LEI data are estimates based on samples and are therefore associated with a higher degree of uncertainty. The SDa, on the other hand, is provided with usage data for all livestock farms within the individual livestock sectors.

Previously, based on LEI data for the various livestock sectors (veal farming sector, pig farming sector (sow/piglet farms and pig fattening farms), cattle farming sector and broiler farming sector), the following reductions had been observed: 37% (veal farms, compared to 2007), 60% (sow/piglet farms, compared to 2009), 69% (pig fattening farms, compared to 2009), 45% (dairy cattle farms, compared to 2008), and 61% (broiler farms, compared to 2009). For the current report, LEI and SDa data have been combined to facilitate long-term trend analysis. LEI registration continued until well into 2012, and therefore shows some overlap with SDa data. Trend comparison shows systematic differences for some of the livestock sectors (see figures in the appendices). These differences are probably the result of sample effects in the LEI data or might be due to extrapolation of sample results to the livestock sector as a whole. The comparison data show that overall, the extent of the reduction in usage level varies per livestock sector. The expert panel has not attempted to quantify this finding, as that would have required further modeling of the results and would have been outside the scope of this report.

In 2013, most of the monitored livestock sectors experienced a further decrease in usage of third- and fourth-generation cephalosporins and fluoroquinolones, to a level close to zero. This has removed most of the concerns regarding usage of these antibiotics in the veal and poultry farming sectors that were expressed in 2013. Usage of third- and fourth-generation cephalosporins is restricted to the cattle farming sector. This usage amounted to almost 1.5 kg of active substances, used to treat a maximum of 830 dairy cows (0.05% of all dairy cows) with a single 3-day course of antibiotics. This seems to be a realistic minimum level to be expected within the boundaries of necessary veterinary care based on careful diagnosis and in accordance with the sector-specific professional guidelines.

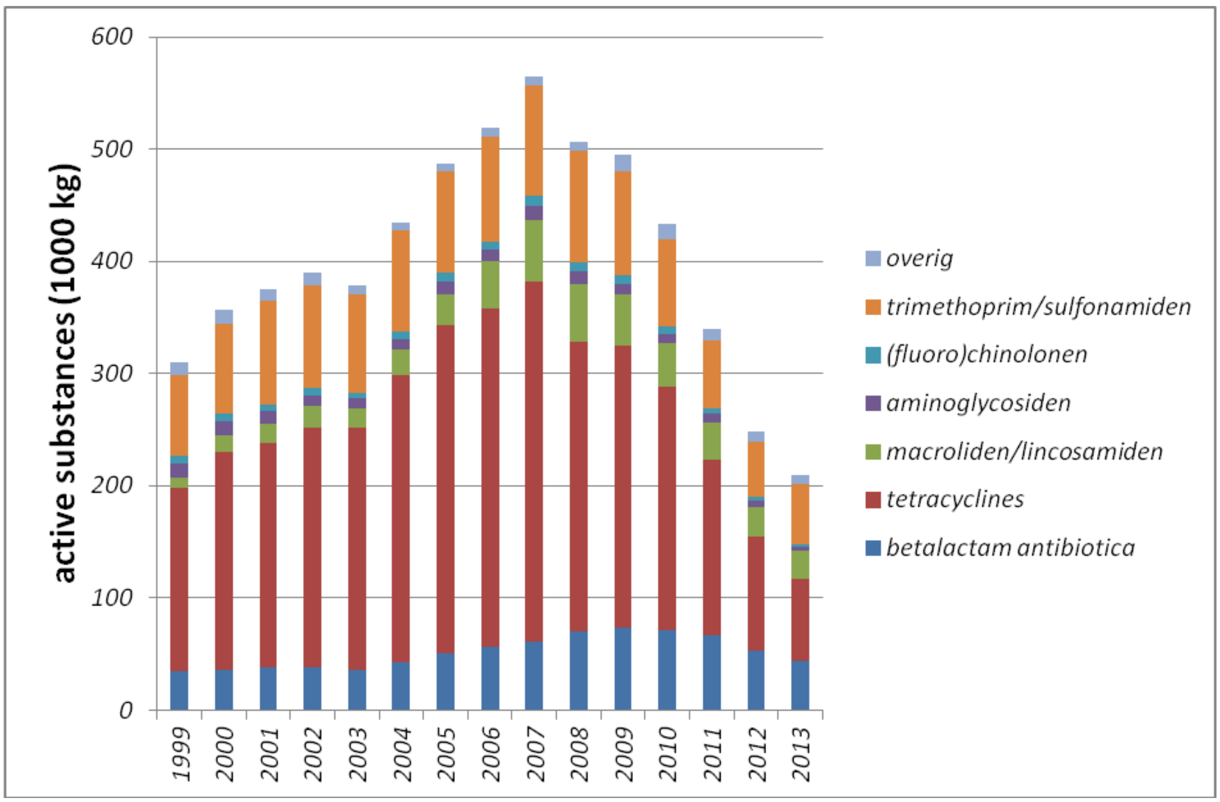
Sectors other than the four livestock sectors subject to monitoring are responsible for 45% of usage of fluoroquinolones. 88% of usage within the monitored livestock sectors occurs at turkey and broiler farms. In 2013, mean usage of fluoroquinolones in the broiler farming sector showed an 80% reduction, to 0.21 $DDDA_F$. No 2012 data for the turkey farming sector are available. According to analyses of the Dutch Animal Health Service (GD) performed at the request of the Dutch Product Board for Poultry and Eggs (PPE), mean usage has decreased by 40% compared to the 2012 level, to a current $DDDA_F$ of 1.33. A further decrease is required, something the poultry farming sector recognizes and is working towards.

Trend analysis based on national sales figures

Sales figures were provided by the federation of the Dutch veterinary pharmaceutical industry (FIDIN). They represent the number of kilograms of active substances sold, and are reported for the main pharmaco-therapeutic groups.

In 2013, sales of antibiotics for veterinary use continued to decline, to 209,240 kg. However, the speed by which sales decrease seems to level off. Compared to the 2012 level, sales decreased by 15.9%, while a decrease of over 25% was observed during the 2011-2012 period. Compared to 2009, used as the reference year by the Dutch government, sales decreased by 57.7%.

Figure 1. Developments in sales of antimicrobial veterinary prescription drugs between 1999 and 2014, in number of kilograms of active substances (x1000) (source: FIDIN), by main pharmacotherapeutic group.



Usage of antibiotics that are of critical importance for public health in agricultural livestock continued to decline. Looking at the number of kilograms of active substances sold, the main development during the 2012-2013 period was a marked decrease in sales of all third-choice antibiotics: a 76% reduction for third- and fourth-generation cephalosporins, and a 50% reduction for fluoroquinolones. Of the antibiotics also considered to be of critical importance for public health and the veterinary prescription drugs that are to be phased out (Health Council of the Netherlands report 2011), aminoglycosides were the ones recording the most prominent reduction in sales (a 40% reduction). The monitored livestock sectors account for 50% of aminoglycoside usage, and the companion animal and horse sectors are thought to account for 25% of usage. The remaining 25% is probably used in livestock sectors not subject to monitoring. Colistin usage decreased by 35%. The livestock sectors not subject to monitoring are likely to account for 10% of colistin usage. Sales increased in the case of the first-choice antibiotics florfenicol (an 18% increase) and combinations of sulphonamides/trimethoprim (a 9% increase, now holding second place in antibiotic therapy), and in the case of the second-choice antibiotics first- and second-generation cephalosporins (a 10% increase) and quinolones (a 7% increase).

Tetracyclines still are the most commonly used group of antibiotics, even though sales dropped by 29,000 kg, accounting for 75% of the total decrease in sales. A remarkable development was the shift in doxycycline's share in tetracycline sales: its share increased to 41% during the 2011-2012 period, but decreased to 31% between 2012 and 2013. As doxycycline is more potent than other tetracyclines, this reduction in the number of kilograms sold has a relatively bigger effect on the total reduction in exposure than reductions in sales of other tetracyclines. Furthermore, this shift could indicate a shift from agents administered orally (in part used for flock/herd treatment) to agents administered parenterally to individual animals. After all, doxycycline can only be administered orally, while the other tetracyclines can be injected as well.

Penicillins had to give up their second-place spot and now hold third place in antibiotic therapy. The meaning of this sentenc was not clear. The sentence is changed into: From the total *of* penicillins sold, the key representatives (90%) of this group are amoxicillin, ampicillin and benzylpenicillin, of which amoxicillin is about 40%.

Benchmarking livestock farms

Following calculations and consultation, a previously proposed subdivision of the cattle farming sector was adopted. As a result, a distinction is now made between four types of cattle farms: dairy cattle farms, rearing farms, suckler cow farms and beef farms.

2013 was the first year in which delivery lines were provided for all of the broiler farms. The data were used to calculate each farm's annual DDDA. Subsequently, provisional benchmark indicators were determined for the broiler and turkey farming sectors. The benchmark thresholds for the broiler farming sector are based on the distribution of the $DDDA_F$ data.

Defined Daily Dose Animal and benchmark thresholds

The 2013 mean, median and 75th percentile show a distinct downwards trend compared to the corresponding 2011 and 2012 parameters (see appendices for a detailed overview of the 2011 and 2012 data). The number of rosé combination farms decreased during the 2012-2013 period (by 12%). Most of these rosé combination farms moved to the rosé veal starter category. This shift resulted in the $DDDA_F$ for rosé combination farms decreasing by half.

Table 4. Annual Defined Daily Dose Animal ($DDDA_F$) for the four livestock sectors and the various types of farms in 2013. Provided parameters are the mean, median (50th percentile), 75th percentile and 90th percentile.

Type of livestock	Type of farm	N	Mean	Median	P75	P90
Veal calves	White veal farms	862	28.3	23	31.3	39.4
	Rosé veal starter farms	264	108	75	93.4	119.3
	Rosé veal fattening farms	723	4.9	1.4	5.1	10.1
	Rosé combination farms	276	10.8	9.4	15.1	21.8
Pigs	Sow/piglet farms	2,085	10.9	6.3	13.2	23.1
	Pig fattening farms	4,991	5.7	3.0	7.9	13.6
Poultry	Broiler farms	770	11.5	8.8	17.7	26.6
	Turkey farms	48	21.9	18.5	30.8	41.6
Cattle	Dairy cattle farms	18,005	2.8	2.8	3.8	4.7
	Rearing farms	472	1.0	0	0.2	2.3
	Suckler cow farms	9,857	0.7	0.1	0.8	2.2
	Beef farms	3,316	1.6	0	0.6	3.9

For the broiler farming sector, analyses of the number of treatment days were performed as well. This was done to facilitate comparison with previous years. In 2013, the mean number of treatment days for the 770 broiler farms was 14.7, with a median of 12.9 and a 75th percentile of 22.5. This represents a clear decrease compared to the 2012 parameters. In 2012, the mean number of treatment days/y was 19.9, with a median and 75th percentile of 17.1 and 29.8 treatment days/y, respectively.

The reported turkey sector data are based on the flocks delivered in 2013. This means that the data also include the 2012 deliveries used for these flocks, while deliveries in the final months of 2013 for flocks not delivered in 2013, will be reported in 2014. These shifts are not expected to affect the reported parameters. Within the turkey sector, a considerable amount of $DDDA_F$ variation was observed.

The 2013 DDDA data were compared to the 2013 benchmark thresholds set at an earlier date. To facilitate interpretation, the benchmark thresholds are provided below. The cattle farming sector benchmark thresholds are still provisional.

Table 5. Signaling and action thresholds for the various livestock sectors and types of farms for 2013, based on the $DDDA_F$.

Type of livestock	Type of livestock farm	Signaling threshold	Action threshold
Veal calves	White veal farms	23	39
	Rosé veal starter farms	67	110
	Rosé veal fattening farms	1	6
	Rosé combination farms	12	22
Pigs	Sow/piglet farms	10	22
	Pig fattening farms	10	13
Poultry	Broiler farms	15	30*
Cattle	Dairy cattle farms	3	6
	Rearing farms	*1*	2
	Suckler cow farms	*1*	2
	Beef farms	*1*	2

*The previous benchmark thresholds in treatment days were 17 and 34 treatment days/year, respectively, determined based on the 2013 median and 75th percentile.

Distribution of livestock farms over the benchmark zones

For each livestock sector and type of livestock farm it was estimated how many of the livestock farms would fall within the various benchmark zones based on the benchmark thresholds determined earlier. For turkey farms, the median and the 75th percentile were used as tentative benchmark indicators for the $DDDA_F$ determined for the farms concerned (19 and 31, respectively). This meant that, by definition, 25% of turkey farms fell within the action zone and another 25% fell within the signaling zone. Changes over the years were also analyzed. Comprehensive tables with year-specific data are included in the appendices.

Table 6. Distribution of livestock farms over the various benchmark zones in 2013.

Type of livestock	Type of livestock farm	Target zone n (%)	Signaling zone n (%)	Action zone n (%)
Veal calves	White veal farms	418 (48%)	354 (41%)	90 (10%)
	Rosé veal starter farms	102 (39%)	128 (48%)	34 (13%)
	Rosé veal fattening farms	330 (46%)	241 (33%)	152 (21%)
	Rosé combination farms	165 (60%)	84 (30%)	27 (10%)
Pigs	Sow/piglet farms	1,366 (66%)	495 (24%)	224 (11%)
	Pig fattening farms	4,126 (83%)	322 (6%)	543 (11%)
Poultry	Broiler farms	528 (68%)	193 (25%)	50 (6%)
	Turkey farms	24 (50%)	12 (25%)	12 (25%)
Cattle	Dairy cattle farms	9,956 (55%)	7,575 (42%)	474 (3%)
	Rearing farms	395 (84%)	27 (6%)	50 (11%)
	Suckler cow farms	2,666 (80%)	184 (6%)	466 (14%)
	Beef farms	7,705 (78%)	1,027 (10%)	1,125 (11%)

When interpreting the data included in the table above, the following should be taken into account. The veal farming sector adjusted the way in which veal farms are categorized in 2012, and the poultry sector transitioned from the use of treatment days to DDDA-based benchmarking. For all livestock sectors and types of livestock farms except the cattle farming sector and pig fattening farms, the benchmark thresholds were derived from the median and 75th percentile. For the cattle farming sector, the median and 90th percentile were used. Despite these differences, however, several distinct trends emerged.

Table 7. Shifts in the proportion of livestock farms in the various benchmark zones between 2011 and 2013.

Type of livestock	Type of livestock farm	Target zone %			Signaling zone %			Action zone %		
Year		2011	2012	2013	2011	2012	2013	2011	2012	2013
Veal calves	White veal farms	31	33	49	44	50	41	25	17	10
	Rosé veal starter farms	33	36	39	42	48	48	25	16	13
	Rosé veal fattening farms	48	38	46	27	33	33	25	29	21
	Rosé combination farms	-	-	60	-	-	30	-	-	10
Pigs	Sow/piglet farms	53	56	66	24	24	24	23	20	11
	Pig fattening farms	74	77	83	16	16	6	10	7	11
Poultry	Broiler farms	47	52	68	30	31	25	23	17	6
Cattle	Dairy cattle farms	-	56	55	-	40	42	-	4	3
	Rearing farms	-	81	83	-	3	6	-	16	11
	Suckler cow farms	-	82	80	-	8	6	-	10	14
	Beef farms	-	-	79	-	-	10	-	-	11

The number of livestock farms within the action zone decreased substantially for all of the livestock sectors. The developments in the number of livestock farms in the signaling zone are more diverse:

- For all four types of veal farms, 40-61% have a usage level exceeding the signaling threshold (which means they fall within the signaling or action zone). While the number of farms within the action zone decreased, the number of farms within the signaling zone did not decrease or decreased only slightly, even though the signaling and action thresholds for white veal and rosé veal starter farms are quite far apart. A positive exception are the rosé combination farms, with a large number of farms (60%) in the target zone. The expert panel has voiced some concerns about how developments in the distribution of veal farms over the various benchmark zones will compare to those in the other livestock sectors in the long term. In time, the veal farming sector will have to realize further reductions, resulting in a considerable increase in the number of veal farms in the target zone.
- The table shows that 66% to 83% of pig and broiler farms are within the target zone. The number of farms within the action and signaling zones combined has decreased substantially over the past few years. The figures for pig fattening farms do present a somewhat rosy picture of the developments, however, as the action threshold for these farms initially was not based on the 75th percentile. The expert panel is considering adjustment of the action threshold for pig fattening farms.
- Usage at rearing farms, suckler cow farms and beef farms is low, with about 80% of farms or more falling within the target zone. At first glance, the reduction in antibiotic usage at dairy cattle farms may appear to be a bit stagnant, as dairy cattle farms are the ones with the lowest target zone percentage. However, the fact that at dairy cattle farms antibiotics are generally used for individual treatment rather than herd treatment should be taken into account. Dairy cattle farms, even the ones within the action zone, show relatively little variation in usage levels, and this is likely to decrease even further during the next benchmarking period, because of new guidelines promoting selective application of dry-cow (intra-mammary) antibiotics. The expert

panel wants to wait and see how the introduction of the guideline on usage of dry-cow antibiotics will affect usage levels in 2014 and only then decide on possible revision of the benchmark thresholds. The expert panel already decided to base the cattle farming benchmark thresholds on the 90th percentile of the $DDDA_F$ distribution rather than on the 75th percentile used for the other livestock sectors.

