BelVet-SAC

Belgian Veterinary Surveillance of Antibacterial Consumption

National consumption report

2022

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SUMMARY

This annual BelVet-SAC report is now published for the fourteenth time and describes the results of antibiotic use in animals in Belgium in 2022 and its evolution since 2011. For the fifth year in a row, the report combines sales data (collected from distributors and compound feed manufacturers) and usage data (collected at farm level), allowing a more detailed study of the usage per animal category.

With a **consumption of 61.3 mg antibiotics/kg biomass**, a record decrease of **-24.5 %** was achieved in 2022 compared to 2021. This decrease was situated in **both 'pharmaceuticals' (-23.3 % mg/kg) and antibacterial premixes (-36.0 % mg/kg)**. In total, **a cumulative reduction of -58.2 %** has been achieved since 2011.

The **comparison of the sales and usage data** shows that the **difference** between these two decreased sharply in 2022 compared to 2021, to **32 tonnes**, which is the **lowest level** since the collection of usage data started. This supports the suggestion from the previous BelVet-SAC report that there was a 'replenishing of the stock' by veterinarians in 2021, while there more was taken from the stock in 2022. However, some antibiotic classes (quinolones and polymyxins) show a strongly deviating result in terms of sales/usage coverage compared to the previous four years. This calls for **caution when interpreting the results**. Since 2022, the new European Veterinary Medicinal Products Regulation allows antibiotics to be purchased directly from the marketing authorisation holder and from abroad. Initiatives are planned to adapt the data collection in due course to better cover the different purchasing channels. The **expansion of the data collection** with new animal species and categories will also shed better light on the relationship between antibiotics sold and used in animals.

Looking at the **evolution of the number of treatment days (BD_{100}) at species level**, calculated from SANITEL-MED usage data, between 2021 and 2022, we see a **decrease in the number of treatment days in pigs (-28.2 %) and veal calves (-9.8 %)**, but an **increase of 11 % in poultry**, more specifically in **broilers**. Compared to 2018, results are still positive in all animal species, with decreases of more than -40 %. The farm-level results confirm these trends. In the **pig sector, the use of antibiotics is decreasing in all animal categories**. In **suckling piglets**, the **median BD_{100} has decreased by -44.5 %** compared to 2021 to a level of **0.91**. In **weaned piglets**, the decrease in the **median BD_{100} is -22.7 % to a value of 9.89**. A decrease of **-23.8 % is observed in fattening pigs, with a median BD_{100} of 1.89**, and **in sows the median BD_{100} was 0.27** in 2022, which is a decrease of **-18.2 %**. These very positive results are reflected in an **optimistic outlook regarding the reduction paths**. Even after the adjustment of threshold values at the beginning of 2023, the number of farms with a red benchmark colour score remains within limits and the number of **alarm users** was approximately **4.5 %** at the end of 2022. In **veal calves**, antibiotic use also **decreased** across the entire benchmark population in 2022, with a -**5.1 % reduction of the median BD_{100} to a value of 15.49**.

This is an encouraging result, but **major challenges remain** in this sector with regard to the reduction pathway, as there were **21 % of farms with a red benchmark colour score and almost 14 % of alarm users** after adjusting the threshold values at the beginning of 2023. Although **broilers** are experiencing a **setback**, with an increase across the entire benchmark group and a **median BD_{100} value of 3.88, which is 10.2 % higher than in 2021**, there is no cause for alarm as there are still very few farms (< 1 %) with a red benchmark colour score and the **number of alarm users is thus correspondingly very low (0.1 %)**. However, an extra critical note has to be made in broiler chickens, since the **use of quinolones increased significantly again in 2022**. Finally, in **laying hens**, use decreased further to a **median BD_{100} of 1.2 (-24.5 % compared to 2021)**. Overall, these results indicate that the species-specific reduction pathways have clearly contributed to the reduction in total use.

In **dairy cattle, it is positive to note that the use of intramammary products decreased further in 2022**. However, this decrease was **again mainly due to a decrease in the use of udder applications for the treatment of clinical mastitis**, while the use of drying off preparations remained relatively stable.

In **dogs and cats**, the **use of antibacterial products** exclusively authorised for use in dogs and cats **has decreased by -5.0 % compared to 2021**. Compared to 2014, there remains an increase of +24.8 %. However, due to the absence of a good overview of the total population of dogs and cats, it is difficult to estimate whether this increase is a result of the increase in the population or in the use of antibiotics. **The use of the red antibiotics in dogs and cats also decreased further in 2022.**

With regard to the reduction targets, it is **extremely positive that the general target of -50 % set for 2020 was amply achieved**. With the total reduction of -58.2 %, even the target for the end of 2024 (-65 %) does not seem far off. In addition, the 2024 targets for premixes and colistin have already been achieved: sales of premixes fell by -83.5 % compared to the reference year 2011, well above the -75 % target that was set for the end of 2024; sales of colistin fell by -55.3 % in 2022 compared to 2021, to a level of 0.52 mg/kg biomass, well below the target of 1 mg/kg biomass at the end of 2024. A fault on these positive results is the increase in the use of the “red” molecules of 1.1 %, even though the total reduction compared to the reference year 2011 is still -82.7 % and therefore still exceeds the target of -75 %.

Conclusion

Overall, the analysis of the antibiotic sales and usage data in 2022 shows positive results, with several targets met or within reach. Special points of attention are the use of critically important antibiotics, and the overall antibiotic use in the veal calf sector. Sustained efforts and adjustments to the data collection, including an expansion of the data collected, will be important in order to be able to take the necessary steps in the coming years to further reduce the use of antibiotics in animals.

SAMENVATTING

Het jaarlijkse BelVet-SAC-rapport wordt nu voor de veertiende keer gepubliceerd en beschrijft de resultaten van het antibioticumgebruik bij dieren in België in 2022 en de evolutie ervan sinds 2011. Voor het vijfde jaar op rij combineert het rapport verkoopdata (verzameld bij verdelers en mengvoederfabrikanten) en gebruiksdata (verzameld op het niveau van de veehouderij), dit maakt een meer gedetailleerde studie van het gebruik per diercategorie mogelijk.

Met een consumptie van 61,3 mg antibiotica/kg biomassa werd in 2022 een recorddaling van -24,5 % opgetekend in vergelijking met 2021. Deze daling situeerde zich zowel in de 'farmaceuticals' (-23,3 % mg/kg) als in de antibacteriële premixen (-36,0 % mg/kg). Met deze daling is sinds 2011 een cumulatieve daling van -58,2 % bereikt.

De vergelijking van de verkoop- en gebruiksdata toont dat het verschil tussen deze twee in 2022 sterk is afgenomen in vergelijking met 2021, tot 32 ton, het laagste niveau sinds de start van de collectie van de gebruiksdata. Dit ondersteunt de suggestie uit het vorige BelVet-SAC-rapport dat er in 2021 sprake was van een 'aanvulling van de voorraad door dierenartsen, terwijl er in 2022 dan meer uit de voorraad werd gehaald. Sommige antibioticaklassen (quinolones en polymyxines) vertonen echter een sterk afwijkend resultaat op het vlak van dekking van verkoop/gebruik in vergelijking met de vorige vier jaren. Dit vraagt om voorzichtigheid bij de interpretatie van de resultaten. De nieuwe Europese Verordening inzake geneesmiddelen voor diergeneeskundig gebruik laat sinds 2022 toe dat antibiotica rechtstreeks in het buitenland worden aangekocht. Er zijn initiatieven gepland om de datacollectie op termijn aan te passen, zodat de verschillende aankoopkanalen beter zullen worden gedekt. Ook de uitbreiding van de datacollectie met nieuwe diersoorten en categorieën zal een beter licht werpen op de relatie tussen de verkochte en de gebruikte antibiotica bij dieren.

Als we kijken naar de evolutie van het aantal behandeldagen (BD_{100}) op diersoortniveau, berekend uit de Sanitel-Med-gebruiksdata, dan zien we tussen 2021 en 2022 een daling in behandeldagen bij varkens (-28,2 %) en vleeskalveren (-9,8 %) maar een stijging van 11 % bij pluimvee, meer bepaald bij braadkippen. Sinds 2018 zijn de resultaten in alle diersoorten wel nog steeds allemaal positief, met dalingen van iets meer dan -40 %. De resultaten op bedrijfsniveau bevestigen deze trends. In de varkenssector daalt het gebruik van antibiotica in alle diercategorieën. Bij de zuigende biggen is de mediane BD_{100} gedaald met -44,5 % ten opzichte van 2021 naar een niveau van 0,91. Bij de gespeende biggen bedraagt de daling van de mediane BD_{100} -22,7 % tot een waarde van 9,89. Bij de vleesvarkens wordt een daling van -23,8 % vastgesteld, met een mediane BD_{100} van 1,89, en bij de zeugen was in 2022 de mediane BD_{100} 0,27 wat een daling betekent van -18,2 % is. Deze zeer positieve resultaten weerspiegelen zich in een optimistisch vooruitzicht in relatie tot de reductiepaden. Zelfs na de aanpassing van de grenswaarden begin 2023 blijft het aantal bedrijven met een rode benchmark-kleurscore binnen de perken en bedroeg het aantal alarmbedrijven eind 2022 ongeveer 4,5 %. Bij vleeskalveren daalde het antibioticagebruik in 2022 ook doorheen de ganse benchmarkpopulatie, met voor de mediane BD_{100} een daling van -5,1 % tot een waarde van 15,49.

Dit is een bemoedigend resultaat maar er blijven grote uitdagingen in deze sector met betrekking tot het reductietraject, aangezien er na aanpassing van de grenswaarden begin 2023, 21 % bedrijven met een rode benchmark-kleurscore en bijna 14 % alarmgebruikers waren. De braadkippen kennen weliswaar een terugval, met een stijging doorheen de ganse benchmarkgroep en een mediane BD_{100} waarde van 3,88 die 10,2 % hoger uitvalt dan in 2021, maar er is geen reden voor alarm aangezien er nog steeds erg weinig bedrijven (< 1 %) met een rode benchmark-kleurscore zijn en dus het aantal alarmgebruikers erg laag is (0,1 %). Er moet echter een kritische kanttekening worden geplaatst bij de braadkippen, aangezien het gebruik van de quinolones opnieuw fors toenam in 2022. Bij de leghennen ten slotte daalde het gebruik verder tot een mediane BD_{100} van 1,2 (-24,5 % t.o.v. 2021). In het algemeen tonen deze resultaten dat de diersoortspecifieke reductietrajecten die werden opgesteld een meerwaarde opleveren en duidelijk hebben bijgedragen aan de totale reductie.

Bij melkvee is het positief om vast te stellen dat het gebruik van intramammaire producten verder daalde in 2022. Deze daling was echter opnieuw hoofdzakelijk een gevolg van een daling van het gebruik van uierpreparaten voor de behandeling van klinische mastitis terwijl het gebruik van droogzetpreparaten relatief stabiel bleef.

Bij honden en katten is het gebruik van antibacteriële producten, die enkel voor het gebruik in deze species zijn vergund, met -5,0 % gedaald in vergelijking met 2021. In vergelijking met 2014 blijft er weliswaar een toename van +24,8 %. Door het ontbreken van een goed overzicht van de totale populatie honden en katten is het echter moeilijk om in te schatten of deze stijging een gevolg is van de toename van de populatie dan wel van het gebruik van antibiotica. Ook het gebruik van de rode antibiotica in honden en katten nam verder af in 2022.

Wat de reductiedoelstellingen betreft, is het uitermate positief dat de algemene doelstelling van -50 % die voor 2020 werd gesteld ruim werd behaald. Met de totale gerealiseerde reductie van -58,2 % lijkt zelfs de doelstelling voor eind 2024 (-65 %) niet meer veraf. Daarbovenop werden de doelstellingen van 2024 voor premixen en colistine nu al behaald: de verkoop van premixen zakte ten opzichte van referentiejaar 2011 al met -83,5%, al een stuk boven de -75% die vooropgesteld werd tegen eind 2024; de verkoop van colistine ging in 2022 met -55,3 % naar omlaag in vergelijking met 2021, tot een niveau van 0,52 mg/kg biomassa, een stuk onder de doelstelling van 1 mg/kg biomassa eind 2024. Een smet op deze positieve resultaten is de stijging in het gebruik van de "rode" moleculen met +1,1 %, hoewel de totale reductie in vergelijking het referentiejaar 2011 nog steeds -82,7 % bedraagt en dus nog steeds het doel van -75 % overstijgt.

Conclusie

De resultaten van de antibioticumverkoop en gebruiksdata in 2022 tonen in het algemeen positieve resultaten, met verschillende doelstellingen behaald of binnen handbereik. Aandachtspunten zijn het gebruik van kritisch belangrijke antibiotica, en het algemene antibioticagebruik in de vleeskalversector. Aanhoudende inspanningen en aanpassingen van de datacollectie, waaronder een uitbreiding van de verzamelde data, zullen belangrijk zijn om de volgende jaren de noodzakelijke stappen te kunnen zetten naar een verdere reductie van het antibioticagebruik bij dieren.

RÉSUMÉ

Pour la quatorzième fois, le rapport annuel BelVet-Sac est publié et décrit les résultats de l'utilisation des antibiotiques chez les animaux en Belgique en 2022 et son évolution depuis 2011. Pour la cinquième année d'affilée, le rapport combine à la fois les données de vente (compilées au niveau des distributeurs et des fabricants d'aliments composés) et les données d'utilisation (compilées au niveau de l'élevage), permettant une étude plus en détail de l'utilisation des antibiotiques par catégorie d'animaux.

Avec une consommation de 61,3 mg d'antibiotiques/kg de biomasse, on constate en 2022 une baisse record de -24,5 % par rapport à 2021. Cette baisse s'observe aussi bien au niveau des produits pharmaceutiques (-23,3 % mg/kg) que des prémélanges antibactériens (-36,0 % mg/kg). Avec cette baisse, on constate depuis 2011 une chute cumulative de -58,2 %.

La comparaison des données de ventes et d'utilisation montre que la différence entre les deux a fortement diminué en 2022 par rapport à 2021, pour atteindre 32 tonnes, soit le niveau le plus bas depuis le début de la collecte des données d'utilisation. Cela confirme la suggestion du précédent rapport BelVet-SAC selon laquelle il y a eu une reconstitution du stock par les vétérinaires en 2021, tandis qu'une plus grande partie du stock a été prélevée en 2022. Toutefois, certaines classes d'antibiotiques (quinolones et polymyxines) affichent un résultat sensiblement différent en termes de couverture des ventes/utilisation par rapport aux quatre années précédentes. Une prudence lors de l'interprétation des résultats est donc requise. Le nouveau règlement européen sur les médicaments à usage vétérinaire autorise l'achat direct d'antibiotiques à l'étranger depuis 2022. Des initiatives sont prévues pour adapter la collecte de données à terme, afin de mieux couvrir les différents canaux d'achat. L'élargissement de la collecte de données à de nouvelles espèces et catégories animales permettra également de mieux comprendre le lien entre les antibiotiques vendus et utilisés chez les animaux.

En examinant l'évolution du nombre de jours de traitement (BD100) au niveau de la catégorie d'animaux, calculée à partir des données d'utilisation Sanitel-Med, nous observons entre 2021 et 2022 une diminution des jours de traitement chez les porcs (-28,2 %) et les veaux de boucherie (-9,8 %) mais une hausse de 11 % chez les volailles, plus précisément chez les poulets de chair. Depuis 2018, les résultats pour toutes les espèces sont toujours positifs, avec des diminutions d'un peu plus de -40 %. Les résultats au niveau de l'exploitation confirment ces tendances. Dans le secteur porcin, l'utilisation des antibiotiques baisse dans toutes les catégories d'animaux. Concernant les porcelets allaités, le BD100médian a baissé de -44,5 % par rapport à 2021 pour atteindre 0,91. Chez les porcelets sevrés, la baisse du BD100 médian est de -22,7 % pour atteindre 9,89. Dans le secteur des porcs de boucherie, on constate une diminution de -23,8 %, avec un BD100médian de 1,89, et pour les truies, le BD100 médian en 2022 était de 0,27, soit une baisse de -18,2 %. Ces résultats très positifs se traduisent par des perspectives optimistes en ce qui concerne les trajectoires de réduction. Même après l'ajustement des valeurs limites au début de l'année 2023, le nombre d'exploitations étant en zone rouge reste contenu et le nombre d'exploitations en alerte à la fin de l'année 2022 était d'environ 4,5 %. Chez les veaux de boucherie, l'usage d'antibiotiques a baissé également en 2022 parmi l'ensemble de la population du benchmark, avec une baisse de -5,1 % pour le BD100 médian qui atteint une valeur de 15,49.

C'est un résultat encourageant, mais des défis majeurs restent à relever dans ce secteur en ce qui concerne la trajectoire de réduction, car après l'ajustement des valeurs limites au début de 2023, 21 % des exploitations étaient en zone rouge et près de 14 % étaient des utilisateurs en alerte. Bien que les poulets de chair connaissent un déclin, avec une augmentation dans l'ensemble du groupe de référence et un BD100 médian de 3,88, soit 10,2 % de plus qu'en 2021, il n'y a pas lieu de s'alarmer car il y a encore très peu d'exploitations (< 1 %) en zone rouge et le nombre d'utilisateurs en alerte est donc très faible (0,1 %). Il convient d'accorder toutefois une attention particulière aux poulets de chair, car l'utilisation des quinolones a de nouveau fortement augmenté en 2022. Enfin, dans les exploitations de poules pondeuses, l'utilisation a continué à diminuer jusqu'à un BD100 médian de 1,2 (-24,5 % par rapport à 2021). Dans l'ensemble, ces résultats montrent que les trajectoires de réduction spécifiques aux espèces animales qui ont été établies apportent une valeur ajoutée et contribuent clairement à la réduction globale.

Dans les exploitations laitières, un élément positif que nous constatons est que l'usage de produits intramammaires a poursuivi sa baisse en 2022. Cependant, cette baisse s'explique à nouveau principalement par une diminution de l'utilisation de préparations mammaires pour le traitement de la mastite clinique tandis que l'utilisation de préparations à des fins de tarissement est restée relativement stable.

Chez les chiens et chats, l'utilisation de produits antibactériens, autorisés uniquement pour certaines espèces, a baissé de -5,0 % comparé à 2021. Par rapport à 2014, l'augmentation reste vraisemblablement de +24,8 %. En l'absence d'une bonne vue d'ensemble de la population totale des chiens et chats, il est difficile de juger si cette hausse est due à une augmentation de la population ou de l'utilisation des antibiotiques. L'utilisation d'antibiotiques rouges chez les chiens et les chats a également diminué en 2022.

En ce qui concerne les objectifs de réduction, il est extrêmement positif à tel point que l'objectif global de -50 % fixé pour 2020 a été largement atteint. Avec une réduction totale de -58,2 %, même l'objectif de fin 2024 (-65 %) ne semble plus très éloigné. En outre, les objectifs de 2024 pour les prémélanges et la colistine ont déjà été atteints : les ventes de prémélanges ont déjà chuté de -83,5 % par rapport à l'année de référence 2011, dépassant déjà largement l'objectif de -75 % d'ici à la fin 2024 ; les ventes de colistine ont diminué de -55,3 % en 2022 par rapport à 2021, pour atteindre un niveau de 0,52 mg/kg de biomasse, bien en deçà de l'objectif de 1 mg/kg de biomasse d'ici à la fin 2024. Ces résultats positifs sont ternis par l'augmentation de l'utilisation des molécules « rouges » de + 1,1 %, bien que la réduction totale par rapport à l'année de référence 2011 soit toujours de -82,7 % et dépasse donc l'objectif de -75 %.

Conclusions

Les résultats des données sur les ventes et l'utilisation d’antibiotiques en 2021 affichent globalement des résultats positifs, plusieurs objectifs ayant été atteints ou étant à portée de main. Les points d’attention sont l’utilisation d’antibiotiques d’importance critique et l’utilisation générale d’antibiotiques dans le secteur des veaux de boucherie. Des efforts soutenus et des ajustements dans la collecte de données, y compris un élargissement des données récoltées, seront importants pour prendre les mesures nécessaires en vue de réduire davantage l'utilisation d'antibiotiques chez les animaux dans les années à venir.

PREFACE

Antibacterial products are valuable tools in the preservation of animal health and animal welfare and must be used responsibly to prevent animal suffering and possibly even save lives. However, the use of antibacterial products invariably leads to the risk of selection of bacteria that are resistant against the substance used. Resistance can then spread in both animal and human populations and the environment. Indeed, consumption of veterinary antibacterial medicines selects for antibacterial resistance in bacteria, leading to potential therapy failure in animals. Additionally, the transfer of resistance genes between bacteria and the transfer of resistant bacteria from animals to humans and vice versa via direct or indirect contact, jeopardizes human health.

Given the importance of securing public as well as animal health, and since antibacterial use in animals is by far the leading driver for veterinary antibacterial resistance, it is crucial to measure the level of veterinary antibacterial use and antibacterial resistance. Moreover, at the European level, EMA (European Medicines Agency) collects data on sales of antibacterial products in veterinary medicine in the framework of the ESVAC (European Surveillance of Veterinary Antibacterial Consumption) project. Therefore, the data collected and presented in this report fit into Belgium's European commitments. This fourteenth BelVet-SAC report gives an overview of the consumption of veterinary antibacterial products in Belgium in 2022 and describes the evolution since 2011.

CONTENTS

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The 2022 data collection and analysis are 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) (use data) under the authority of the Belgian Federal Agency for Medicines and Health products (FAHMP).

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MATERIALS AND METHODS

ANTIBACTERIAL SALES DATA

Data collection

a) Antibacterials for veterinary use

i. Antibacterial pharmaceuticals

The sales data of all veterinary medicinal products (VMPs) in every pharmaceutical formulation containing antibacterial active substances and authorised on the Belgian market were aggregated. These data were requested from the 20 distributors that were licensed and actively supplied veterinarians and pharmacies in Belgium with veterinary medicines during the observation period. The 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 a register of all sales and provide this register to the competent Belgian authority (Federal Agency for Medicines and Health Products, FAMHP) when requested. The distributors were requested by letter dd. December 2022 to upload the required data via a secured web-application (www.belvetsac.ugent.be). These required data consisted of **all antibacterial VMPs that were sold in the year 2022 to a veterinarian or pharmacist in Belgium**. In Belgium, veterinary antibacterial products are only available on prescription or by delivery from the veterinarian. Belgian veterinarians can use antibacterial products both in their daily practice or sell them to animal owners (fig. 1). Sales from one distributor to another are excluded from the input data to prevent double counting.

A pre-filled list of antibacterial VMPs authorised and commercialized in Belgium was provided, together with their marketing authorization holder, national reference code (cti-ext), pharmaceutical formulation and package form. The distributor only needed to provide the number of packages sold for each product for the given year.

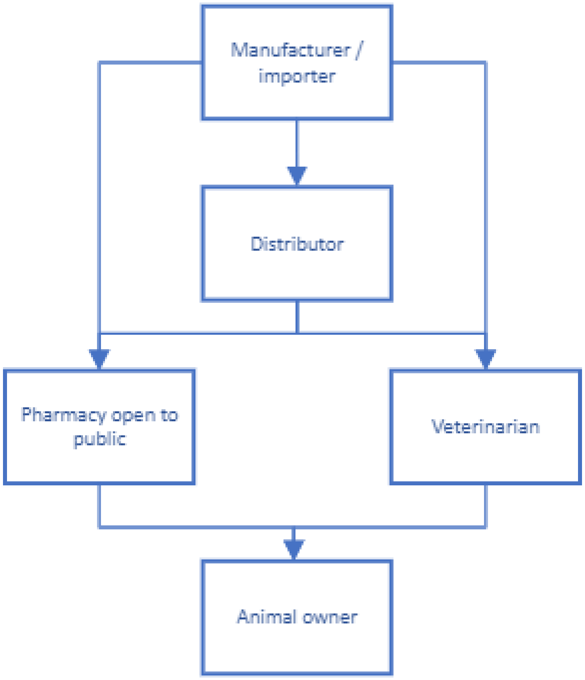


Figure 1. Distribution of veterinary medicinal products (VMPs) in Belgium.

ii. Antibacterial premixes

As premixes can be purchased by feed mills directly from the manufacturers or distributors (fig. 2) data on antibacterial premixes for use in medicated feed were collected separately. This was done by contacting all Belgian compound feed producers, so-called feed mills, that were licensed to produce medicated feed[1] (n=38). The feed mills were asked by letter dd. December 2022 to upload the required data, on the 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. The data on medicated feed containing antibacterial premixes delivered at Belgian farms in 2022 was submitted via the same secure web-application[2]. Producers of medicated feed were asked to provide **sales data on antibacterial premixes as well as on ZnO containing premixes for the year 2022**. A list of authorised and commercialized antibacterial premixes was provided. Antibacterial and ZnO premixes can only be incorporated into medicated feed when prescribed by a veterinarian.

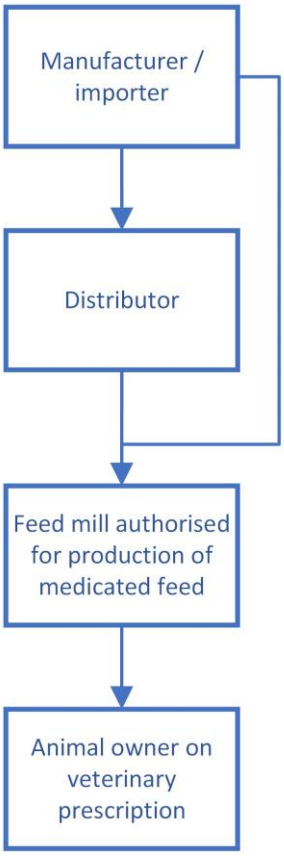


Figure 2. Distribution of veterinary premixes in Belgium.

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

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[3]. The ATCvet codes included in each antibacterial class are listed in Annex I.

The BelVet-SAC data collection covers **all veterinary antibacterial medicines** (Table 1). No antibacterial products are excluded, which contrasts with the ESVAC reporting system where antibacterial products for dermatological use and for use in sensory organs are not reported. This explains why the sales data as presented in this report may slightly differ from what is reported for Belgium in the ESVAC report.

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
Antibacterial agents for dermatological use	QD06A
Antibacterial agents for intrauterine use	QG51AA
Antibacterial agents for systemic use	QJ01
Antibacterial agents for intramammary use	QJ51
Antibacterial agents for use in sensory organs	QS01AA
Antibacterial agents for use as antiparasitic	QP51AG

b) Animal population

Animal population data to calculate the produced biomass were derived from the Eurostat website[4].

From these animal population data, the biomass (in kg) was calculated according to Grave[5] 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 distributors was registered in a database that was developed for that purpose that contained additional product information, as per ESVAC 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

[3] https://www.whocc.no/atcvet/atcvet_index/
[4] http://ec.europa.eu/eurostat/data/database
[5] 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

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

All sales data on antibacterial premixes reported by distributors were excluded to prevent double counting. To ensure total coverage of antibacterial VMP sales in Belgium, data concerning antibacterial premixes from medicated feed producers were added to the data on pharmaceuticals from distributors.

As in the previous reports (BELVET-SAC 2007-2021)[6], yearly sales figures were related to the biomass as a yearly adjusted denominator according to the methodology described by Grave et al. (2010). The animal species included in the biomass calculation account for the vast majority of the animal biomass in Belgium (estimated to be 93% of the total animal biomass in Belgium). However, the calculation of the biomass does not take other animal species in consideration, such as horses, rabbits and companion animals (dogs, cats, …), estimated to be 7% of the total animal biomass in Belgium, whereas the collected sales data on antibacterial VMPs also covers the sales for use in these species. The biomass calculation also includes animals that were slaughtered in Belgium, but raised in other countries and it excludes animals that were 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[7]. The datasets do not provide the exact same amounts 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 were compared with the data obtained from the marketing authorization holders collected in the framework of the antibiotic tax, as well as with the reported use data in Sanitel-Med.

b) Internal data validation

Each data entry of the distributor or compound feed producer, was compared with the data entry of the previous years by the same company. If large, unexpected, discrepancies were observed between the data provided in the subsequent years, data validity was further investigated and corrected if needed.

[6] http://www.belvetsac.ugent.be/
[7] 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. Sanitel-Med, developed and maintained by the FAMHP, is accessible as a web application or through automated data transfer using xml (webservices).

