BelVet-SAC

Belgian Veterinary Surveillance of Antibacterial Consumption

National consumption report

2020

Publication : 22 June 2021

SUMMARY

This annual BelVet-SAC report is now published for the 12th time and describes the antimicrobial use (AMU) in animals in Belgium in 2020 and the evolution since 2011. For the third year this report combines sales data (collected at the level of the wholesalers-distributors and the compound feed producers) and usage data (collected at farm level). This allows to dig deeper into AMU at species and farm level in Belgium.

With a **consumption of 87,6 mg antibacterial compounds/kg biomass** an increase of **+0.2%** is seen in 2020 in comparison to 2019. The increase seen in 2020 is spread over **both pharmaceuticals (+0.2%) and antibacterial premixes (+4.0%).** This unfortunately marks the end of a successful reduction in antibacterial product sales that was seen over the last 6 years resulting in a **cumulative reduction of -40,2% since 2011.**

The gap seen in the coverage of the sales data with the Sanitel-Med collected usage data increased substantially compared to 2019, meaning continuous efforts need to be taken to ensure completeness of the collected usage data.

When looking at the **evolution in the number of treatment days (BD_{100}) at the species level,** as calculated from the SANITEL-MED use data, use increased in poultry (+5,0%) and veal calves (+1,9%), while it decreased in pigs (-3,1%). However, the numerator data for this indicator remain to be updated for 2020, potentially influencing the reliability of the result.

When looking at the farm-level results per animal category, based on the median BD_{100} values, we get to see a more nuanced story with an increased use or stagnation in all pig categories (suckling piglets, median BD_{100} of 1,88, increase of 2%; weaned piglets, median BD_{100} of 18,15, stagnation compared to 2019; and pigs for breeding, median BD_{100} of 0.42, stagnation compared to 2019) except fatteners (median BD_{100} of 2.9, decrease of -11%), and a more positive result in broilers (-9% of the median BD_{100} to 5,35) and veal calves (-9,5% of the median BD_{100}, to 19,35). In contrast, the **laying hen sector** showed alarming increasing results in the **median BD_{100} that increased with +18,0%** compared to 2019. Yet, clearly, the biggest challenge for all three species lies ahead; to achieve the reduction paths, drawn up in consultation with the respective sectors, sustained and considerable efforts will be required. Furthermore, **very worrisome is the continued and clearly increased high use in fluoroquinolones** which should urgently be addressed with actions in the coming year(s).

In dairy cattle it is promising to see that the increasing trend seen since 2015 is finally broken regarding the use of antimicrobial dry cow applicators. However, the number of applicators used for the treatment of mastitis cases continues to increase steadily. Also in **dogs and cats** the **volume of antibacterial products sold has decreased in 2020 with -3.5%** in comparison to 2019. When looking in more detail, however, it can be seen that the sales of **critical antibacterial compounds has increased dramatically for the second year in a row**. This should urge the sector to continue to take actions to further reduce antibacterial use, and specifically of critical antibacterials, in companion animals.

When comparing the results with the AMCRA 2020 reduction targets, the **goal of reducing the overall AMU in animals with 50% by 2020 was unfortunately not achieved**. This further stresses the need for continuous and additional efforts to be made, such as expanding herd level data-collection and benchmarking through the Sanitel-Med and AB Register systems, in combination with multiple other initiatives such as herd health plans, continuous education, increased biosecurity,... Moreover, at the **start of 2021, a renewed Covenant between the sectors, AMCRA and competent authorities was signed**, strengthening the sense of urgency to take action. This Covenant includes further reduction goals up to 65% by 2024 (compared to the reference year 2011). With regards to the **antibacterial premixes**, a plateau seems to have been reached over the last three years, resulting in a **cumulative reduction of -70.4% in comparison to 2011**. By 2024, the aim of -75% (compared to 2011) is maintained, further encouraging the sectors to reduce the use of antibacterial premixes. In regard to the different AMCRA colour classes, **use of "yellow" (+0.2%) and "orange" (-0.1%) classes** remained approximately stable compared to 2019. However, the **use of the "red" products increased dramatically for the third year in a row (+32.1%)** after a very spectacular drop in 2016 and 2017. This increase results in a **reduction of -70.1% in comparison to 2011, meaning the reduction target of -75% by 2020 is unfortunately not achieved**. The restoration of the Royal Decree articles on the conditions for use of critically important antibacterial compounds at the end 2020 will hopefully be a first step to counter the trend seen these last years. Yet it is clear that close surveillance and a joint effort from all stakeholders is mandatory to press on and achieve the reduction goals for 2024.

Conclusion

The 2020 antibacterial product sales and use data unfortunately show a setback in the evolution of AMU in veterinary medicine in Belgium that was not anticipated. Indeed, only one of the three 2020 reduction targets is achieved (-50% reduction of the premixes). Some alarming signals coming from the poultry sector (use of fluoroquinolones in broilers and overall AMU in laying hens), but also the companion animals (use of critically important antibacterial compounds), should be urgently dealt with. All sectors are encouraged to intensify their efforts if the species specific reduction targets created in view of the 2024 targets are to be achieved.

SAMENVATTING

Dit 12de BelVet-SAC rapport beschrijft de resultaten van het antibioticumgebruik bij dieren in België in 2020 en de evolutie sinds 2011. Voor het derde jaar op rij combineert het rapport zowel verkoopdata (verzameld ter hoogte van de groothandelaars – verdelers en mengvoederfabrikanten) als gebruiksdata (verzameld op het niveau van de veehouderij). Deze combinatie laat toe om het gebruik meer in detail te bestuderen per diercategorie.

Met een **consumptie van 87,6 mg antibiotica/kg biomassa** werd in 2020 een stijging van **+0,2%** opgetekend in vergelijking met 2019. De stijging is verdeeld over ene stijging van **+0,2% in de 'pharmaceuticals' en +4,0% in de antibacteriële premixen**. Hiermee wordt helaas een einde gemaakt aan de reeks van 6 jaar reducties op een rij. De **cumulatieve reductie sinds 2011 bedraagt nu -40,2%.**

Het verschil tussen het totale volume antibiotica in de verkoopdata en het volume van gebruiksdata geregistreerd via Sanitel-Med is in 2019 toegenomen. Dit wil zeggen dat er een blijvende inspanning dient gedaan te worden om de verzameling van de gebruiksdata nog vollediger te maken.

Bekijken we de **evolutie in het aantal behandeldagen (BD_{100}) op diersoort niveau**, berekend uit de Sanitel-Med gebruiksdata, dan zien we een toename van +5,0% in het gebruik bij pluimvee en + 1,9% in het gebruik bij vleeskalveren. In de varkenssector is er ene daling van -3,1% te noteren. Hierbij dient evenwel opgemerkt dat de noemer data gebruikt voor deze berekeningen nog niet volledig beschikbaar waren op het moment van opmaken van dit rapport waardoor de cijfers met enige voorzichtigheid moeten geïnterpreteerd worden.

Als we naar de resultaten op bedrijfsniveau per dier categorie kijken, uitgedrukt in de mediane BD_{100}, krijgen we een meer genuanceerd beeld te zien met een stijging of stagnatie in het gebruik in alle varkens categorieën (zuigende biggen, mediane BD_{100} van 1,88, stijging van 2%; gespeende biggen mediane BD_{100} van 18,15, stagnatie ten opzichte van 2019; zeugen, mediane BD_{100} van 0.42, stagnatie in vergelijking met 2019) met uitzondering van de vleesvarkens waar een BD_{100} van 2,9, duidelijke daling van -11,0% wordt opgetekend. In de braadkippensector wordt een positieve re trend gezien met een daling van -9,0 % van de mediane BD_{100} naar een niveau 5,35, alsook in de vleeskalversector waar een daling van de mediane BD_{100} van -9,5% wordt opgemeten naar een niveau van 19,35. De **leghennen sector** daarentegen toont een **alarmerende stijging in de mediane BD_{100} met +18,0%.** De grootste uitdaging voor alle sectoren ligt evenwel in de toekomst in het behalen van de sector specifieke reductiepaden die in overleg met de sectoren werden opgesteld. Om deze doelstelling te halen zullen blijvende en duurzame inspanningen en aanpassingen noodzakelijk zijn. Verder is de **blijvende en duidelijke stijging van het fluoroquinolone gebruik bijzonder verontrustend.** Dit dient dringend aangepakt te worden in de komende jaren.

In de melkveehouderij is het positief om vast te stellen dat de stijgende trend in het gebruik van droogzetpreparaten eindelijk doorbroken werd. Het gebruik van intramammaire producten voor de behandeling van uierontsteking blijft evenwel nog steeds toenemen. **Bij honden en katten** is het volume van gebruikte antibiotica in 2020 met **-3,5% gedaald.** Echter hier zien we dat het **gebruik van de kritisch belangrijke antibiotica voor het tweede jaar op rij sterk is gestegen**. Deze resultaten geven aan dat ook deze sectoren blijvend inspanningen dienen te doen om het gebruik van antibiotica in het algemeen en van de kritische belangrijke antibiotica in het bijzonder verder te doen dalen.

Als we deze resultaten uitzetten tegenover de AMCRA 2020 reductiedoelstellingen dan zien we dat het **doel van 50% reductie van het totaal gebruik tegen 2020 helaas niet werd gerealiseerd is**. Dit benadrukt verder de nood voor blijvende en zelf bijkomende inspanningen. Deze inspanningen omvatten onder andere het uitbreiden van de data collectie op bedrijfsniveau en benchmarking van veehouders en dierenartsen via het Sanitel-Med en AB register systeem, in combinatie met andere initiatieven zoals bedrijfsgezondheidsplannen, permanente vorming, verbeterde bioveiligheid,… Bovendien werd er bij aanvang van 2021 een nieuw convenant ondertekend tussen alle betrokken sectoren, AMCRA en de bevoegde overheden waarin de nood tot verdere actie werd benadrukt. In dit convenant zijn eveneens nieuwe reductiedoelstellingen opgenomen waarbij wordt gestreefd naar een reductie van het totaal AB gebruik van -65% in vergelijking met 2011. Voor wat betreft de **antimicrobiële premixen** is er blijkbaar een plateau bereikt in de laatste drie jaar resulterend in een **cumulatieve reductie van -70,4%** in vergelijking met 2011. Tegen 2024 wordt hier ene reductie van -75% voorzien wat aangeeft dat ook hier nog verdere inspanningen zich opdringen. Wat betreft het gebruik van de verschillende soorten antibiotica hebben we in 2020 een relatieve stabiele situatie gezien voor wat betreft de verkoop van "gele" (+0,2%) en "oranje" (-0,1%) antibiotica terwijl het gebruik van de **kritisch belangrijke "rode" antibiotica voor het derde jaar op rij terug is gestegen (+32,1%)** na de spectaculaire daling in 2016 en 2017. Deze stijging resulteert in een **cumulatieve reductie van het gebruik van "rode" antibiotica van -70,1% in vergelijking met 2011 wat wil zeggen dat de reductiedoelstelling van -75% helaas niet werd**

bereikt. De herinvoering van de artikelen rond het gebruik van de kritisch belangrijke antibiotica in het koninklijk besluit rond het gebruik van antibiotica bij dieren zullen er hopelijk voor zorgen dat er vanaf 2021 opnieuw dalingen kunnen opgetekend worden. Het is evenwel duidelijk dat een nauwe opvolging en inspanningen van alle sectoren noodzakelijk zullen zijn om de doelstellingen van 2024 te realiseren.

Conclusie

De resultaten van de antibioticumverkoop en gebruiksdata in 2020 tonen helaas een terugval in de dalende trends van antibioticumgebruik bij dieren in België. Hierdoor is slechts één van de drie doelstellingen die voorop werden gezet voor 2020 behaald (-50% reductie in het gebruik van gemedicineerde premixen). Er komen verontrustende resultaten uit de pluimveesector (stijging in het gebruik van fluoroquinolones in braadkippen en totaal gebruik bij de leghennen), maar ook de sector van de gezelschapsdieren (gebruik van kritisch belangrijke antibiotica) dient maatregelen te nemen. Alle sectoren worden opgeroepen om blijvend inspanningen te leveren om alsnog de diersoort specifieke reductie doelstellingen die voorop gezet zijn voor 2024 te realiseren.

RESUME

Ce 12ème rapport annuel BelVet-SAC décrit l'utilisation des antibiotiques chez les animaux en Belgique en 2020 ainsi que l'évolution depuis 2011. Pour la troisième année, ce rapport combine les données de ventes (collectées au niveau des grossistes -distributeurs et des producteurs d'aliments composés) et les données d'utilisation (collectées au niveau de l'exploitation). Ceci permet d'étudier plus en détail l'utilisation par catégorie d'animaux.

Avec **une consommation de 87,6 mg de composés antibiotiques/kg de biomasse**, une augmentation de **+0,2%** est observée en 2020 par rapport à 2019. L'augmentation observée en 2020 est répartie à la fois sur les **produits pharmaceutiques (+0,2%) et les prémélanges antibactériens (+4,0%)**. Ceci marque malheureusement la fin d'une série de 6 années consécutives de diminutions. **La baisse cumulée depuis 2011 est désormais de -40,2 %**.

La différence entre le volume total des ventes et les données d'utilisation collectée par Sanitel-Med a considérablement augmenté par rapport à 2019. Cela signifie que des efforts continus doivent être déployés pour garantir une collecte des données d'utilisation encore plus complète.

L'examen de **l'évolution du nombre de jours traitement (BD_{100}) par catégorie d'animaux**, calculée à partir des données d'utilisation provenant de Sanitel-Med, montre une augmentation de l'utilisation chez les volailles (+5,0%) et les veaux de boucherie (+1,9%). Dans le secteur porcin, il est mis en évidence une diminution (-3,1%). Il convient toutefois de noter que les données du dénominateur utilisées pour ces calculs n'étaient pas encore entièrement disponibles au moment de la rédaction de ce rapport, de sorte que les chiffres doivent être interprétés avec une certaine prudence.

Si l'on regarde les résultats au niveau de l'exploitation par catégorie d'animaux, exprimés sur base des valeurs médianes de BD_{100}, on obtient une image plus nuancée avec une augmentation ou une stagnation de l'utilisation dans toutes les catégories de porcs (porcelets allaités, BD_{100} médian de 1,88, augmentation de 2% ; porcelets sevrés BD_{100} médian de 18,15, stagnation par rapport à 2019 ; truies, BD_{100} médian de 0,42, stagnation par rapport à 2019) à l'exception des porcs à l'engraissement où un BD_{100} de 2,9, en nette diminution de -11,0%, est enregistré. Une nouvelle tendance positive est observée dans le secteur des poulets de chair avec une diminution de -9,0% du BD_{100} médian à un niveau de 5,35, ainsi que dans le secteur du veau présentant une diminution du BD_{100} médian de -9,5% à 19.35. Le secteur des **poules pondeuses**, en revanche, affiche une **augmentation alarmante du BD_{100} médian de +18,0%** par rapport à 2019. Cependant, le plus grand défi pour tous les secteurs réside dans la réalisation de trajectoires de réduction qui ont été définies en concertation avec les secteurs respectifs. Pour atteindre cet objectif, des efforts et des ajustements continus et durables seront nécessaires. Par ailleurs, l'augmentation continue et marquée de **l'utilisation des fluoroquinolones est particulièrement préoccupante**. Ce problème doit être résolu de toute urgence dans les années à venir.

Dans l'élevage laitier, il est positif de noter que la tendance à la hausse observée depuis 2015 concernant l'utilisation de préparations à des fins de tarissement a finalement été interrompue. Cependant, l'utilisation de produits intra mammaires pour le traitement de mammite continue d'augmenter régulièrement. **Chez les chiens et les chats**, le volume d'antibiotiques utilisés a **diminué de -3,5%** en 2020 par rapport à 2019. Cependant, nous voyons ici que **l'utilisation des antibiotiques d'importance critique a fortement augmenté pour la deuxième année consécutive**. Ces résultats indiquent que ces secteurs doivent également continuer à faire des efforts pour réduire davantage l'utilisation des antibiotiques en général et des antibiotiques d'importance critique en particulier.

Si l'on compare les résultats obtenus aux objectifs de réduction de l'AMCRA 2020, on constate que **l'objectif d'une réduction de 50 % de la consommation totale d'ici 2020 n'a malheureusement pas été atteint**. Cela souligne encore la nécessité d'efforts continus et même supplémentaires. Ces efforts comprennent l'élargissement de la collecte de données au niveau de l'exploitation et l'analyse comparative des éleveurs et des vétérinaires via Sanitel-Med et AB register, en combinaison avec d'autres initiatives telles que les plans de santé des troupeaux, la formation continue, l'amélioration de la biosécurité,… En outre, au début de 2021, une nouvelle convention a été signée entre tous les secteurs concernés, l'AMCRA et les autorités compétentes, soulignant la nécessité de poursuivre les actions. Ce pacte comprend également de nouveaux objectifs de réduction visant une diminution de l'utilisation totale d'antibiotiques de -65 % par rapport à 2011. En ce qui concerne les **prémélanges antimicrobiens**, un plateau semble avoir été atteint au cours des trois dernières années se traduisant par une **réduction cumulée de -70,4 %** par rapport à 2011. D'ici 2024, l'objectif de -75% (par rapport à 2011) est maintenu, incitant les filières à réduire d'avantage l'utilisation de prémélanges antimicrobiens. Concernant l'utilisation des différents types d'antibiotiques, nous avons constaté une situation relativement stable en 2020 en termes de ventes d'antibiotiques "jaunes" (+0,2%) et "oranges" (-0,1%) tandis que **l'utilisation des antibiotiques d'importance critique** (les antibiotiques "rouges") **a**

augmenté pour la troisième année consécutive (+32,1%) après la baisse spectaculaire de 2016 et 2017. Cette augmentation se traduit par une **diminution cumulée de l'utilisation des antibiotiques "rouges" de -70,1 % par rapport à 2011**, ce qui signifie que **l'objectif de réduction de -75% n'a malheureusement pas été atteint**. La réintroduction des articles de l'arrêté royal sur l'utilisation des antibiotiques chez les animaux garantira, espérons-le, que des diminutions pourront à nouveau être enregistrées à partir de 2021. Cependant, il est clair qu'une surveillance étroite et des efforts de tous les secteurs seront nécessaires pour atteindre les objectifs de 2024.

Conclusion

Les résultats des données sur les ventes et l'usage des antibiotiques en 2020 montrent malheureusement une diminution des tendances à la baisse de l'utilisation des antibiotiques chez les animaux en Belgique. En conséquence, un seul des trois objectifs fixés pour 2020 a été atteint (réduction de 50% de l'utilisation des prémélanges médicamenteux). Certains signaux alarmants provenant du secteur avicole (augmentation de l'utilisation des fluoroquinolones chez les poulets de chair et chez les poules pondeuses), mais aussi du secteur des animaux de compagnie (utilisation d'antibiotiques d'importance critique) doivent être traités en urgence. Tous les secteurs sont appelés à intensifier leurs efforts pour continuer à atteindre les objectifs de réduction spécifiques aux espèces animales qui ont été fixés pour 2024.

PREFACE

Antibacterial products are valuable tools in the preservation of animal health and animal welfare, and must be used responsibly as they may save lives and prevent animal suffering. However, the use of antibacterial products invariably leads to selection of bacteria that are resistant against the substance used. Resistance can then spread in populations and the environment. Antibacterial consumption in animals selects for antibacterial resistant bacteria in animals, leading to therapy failure in bacterial infections. Yet it might also jeopardize human health through transfer of resistant bacteria or their resistance genes from animals to humans and vice versa via direct or indirect contact.

Given the importance in securing public as well as animal health and since it is by far the leading driver for antibacterial resistance, it is crucial to measure the level of antibacterial consumption and antibacterial resistance in animals. This is moreover also required at the European level where consumption data of antibacterial products in veterinary medicine are collected by EMA (European Medicines Agency) in the framework of the ESVAC (European Surveillance of Veterinary Antibacterial Consumption) project. Therefore the data collected and presented in this report also fit into the European commitments of Belgium. This twelfth BelVet-SAC report gives an overview of the consumption of antibacterial products in veterinary medicine in Belgium in 2020 and describes evolutions in use since 2011.

CONTENTS

SUMMARY 2

SAMENVATTING 4

RÉSUMÉ 6

PREFACE 8

CONTENTS 9

THE AUTHORS 12

MATERIALS AND METHODS 13

ANTIMICROBIAL SALES DATA 13

Data collection 13

a) Antibacterials for veterinary use 13

i. Antibacterial pharmaceuticals 13

ii. Antibacterial premixes 13

iii. Antibacterial classes included 14

b) Animal population 15

Data analysis 15

Data validation 16

a) External data validation 16

b) Internal data validation 16

ANTIBACTERIAL USE DATA 17

Data collection in Sanitel-Med 17

a) Notifications of antibacterial use at farm-level 17

b) Number of animals present at farm level 18

i. Veal calf farms 19

ii. Poultry farms 19

iii. Pig farms 19

c) Number of active farms 19

d) Veterinary contract 19

Data analysis 20

a) Determination of the numerator 20

i. Mg active substance used 20

ii. Number of $DDDA_{bel}$ used 20

b) Determination of the denominator 21

i. Animals and kg at risk per species at national level 21

ii. Kg at risk per animal category at farm level 21

c) Indicators 21

i. Mg used 21

ii. BD_{100} 21
i. BD_{100}-species 22
d) Antibacterial use by the contract veterinarian 22
Quality control for possibly erroneous notifications *22*
Quality control for defining the yearly reference populations for benchmarking *22*
a) Active during the whole year 23
b) Notification errors 23
c) Empty stables 23
d) Minimum herd size requirements 23
e) Zero-use and use farms 23
RESULTS 24
ANTIBACTERIAL PRODUCTS SALES DATA 24
Response rate and data validation *24*
Number of antibacterial pharmaceuticals and premixes available on the Belgian market *24*
Animal biomass produced in Belgium *25*
Total sales of antibacterial drugs for veterinary use in Belgium *26*
Antibacterial sales versus biomass *29*
Positioning of Belgium in comparison to the EU member states. *31*
Species specific antibacterial use *32*
Intramammary products in dairy cattle *34*
a) Total sales of intramammary products 34
b) Number of DC and LC injector per dairy cow. 35
Antibacterial pharmaceuticals in dogs and cats *37*
Antibacterial sales per class of antibacterial compound *39*
a) Total sales (antibacterial pharmaceuticals and premixes) 39
b) Antibacterial pharmaceuticals 43
c) Antibacterial premixes 43
Sales per antibacterial active substance *44*
ANTIBACTERIAL USE DATA 47
Notifications in Sanitel-Med *47*
Sanitel-Med coverage of sales data *47*
a) General 47
b) Per species/animal category 48
c) Per antibacterial class 49
Use of critical substances in the Sanitel-Med animal species *50*
Species-level antibacterial use *52*
a) BD_{100}-species 52

Farm-level antibacterial use *53*

a) 2020 reference populations for benchmarking 53

b) Farm-level antibacterial use in 2020 54

c) Evolution of farm-level antibacterial use from 2018 to 2020 55

i. Summary 55

ii. Suckling piglets 55

iii. Weaned piglets 56

iv. Fattening pigs 57

v. Breeding pigs 57

vi. Broilers 58

vii. Laying hens 59

viii. Veal calves 59

d) Distribution of use according to veterinary contract 60

e) Farm-level use of the various antibacterial classes 62

DISCUSSION 63

CONCLUSION 65

ACKNOWLEDGEMENTS 66

APPENDIX 67

APPENDIX A. ATC-VET CODES INCLUDED IN THE DIFFERENT CLASSES OF ANTIBACTERIAL PRODUCTS 67

THE AUTHORS

The 2020 data collection and analysis was performed by the Veterinary Epidemiology Unit of the faculty of Veterinary Medicine from the Ghent University (sales data) and the Data Analysis Unit of the centre of expertise on Antimicrobial Consumption and Resistance in Animals (AMCRA) (consumption data) under the authority of the Federal Agency for Medicines and Health products.

The data collection and analysis of the sales data has been performed by:

Drs. Reshat Jashari,
Prof. dr. Jeroen Dewulf,
Veterinary Epidemiology Unit
Faculty of Veterinary Medicine
Ghent University
Belgium

The data analysis of the use data has been performed by:

Dr. Wannes Vanderhaeghen and the team of the Data Analysis Unit
AMCRA vzw
Belgium

The report has been written by:

Prof. dr. Jeroen Dewulf,
Veterinary Epidemiology Unit
Faculty of Veterinary Medicine
Ghent University
Belgium

Dr. Wannes Vanderhaeghen
Dr. Bénédicte Callens
Dr. Fabiana Dal Pozzo
AMCRA vzw
Belgium

Dr. Antita Adriaens,
Apr. Dries Minne,
DG PRE
Federal Agency for Medicines and Health products
Belgium

Funded by: ***Federal Agency for Medicines and Health products***

Suggested citation: *Belgian veterinary surveillance on antimicrobial consumption report 2020 (BELVETSAC 2020). Brussels: Federal Agency For Medicines and Health Products.*

Contact: infovet@fagg-afmps.be

MATERIALS AND METHODS

ANTIMICROBIAL SALES DATA

Data collection

a) Antibacterials for veterinary use

i. Antibacterial pharmaceuticals

Sales data of all veterinary medicinal products in all pharmaceutical formulations containing antibacterial active substances and authorized on the Belgian market were aggregated. These data were asked from the 21 wholesaler-distributors that are licensed and actively supply veterinarians and pharmacies in Belgium with veterinary medicines during the observation period. The wholesalers-distributors are obliged by law (article 12 sexies, Law on medicines 25th March 1964; Articles 221 and 228 Royal Decree 14th December 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, FAMHP) on demand. They were asked by letter dd. December 2020 to upload the required data via a secured web-application (www.belvetsac.ugent.be). The required data consisted of **all veterinary antibacterial products sold in the year 2020 to a veterinarian or pharmacist in Belgium**. In Belgium, antibacterial products are only available on prescription or by delivery from the veterinarian. Belgian veterinarians can both use antibacterial products in their daily practice, or sell them to animal owners (fig. 1). Sales from one wholesaler-distributor to another were excluded from the input data to prevent double counting. A pre-filled list of antibacterial veterinary medicinal products authorized and marketed on the Belgian market was provided, together with their market authorization holder and national code, pharmaceutical formulation and package form. The wholesaler-distributor only needed to provide the number of packages sold for each product for the given year.

