Belgian Veterinary Surveillance of Antimicrobial Consumption

National consumption report

2007 – 2008 – 2009

Summary

The BelVet-SAC consortium, founded under the wings of the Belgian Antibiotic Policy Coordinating Committee (BAPCOC) set up a surveillance of veterinary antimicrobial consumption in Belgium. Data were uploaded via a secured web-application (www.belvetsac.ugent.be) and consisted of all veterinary antimicrobials sold to a veterinarian or pharmacist in Belgium and of medicated premixes incorporated in medicated feed intended to be used in Belgium for the years 2007, 2008 and 2009. The denominator for animal production was the biomass (in kg) calculated as the sum of the amount of beef, pork and poultry meat produced that year, plus the number of dairy cattle present in Belgium times 500 kg of metabolic weight per head.

The overall evolution in total tons of active substance (antimicrobial pharmaceuticals + antimicrobial medicated premixes) shows a decrease of 14.3% from 2007 to 2008, followed by a small increase of 1.8% from 2008 to 2009 resulting in a total decrease of 12.8% between 2007 and 2009. This decrease is entirely due to the reduction in the use of antimicrobial pharmaceuticals since the use of medicated premixes increased by little under 70% between 2007 and 2009. For 2007, and expressed as mg active substance per kg biomass produced Belgium had the third highest value (168.7 mg/kg) of all EU countries that report their antimicrobial use.

The three most applied antimicrobial classes are sulphonamides and trimethoprim (100.6 tons on average over the three years), tetracyclines (83.7 tons) and penicillins (69.0 tons on average). Especially the increased use of sulphonamides seems to be the reason for the large increase in medicated premixes used over the three consecutive years.

It is very obvious that although a reduction in antimicrobial consumption is seen from 2007 to 2009, the results still show a high consumption of antimicrobials in veterinary medicine and animal production in Belgium. Therefore the publication of this report should also be the onset of a large, thorough and continuous effort to reduce the antimicrobial consumption in animals in the future to a lower level. The situation also urges towards the continuous monitoring of antimicrobial consumption, simultaneously with the follow up of antimicrobial resistance.

Samenvatting

Onder de vleugels van het Belgian Antibiotic Policy Coordinating Committee (BAPCOC) werd het BelVet-SAC consortium opgericht, dat een surveillance heeft opgezet om de nationale consumptie van antibiotica bij dieren te registreren. De data werden opgeladen via een beveiligde webapplicatie (www.belvetsac.ugent.be) enerzijds door de Belgische groothandelaar-verdelers wat betreft de veterinaire antimicrobiële farmaceutica die verkocht werden aan apothekers of dierenartsen in België, anderzijds door de Belgische mengvoederfabrikanten voor de gemedicineerde voormengsels welke antibiotica bevatten, en die zijn geïncorporeerd in gemedicineerd voeder voor gebruik in België. Dit alles werd opgevraagd voor de jaren 2007, 2008 en 2009. Als noemer voor deze gegevens werd de biomassaproductie, als som van de hoeveelheid rundveevlees, varkensvlees en gevogelte geproduceerd dat jaar in België, samen met het aantal aanwezige melkkoeien vermenigvuldigd met hun metabool gewicht (500kg/ stuk).

De evolutie in totale hoeveelheid actieve substantie (ton) zag een daling van 14,3% van 2007 naar 2008, om opnieuw te stijgen met 1,8% van 2008 naar 2009. Over de drie jaren heen was er dus een daling van 12,8% te noteren in totale hoeveelheid actieve substantie. De daling die wordt gezien is volledig toe te schrijven aan het verminderde gebruik van antimicrobiële farmaceutica. Het gebruik van antimicrobiële voormengsels daarentegen steeg met 70% van 2007 tot 2009. In 2007 gebruikte België de derde hoogste hoeveelheid actieve substantie per kg biomassa (168,7 mg/kg) vergeleken met 10 andere Europese landen die hun gebruik rapporteren.

De over de drie jaren heen meest aangewende klassen van antibiotica waren sulfonamiden en trimethoprim (100,6 ton gemiddeld), tetracyclines (83,7 ton) en penicillines (69,0 ton). Vooral het gebruik van sulfonamiden steeg en lijkt de reden te zijn voor het sterk gestegen gebruik van antimicrobiële premixen van 2007 tot 2009.

Het is duidelijk dat alhoewel er een vermindering is gezien van het antibioticaverbruik van 2007 tot 2009, de resultaten duiden op een hoog gebruik van antimicrobiële middelen in de diergeneeskunde en dierlijke productie in België. De resultaten van dit rapport roepen op tot een grootschalige, aanhoudende inspanning om het antibioticumgebruik bij dieren te brengen op een lager niveau. Deze situatie dringt het continu monitoren van antibioticumgebruik, simultaan met het opvolgen van het voorkomen van antibioticumresistentie op.

Résumé

Sous l'aile du Belgian Antibiotic Policy Coordinating Committee (BAPCOC), le consortium BelVet-SAC a été créé. Celui-ci a mis sur pied une surveillance pour enregistrer la consommation nationale d'antibiotiques chez les animaux. Les données ont été uploadées via une application web sécurisée (www.belvetsac.ugent.be) d'une part par les grossistes-répartiteurs belges en ce qui concerne les médicaments antimicrobiens vétérinaires qui ont été vendus à des pharmaciens ou des vétérinaires en Belgique, d'autre part par les fabricants belges d'aliments composés pour les prémélanges médicamenteux contenant des antibiotiques, et qui sont incorporés dans des aliments médicamenteux pour utilisation en Belgique. Tout cela a été réclamé pour les années 2007, 2008 et 2009. Comme dénominateur pour ces données, la production de biomasse, comme somme de la quantité de viande bovine, de viande porcine et de volaille produite cette année-là en Belgique, ainsi que le nombre de vaches laitières présentes ont été multipliés par leur poids métabolique (500kg/tête).

L'évolution de la quantité totale en substance active (tonnes) a connu une diminution de 14,3% de 2007 à 2008, pour de nouveau augmenter de 1,8% de 2008 à 2009. Sur les trois années, on a donc noté une diminution de 12,8% de la quantité totale en substance active. La diminution observée est entièrement à imputer à l'utilisation réduite de médicaments antimicrobiens. L'utilisation de prémélanges antimicrobiens a au contraire augmenté de 70% de 2007 à 2009. En 2007, la Belgique a utilisé une quantité en substance active par kg de biomasse (168,7 mg/kg), et prend par rapport aux 10 autres pays européens qui ont rapportés leur utilisation la troisième place.

Les classes d'antibiotiques les plus utilisées sur les trois années étaient les sulfonamides et triméthoprime (100,6 tonnes en moyenne), tétracyclines (83,7 tonnes), et pénicillines (69,0 tonnes). On note surtout une augmentation de l'utilisation de sulfonamides, qui semble être la raison de la forte hausse de l'utilisation de prémélanges antimicrobiens de 2007 à 2009.

Il est clair que bien que l'on ait observé une diminution de la consommation d'antibiotiques de 2007 à 2009, les résultats ont indiqué une utilisation élevée d'antimicrobiens en médecine vétérinaire et dans la production animale en Belgique. Les résultats de ce rapport appellent à un effort continu à grande échelle pour amener la consommation d'antibiotiques chez les animaux à un niveau raisonnable. Cette situation impose le monitorage continu de la consommation d'antibiotiques, simultanément au suivi de la prévention de la résistance aux antibiotiques.

Preface

Antimicrobials are valuable tools in the preservation of animal health and animal welfare, and must be cherished as they may save lives and prevent animal suffering. Nevertheless, antimicrobial consumption and its link to antimicrobial resistance has become a worldwide point of concern. The World Health Organization has indicated the follow up of antimicrobial resistance as one of the three top priorities for the coming years. Antimicrobial consumption in animals selects for antimicrobial resistant bacteria in animals, leading to therapy failure of bacterial infections. Yet it might also jeopardize human health through either transfer of resistant bacteria or their resistance genes from animals to humans. The magnitude of this risk still needs to be quantified while increasing evidence of resistance transfer between environments is found.

Given the risks both for animal and human health and since it is by far the leading driver for antimicrobial resistance, it is crucial to measure the level of antimicrobial consumption and antimicrobial resistance in animals. BelVet-SAC is a consortium that was founded to deal with the first part of this question: how much antimicrobials are being consumed in veterinary medicine in Belgium?