Firstly, the veterinarian creates 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). Secondly, one or more 'notifications' are added to this Medicinal Delivery Document, 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 of the legally obliged animal species that can be selected are:
  - Pigs:
    - sows (PIGB);
    - 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 or the kg premix needs to be registered and using decimals is also possible.

Products used off-label need to be registered from the same list, if possible. Products used through cascade, products that are authorised but not commercialized 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 used quantity of antibacterial active substance and the BD_{100}-indicator (see below).

Veterinarians can register the data at any moment under the condition that all data from a given quarter need to be registered on the 14th day of the following quarter at the latest. The farmer or responsible of the animals must check the correctness of the data from a given quarter at the latest on the final day of the first month of the following quarter. These 'deadlines' are the 'Data-Lock-Points' (DLP), hence, there are four DLP in a year for veterinarians and farmers.

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 cover data on the use of antibacterial products at 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 will 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.

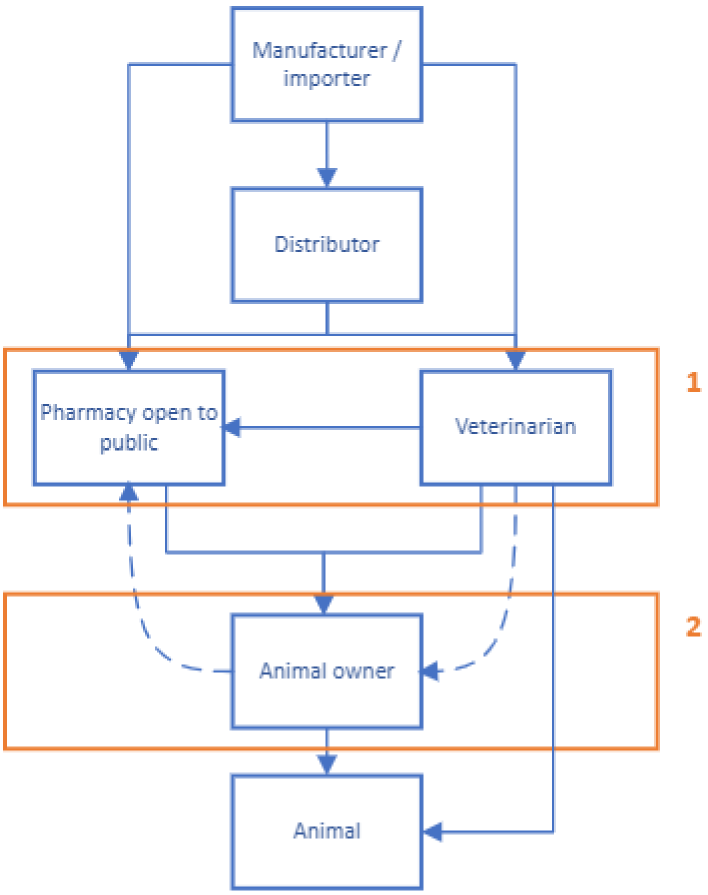


Figure 3. Origin of Sanitel-Med data concerning farm-level use of antibacterial pharmaceuticals. Veterinarians can directly administer antibacterials to the animals, deliver the antibacterials to the farmer (after which the farmer administers them to the animals), or prescribe the antibacterials which can then be bought in a pharmacy (dashed line) or from a feed mill (in case of premixes, not shown in the figure). The registration in Sanitel-Med occurs at two levels (in orange): 1. the veterinarian administering/delivering/prescribing the antibacterial registers this in the system, and 2. the animal owner that checks and validates the registrations.

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 extracted by AMCRA through a secured online business object tool provided by the Federal Agency for the Safety of the Food Chain (FASFC).

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 (cf. further, Calculation of the indicator BD_{100}). The number is deduced from identification and registration data present in the SANITEL[8] -database (owned and managed by the 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, 10th and 20th day of each month and the 1st day of the subsequent month.

ii. Poultry farms

As of 2019, the SANITEL-capacity data of a poultry facility are calculated as the sum of the SANITEL-capacity data of the corresponding poultry sanitary units of that facility.

For 2018, preference was given to the yearly FASFC 'Biosecurity-survey' capacity numbers above SANITEL-data. These were 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 in SANITEL whenever the capacity changes in practice, 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 (cf. 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 sanitary units is accessible to AMCRA as a report, based on a query developed and maintained by the FAMHP, that can be extracted by AMCRA through a secured online business object tool provided by the FASFC.

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

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 extracted by AMCRA through a secured online business object tool provided by the FASFC.

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; for the latter only 'numerator data' (the quantities of antibacterials used) is considered, hence, a denominator is not taken into account.
- The second part focusses on the evolution of the Sanitel-Med use data at 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 numerator 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 possibly erroneous and have not been confirmed as being correct. For the third part, the data were additionally subjected to 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 antibacterial active substance used

The quantity in mg of the antibacterial active substance used is calculated per Sanitel-Med notification, using the formula

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

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 antibacterial active substance per unit of product and is taken from the products' summary of product characteristics (SPC). If the active substance unit is given in international units, the conversion factors provided on the webpage of the AMCRA data analysis unit[9] are used to recalculate the quantity in mg. If the product contains more than one antibacterial active substance, the calculation is done for each substance and the sum is made.

For premixes, if the number of packages of the premix is registered, this is first recalculated to kg premix used. From the quantity in kg premix used, the quantity antibacterial active substance used is calculated by multiplying with the mg active substance per kg premix, obtained from the SPC.

After calculating the total mg of antibacterial active substance used per notification, these 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.

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

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 or through injection, and the daily dose (in mg) per animal for products administered locally or topically. The number of DDDA$_{bel}$ used (# DDDA$_{bel}$) is calculated per notification using the formula

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

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 formulated per animal species [10]. These lists also contain the LA$_{bel}$ (Long-Acting factor defined for Belgium) of each product. This LA$_{bel}$ factor corrects for the longer duration of action of certain products in the calculation of the BD$_{100}$ (cf. 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[9].

b) Determination of the denominator

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

The national number of animals and the kg animal at risk (for antibacterial treatment) per species is calculated from the yearly average number of animals in Belgium per animal category, consulted in the Statbel database[11]. The categories retrieved from that database (these are the categories included in Sanitel-Med) and the standard weights (source: EMA 2013[12]) to calculate the corresponding kg at risk are shown below:

Piglets of <20 kg	12 kg	Broilers	1 kg	Bovines < 1 year to be slaughtered as calves	80 kg
Pigs 20-50 kg + fatteners	50 kg	Laying hens	2 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 [12]):

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				

[10] https://www.amcra.be/nl/analyse-antibioticagebruik/
[11] https://statbel.fgov.be/nl/themas/landbouw-visserij/land-en-tuinbouwbedrijven#figures
[12] https://www.ema.europa.eu/en/documents/scientific-guideline/revised-european-surveillance-veterinary-antimicrobial-consumption-esvac-reflection-paper-collecting_en.pdf

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 antibacterial active substance used in each species is 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:

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

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 number of 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 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 reference population for benchmarking (cf. 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 is calculated by linking the veterinarian responsible for a use notification in Sanitel-Med to the veterinarian having a contract with the farm at the document date. In addition, the part of the antibacterial use (excl. ZnO) at farm level by a veterinarian who is not the contract veterinarian but who is linked to the veterinary practice to which the contract with the farm is allocated, as a legal person, is also determined.

Quality control for possibly erroneous notifications

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

- Intramammary or intrauterine products used in non-adult categories of pigs and cows (piglets, fatteners, calves);
- The number of packages is greater than one of a multi-package product for injection or cutaneous use;
- The number of packages is greater than 50;
- The administered number of packages is lower than the quantity needed to treat an animal of 1 kg (pigs), 0,042 kg (broilers), 2 kg (laying hens) and 35 kg (veal calves), according to the $DDDA_{bel;}$
- The BD_{100} calculated for a notification is higher than 100;
- The premix ppm is unlikely low or high (based on the product specific SPC’s).

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 as 'active' in Sanitel during the whole year. For poultry farms, more specifically, at least one sanitary unit needs 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 animal 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 (reliably) processed due to missing data or due to data considered unreliable (in pigs: no recent count date, or a recent count date but counted animals equalling zero) 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 still adjust the data. Farms that had notification errors that were not adjusted or confirmed as correct were excluded from the benchmarking reference population.

c) Empty stables

Pig farms with recent count data equalling zero for 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 populations.

d) Minimum herd size requirements

For the data until 2020 included, a minimum herd size was defined for all included animal categories, 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.

From 2021 onwards, these criteria were no longer taken into account to define the benchmarking populations of pigs.

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 pig farms, this is at species level (no notifications during the benchmarking period for all categories present at the farm). For farms with broilers, laying hens and veal calves, this is defined at animal category level (no notifications for an animal category during the benchmarking period).

RESULTS

ANTIBACTERIAL PRODUCTS SALES DATA

Response rate and data validation

All 20 distributors that were requested to deliver their sales data on veterinary antibacterial products sold in 2022 responded. One indicated to have stopped activities, therefore data were collected from 19 distributors. Of the 38 contacted compound feed producers, licensed to produce medicated feed, 33 indicated to have produced medicated feed and delivered the data on antibacterial premixes incorporated in medicated feed to be used in Belgium. The remaining five indicated they did not produced medicated feed. Based on the response rate data the coverage is assumed to be 100%.

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 2013 according to the commented compendium of the Belgian Centre for Pharmacotherapeutic Information[13].

Table 2. Armatorium of antibacterial products on the Belgian market from 2012 to 2022.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of Antibacterial pharmaceuticals on the market	294	298	339	329	323	325	326	308	327	346
Number of Antibacterial premixes on the market	23	21	21	19	16	18	13	15	14	13
Total number of Antibacterial products on the market	317	319	360	348	339	343	339	323	341	359

The only new antibacterial products registered on the market in the last nine years are products containing tildipirosin (2011), pradofloxacine (2011), fusidic acid (2014), thiamfenicol (2015) and cefadroxil (2019). The observed variation in available products is largely due to the marketing of new formulations or new generic products based on existing active substances. It is remarkable to see that the number of registered products is increasing although the total sales volumes are decreasing.

[13] www.bcfi-vet.be

Animal biomass produced in Belgium

The produced biomass was calculated based on the Eurostat data for the years 2017-2022 as described above (Table 3).

Table 3. Animal biomass produced in Belgium from 2017 to 2022.

Animal biomass	2017	2018	2019	2020	2021	2022
Meat (tonnes)						
Pork	1 044 560	1 073 120	1 038 916	1 098 710	1 140 740	1 032 200
Beef	281 540	277 310	263 749	254 500	247 060	238 140
Poultry	463 390	469 590	447 786	448 970	455 120	449 040
Sheep/goat	3 230	3 090	3 010	2 830	3 050	2 510
Total biomass from meat production	**1 792 720**	**1 823 110**	**1 753 487**	**1 805 010**	**1 845 970**	**1 719 380**
Dairy cattle						
Dairy cattle (number)	519 160	529 250	537 960	541 090	537 250	543 680
Dairy cattle metabolic weight (tonnes)	259 580	264 625	268 980	270 545	268 625	271 840
Total biomass (tonnes)	**2 052 300**	**2 087 735**	**2 022 450**	**2 075 555**	**2 114 595**	**1 993 730**
Evolution since previous year	**-0,76%**	**+ 1,73%**	**-3,13%**	**+2,63%**	**+1,88%**	**-5,7%**

A **decrease in biomass production of -5,7%** is observed between 2021 and 2022. Compared to the reference year 2011 a decrease of -2,3% is observed in the total biomass production in Belgium.

Total sales of antibacterial medicines for veterinary use in Belgium

The total sales of antibacterial products for veterinary use in Belgium is presented in Figure 4 in tonnes of antibacterial 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.

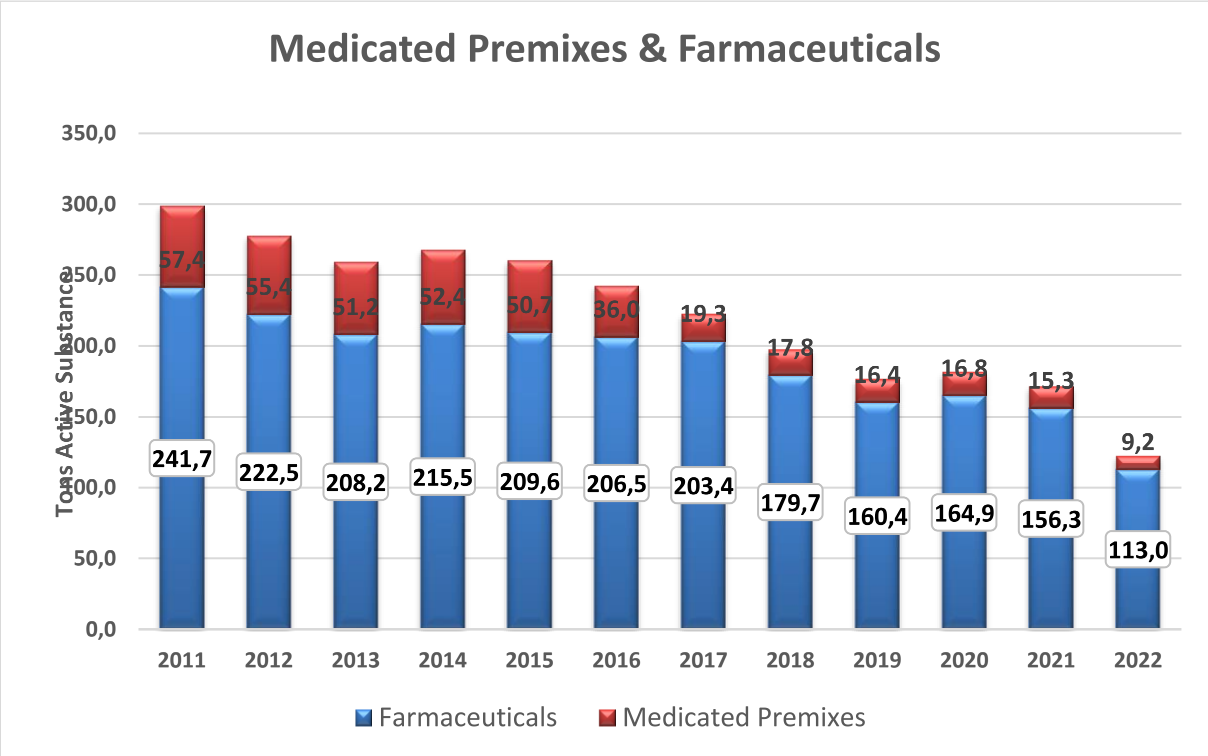


Figure 4. Total national sales of antibacterial compounds for veterinary use in Belgium for the years 2011-2022 (tonnes antibacterial active substance).

Between 2021 and 2022, there was a **decrease of -28,8%** in the total sales of antibacterial products in veterinary medicine in Belgium (122 196,1 kg in 2022 versus 171 595,5kg in 2021). The sales of antibacterial **pharmaceuticals decreased with -27,7%** between 2021 and 2022, and the sales of **antibacterial premixes decreased with -39,7%**. This is by far the largest drop in sales, both in percentages and absolute volumes, since the start of the data collection. **Since 2011 (reference year for reduction initiatives) a decrease of -59,1 % is realized in absolute volumes.**

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

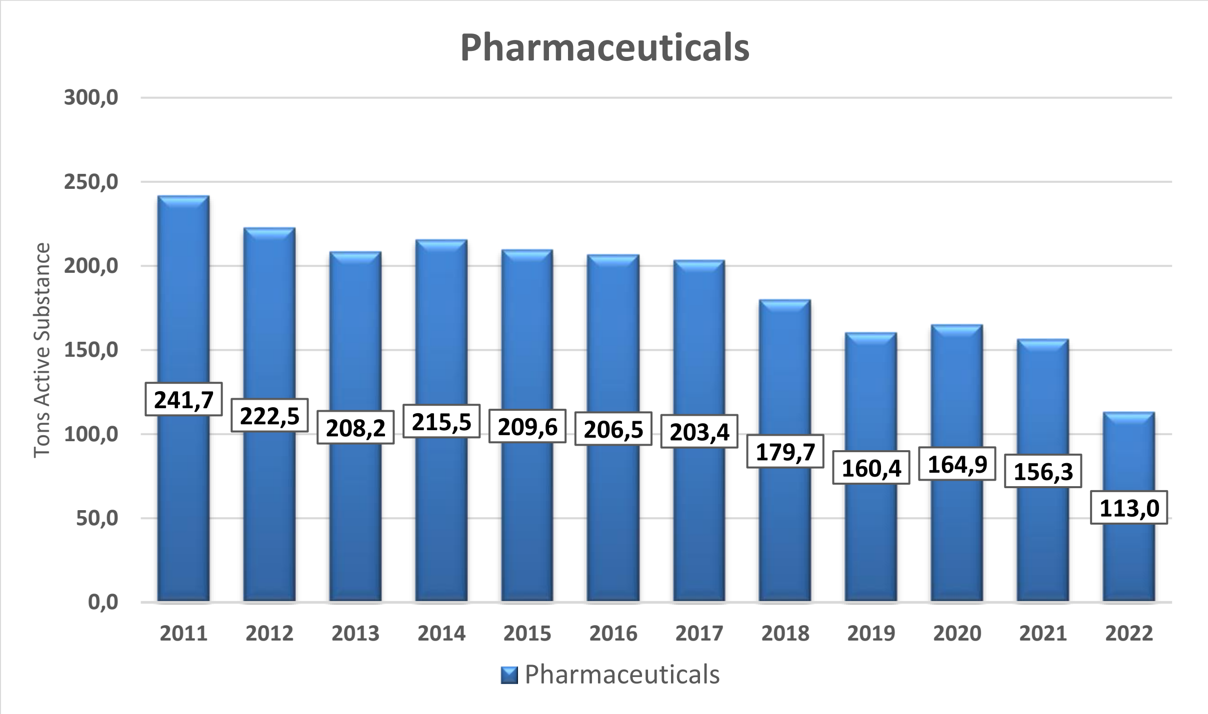


Figure 5. National sales of antibacterial pharmaceuticals for veterinary use in Belgium for the years 2011-2022 (tonnes active substance).

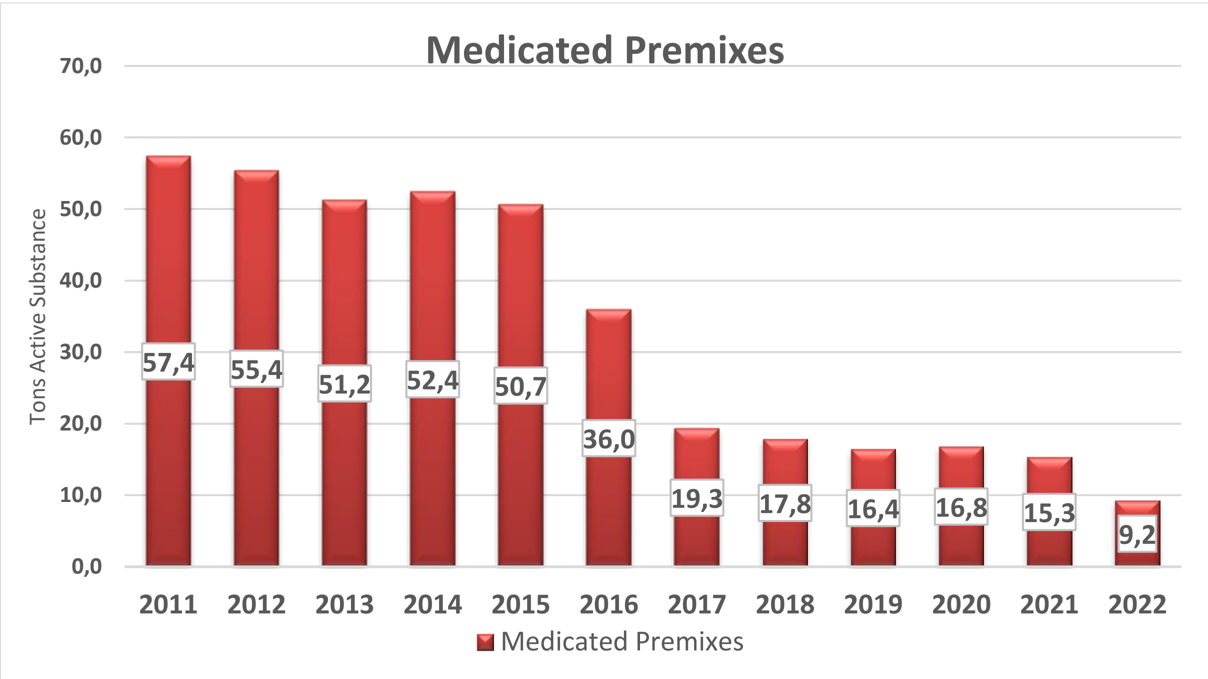


Figure 6. National consumption of antibacterial premixes in Belgium for the years 2011-2022 (tonnes active substance).

From September 2013, the use of Zinc oxide (ZnO) in therapeutic doses (corresponding to 2500 ppm of Zn) in piglets after weaning was allowed. After increased sales between 2013 (use during only one quarter) and 2015, a first decrease was observed in 2016 and continued since. In 2021, sales of ZnO ended as is presented in figure 7.

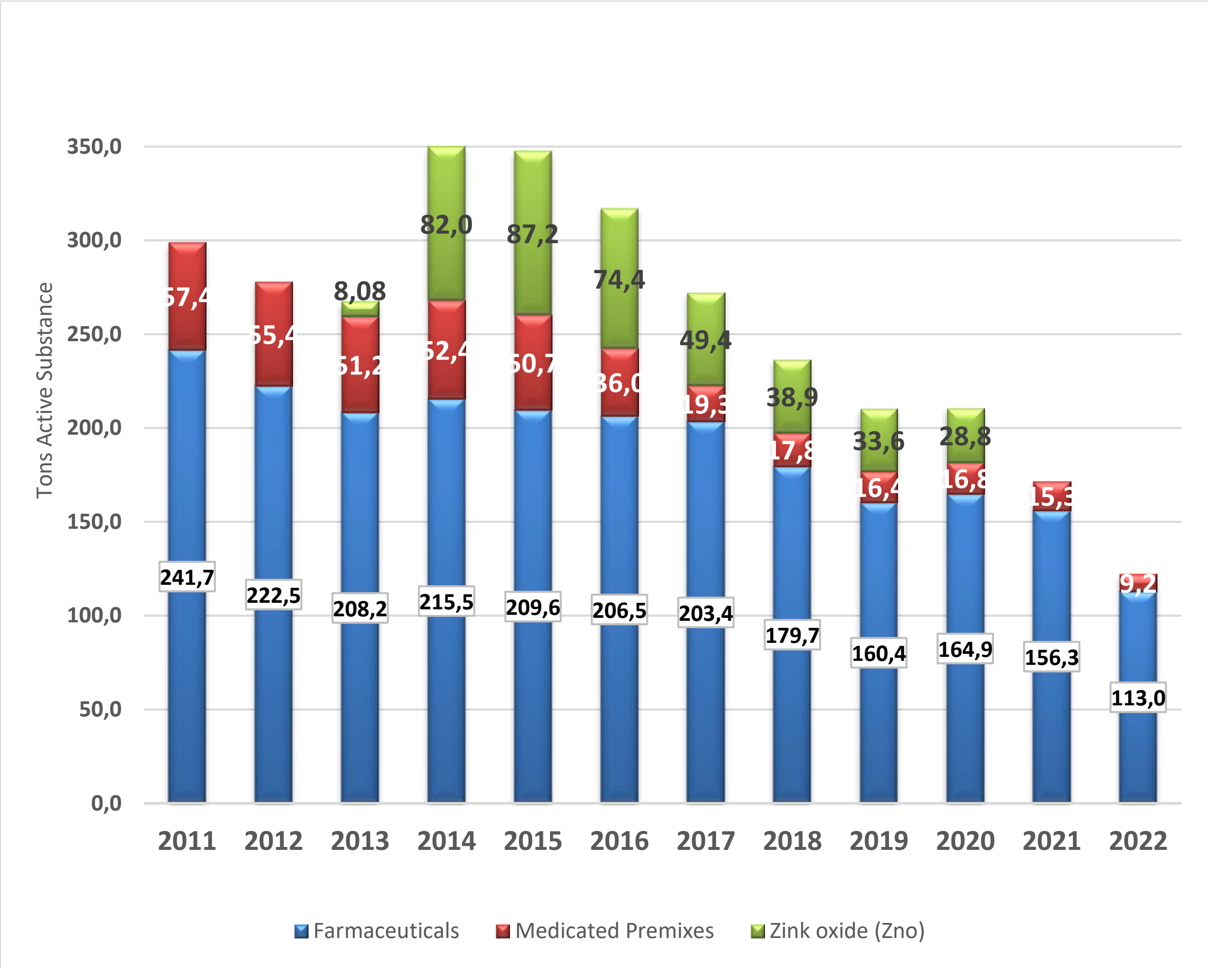


Figure 7. Total national sales of antibacterial compounds for veterinary use in Belgium plus the sales of ZnO for the years 2011-2022 (tonnes active substance).

Antibacterial sales versus biomass

As described above, the total biomass production in 2022 in Belgium has decreased with -5,7% in comparison to 2021. Consequently, the decreasing trends in sales observed in absolute values (kg) is partially tempered by the fact that this decreased volume of antibacterial products is used in a shrinking population. For 2021, the mg of active antibacterial substance used in relation to a kg biomass produced was 81,2 mg/kg whereas in **2022 this is 61,3 mg/kg.** This means **a decrease of -24,5% in comparison to 2021.** This is, both in percentages and absolute volumes, the largest drop in sales since the start of the BELVET-Sac reporting. Split up between the different pharmaceutical forms (premix vs other forms), a decrease of -23,3% is observed for the antibacterial pharmaceuticals and -36,0% for the antibacterial premixes.

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

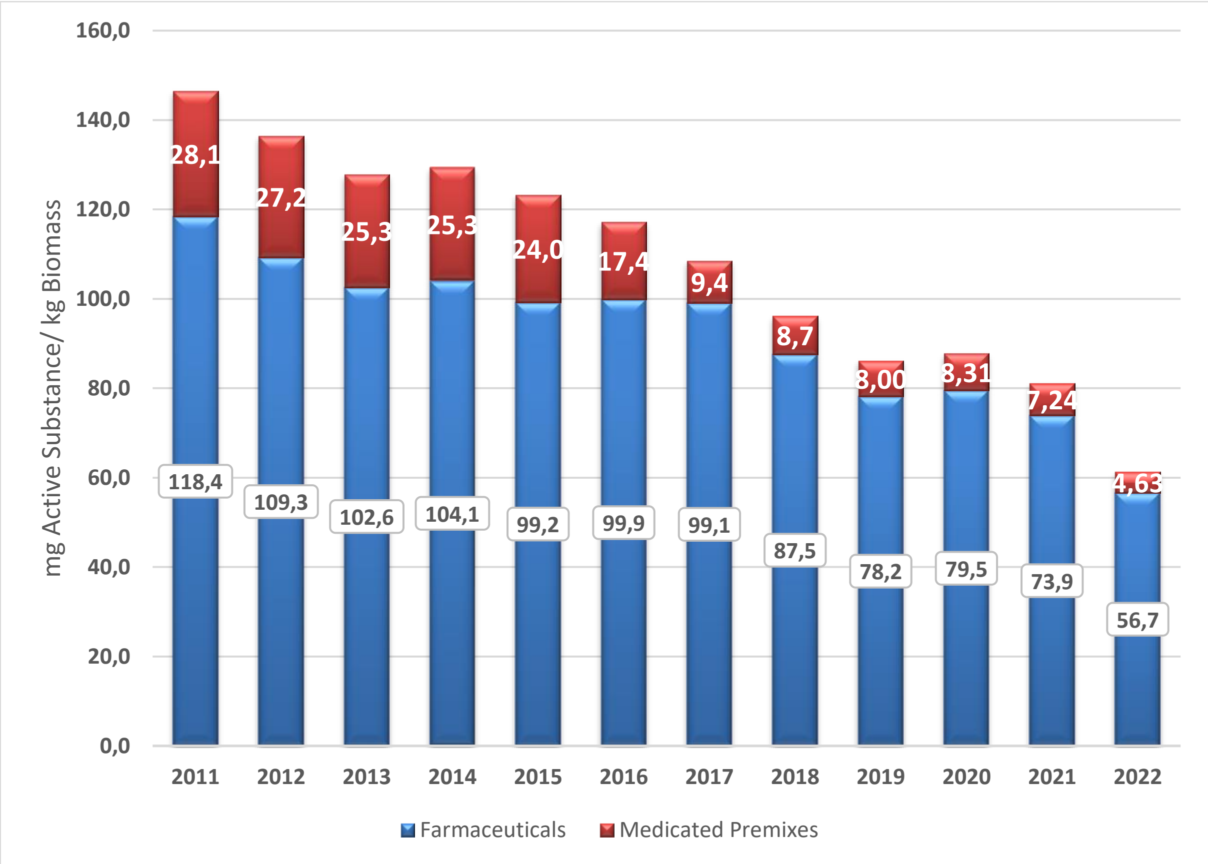


Figure 8. Total mg of active antibacterial substance used per kg biomass produced in Belgium for 2011-2022.