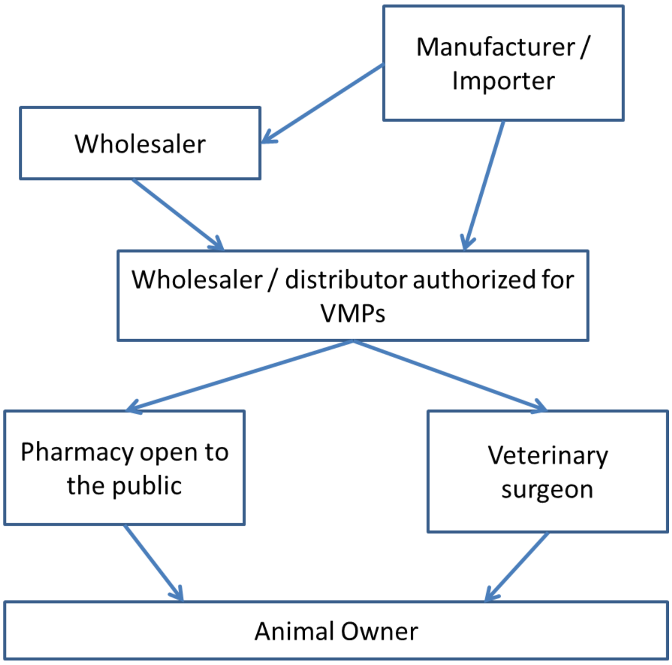


Figure 1. Distribution of veterinary medicinal products (VMPs) in Belgium.

ii. Antibacterial premixes

As antibacterial premixes can be purchased by feed mills directly from the manufacturers or wholesalers (not necessarily through wholesaler-distributors) (fig. 2) data on medicated feed were collected separately. This was done by contacting all

Belgian compound feed producers that are licensed and active to produce medicated feed[1] (n=45). The feed mills were asked by letter dd. December 2020 to upload the required data, on legal basis of article 12 sexies Law on medicines 25th March 1964; Article 221 and 228 Royal Decree 14th December 2006 on medicines for human and veterinary use. This data on medicated feed delivered at Belgian farms in 2020 was also submitted via the secure web-application[2]. Producers of medicated feed were asked to provide **data on the use of antibacterial premixes as well as ZnO containing premixes for the year 2020**. A list of authorised and marketed antibacterial premixes was provided. Antibacterial and ZnO premixes can only be incorporated into medicated feed on prescription of a veterinarian.

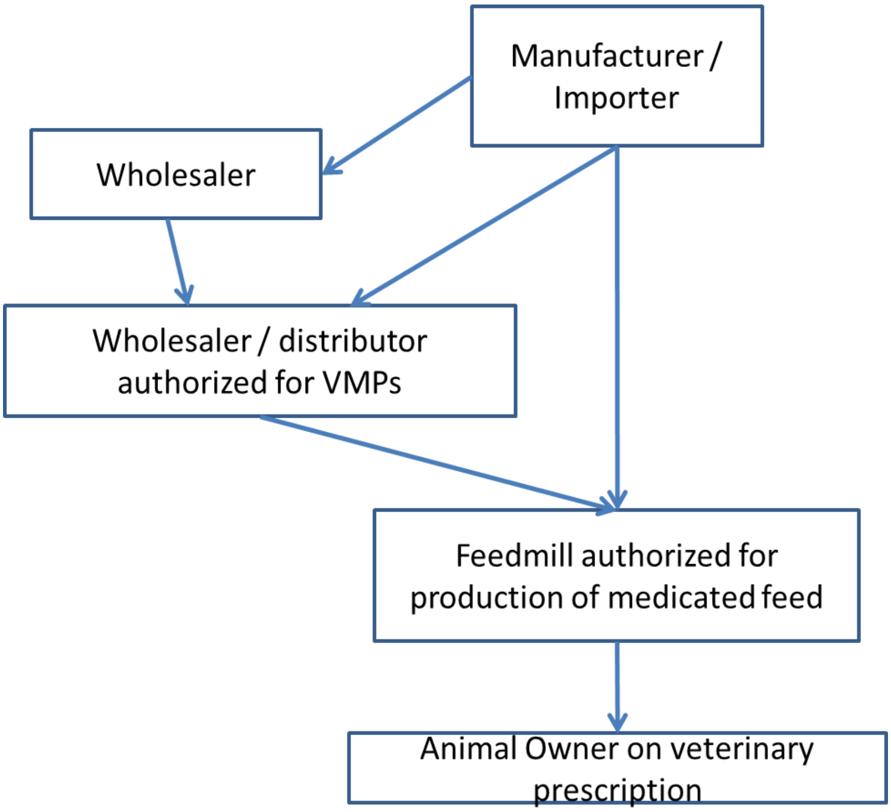


Figure 2. Distribution of veterinary premixes in Belgium.

iii. Antibacterial classes included

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

The BelVet-SAC data collection covers all veterinary antibacterial medicines (Table 1). No antibacterial products are excluded which is in contrast to the ESVAC reporting system where antibacterial products for dermatological use and for use in sensory organs are excluded. This explains why sales data as presented in this report may slightly differ from what is reported for Belgium in the ESVAC report.

As Zinc Oxide (ZnO) products (premixes) were authorized in Belgium since September 2013, sales data were collected and are presented separately.

[1] http://www.favv-afsca.be/bo-documents/Inter_R0-1002_3_dierlijke_producten_erkende_bedrijven.PDF
[2] www.BELVET-SAC.ugent.be

Table 1. Groups of antibacterial agents covered in the data collection and corresponding ATCvet codes.

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

b) Animal population

Animal population data to calculate the produced biomass were derived from the Eurostat website[3].

From these animal population data, the biomass (in kg) was calculated, according to Grave[4] et al., (2010), as the sum of the amount of meat from beef, pork, poultry and small ruminants produced that year in Belgium plus the number of dairy cattle present in Belgium times 500 kg of metabolic weight per head.

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 in accordance with the ESVAC (European Surveillance of Veterinary Antibacterial Consumption) recommendations. This additional information consisted of:

- the different antibacterial active 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 reporting

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

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

As in the previous reports (BELVET-SAC 2007-2019)[5], yearly sales figures were put versus biomass as a yearly adjusted denominator according to the methodology described by Grave et al. (2010). The animal species included represent the vast majority of the biomass present (estimated to be 93% 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 and companion animals (dogs, cats, …) (estimated to be 7% of the biomass present in Belgium), whereas the collected data on antibacterial products

[3] http://ec.europa.eu/eurostat/data/database

[4] Grave K, Torren-Edo J en Mackay D (2010). Comparison of the sales of veterinary antibacterial agents between 10 European countries. *Journal of Antibacterial Chemotherapy*, 65, 2037-2010

[5] http://www.belvetsac.ugent.be/

also covers the sales in these species. The biomass also includes animals slaughtered in Belgium but raised in other countries and it excludes animals raised in Belgium but slaughtered abroad.

Data validation

a) External data validation

To check for correctness and completeness the collected data on premixes were compared to data collected by the compound feed producing industry[6]. The datasets do not provide exactly the same information as the used data collection methodology is slightly different. However, trends and evolutions in the different datasets can be compared. If large discrepancies were observed data validity was further investigated and corrected, if needed.

To check for correctness of the reported pharmaceuticals data trends are compared with the data obtained from the market authorization holders (MAH) collected in the framework of the antibiotic tax as well as with the reported use data in Sanitel-Med.

b) Internal data validation

For each of the data entries of the wholesaler-distributor or compound feed producers results were compared with the data entries of the previous years by the same companies. If large, unexpected, discrepancies were observed between the data provided in the subsequent years, data validity was further investigated and corrected, if needed.

[6] www.bfa.be

ANTIBACTERIAL USE DATA

Data collection in Sanitel-Med

a) Notifications of antibacterial use at farm-level

Since 27 February 2017, veterinarians are legally obliged (Royal Decree of 02.07.2017 modifying Royal Decree of 21.07.2016) to register in the secured online data collection system Sanitel-Med all prescriptions, administrations and deliveries of antibacterial products (pharmaceuticals as well as premixes, incl. premixes containing ZnO as an antidiarrheal substance) on Belgian farms raising pigs, broilers, laying hens and veal calves. The system, developed and maintained by the FAMHP, is accessible as a web application or through automated data transfer using xml (webservices).

Registration is done by first creating a 'Medicinal Delivery Document' containing the identification of the veterinarian and the farm as well as the type, number and date of the reference document (Treatment and Delivery Document, prescription or 'register out' of the veterinarian). To this Medicinal Delivery Document, one or more 'notifications' are added, each representing a specific prescription, delivery or administration of an antibacterial product.

The following data need to be included in a notification:

- The animal species and category for which the antibacterial product is intended.

  The categories that can be selected are

  - Pigs:
    - sows (PIGB);
    - gilts (PIGI);
    - fattening pigs (PIGF);
    - weaned piglets (PIGLW);
    - suckling piglets (PIGLU)
  - Poultry:
    - broilers (BROIR);
    - laying hens (LAYIH)
  - Veal:
    - Veal calves (VECLF)
- The name and quantity of the antibacterial product.

The product needs to be selected from a regularly updated medicinal product list containing all antibacterial product packages commercialized in Belgium, identified through a unique cti-ext code key. As for the antibacterial sales data, all groups of antibacterial agents listed in Table 1 are included. For pharmaceuticals, the number of packages needs to be registered, with the possibility of using decimals (incl. quantities lower than 1). For premixes, either the number of packages, the kg premix or the kg medicated feed in combination with the parts-per-million premix needs to be registered; using decimals is also possible.

Products used off-label need to be registered from the same list. Products used through cascade (products not registered in Belgium, products for human use or products prepared extemporaneously) need to be registered as 'Self-Defined Product' (SDP), requiring additional data fields to allow calculation of the delivered quantity of active substance (see below).

Veterinarians can register the data at any moment under the premise that all data from a given quarter need to be registered at the latest the 14th day of the following quarter. The farmer or responsible of the animals must check the correctness of the data from a given quarter at the latest the final day of the first month of the following quarter. This last day is called the 'Data-Lock-Point' (DLP), hence, there are four DLP in a year.

So-called 'third parties' (i.c. other Belgian data collection systems) can transfer the required data on behalf of a veterinarian and/or farmer. Nonetheless, the respective veterinarian and/or farmer remain(s) responsible for the completeness, correctness and timeliness of the registrations.

Reprising Figure 1 explaining the origin of the antibacterial sales data, the data from Sanitel-Med originate at the bottom of the chain and concern data about the use of antibacterial products at the farm-level (Figure 3). However, from the info provided above, it can be noted that not all Sanitel-Med data are 'use data' in a strict sense; indeed, a prescription or delivery is not 'proof' that the products have also been used in practice, especially not at the time of prescription or delivery. Nonetheless, it is deemed very likely that virtually all products prescribed or delivered are eventually used. It is furthermore assumed that by looking at the data over a period of one or more years, the lag between the moment of prescribing/delivering and using in practice will be averaged and play no relevant role in the calculation of the final result. Therefore, the Sanitel-Med data are referred to as 'use data' – in contrast to the 'sales data' described previously.

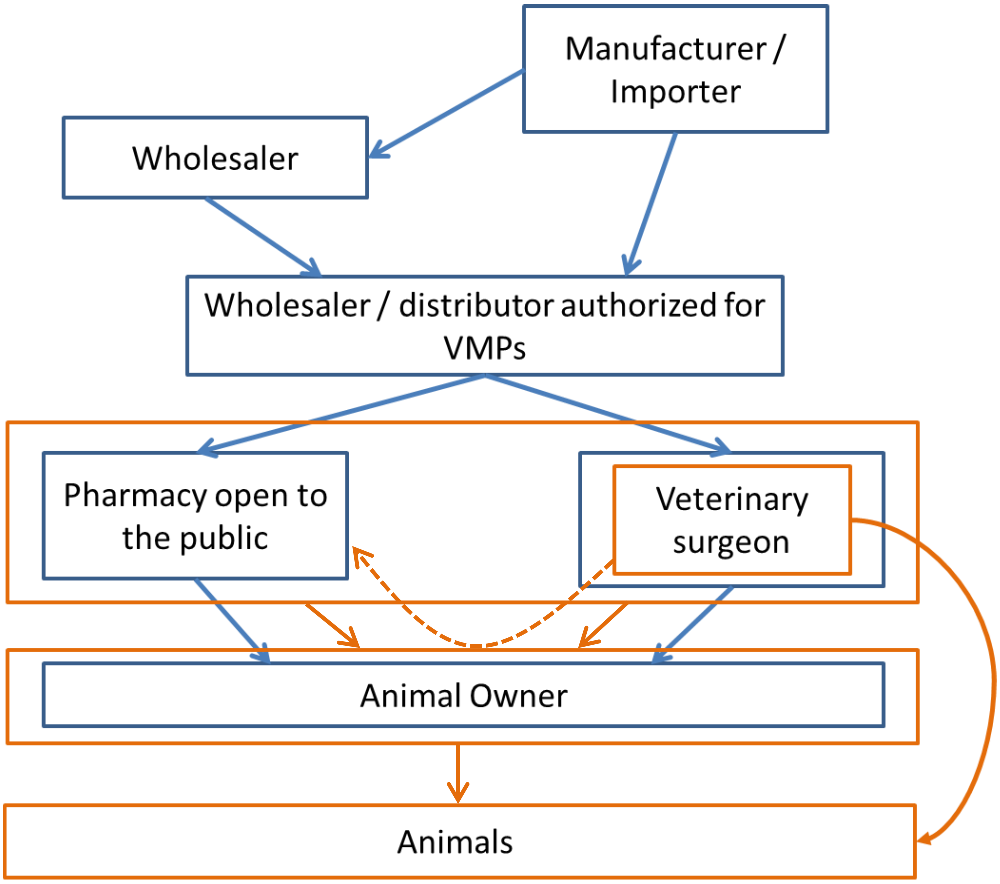


Figure 3. Origin of Sanitel-Med data concerning farm-level use of antibacterial pharmaceuticals. Veterinarians can directly administer antibacterials to the animals, deliver the antibacterials to the farmer after which the farmer administers them to the animals or prescribe the antibacterials which can then be bought in a pharmacy (dashed line) of from a feed mill (in case of premixes, not shown in the figure).

A list with all notifications is accessible to AMCRA as a report, based on a query developed and maintained by the FAMHP, that can be pulled by AMCRA through a secured online business object tool provided by the Federal Agency for the Safety of the Food Chain (FAFSC).

b) Number of animals present at farm level

The number of animals present at each farm is needed to calculate the animal mass 'at risk of treatment' at the farm (cfr. further, Calculation of the indicator BD_{100}). The number is deduced from identification and registration data present in the

SANITEL[7] -database (owned and managed by the Federal Agency for the Safety of the Food Chain (FASFC)) or, specifically for poultry farms for the year 2018, from SANITEL-data combined with data from the yearly 'Biosecurity-survey' organized by the FASFC.

i. Veal calf farms

The average number of calves present at each farm is calculated per semester, as the average over the six corresponding monthly numbers of animals. From January 2018 till July 2019, the monthly number of animals was calculated as the average occupation number taking into account the number of arrivals, births, departures and deaths per month on the farm as notified in SANITEL. From August 2019 onwards, the monthly number of animals is calculated as the average of the number of calves notified as present in SANITEL each 1st, 11th and 21st day of each month and the 1st day of the subsequent month.

ii. Poultry farms

For 2019 and 2020, the SANITEL-capacity data of a poultry facility were calculated as the sum of the SANITEL-capacity data of the corresponding poultry sanitary units in that facility.

For 2018, preference was given to the yearly FAFSC 'Biosecurity-survey' capacity numbers above SANITEL-data. These are either a separate capacity for broilers and laying hens on a facility, a total capacity for broilers and laying hens on a facility, or a total capacity for either broilers or laying hens on a facility. If for a given facility notifications were present in Sanitel-Med for a poultry category missing from the Biosecurity-survey but for which capacity data was available in SANITEL, the SANITEL-capacity was used.

iii. Pig farms

The SANITEL-data include capacity data (updated whenever a change is made to the capacity, for example by building a new or changing an existing stable) as well as count data (the number of animals present needs to be registered in SANITEL by the herd veterinarian at least three times a year). The capacity is the preferred animal number in the calculations. If not available, count data are used. The number of suckling piglets is calculated from the number of sows using the formula $\# \, sucklers = \# \, sows \times {}^{30}/_{12}$. The number of gilts is added to the number of sows if these are present at the farm; if not, gilts are counted as fattening pigs. No separate antibacterial use analysis is done for gilts.

c) Number of active farms

The number of active farms (i.e. having raised animals, hence, where antibacterial products *could* have been used), is needed to determine the reference population for benchmarking (cfr. further, Quality control for defining the yearly reference populations for benchmarking). Being 'active' is encoded as a separate feature in SANITEL at sanitary unit level. A list of active farms is accessible to AMCRA as a report, based on a query developed and maintained by the FAMHP, that can be exported by AMCRA through a secured online business object tool provided by the FAFSC.

d) Veterinary contract

A list with all agreement roles stopped, begun or active since 01/04/2017 between the so-called herd veterinarians and farms , containing the start and end dates of each agreement, is accessible to AMCRA as a report, based on a query developed and maintained by the FAMHP, that can be exported by AMCRA through a secured online business object tool provided by the FAFSC.

[7] http://www.afsca.be/dierlijkeproductie/dieren/sanitel/

Data analysis

The analysis of the Sanitel-Med data is split up into three parts:

- The first part focusses on the coverage of the antibacterial sales data by the Sanitel-Med use data; the latter concern only 'numerator data' (the quantities of antibacterials used); a denominator is not taken into account.
- The second part focusses on the evolution of the Sanitel-Med use data at the species-level, based on the number of treatment days calculated with a species-specific denominator.
- The third part focusses on the Sanitel-Med use data at the farm-level, based on the number of treatment days calculated with a farm-specific denominator.

For the first and second part of the analyses, the data were subjected to quality controls for possibly erroneous notifications (see further, Quality control for possibly erroneous notifications). Hence, the analyses include all numerator data (all notifications) submitted to Sanitel-Med, except those that were considered erroneous and have not been confirmed as being correct. For the third part, the data were additionally subjected to the farm-level quality controls for defining the reference populations for benchmarking (see further, Quality control for defining the yearly reference populations for benchmarking).

a) Determination of the numerator

i. Mg active substance used

This is calculated per Sanitel-Med notification, using the formula

$$active\ substance\ used\ (mg) = quantity\ antimicrobial\ product\ \times strength$$

For pharmaceuticals, the quantity of antibacterial product is the number of packages times the number of units of antibacterial product per package. The strength is the number of units of active substance per unit of antibacterial product and is taken from the products' summary of product characteristics (SPC). If the active substance unit is given in international units, a transformation to mg is done using the conversion factors provided on the webpage of the AMCRA data analysis unit[8]. If the product contains more than one active substance, the calculation is done for each substance and the sum is made.

For premixes, if the number of packages or the kg medicated feed in combination with the parts-per-million is registered, these are first recalculated to the kg premix used. From the kg premix used, the active substance used is calculated by multiplying with the mg active substance per kg premix, taken from the SPC.

After calculating the total mg of active substance used per notification, the amounts can be aggregated by farm, by type of active substance, by animal category and by animal species, and recalculated to kg or tonnes used.

ii. Number of $DDDA_{bel}$ used

The $DDDA_{bel}$ (the Defined Daily Dose Animal for Belgium) is the daily dose (in mg) per kg live bodyweight for products administered orally of through injection, and the daily dose (in mg) per animal for products administered locally or topically. This is calculated per notification using the formula

$$\#\ DDDA_{bel} = mg\ active\ substance / DDDA_{bel}$$

The $DDDA_{bel}$-values for all antibacterial products in the Sanitel-Med medicinal product list and for all self-defined products are defined and maintained by AMCRA in 'Antibacterial-dosing' lists made up per animal species[9]. The lists also contain the LA_{bel} (Long-acting factor defined for Belgium) of each product. This LA_{bel} factor corrects the longer duration of action of certain

[8] https://www.amcra.be/swfiles/files/Principes%20voor%20bepalen%20van%20DDD-bel%20op%20productniveau(2)_109.pdf
[9] https://www.amcra.be/nl/analyse-antibioticagebruik/

products in the calculation of the BD_{100} (cfr. further, Calculation of the indicator BD_{100}). For not-long-acting products, the LA_{bel} equals 1. The procedures for determining the DDD_{bel} and LA_{bel} values are also available on the AMCRA website [10].

b) Determination of the denominator

i. Animals and kg at risk per species at national level

The national number and kg animal at risk (for antibacterial treatment) per species is calculated from the yearly average number of animals present per animal category, consulted in the Statbel database [10]. The categories included from that database and the standard weights (source: EMA 2013 [11]) to calculate the corresponding kg at risk are shown below:

Piglets of <20 kg	12 kg	Laying hens	2 kg	Bovines < 1 year to be slaughtered as calves	80 kg
Pigs 20-50 kg + fatteners	50 kg	Broilers	1 kg		
Breeding pigs >50 kg	220 kg				

ii. Kg at risk per animal category at farm level

Per animal category on each farm, the kg animal 'at risk of treatment' is calculated using the formula

$$kg\ animals\ at\ risk = number\ of\ animals\ \times estimated\ standard\ weight\ (kg)\ at\ treatment$$

The following estimated standard weights at treatment are used (source: EMA 2013 [11]):

Suckling piglets	4 kg	Broilers	1 kg	Veal calves	80 kg
Weaned piglets	12 kg	Laying hens	2 kg		
Fattening pigs	50 kg				
Sows	220 kg				

c) Indicators

i. Mg used

To make a comparison between the yearly antibacterial sales data, which include all animal species, and the Sanitel-Med use data, in total and for each of the species (pigs, poultry, veal calves) separately, the total amount of active substance used in each species was calculated, from the sum of the mg used in all Sanitel-Med notifications for that species.

ii. BD_{100}

To compare and follow up on the use of antibacterial products in the different animal categories, the BD_{100} is used, which represents the % of time an animal is treated with antibacterials. This indicator is calculated with the general formula:

$$BD_{100} = \left[\left({}^{\#DDDA_{bel}}\!/_{kg\ animals\ at\ risk \times days\ at\ risk}\right) \times LA_{bel}\right] \times 100$$

[10] https://statbel.fgov.be/nl/themas/landbouw-visserij/land-en-tuinbouwbedrijven#figures

[11] https://www.ema.europa.eu/en/documents/scientific-guideline/revised-european-surveillance-veterinary-antimicrobial-consumption-esvac-reflection-paper-collecting_en.pdf

To obtain a result per combination of farm and animal category, the BD_{100} is first calculated per Sanitel-Med notification and per month (i.e. with 30,42 days at risk and with the animals at risk determined for that month). Then, the sum of these BD_{100} values over all notifications in one month is made, from which an average over the 12 months in the year is calculated, resulting in a final month-average BD_{100} per animal category on a farm. The comparison between animal categories is then done based on the frequency distribution over all farm-animal category combinations that belong to the core reference population for benchmarking (cfr. further, Quality control for defining the yearly reference populations for benchmarking).

i. *BD_{100}-species*

The BD_{100}-species is calculated with the BD_{100} formula but with numerator and denominator data at species level. It is per species the sum of:

- BD_{100}-species$_{mg/kg}$: in the numerator the total #$DDDA_{bel}$*LA_{bel} used for products administered orally or through injection and in the denominator the animal weight (in kg) at risk.
- BD_{100}-species$_{mg/animal}$: in the numerator the total #$DDDA_{bel}$*LA_{bel} used for products administered locally or topically and in the denominator the number of animals at risk.

d) Antibacterial use by the contract veterinarian

The part of the antibacterial use (excl. ZnO) at farm level by the contract veterinarian was calculated by linking the responsible veterinarian for a use notification in Sanitel-Med to the veterinarian having a contract with the farm at the document date.

Quality control for possibly erroneous notifications

The notified quantity of antibacterials is considered possibly erroneous in the following cases:

- Notifications for pigs:
    - The quantity is greater than one of a multi-package product for injection;
    - The quantity is greater than 100 of a product for injection;
    - The BD_{100} calculated for a notification is higher than 350 for PIGF; higher than 1300 for PIGLW; higher than 100 for PIGB;
    - The premix ppm is unlikely low or high (based on the product-specific SPC's).
- Notifications for poultry:
    - The quantity is greater than 50;
    - The BD_{100} calculated for a notification is higher than 500.
- Notifications for veal calves:
    - The quantity is greater than one of a multi-package product for injection;
    - The quantity is greater than 50 of a product for injection;
    - The BD_{100} calculated for a notification is higher than 500.

Quality control for defining the yearly reference populations for benchmarking

The yearly reference population for benchmarking is used to study the distribution of the BD_{100} in an animal category and its evolution over several years, and it is per animal category defined as the group of farms that, for the whole year under consideration

- were 'active' (see below, point a)
- had no 'errors' in their Sanitel-Med notifications (see below, point b)
- fulfilled the conditions with respect to 'minimum herd size and empty stables' (see below, points c and d).

In the reference populations, a further distinction is made between zero-use farms and use-farms (see below, point e).

a) Active during the whole year

A farm is eligible for inclusion in the benchmarking reference population when it was encoded active during the whole year. For poultry farms, more specifically, at least one sanitary unit needed to have been active during the whole year for the facility to be included. Pig farms encoded as 'active' but not having any registration in Sanitel-Med and either having no recent count date (i.e. count date before the year considered) or having a recent count date (i.e. count date in the year considered) but with all counts in that year equalling zero, were excluded. Veal calf farms encoded as 'active', yet not having any registration in Sanitel-Med and having zero animals in the year considered, were excluded.

b) Notification errors

Two types of errors are distinguished:

i. Notifications that cannot be processed due to missing data on the number of animals present at the farm.
ii. Notifications where the delivered quantity is considered erroneous (see higher, *Quality control for possibly erroneous notifications*).

