Usage of antimicrobial drugs in companion animals 2012 – 2014

Results of a survey of veterinary practices in the Netherlands

January 2017




Preface

This is a copy of the SDa report *Usage of antimicrobial drugs in companion animals 2012 - 2014: Results of a survey of veterinary practices in the Netherlands*. The Netherlands Veterinary Medicines Authority (SDa) drew up this report following a request by the Dutch Ministry of Economic Affairs. The main objectives of the report were to quantify the amounts of antimicrobial drugs used in companion animals, to identify differences in prescription patterns between individual veterinary practices, and to specify the relative contribution of first-, second- and third-choice antimicrobial drugs to overall antimicrobial drug use in companion animals. To this end, usage data for the years 2012, 2013 and 2014 were collected through a survey of practices providing veterinary care for companion animals. A similar survey was conducted to shed light on the usage of antimicrobial drugs in horses.

SDa expert panel member Inge van Geijlswijk conducted the study on behalf of the expert panel, between November 2015 and September 2016. Marloes van Dijk (a veterinarian working at Utrecht University) and Femke Taverne (SDa researcher) assisted her in her research activities. Although the members of the consultative group initially had doubts about the value and necessity of this study, they became more convinced as the study progressed. With this report, the SDa expert panel hopes to show that transparency regarding antimicrobial drug usage contributes to further improvement of veterinarians' level of professionalism, optimization of the usage of antimicrobial drugs, and harmonization between veterinary practices.

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Summary

A total of 111 veterinary practices provided antimicrobial drug procurement data for the years 2012, 2013 and 2014. These data were used to estimate the amounts of antimicrobial drugs used in companion animals registered with these veterinary practices, based on the number of dogs, cats and rabbits registered with the practice concerned. Data provided by 100 of the 111 veterinary practices turned out to be consistent and complete, and these practices were included in the study.

The patient populations specified by the respondents were adjusted in line with an earlier study, which had shown that veterinary practice records tend to result in overestimation of the number of dogs (by 14%) and underestimation of the number of cats (by 34%)[2]. The 2014 pet rabbit population reported by HAS University of Applied Sciences[1] suggested that veterinary practice records result in an 84% underestimation of the number of rabbits. Consequently, the number of rabbits registered with the participating practices was adjusted accordingly.

The Dutch *Diergeneesmiddelenstandaard* (also referred to as the *DG-standaard*) was used to convert the amount of antimicrobial drugs supplied in a particular year into the number of kilograms of dog and/or cat and/or rabbit treated in the year concerned. Based on the number of kilograms treated and the overall weight of the patient population of each veterinary practice, the Defined Daily Dose Animal/year for each veterinary practice ($DDDA_{DAP}$) could be calculated.

Usage of antimicrobial drugs in companion animals showed a decrease compared to the 2009-2011 data. Between 2012 and 2014 it continued to decline, from 3.14 DDDA to 2.60 DDDA (a 17.2% reduction). The 2014 figure indicates that on average, a dog/cat/rabbit in the Netherlands received antimicrobial drugs for 2.6 days/year.

There were big differences between individual practices, with 2014 recording the smallest (a 13-fold) difference between minimum and maximum usage levels. In 2014, the $DDDA_{DAP}$ figures of the 100 veterinary practices ranged from 0.65 to 8.64. The substantial differences between the veterinary practices were in part due to the inclusion of different types of practices. For example, one of the practices was a single-species practice, and another practice only provided specialty care. Additionally, the number of patients per practice varied substantially. It was therefore decided not to include practices with excessively small or excessively big patient populations (<300 dogs or >10,000 dogs).

In 2014, second-choice antimicrobial drugs were the main group of antimicrobial drugs used in companion animals, representing 51% of all antimicrobial drugs used. First-choice antimicrobial drugs and third-choice antimicrobial drugs represented 42% and 6.9%, respectively. The main development between 2012 and 2013 was a $DDDA_{DAP}$ reduction. The main development between 2013 and 2014 was a shift from usage of third- and second-choice antimicrobial drugs towards usage of first-choice antimicrobial drugs. Between 2012 and 2014, usage of third-choice antimicrobial drugs dropped by 73%, from 0.67 (minimum: 0.014, maximum: 2.97) $DDDA_{DAP}$ to 0.189 (minimum: 0.001, maximum: 0.884) $DDDA_{DAP}$.

The patient population of the 100 veterinary practices combined is estimated to represent 13% of all companion animals in the Netherlands. Considering the big differences between individual practices, there still seems to be room for further harmonization of veterinary practices' application of protocols and further reductions in the amounts of antimicrobial drugs prescribed for companion animals. Further research is required to determine how such harmonization can be facilitated.