With **a decrease of -24,5%** in the amount of antibacterials sold per kg biomass in 2022, the descending trend observed since 2014, with the exception of 2020, is continued. When using 2011 as a reference (see the AMCRA 2020 objectives), **a cumulative reduction of -58,2% is achieved**, distributed in a reduction of -52,1% in antibacterial pharmaceuticals and -83,5% in antibacterial medicated premixes (Fig. 9).

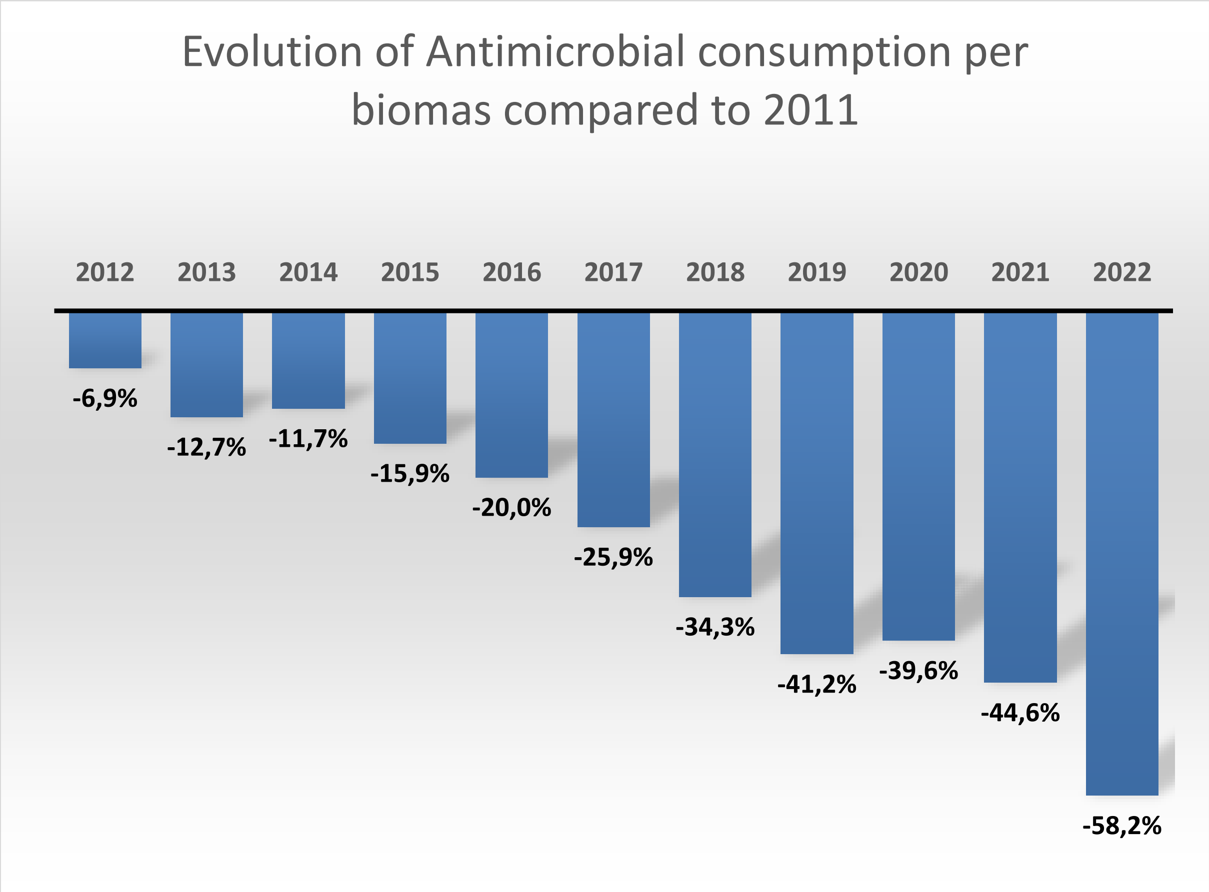


Figure 9. Evolution of antibacterial product sales per kg biomass produced in Belgium with 2011 as reference year.

Positioning of Belgium in comparison to the EU member states.

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

In 2022, the twelfth ESVAC report, presenting results on antimicrobial sales in 31 EU/EEA countries up to the year 2021 was released[14]. In this report the **antimicrobial consumption in animals (sales data) up to 2021 is presented in relation to the animal production in the country.**

In figure 10 the results of the 31 participating countries are presented in mg active substance sold. The animal production is 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.

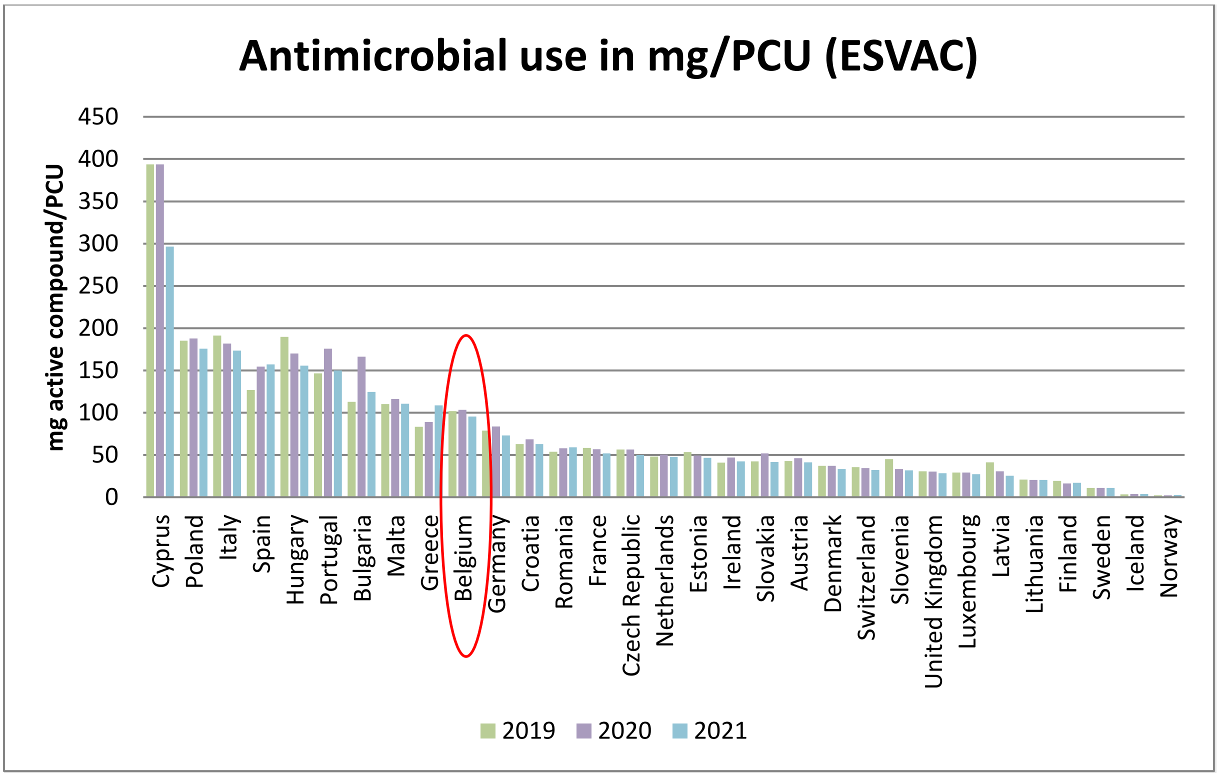


Figure 10. Overall sales of antimicrobial compounds for food-producing species, including horses and rabbits, in mg/PCU, per country between 2018-2021 (source: 12th ESVAC reports on Sales of veterinary antimicrobial agents).

[14] https://www.ema.europa.eu/en/documents/report/sales-veterinary-antimicrobial-agents-31-european-countries-2021-trends-2010-2021-twelfth-esvac_en.pdf

When looking at figure 10, it can be observed that Belgium resides at the tenth position in terms of antimicrobial usage expressed in mg/PCU in 2021. Obviously, when comparing countries, one has to take into account the composition of the animal population (e.g., the relative proportion of ruminants versus monogastric species).

It is remarkable to see that although the mean value of use in Europe has decreased from 109,5 mg/PCU in 2013 to 74,1 mg/PCU in 2021, the median value has only reduced from 62,3 mg/PCU to 47,6 mg/PCU indicating that the reduction is mainly achieved by a reduction in use by the highest users.

Compared to neighbouring countries (France, Luxemburg, Germany, United Kingdom and The Netherlands, Figure 11) with a relatively comparable structure of livestock farming, the use in Belgium remains the highest, although it is approaching the use in Germany and France.

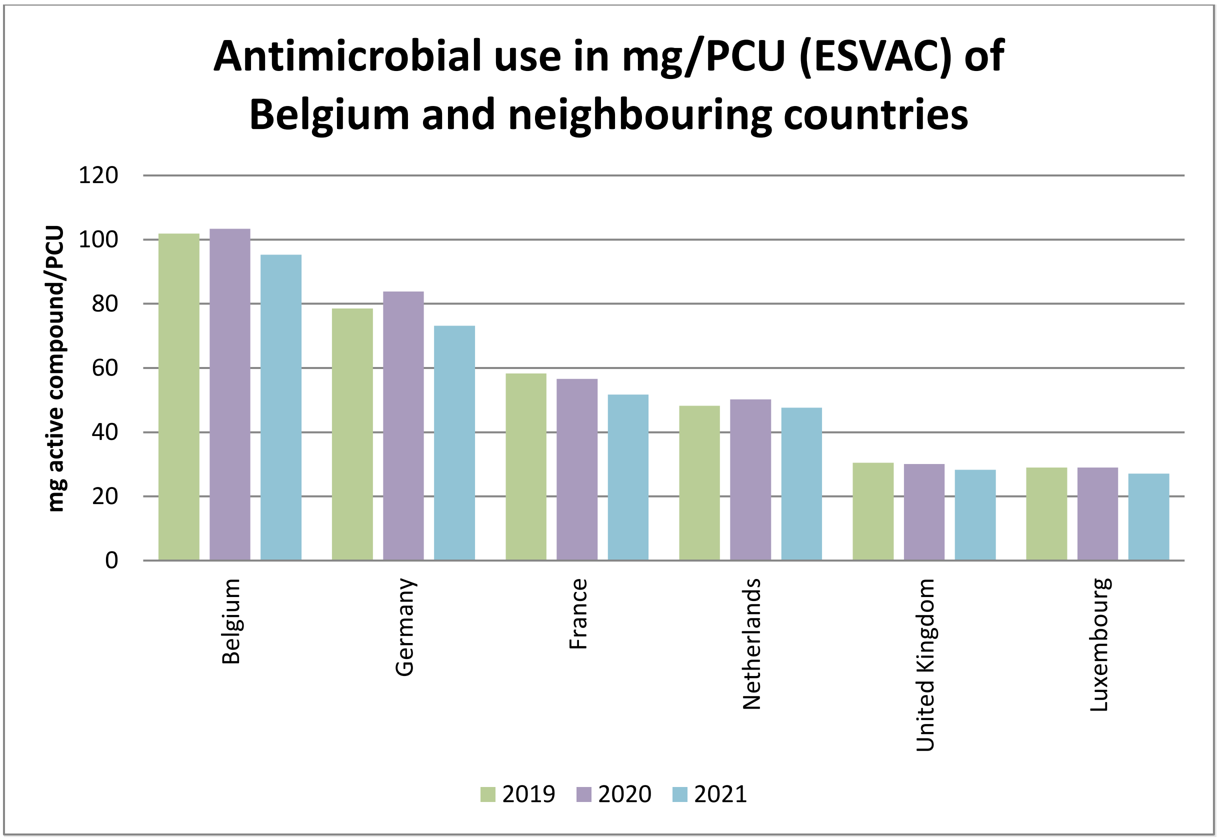
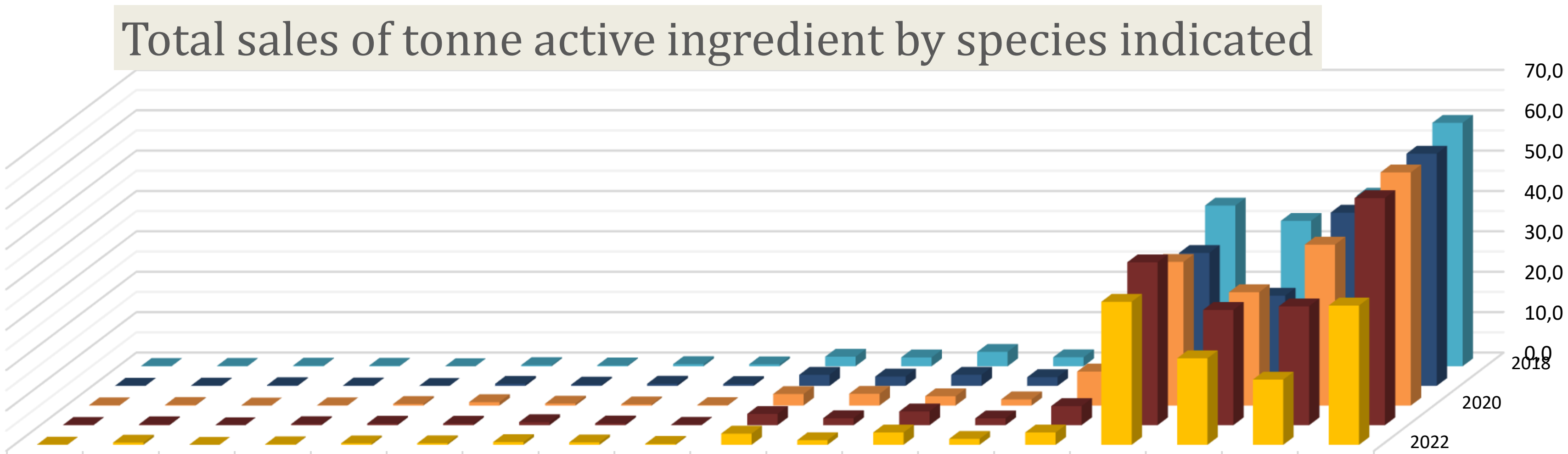


Figure 11. Overall sales of antimicrobials in mg/PCU in 2018-2021 (source: 12th ESVAC report on Sales of veterinary antimicrobial agents) for Belgium and neighbouring countries.

Species specific antibacterial sales

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

In 2022, antibacterial products authorised for both pigs and cattle were sold the most (29,1%). Followed by products only used in pigs (28,2%). The third most sold antibacterial pharmaceuticals are the ones registered for cattle, pigs and poultry (17,5%).



	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
2022	0,1	0,6	0,0	0,1	0,4	0,4	0,7	0,6	0,2	2,8	1,2	3,1	1,5	3,1	35,4	21,4	16,2	34,5
2021	0,1	0,2	0,0	0,3	0,4	0,4	0,8	0,4	0,1	2,8	1,7	3,4	1,7	4,7	40,3	28,5	29,4	56,2
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

Figure 12. Sales of antibacterial pharmaceuticals and premixes per target species, evolution between 2019 and 2022.

Intramammary products in dairy cattle

Some types of antibacterial products can be allocated to one animal species, such as intramammary products used for prevention (DC = dry cow therapy) and 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 six years, separated into the classes of active substances.

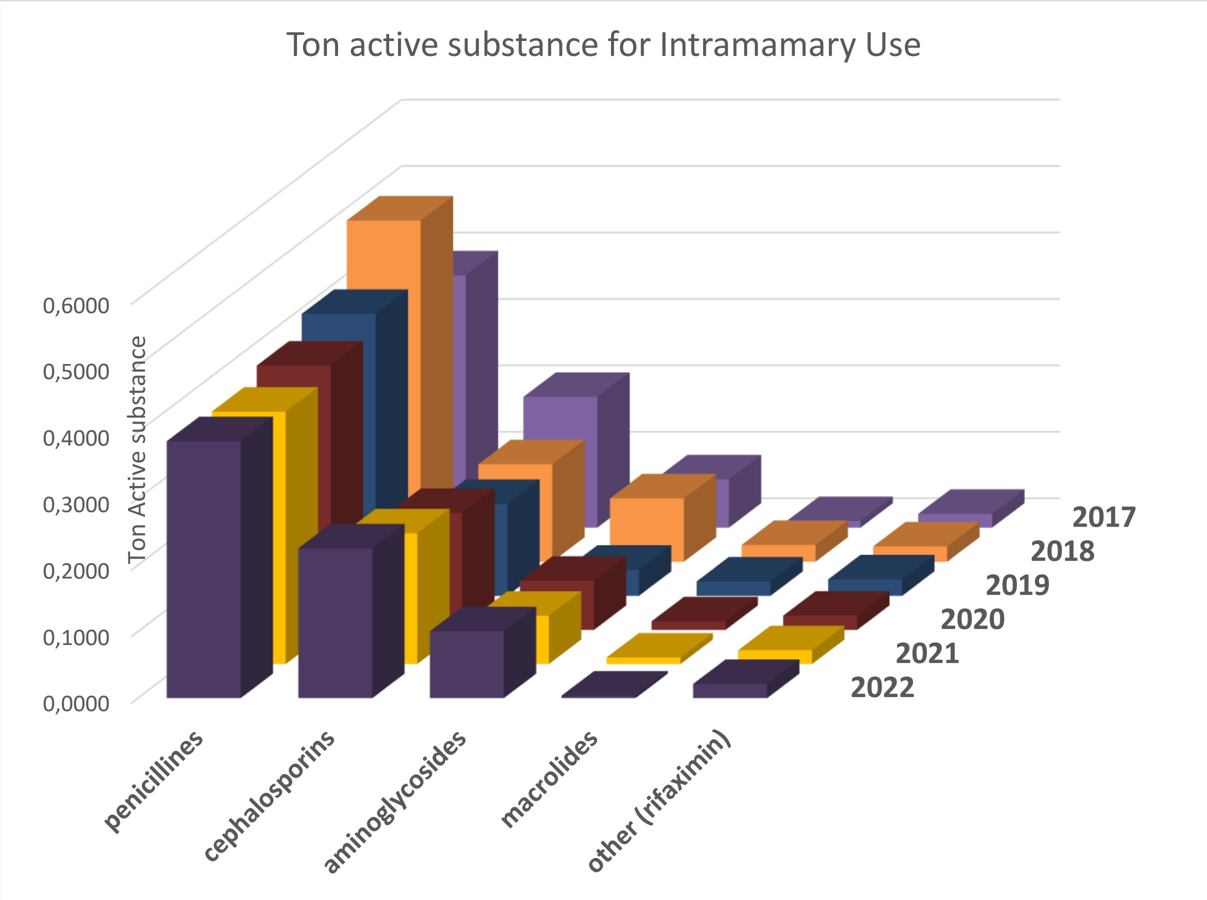


Figure 13. Evolution in sales of antibacterials for intramammary use between 2017 and 2022.

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

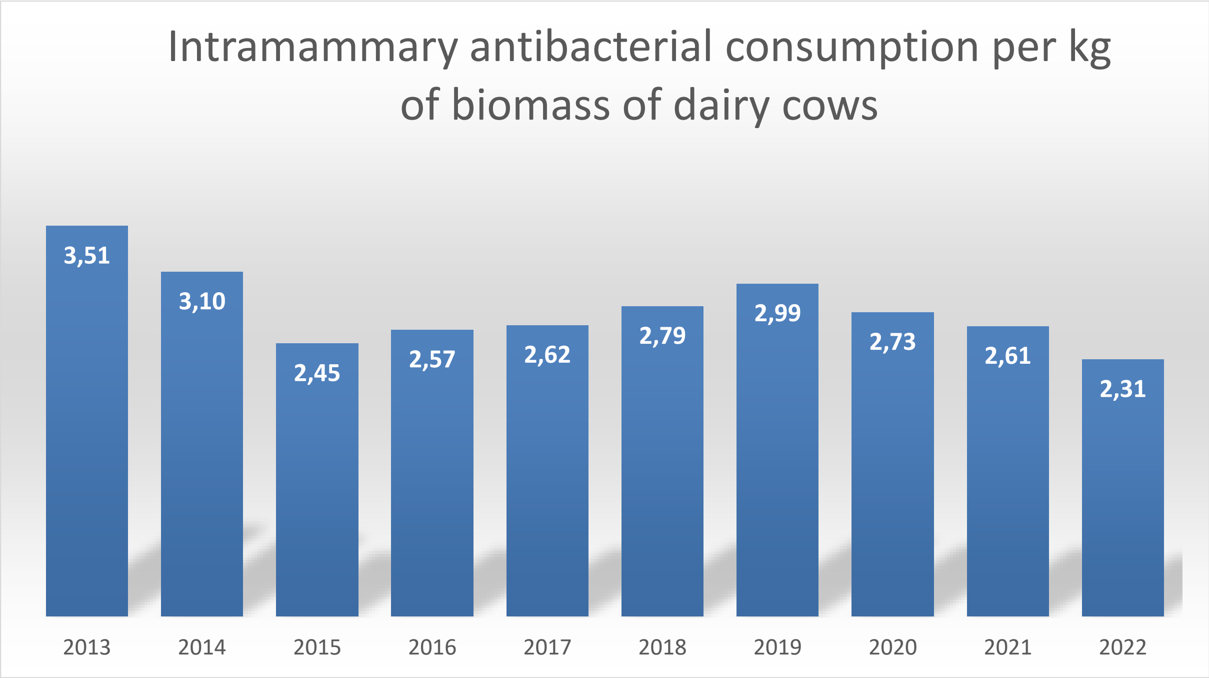


Figure 14. Evolution in sales of antibacterial products for intramammary use expressed in mg per kg biomass of dairy cattle between 2013 and 2022.

From the results of figure 14 it can be seen that the sales of intramammary preparations were substantially reduced between 2013 and 2015 (-30%), however since 2015 the sales steadily increased again (+22%) until 2019. Since 2020 a decrease is observed now for three years in a row, resulting in 2022 in the lowest value since the start of the measurements in 2013 (-34,2%).

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

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

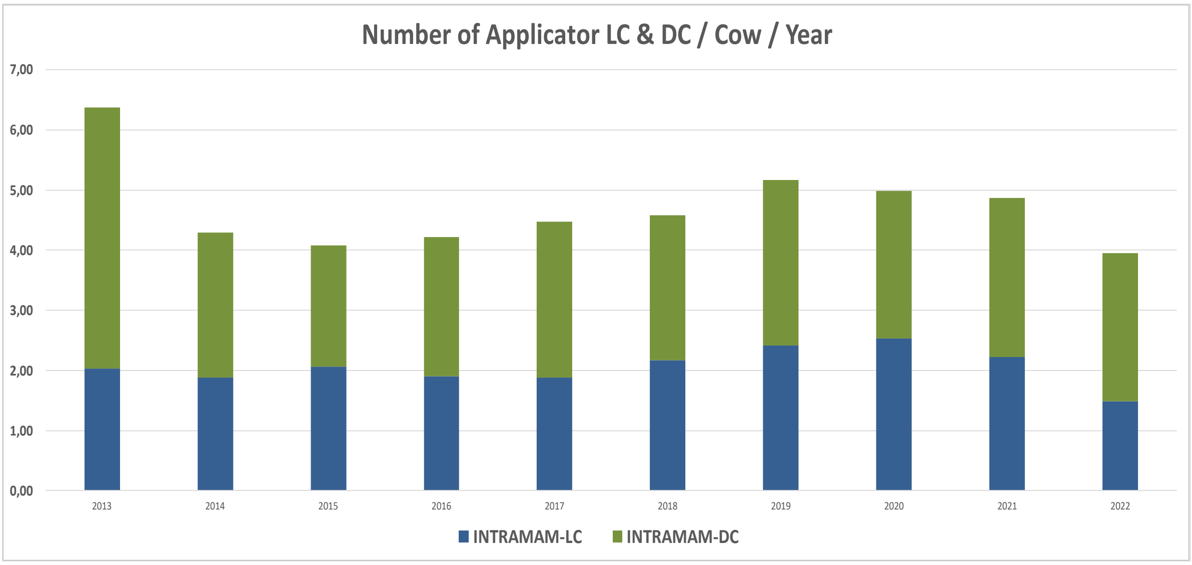


Figure 15. Evolution in sales of the number of intramammary preparations used per cow present over the last 10 years.

Also, in the number of applicators sold per cow per year, a substantial reduction in the 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. Since 2021 a decrease is seen, which is mainly due to a drop in the sales of applicators for the treatment of mastitis cases. The sales of DC applicators remain stable over the last years.

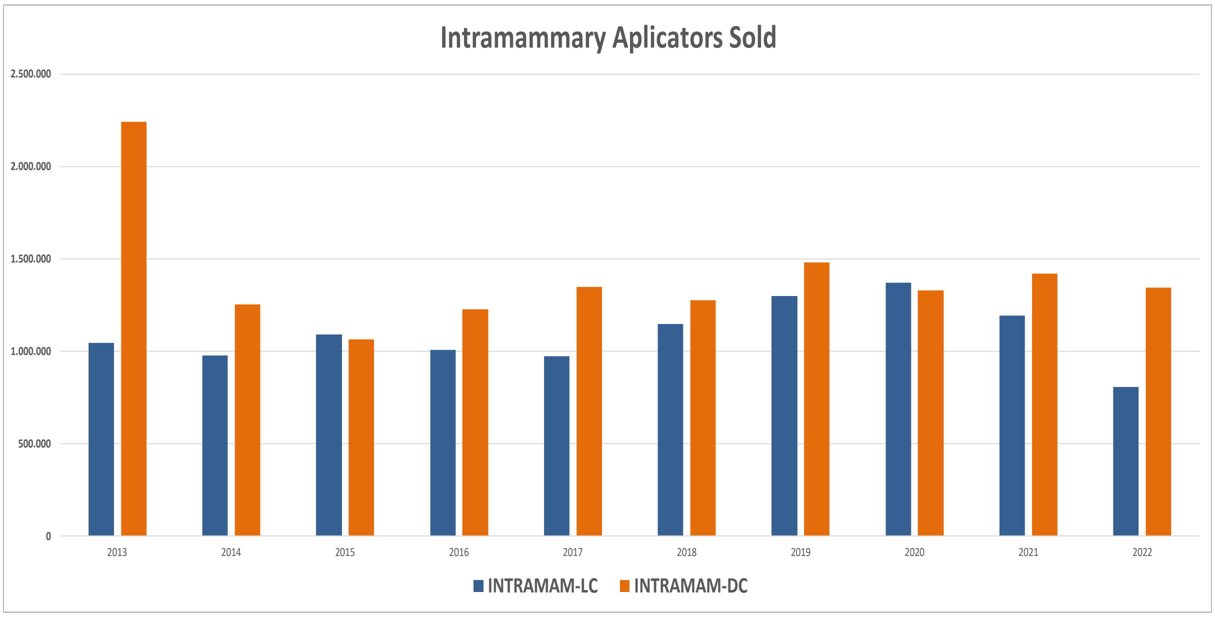


Figure 16. Number of intramammary preparations sold for dry cow therapy (DC) and for treatment of lactating cows (LC) over the last 10 years.

Antibacterial pharmaceuticals in dogs and cats

In 2022, 2643,2 kg of active antibacterial substance was sold as preparations that are solely authorised for use in dogs and cats, this is a decrease of -5,0% in comparison to 2021. Compared to 2014, the total sales of antibacterial substances solely authorised for use in dogs and cats increased with 24,8%. It is noteworthy however 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 compared to the possible evolution of the population size.