Contents

The BelVet-SAC Consortium

The consortium was founded under the wings of BAPCOC, the Belgian Antibiotics Policy Coordinating Committee. The consortium consists of scientific members from the Scientific Institute for Public Health, the Veterinary and Agrochemical Research Centre, Ghent University and the Federal Agency for Medicines and Health products. The main purpose of the consortium is to set up a continuous surveillance system for the veterinary use of all antimicrobial compounds in Belgium. The representatives of each party are experts in antimicrobial use, antimicrobial resistance, drug legislation and data analysis. The combination of all this know-how reassures complete and validated data collection and data analysis. The people that collaborate in this consortium are:

Dr. Davy Persoons, DVM, PhD

Prof. dr. Jeroen Dewulf, DVM, MSc, PhD, Dipl. ECVPH, Dipl. ECPHM

Veterinary Epidemiology Unit
Department of Reproduction, Obstetrics and Herd Health
Faculty of Veterinary Medicine
Ghent University
Salisburylaan 133
9820 Merelbeke
Belgium

Dr. Boudewijn Catry, DVM, PhD

Healthcare associated infections & Antimicrobial resistance
Scientific Institute of Public Health (WIV-ISP)
Juliette Wytmanstraat 14
1050 Brussels
Belgium

Dr. Hein Imberechts, DVM, PhD

Prof. dr. Patrick Butaye, DVM, PhD

Operational Directorate Bacterial Diseases

Dr. Yves Van der Stede, DVM, PhD

CDD-ERA
Veterinary and Agrochemical Research centre
Groeselenberg 99
1180 Brussel
Belgium

Dr. Lionel Laurier, DVM

DG Post
Federal Agency for Medicines and Health products
Victor Hortaplein 40/40
1060 Brussel
Belgium

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Materials and Methods

Data collection

1. Antimicrobials for veterinary use

a. Antimicrobial pharmaceuticals

Sales data of all products in all pharmaceutical formulations registered on the Belgian market that contain antimicrobials were aggregated. They were asked from the 29 wholesaler-distributors that are registered for supplying veterinarians and pharmacies in Belgium with veterinary medicines during the observation period. They are obliged by law (article 12sexies, Law on medicines 25th March 1964; Articles 221 and 228 Royal Decree 14th April 2006 on medicines for human and veterinary use) to keep record of all sales and to deliver these records to the competent authority of the Belgian authority (Federal Agency for Medicines and health Products) on demand. They were asked by letter dd. 14th October 2010 to upload the required data via a secured web-application (www.belvetsac.ugent.be). The required data consisted of all veterinary antimicrobials sold in the years 2007, 2008 and 2009 to a veterinarian or pharmacist in Belgium. In Belgium, antimicrobial products are only available on prescription or by delivery from the veterinarian. Belgian veterinarians can both use antimicrobial products in their daily practice, or sell them to animal owners. Sales from one wholesaler-distributor to another were excluded from the input data to prevent double counting. A pre-filled list of antimicrobial containing specialties registered on the Belgian market was provided, together with its market authorization holder and national code (if available), formulation and package form. The wholesaler-distributor only needed to provide the number of packages sold for each product per year.

b. Medicated premixes

As medicated premixes can be purchased by feed mills directly with the producers or wholesalers (not necessarily through wholesaler-distributors) also data on medicated feed was to be collected. This was done by contacting all feed mills that are licensed to produce medicated feed (n=63). They received a list of registered antimicrobial containing premixes in a data template that was developed in accordance with the sector organization BEMEFA (Belgian Society of Professional Mixed Feed Producers). They were asked by letter dd. 31th March 2011 to upload the required data, on legal basis of article 12sexies Law on medicines 25th March 1964; Article 221 and 228 Royal Decree 14th April 2006 on medicines for human and veterinary use. This data was also submitted via the secure web-application (www.belvetsac.ugent.be). Producers of medicated feed were asked to provide data on the use of antimicrobial containing premixes for the years 2007, 2008, 2009 and 2010. Medicated premixes can only be incorporated into medicated feed on prescription of a veterinarian.

The year 2010 was already included in this data collection round since data were only asked in April 2011, whereas antimicrobial sales data from wholesaler/distributors were asked in 2010. Data on medicated premixes from 2010, however, were not yet included in this report but will be published in the 2010 report together with the 2010 data on antimicrobial pharmaceuticals.

Table 1 provides an overview of the groups of antimicrobial agents covered in the BelVetSAC data-collection system, together with the corresponding ATCvet codes. The ATCvet codes included in each antimicrobial class are listed in appendix A.

Table 1. groups of antimicrobial agents covered in the data collection and corresponding ATCvet codes.

Groups of antimicrobial agents	ATCvet codes
Antimicrobial agents for intestinal use	QA07AA; QA07AB
Antimicrobial agents for dermatological use	QD06A; QD06BA
Antimicrobial agents for intrauterine use	QG51AA; QG51AC; QG51AE; QG51AX QG51BA; QG51BC; QG51BE
Antimicrobial agents for systemic use	QJ01
Antimicrobial agents for intramammary use	QJ51
Antimicrobial agents for use in sensory organs	QS01AA; QS01AB QS02AA QS03AA
Antimicrobial agents for use as antiparasitic	QP51AG

2. Animal production

Animal production data to calculate the produced biomass were derived from the Eurostat website (epp.eurostat.ec.europa.eu) , if no figure was available for a given year, the figure for an as closely as possible adjacent year was taken over.

From these animal production data, biomass (in kg) was calculated as the sum of the amount of beef, porc and poultry meat produced that year, plus the number of dairy cattle present in Belgium times 500 kg of metabolic weight per head. This was done according to Grave et al., (2010).

Data analysis

The total number of packages sold per product for all wholesalers was linked to a for that purpose developed database that contained all additional product information. This additional information consisted of:

- the different active antimicrobial substances the product contains per ml for liquids or mg for solids

- the weight per substance
- the number of units in one package
- for active substances expressed in International Units: the conversion factor to mg
- calculated from the above: the total amount of active substance (per active substance) in one package
- the ATC vet code for each (combination of) active substance(s) required for the ESVAC (European Surveillance of Veterinary Antimicrobial Consumption) reporting

Through this extra information, the number of packages sold can be converted to amount of active substance used.

All sales data on medicated feed premixes included in the data from wholesaler-distributors was excluded from the above data-source to prevent double counting. Data concerning medicated premixes was added to the data from wholesaler-distributors to account for total coverage of veterinary antimicrobial consumption in Belgium.

According to Grave et al. (2010), yearly consumption figures were put versus biomass as a yearly adjusted denominator. The animal species included were based upon the vast majority of the biomass present (estimated to be 92% of the total biomass present in Belgium). It should however be made clear that the calculation of the biomass does not contain other animal species such as horses, rabbits, small ruminants and companion animals (dogs, cats, …) (estimated to be 8% of the biomass present in Belgium), whereas the collected data on antimicrobial use also covers the use in these species. Because of the identical approach used in all other EU countries that report antimicrobial consumption, comparisons can be made with national consumption data from 2007 from 10 European countries (The Netherlands, France, UK, Czech Republic, Switzerland, Germany, Denmark, Finland, Sweden and Norway) as reported by EMA (Grave et al., 2010). For 2008 and 2009 data of Belgium were compared to the Netherlands based on information available in the MARAN report.

The fact that many antimicrobial products are registered for use in different animal species and that there are currently no data available on the proportions of products used in the different species makes extrapolation up to animal species level unachievable at this very moment. The Market Authorization Holders of the products do provide estimated proportions to be included in the periodic safety update reports, yet these estimates are not always at hand, and are often based on limited data. For these reasons, the BelVetSAC consortium judged that it was not feasible to use these data in view of this report.

Results

Response rate

Of the 29 Wholesaler-distributors, requested to deliver their sales data on veterinary antimicrobial products sold in 2007, 2008 and 2009, 28 delivered.

Of the 63 mixed feed producers, licensed for the production of medicated feed, 62 responded and delivered the data on antimicrobial medicated premixes incorporated in medicated feed to be used in Belgium.

Both the non-responding companies were of negligible importance in terms of their market share therefore, data coverage is assumed to be over 99%.

Number of antimicrobial pharmaceuticals and premixes available on the Belgian market

Table 2 provides an overview of the number of antimicrobial pharmaceuticals and the number of antimicrobial medicated premixes available on the Belgian market for the years 2007, 2008 and 2009 according to the commented compendium of the Belgian Centre for Pharmacotherapeutic Information 2007, 2008 and 2009 respectively.