- The pig and veal farming sectors have now been monitored for three consecutive years. The number of livestock farms falling within the action zone during all three years amounted to only 4.1% for the pig farming sector, and 2.8% for the veal farming sector. Persistently high usage levels (exceeding the action threshold) do not seem to be a problem at the moment. Reconsideration of the relevance of developing additional measures specifically for persistent high users is therefore called for.

In short, it turns out that in general, the number of livestock farms within the action zone has decreased. The results regarding the number of livestock farms within the target and signaling zones are more varied. In the pig and broiler farming sectors, over two-thirds of the livestock farms fall within the target zone. Developments towards an increase in the number of farms in the signaling and target zones were observed in the veal farming sector as well, but they are not as pronounced. These developments indicate that veal farms within the signaling zone require more attention if the veal farming sector wants to further reduce its usage of antibiotics in the next few years. Although the cattle farming sector is characterized by a low level of antibiotic use, the number of cattle farms in the signaling zone is relatively high. The use of alternative benchmark thresholds for this livestock sector is being considered.

Benchmarking veterinarians

Following the introduction of the benchmarking method for veterinarians in March of 2014, the 2013 data were analyzed and compared to 2012 data. As veterinarians were only informed of their benchmarking results in 2014, it is too early to expect any positive effects of the introduction of the Veterinary Benchmark Indicator (VBI). After all, prior to the introduction of the VBI veterinarians could not compare their own prescription patterns to those of their colleagues. Any observed shifts in prescription patterns were most likely due to changes at the livestock farm level, as a result of measures taken by livestock farmers and their veterinarians.

According to the databases with 2013 data, one-to-one relationships were registered for 1,529 veterinarians. A limited number of livestock farms (<40) had registered more than one one-to-one relationship with a veterinarian; these farms were not included in the analysis. This represents an increase in the number of veterinarians with whom there were one-to-one relationships of 319 (26%) compared to the previous year. At the time of preparing this report, the proportion of livestock farms without a registered one-to-one relationship with a veterinarian varied from just 1% (broiler farming sector) to 11% (pig farming sector) and 16% (cattle farming sector). At many of these livestock farms, no antibiotics had been prescribed, which meant that no registered one-to-one relationship was required under the legislation on veterinary prescription drugs only to be administered by a veterinarian (so-called 'UDD' products). This requires further consideration, since proper registration of one-to-one relationships is essential for successful benchmarking of veterinarians.

The proportion of veterinarians in the action zone differs for the various types of livestock: veal calves 8%, pigs 5%, broilers 0%, and cattle 2%. These differences between the various types of livestock are similar to the pattern observed in 2012. They can be attributed to differences in usage levels between individual farms within the various livestock sectors, and to differences in the benchmark thresholds the SDa defined for the various types of livestock and farms in 2012.

Table 8. Number of veterinarians per benchmark zone, by livestock sector; specified for veterinarians responsible for several farms per livestock sector and for veterinarians responsible for a single farm per livestock sector.

	Number of veterinarians with several farms per livestock sector who fall within the target, signaling or action zone based on their Veterinary Benchmark Indicator (VBI), by livestock sector			Number of veterinarians with a single farm per livestock sector who fall within the target, signaling or action zone based on the usage level of the farm concerned, by livestock sector		
Livestock sector	**Target**	**Signaling**	**Action**	**Target**	**Signaling**	**Action**
	≤0.10	**(0.10<VBI≤0.30)**	**(VBI>0.3)**	-	-	-
Veal farming sector	65	73	11	32	18	5
Pig farming sector	218	223	23	44	4	3
Broiler farming sector	37	24	0	14	2	0
Cattle farming sector	313	377	14	23	4	2

These percentages may change following revision of the benchmark thresholds to be used for livestock farms. The number of veterinarians within the action zone decreased from 9.6% in 2012 to 3.8% in 2013.

Future benchmark thresholds

Recategorization of the livestock sectors

Pig farming sector

In late 2013 and early 2014, consultations with the pig farming sector took place to discuss a subdivision into more homogenous groups of pig farms and age group-specific benchmarking. The consultation process is still ongoing. The pig farming sector agreed to conclusion of the decision-making process in mid-2014, to enable application of the new benchmarking method in 2015.

Poultry farming sector, including turkey farms

2013 was the first year for which delivery lines for broiler and turkey farms were provided. For both broiler and turkey farms, new benchmark thresholds have been proposed for the 2013-2014 period. The proposed thresholds are based on the 50th and 75th percentiles of the 2013 data. The original benchmark thresholds for broiler farms were based on the number of treatment days. When converted to $DDDA_F$, they represent signaling and action thresholds of 15 and 30, respectively. For turkey farms, the $DDDA_F$ signaling and action thresholds are 19 and 31 DDDA/Y, respectively.

Cattle farming sector

Provisional benchmark thresholds have been defined for the cattle farming sector. This sector (in particular dairy cattle farms) differs from the other livestock sectors due to the high proportion of individual treatments. There is little variation between the various types of cattle farms (rearing farms, suckler cow farms, beef farms). The expert panel is aware of the fact that the presence of different age groups can make it difficult to properly interpret a farm's DDDA. This may result in a farm being assigned to an incorrect benchmark zone. For example, the presence of young stock at a dairy cattle farm can affect the farm's total usage level. According to sensitivity analysis estimates, 100 to 150 livestock farms will be assigned to a lower usage level zone than appropriate. The expert panel will consult with the cattle farming sector in order to improve the benchmarking method for dairy cattle farms. A possible solution might be to adjust the way in which usage of antibiotics is registered or calculated. For the other types of cattle farms, the expert panel uses the same benchmark thresholds. The expert panel intends to come to an agreement with the cattle farming sector regarding the various types of cattle farms in the second half of 2014.

The SDa expert panel proposes to base the 2014 signaling threshold for dairy cattle farms on the 80th percentile. The action threshold shall remain the same (90th percentile of the 2012 data).

Table 9. Signaling and action thresholds for the various types of cattle farms for 2014, based on the DDDA$_F$.

Type of livestock	Type of livestock farm	Signaling threshold	Action threshold
Cattle	Dairy cattle farms	*4*	**6**
	Rearing farms	*1*	**2**
	Suckler cow farms	*1*	**2**
	Beef farms	*1*	**2**

Veal farming sector

The decision-making process regarding the different types of veal farms has already come to an end. A shift from annual benchmarking towards herd-based (and therefore cycle-based) benchmarking is still being discussed, however, as is the application of growth charts. Although these topics are quite difficult to reach a consensus on, the expert panel intends to conclude the decision-making process before the end of 2014.

Towards new, 'future-proof' benchmark thresholds

In 2011, the SDa expert panel defined pragmatic benchmark thresholds based on the distribution of livestock farms' antibiotic usage data. As usage levels have decreased over the last few years, revision of the benchmark thresholds is called for. After all, due to the reduction in the usage that has already been achieved, the current thresholds are losing their discriminatory power. By adjusting the benchmark thresholds in line with current lower usage levels, prescription patterns will continue to improve. It is also important to better address the causes of structural differences in usage levels between the various livestock sectors. We should determine what can be done to intervene in the event of such structural differences. When reviewing the benchmark thresholds, development of antibiotic resistance during the period of decreasing usage levels should also be taken into account. If development of resistance to antibiotics is taken into consideration when defining new benchmark thresholds, a sector-specific benchmarking method seems to be the most likely option for the next few years. The expert panel will present its recommendations on this matter in the course of 2015.

The expert panel also wants to address certain technical aspects of the benchmarking procedure. Over the past few years, benchmarking has become more accurate by subdividing several livestock sectors into different types of livestock farms. Although this limits the number of livestock farms being assigned to an incorrect benchmark zone, it cannot truly account for the high level of heterogeneity within the livestock sectors and the fact that on certain types of livestock farms, animals in different age groups may be present. An additional complication for all of the livestock sectors is the fact that a livestock farm may include animals not belonging to the target species for the type of antibiotic used. This may lead to incorrect classification of livestock farms. If usage levels continue to decline, it is therefore necessary to find out how often livestock farms are actually being assigned to the correct benchmark zone. Although the expert panel intends to consider revising the benchmarking method, it shall only implement such a change if, following consultation with the livestock sectors and possibly external experts as well, an alternative approach is shown to provide clear benefits over the current benchmarking method.

The SDa expert panel is of the opinion that any revision of the benchmarking method should remain valid for the next 4 to 5 years and should offer the livestock sectors a sense of certainty as to where they stand.

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Appendices

Table A1. $DDDA_{NAT}$ data for the pig farming sector as a whole, the two types of pig farms, and the dairy farming sector. These additional analyses were conducted to facilitate comparison with LEI WUR MARAN data.

	Livestock sector							
	Pig farming sector		Sow/piglet farms*		Pig fattening farms*		Dairy farming sector**	
Number of livestock farms with delivery lines	6,425	6,713	2,338	1,345	4,628	5,378		
Group	2012	2013	2012	2013	2012	2013	2012	2013
Amphenicols	0.06	0.09	0.05	0.09	0.07	0.10	0.04	0.05
Aminoglycosides	-	-	0.00	0.00	0.00	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	-	-	0.00	0.00	0.00	0.00	0.04	0.03
3rd- and 4th-generation cephalosporins	-	-	0.00	0.00	0.00	0.00	0.05	0.00
Quinolones	0.03	0.03	0.05	0.05	0.01	0.02	0.00	0.00
Fluoroquinolones	-	-	0.00	0.00	0.00	0.00	0.01	0.00
Macrolides/lincosamides	1.39	1.02	1.57	0.97	1.24	1.07	0.06	0.05
Penicillins	2.91	2.17	5.14	3.44	0.99	1.06	1.85	2.19
Pleuromutilins	0.35	0.12	0.65	0.09	0.10	0.14	0.00	0.00
Polymyxins	0.58	0.44	1.07	0.79	0.17	0.14	0.05	0.02
Tetracyclines	6.79	4.58	6.14	3.69	7.35	5.36	0.48	0.49
Trimethoprim/sulphonamides	1.92	1.40	2.26	1.77	1.63	1.07	0.21	0.23
Combinations of multiple antibiotics	0.27	0.10	0.45	0.14	0.12	0.07	1.30	1.01
Other	-	-	-	-	-	-	-	-
Total	**14.32**	**9.96**	**17.39**	**11.03**	**11.68**	**9.02**	**4.09**	**4.09**

*Number of kilograms of animal estimated based on 2013 animal data provided by the pig farming sector.

**Number of kilograms of animal estimated based on data provided by Statistics Netherlands: 924,600 and 958,20 x 1000 kg, respectively.

Figure A1. Animal-defined daily dosages for the veal farming sector from 2007 as reported by LEI WUR (in DD/AY, MARAN data) and the SDa (in $DDDA_{NAT}$).

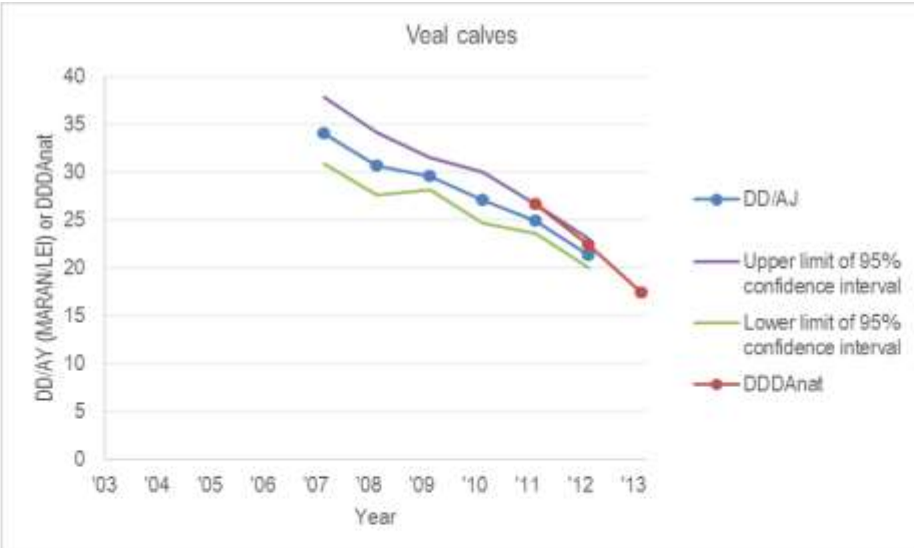


Figure A2. Animal-defined daily dosages for the dairy farming sector from 2004 as reported by LEI WUR (in DD/AY, MARAN data) and the SDa (in $DDDA_{NAT}$).

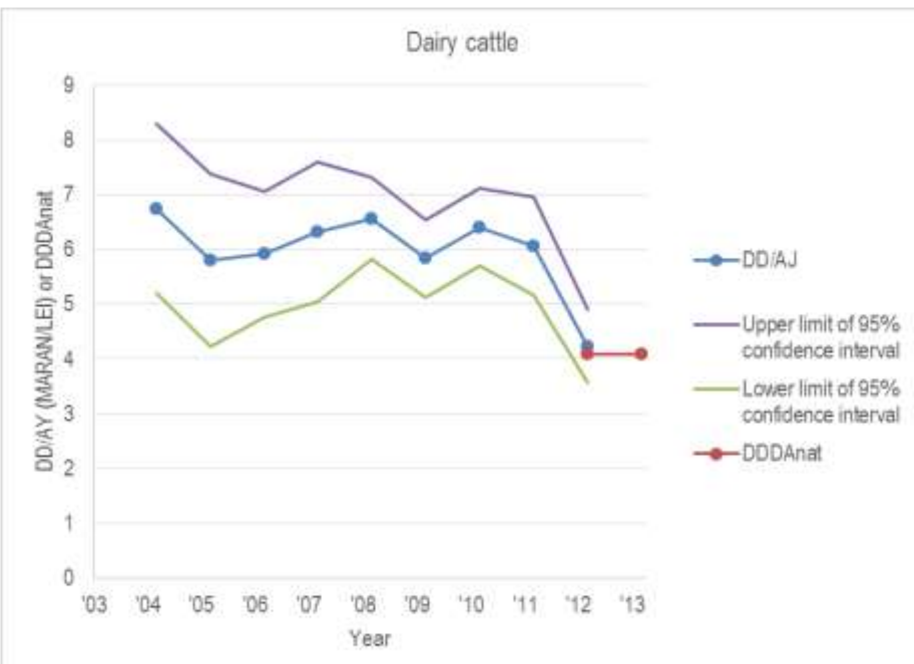


Figure A3. Animal-defined daily dosages for sow/piglet farms from 2004 as reported by LEI WUR (in DD/AY, MARAN data) and the SDa (in $DDDA_{NAT}$). Population data were provided by the pig farming sector.