Farmers are made aware of these errors through 'error reports', providing them the opportunity to take the necessary steps to adjust the data. Farms that have notification errors that have not been adjusted or have not been confirmed as correct were excluded from the benchmarking reference population.

c) Empty stables

Pig farms with recent count data equalling zero at the start of two consecutive trimesters, poultry farms with facility capacities equalling zero at the start of two consecutive trimesters and veal calf farms with at least one semester without animals were excluded from the benchmarking reference population.

d) Minimum herd size requirements

A minimum herd size is defined, as shown below:

Weaned piglets	50 animals	Broilers	4900 animals	Veal calves	25 animals
Fattening pigs	100 animals	Laying hens	4900 animals		
Sows	10 animals				

Poultry and pig farms with animal numbers below the minimum for at least one quarter were excluded from the benchmarking reference population. Veal calf farms with animal numbers below the minimum for at least one semester were excluded from the reference population.

e) Zero-use and use farms

A zero-use farm is defined as a farm that has no notifications in Sanitel-Med in a given period. For pigs farms, this is at species level (no notifications in the period in all categories present at the farm). For farms with broilers, laying hens and veal calves, it is at animal category level (no notifications in the period in that category).

RESULTS

ANTIBACTERIAL PRODUCTS SALES DATA

Response rate and data validation

All of the 21 wholesaler-distributors, requested to deliver their sales data on veterinary antibacterial products sold in 2020, responded. One indicated to have stopped activities therefore data were collected from 20 wholesaler-distributors. All 45 compound feed producers, licensed for the production of medicated feed responded. One feed mill indicate not to have produced any medicated feed (any more) while 44 feed producers delivered the data on antibacterial premixes incorporated in medicated feed to be used in Belgium. Based on the response rate data coverage is assumed to be 100%.

Data providers get more and more accustomed to the system. In the last four years, the internal data validation step recognized one odd report with regard to ZnO which was corrected after contact with the feed manufacturer. Besides this no data corrections were needed.

Number of antibacterial pharmaceuticals and premixes available on the Belgian market

Table 2 provides an overview of the number of antibacterial pharmaceuticals and antibacterial premixes available on the Belgian market since 2011 according to the commented compendium of the Belgian Centre for Pharmacotherapeutic Information[12].

Table 2. Armatorium of antibacterial products on the Belgian market from 2011 to 2020.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Number of Antibacterial pharmaceuticals on the market	282	308	294	298	339	329	323	325	326	308
Number of Antibacterial premixes on the market	23	22	23	21	21	19	16	18	13	15
Total number of Antibacterial products on the market	305	330	317	319	360	348	339	343	339	323

The only new antibacterial products registered on the market in the last 9 years are products containing tildipirosin (2011), pradofloxacine (2011), fusidic acid (2014) and thiamfenicol (2015). The observed variation in available products is largely due to the marketing of new formulations or new generic products based on existing active substances.

[12] www.bcfi-vet.be

Animal biomass produced in Belgium

The produced biomass was calculated based on the Eurostat data for the years 2015-2020 as described above (Table 3).

Table 3. Animal biomass produced in Belgium from 2015 to 2020.

Animal biomass	2015	2016	2017	2018	2019	2020
Meat (ton)						
Pork	1 124 310	1 060 540	1 044 560	1 073 120	1 038 916	1 098 710
Beef	267 880	278 360	281 540	277 310	263 749	254 500
Poultry	452 940	461 250	463 390	469 590	447 786	448 970
Sheep/goat[a]	2 720	3 020	3 230	3 090	3 010	2 830
Total biomass from meat production	**1 847 850**	**1 803 170**	**1 792 720**	**1 823 110**	**1 753 487**	**1 805 010**
Dairy cattle						
Dairy cattle (number)	528 780	529 780	519 160	529 250	537 960	541 090
Dairy cattle metabolic weight (ton)	264 390	264 890	259 580	264 625	268 980	270 545
Total biomass (ton)	**2 112 240**	**2 068 060**	**2 052 300**	**2 087 735**	**2 022 450**	**2 075 555**
Evolution since previous year	**+1,97%**	**-2,09%**	**-0,76%**	**+ 1,73%**	**-3,13%**	**+2,64%**

[a] the biomass of sheep and goat was added to the total biomass for the first time in 2016. In all calculations and tables the new biomass (including sheep and goat) was adapted retrospectively to assure a correct evolution over time.

An **increase in biomass production of +2,64%%** is observed between 2019 and 2020. Compared to the reference year 2011 an increase of + 1,69% is observed in the total biomass production in Belgium mainly due to an increase in dairy cattle and broiler production.

Total sales of antibacterial drugs for veterinary use in Belgium

The total sales of antibacterial products for veterinary use in Belgium is presented in Figure 4 in tons of active substance per year since 2011 (reference year for all reduction initiatives in Belgium). The total amount is subdivided into antibacterial compounds contained in pharmaceuticals (all pharmaceutical formulations except premixes) and antibacterial compounds contained in premixes incorporated into medicated feed intended to be used in Belgium.

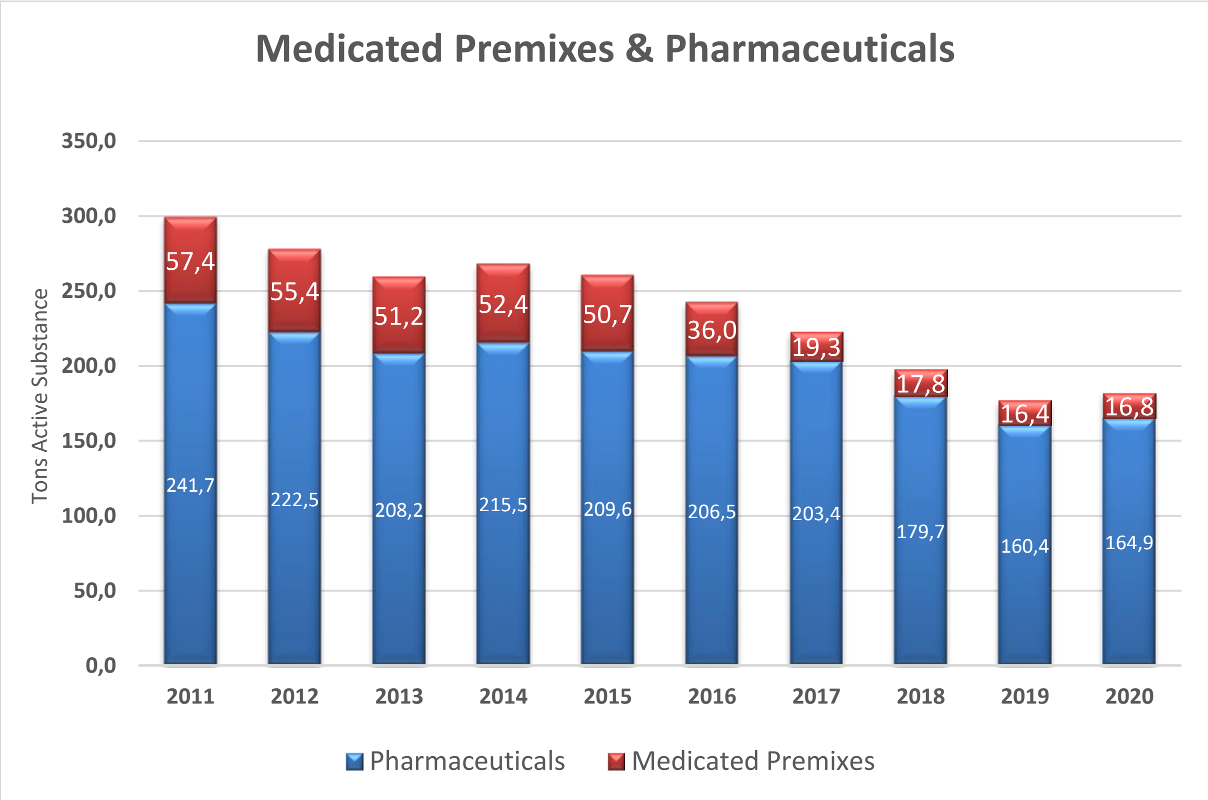


Figure 4. Total national sales of antibacterial compounds for veterinary use in Belgium for the years 2011-2020 (tonnes active substance).

Between 2019 and 2020, there was an **increase of +2.8%** in the total sales of antibacterial products in veterinary medicine in Belgium (181 749,6 kg in 2020 versus 176 819,6 kg in 2019). The use of antibacterial **pharmaceuticals increased with +2.8%** between 2019 and 2020, and the use of **antibacterial premixes increased with +2,5%.** After five years in a row of decreasing total sales numbers this the first increase seen since 2014. **Since 2011 (reference year for reduction initiative) a decrease of -39.2% is realized in absolute volumes.**

Figures 5 and 6 show these data separately for the antibacterial pharmaceuticals and the antibacterial premixes.

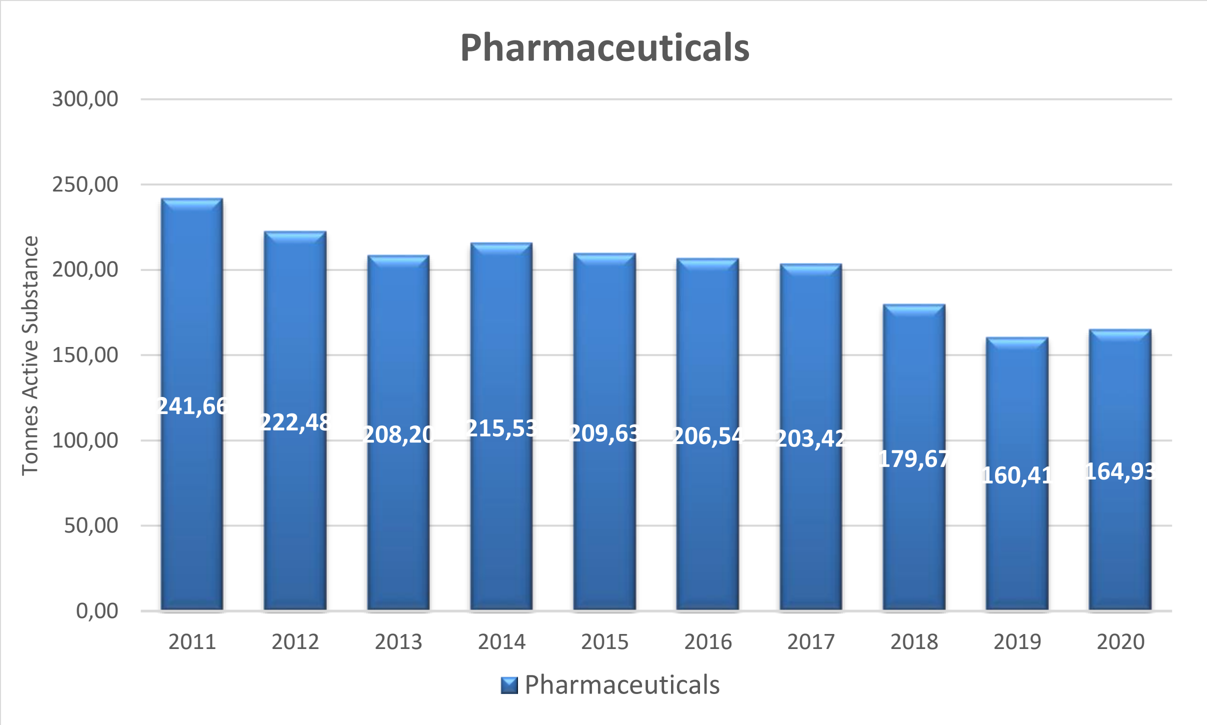


Figure 5. National sales of antibacterial pharmaceuticals for veterinary use in Belgium for the years 2011-2020 (tonnes active substance).

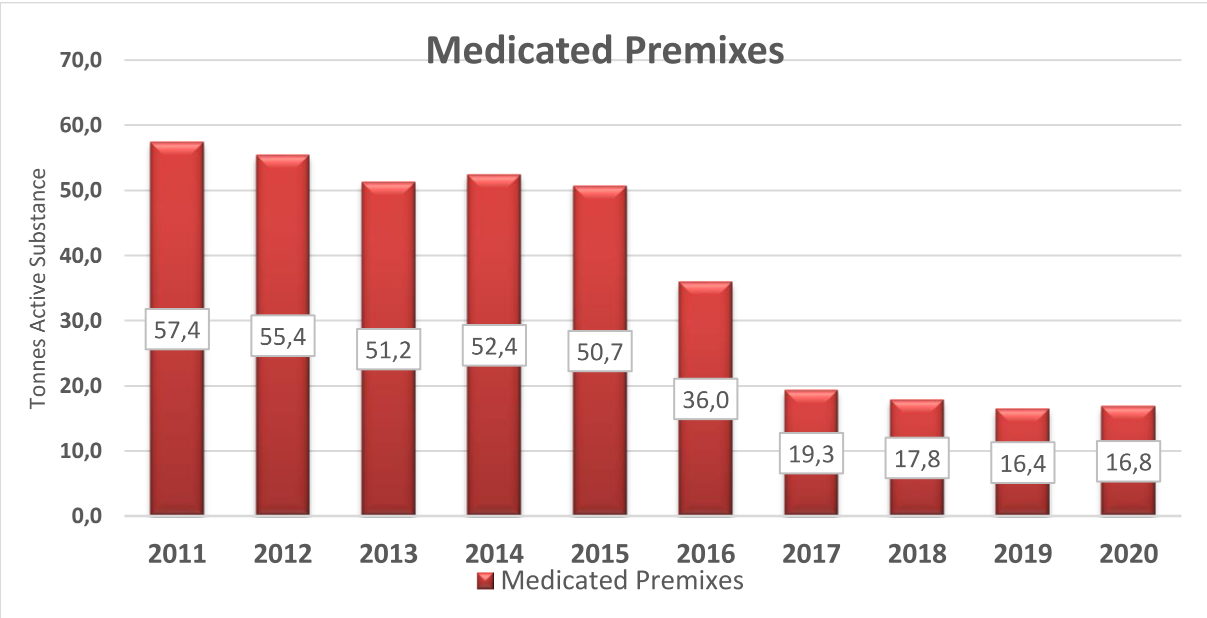


Figure 6. National consumption of antibacterial premixes in Belgium for the years 2011-2020 (tonnes active substance)

Since 2011 the data collection system allows to differentiate the animal species of destination for the antibacterial premixes. In 2020, 99,7% of the antibacterial premixes went to pig feed and only 0,3% was used in poultry or rabbit feed.

From September 2013, the use of Zinc oxide (ZnO) in therapeutic doses (corresponding to 2500 ppm of Zn) in piglets for two weeks after weaning was allowed. After an increased use between 2013 (use during only one quarter) and 2015 a first decrease was observed in 2016 and continued since. In comparison to 2019 the use of ZnO reduced with -14.4% in 2020 as is presented in figure 7.

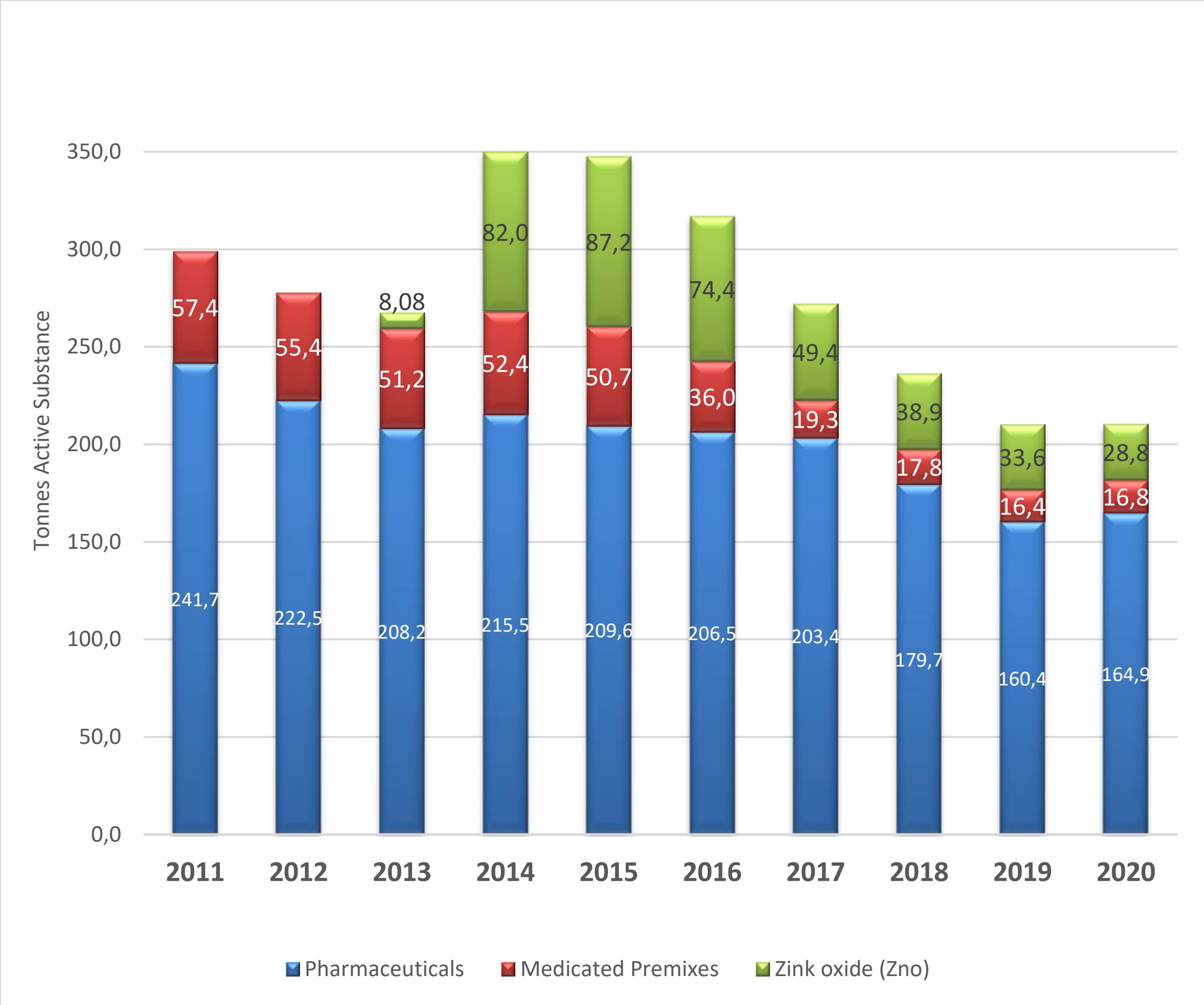


Figure 7. Total national sales of antibacterial compounds for veterinary use in Belgium plus the sales of ZnO for the years 2011-2020 (tonnes active substance).

Antibacterial sales versus biomass

As described above, the total biomass production in 2020 in Belgium has increased with +2.6% in comparison to 2019. As a consequence the increasing trends in sales observed in absolute values (kg) is partially tempered by the fact that this increased volume of antibacterial products is used in an increased population. For 2019, the mg of active substance used in relation to a kg biomass produced was 87,4 mg/kg whereas in **2020 this is 87,6 mg/kg.** This means **an increase of +0.2% in comparison to 2019.** Split up between the different pharmaceutical forms (premix vs other forms), an increase of +0.2% is observed in the antibacterial pharmaceuticals and +4.0% in the antibacterial premixes.

Figure 8 presents these data, again subdivided into antibacterial pharmaceuticals and antibacterial premixes.

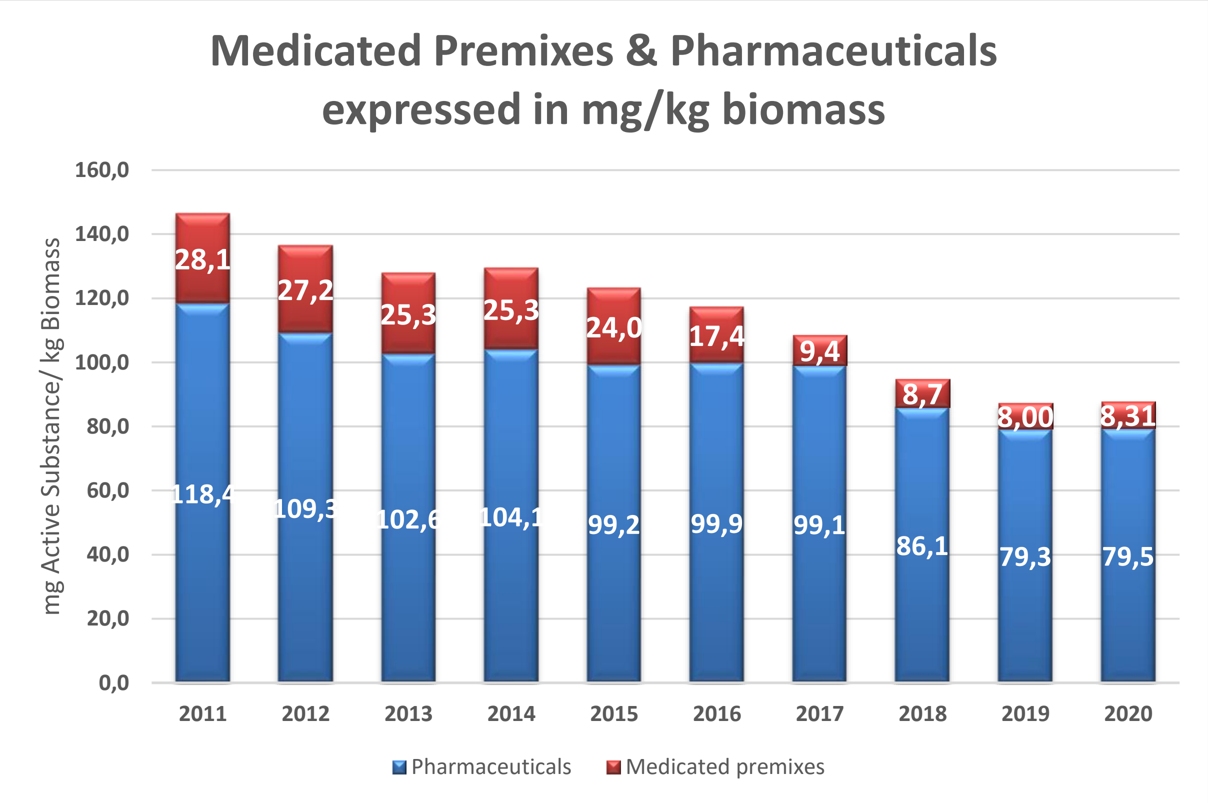


Figure 8. Total mg of active substance used per kg biomass produced in Belgium for 2011-2020.

The increase of +0.2% seen in the amount of antimicrobials used per kg biomass in 2020 is the first increase after five years of reduction. When using 2011 as a reference (see AMCRA 2020 objectives), still **a cumulative reduction of -40.2% is achieved**, distributed in a reduction of -32,9% in antibacterial pharmaceuticals and -70,4% in antibacterial medicated premixes (Fig. 9).

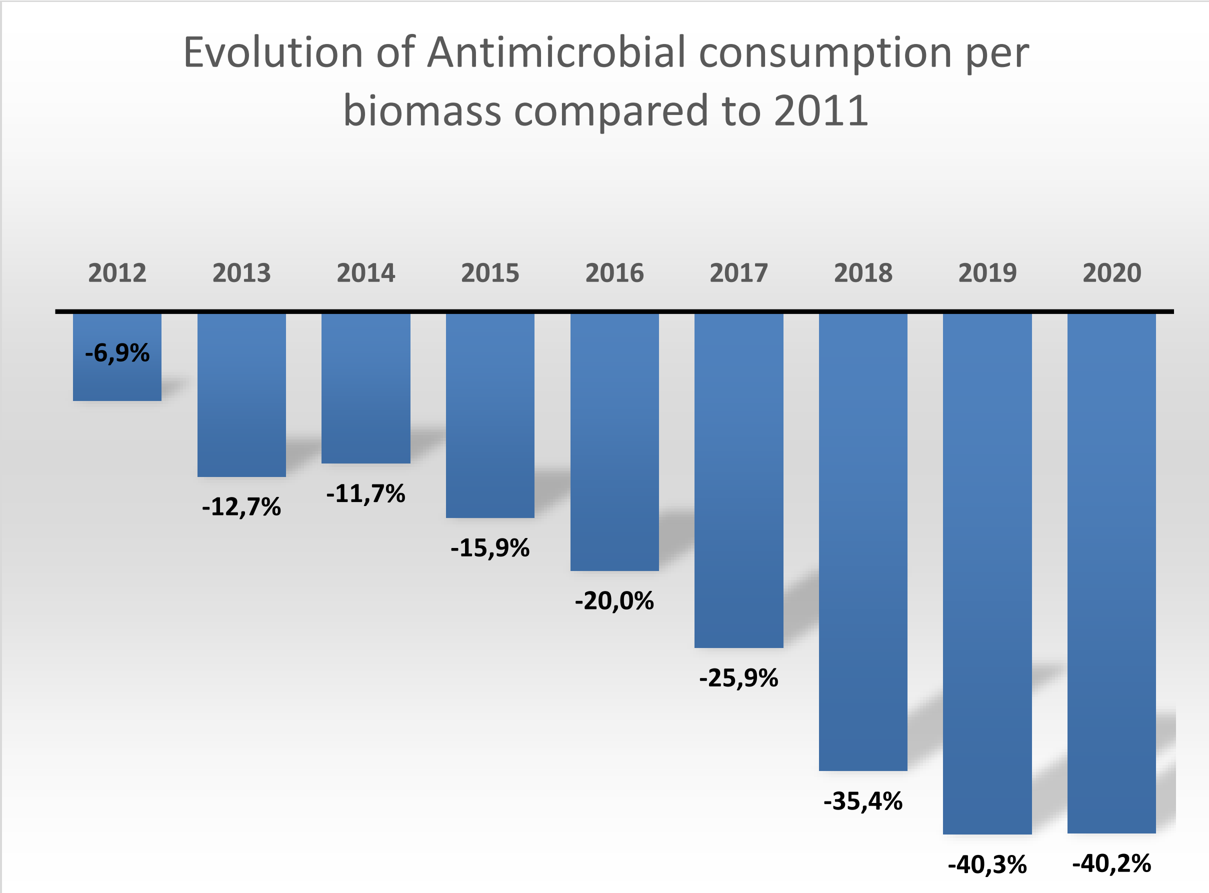


Figure 9. Evolution of antibacterial product sales per kg biomass produced in Belgium with 2011 as reference year.