Table 2. Armatorium of antimicrobial products on the Belgian market in 2007, 2008 and 2009

	2007	2008	2009
Number of antimicrobial pharmaceuticals on the market	158	162	166
Number of antimicrobial medicated premixes on the market	20	23	27
Total number of antimicrobial products on the market	178	185	193

With exception of gamithromycin (since 2009), no additional active substances were registered on the market in the reported years. Zinc bacitracin was withdrawn from the market in 2009. Thus the observed increase in available products is largely due to the marketing of new formulations or new generic products based on existing active substances.

Animal biomass produced in Belgium

The produced biomass was calculated as described above for the years 2007, 2008 and 2009 (Table 3):

Table 3. Animal Biomass produced in Belgium in 2007, 2008 and 2009.

Anima l biomass	2007	2008	2009
Meat (ton)			
Porc	1 063 277	1 056 169	1 082 036
Beef	272 863	216 547	255 017
Poultry	469 304	469 304	469 304
Total biomass from meat production	**1 805 444**	**1 742 020**	**1 806 357**
Dairy cattle			
Dairy cattle (number)	524 900	517 800	517 700
Dariy cattle metabolic weight (ton)	262 450	258 900	258 850
Total biomass (ton)	**2 067 894**	**2 000 920**	**2 065 207**

Figures in red are copied from the most adjacent year where figures were available.

In 2008, a little reduction in the produced biomass is observed, largely the result of the reduced beef production, probably related to the severe outbreak of Bluetongue in 2007. In 2009 the amount of produced biomass is very comparable to 2007.

Total consumption of antimicrobial drugs for veterinary use in Belgium

The total consumption of antimicrobial drugs for veterinary use in Belgium is presented in Figure 1 in tons of active substance per given year. The total amount is subdivided into the part of antimicrobial pharmaceuticals and the part of antimicrobial compounds contained in medicated premixes incorporated into medicated feeds intended to be used in Belgium.

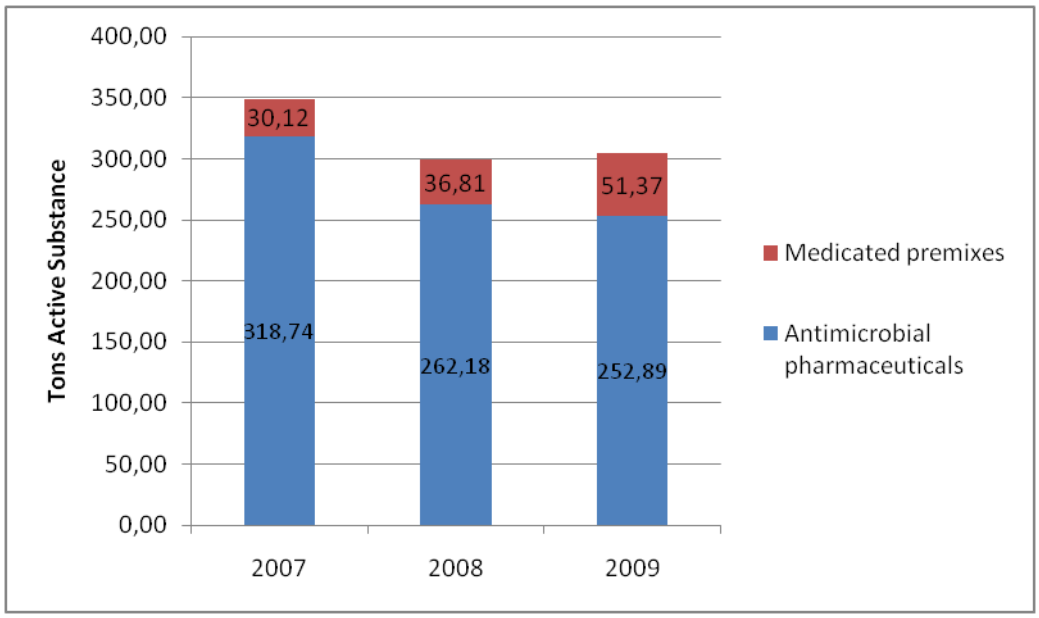

Figure 1. Total national consumption of antimicrobial compounds for veterinary use in Belgium for the years 2007, 2008 and 2009 (tons active substance)

Between 2007 and 2008 there is a decrease of 14.3% in the total consumption of antimicrobial drugs. Between 2008 and 2009 there is an increase of 1.8%, but the level of 2009 is still 12.8% lower than in 2007. The increase in 2009 seems to be largely due to an increase of 40.0% in the use of antimicrobial medicated premixes compared to 2008. Figures 2 and 3 show these data separately for the antimicrobial pharmaceuticals and the antimicrobial medicated premixes.

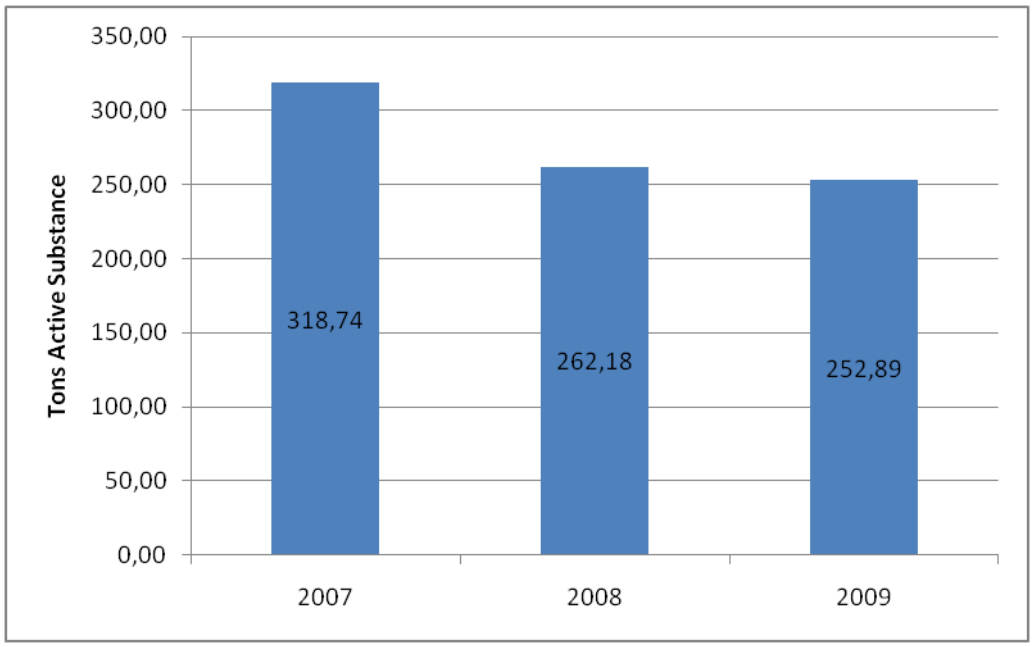

Figure 2. National consumption of antimicrobial pharmaceuticals for veterinary use in Belgium for the years 2007, 2008 and 2009 (tons active substance)

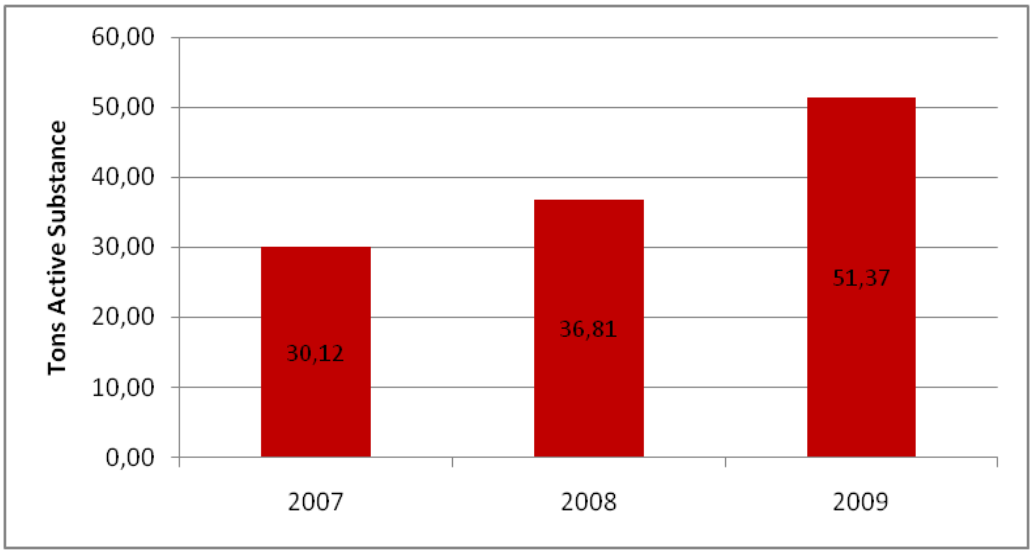

Figure 3. National consumption of antimicrobial medicated premixes in Belgium for the years 2007, 2008 and 2009 (tons active substance)

Antimicrobial use versus biomass

The amount of antimicrobial compounds used in animals in Belgium was plotted against the amount of biomass produced. In total in 2007, 168.7 mg/kg biomass antimicrobial substance was used in Belgium. In 2008, 149.3 mg/kg and in 2009 147.3 mg/kg. Figure 4 presents these data, subdivided into antimicrobial pharmaceuticals and medicated premixes.