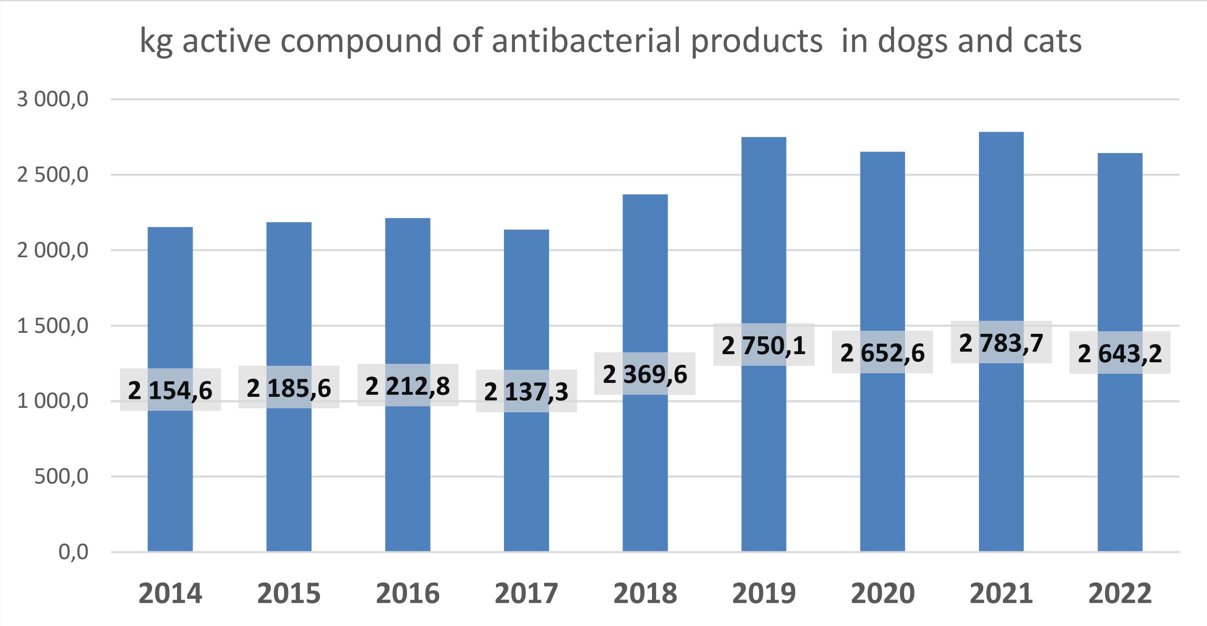
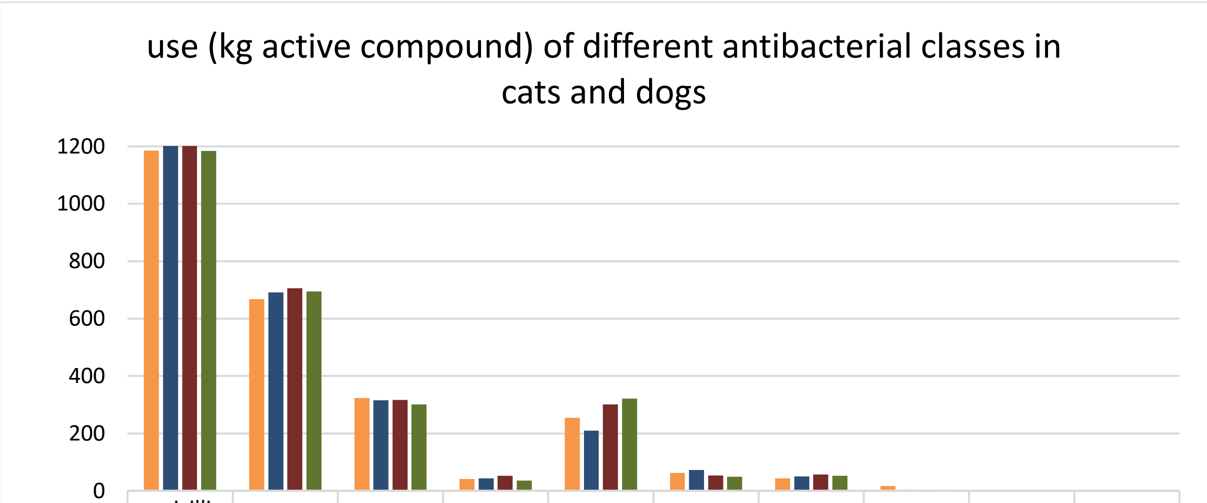


Figure 17. Evolution of sales of antibacterial pharmaceuticals only authorised for use in dogs and cats between 2014 and 2022.



	penicillines-clavulaanzuur	cephalo-sporins	macrolides	penicillines	other	quinolones	tetra-cyclines	amino-glycosides	sulpho-namides	polymixins
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
2021	1293,12	706,34	316,59	52,04	301,02	53,18	56,68	2,64	0,00	0,83
2022	1184,53	694,57	301,29	36,13	320,56	49,39	52,57	3,29	0,00	0,77

Figure 18. Sales of different antibacterial classes in products only authorised for dogs and cats.

Penicillin/clavulanic acid is the most used antibacterial compound in dogs and cats, followed by cephalosporins of the 1° and 2° generation and macrolides. The increased use in "others" is due to an increase in use of metronidazole, administered in combination with spiramycin.

Sales per class of antibacterial compound

a) Total sales (antibacterial pharmaceuticals and premixes)

In Figure 19 and table 4 the total sales of antibacterial active substances per class (ATC level 3 or 4) is presented.

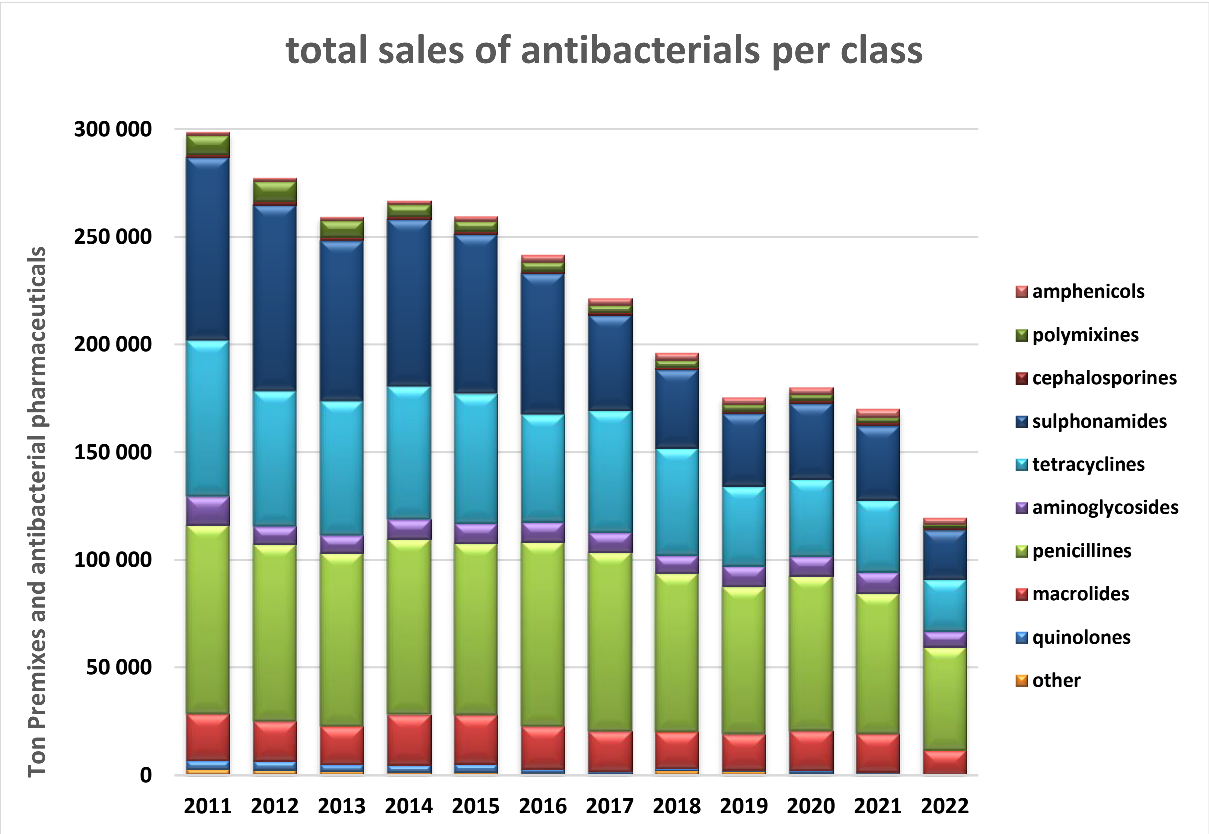


Figure 19. Total sales of antibacterial active substances per class from 2011 to 2022.

In 2022, the most sold group of antibacterial compounds remained the penicillins (49,4 tonnes; 40,5%). The tetracyclines (24,2 tonnes; 19,8%) are the second most sold group, closely followed by the sulphonamides and trimethoprim (23,0 tonnes; 18,8%).

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 in kg and in mg/kg biomass per antibacterial class since 2018.

Class	2018	2019	2020	2021	2022	'18 » '19	'19 » '20	'20 » '21	'21 » '22	2022%
Penicillins	74.704,01	70.037,71	73.418,38	66.800,96	49.449,25	-6,2%	4,8%	-9,0%	-26,0%	40,5
Sulphonam & Trimethoprim	36.515,7	33.764,3	35.402,9	34.586,5	22.958,6	-7,5%	4,9%	-2,3%	-33,6%	18,8
Tetracyclines	50.030,5	37.108,6	35.833,4	33.478,9	24.235,5	-25,8%	-3,4%	-6,6%	-27,6%	19,8
Macrolides	16.957,5	16.360,0	18.154,5	17.683,2	11.586,6	-3,5%	11,0%	-2,6%	-34,5%	9,5
Polymixins	3.525,6	3.034,4	2.762,1	2.467,7	1.041,1	-13,9%	-9,0%	-10,7%	-57,8%	0,9
Aminosides	8.202,8	9.534,0	9.153,1	9.842,8	7.154,0	16,2%	-4,0%	7,5%	-27,3%	5,9
Quinolones	913,6	973,9	1.361,3	750,8	710,8	6,6%	39,8%	-44,8%	-5,3%	0,6
Other**	2.185,6	1.664,3	979,0	776,6	596,7	-23,8%	-41,2%	-20,68%	-23,2%	0,5
Phenicols	3.320,7	3.159,5	3.253,1	3.823,6	3.127,6	-4,9%	3,0%	17,5%	-18,2%	2,6
Cephalosporins 1° & 2° G	782	1.046	1.286	1.259	1.211	33,8%	22,9%	-2,1%	-3,8%	1,0
Cephalosporins 3° & 4° G	143	135	142	125	125	-5,6%	5,0%	-11,7%	-0,7%	0,1
Totaal (kg)	**197.282**	**176.818**	**181.746**	**171.595**	**122.196**	**-10,37%**	**2,79%**	**-5,59%**	**-28,79%**	100

*** zink bacitracine, rifaximin, metronidazol, tiamuline*

Class AB Mg/kg Biomass	2018	2019	2020	2021	2022	'18 » '19	'19 » '20	'20 » '21	'21 » '22	2022%
Penicillins	35,78	34,63	35,37	31,59	24,80	-3,2%	2,1%	-10,7%	-21,5%	38,93
Sulphonam & Trimethoprim	17,49	16,69	17,06	16,36	11,52	-4,5%	2,2%	-4,1%	-29,6%	20,16
Tetracyclines	23,96	18,35	17,26	15,83	12,16	-23,4%	-5,9%	-8,3%	-23,2%	19,51
Macrolides	8,12	8,09	8,75	8,36	5,81	-0,4%	8,1%	-4,4%	-30,5%	10,31
Polymixins	1,69	1,50	1,33	1,17	0,52	-11,2%	-11,3%	-12,3%	-55,3%	1,44
Aminosides	3,93	4,71	4,41	4,65	3,59	20,0%	-6,5%	5,5%	-22,9%	5,74
Quinolones	0,44	0,48	0,66	0,36	0,36	10,0%	36,2%	-45,9%	0,4%	0,44
Other**	1,05	0,82	0,47	0,37	0,30	-21,4%	-42,7%	-22,1%	-18,5%	0,45
Phenicols	1,59	1,56	1,57	1,81	1,57	-1,8%	0,3%	15,4%	-13,2%	2,23
Cephalosporins 1° & 2° G	0,37	0,52	0,62	0,60	0,61	38,1%	19,8%	-3,9%	2,1%	0,73
Cephalosporins 3° & 4° G	0,07	0,07	0,07	0,06	0,06	-2,6%	2,3%	-13,3%	5,3%	0,07
Total mg/kg Biomas	**94,50**	**87,43**	**87,57**	**81,15**	**61,29**	**-7,48%**	**0,16%**	**-7,33%**	**-24,47%**	**100**
Totaal biomassa cfr. Grave et al., 2010)*	2.087.735	2.022.450	2.075.555	2.114.595	1.993.730	**-3,13%**	**2,63%**	**1,88%**	**-5,72%**	

** zink bacitracine, rifaximin, metronidazole, tiamuline

In 2022, the sales of all antibacterial groups were reduced in absolute numbers. When looking in relation to the kg of biomass produced, a slight increase is observed for the quinolones, cephalosporins of the 1° and 2° generation and the cephalosporins of the 3° and 4° generation. It is noteworthy that the sales of all of these molecules reduced last year.

The sales of polymyxins (consisting almost entirely of colistin sulphate) further decreased spectacularly in 2022 with -55,3% (in mg/kg biomass) and this despite the recent phasing out of ZnO as an alternative for colistin in the treatment of post-weaning diarrhoea in piglets. Compared to 2012 (the year before ZnO products were authorised), polymyxin use has dropped with -89,2%.

AMCRA [15] 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 assigned a colour code 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[16] and the lists produced by the World Organisation for Animal Health (WOAH), indicating the importance of antibacterial substances for veterinary health[17]. 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 the risk for selection and for transfer of resistance 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 a higher importance for human medicine and should therefore be used restrictively in veterinary medicine 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, amino(glycol)sides, tetracyclines and aminopenicillins.

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

In figure 20, the evolution of the sales of the different colour groups of antibacterial substances over the last five years is presented. This figure shows that the orange group remains the most used group while the red molecules are used only to a limited extent when expressed as 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 2022, the sales of the orange molecules decreased with -25,1%.
The sales of the yellow molecules also reduced substantially with -23,3%.
Finally, the sales of the red molecules increased to a limited extent with +1,1%. **In comparison to 2011 (reference year) the reduction of red molecules in 2022 is still -82,7% which is largely below the reduction goal of minus 75% by 2020 and 2024.**

[15] www.amcra.be
[16] http://apps.who.int/iris/bitstream/10665/77376/1/9789241504485_eng.pdf
[17] https://www.woah.org/app/uploads/2021/06/a-oie-list-antimicrobials-june2021.pdf

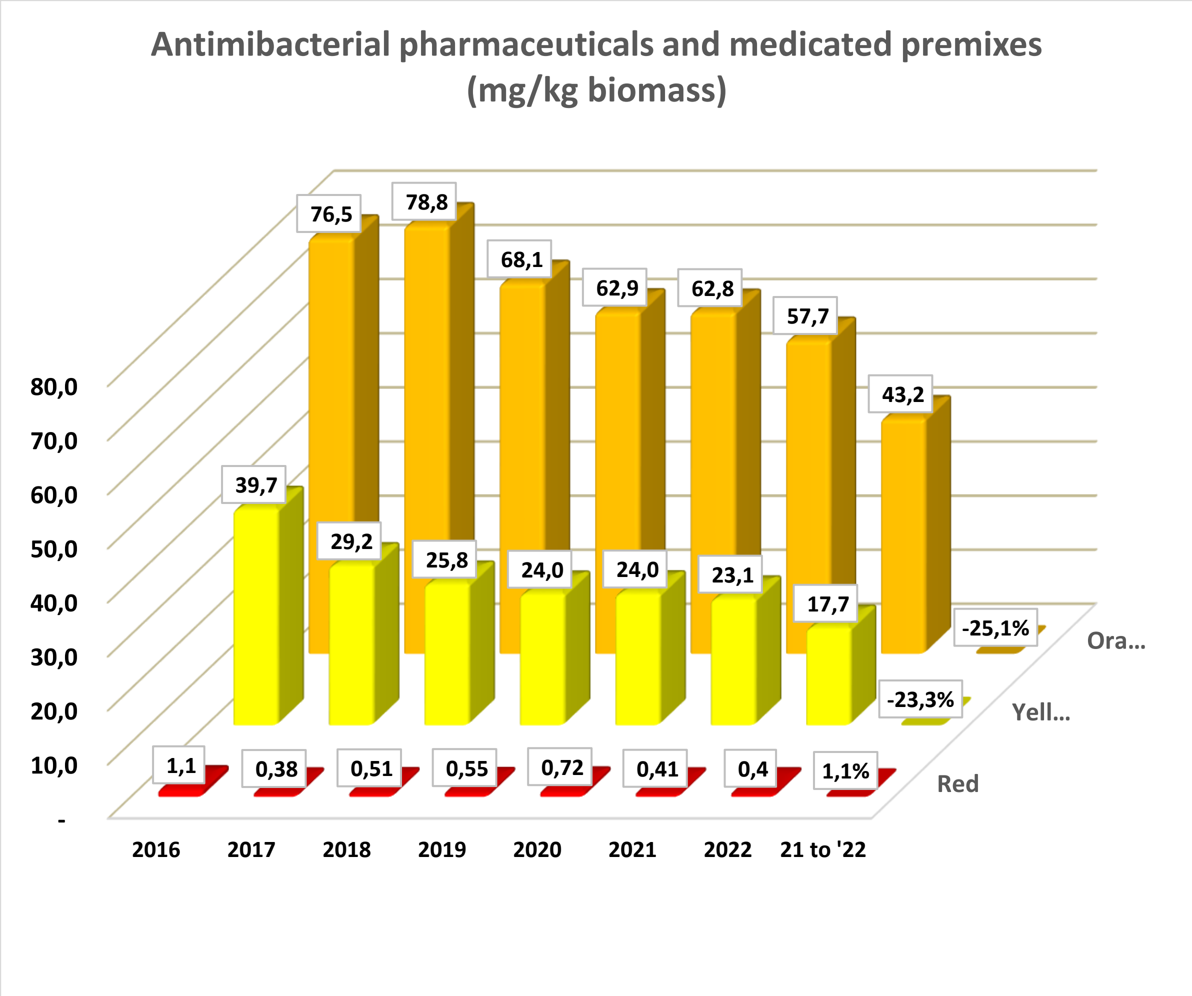


Figure 20: Evolution in the antibacterial consumption (mg/kg biomass) per AMCRA colour code between 2016 and 2022.

A similar graph with products exclusively authorised for dogs and cats (Fig. 21) shows a substantial decrease in the sales of orange molecules and a small increase in the sales of yellow molecules. The sales of red molecules further decreased.

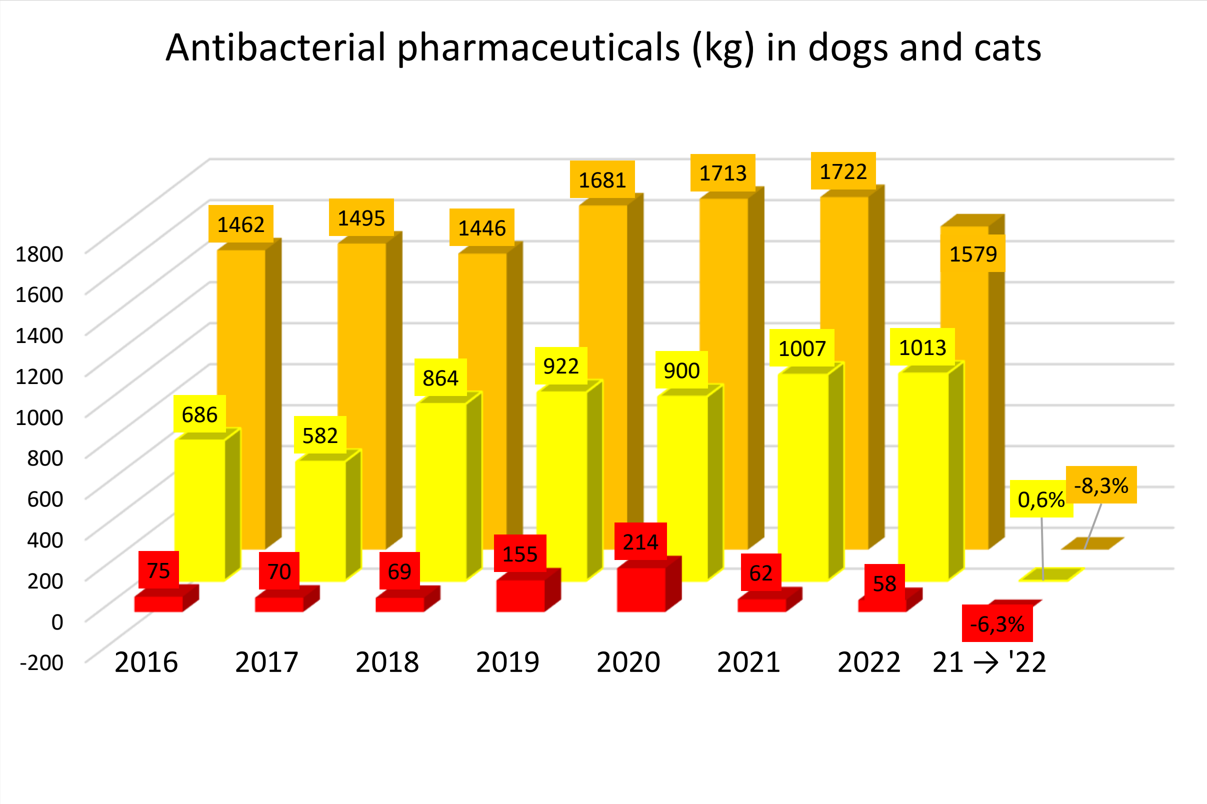


Figure 21: Evolution in the antibacterial sales (kg active compound) per AMCRA colour code for compounds exclusively authorised for use in dogs and cats between 2016 and 2022.

b) Antibacterial pharmaceuticals

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

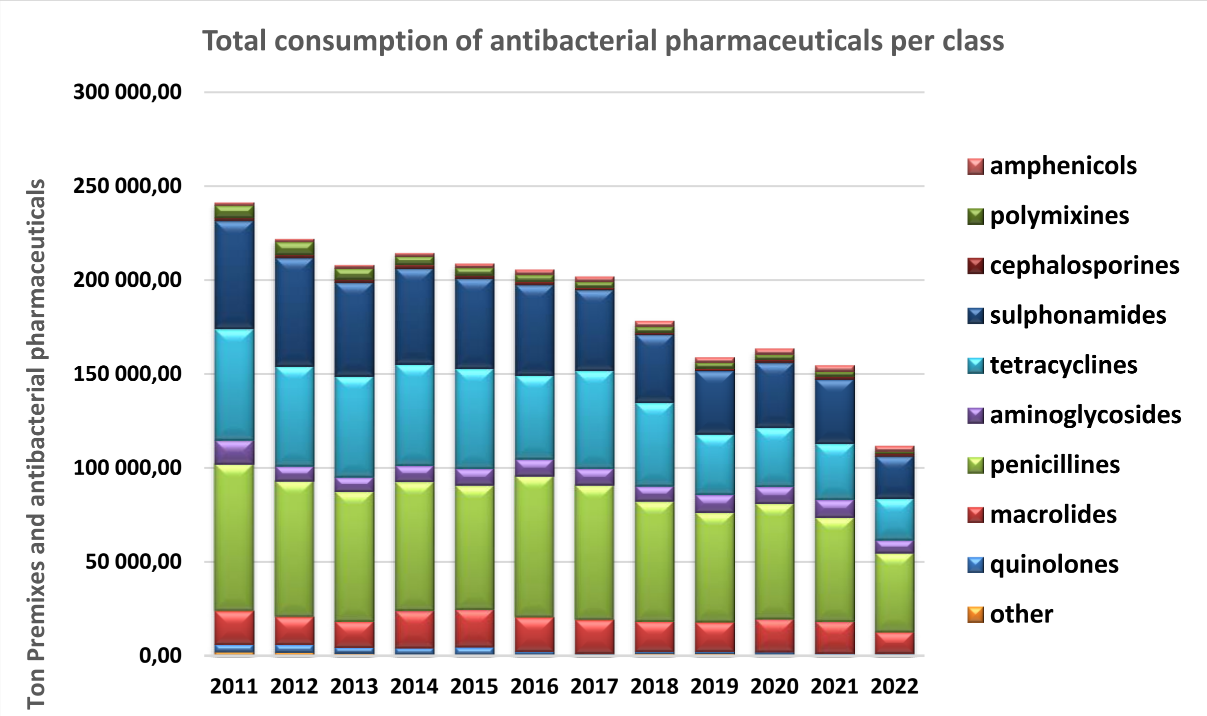


Figure 22. Sales of antibacterial pharmaceuticals per class of antibacterial compounds between 2011 and 2022.

c) Antibacterial premixes

In Figure 23 the sales of antibacterial compounds per class (ATC level 3 or 4) is presented for the antibacterial premixes.

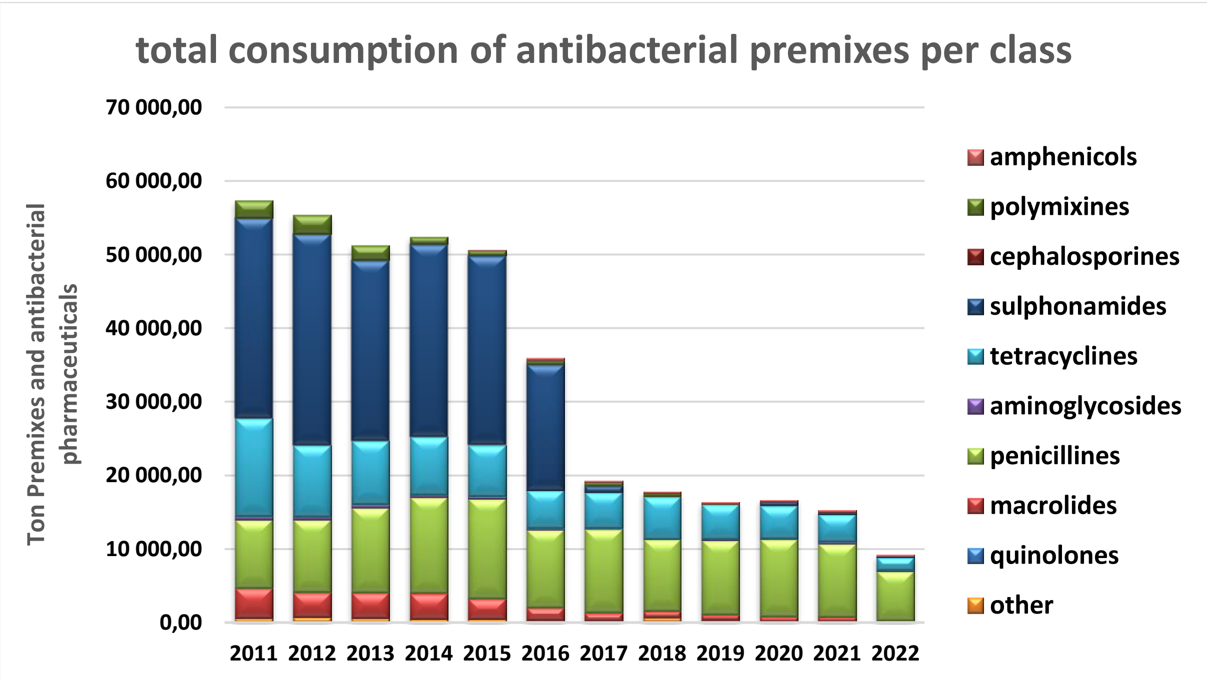


Figure 23. Sales of antibacterial premixes per class of antibacterial compounds between 2011 and 2022.

Sales per antibacterial active substance

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

Table 5. Sales per antibacterial active substance.