The SDa expert panel feels continuous monitoring and benchmarking of the companion animal sector is not necessary, since current usage levels are low, inter-practice differences are decreasing, and third-choice antimicrobial drugs only represent a small proportion of all antimicrobial drugs used. It therefore recommends monitoring the usage of antimicrobial drugs in companion animals once every 3 years, by means of a survey of companion animal veterinary practices similar to the survey described in this report.

Introduction

In the interest of public health, the Netherlands Veterinary Medicines Authority (SDa) promotes prudent usage of antimicrobial drugs in the Dutch livestock sector, with due regard for animal welfare. It strives for full transparency regarding the usage of antimicrobial drugs in agricultural livestock, and defines benchmark thresholds for livestock farmers as well as their veterinarians.
Five livestock sectors (the veal, cattle, pig, broiler and turkey farming sectors) are already subject to monitoring, but in order to further promote transparency the SDa also wants to assess the amounts of antimicrobial drugs used in several other categories of animals. This report provides insight into the usage of antimicrobial drugs in companion animals. In a study similar to the one described in this report, the SDa also assessed usage of antimicrobial drugs in horses.

Background

Antimicrobial drug resistance is a growing concern in the Netherlands, both in human and veterinary medicine. To limit further spread of antimicrobial drug resistance, prudent usage of antimicrobial drugs is key. It is therefore crucial to have knowledge of the amounts of antimicrobial drugs used in various animals. Several years ago, at the request of the Ministry of Economic Affairs, the Ministry of Health, Welfare and Sport, the Dutch livestock sector and veterinarians, the SDa started monitoring antimicrobial drug usage levels in the four main livestock sectors in the Netherlands: the veal, cattle, pig and broiler farming sectors. This was the result of an agreement between the livestock sectors and the Dutch government. In the Netherlands, the great majority of antimicrobial drugs sold for veterinary use can be attributed to the four main livestock sectors. When comparing delivery records of the monitored livestock sectors with sales figures, approximately 9% of antimicrobial drugs sold (2014 figures) cannot be attributed to these four livestock sectors. Except for the 2% of antimicrobial drugs only authorized for use in companion animals, it is currently unclear in which categories of animals the remaining antimicrobial drugs were used. Assessment of the amounts of antimicrobial drugs used in companion animals is necessary to help determine which proportion of antimicrobial drugs authorized for use in agricultural livestock as well as companion animals was in fact administered to companion animals. This will help determine which categories of animals were treated with the multi-species authorized products that could not be attributed to the monitored livestock sectors. This information will help clarify the mass balance discrepancy between the number of kilograms of antimicrobial drugs sold and the reported number of kilograms of antimicrobial drugs administered in the monitored livestock sectors.

Objective

This study was performed to assess the use of antimicrobial drugs in companion animals in the Netherlands. Due to feasibility and affordability considerations, the SDa opted for a survey design. The survey's objective was to provide insight into:

- the amounts of antimicrobial drugs used in companion animals;
- differences between prescription patterns of individual veterinary practices with regard to the antimicrobial drugs prescribed for companion animals;
- the relative contribution of first-, second- and third-choice antimicrobial drugs to overall antimicrobial drug use in companion animals.

Materials and methods

Consultative group

A consultative group was established in order to optimize the level of support for the study and in order to facilitate early recognition of any study design limitations. The consultative group included six companion animal veterinarians from veterinary practices throughout the Netherlands (refer to Appendix 1 for the composition of the consultative group). The consultative group provided feedback on the study protocol, which resulted in several protocol amendments. During the study, the consultative group met a total of three times to discuss the study's progress and the results (on June 17 and July 1, 2015, and on April 18, 2016).

Selection of the veterinary practices

Following consultation with the consultative group it was decided that as a first step, the Netherlands Association for Companion Animal Medicine (GGG), part of the Royal Dutch Society for Veterinary Medicine (KNMvD), would send a letter to all of its members. The aim of this letter was to inform veterinarians about the study and to interest them in participating in the survey. The KNMvD subsequently provided the SDa with contact details of 1,178 veterinary practices for companion animals. On September 7, 2015, all of these practices were sent a letter by post, and they were sent a reminder email on October 21, 2015.

On March 1, 2016, the SDa provided the financier with an interim report, entitled *Gebruik van antibiotica in de gezelschapsdieren-dierenartsenpraktijken in Nederland in de jaren 2012, 2013 en 2014* [Usage of antimicrobial drugs in companion animal veterinary practices in the Netherlands in 2012, 2013 and 2014]. The interim report was based on data from 59 veterinary practices. To make sure the final report would describe the use of antimicrobial drugs in companion animals in the Netherlands as accurately as possible, the SDa later decided to actively approach veterinary practices that had provided incomplete data, and ask them to submit the missing data. In the end 100 veterinary practices had provided all the required data, which were subsequently analyzed and included in the current report.