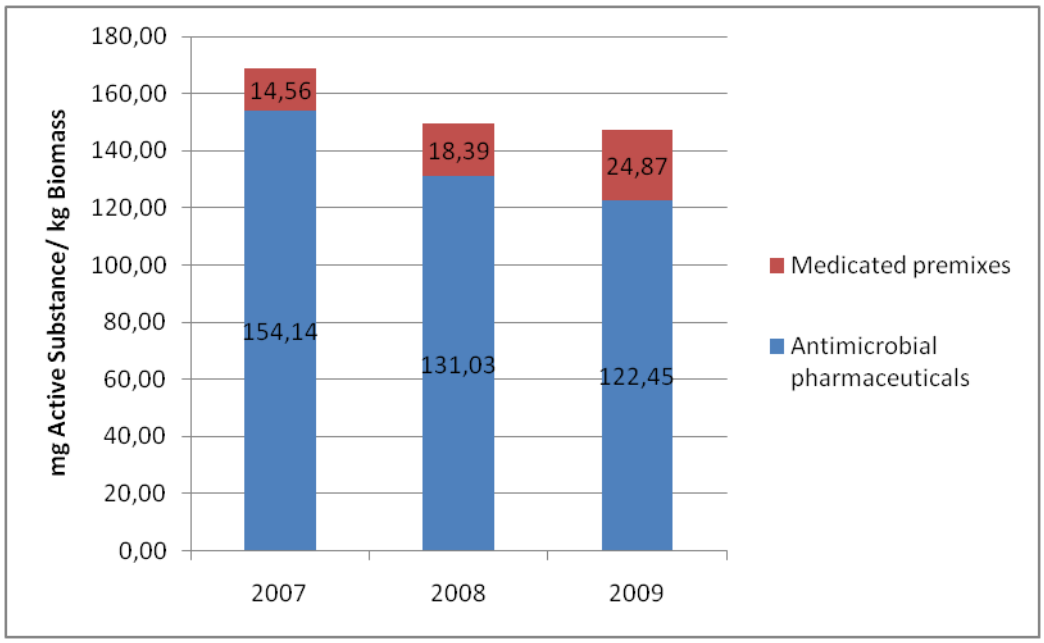

Figure 4. Total mg of active substance used per kg biomass for 2007, 2008 and 2009.

Since there were no important differences in biomass produced over the three years, these figures are similar to the total amount of antimicrobials sold with a decrease of 11.4% between 2007 and 2008 and another small decrease (1.4%) between 2008 and 2009. Looking only at antimicrobial pharmaceuticals in function of the biomass produced, the decrease of 15.0% between 2007 and 2008 is followed by a larger decrease of 6% in 2009. Figures 5 and 6 show these data separately for the antimicrobial pharmaceuticals and the antimicrobial medicated premixes.

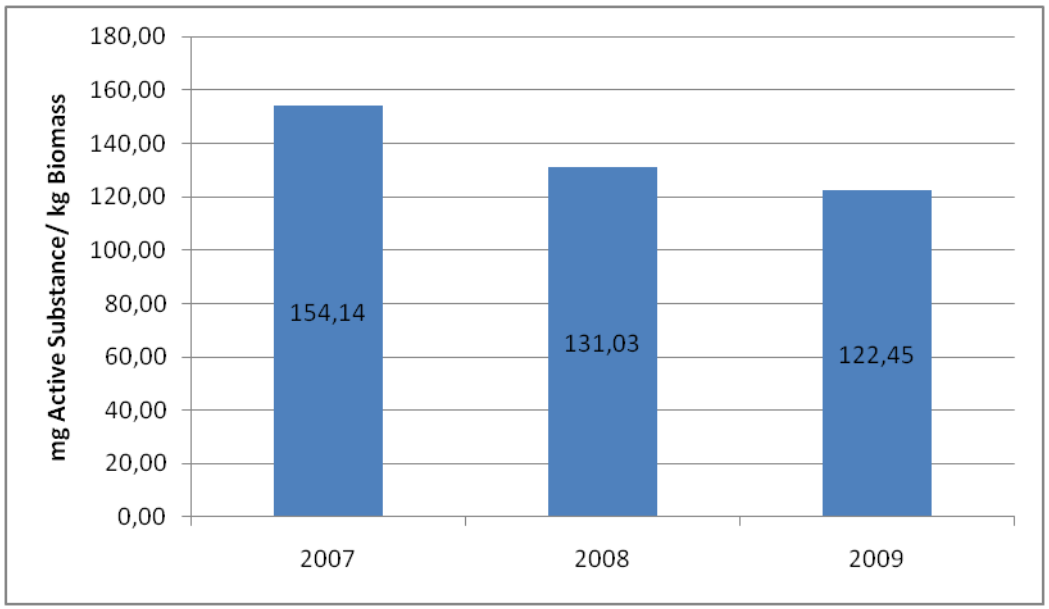

Figure 5. Mg active substance of antimicrobial pharmaceuticals used per kg biomass in Belgium for 2007, 2008 and 2009.

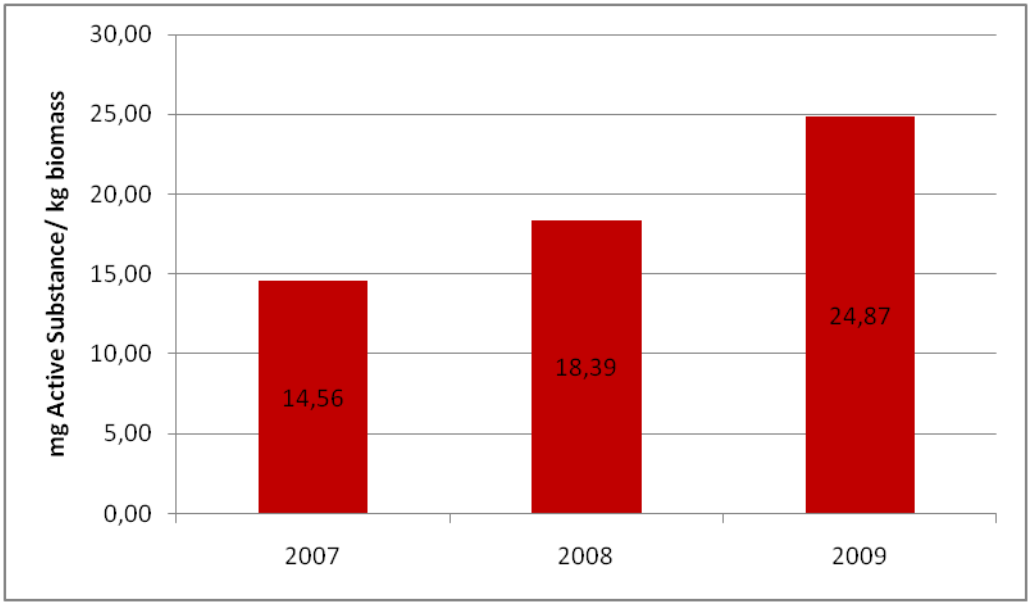

Figure 6. Mg active substance of antimicrobial medicated premixes used per kg biomass in Belgium for 2007, 2008 and 2009.

Comparison with 10 other European countries for 2007, and additionally The Netherlands for 2008 and 2009.

Figure 7 provides a comparison of the amount of active substance used per kg biomass produced with data from Grave et al. (2010) for the year 2007.