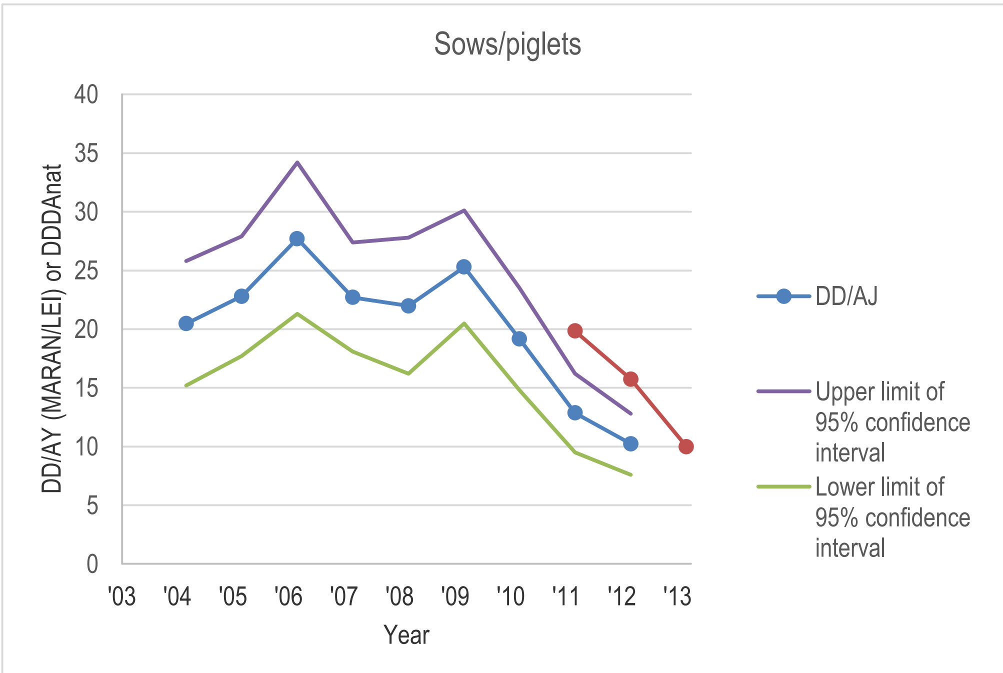


Figure A4. Animal-defined daily dosages for pig fattening farms from 2004 as reported by LEI WUR (in DD/AY, MARAN data) and the SDa (in $DDDA_{NAT}$). Population data were provided by the pig farming sector.

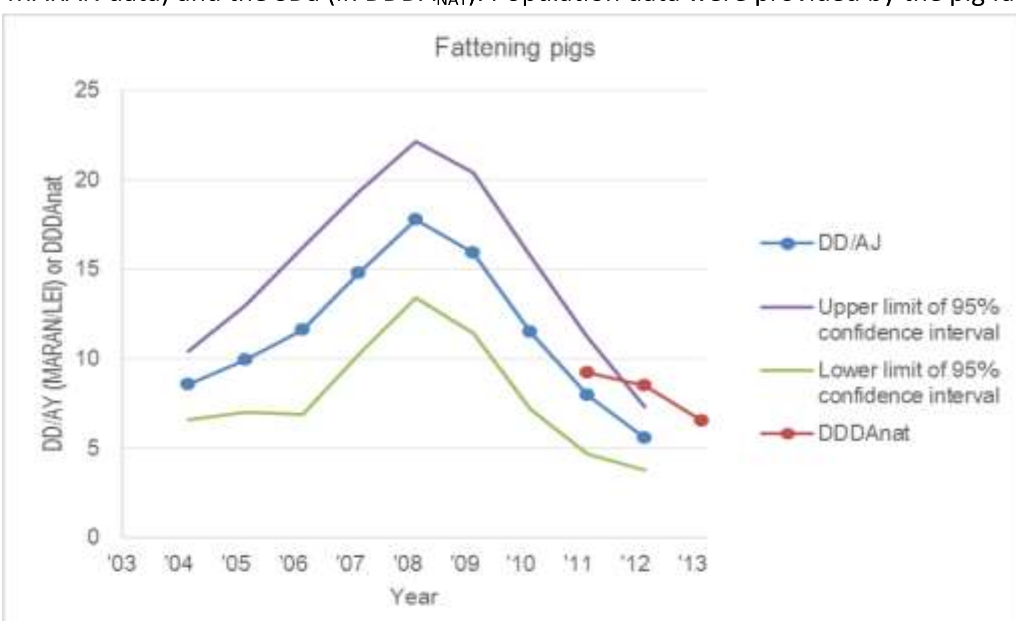


Figure A5. Animal-defined daily dosages for the broiler farming sector from 2004 as reported by LEI WUR (in DD/AY, MARAN data) and the SDa (in $DDDA_{NAT}$).

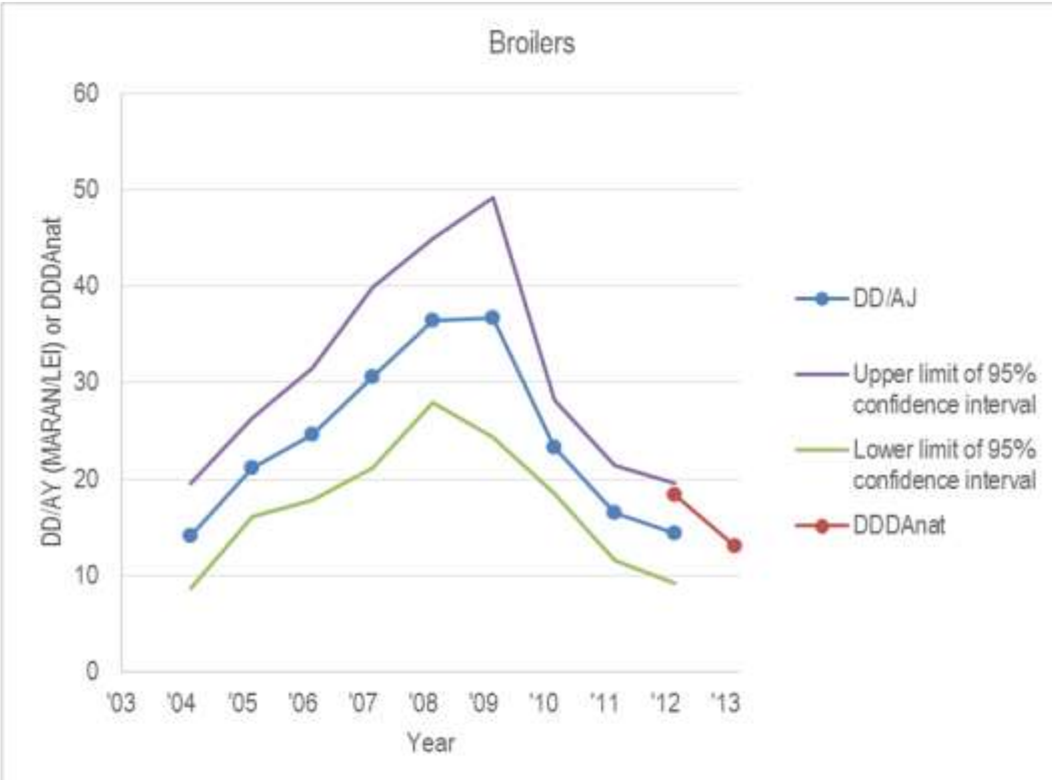


Table A2. Number of agricultural livestock (x 1,000) from 2002 to 2013 in the Netherlands, based on data provided by Eurostat and Statistics Netherlands (CBS).

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Piglets (<20 kg)	4,225	3,896	4,300	4,170	4,470	4,680	4,555	4,809	4,649	4,797	4,993	4,920
Sows	1,140	1,052	1,125	1,100	1,050	1,060	1,025	1,100	1,098	1,106	1,081	1,095
Fattening pigs	3,913	3,934	3,850	3,830	4,040	4,010	4,105	4,099	4,419	4,179	4,189	4,209
Other types of pigs	1,876	1,883	1,865	1,900	1,660	1,960	2,050	2,100	2,040	2,021	1,841	1,789
Turkeys	1,451	1,112	1,238	1,245	1,140	1,232	1,044	1,060	1,036	990	827	841
Other types of poultry	102,200	80,120	86,776	94,220	93,195	94,479	98,184	98,706	102,585	98,253	96,268	98,587
Of which broilers account for	Unknown	50,937	50,127	54,660	42,289	44,262	44,496	41,914	43,352	44,358	43,285	44,748
Veal calves	692	748	775	813	824	860	913	886	921	919	940	1,026
Other types of cattle	3,088	2,986	2,984	2,933	2,849	2,960	3,083	3,112	3,039	2,993	3,045	3,064
Sheep	1,300	1,476	1,700	1,725	1,755	1,715	1,545	1,091	1,211	1,113	1,093	1,074

Table A3. Sales figures for antibiotics for therapeutic use in animals (in kg x 1,000) from 1999 to 2013.

year	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13
betalactams	35	36	38	38	36	43	51	57	61	70	73	71	66	54	45
tetracyclines	162	194	200	214	216	256	292	301	321	257	251	217	157	102	72
macrolides en lincosamides	10	15	17	19	17	23	28	42	55	52	46	39	34	26	25
aminoglycosides	13	12	11	10	9	9	11	11	12	11	10	8,6	7,3	5,8	3,4
(fluoro)quinolones	7	7	6	6	5	7	8	7	9	8	8	6,6	5,1	3,1	2,8
trimethoprim /sulfonamides	72	80	92	92	88	91	91	93	99	100	92	78	58	48	53
other	11	12	11	11	7	6	6	8	8	7	15	13	10	10	8,1
Total therapeutic sales	310	356	376	390	378	434	487	519	565	506	495	433	338	249	209

[1] supplied by the federation of the Dutch veterinary pharmaceutical industry (FIDIN)

Table A4. Mean, median and 75th percentile of antibiotic usage (in $DDDA_F$) for the four main livestock sectors, by type of livestock farm.

Livestock sector	Type of livestock farm	Number of livestock farms N			Mean			Median			P75		
		2011	2012	2013	2011	2012	2013	2011	2012	2013	2011	2012	2013
Veal farming sector	White veal farms	934	904	862	35.6	29.6	28.3	28.6	27.2	23.4	38.9	34.8	31.3
	Rosé veal starter farms	207	189	264	105.4	90.7	108.5	83.2	78.9	75.4	110	99.7	93.4
	Rosé veal fattening farms	671	717	723	5.2	5.6	4.9	1.2	2.2	1.4	6.0	7.2	5.1
	Rosé combination farms	313	365	276	29.9	20.4	10.8	15.7	12.4	9.4	26.2	22.2	15.1
Pig farming sector	Sow/piglet farms	2,528	2,338	2,085	17.6	14.6	10.9	9.8	9.5	6.3	21.6	20.0	13.2
	Pig fattening farms	5,531	4,628	4,491	10.2	9.2	5.7	3.6	4.6	3	11.5	11.1	7.9
Poultry farming sector	Broiler farms*	732	762	770	23.8	19.9	14.7	20.9	17.1	12.9	34.1	29.8	22.5
Cattle farming sector	Dairy cattle farms	-	18,053	18,005	-	2.9	2.8	-	2.7	2.8	-	3.7	3.8
	Rearing farms	-	2,274	472	-	1.1	1	-	0	0	-	0.02	0.2
	Suckler cow/beef farms	-	11,927	-	-	0.8		-	0	-	-	0.6	-
	Suckler cow farms	-	-	9,857	-	-	0.7	-	-	0.1	-	-	0.8
	Beef farms	-	-	3,316	-	-	1.6	-	-	0	-	-	0.6

* In number of treatment days per year

Figure A6. Sales of antibiotics in 2011, 2012 and 2013, by class of antibiotics.

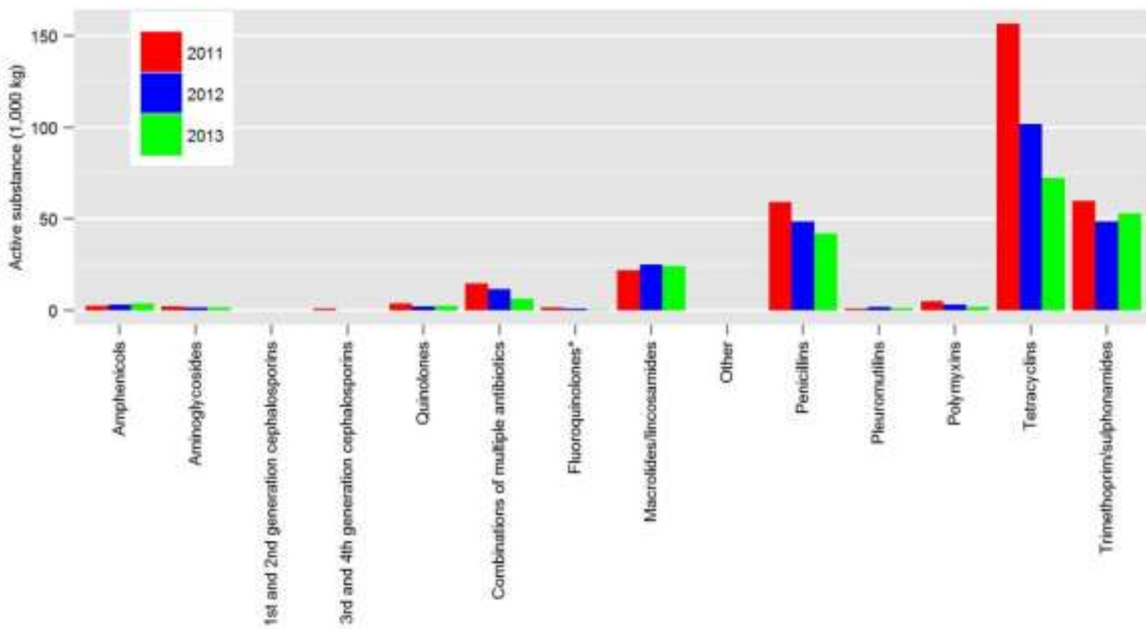
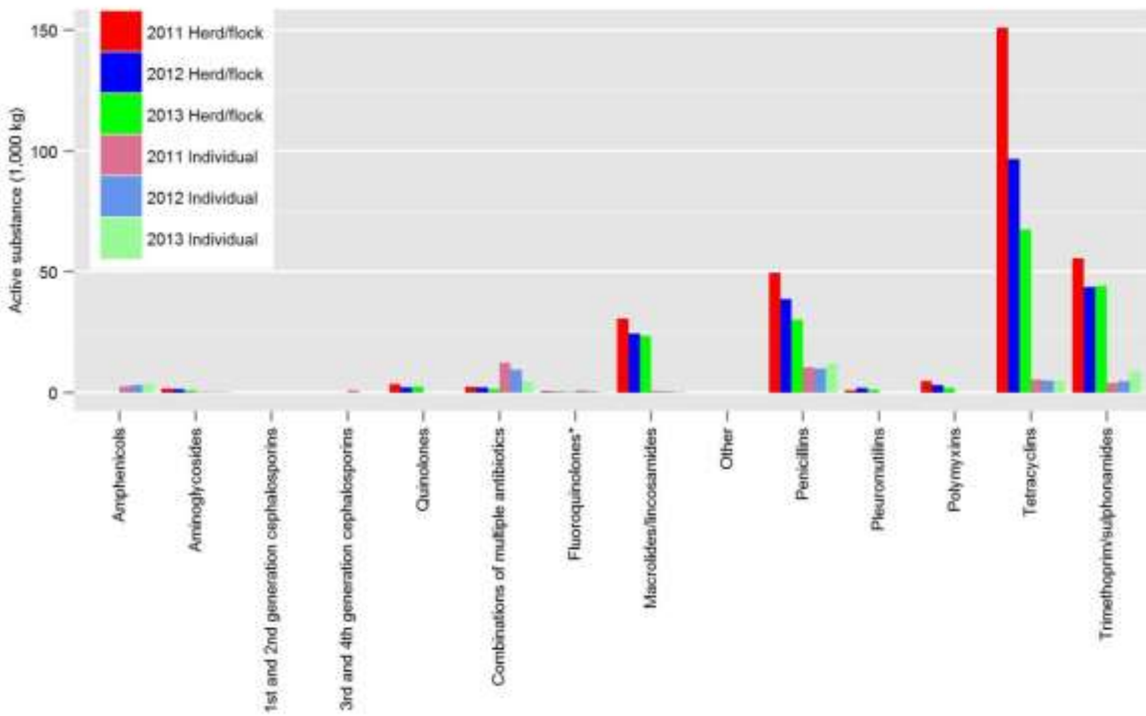


Figure A7. Sales of antibiotics used for flock/herd treatment or individual treatment in 2011, 2012 and 2013, by class of antibiotics.