Positioning of Belgium in comparison to the EU member states.

Since 2009 the European Medicines Agency (EMA) runs the European Surveillance of Antibacterial Consumption (ESVAC) project that aims at the collection of antibacterial sales data in all EU member states in a comparable manner allowing to evaluate trends and compare sales within and between countries. The data collected in Belgium and presented in the annual BelVet-SAC reports are also collected in the framework of this EU wide ESVAC data collection effort.

In 2020, the tenth ESVAC report, presenting results on antibacterial usage in 31 EU /EEA countries in the year 2018 was released[13]. In this report the **antibacterial consumption in animals in 2018 is presented in relation to the animal production in the country.**

In figure 10 the results of the 31 countries are presented in mg active substance sold and the animal production quantified by means of the Population Correction Unit (PCU) which is comparable to the biomass used in this BelVet-SAC report but also includes species as horses and rabbits and corrects more thoroughly for import and export.

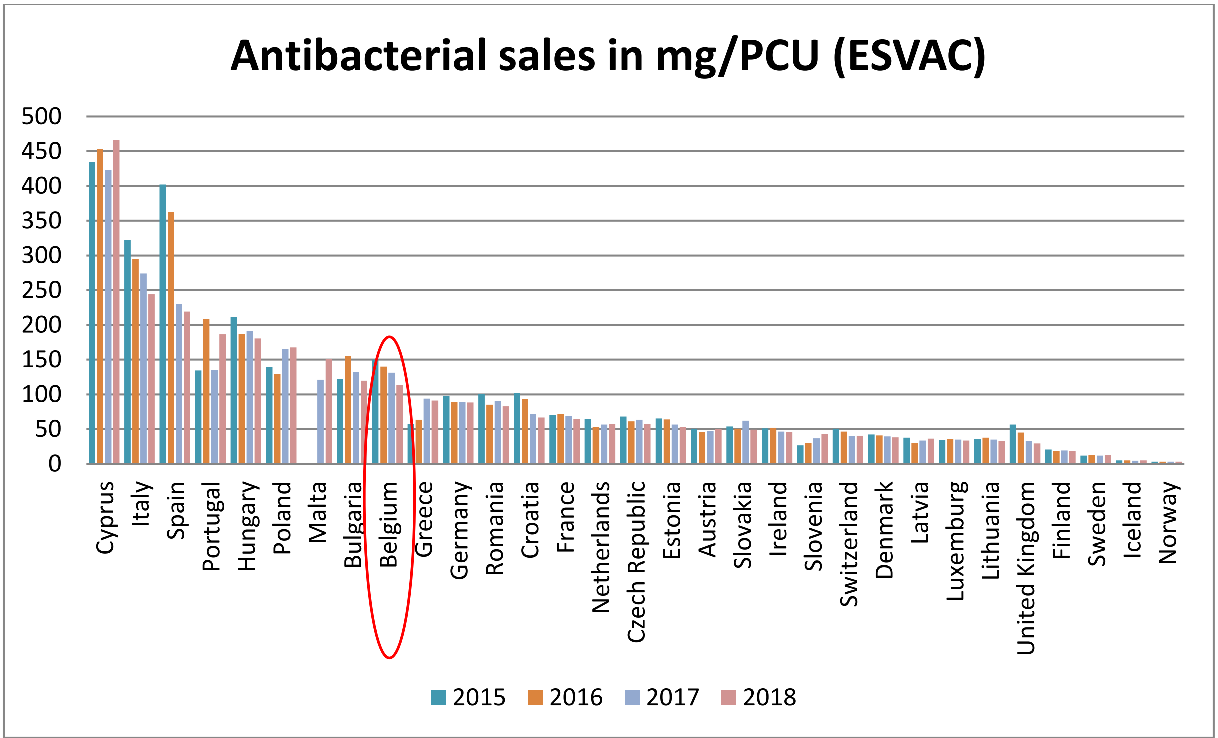


Figure 10. Overall sales of antibacterial compounds for food-producing species, including horses, in mg/PCU, per country between 2015-2018 (source: 10th ESVAC report on Sales of veterinary Antibacterial agents).

When looking at figure 10, it can be observed that Belgium resides at the ninth position in terms of antibacterial usage expressed in mg/PCU in 2018. Obviously, when comparing countries one has to take into account the composition of the animal population (e.g. relative proportion of ruminants versus monogastric species).

Noteworthy, these data do not yet include the substantial decrease in use in Belgium achieved in 2019. It is also remarkable to see that although the mean value of use in Europe has decreased from 109 mg/PCU in 2013 to 91,8 mg/PCU in 2018, the median value has remained more or less stable around 60 mg/PCU (57 mg/PCU in 2018).

13 https://www.ema.europa.eu/en/veterinary-regulatory/overview/antimicrobial-resistance/european-surveillance-veterinary-antimicrobial-consumption-esvac

Compared to neighbouring countries (France, Luxemburg, Germany, United Kingdom, The Netherlands (Figure 11)) with a relatively comparable structure of livestock farming, the use in Belgium remains high and very substantial further reductions are required to achieve the same levels.

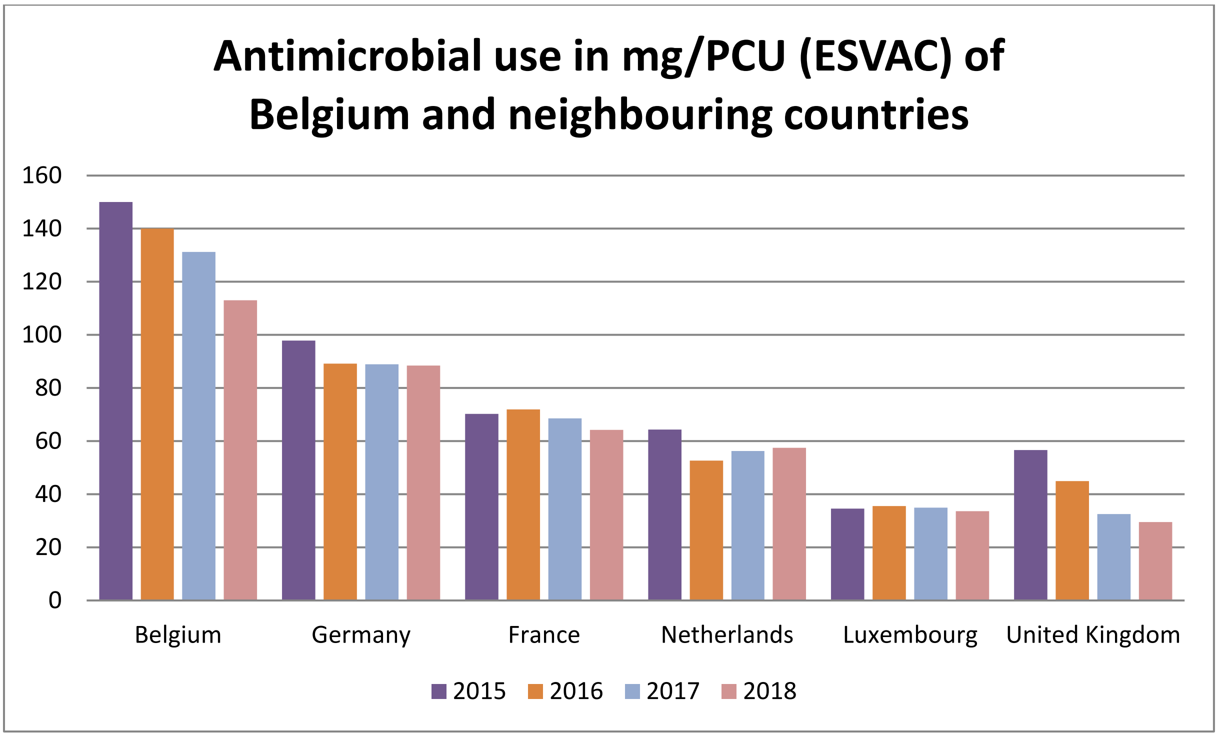
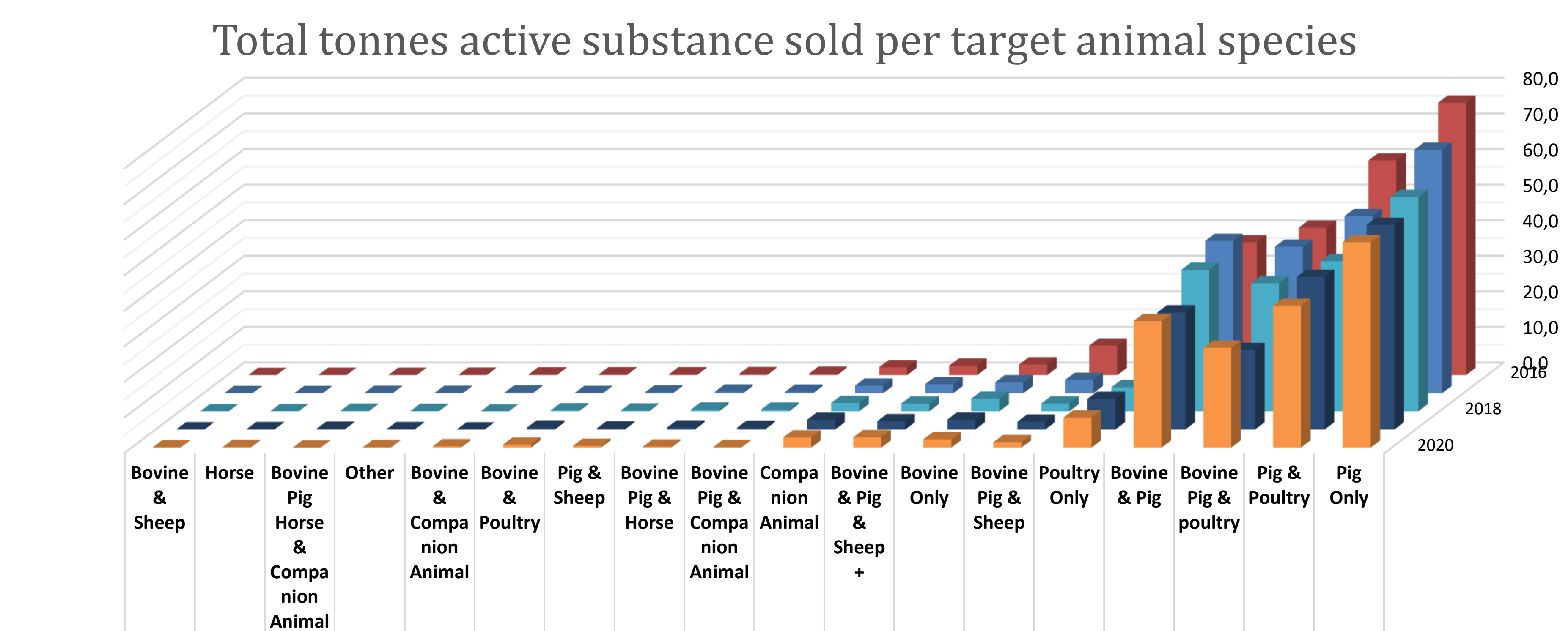


Figure 11. Overall sales of antimicrobials in mg/PCU in 2015-2018 (source: 7th-10th ESVAC report on Sales of veterinary Antibacterial agents) for Belgium and neighbouring countries.

Species specific antibacterial use

As mentioned before, a majority of the antibacterial products available on the Belgian market is authorised for use in multiple species. In figure 12 an overview is given of the total sales and proportion of the total sales according to the authorized target species.

In 2020, antibacterial products authorised only for use in pigs are most used (31.8%) followed by antibacterial products authorised for both pigs and poultry (21.9%). The third most used antibacterial pharmaceuticals are the ones registered for cattle, pigs and poultry (15.4%).



	Bovine & Sheep	Horse	Bovine Pig Horse & Companion Animal	Other	Bovine & Companion Animal	Bovine & Poultry	Pig & Sheep	Bovine Pig & Horse	Bovine Pig & Companion Animal	Companion Animal	Bovine & Pig & Sheep +	Bovine Only	Bovine Pig & Sheep	Poultry Only	Bovine & Pig	Bovine Pig & poultry	Pig & Poultry	Pig Only
2020	0,1	0,1	0,0	0,1	0,4	0,8	0,5	0,3	0,1	2,9	2,9	2,3	1,5	8,4	35,6	28,1	39,9	57,7
2019	0,1	0,1	0,2	0,1	0,0	0,5	0,3	0,5	0,5	2,8	2,3	2,8	2,2	8,6	32,9	22,3	42,9	57,5
2018	0,1	0,1	0,2	0,1	0,0	0,3	0,2	0,5	0,5	2,4	2,2	3,6	2,2	6,8	39,8	36,0	42,2	60,3
2017	0,1	0,1	0,1	0,1	0,2	0,1	0,2	0,4	0,4	2,1	2,5	3,1	3,8	6,6	42,8	41,2	49,8	68,5
2016	0,1	0,1	0,1	0,1	0,2	0,2	0,2	0,3	0,4	2,2	2,7	3,0	8,3	9,0	37,4	41,5	60,4	76,6

Figure 12. Sales of antibacterial pharmaceuticals and premixes per target species, evolution between 2016 and 2020.

Intramammary products in dairy cattle

Other types of antibacterial products that can be allocated to mainly one animal species are the intramammary products used for prevention (DC = dry cow therapy) and otherwise for treatment of udder infections (LC = lactating cows).

a) Total sales of intramammary products

In figure 13 an overview is given of the sales of intramammary products for prevention and treatment of udder infections in the last five years separated into the classes of active substances and related to the biomass of dairy cows present in that year.

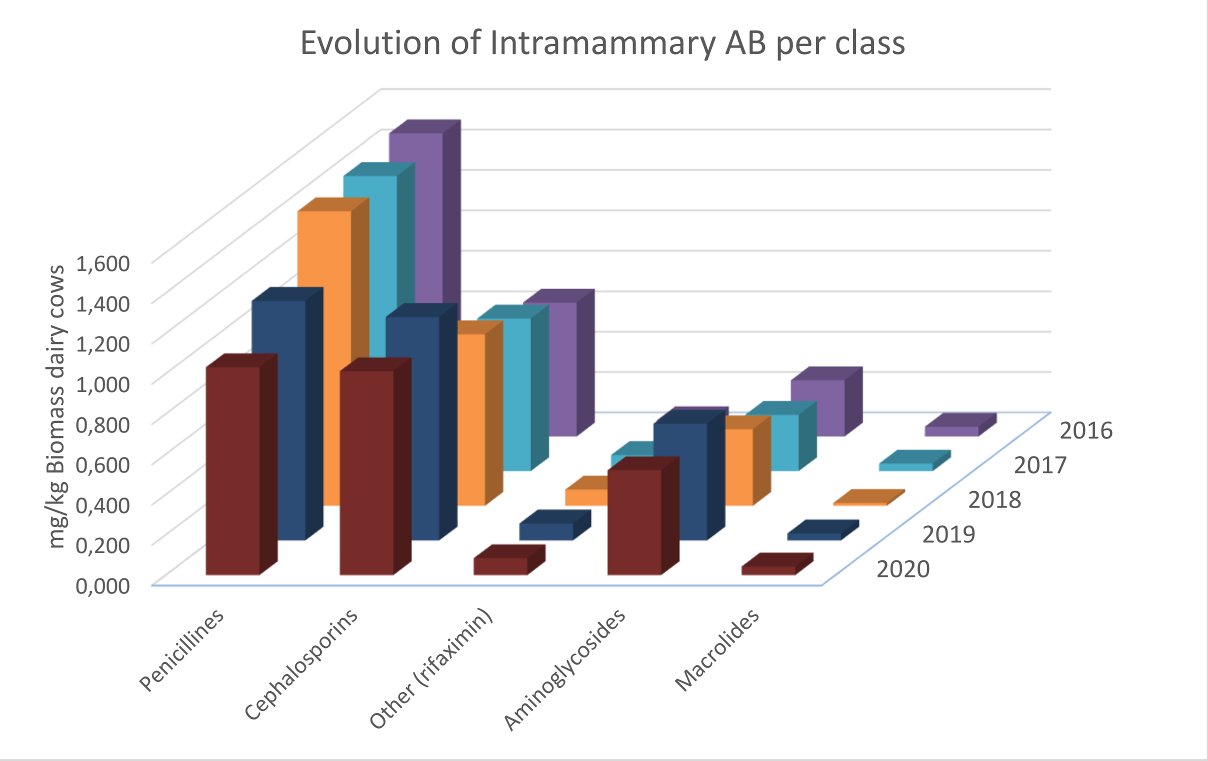


Figure 13. Evolution in sales of antimicrobials for intramammary treatment between 2016 and 2020.

In figure 14 the evolution in overall sales per kg biomass over the last five years of all products for intramammary use is presented.

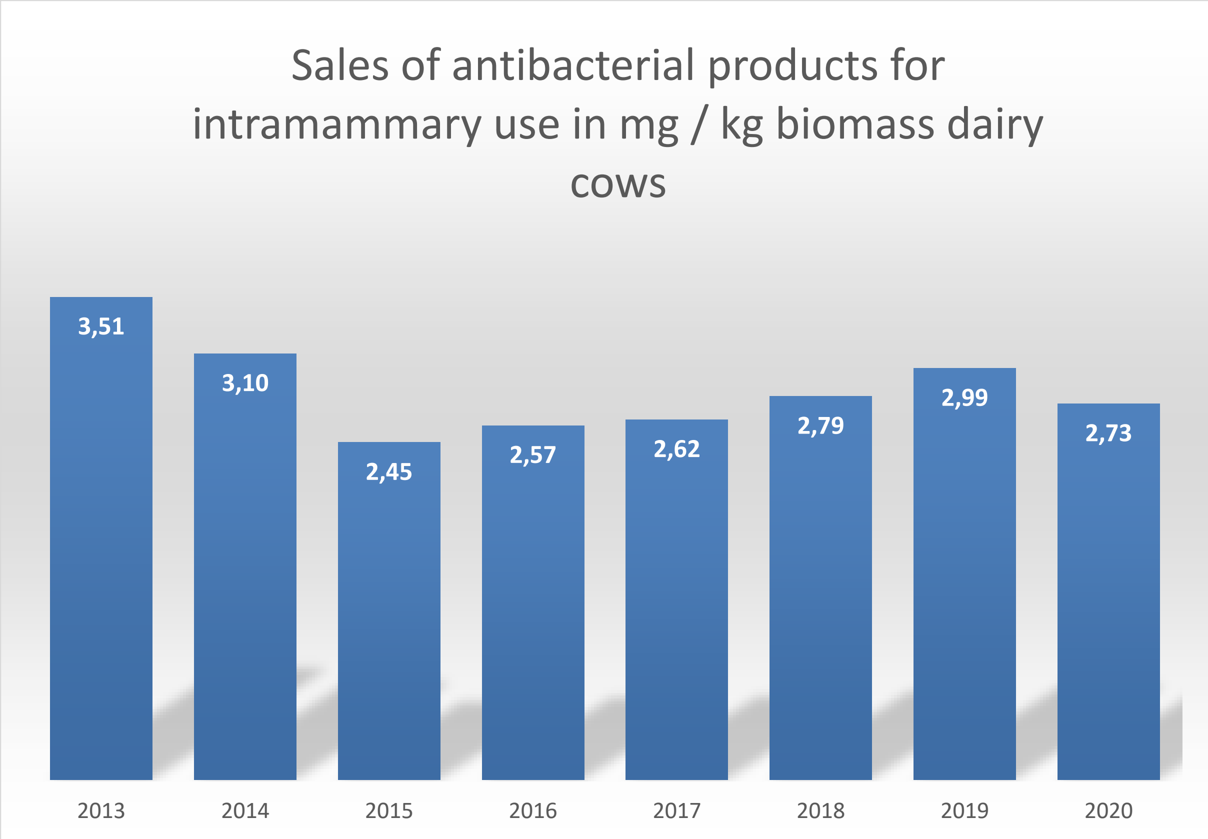


Figure 14. Evolution in sales of antibacterial products for intramammary use expressed in mg per kg biomass of dairy cattle between 2013 and 2020.

From the results of figure 14 it can be seen that the use of intramammary preparations was substantially reduced between 2013 and 2015 (-30%), however since 2015 it has steadily increased again (+22%) until 2019. In 2020 a first decrease is again observed.

b) Number of DC and LC injector per dairy cow.

These sales results can also be presented as the number of injectors used per cow per year.

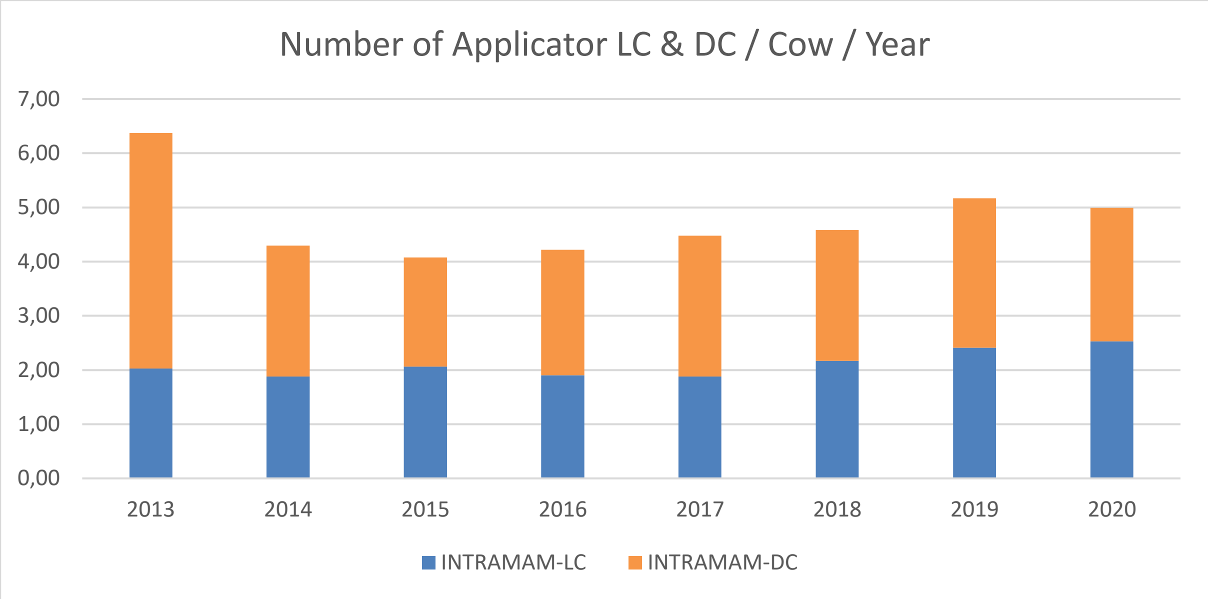


Figure 15. Evolution in use of number of intramammary preparations used per cow present over the last 8 years.

Also from the number of applicators used per cow per year a substantial reduction in sales of intramammary applicators was observed between 2013 and 2015 which is mainly due to a reduction of the sales of DC applicators. Between 2015 and 2019 a steady increase in the sales of DC applicators was observed. In 2020 for the first time again a reduction in the sales of DC applicators was seen. The number of applicators sold for the treatment of mastitis cases however shows an ongoing steadily increase over the last 4 years.

Antibacterial pharmaceuticals in dogs and cats

In 2020, 2652.6kg of active substance was sold as preparations that are solely authorised for use in dogs and cats, this is a reduction of -3.5% in comparison to 2019. Compared to 2014 the total increase of sales of antibacterial substances solely authorised for use in dogs and cats is + 23.11%. The evolution since 2014 is shown below. Until 2019 (with the exception of 2017) a constant increase in sales of antimicrobials that are only authorised for dogs and cats was observed, whereas in 2020 for the first time a decrease is observed. It is noteworthy to mention that we do not have an accurate estimate of the evolution in the total dog and cat population (denominator). Therefore the observed evolution cannot be placed in contrast to the possible evolution of the population size.