		Total kg antibacterials				Antibacterial pharmaceuticals (kg)				Antibacterial premixes (kg)			
Class	Antimicrobial compound	2019	2020	2021	2022	2019	2020	2021	2022	2019	2020	2021	2022
cephalosporins 1G	cefalexine	993,2	1.239,4	1.193,3	1.136,3	993,2	1.239,4	1.193,3	1.136,3				
cephalosporins 1G	cefalonium	8,7	10,8	8,9	8,6	8,7	10,8	8,9	8,6				
cephalosporins 1G	cefapirine	41,3	28,3	48,5	48,3	41,3	28,3	48,5	48,3				
cephalosporins 1G	Cefadroxil				12,4				12,4				
cephalosporins 1G	cefazoline	3,2	7,7	8,3	5,9	3,2	7,7	8,3	5,9				
fenicols	chlooramfenicol	-	-	-	-	-	-	-	-				
fenicols	thiamfenicol				0,8				0,8				
fenicols	florfenicol	3.159,5	3.253,1	3.823,6	3.126,7	2.916,5	2.984,2	3.521,6	2.909,7	243,00	268,92	302,00	217,00
other	metronidazol	254,5	218,1	301,0	320,6	254,5	218,1	301,0	320,6				
other	tiamuline	1.362,2	706,2	408,2	236,4	1.007,8	565,0	314,2	217,0	354,40	141,13	94,00	19,44
other	valnemuline	-	-	-	-	-	-	-	-	-			
other	zink bacitracine	25,4	32,1	46,1	18,2	25,4	32,1	46,1	18,2				
penicillines	cloxacilline	183,8	151,1	116,7	131,2	183,8	151,1	116,7	131,2				
penicillines	fenoxymethylpenicilline	1.424,4	1.512,4	520,7	407,0	1.424,4	1.512,4	520,7	407,0				
penicillines	nafcilline	7,3	8,9	8,6	9,2	7,3	8,9	8,6	9,2				
penicillines	benethamine penicilline	-	-	-	-								
penicillines	penethamaat	-	-	-	-								
penicillines	procaïne benzylpenicilline	-	-	-	-								
penicillines	benzylpenicillin	7.270,87	7.289,92	7.710,32	6.837,80	7.270,87	7.289,92	7.710,32	6.837,80				

sulphonamides	sulfachloorpyridazine natrium	458,5	775,1	215,0	427,5	458,5	775,1	215,0	427,5				
sulphonamides	sulfadiazine	25.602,3	26.647,7	25.115,9	16.923,5	25.602,3	26.113,0	24.895,0	16.812,5	-	534,69	220,94	110,94
sulphonamides	sulfadimethoxine natrium	32,0	-	-	3,6	32,0	-	-	3,6				
sulphonamides	sulfadimidine natrium	-	-	-	-	-	-	-	-				
sulphonamides	sulfadoxine	816,4	935,8	1.104,8	1.160,3	816,4	935,8	1.104,8	1.160,3				
sulphonamides	sulfamethoxazol	1.222,8	1.141,6	2.379,7	612,8	1.222,8	1.141,6	2.379,7	612,8				
sulphonamides	sulfanilamide	-	-	-	-	-	-	-	-				
sulphonamides	trimethoprim	5.632,4	5.902,7	5.771,2	3.831,0	5.632,4	5.795,8	5.727,0	3.808,8	-	106,94	44,19	22,19
polymyxins	polymyxine B sulfaat	1,0	1,0	0,8	0,8	1,0	1,0	0,8	0,8				
polymyxins	colistinesulfaat	3.033,4	2.761,1	2.466,8	1.040,3	2.961,9	2.754,9	2.466,8	1.040,3	71,54	6,17	-	-
amino(glyco)sides	apramycine	102,1	372,6	1.026,5	563,0	-	296,1	787,3	405,6	102,05	76,47	239,13	157,43
amino(glyco)sides	dihydrostreptomycine	8,5	9,3	13,9	11,8	8,5	9,3	13,9	11,8				
amino(glyco)sides	gentamicine	170,7	188,9	189,0	175,8	170,7	188,9	189,0	175,8				
amino(glyco)sides	kanamycine	102,0	83,8	67,1	49,7	102,0	83,8	67,1	49,7				
amino(glyco)sides	neomycine	34,0	23,1	32,6	168,6	34,0	23,1	32,6	168,6				
amino(glyco)sides	paromomycine	2.502,5	2.401,4	2.570,7	2.696,5	2.502,5	2.401,4	2.570,7	2.696,5				
amino(glyco)sides	spectinomycine	6.589,9	6.047,6	5.909,8	3.463,0	6.589,3	6.046,5	5.909,8	3.463,0	0,55	1,09	-	-
amino(glyco)sides	framycetinesulfaat	24,3	26,4	33,2	25,6	24,3	26,4	33,2	25,6				
macrolides	clindamycine	136,3	149,5	147,0	159,4	136,3	149,5	147,0	159,4				
macrolides	erythromycine	-	-	-	-	-	-	-	-				
macrolides	gamithromycine	36,7	16,2	14,3	11,6	36,7	16,2	14,3	11,6				
macrolides	lincomycine	5.066,7	4.659,0	3.867,9	2.577,4	5.066,2	4.657,9	3.867,9	2.577,4	0,55	1,09	-	-
macrolides	pirlimycine	-	-	-	-	-	-	-	-				
macrolides	spiramycine	187,0	165,9	169,6	160,8	187,0	165,9	169,6	160,8				
macrolides	tilmicosine	2.918,8	3.258,1	2.383,2	2.344,4	2.372,8	2.659,7	1.902,6	2.224,4	546,00	598,45	480,60	120,00

macrolides	tulathromycine	119,5	114,6	146,0	152,6	119,5	114,6	146,0	152,6				
macrolides	tylosine	7.808,5	9.750,6	10.934,3	6.132,3	7.674,8	9.664,9	10.759,3	6.022,3	133,75	85,68	175,00	110,00
macrolides	tildipirosine	47,2	37,3	20,6	28,4	47,2	37,3	20,6	28,4				
macrolides	tylvalosin	39,2	3,3	0,3	19,9	37,5	-	-	19,0	1,70	3,32	0,34	0,85
other	rifaximin	22,3	22,6	21,2	21,5	22,3	22,6	21,2	21,5				
penicillines	amoxicilline	60.560,0	63.913,0	57.935,0	41.539,0	50.419,1	53.430,0	47.928,0	34.794,4	10.140,83	10.482,96	10.007,05	6.744,60
penicillines	amoxicilline-clav	279,3	280,5	296,4	287,4	279,3	280,5	296,4	287,4				
penicillines	ampicilline	312,0	262,5	213,2	237,7	312,0	262,5	213,2	237,7				
tetracyclines	chloortetracycline	634,8	686,5	610,1	628,0	634,8	686,5	610,1	628,0	-			
tetracyclines	doxycycline	30.687,1	27.830,0	26.707,7	16.594,2	25.872,1	23.321,6	22.957,7	14.856,7	4.815,00	4.508,47	3.750,00	1.737,50
tetracyclines	oxytetracycline	5.786,7	7.316,8	6.161,1	7.013,3	5.786,7	7.316,8	6.161,1	7.013,3	-	-		
cephalosporins 3G	cefoperazon	4,2	3,6	3,5	3,1	4,2	3,6	3,5	3,1				
cephalosporins 3G	cefovecin	9,4	9,8	9,0	8,8	9,4	9,8	9,0	8,8				
cephalosporins 3G	cefquinome	75,3	85,3	78,1	80,1	75,3	85,3	78,1	80,1				
cephalosporins 4G	ceftiofur	46,4	43,4	34,9	32,5	46,4	43,4	34,9	32,5				
Quinolones	danofloxacine	6,5	7,3	5,8	5,7	6,5	7,3	5,8	5,7				
Quinolones	difloxacine	-	-	-	-	-	-	-	-				
Quinolones	enrofloxacine	375,7	421,4	294,6	244,8	375,7	421,4	294,6	244,8				
Quinolones	flumequine	516,5	845,0	375,5	389,5	516,5	845,0	375,5	389,5				
Quinolones	ibafloxacine	-	-	-	-	-	-	-	-				
Quinolones	marbofloxacine	70,2	81,6	70,4	66,4	70,2	81,6	70,4	66,4				
Quinolones	orbifloxacine	3,2	3,9	3,3	3,3	3,2	3,9	3,3	3,3				
Quinolones	pradofloxacine	1,8	2,1	1,3	1,3	1,8	2,1	1,3	1,3				

Antibacterial Use Data

Notifications in Sanitel-Med

Table 6 shows the number of notifications in Sanitel-Med in 2022 (accession date: 27/04/2023), the number of farms for which notifications were done and the number of veterinarians that did the notifications, in total and per species. As a reference, the data for 2018 (the first full year of Sanitel-Med data-collection) and 2021 were added.

The total number of notifications (-28%), the number of farms (-13%) and vets with notifications (-21%) kept declining compared to 2018. However, small differences are notable between the sectors. In the pig sector, numbers declined consistently but the pig sector remained by far the dominant contributor to all numbers, representing around 75-85% of all data and actors in Sanitel-Med. Even though therapeutical use of ZnO was no longer allowed since 2021, 2022 was the first year with absolutely zero notifications for ZnO registered. The steep decline of pig farms with notifications (-15% compared to 2018) is remarkable, likely reflecting the shrinking farm base.

In the poultry sector, the number of farms with notifications actually retreated to the level of 2018, having been 4% higher for the past two years. Remarkably, the number of notifications in poultry further decreased, even though the used quantities increased (see further). The poultry sector was the smallest sector in 2022 in terms of notifications. The veal sector remained the smallest sector in terms of active vets and farms, even further decreasing, but remarkably the number of notifications slightly increased, whereas the used quantities decreased (see further). In all sectors, the number of vets with notifications decreased since 2018 with more than 20%.

Table 6. Number of notifications and number of farms and veterinarians with notifications per animal species in Sanitel-Med in 2022, 2021 and 2018.

	YEAR	TOTAL	PIG						POULTRY		VEAL	
		n	AB n	*%*	ZnO n	*%*	**Total n**	*%*	**AB n**	*%*	**AB n**	*%*
Notifications	**2022**	**124 496**	92 397	*74*	0	*0*	**92 397**	*74*	**15 035**	*12*	**17 064**	*14*
	2021	147 239	113 783	*77*	7	*<0,1*	113 790	*77*	16 474	*11*	16 975	*12*
	2018	172 076	127 302	*74*	7 593	*4*	134 895	*78*	18 130	*11*	19 051	*11*
Farms	**2022**	**4 534**	3 670	*81*	0	*0*	**3670**	*81*	**744**	*16*	**243**	*5*
	2021	4 895	4000	*82*	7	*0,1*	4 090	*84*	771	*16*	249	*5*
	2018	5 207	4 325	*83*	621	*12*	4 090	*79*	745	*14*	258	*5*
Veterinarians	**2022**	**255**	213	*84*	0	*0*	**213**	*84*	**46**	*18*	**15**	*6*
	2021	271	218	*80*	4	*1*	218	*80*	52	*19*	19	*7*
	2018	324	270	*83*	107	*33*	271	*84*	63	*19*	20	*6*

Last year, the growing discrepancy between the sales and use data suggested that the decline in number of (farms and vets with) notifications was partly due to an increased lack of compliance with the legally required data-collection in Sanitel-Med. The data for 2022 cast doubt on this, as the number of (farms and vets with) notifications generally kept decreasing whereas the gap between sales and use drastically shrank (see further, Figure 24). A smaller base, a lower antibiotic use and more farms without antibiotic use are other possible explanations for the declining numbers.

For 2022, 182 notifications (0,2%) from 94 farms (2,6%) in pigs and 6 notifications (0,04%) from 5 farms (2,1%) in veal calves were excluded for the further analyses due to possible errors (unlikely low or high quantity – see Material and Methods).

Sanitel-Med use data compared with sales data

a) General

The mass antibacterials calculated from all Sanitel-Med notifications in 2022 dipped below 100 tonnes for the first time since the data collection in Sanitel-Med started, reaching a total of 90,2 tonnes (Figure 24). This corresponds to 74% of the total sales quantity, with 72% of the pharmaceuticals total sales and 95% of the total premix sales.

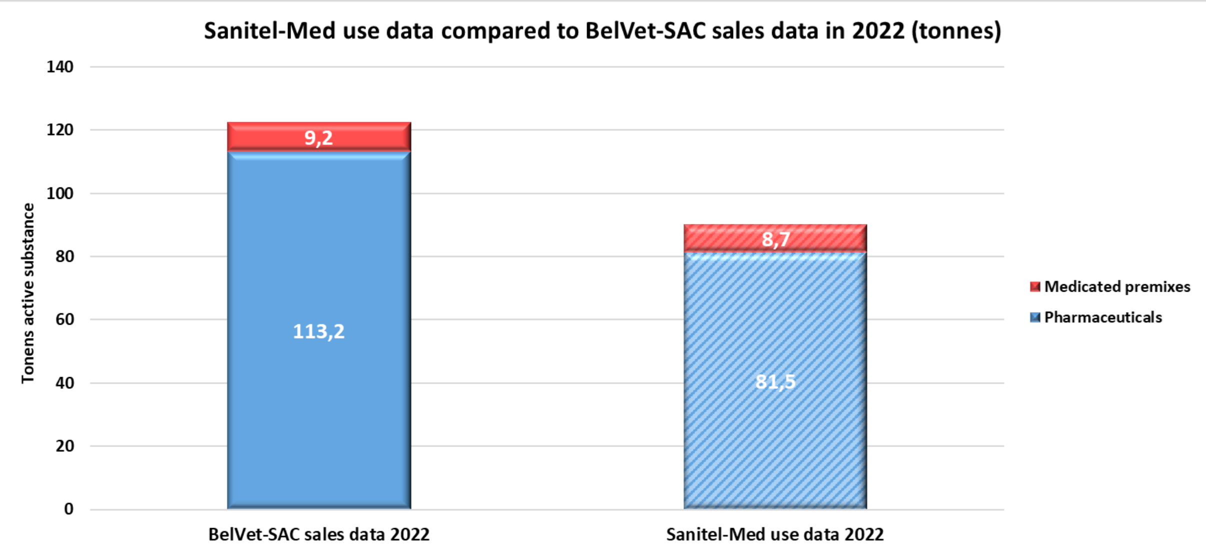


Figure 24. Comparison of tonnes antibacterial active substance used (Sanitel-Med) in 2022 with the tonnes reported for the Belgian sales data for 2022, distinguishing between medicated premixes and pharmaceuticals.

This means the gap between the total quantities of sales and use decreased again, even quite spectacularly compared to 2021. In fact, with 32 tonnes, the gap was in absolute numbers the smallest reported so far (Figure 25). In last years' report, it was predicted that an inverse effect on the (sales) data should be observable if the increase of the gap in 2021 was to be (partly) explained by stock replenishment by the vets. The decreased and record-low gap in 2022 might indeed be an indication that this holds true, in other words, that sales in 2021 were higher than 'expected', whereas in 2022 they are lower than 'expected', driven by the vets' purchase-behaviour. Anyhow, these yearly fluctuations in the difference between sales and use are intriguing and, though difficult to interpret altogether due to the limited use data collection, the coverage of the sales by the use data is considered in more detail in section c below and in the Annex.

The quantity of SDP products remained relatively stable, hence, is not playing any particular role in explaining the yearly differences. For years, SDP notifications have mainly been Neosol 100% (soluble powder for oral use); however, this product has been taken off the Belgian market by the marketing authorisation holder in the course of 2022, leading to other soluble powders for oral use products with neomycin emerging (Neomycine 50, Coophavet and Neomycinsulfat). In addition, Penstrep-ject (injectable solution), Phenoxypen WSP (soluble powder for oral use, authorised and commercialised in Belgium yet still registered as SDP) and Trisulmix (soluble powder for oral use) were used. Especially the latter is remarkable considering the variety of soluble powders with trimethoprim-sulfonamides being authorised and commercialised in Belgium. In the following analyses, SDPs are included in the Sanitel-Med data unless stated otherwise.

Excluding 188 possibly erroneous notifications from pigs and veal calves, as mentioned earlier, amounted to approx. 0,55 tonnes that might (in part) have been used in 2022 but are, as noted, not included in the above and following graphs and analyses.

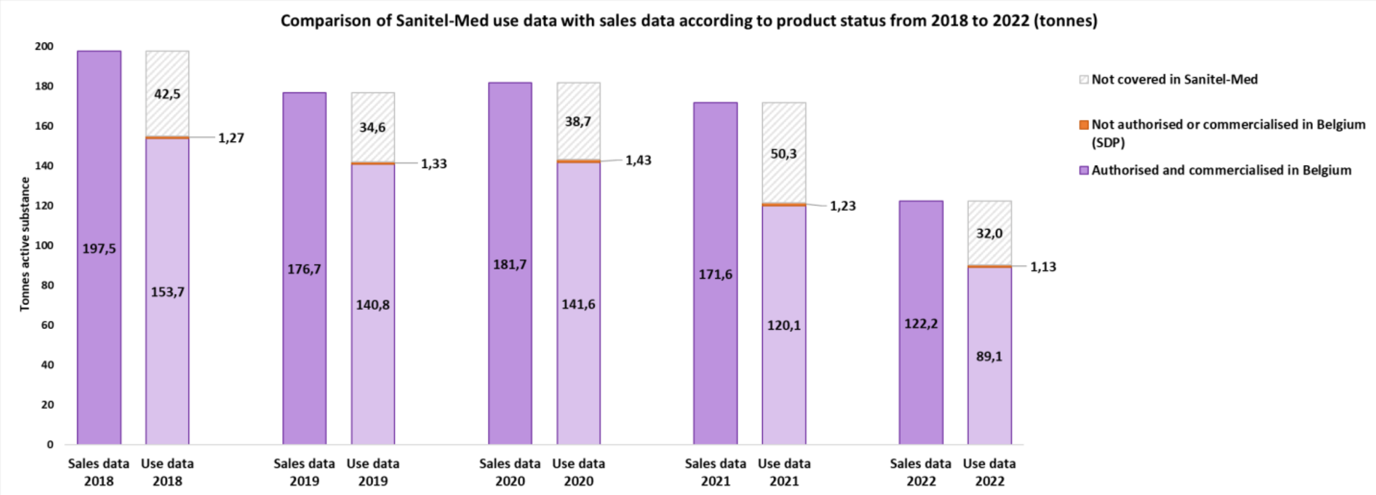
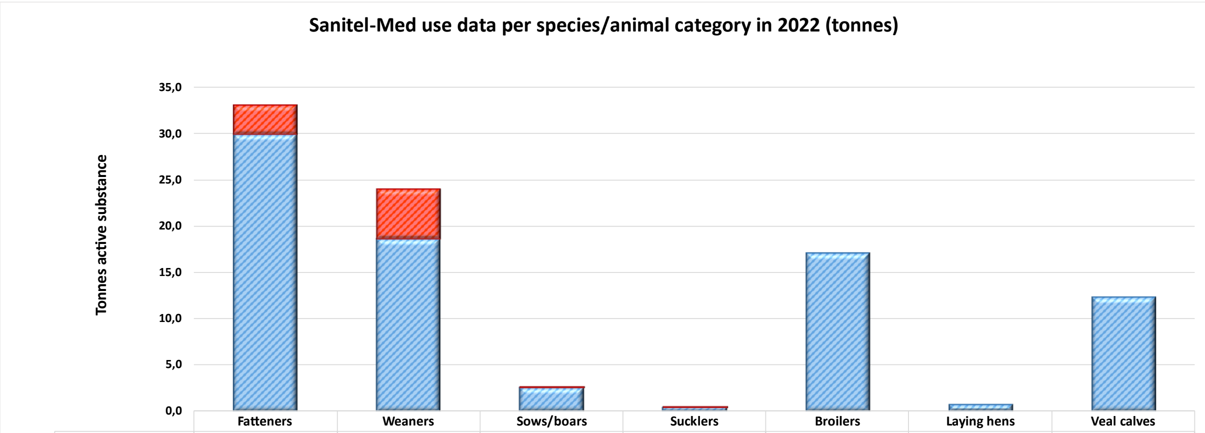


Figure 25. Comparison of tonnes antibacterial active substance used (Sanitel-Med) from 2018 to 2022 with the corresponding Belgian sales data for those years, distinguishing based on products authorised for sale and commercialisation in Belgium. The difference between the 'use' and 'sales' amount is also shown.

b) Per species/animal category

As in previous years, pigs for fattening and weaned piglets remained the animal categories with the largest mass of antibacterials used, but their relative importance decreased from almost 70% of the tonnes used in 2021 to 63% in 2022 (Figure 26). Fatteners represent the largest biomass of livestock in Belgium, explaining their status as users of the highest total mass of antibacterials. In all pig categories, both use of premixes and pharmaceuticals decreased compared to 2021 (data not shown). As the relative importance of pigs decreased, that of poultry increased, representing in 2022 almost 19% of all antibacterials used – compared to 14% in 2021. Veal calves also slightly increased in relative tonnes used, to almost 14% up from 12%.



	Fatteners	Weaners	Sows/boars	Sucklers	Broilers	Laying hens	Veal calves
Medicated premixes	3,2	5,4	0,0	0,0	0	0	0
Pharmaceuticals	29,9	18,6	2,6	0,4	17,1	0,7	12,3

Figure 26. Tonnes active substance of pharmaceuticals and medicated premixes used in 2022 per Sanitel-Med animal category.

c) Per antibacterial class and product

The table below shows the distribution of the 'sales' and 'use' tonnes according to the antibacterial classes outlined in Table 4. For most antibacterial classes, the results are in line with those of the previous years, and the six most sold classes correspond with the six most used. However, there are three results that are quite different from the last years (see Annex I) and therefore they are very remarkable: the tonnes used for macrolides and polymyxins exceeded the tonnes sold, whereas the tonnes used for quinolones amounted to 90% of the tonnes sold.

Table 7. Total tonnes per antibacterial class sold in 2022 (Sales 2022) and total tonnes used in pigs, poultry and veal calves (Use 2022). Next to the tonnes used by each species the % this covers of the sales data (% sales) is shown.

	Sales 2022	Use 2022							
	Tonne	Total tonne	*% sales*	Pig tonne	*% sales*	Poultry tonne	*% sales*	Veal tonne	*% sales*
Penicillins	**49,45**	38,61	***78***	30,24	***61***	5,03	***10***	3,35	***7***
Tetracyclines	**24,24**	17,59	***73***	12,03	***50***	1,64	***7***	3,91	***16***
Sulphonamides	**22,96**	13,39	***58***	9,44	***41***	2,89	***13***	1,05	***5***
Macrolides	**11,59**	11,65	***101***	3,34	***29***	5,60	***48***	2,72	***23***
Aminosides	**7,15**	5,00	***70***	2,10	***29***	1,93	***27***	0,97	***14***
Phenicols	**3,12**	1,63	***52***	1,39	***45***	<0,01	***<1***	0,24	***8***
Cephalosporins 1G/2G	**1,21**	0,01	***1***	0,01	***<1***	-	-	<0,01	***<1***
Polymixins	**1,04**	1,51	***145***	1,36	***131***	0,13	***12***	0,01	***1***
Quinolones	**0,71**	0,63	***89***	<0,01	***<1***	0,57	***80***	0,06	***9***
Other	**0,6**	0,19	***32***	0,19	***32***	-	-	-	-
Cephalosporins 3G/4G	**0,12**	-	-	-	-	-	-	-	-

For the first time since the start of the data collection in Sanitel-Med, the sales and use data were compared on a product-by-product base (based on the products' unique cti-ext codes), allowing to dig deeper than the level of the antibacterial classes, in order to have a better understanding of the relation between the two datasets. As a general remark, it must be noted that the percentages of 'coverage' at the class or substance level by far cannot be generalised for all products – even not for most. This makes sense considering that some products are used to a greater or lesser extent in species currently covered or not covered by Sanitel-Med. A second general observation is that many products show fluctuations in % coverage over the years. This might be a further indication of the complex and difficult-to-map purchase-behaviour of the vets, interacting with other players on the market. A detailed account per product falls outside the scope of this BelVet-SAC report.

Below, we will limit ourselves to an overview of the sales vs. use data per antibacterial substance for which remarkable results were observed, i.e. macrolides, polymyxins and quinolones. A more detailed examination of these classes, the supporting graphs, a comparison of sales and use for all antibacterial classes, and the most notable results concerning the products authorised solely for pigs and/or poultry – considering that the use in these species is fully or largely (~ broilers) covered in Sanitel-Med – are available in Annex I of this report.

The total used tonnes of macrolides were 101% of the total sold tonnes in 2022 (Table 7). This appears to have been caused by the combination of a higher-use-than-sales balance in products with a macrolide as active component, in particular tylosin, and almost equal quantities used and sold of lincomycin-spectinomycin products (lincomycin is a lincosamide and these are included in the macrolides in the sales data). Both events never occurred before, and the combination is all the more exceptional.

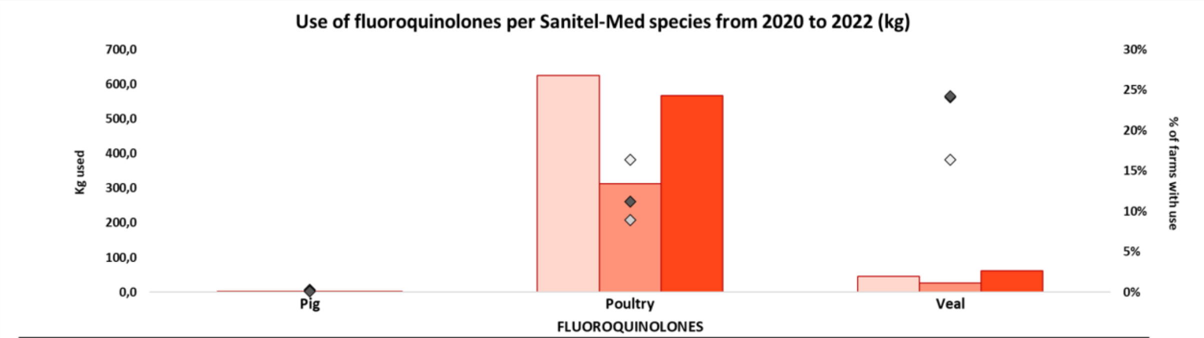
For polymyxins, there was a surplus of the used quantity compared to the sold quantity of 45% (Table 7). In the four previous years (2018-2021), the coverage varied between 84%-92%, so the result of 2022 is quite exceptional. It appears traceable to distinct sales/use patterns of two single products: COLDOSTIN 4800000 IE/g pdr oplosb. po 1 kg and PROMYCINE PULVIS 4,800 IE/mg pdr oplosb. po 1 kg, as for both the used quantity for the first time in the past five years exceeded the sold quantity, being particularly pronounced for COLDOSTIN (see Annex I).

The coverage of the sales quantity of quinolones has since the start of Sanitel-Med never been higher than 49%, with even a minimum of 36% in 2019 (see Annex I). In 2022 however, this coverage increased to 89%! The explanation can be found in the sales of flumequine. More specifically, the sales of ENTERFLUME 50% pdr oplosb. po 1 kg was approx. the same as in 2021 whereas its use increased drastically (see Annex I).

It is not clear how these remarkable results for the macrolides, polymyxins and quinolones should be interpreted. As noted for the general results, stock-management might play a role. However, it is possible that also the altered sales regulation at the European level, which allows since 2022 the purchase from foreign distributors or the direct purchase from the marketing authorisation holder, already has a hand in the current results. It is in this regard noteworthy that for the first time since the start of Sanitel-Med, the used quantity of products exclusively authorised for Av and/or Su, was slightly higher than the sold quantity, a difference even more pronounced when only the ‘vrac’ products, defined as products for oral administration and with a package size of minimum 500 g or ml (but typically at least 1 kg or l), were considered. A more thorough dig through these results is provided in Annex I. Overall, these results advise a cautious and contextual interpretation of the sales data for 2022 and demonstrate the growing importance of collecting use data. Consequently, the FAMHP has started a project to collect the data in a different way. Also the expansion of the use data collection to new species (e.g. bovines) in the coming years is expected to shed more light on the complex interface between sales and use data.

Use of critical substances in the Sanitel-Med animal species

As noted in the previous section, the Sanitel-Med data show an increased use of quinolones in 2022 (Figure 28), approaching the level of the (disappointing) year 2020. This increase was again largely situated in broilers in terms of absolute numbers, however, relatively speaking the tonnes in veal calves increased more dramatically, more than doubling compared to 2021. The % of farms using these products also increased in broilers.