Data collection

All companion animal veterinary practices in the Netherlands were requested by letter as well as email to provide their antimicrobial drug procurement data and number of unique patients for the years 2012, 2013 and 2014. Procurement data for 89 veterinary practices were directly submitted to the SDa by the veterinary pharmaceuticals wholesaler AUV. The remaining practices firstly obtained their procurement data from AUV and then forwarded the data to the SDa. Data regarding veterinary prescription drugs manufactured by MSD were not included in AUV procurement records. Although AUV did supply MSD products, MSD was responsible for billing. Procurement data for MSD products were secondarily requested from MSD, by sending MSD a list of participating veterinary practices. MSD then sent each of the participating practices an email containing their procurement data for 2012, 2013 and 2014, which the practices subsequently forwarded to the SDa. Data regarding products ordered from other wholesalers (such as Aesculaap and AST) were requested from the relevant distributors by the veterinary practices themselves. To this end the practices could use a sample email written by the researchers.

Patient numbers for the years from 2012 to 2014 represented the number of dogs, cats and rabbits that were seen by one of the practice's veterinarians at least once during the study period. The veterinary practices retrieved these numbers from their practice management system by means of a standardized query.

Data analysis

The SDa received procurement data (the number of packages ordered per calendar year, by EAN code) from companion animal-only veterinary practices and mixed-animal veterinary practices. For companion animal-only veterinary practices and mixed-animal veterinary practices with separate companion animal and non-companion animal procurement records, the SDa converted the procurement data into the number of kilograms of dog/cat/rabbit treated, based on the authorized dosages for the animals concerned (in the absence of authorized dosages, dosages were based on the best available scientific evidence), as defined in the *DG-standaard*. For mixed-animal veterinary practices with combined companion animal and non-companion animal procurement records, the SDa initially tried to specify the procurement data by category of animals. For some products, however, the SDa could not determine in which category of animals they had been used. As a result it was decided to exclude mixed-animal practices with combined procurement records from the study.

For dogs and cats, the overall number of kilograms were calculated using previously reported average body weights[2]: 19.1 kg for dogs, and 4.1 kg for cats. For rabbits, 2.5 kg was used as the standard body weight.

An earlier study had included 68 of the then 820 companion animal veterinary practices in the Netherlands. The dog and cat populations of these 68 practices were extrapolated to estimate the national companion animal population in the Netherlands, based on the number of participating veterinary practices[2]. The number of dogs estimated by extrapolation turned out to exceed the number of dogs officially recorded in the Netherlands (114% of the official number). This overestimation was attributed to owners not having informed their veterinarian of their dog's death. Extrapolation of the number of cats resulted in an estimate that was lower than the number of cats officially recorded (66% of the official number). It is a well-known fact that a proportion of the cat population in the Netherlands is never seen by a veterinarian. Therefore, it was decided to normalize each practice's patient numbers based on the dog:cat ratio in the Netherlands, assuming this national ratio also applies to the populations registered with regular companion animal veterinary practices.

To facilitate comparison with data from the older study[2], the SDa decided that its study should use the same correction factor to adjust for overestimation (by 14%) of the number of dogs and underestimation (by 34%) of the number of cats. The SDa compared the number of rabbits registered with the participating veterinary practices with national pet rabbit population data[1] in order to determine the degree of underestimation. To arrive at 13.2% (the percentage cats and dogs included in this study) of the national pet rabbit population, the number of rabbits registered with the participating practices had to be adjusted by a factor of 6.25 (assuming an 84% underestimation). Such adjustments were required since antimicrobial drug usage levels should pertain to the overall populations of the species concerned rather than just the animals seen by veterinarians.

The SDa subsequently calculated the theoretical number of days per year that an average dog/cat/rabbit was treated with antimicrobial drugs (= Defined Daily Dose Animal, $DDDA_{DAP}$), based on the number of kilograms of dog/cat/rabbit actually treated and the overall weight of dogs/cats/rabbits making up the veterinary practice's patient population (the number at risk) for the years 2012, 2013 and 2014. For over 90% of the veterinary prescription drugs it was unclear whether they had been administered to dogs, to cats or to rabbits, which meant the resulting $DDDA_{DAP}$ figures could not be categorized by species. Such categorization would require examination of prescription data instead of procurement data. The available information was used to determine the relative contribution of first-, second- and third-choice antimicrobial drugs, and to identify trends in antimicrobial drug use between 2012 and 2014.

Definition:

The parameter **$DDDA_F$** represents the 'Defined Daily Dose Animal' based on the antimicrobial drug usage data of **a particular livestock farm**. The $DDDA_F$ is determined by first calculating the total number of kilograms treated at a particular livestock farm in a specific year, based on the amount of antimicrobial drugs obtained by the livestock farm in the year concerned, and then dividing this number by the average number of kilograms of animal present at the livestock farm concerned.