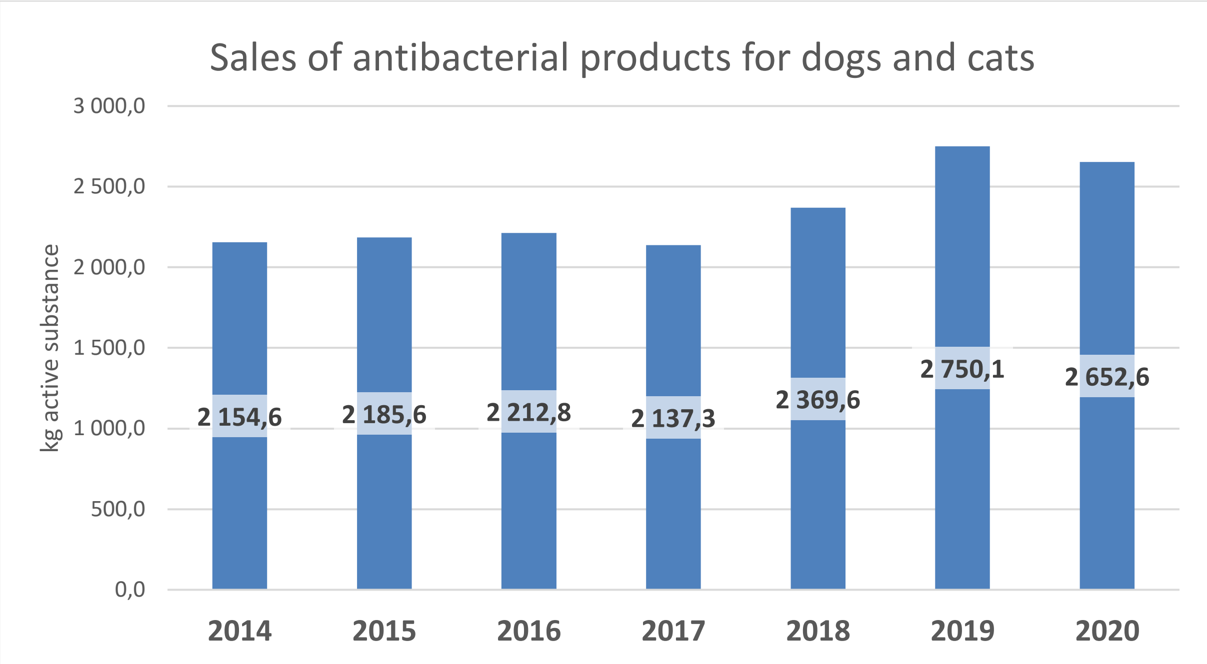
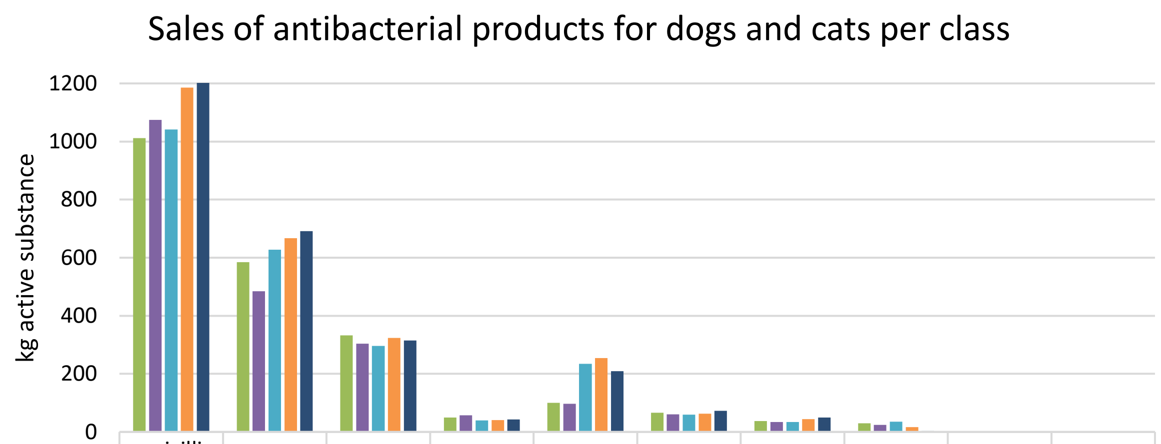


Figure 16. Evolution of sales of antibacterial pharmaceuticals only authorised for use in dogs and cats between 2014 and 2020.



	penicillines-clavulaanzuur	cephalo-sporins	macrolides	penicillines	other	quinolones	tetra-cyclines	amino-glycosides	sulpho-namides	polymixins
2016	1011,93	584,54	332,71	49,43	100,47	65,54	37,32	30,01	0,00	0,83
2017	1074,26	484,65	304,01	56,76	96,69	61,03	34,47	24,73	0,00	0,75
2018	1040,98	627,78	295,76	39,39	234,43	60,01	34,18	35,00	0,00	0,68
2019	1185,15	667,64	323,29	41,00	254,47	62,73	43,78	16,90	0,00	0,85
2020	1265,25	691,73	315,18	42,87	209,31	72,86	49,58	3,62	0,00	0,85

Figure 17. Sales of different antibacterial classes in products only registered for dogs and cats.

Penicillin/clavulanic acid is the most used antibacterial compound in dogs and cats, followed by cephalosporines of the 1° and 2° generation and macrolides. In the cephalosporines of the 1° and 2° generation a continued increase is observed since 2018 due to an increased use in cefalexine, a narrow spectrum cephalosporine. The increased use in “others” is due to an increase in use of metronidazole, administered in combination with spiramycine.

Antibacterial sales per class of antibacterial compound

a) Total sales (antibacterial pharmaceuticals and premixes)

In Figure 18 and table 4 the total sales of antibacterial active substances per class (ATC level 3 or 4) is presented.

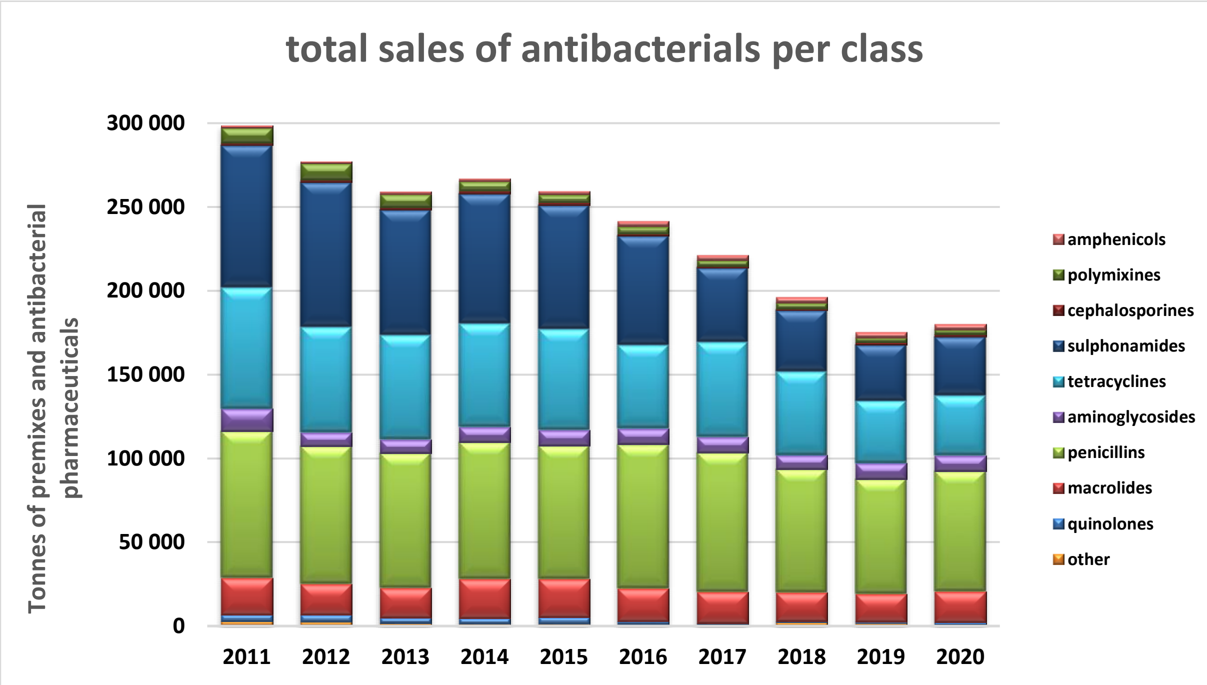


Figure 18. Total sales of antibacterial active substances per class from 2011 to 2020.

In 2020, the most sold group of antibacterial compounds remained the penicillins (72.0 tons; 39.6%). The tetracyclines (35.8 tons; 19.7%) are the second most sold group closely followed by the sulphonamides and trimethoprim (35.3 tons; 19,4%). In table 4, the evolution of the sold products per antimicrobial class in mg/kg biomass in the last 5 years is presented.

Table 4. The evolution of sales (mg/kg biomass) per antibacterial class since 2014.

Class AB Mg/kg Biomass	2014	2015	2016	2017	2018	2019	2020	'14 » '15	'15 » '16	'16 » '17	'17 » '18	'18 » '19	'19 » '20	2020%
Penicillins	39,91	38,09	42,03	40,96	35,78	34,63	35,37	-4,6%	10,3%	-2,6%	-12,6%	-3,2%	2,1%	40,40
Sulphonamides & Trimethoprim	37,39	35,08	31,64	21,56	17,49	16,69	17,06	-6,2%	-9,8%	-31,8%	-18,9%	-4,5%	2,2%	19,48
Tetracyclines	29,92	28,49	24,16	27,66	23,96	18,35	17,26	-4,8%	-15,2%	14,4%	-13,3%	-23,4%	-5,9%	19,72
Macrolides	11,27	10,80	9,57	9,18	8,12	8,09	8,75	-4,2%	-11,4%	-4,0%	-11,5%	-0,4%	8,1%	9,99
Polymixins	2,74	2,25	2,03	1,76	1,69	1,50	1,33	-17,6%	-9,9%	-13,3%	-4,1%	-11,2%	-11,3%	1,52
Aminosides	4,34	4,47	4,48	4,49	3,93	4,71	4,41	3,1%	0,2%	0,3%	-12,6%	20,0%	-6,5%	5,04
Quinolones	1,69	1,92	0,82	0,29	0,44	0,48	0,66	13,7%	-57,5%	-64,2%	50,0%	10,0%	36,2%	0,75
Other**	0,61	0,57	0,55	0,50	1,05	0,82	0,47	-6,1%	-3,8%	-9,4%	109,5%	-21,4%	-42,7%	0,54
Phenicols	0,78	0,99	1,46	1,50	1,59	1,56	1,57	26,5%	47,3%	3,0%	6,1%	-1,8%	0,3%	1,79
Cephalosporins 1° & 2° G	0,39	0,37	0,44	0,41	0,37	0,52	0,62	-4,4%	16,3%	-6,7%	-7,8%	38,1%	19,8%	0,71
Cephalosporins 3° & 4° G	0,38	0,35	0,25	0,09	0,07	0,07	0,07	-9,5%	-28,3%	-65,9%	-19,2%	-2,6%	2,3%	0,08
Total mg/kg Biomass	**129,42**	**123,39**	**117,43**	**108,40**	**94,50**	**87,43**	**87,57**	**-4,66%**	**-4,83%**	**-7,69%**	**-12,83%**	**-7,48%**	**0,16%**	**100**
Total biomass cfr. Grave et al., 2010)*	2.068.815	2.109.520	2.065.040	2.052.300	2.087.735	2.022.450	2.075.555	**1,97%**	**-2,11%**	**-0,62%**	**1,73%**	**-3,13%**	**2,63%**	
** *zinc bacitracin, rifaximin, metronidazole, tiamulin*														

In 2020, of the three main compounds (penicillins, sulphonamides and tetracyclines) only tetracyclines continued to decrease whereas the penicillins and the sulphonamides and thrimethoprim slightly increased. Also the use of the macrolides increased for the first time since many years. Also the sales of cephalosporines of the 1° and 2° generation grew for the second year in a row (+19.8%). The reduction in sales of cephalosporines of the 3° and 4° generation has apparently stopped and for the first year since 2013 a limited increase is seen. Finally, the use of quinolones increased for the third year in a row (+36.2%). The latter is worrisome as the quinolones are categorized as "red" antimicrobials. The use of these molecules decreased very substantially in 2016 and 2017, however it increased again in 2018 and continued at this level in 2019. The increase in 2020 is largely due to an continued increase in the use of flumequine (which is mainly applied in poultry) completed by a moderate increase in the use of enrofloxacin and marbofloxacin (table 5). The cephalosporins of the 3rd and 4th generation (the second group of "red" molecules) increased also slightly in 2020 mainly due to an increased use of cefquinome (table 5).

The use of polymyxins (almost entirely colistin sulphate) continues to decrease in 2020 with another -11.3%. This is a positive trend given the simultaneous decrease in use of ZnO as an alternative for colistin in the treatment of post-weaning diarrhoea in piglets, meaning that alternative treatments without use of antibiotics or ZnO may have been used more frequently. When comparing to 2012 (before authorization of ZnO products), polymyxin use has dropped with -71.3%.

AMCRA (centre of expertise on AntiMicrobial Consumption and Resistance in Animals)[14] published its first guidelines on responsible antibacterial consumption in 2013 and made them available online since 2016. In these guidelines, the different antibacterial classes available in veterinary medicine are given a colour to make a differentiation in terms of their importance for human and animal health. The ranking of importance is based on the WHO list on antibacterial compounds with importance for human health[15] and the lists produced by the World Animal Health Organization (OIE) indicating the importance of antibacterial substances for veterinary health[16]. When creating these lists, priority was given to human health.

The group of yellow products contains the antibacterial classes with the lowest importance for human medicine in terms of resistance selection and transfer and therefore no additional restrictions, on top of the legal requirements, are suggested for the use of these compounds. The yellow group contains the majority of the penicillins, the sulphonamides (and diaminopyrimidines), the cephalosporins of the first generation and the phenicols.

The group of orange products are of higher importance for human medicine and should therefore be used restrictively and only after good diagnostics allowing to target the therapy. The orange group contains the highest amount of different molecules including all available macrolides, polymyxins, aminoglycosides, tetracyclines and aminopenicillins.

The red group of products are the products of the highest importance for human medicine and therefore their use should be avoided in veterinary medicine as much as possible. AMCRA advises to use these molecules only under very strict conditions. This group contains the cephalosporins of the 3rd and 4th generation and the quinolones.

In figure 19, the evolution of use of the different colour groups of antibacterial substances over the last 4 years is presented. From this figure it can be seen that the orange group remains the most widely used group whereas the red molecules are only limitedly used when expressed in mg active substance per kg biomass. Yet the red molecules are generally more modern molecules with a high potency and therefore a low molecular weight in relation to their treatment potential. In 2020, the use of yellow molecules has marginally increased (+0.2 %) whereas the use of orange molecules has marginally decreased (-0.1%). The use of the red molecules on the other hand has very substantially increased with + 32.1%. this increase is seen for the third year in a row. **In comparison to 2011 (reference year) the reduction of red molecules is -70.1% which is above the reduction aim of minus 75% by 2020.**

[14] www.amcra.be
[15] http://apps.who.int/iris/bitstream/10665/77376/1/9789241504485_eng.pdf
[16] http://web.oie.int/downld/Antibacterials/OIE_list_Antibacterials.pdf

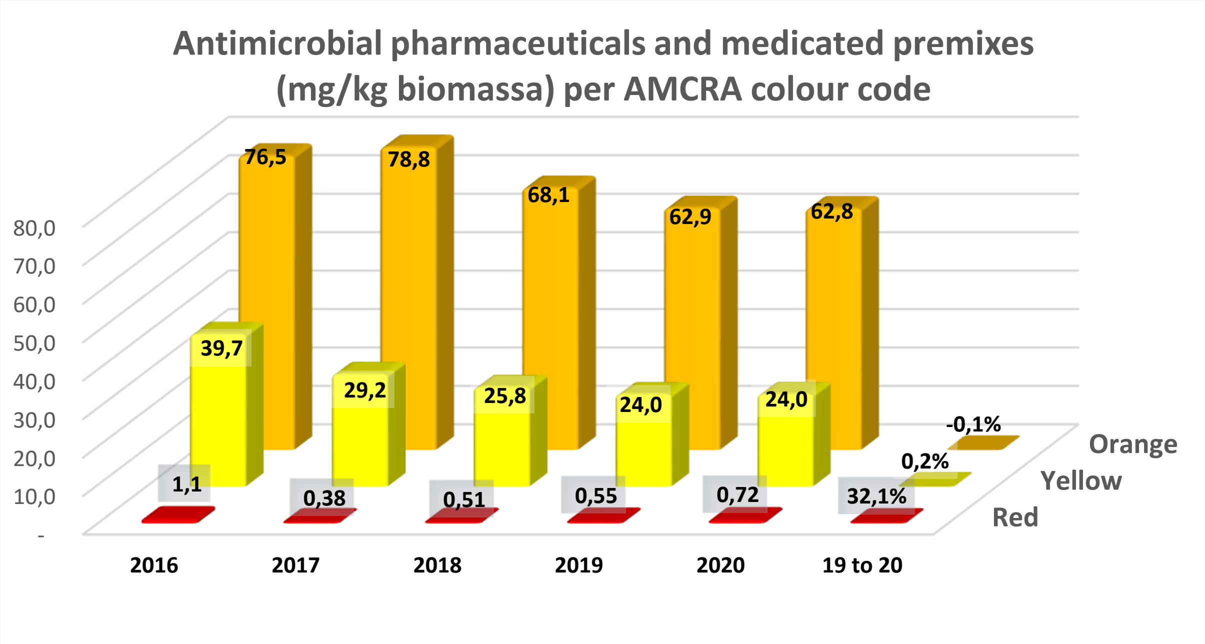


Figure 19: Evolution in the antibacterial consumption (mg/kg) per AMCRA colour code between 2016 and 2020.

A similar graph with products exclusively authorised for dogs and cats (Fig. 20) shows an small increase in use of orange products and a small decrease in use of yellow products, yet the use of red molecules has increased very substantially and this is due to the increased use of enrofloxacine.

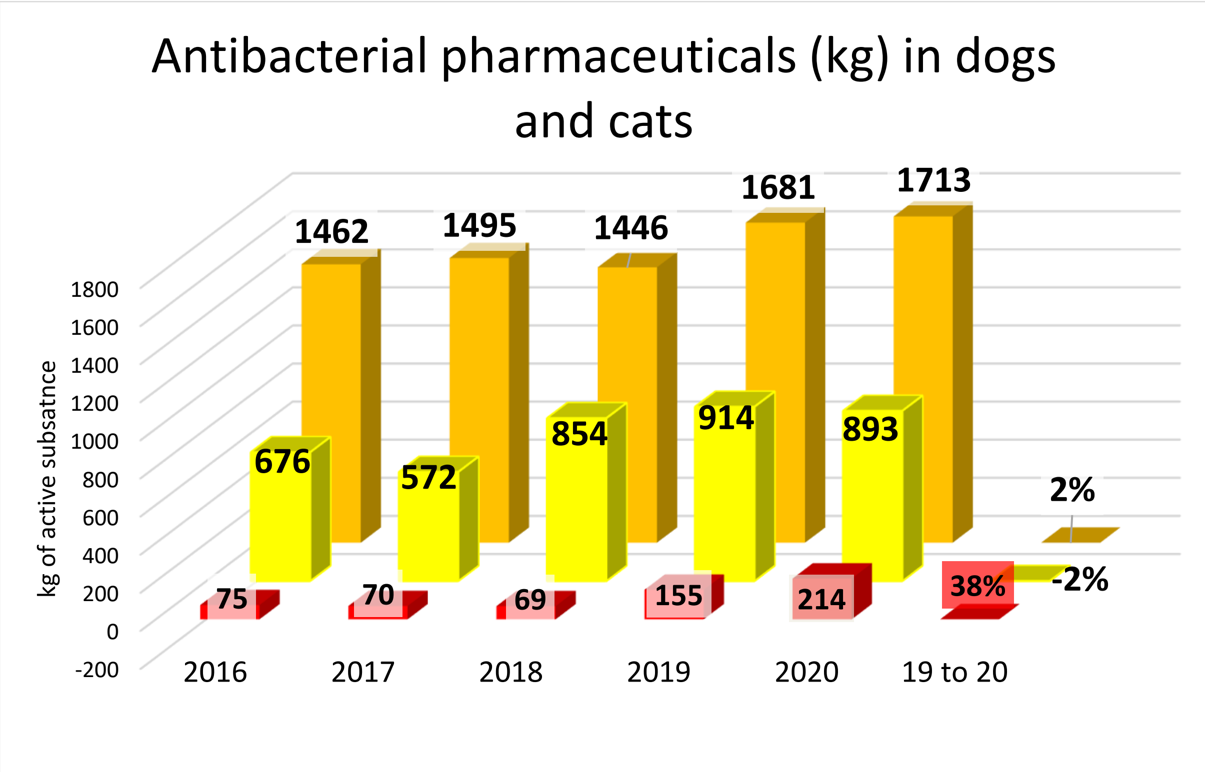


Figure 20: Evolution in the antibacterial sales (kg active compound) per AMCRA colour code for compounds exclusively authorised for use in dogs and cats between 2014 and 2019.

b) Antibacterial pharmaceuticals

In Figure 21 the sales of antibacterial compounds per class (ATC level 3 or 4) is presented for the pharmaceuticals.

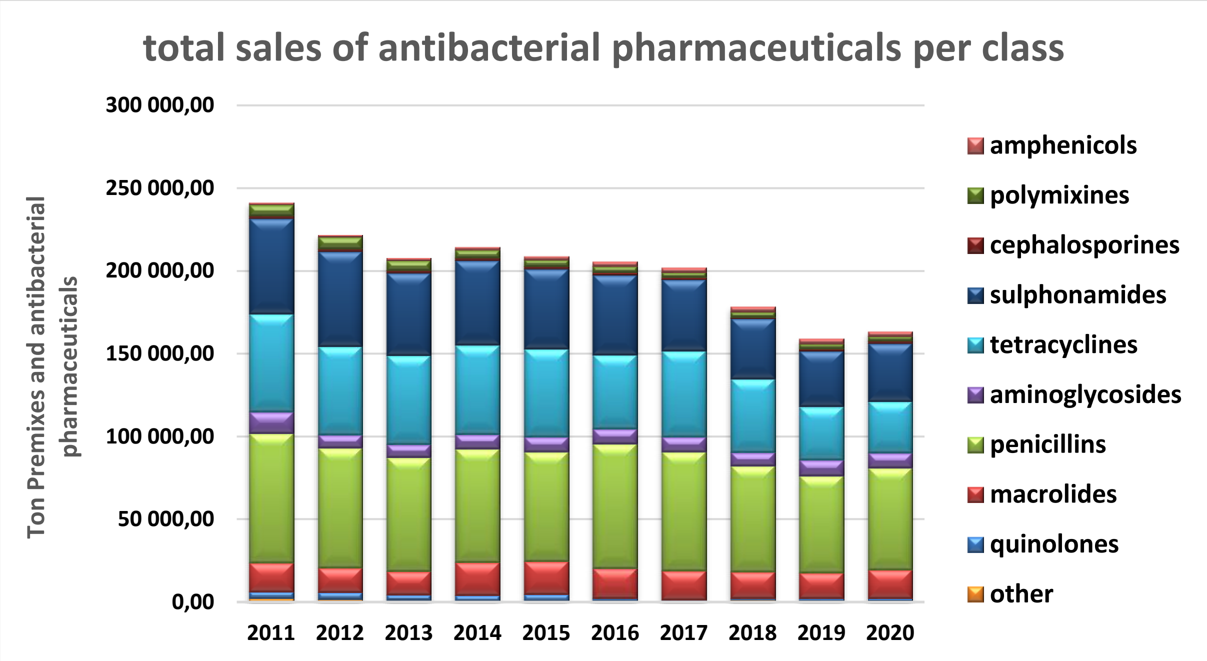


Figure 21. Sales of antibacterial pharmaceuticals per class of antibacterial compounds between 2011 and 2020.

c) Antibacterial premixes

In Figure 22 the sales of antibacterial compounds per class (ATC level 3 or 4) is presented for the antibacterial premixes.

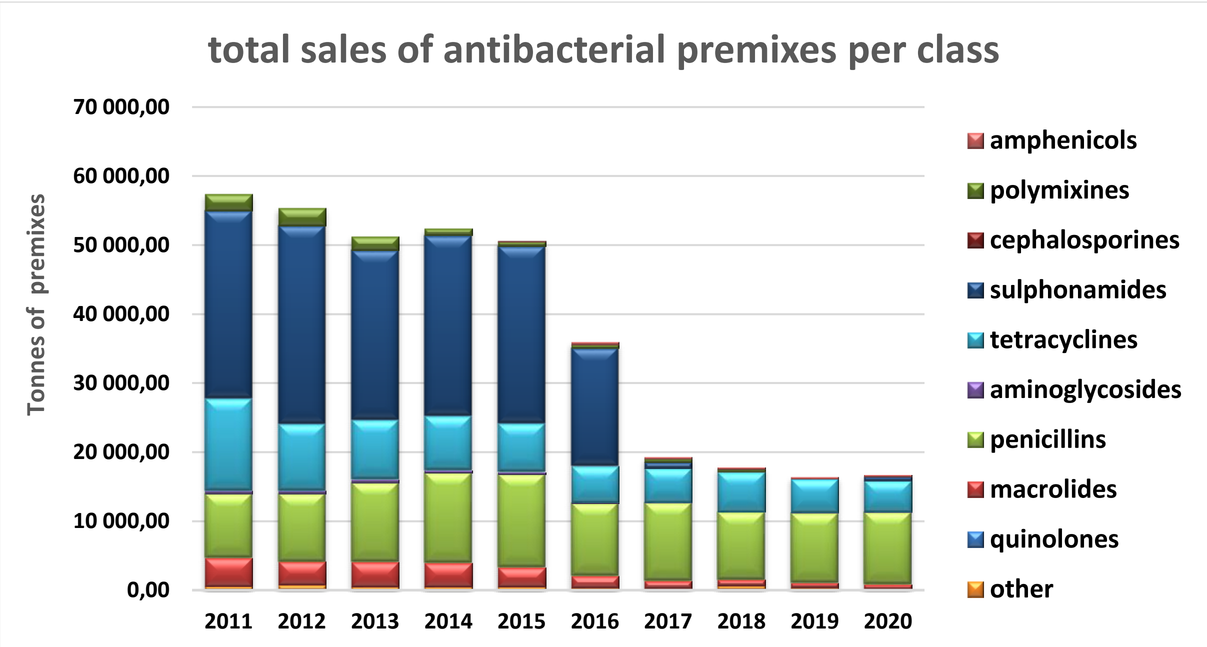


Figure 22. Sales of antibacterial premixes per class of antibacterial compounds between 2011 and 2020.

Sales per antibacterial active substance

Table 5 gives the amounts sold per individual active substance, grouped per antibacterial class.