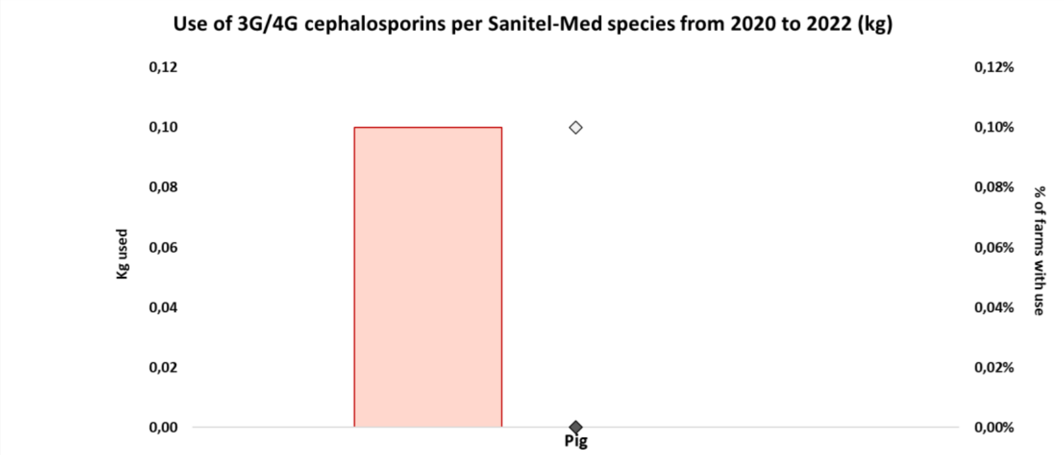


	Pig	Poultry	Veal
2020 - Kg used	0,3	625,2	46,4
2021 - Kg used	2,7	313,1	27,0
2022 - Kg used	0,2	567,3	62,3
2020 - % of farms	0,3%	16,4%	16,4%
2021 - % of farms	0,2%	8,9%	24,1%
2022 - % of farms	0,1%	11,2%	24,2%

Figure 28. Kg used of the quinolones in pigs, poultry and veal calves from 2020 to 2022, and the % of farms with notifications of use of these critical substances.

Evidently, these are very disappointing results, and they should ring the alarm in both sectors. True, the quinolones sales data showed a decrease in 2022 but, as explained above, a contextual interpretation should be warranted as the relationship between the sold and used quantities is of such atypical nature for 2022. If the sectors, despite their engagements in the current covenant, do not manage to keep their use at an acceptable level with the current regulations (be it private or legal), as appears to be the case based on the poor 'use' results for quinolones in two out of the three most recent years, calling for new, stricter measures might be inevitable.

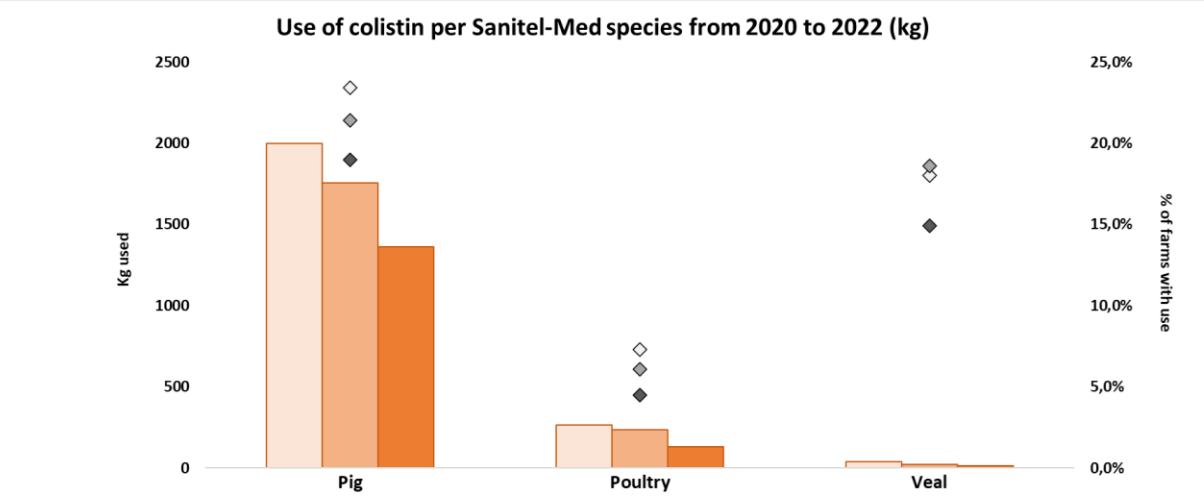
In pigs, the use of quinolones remained stable at a very low level, whereas the use of cephalosporins 3G/4G remained completely absent in 2022 (Figure 29). As in previous years, in poultry nor in veal calves cephalosporins 3G/4G were used in 2022.



CEPHALOSPORINES 3G/4G	Pig
2020 - Kg used	0,10
2021 - Kg used	0,00
2022 - Kg used	0,00
2020 - % of farms	0,10%
2021 - % of farms	0,00%
2022 - % of farms	0,00%

Figure 29. Kg used of the 3rd and 4th generation cephalosporins in pigs from 2020 to 2022, and the % of farms with notifications of use of these critical substances.

With respect to colistin use, pigs expectedly remained the species with the largest use, although the used amount as well as the % of farms with notifications using this substance continued to decrease (Figure 30). The used amount of colistin also decreased in veal calves and in poultry.



POLYMYXINS	Pig	Poultry	Veal
2020 - Kg used	2000	266	39
2021 - Kg used	1755	236	21
2022 - Kg used	1362	131	12
2020 - % of farms	23,4%	7,3%	18,0%
2021 - % of farms	21,4%	6,1%	18,6%
2022 - % of farms	19,0%	4,5%	14,9%

Figure 30. Kg used of polymyxins (colistin) in pigs, poultry and veal calves from 2020 to 2022, and the % of farms with notifications of use of colistin.

Species-level antibacterial use, the BD_{100}-species

Table 8 shows the evolution of the (kg) animals at risk for treatment per species at national level between 2018 and 2022. This is the denominator for the BD_{100}-species. As noted from the slaughter data (biomass, Table 3), the overall number of animals present 'daily' in the farms, hence, the kg animals at risk for treatment with antibiotics, decreased, especially for pigs.

Table 8. Number and kg animals at risk from 2018 till 2022 in pigs, poultry and veal calves.

	Animals at risk (x 10^3)					Kg at risk (x 10^3)				
	2018	**2019**	**2020**	**2021**	**2022**	**2018**	**2019**	**2020**	**2021**	**2022**
PIGS	6 209	6 085	6 218	6 039	5 751	318 869	311 901	316 048	305 965	289 561
POULTRY	43 624	44 902	49 016	48 919	48 754	54 921	55 860	60 838	60 892	60 474
VEAL CALVES	170	171	171	173	168	13 629	13 717	13 718	13 856	13 452

Table 9 gives the evolution of daily doses used per species at national level. This is the numerator for the BD_{100}-species. A distinction is made between products for which the doses are expressed as mg/animal (products for local or topical use) and for which doses are expressed as mg/kg (products for systemic use). The number of doses used of all types of products decreased (drastically) in pigs and veal calves, but increased in poultry.

Table 9. Doses used of products administered locally or topically versus orally or through injection from 2018 till 2022 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**	**2021**	**2022**	**2018**	**2019**	**2020**	**2021**	**2022**
PIGS	592 646	499 125	555 509	554 976	480 719	8 055 409	7 464 321	7 173 705	6 168 279	4 185 594
POULTRY	0	0	0	0	0	1 135 779	1 084 527	1 136 684	672 183	741 227
VEAL CALVES	2 055	3 414	3 414	4 471	3 869	1 401 692	1 108 610	1 098 139	885 639	775 567

The resulting BD_{100}-species (Figure 31), expressing the sector-level treatment days out of 100 days based on the total, national amount of daily doses of antibacterials used per species and the total, national mass of animals at risk per species, between 2021 and 2022 decreased with -28,2% for pigs and -9,8% for veal calves; it however increased by +11% for poultry. That gives a total result over the past five years, of -42,7% for pigs, -40,7% for poultry and -43,9% for veal calves.

It is remarkable to note that after this five-year period, the efforts to reduce antibacterial use in the different sectors, each with their own specificities, have led to more or less the same result. Yet, the path to this result is different, with a continuous downward slope in pigs and veal calves, while the broilers seem to bounce back from their spectacular decrease between 2020 and 2021. Furthermore, it must be noted that the veal calves sector has the most remarkable result in absolute numbers, having cut back the period of time a 'Belgian' calf is treated with antibiotics with nearly two weeks. Even so, the use in veal calves remained far higher than the use in pigs and poultry.

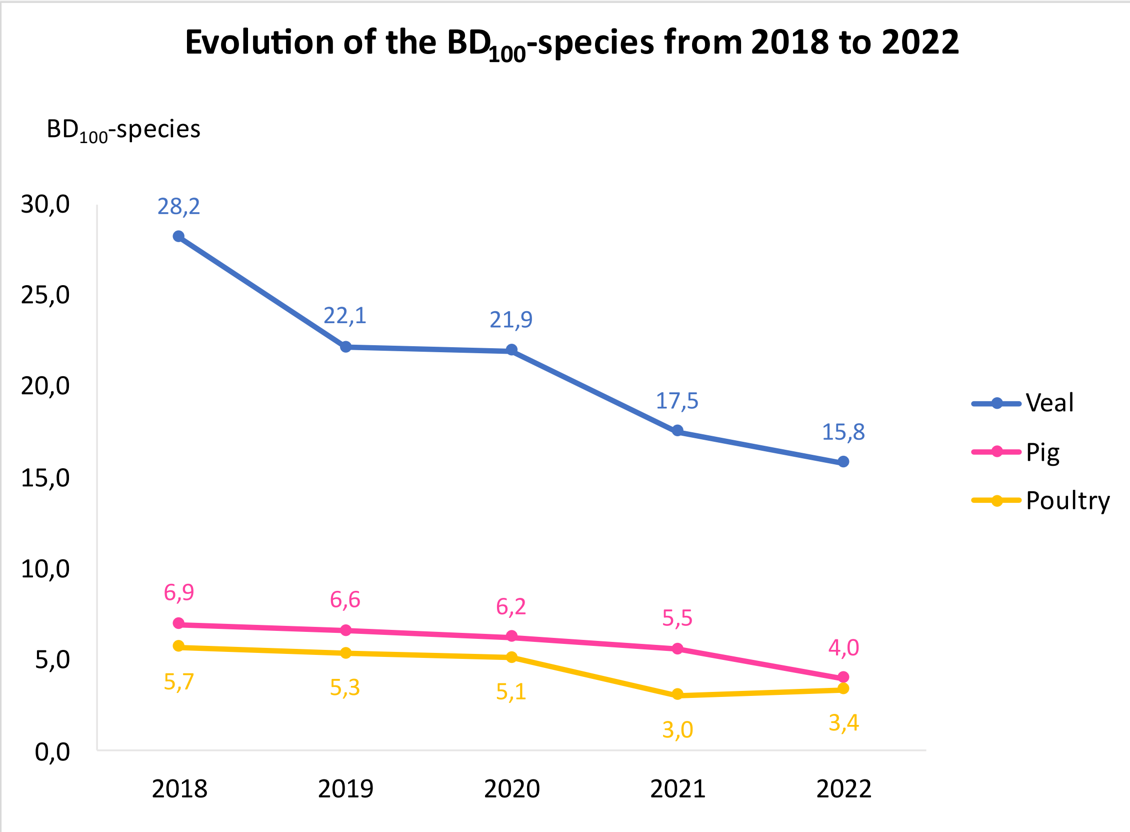


Figure 31. Antibacterial use (BD_{100}-species) from 2018 to 2022 in pigs, poultry and veal calves.

Farm-level antibacterial use

a) 2022 reference populations for benchmarking

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 2022 reference populations for benchmarking, are presented in Table 10. Overall, a total of 4440 pig farms (note: different pig categories present on one farm is common), 979 poultry farms and 232 veal calf farms could be included in the 2022 reference populations. In most following analyses, zero-use farms were excluded from the data. More details about the number and evolution of zero-use farms is provided in the animal category specific sections below.

Table 10. Number of farms and zero-use farms per Sanitel-Med animal category that were part of the 2022 reference populations for benchmarking.

	PIGS				POULTRY		VEAL CALVES
	Sucklers	Weaners	Fatteners	Breeders	Broilers	Laying hens	
n farms	1 522	1 552	4 125	1 539	767	214	232
n (%) zero-use farms[1]	274 (18)	168 (11)	912 (22)	274 (18)	128 (17)	142 (66)	2 (1)

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

b) Farm-level antibacterial use in 2022

Below, the distribution of the farm-level BD_{100} in the 2022 reference population (excluding zero-use farms) of each Sanitel-Med animal category is shown as a boxplot with the median use indicated (Figure 32). The use remained the highest in veal calves and weaners, and broilers reclaimed their third place more clearly due to an increase in the antibacterial use in broilers (see further). The right-skewed distribution with 'tails' of high users remained in all categories.

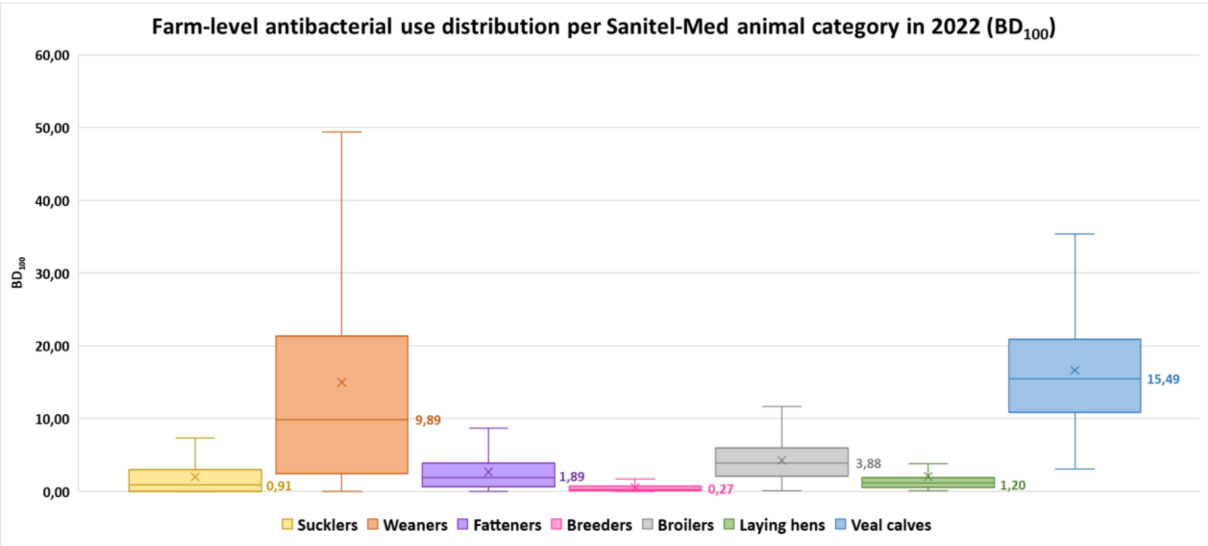


Figure 32. Boxplots representing the BD_{100}-distribution in the 2022 reference population of each Sanitel-Med animal category. Outliers are not shown, zero-use farms (see Table 10) were excluded. The median values are provided next to the lines in the boxes.

c) Evolution of farm-level antibacterial use from 2018 to 2022

i. Summary

The evolution of the median farm-level BD_{100} in the benchmark reference populations from 2018 to 2022 shows a drastic decrease over this period in most Sanitel-Med animal categories, even though there are also some 'bumps in the road' for most of them (Figure 33). Broilers are the sole category with an increase in 2022 compared to 2021, the decrease in the laying hens is fortunately continuing. These are generally quite favorable results. It must be noted that most of the median values reported here are much lower than those reported last year. This is due to the revision of the quality control criteria (which were also applied retrospectively), which has led to the exclusion of several dozen more farms (especially with notifications with extreme quantities) from the reference populations for benchmarking as compared to the results reported previously.

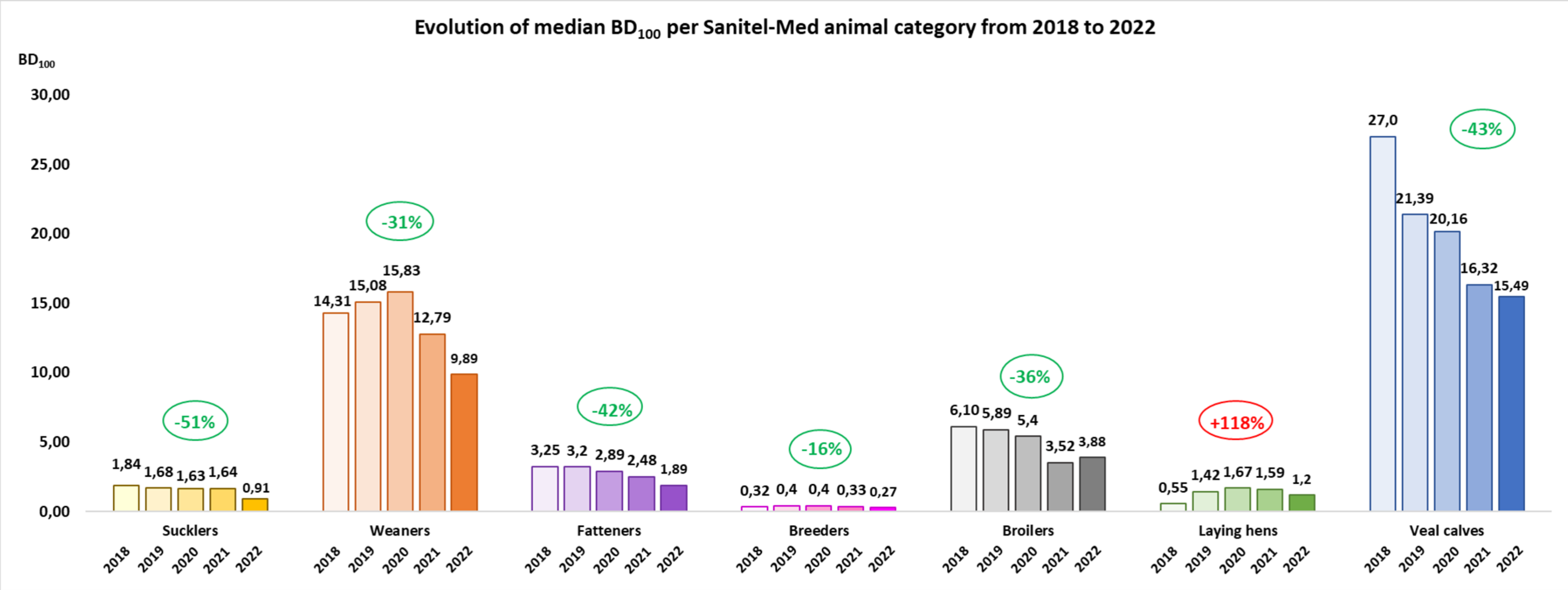


Figure 33. Evolution of the median of the BD_{100}-distribution in the reference populations for 2018 till 2022 per Sanitel-Med animal category. Zero-use farms were excluded from the analysis. The total decrease/increase in 2022 compared to 2018 (in %) is given per animal category.

The next sections provide more details on the evolution of the distributions of antibacterial use in 'the reference groups' for benchmarking, 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. Pigs

1. Suckling piglets

Table 11a. Parameters describing the distributions of the farm-level antibacterial use in the reference populations for benchmarking of suckling piglets from 2018 to 2022 and the % difference (% diff) over the years.

Parameters BD_{100}	2018	2019	2020	2021	2022	% diff 22-21	% diff 22-18
P25	0,12	0,12	0,21	0,12	0,01	**-91,67%**	**-91,67%**
P50	1,84	1,68	1,63	1,64	0,91	**-44,51%**	**-50,54%**
P75	5,77	5,19	4,75	4,68	2,97	**-36,54%**	**-48,53%**
P90	11,57	9,94	9,94	8,57	5,37	**-37,34%**	**-53,59%**
Mean	4,42	3,83	3,89	3,47	2,00	**-42,36%**	**-54,75%**
Sum	5398	4600	4777	4809	2494	**-48,14%**	**-53,80%**
Total n farms	1356	1325	1372	1645	1522	ND	ND
% farms with zero use[1]	10%	9%	10%	16%	18%	ND	ND

[1] *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 shown in Table 11a, the antibacterial use in suckling piglets in 2022 further decreased throughout the entire benchmarking population of farms. There were again less than 10% farms, using antibacterials in suckling piglets, in the red zone which is remarkable considering the strong reduction in the action value, that became applicable as of this year, as compared to the previous two years (Table 11b). Almost 90% of the farms were even already below the 2024 action value. Approx. 65% of farms were already in the green zone. When including the zero-use farms (see Figure 31) this number increases to over 70%.

2. Weaned piglets

Similarly to sucklers, the decrease of the antibacterial use in weaned piglets in 2022 was situated throughout the entire benchmarking population of farms (Table 12a), though the decrease was more modest. Indeed, the weaned piglets remain the most difficult pig category to reduce antibiotic use, yet reductions of around -25% throughout the benchmarking population is generally a staggering result. Less than 10% of farms were in the red zone (with the 'new' action value applied) and only 15% of farms are still above the future action value (Table 12b). Around 60% of farms with weaned piglets (excluding zero-use farms) were below the attention value, increasing to almost 65% including the zero-use farms (see Figure 31).

Table 12a. Parameters describing the distributions of the farm-level antibacterial use in the reference population for benchmarking of weaned piglets from 2018 to 2022 and the % difference (% diff) over the years.

Parameters BD_{100}	2018	2019	2020	2021	2022	% diff 22-21	% diff 22-18
P25	3,61	4,40	3,69	3,26	2,47	**-24,23%**	**-31,58%**
P50	14,31	15,08	15,83	12,79	9,89	**-22,67%**	**-30,89%**
P75	31,77	30,53	31,55	28,81	21,34	**-25,93%**	**-32,83%**
P90	53,11	50,85	55,09	49,75	37,19	**-25,25%**	**-29,98%**
Mean	22,30	21,94	22,55	20,60	14,95	**-27,43%**	**-32,96%**
Sum	28989	28459	30010	30463	20697	-32,06%	-28,60%
Total n farms	1370	1367	1401	1615	1552	ND	ND
% farms with zero use[1]	5%	5%	5%	8%	11%	ND	ND

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

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**
31/12/2024	**14**	**30**

3. *Fattening pigs*

The decrease of the antibacterial use in fatteners in 2022 was also situated throughout the entire benchmarking population of farms (Table 13a). Slightly more than 10% of farms were above the new action value, a value that will be stable for the remainder of the reduction path (Table 13b). Around 60% of farms, excluding zero-use farms, and 70% of farms including zero-use farms (see Figure 31), were below the attention value.

Table 13a. Parameters describing the distributions of the farm-level antibacterial use in the reference population for benchmarking of fattening pigs from 2018 to 2022 and the % difference (% diff) over the years.

Parameters BD_{100}	2018	2019	2020	2021	2022	% diff 22-21	% diff 22-18
P25	1,18	1,27	1,14	0,94	0,63	**-32,98%**	**-46,61%**
P50	3,25	3,20	2,89	2,48	1,89	**-23,79%**	**-41,85%**
P75	6,53	6,41	5,87	5,00	3,83	**-23,40%**	**-41,35%**
P90	10,79	10,49	10,03	8,39	6,05	**-27,89%**	**-43,93%**
Mean	4,75	4,73	4,29	3,64	2,66	**-26,92%**	**-44,00%**
Sum	15644	15320	14195	12723	8541	**-32,87%**	**-45,40%**
Total n farms	3599	3519	3621	4307	4125	ND	ND
% farms with zero use[1]	8%	8%	9%	19%	22%	ND	ND

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

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

4. *Breeding pigs*

As in the other pig categories, 2022 saw an overall decrease of the antibacterial use in the benchmarking population of farms with breeding pigs, but the reductions appeared more pronounced with the highest users (Table 14a). Only 5% of farms, using antibacterials in breeding pigs, were in the red zone (data not shown). However, only 50% of farms using antibacterials in breeding pigs were in the green zone (data not shown), which is much lower than in the other animal categories. This is an intriguing result, which should be discussed with the sector to gain a better understanding of the factors explaining this.

Table 14a. Parameters describing the distributions of the farm-level antibacterial use in the reference population for benchmarking of breeding pigs from 2018 to 2022 and the % difference (% diff) over the years.

Parameters BD_{100}	2018	2019	2020	2021	2022	% diff 22-21	% diff 22-18
P25	0,05	0,09	0,09	0,07	0,06	**-14,29%**	**20,00%**
P50	0,32	0,40	0,40	0,33	0,27	**-18,18%**	**-15,63%**
P75	0,97	1,03	1,06	0,91	0,72	**-20,88%**	**-25,77%**
P90	1,96	2,07	2,12	1,87	1,26	**-32,62%**	**-35,71%**
Mean	0,87	0,86	0,85	0,75	0,51	**-32,00%**	**-41,38%**
Sum	1064	1032	1041	1073	642	**-40,17%**	**-39,66%**
Total n farms	1348	1320	1367	1685	1539	ND	ND
% farms with zero use[1]	9%	9%	10%	15%	18%	ND	ND

[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

5. Evolution of zero-use farms

As noted, zero-use farms were excluded from the results presented above. Nonetheless, the (evolution of the) number of zero-use farms merits closer attention, as it should tell something about the number of farms that raise animals without using any antibiotics at all. This would be a positive trend, even though the practice of zero-use is, as such, not promoted by any of the policymakers nor AMCRA. Rather, the policies are that antibiotic use should be reduced to the necessary minimum, by improving overall health management at the farm. If this results in avoiding all antibiotic use, all the better, but sick animals that require antibiotics should at all times remain eligible for the right (antibiotic) treatment.

In pigs, the number of zero-use farms has been increasing over the past years, as illustrated in Tables 11a-14a. Overall, there were 942 pig farms that reported no antibacterial use in all their animal categories in 2022 (22% of the number of farms with all of their animal categories belonging to the benchmark reference group). Only a few of these farms had also other animals of the species followed up in Sanitel-Med (in casu, broilers), but none had zero-use in the latter category.

More than half of the 2022 zero-use pig farms (493, representing 12% in total) also had zero-use in 2021, and 98 farms (2% in total) even had zero-use in 2020, hence for three consecutive years. From the pig farms that showed zero-use in 2021, 16% appeared not to have animals in 2022, 18% had categories that were not in the benchmark reference group in 2022, 58% still had zero-use in 2022 and only 10% did not show zero-use in 2022.

In conclusion for the pig sector, a major leap forward appears to have been taken in 2022. Big reductions were achieved in all categories, and the situation seems much more positive in terms of achieving the reduction paths compared to 2021. It must be noted that this is partly caused by a small adaptation in the quality control methodology that has been applied in 2022, which has led to the exclusion of more farms from the benchmark reference groups, in particular those with (suspected erroneously) high antibiotic use. However, as this correction was done retrospectively, the trend in the use results is not affected and positivity should prevail. Nonetheless, the work is not over yet, as more reduction is required and, as often, the last bits may prove to be the hardest. The good results of 2022 should be an encouragement for all stakeholders to maintain their efforts in the next years.

iii. Poultry

1. Broilers

After the spectacular decreases obtained in broilers in 2021, the antibiotic use in 2022 increased again, a trend visible throughout the whole benchmarking population of broiler farms. Consultation with the sector revealed that a number of problems were at hand, for example poorer quality of the chicks and an adverse effect of the (imprudent) limiting of lincomycin-spectinomycin use at the start of broiler-tomes, leading to increased antibiotic use later in the cycles. Yet, the results should not be dramatized as still only 1% of broiler farms is above the 'new' action threshold, an astounding result at this phase of the reduction path compared to the other sectors (Table 15b). Even the lower action value applicable as of end of 2024 would currently lead to only 3% of farms in the red zone. Also approx. 65% of broiler farms are below the attention value, increasing to more than 70% when including the zero-use broiler farms.