The DDDA for companion animals is calculated for **a particular veterinary practice**, and represented by the parameter **$DDDA_{DAP}$.**

The $DDDA_{DAP}$ is determined as follows:
$DDDA_{DAP}$ (for companion animals): first, the number of kilograms of companion animals treated by a particular veterinary practice in a specific year is calculated, based on the amount of antimicrobial drugs procured/delivered by the veterinary practice concerned, after which the number of kilograms is divided by the number of animals seen at least once by one of the practice's veterinarians over a 3-year period multiplied by the standardized average body weight of companion animals.

Example: 1 $DDDA_{DAP}$ per year would mean that on average, each companion animal registered with the veterinary practice receives antimicrobial drug treatment for 1 day a year. In other words: on an average day, 1 in 365 companion animals registered with the veterinary practice receives antimicrobial drug treatment.

Statistical analysis

To identify changes over time, paired samples t-tests were performed using SPSS Statistics, version 24, on a Microsoft Windows PC.

Results

The study included 100 veterinary practices. In 2014, a total of 226,940 dogs, 225,476 cats and 25,310 rabbits were registered with these practices. The average number of dogs, cats and rabbits per veterinary practice was 3,061, 2,641 and 303, respectively. These numbers were adjusted using the correction factors referred to in the Data analysis section. Following adjustment, the practices turned out to represent 13.27% of the national dog population and 13.14% of the national cat population. According to official records, 1.5 million dogs, 2.6 million cats and 1.2 million rabbits were present in the Netherlands in 2014[1].

In 2012, the mean $DDDA_{DAP}$ for all dogs, cats and rabbits registered with the included veterinary practices was 3.14 (±1.52). In 2013 and 2014, the mean $DDDA_{DAP}$ figures were 2.77 (±1.39) and 2.60 (±1.32), respectively. Some of these differences reached statistical significance (p-value for the 2012-2013 difference: 0.001; p-value for the 2013-2014 difference: 0.129; p-value for the 2012-2014 difference: <0.001) (see Table 1).

Table 1.
Usage of antimicrobial drugs in companion animals in the Netherlands in 2012, 2013 and 2014 (in DDDA), by group of antimicrobial drugs

Group of antimicrobial drugs	No. of practices with reported use	Mean DDDA	Minimum DDDA	Maximum DDDA	Standard deviation	Relative contribution of 1st-/2nd-/3rd-choice ABs	% decline from 2012 level
Overall antimicrobial drug use in 2012	100	3.136	0.171	7.553	1.521		
First-choice ABs in 2012	100	0.863	0.006	3.998	0.629	27.5%	
amphenicols	0	-	-	-	-		
combinations of multiple antimicrobial drugs	87	0.201	0.006	1.090			
macrolides/lincosamides	31	0.045	0.019	0.829			
other	64	0.075	0.007	0.495			
penicillins	66	0.158	0.008	2.216			
tetracyclines	95	0.201	0.000	0.898			
trimethoprim/sulfonamides	76	0.183	0.000	1.790			
Second-choice ABs in 2012	100	1.607	0.015	4.330	0.933	51.2%	
aminoglycosides	14	0.002	0.003	0.065			
1st- and 2nd-gen. cephalosporins	85	0.303	0.004	1.873			
combinations of multiple antimicrobial drugs	10	0.027	0.019	1.642			
macrolides/lincosamides	3	0.002	0.038	0.149			
penicillins	99	1.269	0.015	4.047			
polymyxins	2	0.003	0.073	0.209			
Third-choice ABs in 2012	98	0.666	0.014	2.968	0.459	21.2%	
3rd- and 4th-gen. cephalosporins	79	0.346	0.056	2.289			
fluoroquinolones	98	0.320	0.012	1.319			

Table 1.
Usage of antimicrobial drugs in companion animals in the Netherlands in 2012, 2013 and 2014 (in DDDA), by group of antimicrobial drugs
(continued)