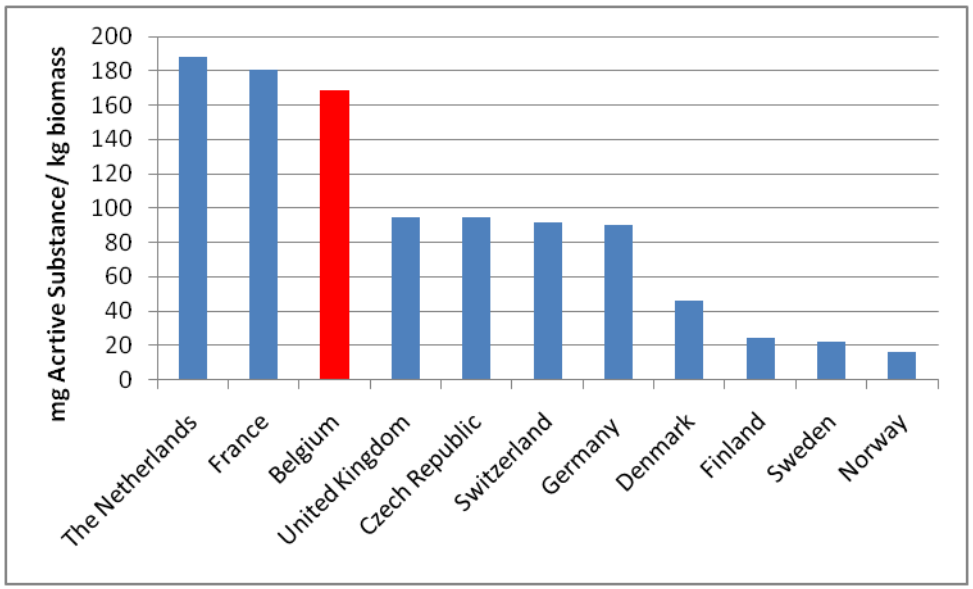

Figure 7. Comparison of mg active substance per kg biomass of Belgium with 10 other European Countries for 2007 according to Grave et al. (2010).

Of the 11 countries presented, Belgium has the third highest consumption of antimicrobial drugs per kg biomass produced. For The Netherlands, antimicrobial consumption per kg of biomass produces was also calculated accordingly for the years 2008 and 2009. Table 4 provides an overview of the amount of antimicrobial substance used in The Netherlands in 2007, 2008 and 2009 obtained from the Maran 2009 report (www.lei.wur.nl), as well as the amount of biomass produced according to Eurostat database (epp.eurostat.ec.europa.eu), from which the amount used per kg biomass produced was calculated.

Table 4. Mg active substance used per kg biomass produced in The Netherlands in the years 2007 – 2009.

Year	Antimicrobial consumption (kg) [1]	Biomass produced (tons) [2]	mg active compound/ kg biomass
2007	590 000	3 141 488	188
2008	529 000	3 228 214	164
2009	518 000	3 239 767	160

[1] MARAN report 2009

[2] Eurostat (epp.eurostat.ec.europa.eu)

In Figure 8 the results of the Netherlands are compared to the results of Belgium for 2007-2009.

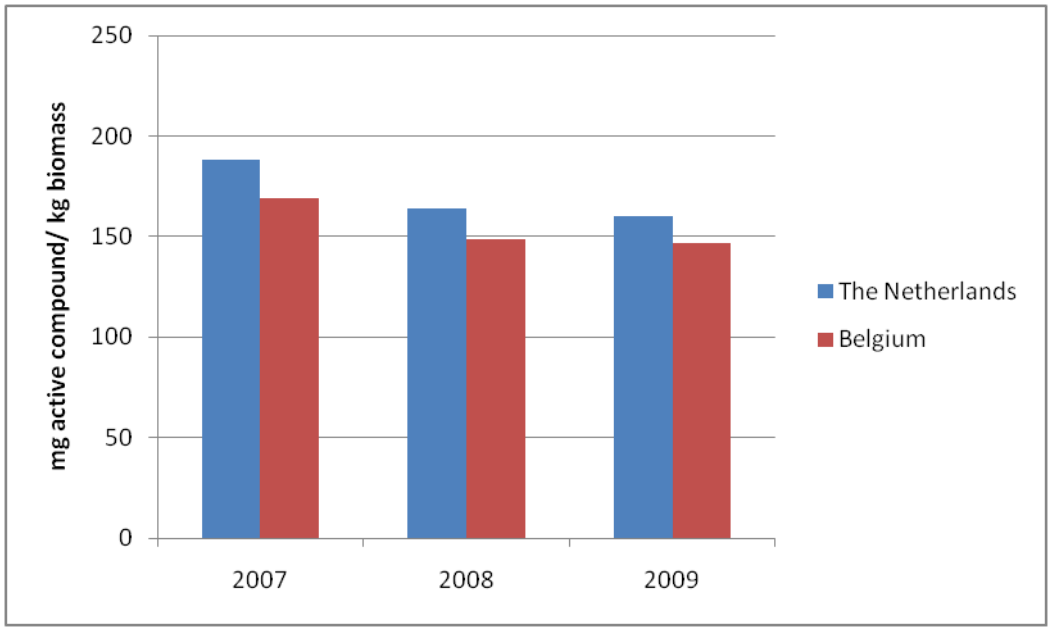

Figure 8. Comparison of mg active substance used per kg biomass produced between Belgium and The Netherlands for the years 2007 – 2009.

In 2007, Belgium used 10.1% less antimicrobial active substance per kg biomass than The Netherlands, in 2008 this was 9.1% and in 2009 8.1%. Relative to The Netherlands, that has very comparable types and methods of animal production as Belgium, Belgium thus uses less antimicrobial substances per kg biomass, but the difference becomes smaller with the years.

Antimicrobial use per class of antimicrobial compounds

1. Total consumption (antimicrobial pharmaceuticals and premixes)

In Figure 9 the total consumption of antimicrobials per class (ATC level 3 or 4) is presented. 30.2% of the compounds used were sulfonamides and trimethoprim, 25.1% tetracyclines, 21.5% penicillines and 7.5% macrolides.

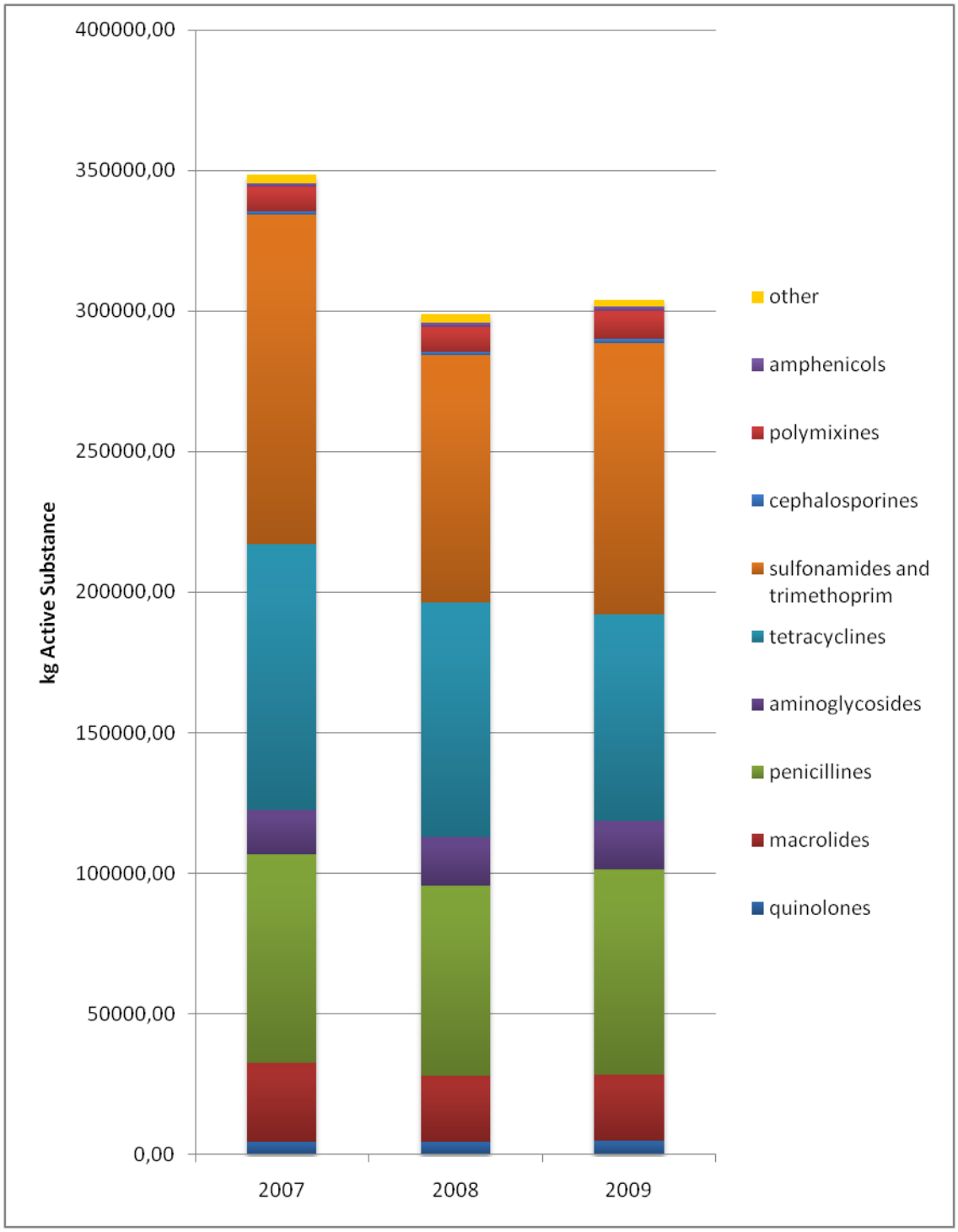

Figure 9. Total antimicrobial use per class of antimicrobials.