Table 5. Sales per antibacterial active substance.

		Total Kg					Antibacterial pharmaceuticals (kg)					Antibacterial premixes (kg)				
Class	Antibacterial compound	2016	2017	2018	2019	2020	**2016**	**2017**	**2018**	**2019**	**2020**	**2016**	**2017**	**2018**	**2019**	**2020**
cephalosporins 1G	cefalexin	837,3	763,0	720,2	993,2	1239,4	837,3	763,0	720,2	993,2	1239,4					
cephalosporins 1G	cefalonium	12,2	10,2	9,3	8,7	10,8	12,2	10,2	9,3	8,7	10,8					
cephalosporins 1G	cefapirin	31,7	44,3	45,3	41,3	28,3	31,7	44,3	45,3	41,3	28,3					
cephalosporins 1G	cefazolin	17,7	16,0	7,3	3,2	7,7	17,7	16,0	7,3	3,2	7,7					
fenicols	chlooramfenicol	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
fenicols	florfenicol	3006,5	3077,5	3320,7	3159,5	3253,1	2632,3	2816,2	3041,5	2916,5	2984,2	374,1	261,3	279,2	243,0	268,9
other	metronidazole	100,5	96,7	234,4	254,5	218,1	100,5	96,7	234,4	254,5	218,1					
other	tiamulin	994,2	879,0	1901,6	1362,2	706,2	640,4	624,6	1236,0	1007,8	565,0	353,8	254,4	665,6	354,4	141,1
other	valnemulin	0,0	0,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,3	0,0	0,0	0,0
other	zinc bacitracin	23,3	28,9	28,2	25,4	32,1	23,3	28,9	28,2	25,4	32,1					
penicillins	benethamine penicillin	22,1	33,7	38,2	58,6	63,8	22,1	33,7	38,2	58,6	63,8					
penicillins	cloxacillin	286,9	260,0	257,2	183,8	151,1	286,9	260,0	257,2	183,8	151,1					
penicillins	fenoxymethylpenicillin	796,4	864,2	1078,4	1424,4	1512,4	796,4	864,2	1078,4	1424,4	1512,4					
penicillins	nafcillin	6,3	6,0	6,0	7,3	8,9	6,3	6,0	6,0	7,3	8,9					
penicillins	penethamate	184,8	235,2	202,0	198,6	175,4	184,8	235,2	202,0	198,6	175,4					
penicillins	procaine benzylpenicillin	10359,3	9426,0	9583,8	7013,7	7050,7	10359,3	9426,0	9583,8	7013,7	7050,7					
sulphonamides	sulphachloropyridazine sodium	1094,5	1176,4	1050,7	458,5	775,1	1094,5	1176,4	1050,7	458,5	775,1					
sulphonamides	sulphadiazine	51631,2	33703,6	27303,7	25602,3	26647,7	37350,2	32971,4	27266,8	25602,3	26113,0	14281,0	732,3	36,9	0,0	534,7
sulphonamides	sulphadimethoxine sodium	0,0	0,0	37,7	32,0	3,4	0,0	0,0	37,7	32,0	3,4					
sulphonamides	sulphadimidine sodium	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
sulphonamides	sulphadoxine	922,8	1174,1	1238,4	816,4	935,8	922,8	1174,1	1238,4	816,4	935,8					
sulphonamides	sulphamethoxazole	785,4	810,8	792,6	1222,8	1141,6	785,4	810,8	792,6	1222,8	1141,6					

sulphonamides	sulphanilamide	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
sulphonamides	trimethoprim	10906,3	7390,8	6092,7	5632,4	5902,7	8050,1	7244,4	6085,3	5632,4	5795,8	2856,2	146,5	7,4	0,0	106,9
amino(glyco)sides	apramycin	79,5	49,5	34,0	102,1	372,6	26,3	12,5	0,2	0,0	296,1	53,2	37,0	33,8	102,1	76,5
amino(glyco)sides	dihydrostreptomycine	6,3	131,7	6,0	8,5	9,3	6,3	131,7	6,0	8,5	9,3					
amino(glyco)sides	Framycetin sulphate	11,3	16,3	17,8	24,3	26,4	11,3	16,3	17,8	24,3	26,4					
amino(glyco)sides	gentamicin	136,1	141,7	172,9	170,7	188,9	136,1	141,7	172,9	170,7	188,9					
amino(glyco)sides	kanamycin	22,7	25,3	53,2	102,0	83,8	22,7	25,3	53,2	102,0	83,8					
amino(glyco)sides	neomycin	683,8	672,9	47,7	34,0	23,1	683,8	672,9	47,7	34,0	23,1					
amino(glyco)sides	paromomycin	1878,4	1807,1	2510,2	2502,5	2401,4	1878,4	1807,1	2510,2	2502,5	2401,4					
amino(glyco)sides	spectinomycin	6437,2	6380,4	5361,0	6589,9	6047,6	6320,8	6360,6	5356,6	6589,3	6046,5	116,4	19,8	4,4	0,6	1,1
macrolides	clindamycin	142,7	121,2	135,8	136,3	149,5	142,7	121,2	135,8	136,3	149,5					
Macrolides	erythromycin	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Macrolides	gamithromycin	32,9	29,8	39,3	36,7	16,2	32,9	29,8	39,3	36,7	16,2					
Macrolides	lincomycin	4582,0	4990,6	4378,7	5066,7	4659,0	4465,6	4970,8	4374,3	5066,2	4657,9	116,4	19,8	4,4	0,6	1,1
Macrolides	pirlimycin	0,2	0,0	0,0	0,0	0,0	0,2	0,0	0,0	0,0	0,0					
Macrolides	spiramycin	195,4	183,7	160,0	187,0	165,9	195,4	183,7	160,0	187,0	165,9					
Macrolides	tildipirosin	48,9	48,5	49,2	47,2	37,3	48,9	48,5	49,2	47,2	37,3					
Macrolides	tilmicosin	3785,5	3160,2	2824,7	2918,8	3258,1	2637,1	2344,6	2113,7	2372,8	2659,7	1148,4	815,6	711,0	546,0	598,4
Macrolides	tulathromycin	133,1	142,2	128,1	119,5	114,6	133,1	142,2	128,1	119,5	114,6					
Macrolides	tylosin	10581,1	9839,8	9181,1	7808,5	9750,6	10149,1	9600,2	9040,3	7674,8	9664,9	432,0	239,5	140,9	133,8	85,7
Macrolides	tylvalosin	259,8	330,2	60,5	39,2	3,3	259,8	330,2	46,2	37,5	0,0			14,4	1,7	3,3
other	rifaximin	21,4	20,7	21,3	22,3	22,6	21,4	20,7	21,3	22,3	22,6					
penicillins	amoxicillin	74840,9	72929,0	63182,0	60560,0	63913,0	64267,8	61549,1	53406,1	50419,1	53430,0	10573,1	11380,0	9775,9	10140,8	10483,0
penicillins	amoxicillin-clavulanic acid	244,3	257,6	230,0	279,3	280,5	244,3	257,6	230,0	279,3	280,5					
penicillins	ampicillin	297,8	302,8	356,3	312,0	262,5	297,8	302,8	356,3	312,0	262,5					
polymyxins	Colistin sulphate	4195,0	3613,9	3524,9	3033,4	2761,1	3719,4	3156,1	3134,9	2961,9	2754,9	475,6	457,8	390,0	71,5	6,2
polymyxins	polymyxin B sulphate	0,8	0,8	0,7	1,0	1,0	0,8	0,8	0,7	1,0	1,0					
tetracyclines	chlortetracycline	717,2	664,9	738,5	634,8	686,5	680,1	664,9	738,5	634,8	686,5	37,1	0,0	0,0	0,0	0,0
tetracyclines	doxycyclin	38130,4	46540,0	39843,2	30687,1	27830,0	33120,0	41705,1	34070,8	25872,1	23321,6	5010,4	4834,9	5772,4	4815,0	4508,5

tetracyclines	oxytetracycline	11052,0	9552,0	9448,8	5786,7	7316,8	10926,9	9448,0	9444,8	5786,7	7316,8	125,1	104,0	4,0	0,0	0,0
(fluoro)quinolones	danofloxacin	42,5	12,0	8,4	6,5	7,3	42,5	12,0	8,4	6,5	7,3					
(fluoro)quinolones	difloxacin	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
(fluoro)quinolones	enrofloxacin	719,3	306,5	305,4	375,7	421,4	719,3	306,5	305,4	375,7	421,4					
(fluoro)quinolones	flumequin	610,6	176,0	519,5	516,5	845,0	610,6	176,0	519,5	516,5	845,0					
(fluoro)quinolones	ibafloxacin	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
(fluoro)quinolones	marbofloxacin	306,6	99,0	75,3	70,2	81,6	306,6	99,0	75,3	70,2	81,6					
(fluoro)quinolones	orbifloxacin	3,0	2,7	2,9	3,2	3,9	3,0	2,7	2,9	3,2	3,9					
(fluoro)quinolones	pradofloxacin	2,9	2,5	2,1	1,8	2,1	2,9	2,5	2,1	1,8	2,1					
cephalosporins 3G	cefoperazone	5,9	5,0	5,4	4,2	3,6	5,9	5,0	5,4	4,2	3,6					
cephalosporins 3G	cefovecin	9,3	9,0	9,1	9,4	9,8	9,3	9,0	9,1	9,4	9,8					
cephalosporins 3G	cefquinome	132,6	89,2	75,6	75,3	85,3	132,6	89,2	75,6	75,3	85,3					
cephalosporins 4G	ceftiofur	366,6	71,4	53,3	46,4	43,4	366,6	71,4	53,3	46,4	43,4					

ANTIBACTERIAL USE DATA

Notifications in Sanitel-Med

Table 6 shows the number of notifications (incl. ZnO) in Sanitel-Med in 2020 (date: 25/03/2021), the number of farms for which notifications were done and the number of veterinarians that did the notifications, in total and per species. The pig sector remained the largest sector in all terms and the veal sector remained the smallest sector, for the first time since being monitored now also in terms of notifications. The sum of the veterinarians per species does not equal the total number, meaning that some veterinarians did notifications for multiple species.

Table 6. Number of notifications and farms and veterinarians with notifications per animal species in Sanitel-Med in 2020.

	TOTAL	PIG						POULTRY		VEAL	
	n	AB n	*%*	ZnO n	*%*	Total n	*%*	AB n	*%*	AB n	%
Notifications	**166 298**	121 285	*73*	6 454	*4*	127 739	*77*	20 651	*12*	17 908	11
Farms	**4 990**	4 089	*82*	503	*10*	4 090	*82*	776	*16*	250	5
Veterinarians	**290**	239	*82*	100	*34*	240	*83*	56	*19*	18	6

It is remarkable that almost all numbers in this table in absolute terms are decreasing for the second year in a row. In comparison with 2018 (data not shown), the number of notifications and farms and veterinarians with notifications has decreased with 3%, 6% and 7%, respectively. Only in poultry, the number of notifications is increasing for the second year.

Sanitel-Med coverage of sales data

a) General

The mass antibacterials calculated from all Sanitel-Med notifications in 2020 covered 79% of the mass according to the 2020 Belgian sales data as presented above. The coverage was 77% for pharmaceuticals and 94% for premixes medicated with antibacterials (Figure 23). In 2019, coverage for premixes was 93% while it was 79% for pharmaceuticals. Accordingly, the total tonnes uncovered by Sanitel-Med increased compared to the situation in 2019 (Figure 24).

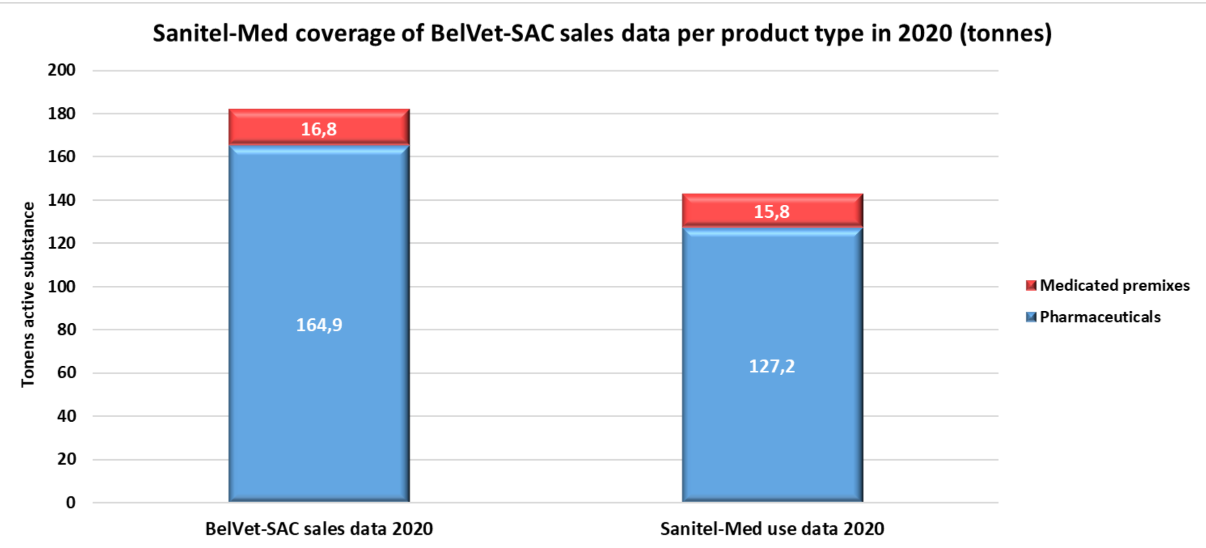


Figure 23. Comparison of tonnes active substance used (Sanitel-Med) in 2020 with the Belgian sales data for 2020, distinguishing among medicated premixes and pharmaceuticals.

It is unclear what is causing the difference between the sales and use data, although it is very likely that there are multiple causes, one clearly being the limited number of species included in Sanitel-Med while the sales data cover all animal species; others may be: stockpiling at the level of the vets, a part of the use that is not notified in Sanitel-Med, … Evidently, it is also difficult to know what is causing the variation in the coverage of the sales data by the Sanitel-Med use data.

It must be noted that the coverage result is slightly confounded because Sanitel-Med accepts notifications from products not authorised for sale in Belgium (notified as Self Defined Products – SDPs). The part SDPs make up from the Sanitel-Med total tonnes slightly increased to approx. 1,4 tonnes in 2020 (Figure 24). Virtually all of this use is due to the cascade use of Neosol 100%; only one other product was additionally notified: Penstrep-ject.

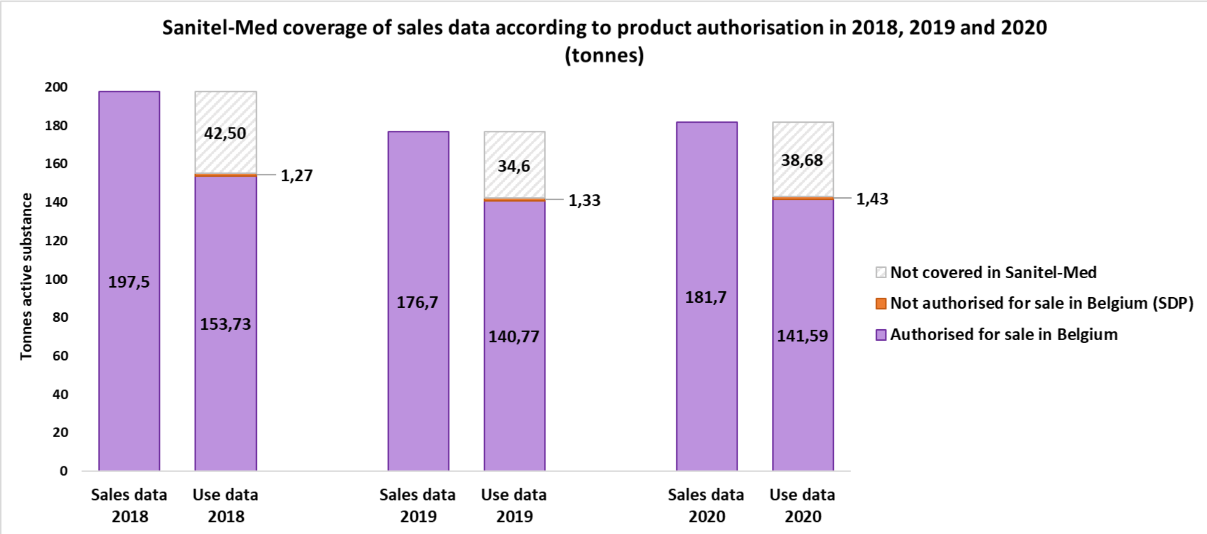


Figure 24. Comparison of tonnes active substance used (Sanitel-Med) from 2018 to 2020 with the corresponding Belgian sales data for those years, distinguishing based on authorisation of the products for sale in Belgium. The part of the sales data not covered by Sanitel-Med data is also shown.

In the following analyses, SDPs are always included in the Sanitel-Med data unless stated otherwise.

b) Per species/animal category

In 2020, pigs for fattening and weaned piglets remained the animal categories with the largest mass of antibacterials used. Taken together they account for 67% of tonnes used (Figure 25). As in the previous years, weaners used the highest total mass of antibacterials when including ZnO. Remarkably, the tonnes pharmaceuticals used in fatteners further decreased in 2020, down from 58,7 tonnes in 2018 (-18%); on the other hand, the tonnes pharmaceuticals used in weaners increased again in 2020, reaching a level higher than that in 2018 (29,7 tonnes). The total use of ZnO decreased dramatically compared to 2019 (approx. minus 10 tonnes), almost equalling the amount of ZnO sold in 2020.

In poultry, tonnes used in broilers increased compared to 2019, but especially the evolution in laying hens was remarkable, with a doubling of used tonnes compared to the previous two years.

Tonnes used in veal calves further decreased.

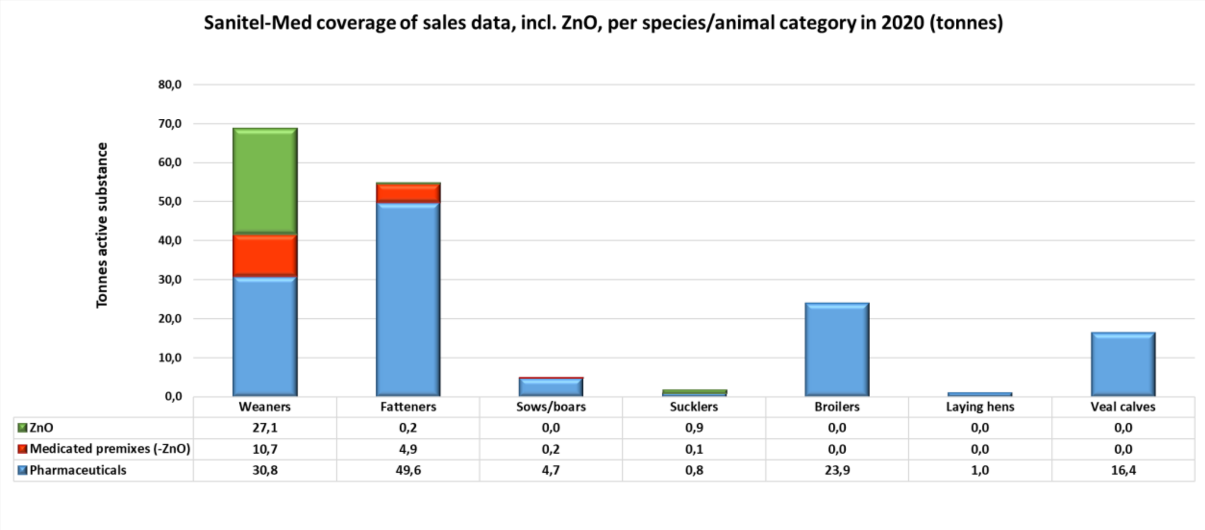


Figure 25. Tonnes active substance of pharmaceuticals, medicated premixes and ZnO used in 2020 per Sanitel-Med animal category.

c) Per antibacterial class

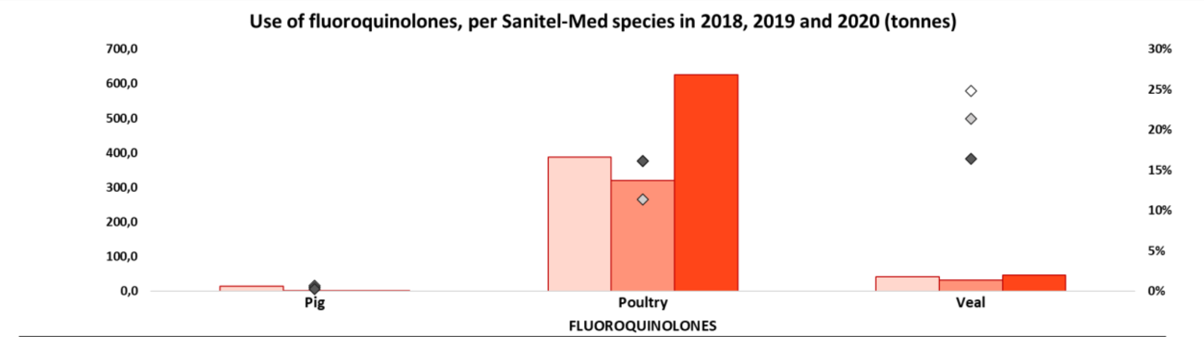
When breaking down the total used tonnes in the different antibacterial classes, coverage of sales data was above or around 80% for penicillins, tetracyclines, macrolides, aminosides and polymyxins (Table 7), as was the case in 2019 except for aminosides. Likewise, coverage remained very low for cephalosporins. Compared with 2019 coverage of most classes showed some variation. Most remarkably differences were the decrease of the coverage of tetracycline and trimethoprim-sulpha sales (-7% and -6% respectively), the increase in aminosides coverage and the increase of the quinolones coverage (+12%), situated fully in poultry. Almost 50% of all quinolones use in Belgian animals was situated in poultry alone (more specifically: broilers).

Table 7. Total tonnes per antibacterial class sold in 2020 (Sales 2020) and total tonnes used in pigs, poultry and veal calves (Use 2020). Next to the tonnes used by each species the % this covers of the sales data (% sales) is shown.

	Sales 2020	Use 2020							
	Tonne	Total tonne	***% sales***	Pig tonne	***% sales***	Poultry tonne	***% sales***	Veal tonne	***% sales***
Penicillins	**73,4**	60,9	***83***	47,2	***64***	9,1	***12***	4,6	***6***
Tetracyclines	**35,8**	30,1	***84***	23,5	***66***	1,5	***4***	5,1	***14***
Trim-sulpha	**35,4**	21,6	***61***	16,4	***46***	4,4	***12***	0,8	***2***
Macrolides	**18,2**	17,8	***98***	7,2	***40***	6,3	***35***	4,2	***23***
Aminosides	**9,2**	7,1	***78***	3,1	***34***	2,7	***30***	1,3	***14***
Phenicols	**3,3**	1,9	***57***	1,6	***50***	<0,1	***1***	0,2	***7***
Polymixins	**2,8**	2,4	***86***	2,1	***75***	0,3	***10***	<0,1	***1***
Cephalosporins	**1,4**	0,0	***1***	0,0	***1***	0	***0***	<0,1	***<1***
Quinolones	**1,4**	0,7	***49***	0,0	***<1***	0,6	***46***	<0,1	***3***
Other	**1,0**	0,6	***60***	0,6	***60***	0	***0***	0	***0***

Use of critical substances in the Sanitel-Med animal species

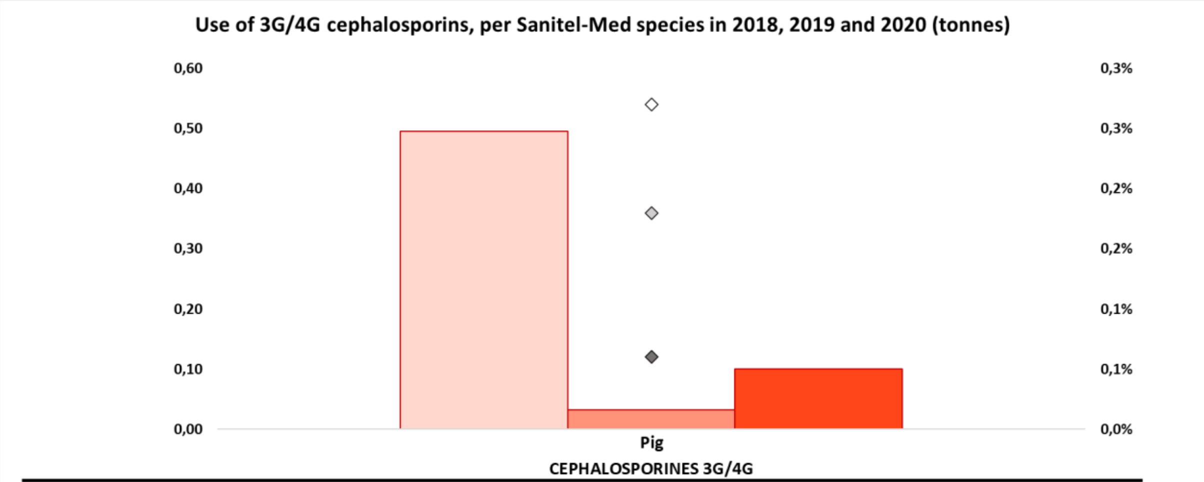
The mass of (fluoro)quinolones used in poultry increased dramatically in 2020 (Figure 26a), far exceeding the mass used in 2018, while the % of farms using these products equalled that of 2018. This indicates that these products with a red AMCRA colour code became a more 'habitual' use on a limited number of farms instead of an exceptional use on a larger number of farms in the poultry sector. A % of veal calf farms comparable to that of poultry used (fluoro)quinolones in 2020 but total mass used was far lower than in poultry, suggesting a rather targeted use for individual veal calves. Still, in veal calves the % of farms decreased but total mass used increased in 2020 compared to 2019.