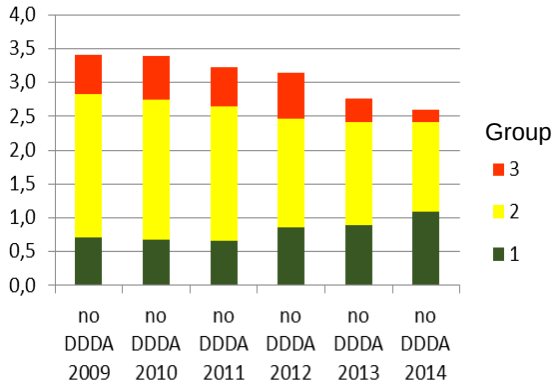
Group of antimicrobial drugs	No. of practices with reported use	Mean DDDA	Minimum DDDA	Maximum DDDA	Standard deviation	Relative contribution of 1st-/2nd-/ 3rd-choice ABs	% decline from 2012 level
Overall antimicrobial drug use in 2013	100	2.766	0.295	9.204	1.386		
First-choice ABs in 2013	99	0.887	0.145	3.840	0.531	32.1%	
amphenicols	1	-	-	-	-		
combinations of multiple antimicrobial drugs	87	0.193	0.002	1.089			
macrolides/lincosamides	40	0.064	0.010	1.294			
other	67	0.077	0.010	0.413			
penicillins	61	0.127	0.008	1.108			
tetracyclines	95	0.207	0.001	1.229			
trimethoprim/sulfonamides	88	0.219	0.001	1.398			
Second-choice ABs in 2013	100	1.527	0.025	7.658	0.993	55.2%	
aminoglycosides	17	0.002	-	0.034			
1st- and 2nd-gen. cephalosporins	81	0.305	0.006	6.871			
combinations of multiple antimicrobial drugs	13	0.019	0.013	0.587			
macrolides/lincosamides	3	0.003	0.020	0.149			
penicillins	99	1.198	0.025	3.275			
polymyxins	0	-	-	-			
Third-choice ABs in 2013	97	0.352	0.007	1.456	0.284	12.7%	
3rd- and 4th-gen. cephalosporins	76	0.163	0.018	0.818			
fluoroquinolones	96	0.189	0.003	1.158			

Table 1.
Usage of antimicrobial drugs in companion animals in the Netherlands in 2012, 2013 and 2014 (in DDDA), by group of antimicrobial drugs
(continued)

Group of antimicrobial drugs	No. of practices with reported use	Mean DDDA	Minimum DDDA	Maximum DDDA	Standard deviation	Relative contribution of 1st-/2nd-/ 3rd-choice ABs	% decline from 2012 level	
Overall antimicrobial drug use in 2014	100	2.596	0.655	8.638	1.317		17.2%	
First-choice ABs in 2014	100	1.093	0.191	3.640	0.599	42.1%	-26.6%	(increase)
amphenicols	0	-	-	-				
combinations of multiple antimicrobial drugs	90	0.214	0.007	1.337				
macrolides/lincosamides	75	0.138	0.010	1.202				
other	78	0.129	0.021	0.701				
penicillins	63	0.113	0.011	1.108				
tetracyclines	98	0.249	0.001	2.054				
trimethoprim/sulfonamides	88	0.252	0.002	1.766				
Second-choice ABs in 2014	99	1.323	0.039	5.795	0.793	51.0%	17.6%	
aminoglycosides	11	0.001	-	0.028				
1st- and 2nd-gen. cephalosporins	74	0.174	0.004	1.227				
combinations of multiple antimicrobial drugs	11	0.007	0.000	0.320				
macrolides/lincosamides	2	0.004	0.134	0.249				
penicillins	99	1.137	0.039	5.328				
polymyxins	0	-	-	-				
Third-choice ABs in 2014	95	0.180	0.001	0.884	0.195	6.9%	73.0%	
3rd- and 4th-gen. cephalosporins	53	0.068	0.003	0.491				
fluoroquinolones	94	0.111	0.001	0.698				

The $DDDA_{DAP}$ figures varied by veterinary practice and from year to year. Throughout the study period (2012-2014), individual practices' overall DDDA figures ranged from 0.17 (2012) to 9.20 (2013) (a 54-fold difference) (see Table 1). The mean DDDA/year per practice for the 3 years combined ranged from 0.42 to 6.76 (a 16-fold difference). There was a 13-fold difference between the minimum and maximum 2014 DDDA figures recorded for individual practices.

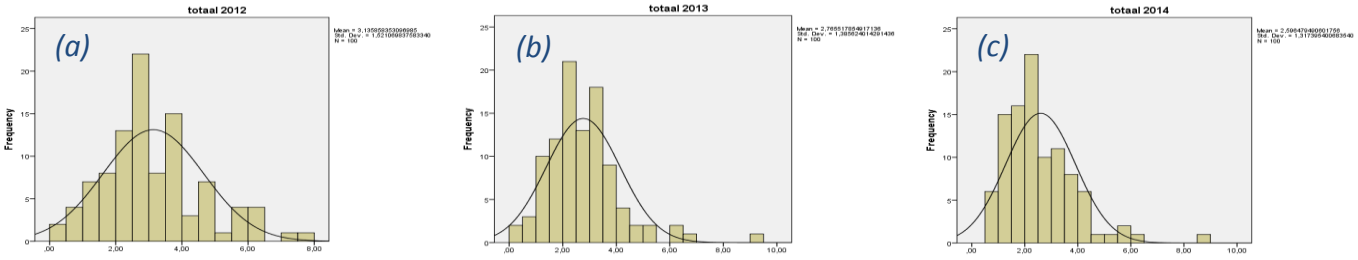
Figure 1. Relative contribution of first-, second- and third-choice antimicrobial drugs in the years 2009 through 2014