Usage of antibiotics in $DDDA_F$ in veal calves

White veal calves

Number of white veal farms: 862
Number of white veal farms with $DDDA_F$ = 0: 7
Number of white veal farms that used third- and fourth-generation cephalosporins: 2
Number of white veal farms that used fluoroquinolones: 122

Table A5. Usage of antibiotics in $DDDA_F$ at white veal farms.

n	Mean	Median	P75	P90
862	28.3	23.4	31.3	39.4

Figure A8. Mean antibiotic use at white veal farms in 2011, 2012 and 2013, by ATCvet group (left) and by first-, second- and third-choice products (right).

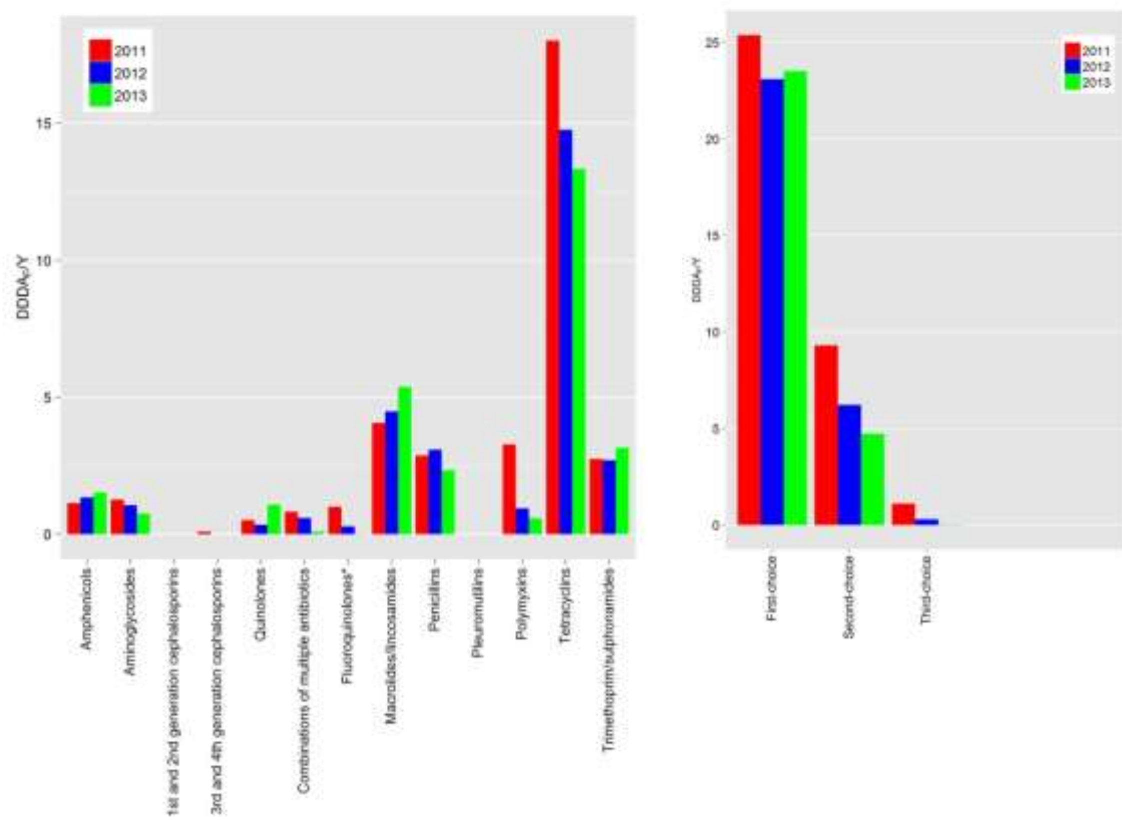


Table A6. Usage in $DDDA_F$ at white veal farms in 2013, by ATCvet group and route of administration.

ATCvet group	Route of administration	# of farms with $DDDA_F$ = 0	$DDDA_F$ Median	P75	Mean
amphenicols	Intramammary	862	0.00	0.00	0.00
amphenicols	Oral	862	0.00	0.00	0.00
amphenicols	Parenteral	20	1.11	1.71	1.52
aminoglycosides	Intramammary	862	0.00	0.00	0.00
aminoglycosides	Oral	654	0.00	0.00	0.68
aminoglycosides	Parenteral	531	0.00	0.08	0.08
3rd- and 4th-generation cephalosporins	Intramammary	862	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Oral	862	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Parenteral	860	0.00	0.00	0.00
quinolones	Intramammary	862	0.00	0.00	0.00
quinolones	Oral	736	0.00	0.00	1.08
quinolones	Parenteral	862	0.00	0.00	0.00
combinations of multiple antibiotics	Intramammary	862	0.00	0.00	0.00
combinations of multiple antibiotics	Oral	862	0.00	0.00	0.00
combinations of multiple antibiotics	Parenteral	642	0.00	0.00	0.10
fluoroquinolones	Intramammary	862	0.00	0.00	0.00
fluoroquinolones	Oral	844	0.00	0.00	0.01
fluoroquinolones	Parenteral	749	0.00	0.00	0.01
macrolides/lincosamides	Intramammary	862	0.00	0.00	0.00
macrolides/lincosamides	Oral	53	3.89	5.43	4.72
macrolides/lincosamides	Parenteral	118	0.29	0.67	0.65
penicillins	Intramammary	840	0.00	0.00	0.01
penicillins	Oral	323	0.18	2.67	1.67
penicillins	Parenteral	33	0.45	0.83	0.66
polymyxins	Intramammary	862	0.00	0.00	0.00
polymyxins	Oral	659	0.00	0.00	0.57
polymyxins	Parenteral	708	0.00	0.00	0.02
tetracyclines	Intramammary	862	0.00	0.00	0.00
tetracyclines	Oral	18	11.91	16.34	13.26
tetracyclines	Parenteral	616	0.00	0.02	0.06
trimethoprim/sulphonamides	Intramammary	862	0.00	0.00	0.00
trimethoprim/sulphonamides	Oral	333	0.48	2.72	3.02
trimethoprim/sulphonamides	Parenteral	200	0.07	0.15	0.13

Calves at rosé veal starter farms

Number of rosé veal starter farms: 264
Number of rosé veal starter farms with $DDDA_F$ = 0: 7
Number of rosé veal starter farms that used third- and fourth-generation cephalosporins: 0
Number of rosé veal starter farms that used fluoroquinolones: 30

Table A7. Usage of antibiotics in $DDDA_F$ at rosé veal starter farms.

n	Mean	Median	P75	P90
264	108.5	75.4	93.4	119.3

Figure A9. Mean antibiotic use at rosé veal starter farms in 2011, 2012 and 2013, by ATCvet group (left) and by first-, second- and third-choice products (right).

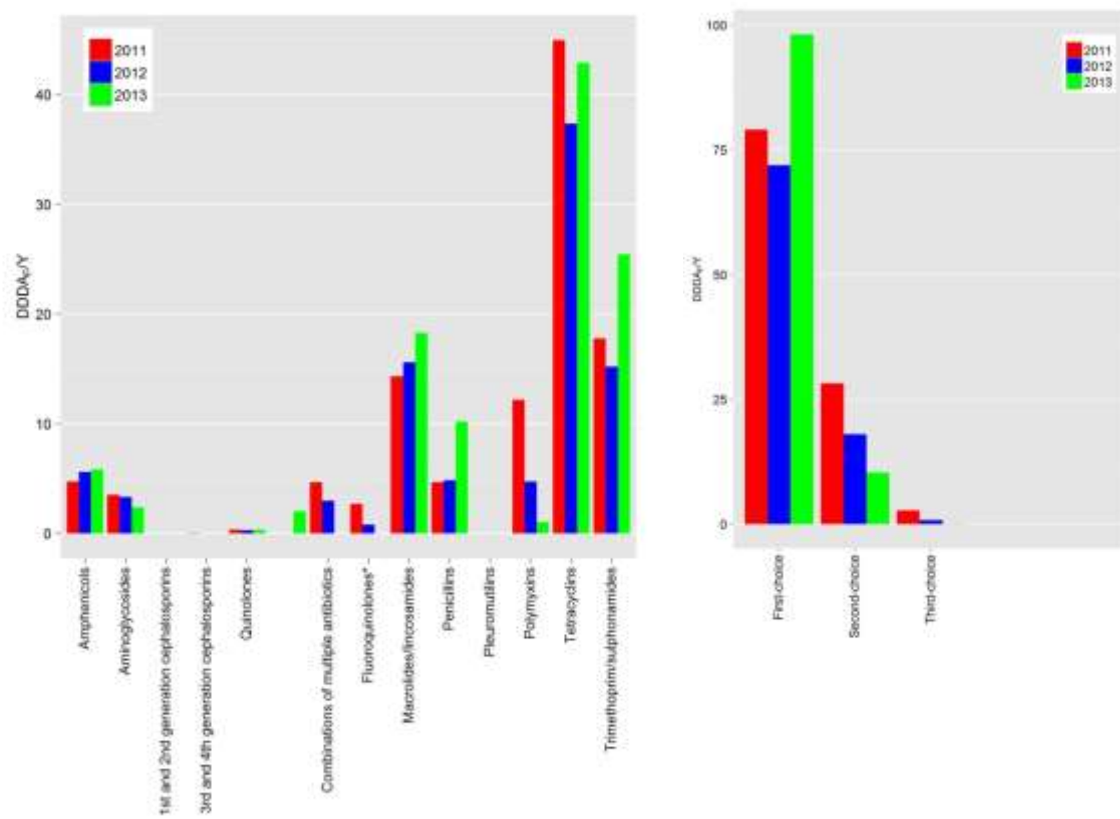


Table A8.Usage in $DDDA_F$ at rosé veal starter farms in 2013, by ATCvet group and route of administration.

ATCvet group	Route of administration	# of rosé veal starter farms with $DDDA_F = 0$	$DDDA_F$ Median	P75	Mean
amphenicols	Intramammary	264	0.00	0.00	0.00
amphenicols	Oral	264	0.00	0.00	0.00
amphenicols	Parenteral	12	4.56	7.08	5.83
aminoglycosides	Intramammary	264	0.00	0.00	0.00
aminoglycosides	Oral	207	0.00	0.00	1.95
aminoglycosides	Parenteral	149	0.00	0.41	0.45
quinolones	Intramammary	264	0.00	0.00	0.00
quinolones	Oral	242	0.00	0.00	0.33
quinolones	Parenteral	264	0.00	0.00	0.00
combinations of multiple antibiotics	Intramammary	264	0.00	0.00	0.00
combinations of multiple antibiotics	Oral	264	0.00	0.00	0.00
combinations of multiple antibiotics	Parenteral	199	0.00	0.00	2.03
fluoroquinolones	Intramammary	264	0.00	0.00	0.00
fluoroquinolones	Oral	263	0.00	0.00	0.00
fluoroquinolones	Parenteral	234	0.00	0.00	0.02
macrolides/lincosamides	Intramammary	264	0.00	0.00	0.00
macrolides/lincosamides	Oral	32	15.02	20.73	15.57
macrolides/lincosamides	Parenteral	48	1.41	3.18	2.70
penicillins	Intramammary	249	0.00	0.00	0.03
penicillins	Oral	134	0.00	1.64	2.25
penicillins	Parenteral	17	1.97	3.58	7.91
polymyxins	Intramammary	264	0.00	0.00	0.00
polymyxins	Oral	224	0.00	0.00	0.99
polymyxins	Parenteral	223	0.00	0.00	0.07
tetracyclines	Intramammary	264	0.00	0.00	0.00
tetracyclines	Oral	13	34.46	47.34	42.46
tetracyclines	Parenteral	187	0.00	0.09	0.44
trimethoprim/sulphonamides	Intramammary	264	0.00	0.00	0.00
trimethoprim/sulphonamides	Oral	53	5.86	12.19	24.98
trimethoprim/sulphonamides	Parenteral	79	0.18	0.47	0.45

Calves at rosé veal fattening farms

Number of rosé veal fattening farms: 723
Number of rosé veal fattening farms with $DDDA_F$ = 0: 131
Number of rosé veal fattening farms that used third- and fourth-generation cephalosporins: 1
Number of rosé veal fattening farms that used fluoroquinolones: 17

Table A9. Usage of antibiotics in $DDDA_F$ at rosé veal fattening farms.

n	Mean	Median	P75	P90
723	4.9	1.4	5.1	10.1

Figure A10. Mean antibiotic use at rosé veal fattening farms in 2011, 2012 and 2013, by ATCvet group (left) and by first-, second- and third-choice products (right).

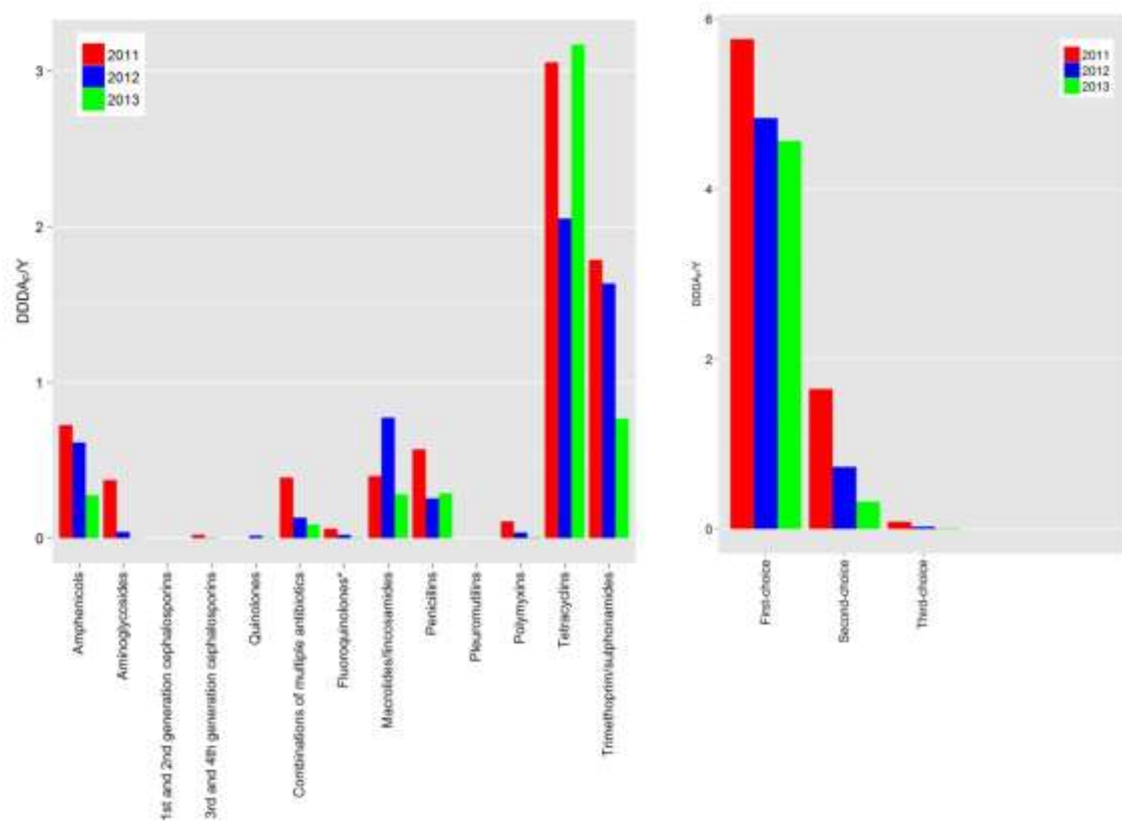


Table A10. Usage in $DDDA_F$ at rosé veal fattening farms in 2013, by ATCvet group and administration.