2. Antimicrobial pharmaceuticals

In Figure 10 the consumption of antimicrobials per class (ATC level 3 or 4) is presented for the pharmaceuticals

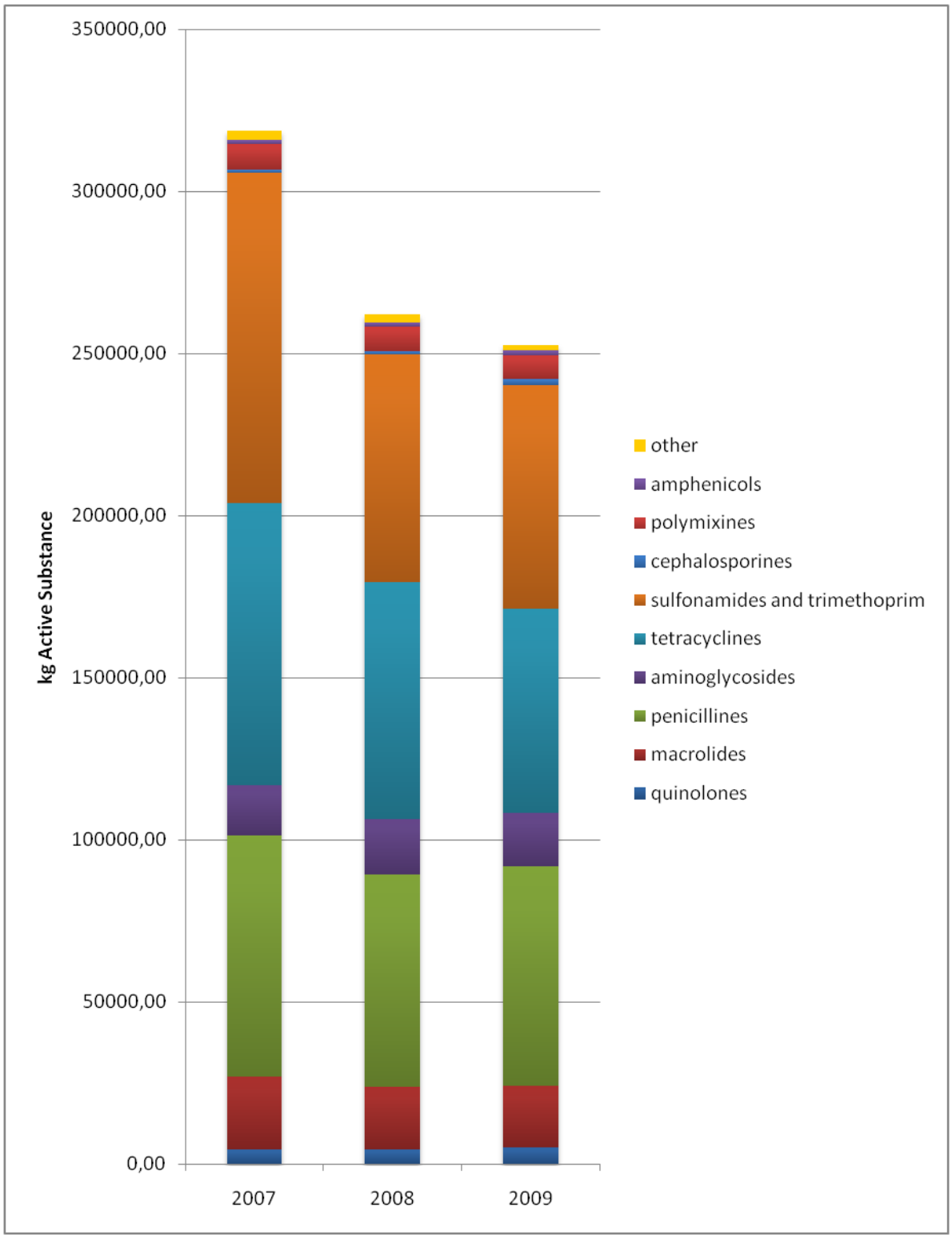

Figure 10. Use of antimicrobial pharmaceuticals (ex. Medicated premixes) per class of antimicrobials.

3. Medicated premixes

In Figure 11 the consumption of antimicrobials per class (ATC level 3 or 4) is presented for the medicated premixes

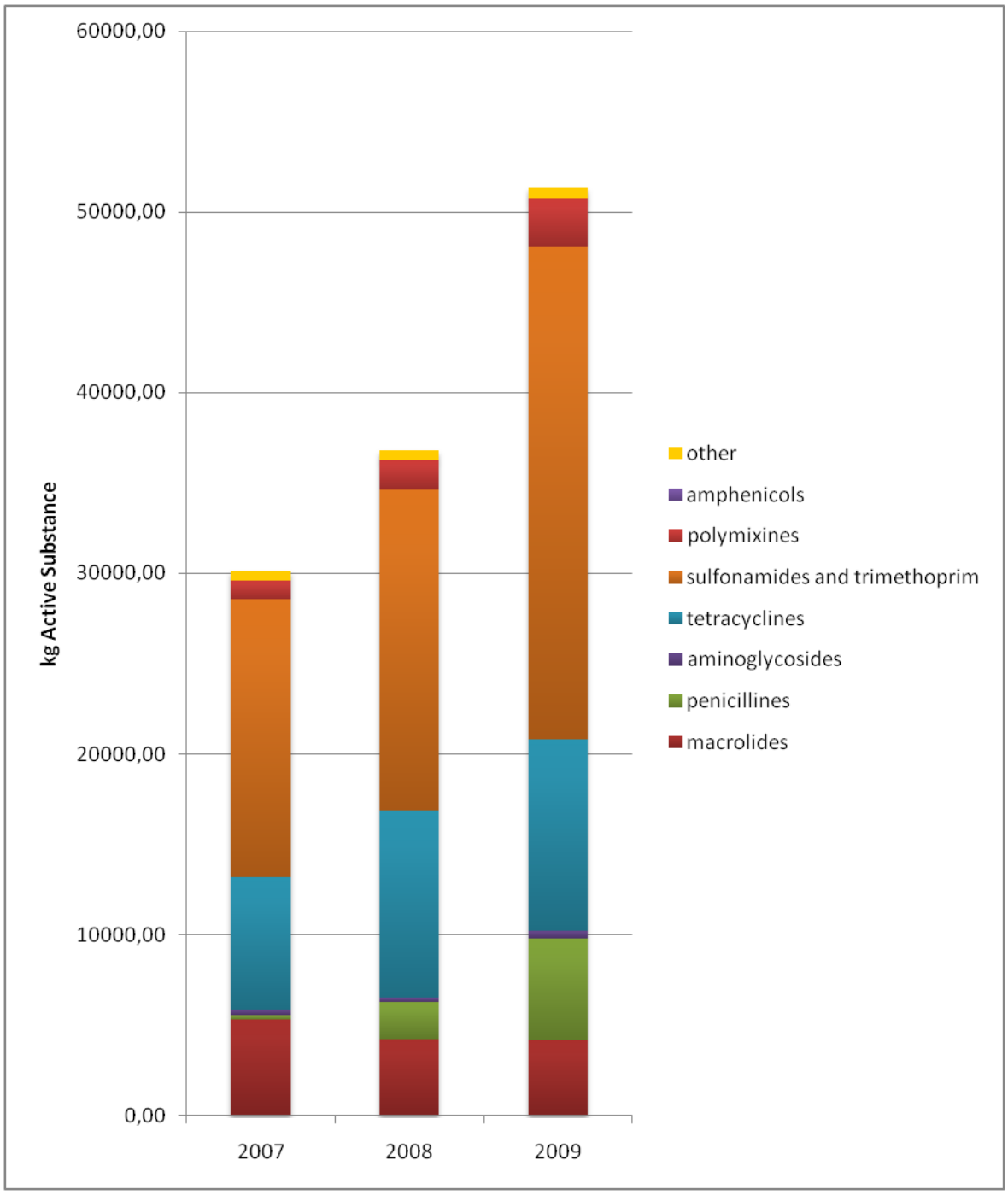

Figure 11. Use of antimicrobial medicated premixes per class of antimicrobials.