In 2014, overall usage of antimicrobial drugs in companion animals was 17.2% lower than the 2012 level (see Table 1). Throughout the observation period, use of first-choice antimicrobial drugs rose by 27%, while second- and third-choice antimicrobial drugs showed an 18% and a 73% reduction, respectively (see Figure 1). In 2012, 2013 and 2014, third-choice antimicrobial drugs accounted for 21%, 13% and 6.9% of overall antimicrobial drug use, respectively. The relative contribution of first-choice antimicrobial drugs increased during the study period (2012: 28%; 2013: 32%; 2014: 42%). While first-choice antimicrobial drugs accounted for 42% of all antimicrobial drugs used in companion animals in 2014, second- and third-choice antimicrobial drugs accounted for 51% and 6.9%, respectively.

In 2014, 96% of veterinary practices recorded a decline in their $DDDA_{DAP}$ figure for third-choice antimicrobial drugs compared to 2012 (defined as a ≥0.010 reduction in $DDDA_{DAP}$ from 2012 to 2014). In 1% of veterinary practices, the $DDDA_{DAP}$ figure for third-choice antimicrobial drugs remained virtually unchanged (defined as a <0.010 change in $DDDA_{DAP}$ from 2012 to 2014). It should be noted, however, that the practice concerned had a low $DDDA_{DAP}$ level for third-choice antimicrobial drugs to begin with (0.05 in 2012). Of the veterinary practices included in the study, 3% recorded an increase in their $DDDA_{DAP}$ figure for third-choice antimicrobial drugs (defined as a ≥0.010 rise in $DDDA_{DAP}$ from 2012 to 2014). One of these practices had not used any third-choice antimicrobial drugs at all in 2012 and 2013, but recorded a $DDDA_{DAP}$ of 0.03 for the year 2014. The other two practices recorded a $DDDA_{DAP}$ of 0.12 and 0.24, respectively, for 2014, and lower figures for 2012. Five practices in 2014, two practices in 2013, and three practices in 2012 had not used any third-choice antimicrobial drugs at all.

Figure 2. Usage level distributions based on participating veterinary practices, for the years 2012 (a), 2013 (b) and 2014 (c)



The 2012 distribution is markedly wider than the 2014 distribution (see Figure 2). In the 2012, 2013 and 2014 distributions, 5, 4 and 3 outliers were detected, respectively.

Discussion

Usage of antimicrobial drugs in individual veterinary practices

Usage of antimicrobial drugs in companion animals has steadily declined since 2009, as indicated by $DDDA_{DAP}$ levels of 3.42 (2009), 3.40 (2010), 3.27 (2011)[2], 3.14 (2012), 2.77 (2013), and 2.60 (2014). For 2014, this study identified a mean $DDDA_{DAP}$ of 2.60. This finding means that on average, a dog, cat or rabbit registered with a participating veterinary practice received 2.6 days of antimicrobial drug treatment per year.

Most veterinary practices recorded a usage level similar to the usage level recorded in human primary care (which would amount to 3.85 DDDs/year[4]). The SDa wanted to compare the amounts used in companion animals with the amounts used in monitored livestock sectors. Livestock that is housed and treated individually was identified as best suited for such comparison. The SDa therefore decided to compare usage in companion animals with usage in dairy cattle and suckler cows. The usage level recorded for dairy cattle and suckler cows amounted to 2.3 DDDA[5]. The $DDDA_{DAP}$ figures recorded for the 100 individual veterinary practices for the years 2012, 2013 and 2014, range from 0.17 to 9.20.

The main development between 2012 and 2013 was a decline in overall $DDDA_{DAP}$ figures, while the main development between 2013 and 2014 was a distinct shift from usage of third- and second-choice antimicrobial drugs towards usage of first-choice antimicrobial drugs. Usage of third-choice antimicrobial drugs showed the steepest decline as a result of these developments (with a 73% reduction between 2012 and 2014). With a $DDDA_{DAP}$ of 0.68, in 2012 third-choice antimicrobial drugs still accounted for 21% of overall antimicrobial drug use. This was quite similar to the 2011 level (a $DDDA_{DAP}$ of 0.59, representing a relative contribution of 18.2%). In 2013 and in particular in 2014, usage of third-choice antimicrobial drugs declined distinctly, to a mean $DDDA_{DAP}$ of 0.19, representing just 6.9% of antimicrobial drug use in 2014. This welcome development may be attributable to better education, more veterinarians participating in continuing education, and implementation of guidelines on the use of antimicrobial drugs in companion animal medicine.