	Pig	Poultry	Veal
2018 - Kg used	14,2	388,3	41,3
2019 - Kg used	0,4	320,8	32,2
2020 - Kg used	0,3	625,2	46,4
2018 - % of farms	1%	16%	25%
2019 - % of farms	0%	11%	21%
2020 - % of farms	0%	16%	16%

Figure 26a. Kg used of the (fluoro)quinolones in pigs, poultry and veal calves from 2018 to 2020, and the % of farms with notifications of use of these critical substances.

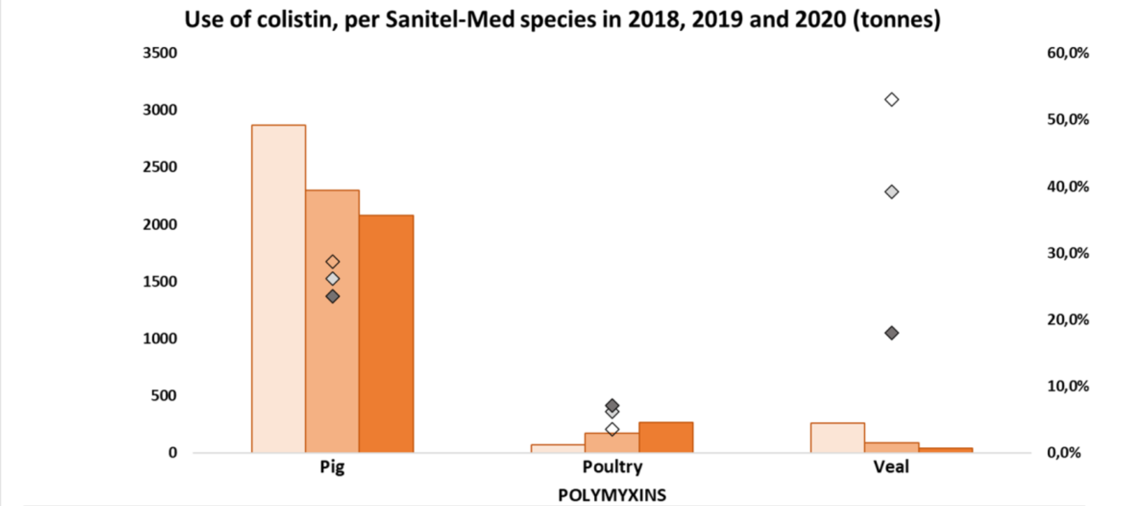
The use of (fluoro)quinolones and cephalosporins 3G/4G (Figure 26b) remained stable at a very low level in pigs.



	Pig
2018 - Kg used	0,50
2019 - Kg used	0,03
2020 - Kg used	0,10
2018 - % of farms	0,3%
2019 - % of farms	0,2%
2020 - % of farms	0,1%

Figure 26b. Kg used of the 3rd and 4th generation cephalosporins in pigs from 2018 to 2020, and the % of farms with notifications of use of these critical substances.

As in previous years, pigs remained the species with the largest use of colistin, although the used mass as well as the % of farms with notifications using this substance continued to decrease (Figure 27). Used mass as well as the % of farms using colistin also decreased in veal calves but it drastically increased in poultry, with more than four times the mass used in 2020 compared to 2018 and doubling the % of farms with notifications. This trend is totally situated in laying hens (data not shown).



	Pig	Poultry	Veal
2018 - Kg used	2870,9	66,4	257,7
2019 - Kg used	2297,6	172,1	89,2
2020 - Kg used	2081	266	39
2018 - % of farms	28,7%	3,5%	53,1%
2019 - % of farms	26,2%	6,2%	39,2%
2020 - % of farms	23,5%	7,1%	18,0%

Figure 27. Kg used of polymyxins (colistin) in pigs, poultry and veal calves from 2018 to 2020, and the % of farms with notifications of use of colistin.

Species-level antibacterial use

a) BD_{100}-species

Table 8 shows the evolution of the (kg) animals at risk of treatment per species at national level between 2018 and 2020. This is the denominator data for the BD_{100}-species.

Table 8. Number and kg animals at risk in 2018, 2019 and 2020 in pigs, poultry and veal calves.

	Animals at risk			kg at risk		
	2018	**2019**	**2020***	**2018**	**2019**	**2020***
PIGS	6 209 131	6 085 101	6 112 906	318 868 970	311 900 606	311 335 682
POULTRY	43 624 079	44 902 016	44 902 016	54 921 459	55 859 741	55 859 741
VEAL CALVES	170 363	171 462	166 952	13 629 040	13 716 960	13 356 160

** The final data for 2020 were not available yet (date last consultation: 03/06/2021). Provisional data for 2020 (dated May 2020) were used for pigs and veal calves. For poultry, data of 2019 were used.*

Table 9 shows the evolution of daily doses used per species at national level. This is the numerator data for the BD_{100}-species. Note that a distinction is made between products for which the doses are expressed as mg/animal and for which doses are expressed as mg/kg.

Use of antibacterial products for systemic administration continuously decreased for pigs and veal calves while increasing again in 2020 in poultry, after a decrease in 2019.

Table 9. Number of doses used from products administered locally or topically versus orally or through injection in 2018, 2019 and 2020 in pigs, poultry and veal calves.

	n $DDDA_{bel}$ × LA_{bel} (locally/topically)			n $DDDA_{bel}$ × LA_{bel} ($x10^3$) (orally, injection)		
	2018	**2019**	**2020**	**2018**	**2019**	**2020**
PIGS	592 648	499 151	552 299	8 299 503	7 650 366	7 395 949
POULTRY	0	0	0	1 140 176	1 088 249	1 142 535
VEAL CALVES	2 059	3 339	3 364	1 408 190	1 114 890	1 106 707

The BD_{100}-species, expressing the treatment days out of 100 days based on the total amount of antibacterials used per species and the total mass animals at risk per species, increased for broilers (+5,0%) and veal calves (+1,9%) between 2019 and 2020 (Figure 28), while it decreased for pigs (-3,1%). Use in veal calves remained far higher than that in pigs and poultry. Due to the constraints of the denominator data, these results need to be interpreted with due caution. However, it is a result in line with the sales data results that showed a global status quo over all animals.

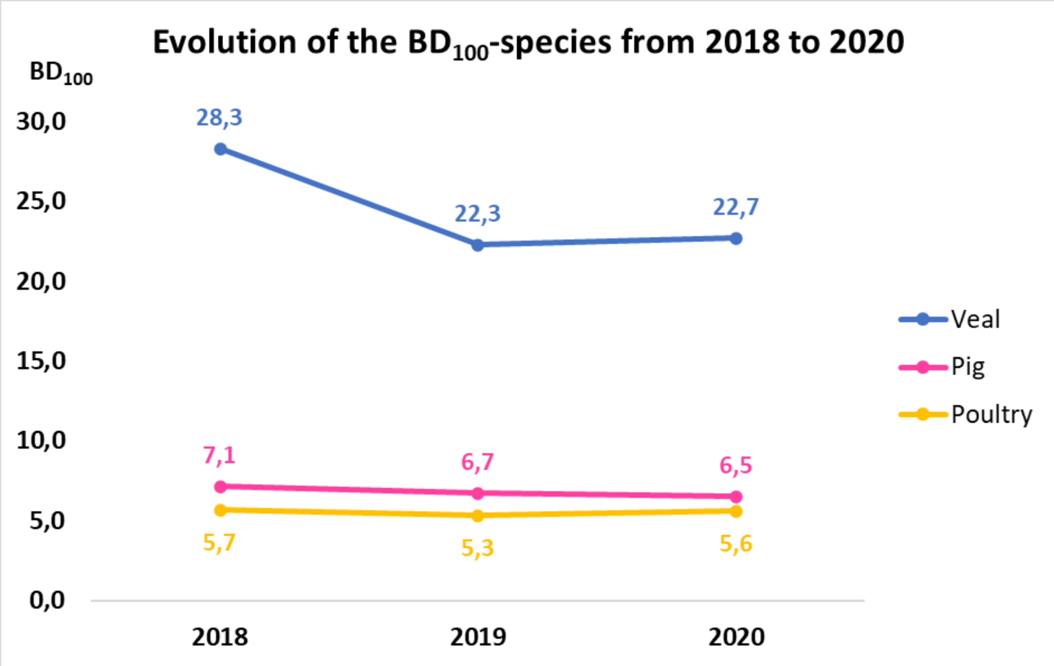


Figure 28. Antibacterial use (BD_{100}-species) in 2018, 2019 and 2020 in pigs, poultry and veal calves.

Farm-level antibacterial use

a) 2020 reference populations for benchmarking

Table 10 shows the number of farms per Sanitel-Med animal category that, after applying the farm-level quality controls, were found eligible to be included in the 2020 reference populations for benchmarking. This amounted to a total of 4017 pig farms, 954 poultry farms and 238 veal calf farms.

Table 10. Number of farms and zero-use farms per Sanitel-Med animal category that were part of the 2020 reference populations for benchmarking.

	PIGS				POULTRY		VEAL CALVES
	Sucklers	Weaners	Fatteners	Breeders	Broilers	Laying hens	
n farms	1 537	1 575	3 710	1 538	749	205	238
n zero-use farms[1]	146	72	316	146	104	126	0

[1] For pigs, zero-use is at farm level (hence, if four animal categories are present at the farm, zero-use is only when there is no AMU in all four categories), whereas for poultry and veal calves, it relates to the animal category.

b) Farm-level antibacterial use in 2020

Below the distribution of the farm-level BD_{100} in the 2020 reference population of each Sanitel-Med animal category is shown as a box-plot with the median use indicated (Figure 29). Note that the zero-use farms in each reference population (see Table 10) were excluded to produce the box-plots. As in 2018 and 2019 (Figure 30), use was highest in veal calves, weaners and broilers. The distribution in all categories was right-skewed, meaning there is a 'tail' of high users.

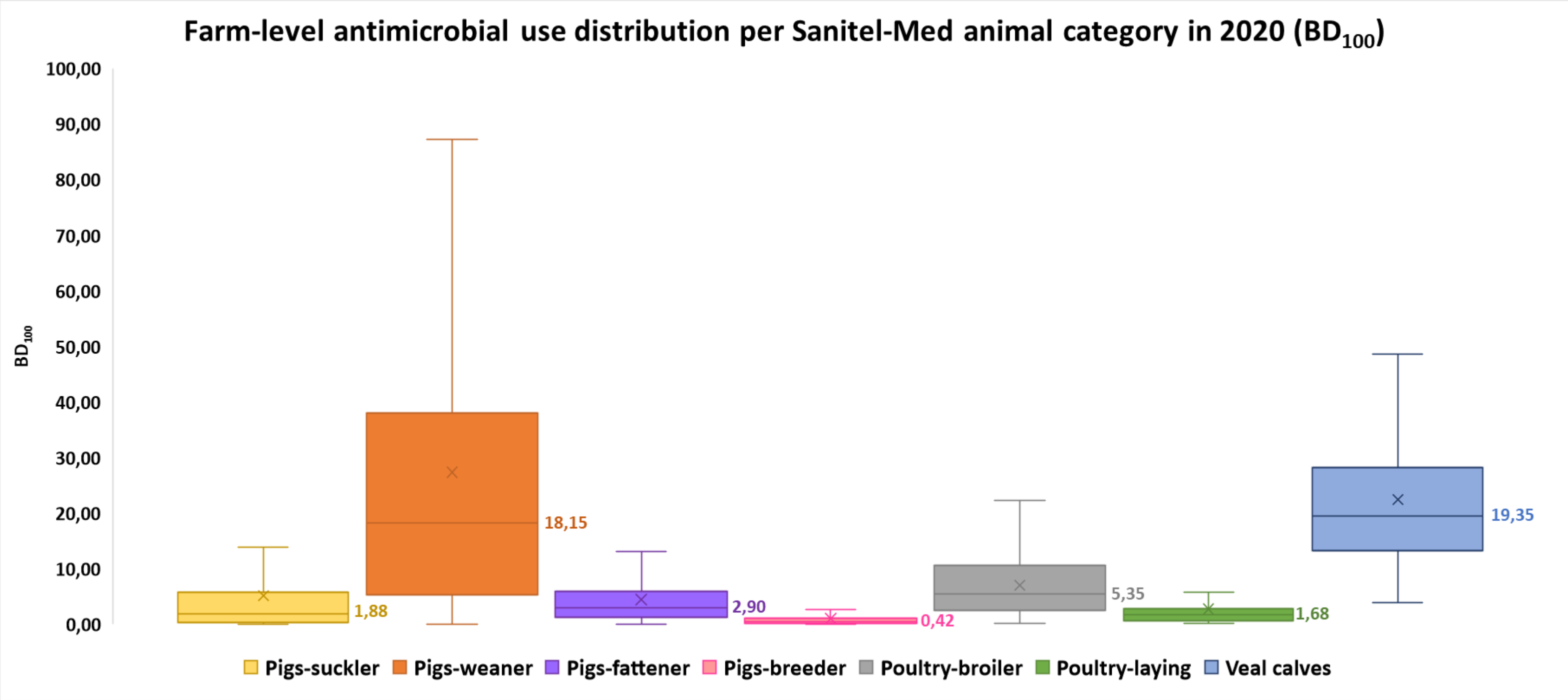


Figure 29. Box-plots representing the BD_{100}-distribution in the 2020 reference population of each Sanitel-Med animal category. Outliers are not shown, zero-use farms were excluded. The median values are provided next to the lines in the boxes.

c) Evolution of farm-level antibacterial use from 2018 to 2020

i. *Summary*

The evolution of the median farm-level BD_{100} in the benchmark reference populations from 2018 to 2020 shows a decrease over this period in most Sanitel-Med animal categories, with highest reductions in veal calves (Figure 30). However, a closer look reveals that the median use in suckling piglets increased and in weaned piglets it stagnated in 2020 compared to 2019. After the strong increase of the median BD_{100} between 2018 and 2019 in breeding pigs, it stagnated in 2020. Only in fatteners, broilers and veal calves the median BD_{100} decreased continuously. In laying hens, the median BD_{100} dramatically increased, especially between 2018 and 2019. Even though the use in this category is generally very low and still situated in a small part of the farms, the trend is worrying with also the number of zero-use farms decreasing over the years (Table 16). Overall, these appear to be worrying results; The may partially seem to contradict the results of the BD_{100}-species indicator yet this can be explained by the fact that the BD_{100}-species indicator describes all the use in which the use in the largest or most using farms will have an important influence whereas the farm-level median BD_{100} describes the median use over all farms and therefore each farm counts equally independently of the farm size.

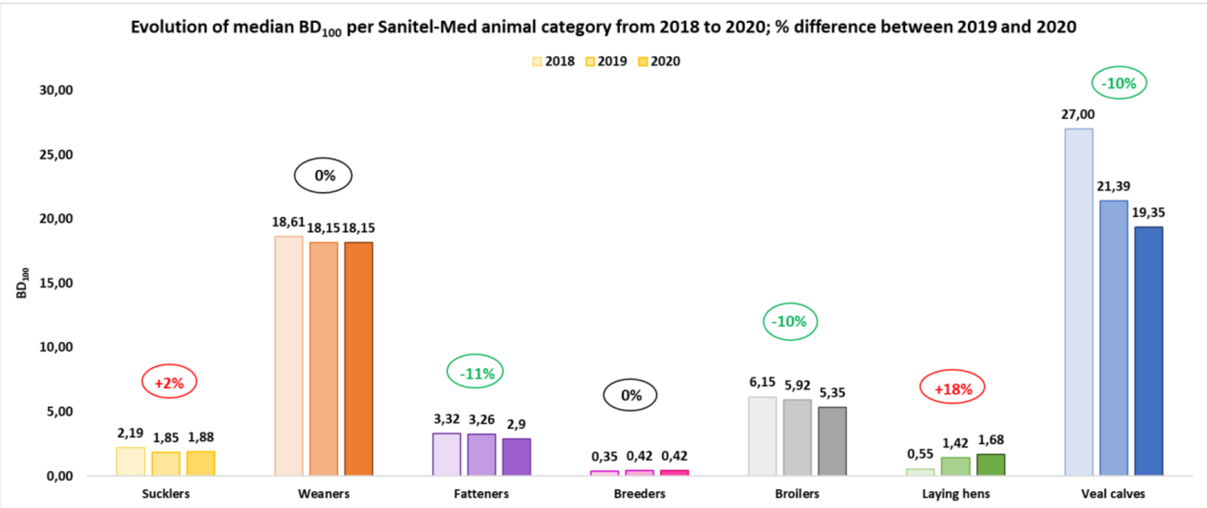


Figure 30. Evolution of the median of the BD_{100}-distribution in the reference populations for 2018, 2019 and 2020 of each Sanitel-Med animal category. Zero-use farms per year were excluded for the analysis.

Below per animal category more details of the evolution in the benchmarking reference populations for 2018, 2019 and 2020 are presented, as well as the threshold values that have been outlined for the antibacterial use reduction paths that apply as of 2021 (Tables 11-17).

ii. *Suckling piglets*

Table 11a. Parameters describing the distributions of the farm-level antimicrobial use in the reference populations for benchmarking of suckling piglets from 2018 to 2020 and % difference (% diff) over the years.

Parameters BD_{100}	2018	2019	2020	% diff 18-20	% diff 19-20
Mean	5,41	5,05	5,14	-4,99%	+1,78%
P25	0,18	0,16	0,25	+38,89%	+56,25%
P50	2,19	1,85	1,88	-14,16%	+1,62%
P75	6,44	5,80	5,66	-12,11%	-2,41%
P90	13,30	12,60	12,73	-4,29%	+1,03%
Sum	7855	7138	7144	-9,05%	+0,08%
Total n farms	1580	1535	1537	-2,72%	+0,13%
% farms with zero use[1]	8,2%	7,9%	9,5%	+1,3%	+1,6%

[1] *These zero use farms were not included in the data for determining the parameter values.*

Table 11b. The thresholds of the BD_{100} reduction path 2021-2024 for suckling piglets.

Date of application	Attention value	Action value
01/01/2021	2	10
01/01/2023	2	6
01/01/2024	2	5

As illustrated in Table 11a, the increase of the antibacterial use in suckling piglets in 2020 was situated in the lower and higher use range of the population. Even though it is positive that more than 50% of the farms were below the attention value, it remains the goal to have as many farms as possible below this threshold, as it indicates 'acceptable' use. Furthermore, between 10% and 15% of farms had antibacterial use above the current action threshold (data not shown). In less than two years, the action value will decrease to 6 (Table 11b). Currently, between 20% and 25% of farms with suckling piglets have antibacterial use above that value (data not shown). Hence, a substantial effort will be required to avoid a surge in farms with 'alarm use' (= continuous or repeated use in the red zone).

iii. Weaned piglets

The stagnation of the median BD_{100} in weaned piglets in 2020 compared to 2019 is combined with a decrease in the lower use range but an increase in the higher use range, stretching the tail of the use distribution (Table 12a). With a P85 in 2020 of 52,2 more than 15% of farms with weaned piglets in 2020 were above the action threshold (data not shown). In less than two years, the action value will decrease to 40, and then to 30. As in suckling piglets, based on the current figures (between 30% and 35% of farms with median BD_{100} above the action threshold of 30, data not shown) substantial efforts will be needed very soon to ensure that the situation is not derailed in terms of alarm use. Furthermore, currently only some 45% of farms with weaned piglets achieve the attention BD_{100}-value.

Table 12a. Parameters describing the distributions of the farm-level antimicrobial use in the reference population for benchmarking of weaned piglets from 2018 to 2020 and % difference (% diff) over the years.

Parameters BD_{100}	2018	2019	2020	% diff 18-20	% diff 19-20
Mean	29,06	27,05	27,18	-6,47%	+0,48%
P25	5,06	5,62	5,10	+0,79%	-9,25%
P50	18,61	18,15	18,15	-2,47%	0,00%
P75	39,66	37,02	37,97	-4,26%	+2,57%
P90	69,15	61,15	63,35	-8,39%	+3,60%
Sum	44700	40898	40845	-8,62%	-0,13%
Total n farms	1608	1583	1575	-2,05%	-0,51%
% farms with zero use [1]	4,4%	4,5%	4,6%	+0,2%	+0,1%

[1] *These zero use farms were not included in the data for determining the parameters.*

Table 12b. The thresholds of the BD_{100} reduction path 2021-2024 for weaned piglets.

Date of application	Attention value	Action value
01/01/2021	14	50
01/01/2023	14	40
01/01/2024	14	30

iv. Fattening pigs

For the second year in a row, antibacterial use in fatteners showed a general decrease, with the reduction evenly spread across the population (Table 13a). As fatteners represent the largest group of all animals in terms of mass antibacterial compounds used (when excluding ZnO) and mass animals at risk or biomass produced, the result in this category is of mayor importance for the general result of antimicrobial use in animals in Belgium. Despite these encouraging results, as in the other pig categories a warning must be given with respect to the reduction path for fattening pigs. The attention threshold is not within reach for a large number of farms and with the current figures almost 25% of farms will be in the red zone in less than 2 years (data not shown). Hence, important work remains to be done in this category as well.

Table 13a. Parameters describing the distributions of the farm-level antimicrobial use in the reference population for benchmarking of fattening pigs from 2018 to 2020 and % difference (% diff) over the years.

Parameters BD_{100}	2018	2019	2020	% diff 18-20	% diff 19-20
Mean	4,91	4,88	4,37	-11,00%	-10,45%
P25	1,20	1,29	1,14	-5,00%	-11,63%
P50	3,32	3,26	2,90	-12,65%	-11,04%
P75	6,64	6,52	5,91	-10,99%	-9,36%
P90	11,28	10,73	10,13	-10,20%	-5,59%
Sum	17197	16750	14840	-13,71%	-11,40%
Total n farms	3813	3721	3710	-2,70%	-0,30%
% farms with zero use [1]	8,1%	7,8%	8,5%	+0,4%	+0,7%

[1] *These zero use farms were not included in the data for determining the parameters.*

Table 13b. The thresholds of the BD_{100} reduction path 2021-2024 for fattening pigs.

Date of application	Attention value	Action value
01/01/2021	**2,7**	**9**
01/01/2023	**2,7**	**6**
01/01/2024	**2,7**	**6**

v. Breeding pigs

Table 14a. Parameters describing the distributions of the farm-level antimicrobial use in the reference population for benchmarking of breeding pigs from 2018 to 2020 and % difference (% diff) over the years.

Parameters BD_{100}	2018	2019	2020	% diff 18-20	% diff 19-20
Mean	0,96	0,96	0,97	+1,04%	+1,04%
P25	0,06	0,10	0,10	+66,67%	0,00%
P50	0,35	0,42	0,42	+20,00%	0,00%
P75	1,07	1,11	1,11	+3,74%	0,00%
P90	2,15	2,26	2,32	+7,91%	+2,65%
Sum	1399	1352	1339	-4,29%	-0,96%
Total n farms	1580	1536	1538	-2,66%	+0,13%
% farms with zero use [1]	8,2%	7,9%	9,5%	+1,3%	+1,6%

[1] *These zero use farms were not included in the data for determining the parameters.*

Table 14b. The thresholds of the BD_{100} reduction path 2021-2024 for breeding pigs.

Date of application	Attention value	Action value
01/01/2021	0,28	1,65
01/01/2023	0,28	1,65
01/01/2024	0,28	1,65

Unfortunately, 2020 showed no signs of 'recovery' in the breeding pigs as compared to 2019, when most parameters indicated an increasing antibacterial use, with the P90 even further increasing (Table 14a). This trend should be addressed in the sector. It is the category with least farms above the currently applied attention and action values (data not shown). it might be deemed reassuring that the action value is agreed to remain stable over the years, but the current figures illustrate that many farms are far from acceptable use in breeding pigs, and still a considerable number of 15-20% farms (data not shown) will get labeled as alarm users in the near future if no measures are taken.

In conclusion for the pig sector, the situation is variable. From the animal category specific farm level data it can be understood that the slightly positive result at the species level likely follows from the relatively positive results in 2020 in the fattening pigs, which as noted earlier has the largest impact on the pig and even the overall animal antibacterial use results. However, the remaining pig categories stagnated in 2020, and with an eye on the reduction paths which have come into effect the beginning of 2021, substantial efforts are needed in the whole sector in order to keep the situation with respect to alarm use controllable for all stakeholders involved, and, ultimately, to be able to achieve the overall reduction aim in 2024.

vi. Broilers

Table 15a. Parameters describing the distributions of the farm-level antimicrobial use in the reference population for benchmarking of broilers from 2018 to 2020 and % difference (% diff) over the years.

Parameters BD_{100}	2018	2019	2020	% diff 18-20	% diff 19-20
Mean	8,12	7,46	6,97	-14,16%	-6,57%
P25	3,23	2,82	2,40	-25,70%	-14,89%
P50	6,15	5,92	5,35	-13,01%	-9,63%
P75	11,47	10,44	10,49	-8,54%	<u>+0,48%</u>
P90	16,91	16,12	15,10	-10,70%	-6,33%
Sum	5141	4660	4495	-12,57%	-3,54%
Total n farms	728	731	749	3,02%	2,60%
% farms with zero use [1]	13,0%	14,5%	13,9%	+1,5%	-0,5%

[1] These zero use farms were not included in the data for determining the parameters.

Table 15b. The thresholds of the BD_{100} reduction path 2021-2024 for breeding pigs.

Date of application	Attention value	Action value
01/01/2021	6	14
01/01/2023	5	12
01/01/2024	5	10

The farm-level antibacterial use in broilers continued to decrease in 2020 (Table 15a). It is rewarding that approx. 55% of broiler farms achieved the BD_{100}-attention value (data not shown). Still, work remains to be done, as between 10% and 15% of broiler farms have an antibacterial use above the action value, and with the planned decrease of that value, 20-25% of broiler farms are eligible for becoming alarm users within a few years unless substantial further reductions are achieved.

vii. Laying hens

In contrast to the broilers, the farm-level use for laying hens dramatically increased over the last three years (Table 16). It must of course be noted that this sector is by far most affected by the exclusion of the zero use farms as is done for the current analyses, with only 38,5% of laying hen farms notifying antibacterial use. Yet, worryingly, also the % of zero use farms is decreasing. These evolutions should be acted upon by the sector. In this sense, the sector deserves credit for having established an attention and action value itself for this category. Currently, less than 5% of laying hens farms (zero use farms included) are above the action value (data not shown).