ATCvet group	Route of administration	# of farms with $DDDA_F$ = 0	$DDDA_F$ Median	P75	Mean
amphenicols	Intramammary	723	0.00	0.00	0.00
amphenicols	Oral	723	0.00	0.00	0.00
amphenicols	Parenteral	216	0.27	0.61	0.28
aminoglycosides	Intramammary	723	0.00	0.00	0.00
aminoglycosides	Oral	720	0.00	0.00	0.00
aminoglycosides	Parenteral	712	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Intramammary	723	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Oral	723	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Parenteral	722	0.00	0.00	0.00
quinolones	Intramammary	723	0.00	0.00	0.00
quinolones	Oral	720	0.00	0.00	0.01
quinolones	Parenteral	723	0.00	0.00	0.00
combinations of multiple antibiotics	Intramammary	723	0.00	0.00	0.00
combinations of multiple antibiotics	Oral	723	0.00	0.00	0.00
combinations of multiple antibiotics	Parenteral	628	0.00	0.00	0.09
fluoroquinolones	Intramammary	723	0.00	0.00	0.00
fluoroquinolones	Oral	722	0.00	0.00	0.00
fluoroquinolones	Parenteral	707	0.00	0.00	0.01
macrolides/lincosamides	Intramammary	723	0.00	0.00	0.00
macrolides/lincosamides	Oral	688	0.00	0.00	0.08
macrolides/lincosamides	Parenteral	500	0.00	0.04	0.20
penicillins	Intramammary	721	0.00	0.00	0.00
penicillins	Oral	711	0.00	0.00	0.02
penicillins	Parenteral	362	0.00	0.20	0.27
polymyxins	Intramammary	723	0.00	0.00	0.00
polymyxins	Oral	718	0.00	0.00	0.01
polymyxins	Parenteral	719	0.00	0.00	0.00
tetracyclines	Intramammary	723	0.00	0.00	0.00
tetracyclines	Oral	474	0.00	1.87	2.94
tetracyclines	Parenteral	636	0.00	0.00	0.23
trimethoprim/sulphonamides	Intramammary	723	0.00	0.00	0.00
trimethoprim/sulphonamides	Oral	547	0.00	0.00	0.75
trimethoprim/sulphonamides	Parenteral	634	0.00	0.00	0.01

Calves at rosé combination farms

Number of rosé combination farms: 276
Number of rosé combination farms with $DDDA_F$ = 0: 44
Number of rosé combination farms that used third- and fourth-generation cephalosporins: 0
Number of rosé combination farms that used fluoroquinolones: 24

Table A11. Usage of antibiotics in $DDDA_F$ at rosé combination farms.

n	Mean	Median	P75	P90
276	10.8	9.4	15.1	21.8

Figure A11. Mean antibiotic use at rosé combination farms in 2011, 2012 and 2013, by ATCvet group (left) and by first-, second- and third-choice products (right).

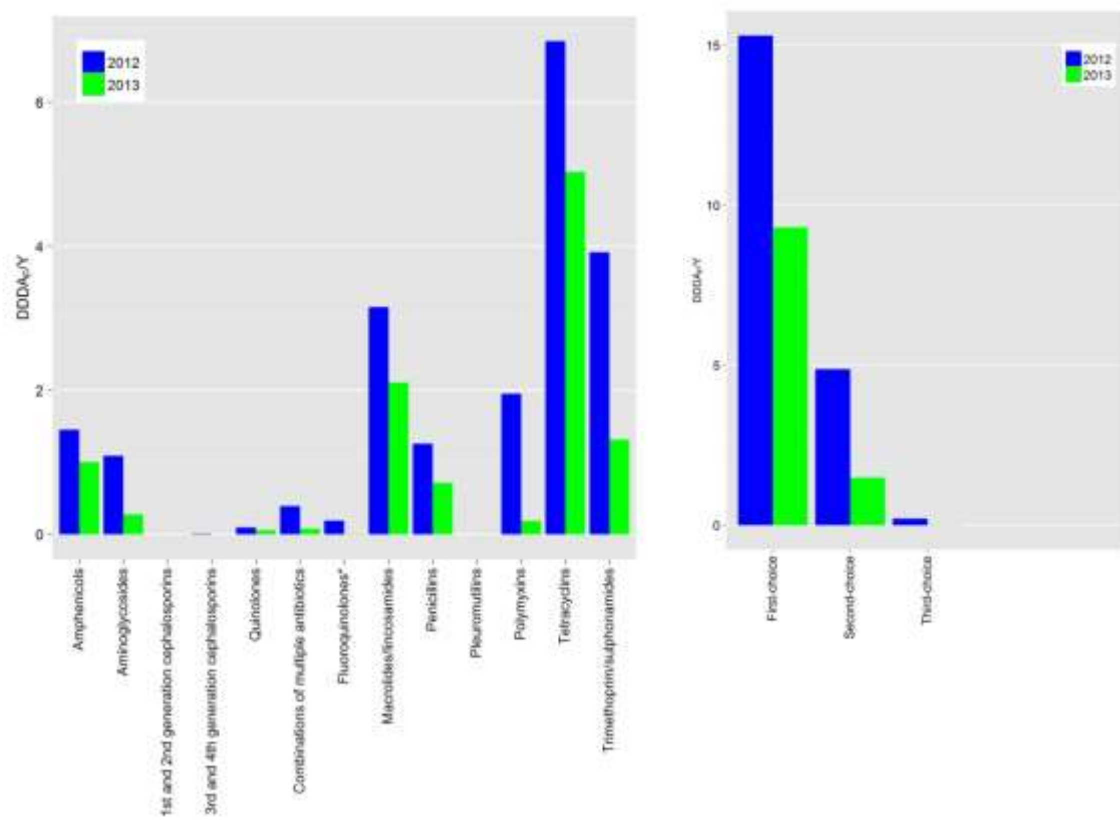


Table A12. Usage in $DDDA_F$ at rosé combination farms in 2013, by ATCvet group and route of administration.

ATCvet group	Route of administration	# of rosé combination farms with $DDDA_F$ = 0	$DDDA_F$ Median	P75	Mean
amphenicols	Intramammary	276	0.00	0.00	0.00
amphenicols	Oral	276	0.00	0.00	0.00
amphenicols	Parenteral	54	0.78	1.40	1.01
aminoglycosides	Intramammary	276	0.00	0.00	0.00
aminoglycosides	Oral	241	0.00	0.00	0.21
aminoglycosides	Parenteral	202	0.00	0.02	0.07
quinolones	Intramammary	276	0.00	0.00	0.00
quinolones	Oral	270	0.00	0.00	0.06
quinolones	Parenteral	276	0.00	0.00	0.00
combinations of multiple antibiotics	Intramammary	276	0.00	0.00	0.00
combinations of multiple antibiotics	Oral	276	0.00	0.00	0.00
combinations of multiple antibiotics	Parenteral	205	0.00	0.01	0.08
fluoroquinolones	Intramammary	276	0.00	0.00	0.00
fluoroquinolones	Oral	273	0.00	0.00	0.00
fluoroquinolones	Parenteral	254	0.00	0.00	0.01
macrolides/lincosamides	Intramammary	276	0.00	0.00	0.00
macrolides/lincosamides	Oral	110	0.94	2.32	1.51
macrolides/lincosamides	Parenteral	106	0.11	0.48	0.60
penicillins	Intramammary	269	0.00	0.00	0.01
penicillins	Oral	184	0.00	0.16	0.32
penicillins	Parenteral	78	0.20	0.55	0.39
polymyxins	Intramammary	276	0.00	0.00	0.00
polymyxins	Oral	234	0.00	0.00	0.18
polymyxins	Parenteral	246	0.00	0.00	0.01
tetracyclines	Intramammary	276	0.00	0.00	0.00
tetracyclines	Oral	75	3.85	7.58	4.99
tetracyclines	Parenteral	211	0.00	0.00	0.05
trimethoprim/sulphonamides	Intramammary	276	0.00	0.00	0.00
trimethoprim/sulphonamides	Oral	119	0.41	1.85	1.17
trimethoprim/sulphonamides	Parenteral	135	0.01	0.06	0.15

Usage of antibiotics in $DDDA_F$ at cattle farms

Dairy cattle

Number of dairy cattle farms: 18,005
Number of dairy cattle farms with $DDDA_F$ = 0: 296
Number of dairy cattle farms that used third- and fourth-generation cephalosporins: 613
Number of dairy cattle farms that used fluoroquinolones: 1,340

Table A13. Usage of antibiotics at dairy cattle farms, presented as total usage (A), usage of dry-cow (intramammary) antibiotics (B), usage of mastitis injectors (C), and usage of oral antibiotics in calves (D).

A

Total usage, in $DDDA_F$				
n	**Mean**	**Median**	**P75**	**P90**
18,005	2.8	2.8	3.8	4.7

B

Usage of dry-cow (intramammary) antibiotics, in $DDDA_F$ (animals >2 years of age)				
n	**Mean**	**Median**	**P75**	**P90**
18,005	1.8	1.9	2.6	3.1

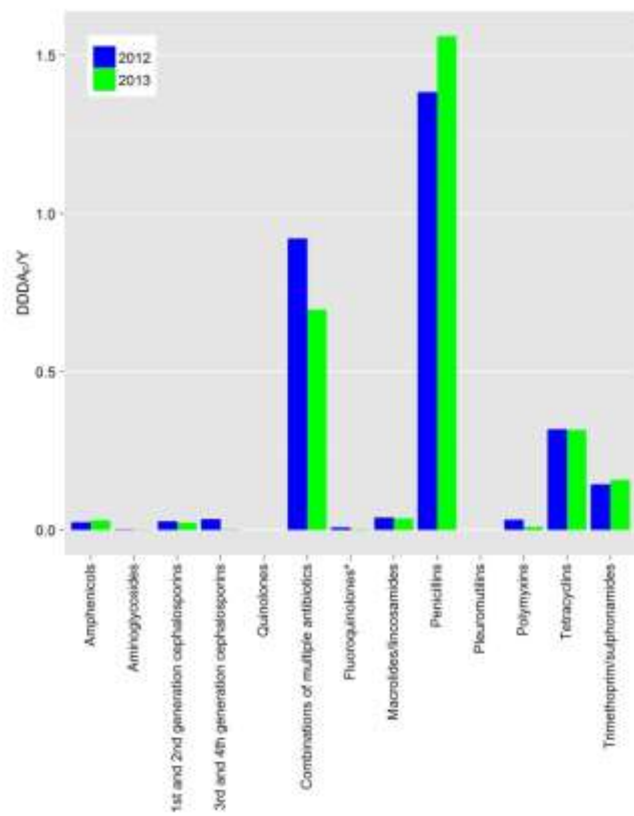
C

Usage of mastitis injectors, in $DDDA_F$ (animals >2 years of age)				
n	**Mean**	**Median**	**P75**	**P90**
18,005	*0.8*	*0.6*	*1.1*	*1.7*

D

Usage of oral antibiotics in calves, in $DDDA_F$ (animals <56 days of age)				
n	**Mean**	**Median**	**P75**	**P90**
18,005	4.8	0	0	20

Figure A12. Mean antibiotic use at dairy cattle farms in 2013, by ATCvet group (left) and by first-, second- and third-choice products (right).



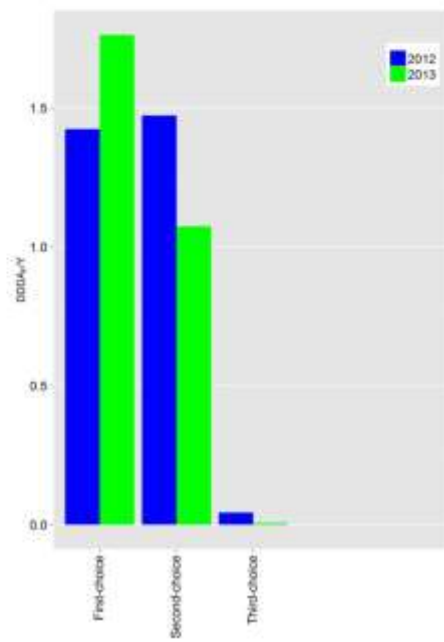


Table A14. Usage in $DDDA_F$ at dairy cattle farms in 2013, by ATCvet group and route of administration.

			$DDDA_F/Y$		
ATCvet group	Route of administration	# of dairy cattle farms with $DDDA_F = 0$	Median	P75	Mean
amphenicols	Intramammary	18,005	0.00	0.00	0.00
amphenicols	Dry-cow (intramammary) antibiotic	18,005	0.00	0.00	0.00
amphenicols	Oral	18,005	0.00	0.00	0.00
amphenicols	Parenteral	10,985	0.00	0.04	0.03
amphenicols	Intrauterine	18,005	0.00	0.00	0.00
aminoglycosides	Intramammary	18,005	0.00	0.00	0.00
aminoglycosides	Dry-cow (intramammary) antibiotic	18,005	0.00	0.00	0.00
aminoglycosides	Oral	17,855	0.00	0.00	0.00
aminoglycosides	Parenteral	17,647	0.00	0.00	0.00
aminoglycosides	Intrauterine	18,005	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	Intramammary	17,712	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	Dry-cow (intramammary) antibiotic	18,005	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	Oral	18,005	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	Parenteral	18,005	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	Intrauterine	12,072	0.00	0.01	0.02
3rd- and 4th-generation cephalosporins	Intramammary	17,497	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Dry-cow (intramammary) antibiotic	17,998	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Oral	18,005	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Parenteral	17,836	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Intrauterine	18,005	0.00	0.00	0.00
quinolones	Intramammary	18,005	0.00	0.00	0.00
quinolones	Dry-cow (intramammary) antibiotic	18,005	0.00	0.00	0.00
quinolones	Oral	18,002	0.00	0.00	0.00
quinolones	Parenteral	18,005	0.00	0.00	0.00
quinolones	Intrauterine	18,005	0.00	0.00	0.00
combinations of multiple antibiotics	Intramammary	5,327	0.22	0.52	0.36
combinations of multiple	Dry-cow (intramammary) antibiotic	12,777	0.00	0.18	0.27

antibiotics					
combinations of multiple antibiotics	Oral	17,985	0.00	0.00	0.00
combinations of multiple antibiotics	Parenteral	8,259	0.02	0.09	0.07
combinations of multiple antibiotics	Intrauterine	18,005	0.00	0.00	0.00
fluoroquinolones	Intramammary	18,005	0.00	0.00	0.00
fluoroquinolones	Dry-cow (intramammary) antibiotic	18,005	0.00	0.00	0.00
fluoroquinolones	Oral	17,986	0.00	0.00	0.00
fluoroquinolones	Parenteral	16,679	0.00	0.00	0.00
fluoroquinolones	Intrauterine	18,005	0.00	0.00	0.00
macrolides/lincosamides	Intramammary	17,643	0.00	0.00	0.01
macrolides/lincosamides	Dry-cow (intramammary) antibiotic	18,005	0.00	0.00	0.00
macrolides/lincosamides	Oral	17,964	0.00	0.00	0.00
macrolides/lincosamides	Parenteral	13,554	0.00	0.00	0.03
macrolides/lincosamides	Intrauterine	18,005	0.00	0.00	0.00
penicillins	Intramammary	5,880	0.12	0.33	0.22
penicillins	Dry-cow (intramammary) antibiotic	4,180	1.07	1.77	1.09
penicillins	Oral	17,627	0.00	0.00	0.00
penicillins	Parenteral	3,217	0.15	0.34	0.25
penicillins	Intrauterine	18,005	0.00	0.00	0.00
polymyxins	Intramammary	18,005	0.00	0.00	0.00
polymyxins	Dry-cow (intramammary) antibiotic	18,005	0.00	0.00	0.00
polymyxins	Oral	16,157	0.00	0.00	0.01
polymyxins	Parenteral	17,492	0.00	0.00	0.00
polymyxins	Intrauterine	18,005	0.00	0.00	0.00
tetracyclines	Intramammary	18,005	0.00	0.00	0.00
tetracyclines	Dry-cow (intramammary) antibiotic	18,005	0.00	0.00	0.00
tetracyclines	Oral	17,117	0.00	0.00	0.01
tetracyclines	Parenteral	4,191	0.13	0.31	0.22
tetracyclines	Intrauterine	6,881	0.03	0.13	0.09
trimethoprim/sulphonamides	Intramammary	18,005	0.00	0.00	0.00
trimethoprim/sulphonamides	Dry-cow (intramammary) antibiotic	18,005	0.00	0.00	0.00
trimethoprim/sulphonamides	Oral	15,989	0.00	0.00	0.01
trimethoprim/sulphonamides	Parenteral	3,608	0.09	0.20	0.15
trimethoprim/sulphonamides	Intrauterine	18,005	0.00	0.00	0.00

Suckler cows

Number of suckler cow farms: 9,856
Number of suckler cow farms with $DDDA_F$ = 0: 4,589
Number of suckler cow farms that used third- and fourth-generation cephalosporins: 33
Number of suckler cow farms that used fluoroquinolones: 131

Table A15. Usage of antibiotics in $DDDA_F$ at suckler cow farms.

n	Mean	Median	P75	P90
9,857	0.7	0.1	0.8	2.2

Figure A13. Mean antibiotic use at suckler cow farms in 2013, by ATCvet group (left) and by first-, second- and third-choice products (right).