The yearly increase in the use of antimicrobial medicated premixes seems to be largely due to an increase in the use of tetracyclines, penicillins and sulphonamides and trimethoprim. Especially the use of amoxicillin (Table 5) has largely increased since 2007. In 2009, almost 28 times the amount of amoxicillin as medicated premix was used as in 2007.

Antimicrobial use per active substance

Table 5 gives the amounts used per individual active substance, grouped per class of antimicrobials.

Table 5. Antimicrobial use per active substance.

Class	Active substance	Total (kg)			Antimicrobial pharmaceuticals (kg)			Medicated premixes (kg)		
		2007	2008	2009	2007	2008	2009	2007	2008	2009
aminoglycosides	apramycine	377,7	295,1	253,9	304,6	209,1	164,3	73,1	86,0	89,6
	clindamycine	146,2	154,4	136,9	146,2	154,4	136,9	0,0	0,0	0,0
	dihydrostreptomycine	7222,0	7810,9	7783,1	7222,0	7810,9	7783,1	0,0	0,0	0,0
	gentamicine	110,6	135,8	163,1	110,6	135,8	163,1	0,0	0,0	0,0
	kanamycine	0,1	2,3	10,9	0,1	2,3	10,9	0,0	0,0	0,0
	neomycine	1430,9	1377,2	1299,5	1430,9	1377,2	1299,5	0,0	0,0	0,0
	paromomycine	1526,8	1647,3	1423,5	1526,8	1647,3	1423,5	0,0	0,0	0,0
	spectinomycine	4980,6	6062,1	6050,3	4740,3	5865,0	5717,0	240,4	197,1	333,4
cephalosporins	cefalexine	171,7	238,7	604,4	171,7	238,7	604,4	0,0	0,0	0,0
	cefalonium	8,6	17,7	17,7	8,6	17,7	17,7	0,0	0,0	0,0
	cefapirine	14,3	14,6	13,8	14,3	14,6	13,8	0,0	0,0	0,0
	cefazoline	0,4	0,8	0,4	0,4	0,8	0,4	0,0	0,0	0,0
	cefoperazon	4,5	7,6	6,4	4,5	7,6	6,4	0,0	0,0	0,0
	cefovecin	5,3	6,8	8,1	5,3	6,8	8,1	0,0	0,0	0,0
	cefquinome	132,9	144,4	151,2	132,9	144,4	151,2	0,0	0,0	0,0
	ceftiofur	571,7	655,7	865,6	571,7	655,7	865,6	0,0	0,0	0,0
amphenicols	chlooramfenicol	2,1	2,2	2,4	2,1	2,2	2,4	0,0	0,0	0,0
	florfenicol	1303,1	1560,4	1666,0	1303,1	1534,5	1649,4	0,0	26,0	16,6
macrolides	erythromycine	49,9	50,0	53,9	49,9	50,0	53,9	0,0	0,0	0,0
	gamithromycine	0,0	0,0	25,8	0,0	0,0	25,8	0,0	0,0	0,0
	lincomycine	6109,2	6011,1	6084,4	5411,6	5581,3	5529,5	697,6	429,8	554,9
	pirlimycine	0,5	0,5	0,4	0,5	0,5	0,4	0,0	0,0	0,0
	spiramycine	602,8	712,4	732,3	602,8	712,4	732,3	0,0	0,0	0,0
	tilmicosine	6147,9	4968,2	4873,7	3209,0	2438,9	2615,8	2938,9	2529,3	2257,8
	tulathromycine	51,1	53,4	66,0	51,1	53,4	66,0	0,0	0,0	0,0
	tylosine	14990,6	11869,7	11553,7	13292,6	10620,8	10199,8	1698,0	1248,9	1354,0
penicillins	amoxicilline	64345,2	56577,5	62384,6	64150,3	54538,6	56785,1	194,8	2038,8	5599,5
	amoxicilline-clavulanic acid	694,6	766,4	768,3	694,6	766,4	768,3	0,0	0,0	0,0
	ampicilline	466,9	463,0	505,8	466,9	463,0	505,8	0,0	0,0	0,0
	cloxacilline	494,0	528,1	573,2	494,0	528,1	573,2	0,0	0,0	0,0
	fenoxymethylpenicilline	68,3	212,2	157,3	68,3	212,2	157,3	0,0	0,0	0,0
	nafcilline	23,3	23,4	33,3	23,3	23,4	33,3	0,0	0,0	0,0
	penethamaat	329,5	336,0	282,8	329,5	336,0	282,8	0,0	0,0	0,0
	procaïne benzylpenicilline	8022,8	8646,0	8526,9	8022,8	8646,0	8526,9	0,0	0,0	0,0
polymyxins	colistinesulfaat	8787,8	8947,7	9906,3	7764,7	7320,5	7279,8	1023,1	1627,2	2626,5
	polymyxine B sulfaat	0,7	1,2	1,1	0,7	1,2	1,1	0,0	0,0	0,0

Table 5 continued. Antimicrobial use per active substance

Class	Active substance	Total (kg)			Antimicrobial pharmaceuticals (kg)			Medicated premixes (kg)		
		2007	2008	2009	2007	2008	2009	2007	2008	2009
quinolones	danofloxacine	101,8	83,7	81,4	101,8	83,7	81,4	0,0	0,0	0,0
	difloxacine	39,4	26,9	27,3	39,4	26,9	27,3	0,0	0,0	0,0
	enrofloxacine	908,4	986,6	1046,0	908,4	986,6	1046,0	0,0	0,0	0,0
	flumequine	3239,0	3070,5	3633,0	3239,0	3070,5	3633,0	0,0	0,0	0,0
	ibafloxacine	3,2	4,0	3,6	3,2	4,0	3,6	0,0	0,0	0,0
	marbofloxacine	196,4	231,9	230,5	196,4	231,9	230,5	0,0	0,0	0,0
	orbifloxacine	0,7	0,6	0,1	0,7	0,6	0,1	0,0	0,0	0,0
sulfonamides and trimethoprim	sulfachloorpyridazine natr.	1802,7	1717,2	1700,7	1802,7	1717,2	1700,7	0,0	0,0	0,0
	sulfadiazine	80721,5	67606,5	71502,3	67928,5	52797,4	48741,0	12792,9	14809,2	22761,4
	sulfadimethoxine natrium	411,6	407,5	460,2	411,6	407,5	460,2	0,0	0,0	0,0
	sulfadimidine natrium	1161,6	829,5	747,4	1161,6	829,5	747,4	0,0	0,0	0,0
	sulfadoxine	254,3	251,5	229,9	254,3	251,5	229,9	0,0	0,0	0,0
	sulfamethoxazol	79,0	105,7	129,6	79,0	105,7	129,6	0,0	0,0	0,0
	sulfanilamide	16070,3	2940,1	6598,0	16070,3	2940,1	6598,0	0,0	0,0	0,0
	trimethoprim	16838,2	14196,1	14995,2	14279,6	11234,3	10442,9	2558,6	2961,8	4552,3
tetracyclines	chloortetracycline	940,6	1053,6	2210,6	940,6	884,4	825,7	0,0	169,3	1384,9
	doxycycline	64705,7	55769,3	54719,0	64694,7	50749,9	46312,6	11,1	5019,4	8406,4
	oxytetracycline	28895,8	26537,7	16567,1	21554,0	21405,3	15760,4	7341,8	5132,4	806,7
other	metronidazole	68,3	70,2	71,8	68,3	70,2	71,8	0,0	0,0	0,0
	rifaximin	5,5	7,8	10,5	5,5	7,8	10,5	0,0	0,0	0,0
	tiamuline	2684,8	2396,3	2041,1	2571,3	2218,1	1648,5	113,5	178,1	392,6
	valnemuline	432,8	352,9	233,6	0,0	0,0	0,0	432,8	352,9	233,6
	zink bacitracine	99,0	43,4	31,3	99,0	43,4	31,3	0,0	0,0	0,0
TOTAL (kg)		348855,1	298990,3	304257,2	318738,5	262183,9	252886,9	30116,6	36806,4	51370,3

Discussion

This report provides the first complete data on the use of antimicrobial drugs in animals in Belgium for the years 2007, 2008 and 2009. Many European countries have been reporting these figures already for several years and it is of utmost importance that a country with an important animal production such as Belgium also collect these data. Moreover it has recently become a European engagement from member states to report on the level of antimicrobial consumption in animal production. Also in the context of methicillin resistant Staphylococcus aureus, extended spectrum beta-lactamase, and other emerging resistance traits, comparable and evolutionary data on antimicrobial consumption are needed. Moreover evaluations and risk assessments made for different purposes such as authorization of products, resistance evaluation, public health threats, environmental matters and priority claims for research, all will benefit from standardized consumption patterns.