Table 16. Parameters describing the distributions of the farm-level antimicrobial use in the reference population for benchmarking of laying hens from 2018 to 2020 and % difference (% diff) over the years. Also indicated are the currently applicable thresholds for laying hens that came into effect in 2021.

Parameters BD_{100}	2018	2019	2020	% diff 18-20	% diff 19-20
Mean	1,29	1,95	2,65	+105,43%	+35,90%
P25	0,27	0,39	0,61	+126,93%	+56,41%
P50	0,55	1,42	1,68	+205,45%	+18,31%
P75	1,35	3,24	2,74	+102,96%	-15,43%
P90	3,05	4,60	6,88	+125,57%	+49,57%
Sum	84	131	209	+148,81%	+59,54%
Total n farms	197	198	205	4,06%	3,54%
% farms with zero use [1]	67,0%	66,2%	61,5%	-5,5%	-4,7%

Threshold values [2]	
Attention value	**0**
Action value	**3**

[1] *These zero use farms were not included in the data for determining the parameters.*

[2] *These values were agreed in consultation with the sector. An evolution in time of these values (reduction path) is not foreseen.*

In conclusion for the poultry sector, opposing trends emerge in broilers and laying hens, probably (partly) explaining the overall negative result at the species level (Figure 28), although it must be noted again that the denominator data for the BD_{100}-species indicator are not yet available for poultry for 2020. Regardless, considering the upward trend in laying hens and the ambitions expressed in the reduction path for broilers, in combination with the worrying qualitative results (use of fluoroquinolones and colistin) in both subsectors much work remains to be done.

viii. Veal calves

Although the result of the veal calf sector is generally positive, with a continued decrease in 2020, a false note is found in the high use range (Table 17a). It may be (part of) the explanation for the increase of the species-level indicator for the veal calves (Figure 28), especially when the group of farms with an increased use would concern relatively large farms. Indeed, at the species-level, the result of large farms has a greater impact than that of small farms, while in the distribution shown below, all farms have an equal impact.

Regardless, it must be noted that over 20% of veal calf farms (data not shown) do not reach the current action value (Table 17b). With the planned reductions in 2023 and 2024 continuous serious efforts will be required to achieve the necessary reductions, especially considering the increase in the P90 in 2020. It is positive that over 50% of veal calf farms achieve the current attention value but also that value will decrease in time. The sector is called upon to continue its efforts and, where possible, to strengthen them in the coming months.

Table 17a. Parameters describing the distributions of the farm-level antimicrobial use in the reference population for benchmarking of veal calves from 2018 to 2020 and % difference (% diff) over the years.

Parameters BD_{100}	2018	2019	2020	% diff 18-20	% diff 19-20
Mean	29,6	22,81	22,42	-24,26%	-1,71%
P25	19,73	15,19	13,19	-33,15%	-13,17%
P50	27,00	21,39	19,35	-28,33%	-9,54%
P75	39,13	28,4	28,15	-28,06%	-0,88%
P90	47,27	36,18	39	-17,50%	+7,79%
Sum	7046	5405	5335	-24,28%	-1,30%
Total n farms	240	238	238	-0,83%	0,00%
% farms with zero use [1]	<0,1%	<0,1%	0%	-100,00%	-100,00%

[1] *These zero use farms were not included in the data for determining the parameters.*

Table 17b. The thresholds of the BD_{100} reduction path 2021-2024 for veal calves[1].

Date of application	Attention value	Action value
01/01/2021	**20**	**30**
01/01/2023	**18**	**26**
01/01/2024	**16**	**22**

[1] *Recalculated with a standard treatment weight of 80 kg.*

In conclusion the result of the veal calf sector is generally positive, with a continued decrease in 2020. Yet a false note is found in the high use range (Table 17a). It may be (part of) the explanation for the increase of the species-level indicator for the veal calves (Figure 28). Regardless, it must be noted that over 20% of veal calf farms (data not shown) do not reach the current action value (Table 17b). With the planned reductions in 2023 and 2024 continuous serious efforts will be required to achieve the necessary reductions. The sector is called upon to continue its efforts and, where possible, to strengthen them in the coming months.

d) Distribution of use according to veterinary contract

As shown in Figure 30, there were stark differences in the role of the contract veterinarian (the veterinarian charged with the epidemiological surveillance) in terms of antibacterial use between the three sectors.

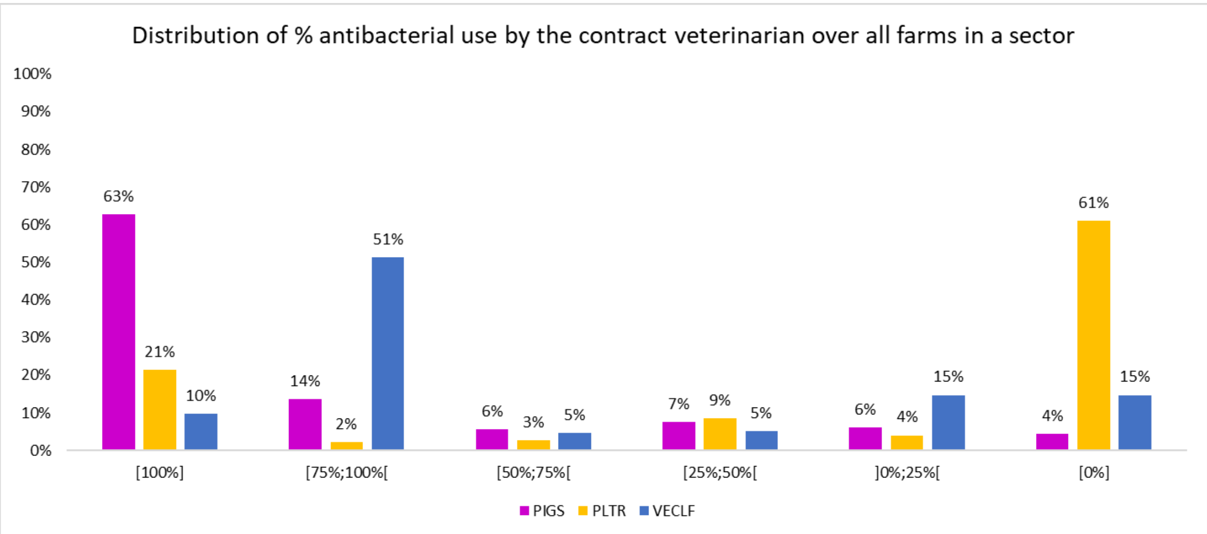


Figure 30. Distribution of the percentage of antibacterial use (excl. ZnO) that was done by the contract veterinarian on pig, poultry and veal calf farms. Six intervals are shown: 100% of use was done by the contract vet, between 75% and 100%, between 50% and 75%, between 25% and 50%, between 0% and 25% and 0%.

On 63% of the pig farms, 100% of the use could be attributed to the contract veterinarian. In contrast, on 61% of the poultry farms, 0% of the use could be attributed to the contract veterinarian. In veal calves, situation was in between, with still more than half of veal calf farms where 75% or more of the use could be attributed to the contract vet.

e) Farm-level use of the various antibacterial classes

Compared over the last three years, the number of treatment days with the different antibacterial classes and the proportions this represents in the total treatment days per species remained broadly stable (Figure 37). In pigs, there were notable increases in use of broad-spectrum penicillins, lincomycin-spectinomycin, aminoglycosides and amphenicols, while use of tetracyclines, polymyxins and trim-sulpha products decreased. In poultry, the importance of macrolides, (fluoro)quinolones and polymyxins increased, whereas that of lincosamides, tetracyclines and broad-spectrum penicillins decreased. In bovines, use of polymyxin use decreased noteworthily, whereas use of amphenicols and aminoglycosides increased. A relative stability of the used antibacterial classes is important in light of the follow up of the reduction paths.

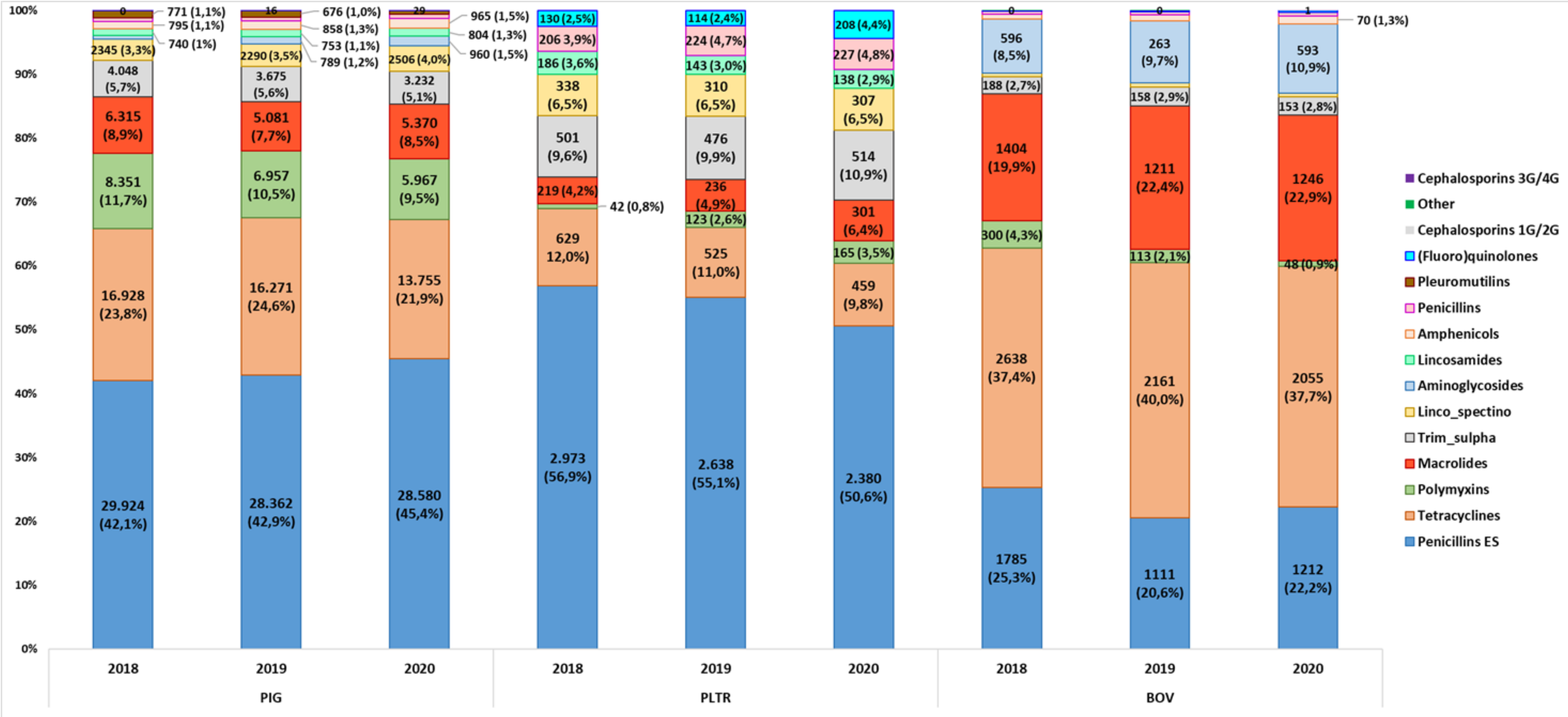


Figure 37. Number of treatment days with the different antibacterial classes and percentage of the total number of treatment days per species in 2018, 2019 and 2020. Numbers/percentages not shown are classes where use was below 1% of treatment days.

DISCUSSION

In the context of the increasing (awareness on) antimicrobial resistance development, comparable data and evolutions of antimicrobial consumption (AMU) are of utmost importance. This annual BelVet-SAC report is now published for the twelfth time and describes the antimicrobial use in animals in Belgium in 2020 and the evolution since 2011. For the third year this report combines sales data (collected at the level of the wholesaler-distributors and the compound feed producers) and usage data (collected at farm level). This allows to dig deeper into AMU at species and farm level in Belgium.

As always, in the sales data, the dependency on the biomass factor may influence the result. This means that changes regarding the net import or export of slaughter animals (increasing or decreasing biomass in BE) will have an influence on the outcome. Furthermore, we have to take into account that it is not 100% sure that all products sold in Belgium by the wholesaler-distributors are also used in Belgium. Veterinarians living near the country borders may also use medicines bought in Belgium to treat animals abroad. However, also the contrary may happen, i.e. veterinarians from neighbouring countries using products in Belgium that are not included in the BelVet-SAC sales data. The usage data might help to shed some light on this. Indeed, cascade use ('import') is requested to be registered in Sanitel-Med as 'Self Defined Products' and in 2020 approximately 1,4 ton of SDPs (predominantly Neosol 100%) was registered, a slight increase compared to 2019. In 2020, sales data were 38,68 tonnes higher than usage data (not corrected for SDPs), which is an increase compared to 2019 (34,6 tonnes) but still below the level of 2018 (42,5 tonnes). As the usage data do not cover all animal species, most of this difference will be explained by usage in the non-included species or categories, most importantly bovines but also other poultry categories and companion animals, horses, rabbits, turkeys, ... It can also not be excluded that some usage is not being registered in Sanitel-Med for the currently obliged animal categories. However, the increase in the uncovered quantity compared to 2019 and the decrease in number of notifications in Sanitel-Med (together with a decreased number of notifying veterinarians and farms) clearly demonstrates the need for increased sensibilisation and controls to further ensure the completeness of the collected usage data.

With a **consumption of 87,6 mg antimicrobial/kg biomass** an increase of **+0.2%** in comparison to 2019 is observed in 2020. This unfortunately reverses/stops the trend of the past five years where important decreases of antimicrobial usage in animals were observed. Overall, a cumulative reduction of **-40,2% since 2011** is thus achieved**.** The increase in 2020 is seen in both **pharmaceuticals (+0.2% mg/kg) and antibacterial premixes (+4.0% mg/kg).** In absolute values the observed increase in antibacterial sales is even larger (+2.6%) yet this is partially nullified by the substantial increase in biomass in Belgium in 2020. This effect may reflect an increased size of the national herd, yet it might also be influenced by increased import of live animals.

As in 2019, the total AMU in animals in 2020 is in large part determined by the pig sector and more specifically, by the fatteners and the weaners. Together, they accounted for 67% of tonnes used. Broilers and veal calves accounted for 17% and 11% of tonnes used, respectively, and the remaining animal categories (sows/boars; sucklers; layers) only for 5%. Laying hens, however, showed a dramatic increase in use, doubling the tonnes pharmaceuticals used in 2020 compared to 2019.

When looking at the **evolution in the number of treatment days (BD_{100}) at the species level,** as calculated from the SANITEL-MED use data, use increased in poultry (+5,0%) and veal calves (+1,9%), while it decreased in pigs (-3,1%) between 2019 and 2020. Overall, these results appear to be in line with the stagnation in the sales data, although it must be noted that the denominator data, especially for poultry, could not yet be updated at the time of finalising this report. They anyhow seem to be encouraging for the pig sector while calling for increased efforts in the other sectors. However, when digging deeper in the farm level results per animal category it becomes clear the latter actually accounts for all three species covered in Sanitel-Med and at the same time things are not that negative for the poultry and veal calf sector.

The farm-level pig results per animal category show rather negative results in suckling piglets (median BD_{100} of 1.88, increase of 2% compared to 2019), weaned piglets (median BD_{100} of 18.15, stagnation compared to 2019) and pigs for breeding (median BD_{100} of 0.42, stagnation compared to 2019). Moreover, when taking multiple parameters into account, in these three categories use clearly increases. The fatteners on the contrary have general favorable results, with a median BD_{100} of 2.9 (decrease of -11% compared to 2019). Hence, as the fatteners are the largest group of farms, representing also the largest mass of animals at risk, its positive results probably masks the other categories at the species level. After the encouraging results for the pig sector in the past years, these results should be a wake-up call for the pig sector, showing they cannot afford to be lulled to sleep, especially not in light of the recently started reduction paths for the pig categories (see further).

In contrast, in broilers and veal calves the farm-level data appear to be more positive than the BD_{100}-species suggests, with general reductions (-9% of the broiler median BD_{100}, to 5.35; -9.5% of the veal calve median BD_{100}, to 19.35) in 2020 in comparison to 2019. However, some farms do appear to have an increased use in these sectors, and especially when these are larger farms this might have a considerable impact on the BD_{100}-species. As said however, the fact that the denominator data for the BD_{100}-species remain to be updated for 2020 might be the most important explanation for the discrepant results. For poultry, it must also be noted that part of the positive result in broilers will be nullified by the spectacular increase in laying hens, although all in all this sector remains to represent a minor 'weight' compared to broilers. Yet, it is especially disappointing that the increase in laying hens is partially due to an increased use in colistine. Likewise, the reduction seen in the broiler production is partially superseded by the continued high use of fluoroquinolones in this production. An issue that urgently should be resolved. It is hoped that the "10 point plan" to address the AMU which was set up by the poultry sector in 2020 will help reverse the trend.

The continuous reduction in the veal calf production is encouraging and can likely be linked to the enhanced actions organized in this production sector through the development of a "10 point program" aiming at reducing the use in this sector. However, even after this important reduction the median use (expressed in BD_{100}) in the veal production still is at 19.4% of the production period which remains the highest value of all sectors and therefore needs to be further reduced.

Despite all that can be said about the smaller and bigger trends that appear from the species as well as farm-level data, it is clear that a big challenge still lies ahead. Indeed, as of 2021, benchmarking of the different sectors is done according to reduction paths, drawn up in consultation with the respective sectors. Both towards the currently applied thresholds and the for the future foreseen thresholds, substantial % of farms are (10-15% in most categories) and will be (20-25% in most categories) red users, hence becoming eligible for increased follow-up pressure when they would be labelled 'alarm users'. These would be untenable situations for all stakeholders involved, especially when considering that the actual aim should be for all farms to achieve the safe, green zone below the attention value. Hence, all stakeholders are called upon to increase their efforts and, through well-thought succession schedules, encourage and support the farmers and vets involved to reduce the antimicrobial use in a sustainable way.

For other species such as cattle, horses and companion animals no herd or animal level use data are yet available in Sanitel-Med. Yet the BelVet-SAC sales data do allow to get a rough estimate of the antimicrobial use evolutions in these species. **In dairy cattle it is promising to see that the increasing trend seen since 2015 is finally broken regarding the use of antimicrobial dry cow applicators**. However, the number of applicators used for the treatment of mastitis cases continues to increase steadily. Also in dogs and cats the volume of antibacterial products sold has decreased in 2020 with -3.5% in comparison to 2019. Even though actual use data for these species are lacking, these are promising results. When looking in more detail, however, it can be seen that the sales of critical antibacterial compounds has increased dramatically for the second year in a row. This should urge the sector to continue to take actions to further reduce antibacterial use, and specifically of critical antibacterials, in companion animals.

The details of the use of the different antibacterial classes show – as in previous years – that penicillins (39.6%) form the largest group of consumed antimicrobials, followed by tetracyclines (19,7%) and the sulphonamides (19,4%). Unfortunately, for the majority of the antimicrobial classes, an increase in sales was observed in 2020. Especially worrisome is the increase in sales of critically important antibacterial compounds as seen for the quinolones and cephalosporins of the 3rd and 4th generation (resp. +36% and +2.3% in kg/kg biomass compared to 2019). For the quinolones, this increase is mostly due to the increased use of flumequine. Also the sales of cephalosporins of the 1st and 2nd generation have increased substantially for the second year in a row (again due to cefalexin). Surprisingly, an increase is seen in the classes of penicillins, trimethoprim-sulpha and macrolides (with a substantial increase in sales of tylosin), for the first time in at least 5 years. On a positive note, the use of colistin is further decreasing, so is the case for tetracyclines and aminosides. The latter partially reverses the important increase seen in 2019.

The use of ZnO in 2020 decreased by about 10 tonnes compared to 2019 and this specifically in weaners. A decrease in use that is larger than the decrease observed in the sales. However, seeing as ZnO is no longer be authorised for use for post-weaning diarrhoea in piglets as of 2021, follow up is required to make sure the remaining 27 tonnes are reduced to 0, but also that the use of colistin does not increase again in response, after decreasing over the last 3 years.

When comparing the notifications made by the farm contract veterinarian to those made by another veterinarian, it is remarkable to see some large differences between the sectors. In the majority of the pig farms, all notifications are made solely by the contract veterinarian whereas in the poultry sector, for 61% of the farms, 0 notifications can be attributed to the contract veterinarian. This latter very remarkable result is probably caused by the fact that many poultry veterinarians no longer have a contract as a natural person (rather, the contract is drawn up with the veterinary practice) while the notifications in Sanitel-Med likely are done with their personal vet code.

Comparing the Belgian sales data with the results of other European countries and especially our neighbouring countries shows that even if there is still a substantial gap to be bridged, the results of 2018 were on the right track. Yet it should be reminded that the European data (ESVAC) are published with a two year delay (latest EU data are from 2018) and therefore do not take into account the very substantial reductions achieved in 2019 in Belgium, nor the results in the current report.

When comparing the overall results achieved in 2020 with the three AMCRA 2020 reduction targets, the **goal of reducing the overall AMU in animals with 50% by 2020 was unfortunately not achieved**, stranding at 40.2% reduction compared to 2011. This further stresses the need for continuous and additional efforts to be made, such as expanding herd level data-collection and benchmarking through the Sanitel-Med and AB register systems, in combination with multiple other initiatives such as herd health plans, continuous education, increased biosecurity,... Moreover, with the start of 2021, a renewed Covenant between the sectors, AMCRA and competent authorities was signed, strengthening the sense of urgency to take action. The new Covenant includes further reduction goals up to 65% by 2024 (compared to the reference year 2011)[17]. With regards to the **antibacterial premixes**, a plateau seems to have been reached over the last three years, **resulting in a cumulative reduction of -70.4% in comparison to 2011**. By 2024, the aim of -75% (compared to 2011) is maintained, further encouraging the sectors to reduce the use of antibacterial premixes. In regard to the different AMCRA colour classes, use of “yellow” (+0.2%) and “orange” (-0.1%) classes remained approximately the same compared to 2019. However, the use of the “**red” products** increased dramatically for the third year in a row (+32.1%) after a very spectacular drop in 2016 and 2017. This increase unfortunately results in **a reduction of -70.1% in comparison to 2011**, meaning the reduction target of -75% by 2020 is no longer achieved. The restoration of the Royal Decree articles on the conditions for use of critically important antibacterial compounds at the end 2020 will hopefully be a first step to counter the trend seen these last years. Yet it is clear that close surveillance and a joint effort from all stakeholders is mandatory to press on and achieve the reduction goals for 2024.

CONCLUSION

The 2020 antibacterial product sales and use data unfortunately show a setback in the evolution of AMU in veterinary medicine in Belgium that was not anticipated. Indeed, only one of the three 2020 reduction targets is achieved (-50% reduction of the premixes). It is clear that close surveillance and a joint effort from all stakeholders is mandatory to press on and achieve the reduction goals for 2024. Additionally, some alarming signals coming from the poultry sector (use of fluorouinolones in broilers and overall AMU in laying hens) but also the companion animals (use of critically important antibacterial compounds), should be urgently dealt with, and the rather disappointed results in the pig sector should be a wake-up call. All sectors are encouraged to intensify their efforts as the 202 data have illustrated that no sector can permit to loosen its focus if the species specific reduction targets created in view of the 2024 targets are to be achieved.

[17] https://www.amcra.be/nl/visie-2024/

ACKNOWLEDGEMENTS

Belgian wholesaler-distributors and compound feed producers are much obliged for their cooperation and for providing the data on the consumption of antimicrobials in animals in Belgium. All veterinarians and third party organisations who provide data to the SANITEL-MED system are acknowledged for their efforts. We would like to thank Gudrun Sommereyns from the Belgian Centre for Pharmacotherapeutic Information for providing the information on the commercialised medicinal products.

APPENDIX

Appendix A. ATC-vet codes included in the different classes of antibacterial products

Class of Antibacterials	ATCvet codes included
Aminoglycosides	QJ01FF01
	QJ01GB03; QJ01GB90
	QS01AA11
	QD06AX04
	QS02AA14; QS02AA57
	QG51AA04
	QA07AA06
	QJ51RG01
	QJ51CE59
	QJ01XX04
Other	QJ01XX10
	QJ01XQ01; QJ01XQ02
	QJ51XX01
	QJ01RA04
Cephalosporins	QJ01DB01
	QJ01DD90; QJ01DD91
	QJ51DB01; QJ51DB04; QJ51DB90
	QJ01DE90
	QJ51DE90
	QG51AX02
	QJ51DD12
	QJ51RD01
Amphenicols	QJ01BA90
	QS01AA01
Macrolides	QJ01FA02; QJ01FA90; QJ01FA92; QJ01FA91; QJ01FA94; QJ01FA95
	QJ01FF02; QJ01FF52
	QJ51RF03
	QJ51FF90
Penicillins	QJ01CA01; QJ01CA04; QJ01CA51
	QJ51RC26
	QJ01CR02
	QJ51CF02
	QJ01CE02; QJ01CE09; QJ01CE30; QJ01CE90
	QJ51CA51
Polymyxins	QJ01XB01

	QA07AA10
	QS02AA11
Pyrimidines	QJ01EW10; QJ01EW13
	QJ01EA01
Quinolones	QJ01MA90; QJ01MA92; QJ01MA93; QJ01MA94; QJ01MA95; QJ01MA96
	QJ01MB07
Sulphonamides and trimethoprim	QJ01EW09; QJ01EW11; QJ01EW12
	QJ01EQ03
tetracyclines	QJ01AA02; QJ01AA03; QJ01AA06
	QD06AA02; QD06AA03