Although there were big differences between individual veterinary practices, the extent of inter-practice variation decreased between 2012 and 2014. In 2014, there was a 13-fold difference between the minimum $DDDA_{DAP}$ and the maximum $DDDA_{DAP}$ recorded for individual practices.

Practice characteristics and generalizability

This study included companion animal veterinary practices with varying levels of specialization. They ranged from single-species practices to mixed-species practices, and from secondary care practices specializing in internal medicine to mobile practices only making house calls. Such practice-specific characteristics probably have contributed to the inter-practice differences identified in this study, and may very well justify the higher usage levels of certain practices.

However, the SDa could not include a more detailed specification of usage patterns in its report, as it had to ensure usage data can never be traced back to the veterinary practices concerned.

Based on available sales figures, the SDa estimated the amount of antimicrobial drugs only authorized for use in companion animals that had been used in the companion animal population in the Netherlands, and it subsequently added the amount of antimicrobial drugs with a multi-species indication used in companion animals according to the study data. This calculation resulted in a $DDDA_{DAP}$ of 4.3. This indicates that the 100 veterinary practices that participated in this study (as well as the 68 practices included in the prior study[2], considering the level of similarity) either had overestimated their practice's patient population (resulting in their $DDDA_{DAP}$ figures being on average 1.7 $DDDA_{DAP}$ lower than the national usage level), or had been more prudent in their usage of antimicrobial drugs. The latter reason would mean that in terms of prescription patterns, the participating practices were not fully representative of the 1,000 other veterinary practices in the Netherlands.

Considering the big differences between individual practices, there still seems to be room for further harmonization of the treatment protocols used by veterinary practices. Improved implementation of existing guidelines and development of new guidelines for other common indications will lead to further reductions in the amounts of antimicrobial drugs used.

Limitations

When interpreting the study results, some limitations of the study should be taken into account. Due to privacy-related considerations, the researchers could not ascertain whether the supplied antimicrobial drug procurement data were correct and complete. In particular small amounts of special antimicrobial drugs that were not obtained through regular wholesalers (primarily antimicrobial drugs obtained from human pharmacies) have not been included in the study data. In the previous study, usage of antimicrobial drugs for human use represented 5% of overall use[2], while in the SDa study it turned out to represent 2% of overall use. This only refers to antimicrobial drugs that can be administered intravenously (cefalozin). Current legislation discourages veterinary use of antimicrobial drugs authorized for human use (veterinary use is only allowed following a culture and sensitivity testing). The SDa expects the number of administered treatments not included in the study data to be very small, and that such treatments primarily concerned oral solutions containing metronidazole and trimethoprim/sulfamethoxazole, and formulations containing nitrofurantoin.

It should be noted that the SDa study used veterinary practices' procurement data to determine usage levels, while usage levels in the previous study[2] were based on prescription data. Consequently, usage levels reported in the previous study have been adjusted for loss or disposal of unused antimicrobial drugs (i.e. spillage), while usage levels in the SDa report have not. As a result, the SDa study may have overestimated usage levels and consequently underestimated changes over time compared to the previous study. As the previous study focused on an earlier period, no definite statements can be made in this regard. Considering the

continuous nature of the developments observed in 2011 and 2012, however, the SDa does not expect spillage to have substantially affected its study results.

In line with foreign studies assessing the amounts of antimicrobial drugs used by companion animal veterinary practices and its method for determining usage levels in the main livestock sectors in the Netherlands, the SDa decided to base its estimations on standardized animal weights. This may, however, have affected the accuracy of practice-specific data (e.g. in the event of a veterinary practice specialized in treatment of Chihuahuas).

As there is no gold standard for determining patient population sizes, it is not possible to conclude with absolute certainty whether on average, usage of antimicrobial drugs by the participating veterinary practices was below the national usage level.

Mass balance

In 2014, there was a 16,957 kg mass balance discrepancy between the number of kilograms of antimicrobial drugs sold and the recorded number of kilograms of antimicrobial drugs administered in the monitored livestock sectors[6]. Antimicrobial drugs only authorized for use in companion animals accounted for 4,310 kg (with third-choice antimicrobial drugs accounting for 22.6 kg), which still left a 12,647 kg discrepancy. The horse population in the Netherlands (as recorded by Sectorraad Paarden, the foundation representing the Dutch horse sector) could have been responsible for up to 2,600 kg (20.6%) of this 12,647 kg discrepancy[7]. The remaining 10,047 kg mass balance discrepancy was in part due to the fact that veterinary prescription drugs authorized for use in agricultural livestock as well as companion animals had been obtained for use in companion animals. As a result of ordering such veterinary prescription drugs with the intent of administering them to companion animals, the companion animal practices participating in the SDa survey were responsible for 129 kg in terms of active substances.