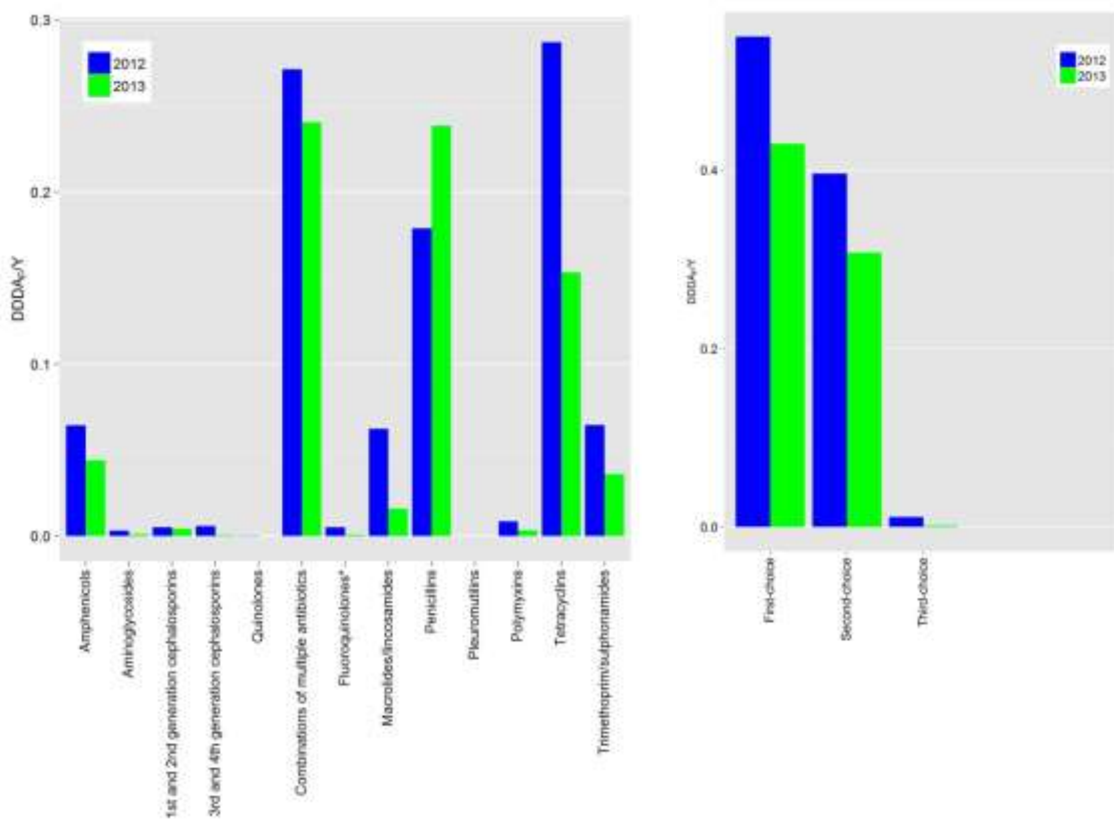


Table A16. Usage in $DDDA_F/Y$ at suckler cow farms in 2013, by ATCvet group and route of administration.

ATCvet group	Route of administration	# of suckler cow farms with $DDDA_F/Y$ = 0	$DDDA_F/Y$ Median	P75	Mean
amphenicols	Intramammary	9,856	0.00	0.00	0.00
amphenicols	Dry-cow (intramammary) antibiotic	9,856	0.00	0.00	0.00
amphenicols	Oral	9,856	0.00	0.00	0.00
amphenicols	Parenteral	8,413	0.00	0.00	0.04
amphenicols	Intrauterine	9,856	0.00	0.00	0.00
aminoglycosides	Intramammary	9,856	0.00	0.00	0.00
aminoglycosides	Dry-cow (intramammary) antibiotic	9,856	0.00	0.00	0.00
aminoglycosides	Oral	9,848	0.00	0.00	0.00
aminoglycosides	Parenteral	9,789	0.00	0.00	0.00
aminoglycosides	Intrauterine	9,856	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	Intramammary	9,846	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	Dry-cow (intramammary) antibiotic	9,856	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	Oral	9,856	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	Parenteral	9,856	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	Intrauterine	9,692	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Intramammary	9,843	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Dry-cow (intramammary) antibiotic	9,856	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Oral	9,856	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Parenteral	9,836	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Intrauterine	9,856	0.00	0.00	0.00
quinolones	Intramammary	9,856	0.00	0.00	0.00
quinolones	Dry-cow (intramammary) antibiotic	9,856	0.00	0.00	0.00
quinolones	Oral	9,855	0.00	0.00	0.00
quinolones	Parenteral	9,856	0.00	0.00	0.00
quinolones	Intrauterine	9,856	0.00	0.00	0.00
combinations of multiple antibiotics	Intramammary	9,516	0.00	0.00	0.02
combinations of multiple antibiotics	Dry-cow (intramammary) antibiotic	9,684	0.00	0.00	0.02

combinations of multiple antibiotics	Oral	9,856	0.00	0.00	0.00
combinations of multiple antibiotics	Parenteral	7,367	0.00	0.01	0.20
combinations of multiple antibiotics	Intrauterine	9,856	0.00	0.00	0.00
fluoroquinolones	Intramammary	9,856	0.00	0.00	0.00
fluoroquinolones	Dry-cow (intramammary) antibiotic	9,856	0.00	0.00	0.00
fluoroquinolones	Oral	9,854	0.00	0.00	0.00
fluoroquinolones	Parenteral	9,726	0.00	0.00	0.00
fluoroquinolones	Intrauterine	9,856	0.00	0.00	0.00
macrolides/lincosamides	Intramammary	9,844	0.00	0.00	0.00
macrolides/lincosamides	Dry-cow (intramammary) antibiotic	9,856	0.00	0.00	0.00
macrolides/lincosamides	Oral	9,847	0.00	0.00	0.00
macrolides/lincosamides	Parenteral	9,292	0.00	0.00	0.02
macrolides/lincosamides	Intrauterine	9,856	0.00	0.00	0.00
penicillins	Intramammary	9,509	0.00	0.00	0.01
penicillins	Dry-cow (intramammary) antibiotic	9,475	0.00	0.00	0.05
penicillins	Oral	9,801	0.00	0.00	0.00
penicillins	Parenteral	7,097	0.00	0.07	0.17
penicillins	Intrauterine	9,856	0.00	0.00	0.00
polymyxins	Intramammary	9,856	0.00	0.00	0.00
polymyxins	Dry-cow (intramammary) antibiotic	9,856	0.00	0.00	0.00
polymyxins	Oral	9,724	0.00	0.00	0.00
polymyxins	Parenteral	9,778	0.00	0.00	0.00
polymyxins	Intrauterine	9,856	0.00	0.00	0.00
tetracyclines	Intramammary	9,856	0.00	0.00	0.00
tetracyclines	Dry-cow (intramammary) antibiotic	9,856	0.00	0.00	0.00
tetracyclines	Oral	9,730	0.00	0.00	0.02
tetracyclines	Parenteral	8,190	0.00	0.00	0.08
tetracyclines	Intrauterine	7,944	0.00	0.00	0.06
trimethoprim/sulphonamides	Intramammary	9,856	0.00	0.00	0.00
trimethoprim/sulphonamides	Dry-cow (intramammary) antibiotic	9,856	0.00	0.00	0.00
trimethoprim/sulphonamides	Oral	9,646	0.00	0.00	0.01
trimethoprim/sulphonamides	Parenteral	8,369	0.00	0.00	0.03
trimethoprim/sulphonamides	Intrauterine	9,856	0.00	0.00	0.00

Beef bulls

Number of beef farms: 3,316
Number of beef farms with $DDDA_F/Y$ = 0: 2,083
Number of beef farms that used third- and fourth-generation cephalosporins: 3
Number of beef farms that used fluoroquinolones: 47

Table A17. Usage of antibiotics in $DDDA_F/Y$ at beef farms.

n	Mean	Median	P75	P90
3,316	1.6	0	0.6	3.9

Figure A14. Mean antibiotic use at beef farms in 2013, by ATCvet group (left) and by first-, second- and third-choice products (right).

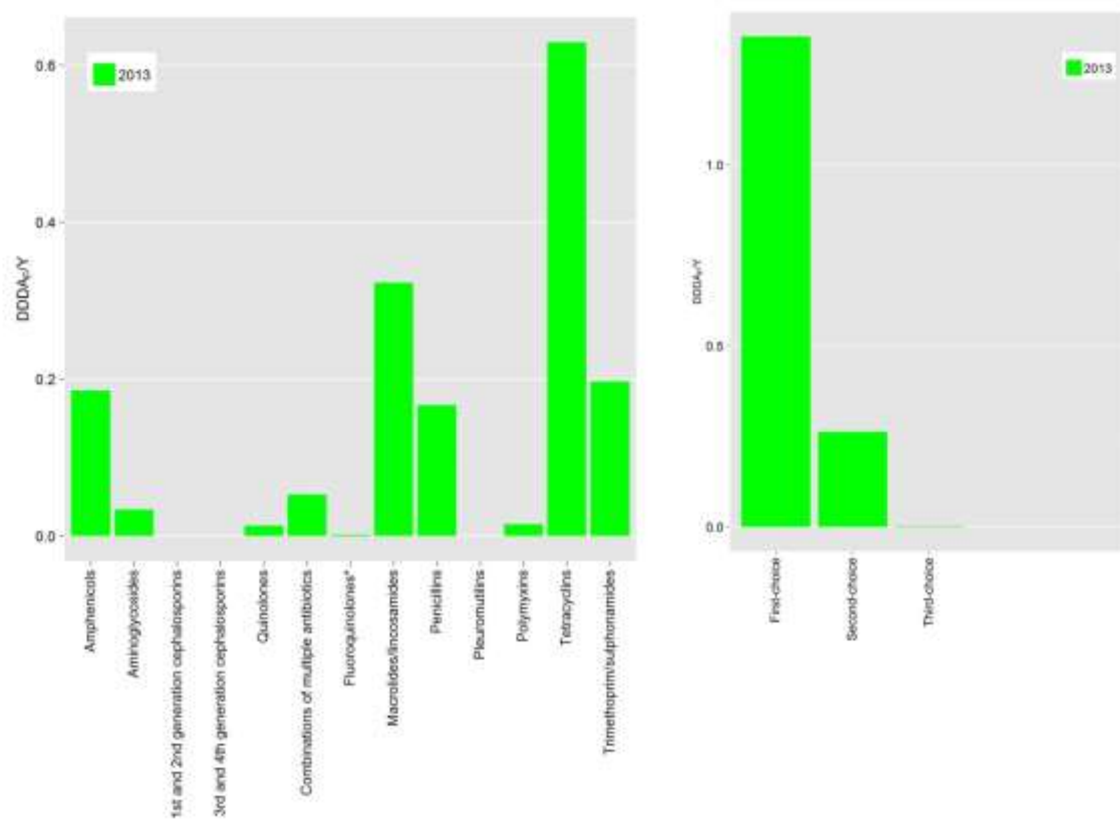


Table A18. Usage in $DDDA_F$ at beef farms in 2013, by ATCvet group and route of administration.

ATCvet group	Route of administration	# of beef farms with $DDDA_F/Y = 0$	$DDDA_F$ Median	$DDDA_F$ P75	$DDDA_F$ Mean
amphenicols	Intramammary	3,316	0.00	0.00	0.00
amphenicols	Dry-cow (intramammary) antibiotic	3,316	0.00	0.00	0.00
amphenicols	Oral	3,316	0.00	0.00	0.00
amphenicols	Parenteral	2,484	0.00	0.00	0.19
amphenicols	Intrauterine	3,316	0.00	0.00	0.00
aminoglycosides	Intramammary	3,316	0.00	0.00	0.00
aminoglycosides	Dry-cow (intramammary) antibiotic	3,316	0.00	0.00	0.00
aminoglycosides	Oral	3,266	0.00	0.00	0.03
aminoglycosides	Parenteral	3,230	0.00	0.00	0.01
aminoglycosides	Intrauterine	3,316	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	Intramammary	3,316	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	Dry-cow (intramammary) antibiotic	3,316	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	Oral	3,316	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	Parenteral	3,316	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	Intrauterine	3,303	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Intramammary	3,315	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Dry-cow (intramammary) antibiotic	3,316	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Oral	3,316	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Parenteral	3,314	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Intrauterine	3,316	0.00	0.00	0.00
quinolones	Intramammary	3,316	0.00	0.00	0.00
quinolones	Dry-cow (intramammary) antibiotic	3,316	0.00	0.00	0.00
quinolones	Oral	3,285	0.00	0.00	0.01
quinolones	Parenteral	3,316	0.00	0.00	0.00
quinolones	Intrauterine	3,316	0.00	0.00	0.00
combinations of multiple antibiotics	Intramammary	3,298	0.00	0.00	0.00
combinations of multiple	Dry-cow (intramammary) antibiotic	3,302	0.00	0.00	0.00

antibiotics					
combinations of multiple antibiotics	Oral	3,316	0.00	0.00	0.00
combinations of multiple antibiotics	Parenteral	2,887	0.00	0.00	0.05
combinations of multiple antibiotics	Intrauterine	3,316	0.00	0.00	0.00
fluoroquinolones	Intramammary	3,316	0.00	0.00	0.00
fluoroquinolones	Dry-cow (intramammary) antibiotic	3,316	0.00	0.00	0.00
fluoroquinolones	Oral	3,309	0.00	0.00	0.00
fluoroquinolones	Parenteral	3,275	0.00	0.00	0.00
fluoroquinolones	Intrauterine	3,316	0.00	0.00	0.00
macrolides/lincosamides	Intramammary	3,315	0.00	0.00	0.00
macrolides/lincosamides	Dry-cow (intramammary) antibiotic	3,316	0.00	0.00	0.00
macrolides/lincosamides	Oral	3,048	0.00	0.00	0.24
macrolides/lincosamides	Parenteral	2,830	0.00	0.00	0.08
macrolides/lincosamides	Intrauterine	3,316	0.00	0.00	0.00
penicillins	Intramammary	3,289	0.00	0.00	0.00
penicillins	Dry-cow (intramammary) antibiotic	3,283	0.00	0.00	0.01
penicillins	Oral	3,215	0.00	0.00	0.06
penicillins	Parenteral	2,556	0.00	0.00	0.10
penicillins	Intrauterine	3,316	0.00	0.00	0.00
polymyxins	Intramammary	3,316	0.00	0.00	0.00
polymyxins	Dry-cow (intramammary) antibiotic	3,316	0.00	0.00	0.00
polymyxins	Oral	3,237	0.00	0.00	0.01
polymyxins	Parenteral	3,259	0.00	0.00	0.00
polymyxins	Intrauterine	3,316	0.00	0.00	0.00
tetracyclines	Intramammary	3,316	0.00	0.00	0.00
tetracyclines	Dry-cow (intramammary) antibiotic	3,316	0.00	0.00	0.00
tetracyclines	Oral	2,910	0.00	0.00	0.57
tetracyclines	Parenteral	2,887	0.00	0.00	0.05
tetracyclines	Intrauterine	3,147	0.00	0.00	0.01
trimethoprim/sulphonamides	Intramammary	3,316	0.00	0.00	0.00
trimethoprim/sulphonamides	Dry-cow (intramammary) antibiotic	3,316	0.00	0.00	0.00
trimethoprim/sulphonamides	Oral	3,031	0.00	0.00	0.18
trimethoprim/sulphonamides	Parenteral	2,865	0.00	0.00	0.02
trimethoprim/sulphonamides	Intrauterine	3,316	0.00	0.00	0.00

Rearing farms

Number of rearing farms: 472
Number of rearing farms with $DDDA_F$ = 0: 344
Number of rearing farms that used third- and fourth-generation cephalosporins: 0
Number of rearing farms that used fluoroquinolones: 4

Table A19. Usage of antibiotics in $DDDA_F$ at rearing farms.

n	Mean	Median	P75	P90
472	1.0	0	0.2	2.3

Figure A15. Mean antibiotic use at rearing farms in 2013, by ATCvet group (left) and by first-, second- and third-choice products (right).