This report can thus also be seen as a starting point for continuous monitoring of these figures in future. The reported figures will also be used as a reference for comparison and to evaluate effects of policy measures.

The choice to collect data at the level of the wholesaler-distributors for the antimicrobial pharmaceuticals and at the level of the mixed feed producers for the antimicrobial feed premixes was the most sensible one at the moment. This level both warrants the most complete data and is the closest possible level to the end-user that was practically achievable. Wholesaler-distributors were asked to provide only data on sales to veterinarians or pharmacists, no sales to other wholesaler-distributors, by which double counting could be avoided. Feed premixes do not necessarily follow the chain through wholesaler-distributors, but mixed feed producers can purchase the premixes directly at the level of the producers or pharmaceutical wholesaler. To cover both, data were collected at the level of the mixed feed producers.

One thing that could not be taken into account is whether all products sold in Belgium by the wholesaler-distributors were also used in Belgium . The possibility exists that veterinarians living near the country borders also use medicines bought in Belgium to treat animals abroad. The same holds for medicated feeds, feed produced in Belgium is not necessarily to be used in Belgium. Yet the opposite situation does also exist: medication or feed from abroad can also be used in Belgium, and it is assumed that both ways will neutralize one another.

It also needs to be highlighted that although the obtained results are very useful they are also very crude and much more and much finer conclusions could have been drawn if more detailed data would have been available. In the first place it would be useful to have data where antimicrobial consumption can be attributed to the different animal species. Subsequently it would be better to have data on the amount of treatments attributed to an animal during its live span rather than the amount of kg of a given compound consumed since the number of treatments is much more relevant in relation to the development of antimicrobial resistance then the total amount of antimicrobials consumed expressed in kg. It is the belief of the Consortium that providing detailed, accurate data on animal species level would imply the collection of data directly at the end user level. This is however, up to now, not possible in the Belgian situation.

As the total consumption of antimicrobials in veterinary medicine is concerned a decrease of 14.3% between 2007 and 2008 could be observed whereas in 2009 there was again a little increase of 1.8%. Yet, over the three recorded years the total consumption reduced with 12.8% compared to the level of 2007. This reduction follows the same trend, yet to a lesser extent, as observed in The Netherlands in the same years (MARAN report, 2009). When looking more into detail to the type of antimicrobials (pharmaceuticals versus medicated premixes) it is very clear that the reduction is mainly due to a reduced use of pharmaceuticals. This reduction follows the same trend as has been seen in The Netherlands in the same years (MARAN report, 2009), with lower total amounts used. The use of antimicrobial medicated premixes has in contrast increased yearly with a total increase of 70% between 2007 and 2009. In this it is important to indicate that medicated premixes (with antimicrobials) are used almost only in pig production (>95%). As a result this increase is largely contributable to one production branch. Whether the reduction in pharmaceuticals has also occurred predominantly in pig production cannot be determined based upon the available data since the method of data collection does not allow to differ between animal species. However a sort of trade off in pig production between pharmaceuticals and medicated premixes is likely, mainly since the amount of pig biomass produced did not alter much between the years.

A clear explanation for the increased use of medicated premixes is not readily available. Possible hypotheses are the stop of the use of the on-truck mill for the supplementation of feed with medicines on farm at the moment of filling into the silo. This may have been replaced by the direct use of medication in feeds produced in the feed mill. Another explanation might be the increased availability of different registered medicated premixes as shown in table 2.

Of the total amounts used (antimicrobial pharmaceuticals and medicated premixes), on average 30.2% were sulfonamides and trimethoprim, 25.1% tetracyclines, 21.5% penicillines (21.9% together with the cephalosporins) and 7.5% macrolides, together representing 84.7% of the total use. In the Netherlands, the figures from the MARAN 2009 report are on average for the latter three years: 53.6% tetracyclines, 18.2% sulfonamides and trimethoprim, 13.2% penicillines and cephalosporins and 10.0% macrolides, together representing 95.0% of the total amount used. The four primarily used groups thus are the same also their joint representation resembles, but the ratios between the different groups differ. In Belgium, less tetracyclines and less macrolides are used, and instead more penicillins/cephalosporins and more sulphonamides and trimethoprim are used. When putting the total amount of antimicrobials used in Belgium against the amount of biomass of the most relevant species (in terms of produced biomass), compared to the total amount used a further decrease can be seen in 2009. This is due to a slightly less production of biomass in 2008. When comparing these results to the results of other European countries (calculated in a comparable manner in Grave et al., 2010) Belgium turns out to be the third largest consumer of antimicrobial products per kg biomass produced of the reporting European countries (Figure 7). Whether this comparison is completely valid is subject to discussion, since the main types and methods of animal production may vary between countries and also the level of data coverage is not always clear. When compared to our neighboring country The Netherlands, that has very comparable types and methods of animal production as Belgium, the difference in mg active substance per kg of biomass systematically decreases from 2007 to 2009 with The Netherlands gradually decreasing more. These comparisons between countries are very interesting and therefore all EU countries should be strongly stimulated to report their antimicrobial consumption figures in this manner.

Spain recently published a report on the sales of veterinary antimicrobial agents in Spain in 2009 (Agencia española de medicamentos y productos sanitarios). With an assumed data coverage of 90-100% (yet not all ATCvet codes covered in the Belgian collection are covered in the Spanish data), the total amount used in Spain in 2009 was 1 102 350 kg. Calculated from Eurostat database in the same way as explained in the Material and Methods section of this report, the biomass produced in Spain in 2009 is 5 619 822 tons, resulting is a use of 196 mg active substance per kg of biomass produced.

It is very obvious that although a reduction is seen from 2007 to 2009 and Belgium is not the highest consumer of the reporting European countries, the results show a high consumption of antimicrobials in veterinary medicine in Belgium. Therefore the publication of this report should also be the onset of a large, thorough and continuous effort to reduce the antimicrobial consumption in veterinary medicine in the future. The situation also demands to be followed up in future, and urges towards the continuous monitoring of antimicrobial consumption, linked to the follow up of antimicrobial resistance.

Conclusion

There is an important reduction in antimicrobials used in animals between 2007 and 2009 , yet the total consumption of antimicrobials turns out to be high in Belgium, and placed Belgium at the third place in 2007 of the reporting European countries.

This data should be the onset of a large, thorough and continuous effort to further reduce the antimicrobial consumption in veterinary medicine in the future and urges the continuous follow up and registration of antimicrobial usage in animal husbandry in Belgium.

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Appendix

Appendix A. ATCvet codes included in the different classes of antimicrobials

Class of antimicrobials	ATCvet codes included
Aminoglycosides	QJ01G QJ51G QJ51RG QJ51RA01
Cephalosporins	QJ01D QJ51D
Amphenicols	QJ01B QJ51B QJ51RB QS01AA01 QS02AA01 QS03AA08
Macrolides	QJ01F QJ51F QJ51RF
Penicillins	QJ01C QJ01RA01 QJ51C QJ51RC
Polymyxins	QA07AA05 QJ01XB QJ01RA95 QJ51XB QS01AA18 QS02AA11 QS03AA03
Quinolones	QJ01MA ; QJ01MB
Sulfonamides and trimethoprim	QA07AB QD06BA QG51AE QG51BE QJ01E QJ51E QJ51RE QP51AG QS01AB
Tetracyclines	QD06AA QG51AA QJ01A QJ51A QJ51RA QS01AA QS02AA QS03AA
Other	QA07AA11 ; QA07AA93 QD06AX05 ; QD06AX11 QG51AA06 QJ01XD01 ; QJ01XQ ; QJ01XX QJ51XX