The number of zero users in broilers has been relatively stable over the years yet increased in 2022 (Table 15a). Of the zero-users in 2022, almost 70% were also zero-users in 2021, and more than 50% were zero-users for three consecutive years. All the broiler farms that were zero-user in 2021 remained zero-user in 2022. If the data are correct and antibiotic use is properly registered, this would mean the number of broiler farms finishing off their flocks without the need for using antibiotics is increasing.

Table 15a. Parameters describing the distributions of the farm-level antibacterial use in the reference population for benchmarking of broilers from 2018 to 2022 and the % difference (% diff) over the years.

Parameters BD_{100}	2018	2019	2020	2021	2022	% diff 22-21	% diff 22-18
P25	3,21	2,81	2,40	1,84	2,11	**14,67%**	**-34,27%**
P50	6,10	5,89	5,40	3,52	3,88	**10,23%**	**-36,39%**
P75	11,42	10,40	10,43	5,51	6,00	**8,89%**	**-47,46%**
P90	16,90	16,10	15,14	7,61	7,89	**3,68%**	**-53,31%**
Mean	8,08	7,43	6,95	3,94	4,23	**7,36%**	**-47,65%**
Sum	5121	4645	4461	2594	2704	**4,24%**	**-47,20%**
Total n farms	731	730	743	768	767	ND	ND
% farms with zero use[1]	13%	14%	14%	14%	17%	ND	ND

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

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

Date of application	Attention value	Action value
01/01/2021	**6**	**14**
01/01/2023	**5**	**12**
31/12/2024	**5**	**10**

2. Laying hens

The farm-level use for laying hens further decreased in 2022, yet it still remains higher than in the first years of data collection (Table 16a). As noted before, this sector is by far the most affected by the exclusion of the zero use farms as is done for the current analyses, with only 34% of laying hen farms notifying antibacterial use in 2022. Indeed, the number of zero users remained stable at this high level in 2022.

Table 16a. Parameters describing the distributions of the farm-level antibacterial use in the reference population for benchmarking of laying hens from 2018 to 2022 and the % difference (% diff) over the years.

Parameters BD_{100}	2018	2019	2020	2021	2022	% diff 22-21	% diff 22-18
P25	0,27	0,37	0,61	0,64	0,54	**-15,63%**	**100,00%**
P50	0,55	1,42	1,67	1,59	1,20	**-24,53%**	**118,18%**
P75	1,35	3,23	2,67	3,19	1,93	**-39,56%**	**42,96%**
P90	2,97	4,6	6,8	5,30	3,78	**-28,73%**	**27,27%**
Mean	1,28	1,94	2,61	2,32	2,02	**-12,93%**	**57,81%**
Sum	83	130	209	167	146	**-12,57%**	**75,90%**
Total n farms	198	196	205	211	214	ND	ND
% farms with zero use[1]	67%	66%	61%	66%	66%	ND	ND

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

Table 16b. The thresholds of the BD_{100} reduction path 2021-2024 for laying hens.

Threshold values [1]	
Attention value	**0**
Action value	**3**

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

In conclusion for the poultry sector, the results are a bit disappointing, when considering the overall increase in antibiotic use in the broilers and specifically also the increase in the use of quinolones. Nonetheless, the situation is not dramatic, yet requires a renewed elan to regain the good results of the past. It will be interesting to see the results for the whole sector when the new data-collection legislation will become applicable.

iv. Veal calves

The result of the veal calf sector is generally positive even though the achieved reductions are smaller than last year (Table 17a). Lowering of the action value has led to an increased number of 'red' farms (approx. 20%), and there is another lowering of the threshold foreseen. This means that a lot of work remains to be done, also in the lower use section, as still only around 30% of farms are below the future attention value. It is remarkable that, as in previous years, there are hardly any zero-use farms in the veal sector, likely reflecting the challenging nature of this sector to raise animals without antibiotics under the current (economic) circumstances.

Table 17a. Parameters describing the distributions of the farm-level antibacterial use in the reference population for benchmarking of veal calves from 2018 to 2022 and the % difference (% diff) over the years.

Parameters BD_{100}	2018	2019	2020	2021	2022	% diff 22-21	% diff 22-18
P25	19,73	15,71	14,54	11,72	10,88	**-7,17%**	**-44,86%**
P50	27,00	21,39	20,16	16,32	15,49	**-5,09%**	**-42,63%**
P75	39,13	28,16	28,02	24,15	20,84	**-13,71%**	**-46,74%**
P90	47,27	35,60	38,80	31,88	25,11	**-21,24%**	**-46,88%**
Mean	29,60	22,77	22,59	18,84	16,63	**-11,73%**	**-43,82%**
Sum	7046	5259	5264	4521	3826	**-15,37%**	**-45,70%**
Total n farms	240	232	233	241	232	ND	ND
% farms with zero use[1]	1%	0%	0%	0%	1%	ND	ND

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

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	**16**	**22**
31/12/2024	**12**	**18**

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

In conclusion, the efforts the sector has made in the past years are acknowledged and the result of the veal calf sector is generally positive for 2022. The sector should draw the conclusion from these results that there is a strong need to stimulate all partners involved (including external partners) to keep up the good work.

d) Percentage of alarm users in different species

Figure 34 summarizes the percentage of farms, including zero-use farms, in each benchmarking color zone, based on the farm-level use results end of 2022. The 'purple zone' represents the 'alarm users'. As a subzone of the 'red zone', it comprises farms that have been 'red' for two consecutive years (with the exception of farms that have reduced the past year with minimum 20% of the action value) or have been repeatedly 'red' in the last three years.

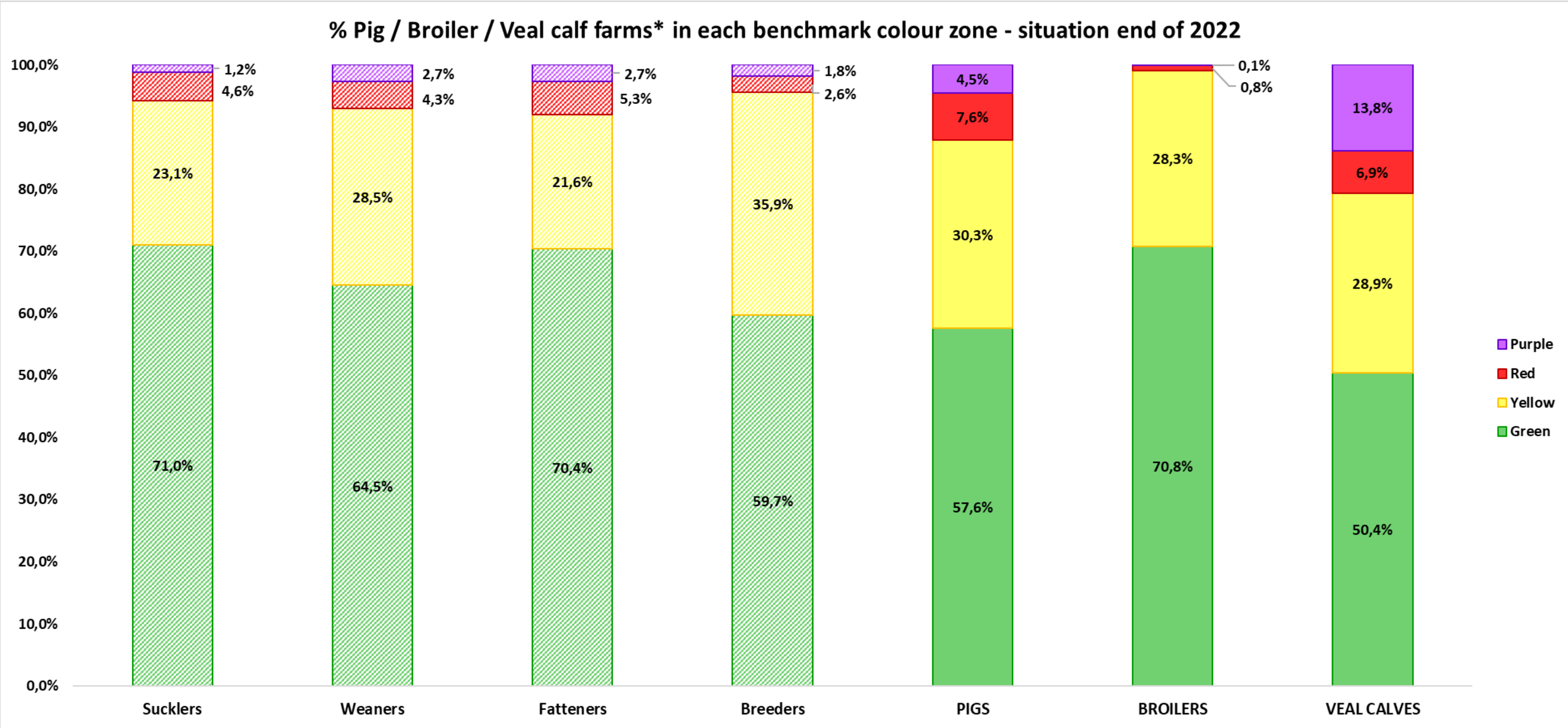


Figure 34. Distribution of the percentage of farms in the different benchmarking color zones. *: including zero-use farms

As can be deduced from the overview per animal category in the previous section, the results are the most positive for poultry farms and the most challenging for veal farms, with pig farms in between. This has to do with the results achieved so far in the sectors as well as with the 'starting' level of antibiotic use in the different sectors, but possibly also with the ambition displayed in the sector-specific reduction paths. It is likely that the reductions still to be achieved are a strong incentive for the pigs and veal calves sectors to continue their efforts, whereas the poultry sector instead might have the feeling to have already landed. This might partly explain the rather disappointing results for broilers in 2022, but it also raises the question whether the agreed reduction path was too low in ambition. It is important to underline the fact that the level of antibiotic resistance remains by far the highest in broilers. Looking forward to the situation as projected onto the end of 2024 with the current farm-level results (Figure 35), it indeed shows that serious challenges remain in the pig and especially in the veal sector, whereas there seems to be hardly any problem in broilers. This requires a serious discussion with all stakeholders in order to ensure each delivers its fair share in the reduction targets and continues its efforts to contribute, ultimately, to a lowered level of antibiotic resistance.

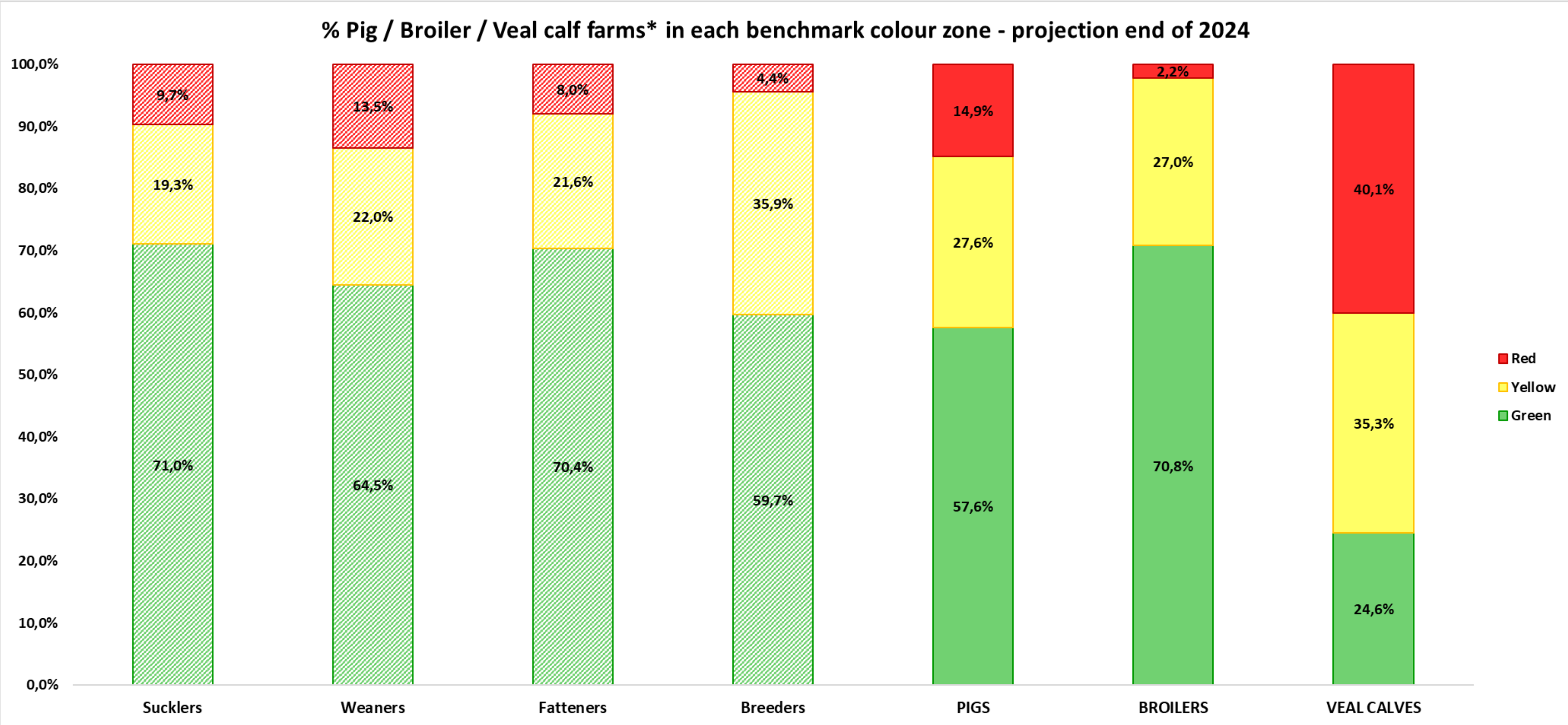


Figure 35. Projection of the distribution of the percentage of farms in the different benchmarking color zones end of 2024, with the current farm-level usage. *: including zero-use farms.

Alarm users, which are included as a reduction target (max. 1% end of 2024), are subject to specific measures in the Bepork and Belplume quality scheme; however, the results include more pig and poultry farms than only the Bepork and Belplume farms, respectively, and the veal farms are currently exempt from a binding framework. Even though the sector has taken good initiatives and is enthusiastically cooperating with stakeholders and AMCRA, a legal framework seems desirable to cover all farms in all sectors. This will hopefully help to maintain the efforts required to achieve the targets.

e) Antibiotic use by the contract-veterinarian

Compared to the previous years, the analysis of the antibacterial use in relation to the vets who are charged with the epidemiological surveillance on the farms (= the contract-vet, CVET) was done in two different ways (Figure 36a and 36b).

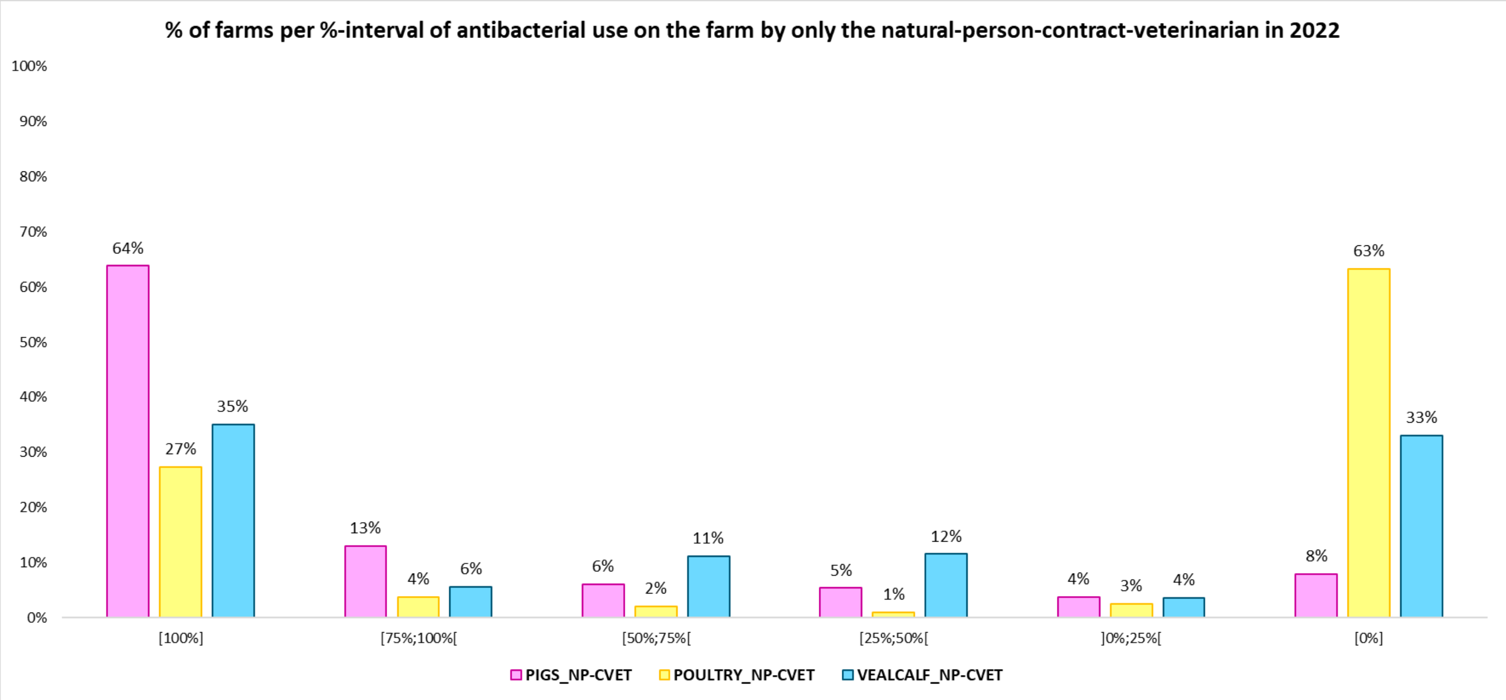


Figure 36a. The % of farms with the % of the antibiotic use, per 25%-intervals, that was done by a natural person contract veterinarian (NP-CVET) on pig, poultry and veal calf farms in 2022.

Figure 36a depicts the results when only considering use registered by a natural person CVET. Figure 36b shows the results when additionally including, in case the farm has its contract with a veterinary legal person, the use that was done by (a) vet(s) that is/are part of that legal person.

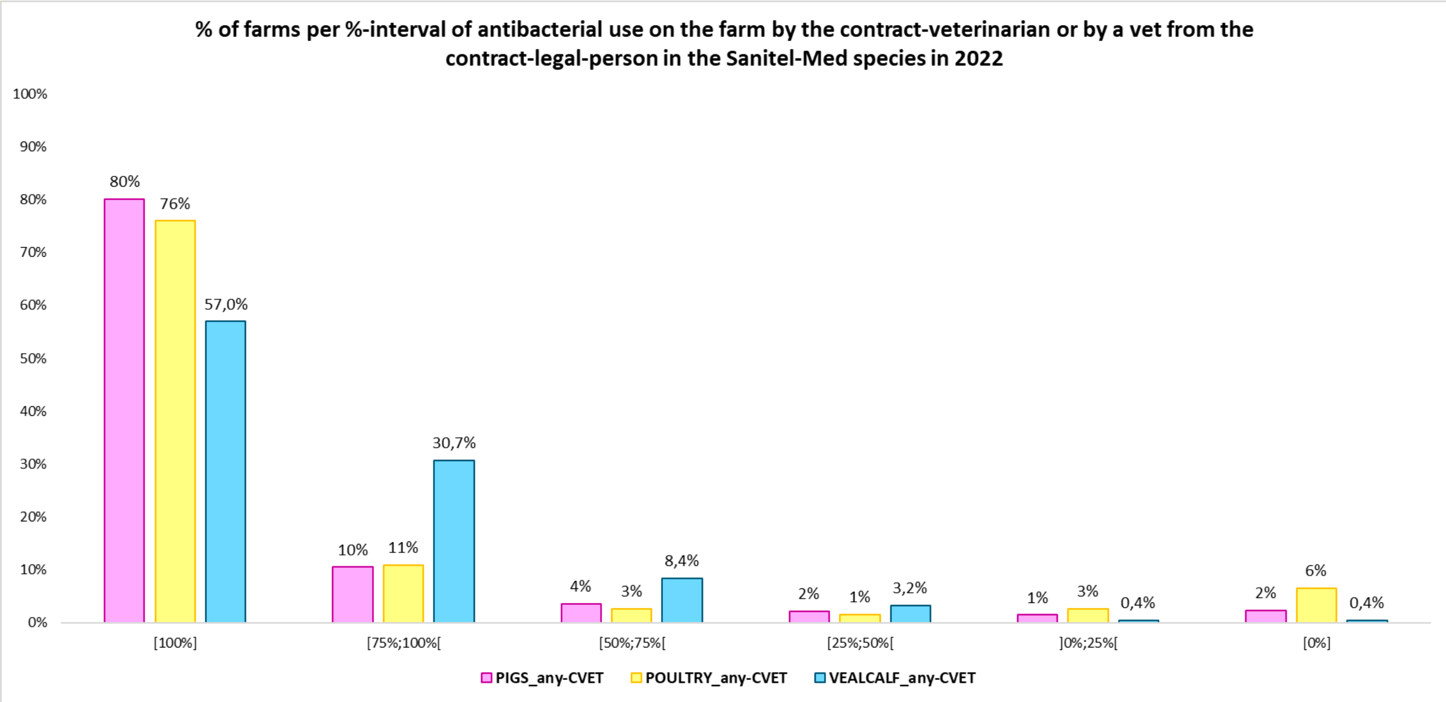


Figure 36b. The % of farms with the % of the antibiotic use, per 25%-intervals, that was done by a natural person contract veterinarian or, if the contract veterinarian of the farm is a legal person, by (a) vet(s) belonging to that legal-person.

The two graphs show totally different results. Indeed, it appears that especially in poultry, legal person CVET are widely appearing, and play an important role in the antibacterial use on the farms. Combining the natural and legal person CVET, 76% of poultry farms had 100% of their antibacterial use prescribed, administered or delivered solely by a CVET (natural or legal), compared to merely 27% when looking only at the natural person CVET. In pigs, the natural person contract-vet remains most important but when including the legal-person CVET pig farms had the highest overall percentage of farms where 100% of antibiotic use was registered by a CVET only. The most 'diffuse' picture emerges in the veal sector with the overall lowest percentage of farms where 100% of antibiotic use was registered solely by the CVET. It must be noted that the information about which individual veterinarians belong to a legal person is not obliged to be regularly updated.

f) Farm-level use of the various antibacterial classes

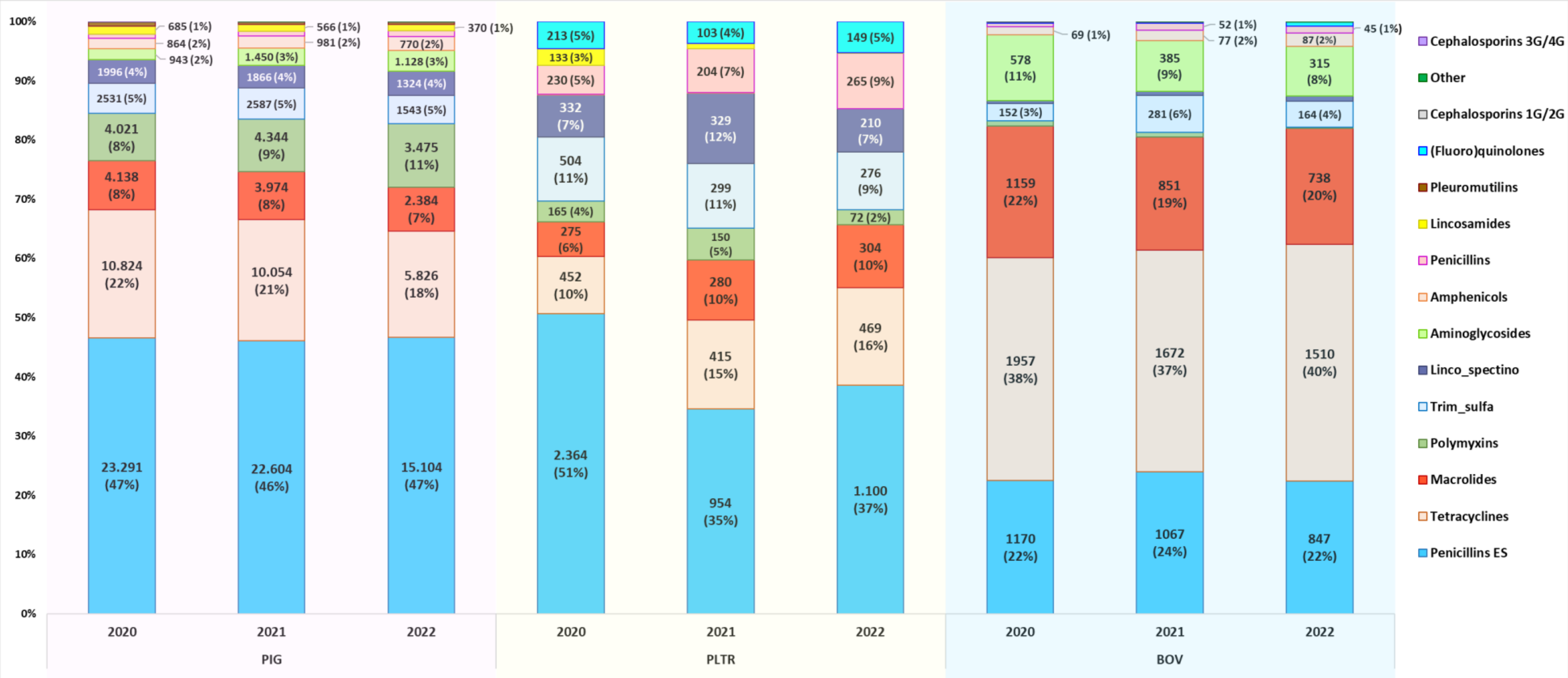


Figure 37. Number of treatment days with the different antibacterial classes and percentage of the total number of treatment days per species in 2020, 2021 and 2022. Numbers/percentages not shown are classes where use was below 1% of treatment days.

In pigs, the total number of treatment days decreased in 2022 but the proportions remained rather stable for all major antibacterial classes compared to the previous years (Figure 33). Yet, the proportion of tetracyclines appears to further decrease, whereas the proportion of polymyxines remarkably increases. In poultry, broad-spectrum penicillins, the main class, increased both in total treatment days as in proportion, and also tetracyclines, macrolides, amphenicols and, unfortunately, quinolones gained importance. In contrast, polymyxins (in laying hens), trim-sulfa and particularly lincomycin-spectinomycin antibiotics decreased in importance. In veal calves, the situation was comparable to the situation in pigs, with the decrease rather 'evenly' spread across antibacterial classes and proportions remaining relatively stable, even though the importance of tetracyclines and also quinolones increased.

DISCUSSION

In the context of the increasing (awareness on) antibacterial resistance development, comparable data and monitoring of evolutions of antibacterial consumption (AMU) are of utmost importance. This annual BelVet-SAC report is now published for the fourteenth time and describes the AMU in animals in Belgium in 2022 and its evolution since 2011. This report combines for the fifth year the sales data (collected at the level of the Belgian distributors and compound feed producers) and the use data (collected at farm level). This allows to dig deeper into AMU at species and farm level in Belgium.

- ***Generally favourable results, but …***

Overall, 2022 appears to have been a particularly fruitful year. Indeed, the reduction of -58,2% in the mg antibiotics standardised with the kg biomass, calculated from the 2022 sales data, not only smashes the general target of -50% set for 2020, it also takes a giant leap towards the target of -65% set for 2024. Furthermore, the mg/kg colistin calculated from the sales data dives dramatically under the target of 1 mg/kg, the reduction in the sales of premedicated feeds already exceeds the 2024-target of -75% and, despite a small increase in the sold quantities of quinolones, the target of -75% still seems largely maintained. In addition, the Sanitel-Med use data show encouraging results for pigs and veal calves, and while broilers appear to bounce back a little from the major reductions achieved in 2021, they still have their sector-specific reduction target within reach.

While all this may justifiably be cause for optimism and satisfaction with the efforts made, a closer look reveals some catches. Indeed, a more detailed comparison of the sales and use data, done for the first time since the Sanitel-Med data collection started, suggests that the 2022 sales data are not (or no longer) painting the full picture of the antibacterial consumption in animals in Belgium. This at least for some antibacterial classes, unfortunately particularly these classes that are of greater importance and with specific reduction targets, the quinolones and colistin. This emphasises the need to adapt and expand the species level use data collection. Apart from this, the results of the quinolones in the broiler sector, with serious increases in two out of the last three years, combined with the general increase in antibiotic use in this sector compared to the continued reductions in pigs and veal calves, is cause for scrutiny. Finally, the veal calf sector still seems to have a long way to go towards achieving their reduction target.