Considering that the companion animal population included in the study represented 13.2% of the national population, this figure of 129 kg can be extrapolated to estimate the total number of kilograms of such veterinary prescription drugs ordered by Dutch veterinary practices with the intent of using them in companion animals. Extrapolation results in 980 kg, lowering the 2014 mass balance discrepancy to 16,957 - 4,310 - 2,600 - 980 = 9,067 kg.

Of the 129 kg of active substances referred to above, 1.67 kg could be attributed to third-choice antimicrobial drugs. Extrapolation of the latter figure suggests that in terms of active substances, Dutch companion animal practices used a total of 12.65 kg of third-choice antimicrobial drugs that were authorized for use in agricultural livestock as well as companion animals. It therefore follows that of the 429 kg of third-choice antimicrobial drugs sold in the Netherlands in 2014, 170 kg concerned products used in the monitored livestock sectors[6], 22.6 kg concerned products only authorized for use in companion animals, and 12.65 kg concerned products with a multi-species indication that were used in companion animals. Consequently, usage of third-choice

antimicrobial drugs in companion animals amounted to 35.25 kg in total. Assuming the horses included in the other SDa study represented 15.7% of the horse population in the Netherlands, overall usage of third-choice antimicrobial drugs in horses was estimated at 6 kg. This means that of the 429 kg of third-choice antimicrobial drugs sold in 2014, as yet 429 - 170 - 35.25 - 6 = 217.75 kg cannot be attributed to a particular category of animals.

Conclusion

Developments in the usage of antimicrobial drugs in companion animals in the Netherlands have been consistent for several years now. Usage levels have been declining, and distributions have become more narrow over the past few years. Usage in companion animals turned out to be quite similar to human usage based on GP prescriptions. A distinct shift from usage of third- and second-choice antimicrobial drugs towards usage of first-choice antimicrobial drugs was observed over the 3-year study period.

National records showed that 4,310 kg of antimicrobial drugs sold concerned products only authorized for use in companion animals, which means these products must have been used in companion animals. An additional amount of 980 kg concerned products with a multi-species indication that veterinarians had administered to companion animals. Such use of antimicrobial drugs authorized for use in agricultural livestock as well as companion animals contributed to the mass balance discrepancy between the number of kilograms of antimicrobial drugs sold and the recorded number of kilograms of antimicrobial drugs administered in the monitored livestock sectors.

The SDa expert panel feels continuous monitoring and benchmarking of the companion animal sector is not necessary, since current usage levels are low, inter-practice differences are decreasing, and third-choice antimicrobial drugs only represent a small proportion of all antimicrobial drugs used. It therefore recommends monitoring the usage of antimicrobial drugs in companion animals once every 3 years, by means of a survey of companion animal veterinary practices similar to the survey described in this report. A 3-year interval would provide a suitable level of continuity for the monitoring process. Such a relatively short monitoring interval would also facilitate the data collection process. After all, a shorter interval means that throughout the monitoring period, fewer changes will be implemented in the participating veterinary practices and their practice management systems.

References

1. HAS University of Applied Sciences, HAS Training and Consultancy, Den Bosch, and Faculty of Veterinary Medicine, Utrecht. Feiten & Cijfers Gezelschapsdierensector 2015 [2015 facts & figures on the companion animal sector].

2. Van Geijlswijk, Inge, Alsters, Steffie & Schipper, Louska. Voorschrijven van antimicrobiële middelen in de gezelschapsdierenpraktijk [Prescription of antimicrobial agents in companion animal practices]. Tijdschrift voor Diergeneeskunde, 138(9), pp. 26-29, September 1, 2013.

3. SDa. Usage of antimicrobial drugs in horses 2012 - 2014: Results of a survey of veterinary practices in the Netherlands. January 2017.

4. NethMap 2015: Consumption of antimicrobial agents and antimicrobial resistance among medically important bacteria in the Netherlands. June 2015.

5. SDa. Usage of Antibiotics in Agricultural Livestock in the Netherlands in 2014. Revision October 2015.

6. SDa. Usage of Antibiotics in Agricultural Livestock in the Netherlands in 2013. September 2014.

Appendix 1 – Composition of the consultative group

The consultative group established for the survey regarding usage of antimicrobial drugs in companion animals had the following members:

Tjerk Bosje	Medisch Centrum voor Dieren, Amsterdam
Ed Hermens	Dierenkliniek Helsdingen, Vianen
Walter van Look	Dierenkliniek Statenlaan, The Hague
Saskia Nab	Dierenkliniek De Postwagen, Venlo
Louska Schipper	Professor in Veterinary Pharmacology, Pharmacotherapy and Toxicology, Faculty of Veterinary Medicine, Utrecht University, and veterinarian at A.B.C. voor Dieren, Amersfoort
Lonneke Stark	LA Louis, Polsbroek

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