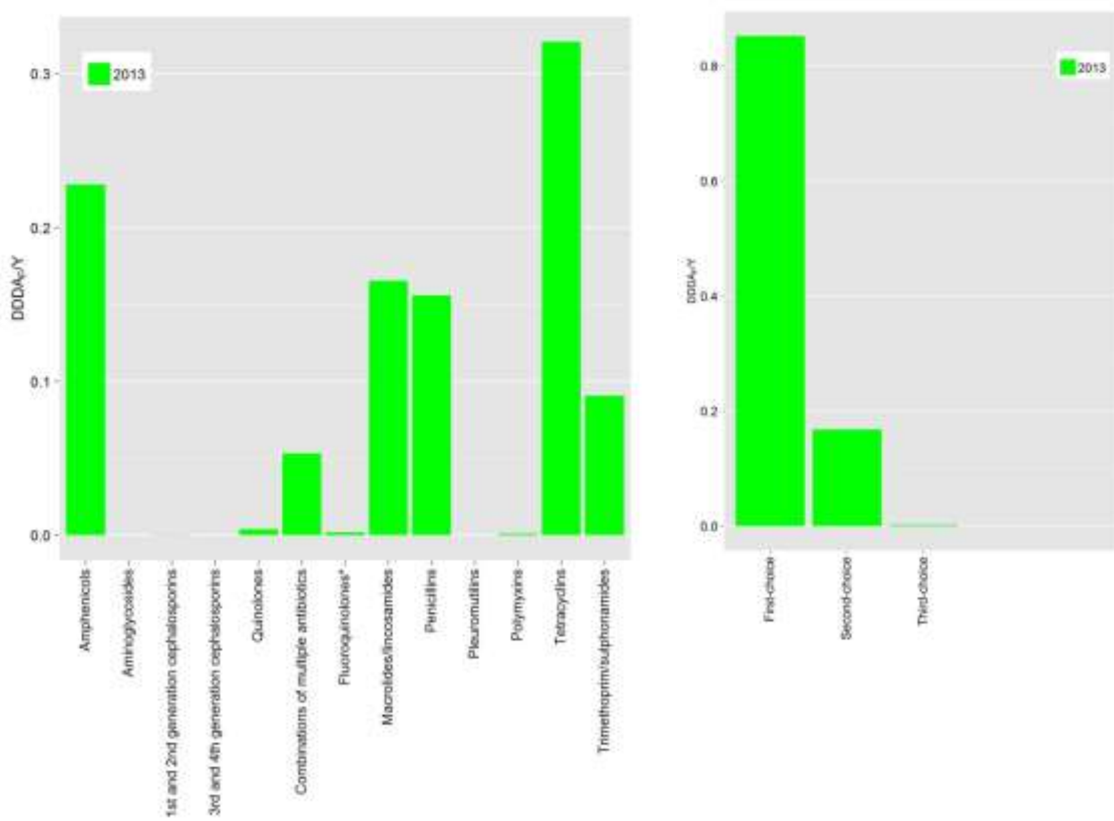


Table A20. Usage in $DDDA_F$ at rearing farms in 2013, by ATCvet group and route of administration.

ATCvet group	Route of administration	# of rearing farms with $DDDA_F/Y = 0$	$DDDA_F/Y$ Median	P75	Mean
amphenicols	Intramammary	472	0.00	0.00	0.00
amphenicols	Dry-cow (intramammary) antibiotic	472	0.00	0.00	0.00
amphenicols	Oral	472	0.00	0.00	0.00
amphenicols	Parenteral	385	0.00	0.00	0.23
amphenicols	Intrauterine	472	0.00	0.00	0.00
aminoglycosides	Intramammary	472	0.00	0.00	0.00
aminoglycosides	Dry-cow (intramammary) antibiotic	472	0.00	0.00	0.00
aminoglycosides	Oral	472	0.00	0.00	0.00
aminoglycosides	Parenteral	471	0.00	0.00	0.00
aminoglycosides	Intrauterine	472	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	Intramammary	472	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	Dry-cow (intramammary) antibiotic	472	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	Oral	472	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	Parenteral	472	0.00	0.00	0.00
1st- and 2nd-generation cephalosporins	Intrauterine	470	0.00	0.00	0.00
quinolones	Intramammary	472	0.00	0.00	0.00
quinolones	Dry-cow (intramammary) antibiotic	472	0.00	0.00	0.00
quinolones	Oral	471	0.00	0.00	0.00
quinolones	Parenteral	472	0.00	0.00	0.00
quinolones	Intrauterine	472	0.00	0.00	0.00
combinations of multiple antibiotics	Intramammary	472	0.00	0.00	0.00
combinations of multiple antibiotics	Dry-cow (intramammary) antibiotic	472	0.00	0.00	0.00
combinations of multiple antibiotics	Oral	472	0.00	0.00	0.00
combinations of multiple antibiotics	Parenteral	438	0.00	0.00	0.05
combinations of multiple antibiotics	Intrauterine	472	0.00	0.00	0.00
fluoroquinolones	Intramammary	472	0.00	0.00	0.00
fluoroquinolones	Dry-cow (intramammary) antibiotic	472	0.00	0.00	0.00
fluoroquinolones	Oral	472	0.00	0.00	0.00

fluoroquinolones	Parenteral	468	0.00	0.00	0.00
fluoroquinolones	Intrauterine	472	0.00	0.00	0.00
macrolides/lincosamides	Intramammary	471	0.00	0.00	0.01
macrolides/lincosamides	Dry-cow (intramammary) antibiotic	472	0.00	0.00	0.00
macrolides/lincosamides	Oral	459	0.00	0.00	0.07
macrolides/lincosamides	Parenteral	439	0.00	0.00	0.08
macrolides/lincosamides	Intrauterine	472	0.00	0.00	0.00
penicillins	Intramammary	472	0.00	0.00	0.00
penicillins	Dry-cow (intramammary) antibiotic	471	0.00	0.00	0.02
penicillins	Oral	466	0.00	0.00	0.04
penicillins	Parenteral	415	0.00	0.00	0.10
penicillins	Intrauterine	472	0.00	0.00	0.00
polymyxins	Intramammary	472	0.00	0.00	0.00
polymyxins	Dry-cow (intramammary) antibiotic	472	0.00	0.00	0.00
polymyxins	Oral	471	0.00	0.00	0.00
polymyxins	Parenteral	468	0.00	0.00	0.00
polymyxins	Intrauterine	472	0.00	0.00	0.00
tetracyclines	Intramammary	472	0.00	0.00	0.00
tetracyclines	Dry-cow (intramammary) antibiotic	472	0.00	0.00	0.00
tetracyclines	Oral	452	0.00	0.00	0.27
tetracyclines	Parenteral	445	0.00	0.00	0.05
tetracyclines	Intrauterine	471	0.00	0.00	0.00
trimethoprim/sulphonamides	Intramammary	472	0.00	0.00	0.00
trimethoprim/sulphonamides	Dry-cow (intramammary) antibiotic	472	0.00	0.00	0.00
trimethoprim/sulphonamides	Oral	453	0.00	0.00	0.06
trimethoprim/sulphonamides	Parenteral	428	0.00	0.00	0.03
trimethoprim/sulphonamides	Intrauterine	472	0.00	0.00	0.00

Usage of antibiotics in $DDDA_F$ at pig farms

Sows and piglets

Number of sow/piglet farms: 2,085
Number of sow/piglet farms with $DDDA_F$ = 0: 96
Number of sow/piglet farms that used third- and fourth-generation cephalosporins: 1
Number of sow/piglet that used fluoroquinolones: 14

Table A21. Usage of antibiotics in $DDDA_F$ at sow/piglet farms.

n	Mean	Median	P75	P90
2,085	10.9	6.3	13.2	23.1

Figure A16. Mean antibiotic use at sow/piglet farms in 2013, by ATCvet group (left) and by first-, second- and third-choice products (right).

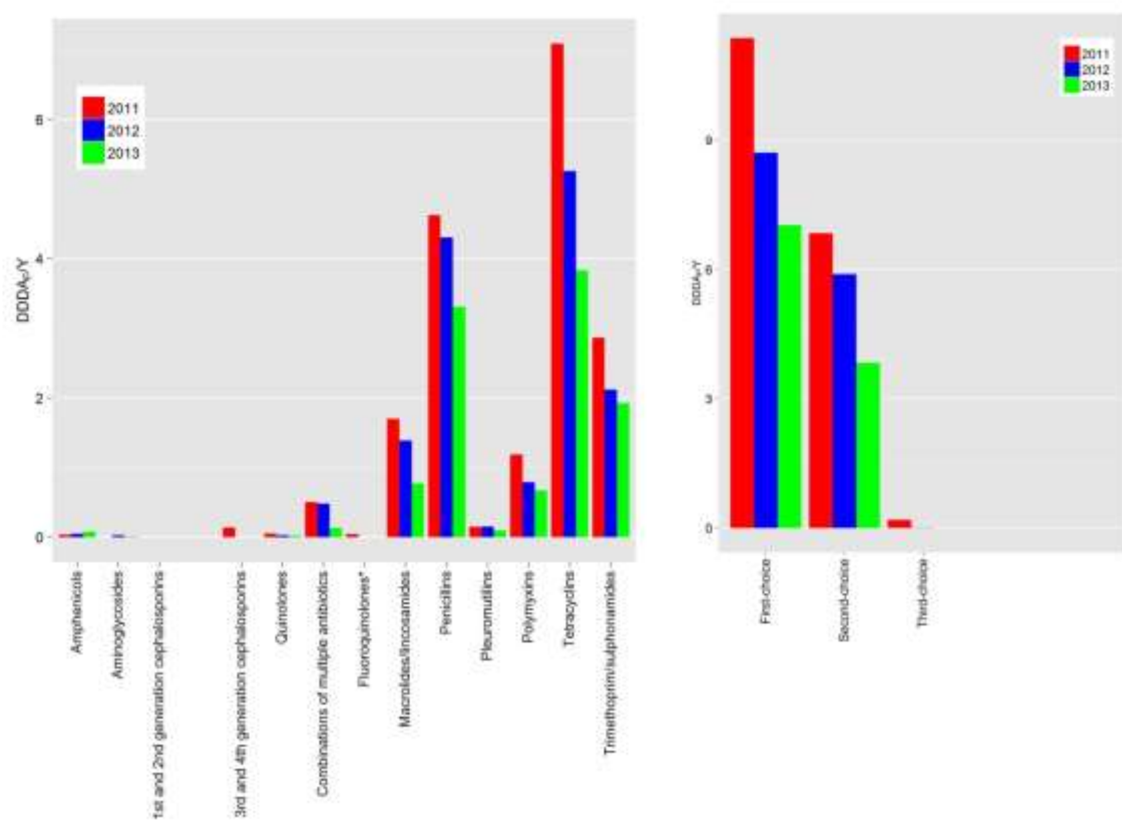


Table A22. Usage in $DDDA_F$ at sow/piglet farms in 2013, by ATCvet group and route of administration.

ATCvet group	Route of administration	# of sow/piglet farms with $DDDA_F$ = 0	$DDDA_F$ Median	$DDDA_F$ P75	$DDDA_F$ Mean
amphenicols	Intramammary	2,085	0	0	0.00
amphenicols	Oral	2,082	0	0	0.00
amphenicols	Parenteral	1,637	0	0	0.08
aminoglycosides	Intramammary	2,085	0	0	0.00
aminoglycosides	Oral	2,080	0	0	0.01
aminoglycosides	Parenteral	2,083	0	0	0.00
3rd- and 4th-generation cephalosporins	Intramammary	2,085	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Oral	2,085	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Parenteral	2,084	0.00	0.00	0.00
quinolones	Intramammary	2,085	0.00	0.00	0.00
quinolones	Oral	2,056	0.00	0.00	0.02
quinolones	Parenteral	2,085	0.00	0.00	0.00
combinations of multiple antibiotics	Intramammary	2,085	0.00	0.00	0.00
combinations of multiple antibiotics	Oral	2,059	0.00	0.00	0.02
combinations of multiple antibiotics	Parenteral	1,459	0.00	0.03	0.11
fluoroquinolones	Intramammary	2,085	0.00	0.00	0.00
fluoroquinolones	Oral	2,084	0.00	0.00	0.00
fluoroquinolones	Parenteral	2,072	0.00	0.00	0.00
macrolides/lincosamides	Intramammary	2,085	0.00	0.00	0.00
macrolides/lincosamides	Oral	1,663	0.00	0.00	0.35
macrolides/lincosamides	Parenteral	1,418	0.00	0.17	0.42
penicillins	Intramammary	2,085	0.00	0.00	0.00
penicillins	Oral	1,347	0.00	1.11	2.26
penicillins	Parenteral	168	0.79	1.40	1.05
pleuromutilins	Intramammary	2,085	0.00	0.00	0.00
pleuromutilins	Oral	2,033	0.00	0.00	0.10
pleuromutilins	Parenteral	2,027	0.00	0.00	0.00
polymyxins	Intramammary	2,085	0.00	0.00	0.00
polymyxins	Oral	1,223	0.00	0.24	0.60
polymyxins	Parenteral	1,482	0.00	0.02	0.07
tetracyclines	Intramammary	2,085	0.00	0.00	0.00
tetracyclines	Oral	884	0.70	3.70	3.46

tetracyclines	Parenteral	831	0.06	0.34	0.38
trimethoprim/sulphonamides	Intramammary	2,085	0.00	0.00	0.00
trimethoprim/sulphonamides	Oral	992	0.14	1.76	1.73
trimethoprim/sulphonamides	Parenteral	727	0.06	0.23	0.20

Pig fattening farms

Number of pig fattening farms: 4,991
Number of pig fattening farms with $DDDA_F$ = 0: 707
Number of pig fattening farms that used third- and fourth-generation cephalosporins: 0
Number of pig fattening that used fluoroquinolones: 4

Table A23. Usage of antibiotics in $DDDA_F$ at pig fattening farms.

n	Mean	Median	P75	P90
4,991	5.7	3.0	7.9	13.6

Figure A17. Mean antibiotic use at pig fattening farms in 2013, by ATCvet group (left) and by first-, second- and third-choice products (right).

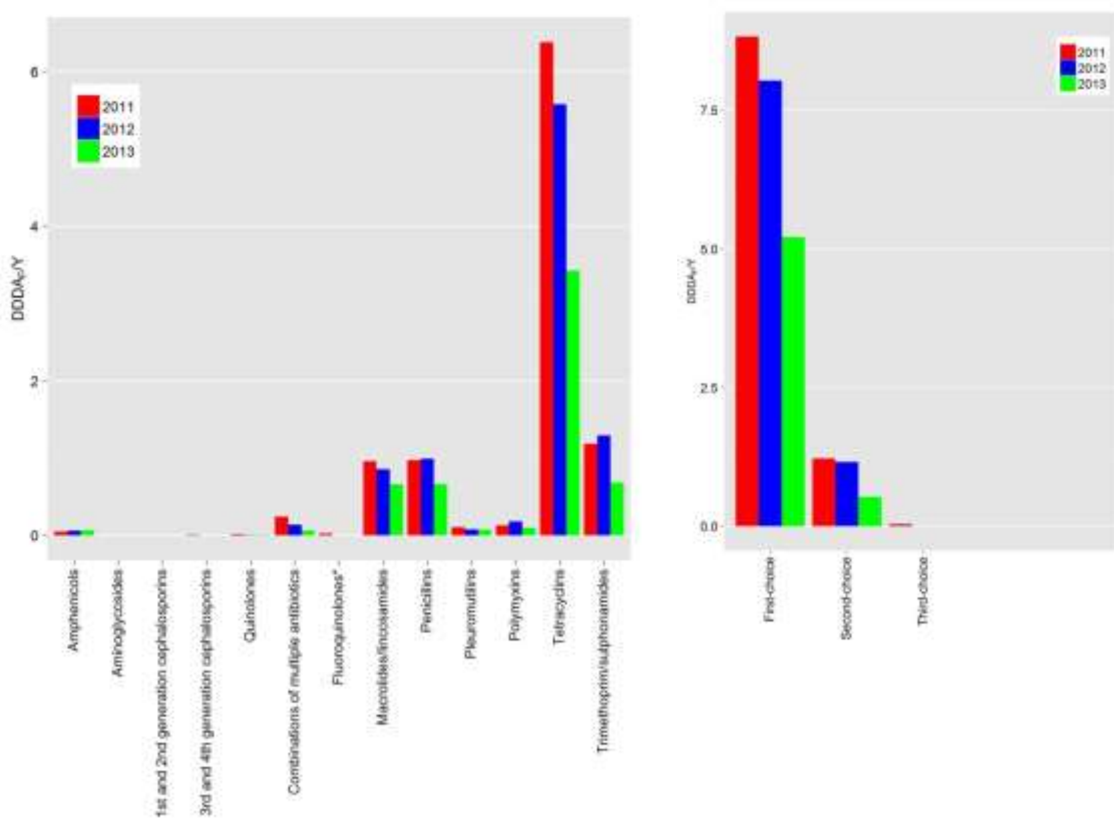


Table A24. Usage in $DDDA_F$ at pig fattening farms in 2013, by ATCvet group and route of administration.

ATCvet group	Route of administration	# of pig fattening farms with $DDDA_F$ = 0	$DDDA_F$/Y		
			Median	P75	Mean
amphenicols	Intramammary	4,991	0.00	0.00	0.00
amphenicols	Oral	4,991	0.00	0.00	0.00
amphenicols	Parenteral	4,200	0.00	0.00	0.07
aminoglycosides	Intramammary	4,991	0.00	0.00	0.00
aminoglycosides	Oral	4,989	0.00	0.00	0.00
aminoglycosides	Parenteral	4,991	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Intramammary	4,991	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Oral	4,991	0.00	0.00	0.00
3rd- and 4th-generation cephalosporins	Parenteral	4,991	0.00	0.00	0.00
quinolones	Intramammary	4,991	0.00	0.00	0.00
quinolones	Oral	4,969	0.00	0.00	0.01
quinolones	Parenteral	4,991	0.00	0.00	0.00
combinations of multiple antibiotics	Intramammary	4,990	0.00	0.00	0.00
combinations of multiple antibiotics	Oral	4,960	0.00	0.00	0.02
combinations of multiple antibiotics	Parenteral	4,405	0.00	0.00	0.04
fluoroquinolones	Intramammary	4,991	0.00	0.00	0.00
fluoroquinolones	Oral	4,991	0.00	0.00	0.00
fluoroquinolones	Parenteral	4,987	0.00	0.00	0.00
macrolides/lincosamides	Intramammary	4,991	0.00	0.00	0.00
macrolides/lincosamides	Oral	3,955	0.00	0.00	0.62
macrolides/lincosamides	Parenteral	4,342	0.00	0.00	0.04
penicillins	Intramammary	4,991	0.00	0.00	0.00
penicillins	Oral	4,639	0.00	0.00	0.27
penicillins	Parenteral	1,345	0.16	0.45	0.40
Pleuromutilins	Intramammary	4,991	0.00	0.00	0.00
Pleuromutilins	Oral	4,884	0.00	0.00	0.07
pleuromutilins	Parenteral	4,802	0.00	0.00	0.00
polymyxins	Intramammary	4,991	0.00	0.00	0.00
polymyxins	Oral	4,602	0.00	0.00	0.09
polymyxins	Parenteral	4,599	0.00	0.00	0.01
tetracyclines	Intramammary	4,991	0.00	0.00	0.00
tetracyclines	Oral	2,387	0.56	4.40	3.16

tetracyclines	Parenteral	2,340	0.03	0.23	0.28
trimethoprim/sulphonamides	Intramammary	4,991	0.00	0.00	0.00
trimethoprim/sulphonamides	Oral	3,580	0.00	0.30	0.67
trimethoprim/sulphonamides	Parenteral	4,689	0.00	0.00	0.01

Usage of antibiotics in $DDDA_F$ at poultry farms

Broilers

Number of broiler farms: 770
Number of broiler farms with $DDDA_F$ = 0: 125
Number of broiler farms that used third- and fourth-generation cephalosporins: 0
Number of broiler farms that used fluoroquinolones: 116

Table A25. Usage of antibiotics in $DDDA_F$ at broiler farms.

n	Mean	Median	P75	P90
770	11.5	8.8	17.7	26.6

Figure A18. Mean antibiotic use in number of treatment days per year at broiler farms in 2011, 2012 and 2013.

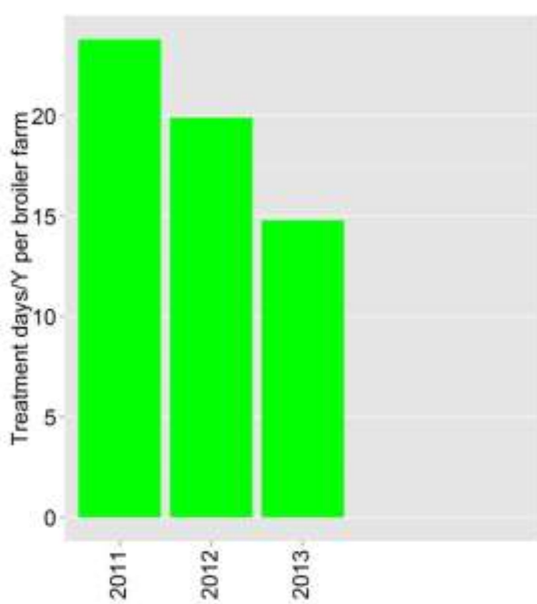


Figure A19. Mean antibiotic use at broiler farms in 2013, by ATCvet group (left) and by first-, second- and third-choice products (right).

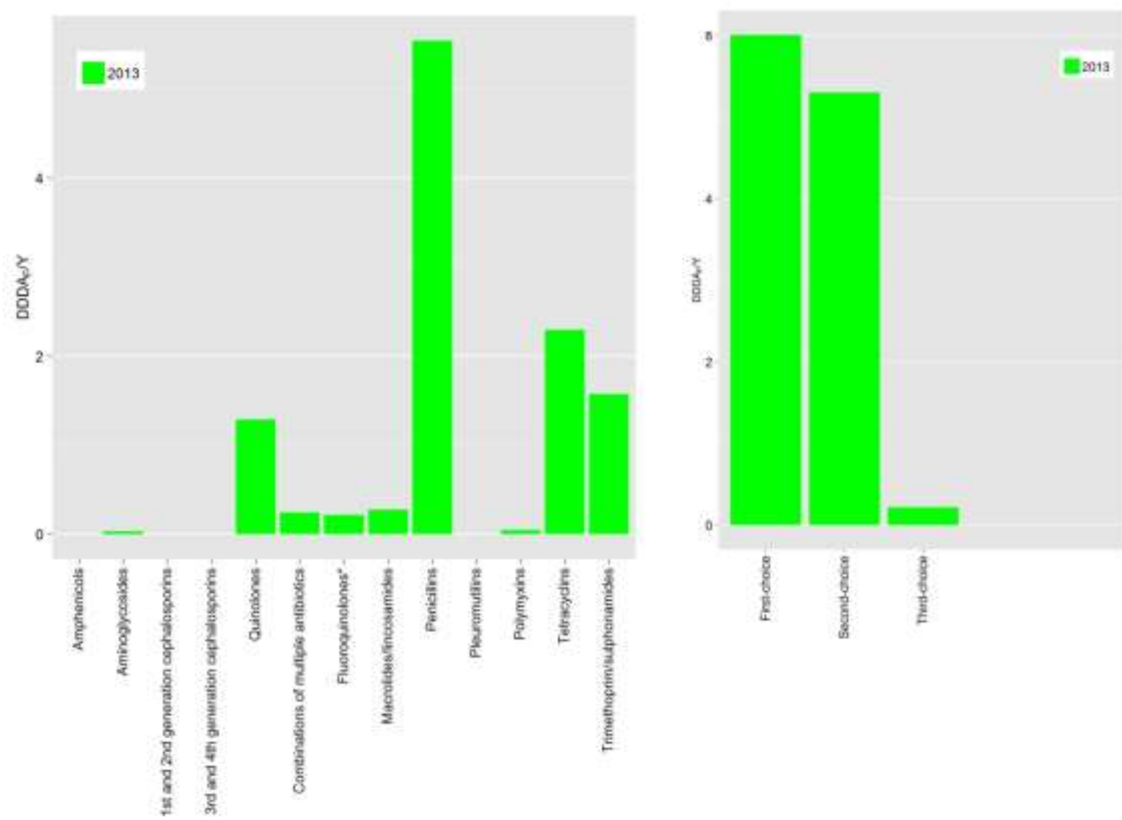


Table A26. Usage in DDDA$_F$ at broiler farms in 2013, by ATCvet group and route of administration.

ATCvet group	Route of administration	# of rearing farms with DDDA$_F$/Y = 0	DDDA$_F$		
			Median	P75	Mean
aminoglycosides	Oral	751	0.00	0.00	0.03
quinolones	Oral	604	0.00	0.00	1.29
combinations of multiple antibiotics	Oral	533	0.00	0.27	0.25
fluoroquinolones	Oral	654	0.00	0.00	0.22
macrolides/lincosamides	Oral	619	0.00	0.00	0.28
penicillins	Oral	282	2.95	8.53	5.54
pleuromutilins	Oral	767	0.00	0.00	0.00
polymyxins	Oral	759	0.00	0.00	0.05
tetracyclines	Oral	421	0.00	3.27	2.59
trimethoprim/sulphonamides	Oral	339	0.52	2.04	1.57

Turkeys

Number of turkey farms: 48
Number of turkey farms with $DDDA_F/J=0$: 1

Number of farms that used third- and fourth-generation cephalosporins:0
Number of farms that used fluoroquinolones: 36

Table A27. Usage of antibiotics in $DDDA_F$ at turkey farms.

n	Mean	Median	P75	P90
48	21.9	18.5	30.8	41.6

Figure A20. Mean antibiotic use at turkey farms in 2013, by ATCvet in 2013 per ATCvet group (links) en first -, second- and third-choice antibiotics (right).

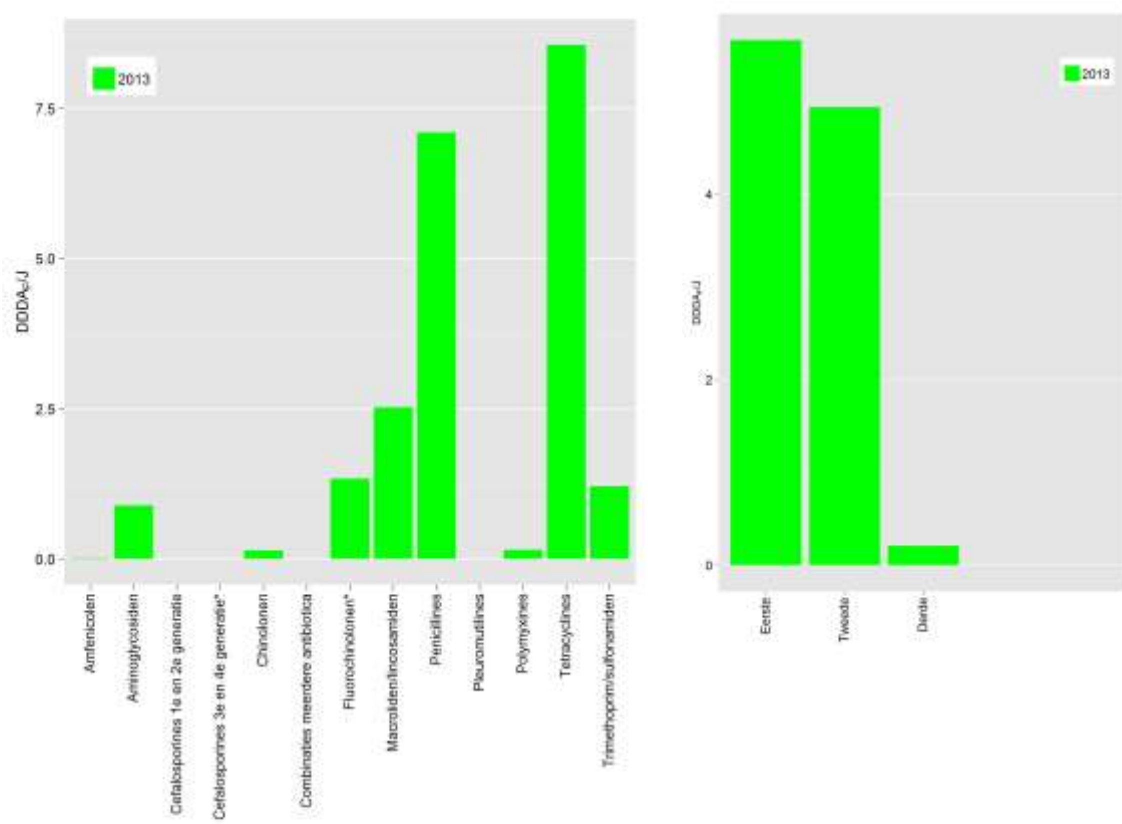


Table A28. Usage in $DDDA_F$ at turkey farms in 2013, by ATCvet group and route of administration.

ATCvet group	Route of administration	# of turkey farms with $DDDA_F$ = 0	$DDDA_F$		
			Median	P75	Mean
amphenicols	Oral	47	0.00	0.00	0.01
aminoglycosides	Oral	40	0.00	0.00	0.89
quinolones	Oral	46	0.00	0.00	0.14
fluoroquinolones	Oral	12	0.96	2.25	1.33
macrolides/lincosamides	Oral	7	1.47	3.21	2.52
penicillins	Oral	10	3.99	10.00	7.10
polymyxins	Oral	38	0.00	0.00	0.15
tetracyclines	Oral	6	7.88	12.60	8.56
trimethoprim/sulphonamides	Oral	28	0.00	1.86	1.21

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SDa/1145/2014