Below, the results are discussed in more detail.

- ***A major reduction in mg/kg biomass antibiotics sold***

With a **consumption of 61,3 mg antibiotic/kg biomass in 2022** a **decrease of almost -25%** is achieved in comparison to 2021. The decrease in 2022 is apparent in both **pharmaceuticals (-23,3% mg/kg) and antibacterial premixes (-36% mg/kg).** With 2011 as a reference, a **cumulative reduction of -58,2%** is achieved**.** Noteworthy, this is despite an atypically big decrease in the yearly biomass of -5,7%. Indeed, in absolute values the reduction in sold antibiotics is -28,8%, with the 2022 total (122,4 tonnes) being almost 50 tonnes below the 2021 total (171,6 tonnes). Compared to 2011 this represents a reduction of 177 tonnes (-59,1%) of active substance.

Next to an actual decreased use of antibacterial VMPs, at least two other possible explanations are worth mentioning that could contribute to this larger than expected decrease in sales.

In 2021, a remarkably large difference between the sales and use data (over 50 tonnes, >10 tonnes more than in previous years) led us speculating that for example stockpiling at the level of the vets might have been at play, consequently meaning that such 'peak' could be expected to be followed by a 'drop' in 2022. In other words, should in 2021 more-than-'expected' antibiotics have been sold, in 2022 it could be anticipated that less-than-'expected' antibiotics would be sold. With the gap between sales and use observed in 2022 (32 tonnes) being much lower than in 2021, even at its lowest level since the start of the Sanitel-Med data-collection, a reverse-stockpiling effect indeed seems part of the explanation. This is further supported by the observation that for some products, e.g. macrolides (more specifically, the lincomycin-spectinomycin antibiotics) and colistin, the use for the first time exceeded the sold quantities – in case of colistin even with almost 50%. Furthermore, while the used quantities of quinolones in previous years were never above 49% of the sold quantities, in 2022 this was 90%. This might indicate that part of these products were bought in 2021 by veterinarians and only used in 2022.

Another phenomenon that may act is that, due to the change in the European legislation, veterinary medicinal products can, since entry into force of Regulation EU 2019/6 in January 2022, be bought in other European countries or directly from the marketing authorisation holder. In previous years, the possibility of antibiotics bought outside Belgium but used inside

Belgium was acknowledged, but it was always supposed that the reverse also happened, in a balanced way. We now might be observing that more antibiotics have been bought outside Belgium than usually. This would mean that the achieved result for the sales data is 'artificially' better than in reality.

Taken together, caution should be exercised when interpreting the sales data in the coming years. To counter the potential growing unreliableness of the sales data at the level of Belgian stakeholders, the FAMHP has started a project, financed in part by the EC, looking into a new data collection system at the level of veterinarians and pharmacists. This would ensure proper collection of sales data, as purchase of antibacterials from outside Belgium would then also be captured.

- ***No change of the situation in a European context yet***

Comparing the Belgian sales data with the results of other European countries, and especially our neighbouring countries, shows **that we are catching up**, even if there is still a substantial gap to be bridged. **Nonetheless, Belgium remains having the highest AMU (expressed in mg/pcu) of all our neighbouring countries** according to the most recent ESVAC report. Yet it should be reminded that the ESVAC data for 2022 will be published by the end of 2023 and therefore it is currently not possible to take into account the reductions achieved in Belgium in 2022 , as covered in this BelVet-SAC report.

- ***AMU further decreases in pigs and veal calves, yet increases in broilers***

As in previous years, the total AMU in animals in 2022 was in large part determined by the pig sector and more specifically, by the fatteners and the weaners. Yet, their importance decreased, from 70% to 63% of tonnes used. With this, the relative importance of veal calves and especially of broilers increased, the latter up to 18%. Indeed, poultry and more specifically the broilers, were the only Sanitel-Med animal category where the used tonnes increased in 2022 compared to 2021. In addition, with regard to the use of the critical antibacterials, the used kg of quinolones increased in broilers, approaching the level of the dramatic year 2020. Worryingly, an increase in use of quinolones was also observed in veal calves. This means that in two out of the last three years, these sectors have shown that it is difficult to contain the strongly discouraged use of quinolones. If this would indeed be reflective of increasing problems with multi-resistant bacterial infections, it should even more be a cause for maintaining and enforcing prudent antibacterial use practices and preventive measures.

The **number of treatment days (BD_{100}) at the species level** shows a further decrease in 2022 for **pigs (-28,2%) and for veal calves (-9,8%)** compared to 2021, whereas for **poultry the BD_{100}-species increased with +11%**. Even though since 2018 similar reductions have been achieved in all three species (-42,7% in pigs, -40,7% in poultry and -43,9% in veal calves), the sentiment in the sectors might be different.

The **farm-level results per animal category show similar results**. For all pig categories, proper reductions have been achieved. For the suckling piglets the median BD_{100} dropped to 0,91, approx. -45% lower than in 2021. In weaned piglets the median BD_{100} went down to 9,89 – a decrease of -23% compared to 2021, and in fatteners a decrease of -24% resulted in a median BD_{100} of 1,89. Finally, in pigs for breeding the median BD_{100} in 2022 was 0,27 compared to 0,33 in 2021, representing a decrease of -18%. These very nice reductions mean that, despite the reduction in the action values for most categories that came into effect beginning of 2023 (or perhaps, thanks to), the number of red farms (hence, possible alarm users) remained similar or even lower than with the previous threshold values. Indeed, even the final threshold values that will be applicable beginning (suckling piglets, fatteners) or end (weaned piglets) of 2024 seem not so far out of reach, illustrating that the efforts to maintain a workable situation have paid off. It must be noted though that these very favorable results are partly artificial, as the revision of the quality control measures for the data analysis have resulted in a general decrease of the distribution parameters describing the AMU in the benchmarking reference populations – by cutting away a group of farms with suspicious high use. Still, credits are with the sector, as the reduction trend is evident throughout the whole group of farms. The increasing number of zero-use pig farms is another positive element that should encourage the sector to maintain its efforts.

In broilers, a big reduction was achieved in 2021 from which the sector appears to have somewhat bounced back in 2022, with the AMU increasing throughout the benchmarking reference population, and the median BD_{100} going from 3,52 to 3,88 (+10%). Consultation with the sector has learned that various problems lay at the base of this increase, such as poorer egg-quality. Remarkably, they also partly explain the increase by the seemingly failing of further, different reduction efforts. Indeed, whereas the major leap forward in 2021 was to be explained by a decrease of AMU later in the life-cycles (use of broad-spectrum penicillins in the first place), the reduction efforts in 2022 focused more on the early-life antibiotics, specifically lincomycin-spectinomycin. However, this appears not to have been a big success, as it is deemed to lead to more use of (critical) antibiotics later in the cycle. Although we acknowledge the efforts that have been made, it is difficult to accept that certain antibiotic use should be considered ‘elemental’ in the current system, especially as it basically comes down to preventive use. We therefore encourage the sector to reinvigorate their efforts to tackle the various problems that are causing the need to use antibiotics, as there sure remains room for improvements, and also not to lose track of the positive work achieved in the other sectors. The fact that the sector-specific reduction targets remain within reach luckily means no man is overboard. It is also positive that the number of zero-use broiler farms appears to increase over the years, and that the sector of the laying hens continues the positive evolution of reducing after its 2020-peak AMU.

In veal calves the reduction of the AMU continued throughout the whole benchmark population, albeit less pronounced than in 2021 compared to 2020, with the median farm level BD_{100} at 15,49, down from 16,32 in 2021 (-5%). This is a rather modest decrease, and it appears that larger reductions occurred in the higher-user-section. Of the three Sanitel-Med sectors, the veal calves remain the sector with not only the highest ‘basic’ use, with almost no zero-users, but also with the largest reductions still required to remain in line with the reduction path. In the last years, the sector has shown a clear will to cooperate and invest energy in reducing the AMU. An intensification of these efforts will be required to keep track with the ambitious reduction path, as with the AMU results end-of-2022, 40% of farms would become red farms end of 2024.

- ***Favorable results in cattle and companion animals***

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 antibacterial use evolutions in some of these species. **In dairy cattle it is positive to observe that the average intramammary antibacterial use per milk cow decreased for the third year in a row, resulting in the lowest value (2,31) since start of the measurements in 2013.** Like in 2021, the decrease is especially apparent in applicators used for mastitis therapy. This suggests that the practice of selective dry-cow therapy is still not gaining traction. This should be more a point of attention for the dairy cattle sector.

In dogs and cats, the volume of antibacterial products in 2022 decreased again with -5,0% in comparison to 2021. In the last four years, the AMU in these species appears to stabilise at a level which is +20-25% higher than the years before. With the absence of an accurate estimate of the evolution in the total dog and cat population (denominator) it remains difficult to interpret these results. It is good to see that t**he use of critical important antimicrobials (red molecules) in dogs and cats further decreased** compared to 2021.

- ***Reductions in all antibacterial classes, however …***

The details of the sales of the different antibacterial classes show that penicillins remain the largest group of consumed antimicrobials, with tetracyclines and sulphonamides completing the top 3. The **overall observed decrease in sold antibacterials is spread over most of the different antibacterial classes**, but it is especially regretful for **the quinolones and the cephalosporins** whose sales increased. The sold quantity of **colistin** has decreased spectacularly in 2022 with **-55,3% mg/kg biomass.** It should be repeated that it is a nice and apparently structural result that the extensive therapeutical use of ZnO only a few years ago has not been replaced by the use of colistin or another antibacterial product. On an important sidenote, for both quinolones and colistin a remarkably atypical relationship between sales and use is observed in 2022, which should be taken into account when interpreting the results.

- ***The results in light of the reduction targets: modest optimism***

The initial general reduction target (-50% by 2020) as formulated in the AMCRA Vision 2020 and the first Covenant between the sectors, AMCRA and competent authorities, has now been reached, which in itself is a satisfactory achievement. Moreover, the decrease is so big that even the **renewed overall reduction target of -65% by 2024**, agreed to in a new covenant as well as the Belgian National Action Plan for AMR, **comes within reach**, even though there are still two years to go. However, there still is an important step to take and setbacks have occurred in the past, hence we must stay vigilant. Additionally, in the light of the detailed comparison of the sales vs. use data, we should evaluate the current sales data collection model to make sure all distribution channels are covered, including purchase directly from marketing authorisation holders and from other Member States. This also underlines the growing importance of use data collection, which gives a more accurate description of the actual antibiotic consumption in animals. This implies that efforts need to be made to speed up the extension of the use data collection to the other animal species.

A stunning result for the **premixes (-83,5%)** is observed. The goal set in the second covenant was -75%, meaning this goal has already largely been achieved. It is our hope that this level will at least be maintained in the coming years; and even though the sector has set its horizon for total discontinuation of feed premedicated with antibacterials only in 2030, the current result suggests this might be achieved earlier.

The most worrying result in light of the reduction target is that for the **'red' products**. The aim expressed in the covenant was to at least maintain the level of -75% reduction compared to 2011. Despite the small increase with 1,1%, this has again been **achieved in 2022 with a reduction compared to 2011 of -82,7%**. However, it is apparent that the sectors have difficulties to fulfil the agreements and ambitions with respect to the actual use of quinolones, and it might be questioned whether the current policies require refining or even tightening. Luckily, use of 'yellow' (-23,3%) and 'orange' (-25,1%) antibacterials decreased in 2022.

The herd-level data collection in pigs, broilers, laying hens and veal calves, already existing for multiple years, have led to the establishment of **sector-specific reduction paths as a central strategy** to support achieving the national reduction target(s). These reduction paths are deemed ambitious yet realistic and, foremost, essential to get the sectors moving towards the required further reductions of AMU. Indeed, the increased attention towards 'alarm users' in the sectoral quality schemes is likely to have contributed to the remarkable decreases observed in pigs this year (and in poultry last year). Nonetheless, it will be important to maintain the efforts to take the final steps in pigs. The poultry sector is still in comfortable waters and should better take advantage of that situation to achieve structural and durable reductions in all phases of the chick's life cycle. The veal calf sector has a special position; the achievements so far have been remarkable but the way to go remains long. However, the sector has shown remarkable will to cooperate and act, and it is our conviction that with their best efforts and cooperation towards the common goal in all steps of the chain, much more progress lies within reach.

CONCLUSION

The 2022 antibacterial product sales and use data appear to be a victory lap, with giant steps forward taken for the general reduction target, the premix reduction target and the colistin reduction target. All species and sectors are in the hopeful position of much work having been done and nice results having been achieved, yet acknowledging that continuation of, reinforcing or reorienting the efforts will be required to succeed. A major focus point of the near future should be to get a clear view of the reliability of the current sales data collection for following up on and informing the Belgian policy on antibacterial consumption in animals.

ACKNOWLEDGEMENTS

Belgian 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.

ANNEXES

ANNEX I. ATC-VET CODES INCLUDED IN THE DIFFERENT CLASSES OF ANTIBACTERIAL PRODUCTS

Class of Antibacterials	ATCvet codes included
Aminoglycosides	QJ01GB
	QS01AA11
	QA07AA06
	QJ51RG
	QJ01XX04
Other	QJ01XQ
	QJ51XX01
	QJ01RA04
Cephalosporins	QJ01DB
	QJ01DD
	QJ51DB
	QJ01DE
	QJ51DE
	QJ51RD
Amphenicols	QJ01BA
	QD06AX
Macrolides	QJ01F
	QJ51RF
	QJ51FF
	QJ01FF
	QD06AX
Penicillins	QJ01C
	QJ51RC
	QJ51C
Polymyxins	QJ01XB
	QA07AA10
Quinolones	QJ01M
Sulphonamides and trimethoprim	QJ01E

tetracyclines	QJ01A
	QD06AA

Annex II. Comparison sales and use data

This Annex provides more details about the comparison of the Sales and the Use data.

Evaluation of the relationship between Sales and Use per antibacterial class

First, an overview of the total Sales vs. Use quantities (kg) of all antibacterial classes – as distinguished in the Sales section of the report – over the past five years is shown (Figures A1-A11). For the Use quantities, registrations with possibly erroneous (extreme) quantities and Self-Defined Products (SDP) were excluded.

Aminoglycosides

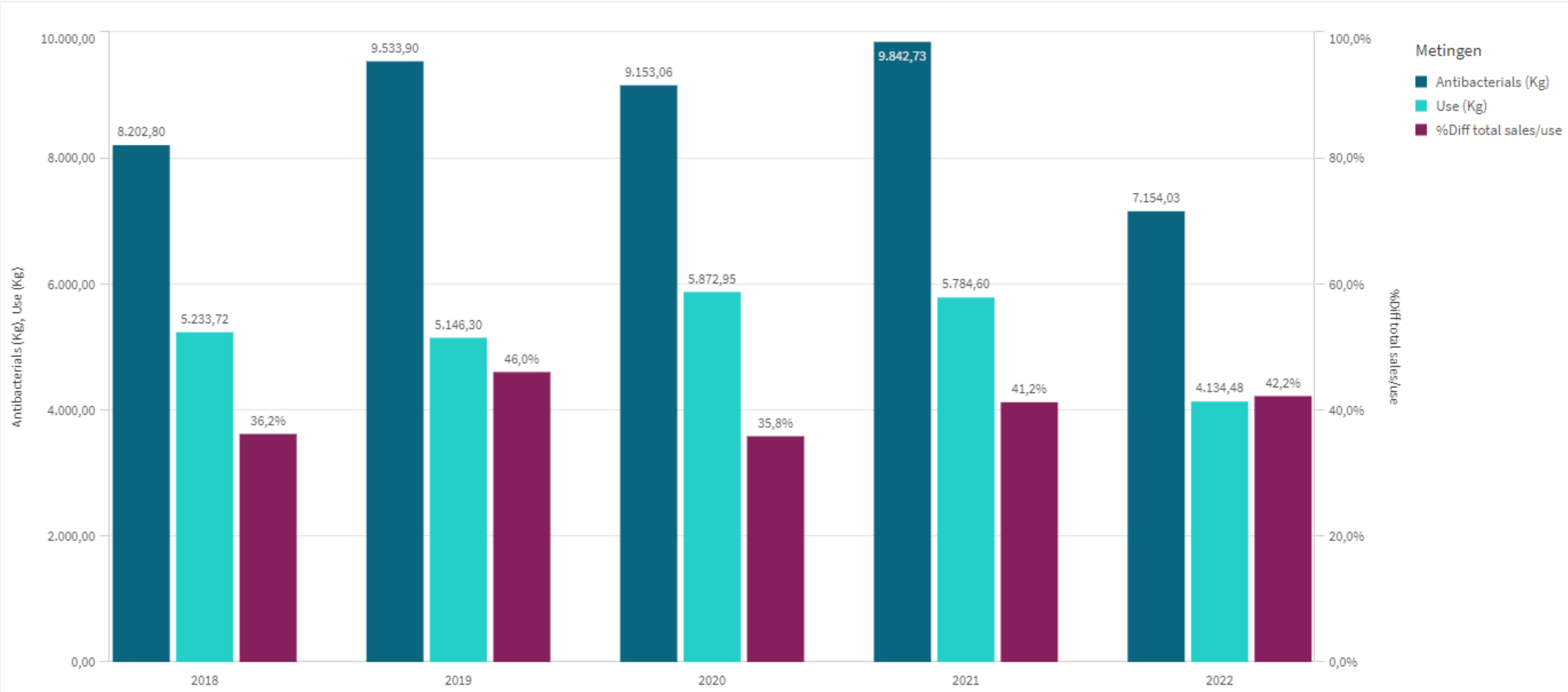


Figure A1. Total Sales quantity (kg) and total Use quantity (kg) of Aminoglycosides and % difference between the two quantities, from 2018 to 2022.

Cephalosporins 1G/2G

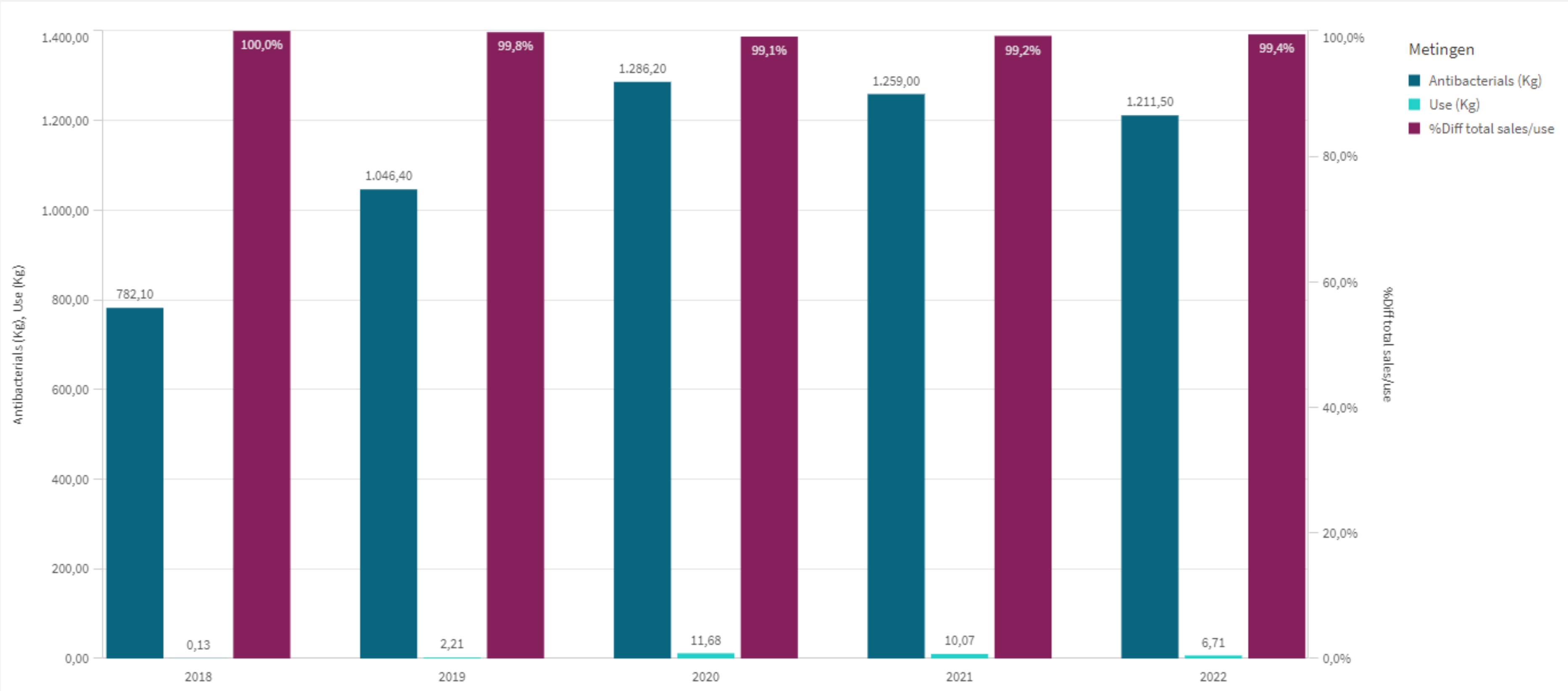


Figure A2. Total Sales quantity (kg) and total Use quantity (kg) of Cephalosporins 1G/2G and % difference between the two quantities, from 2018 to 2022.

Cephalosporins 3G/4G

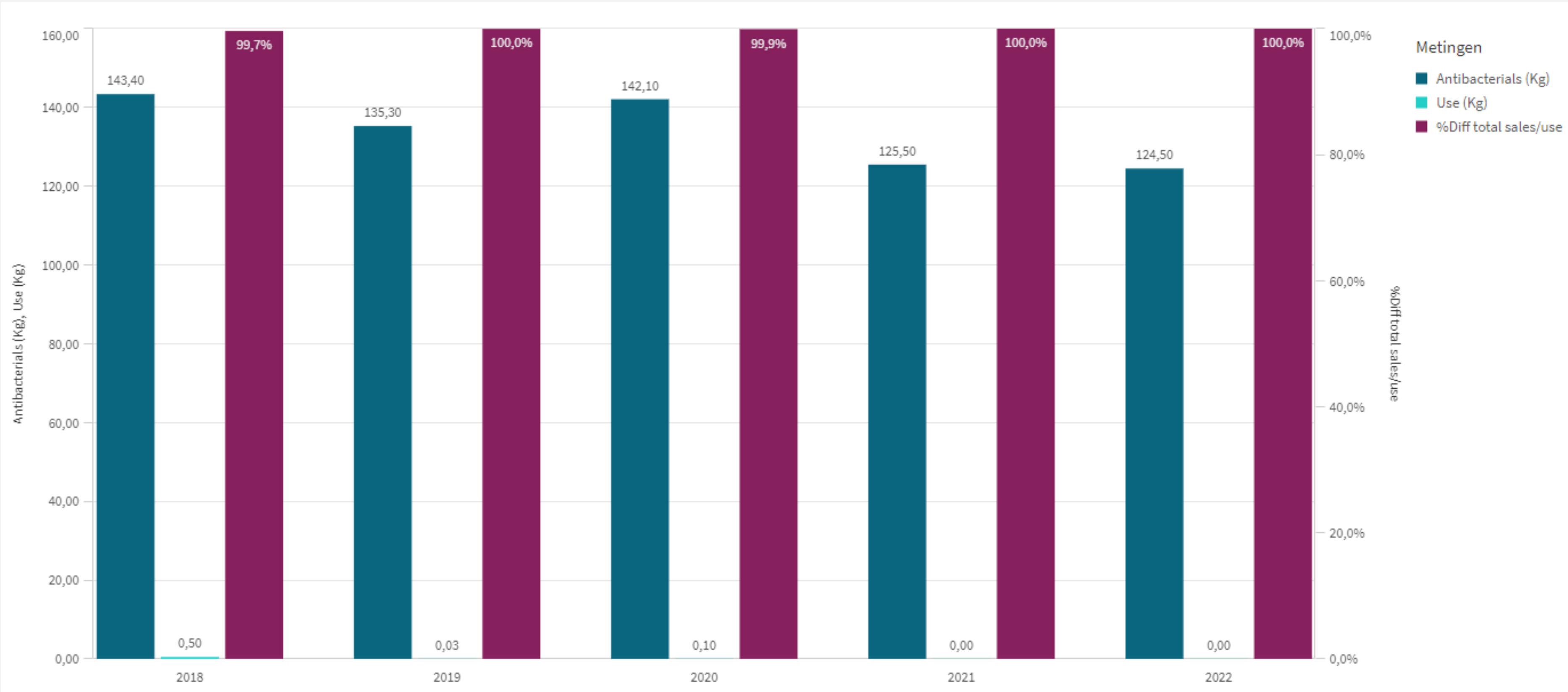


Figure A3. Total Sales quantity (kg) and total Use quantity (kg) of Cephalosporins 3G/4G and % difference between the two quantities, from 2018 to 2022.

Macrolides

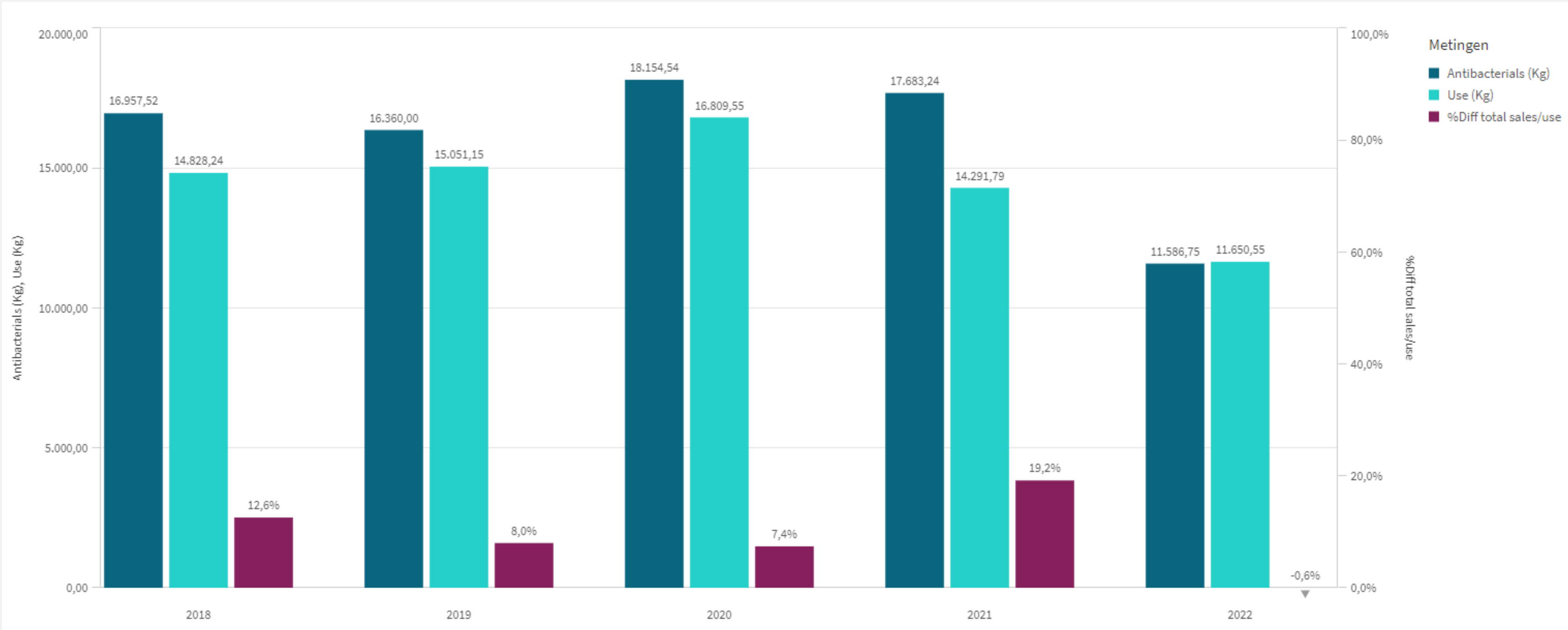


Figure A4. Total Sales quantity (kg) and total Use quantity (kg) of Macrolides and % difference between the two quantities, from 2018 to 2022.

Other

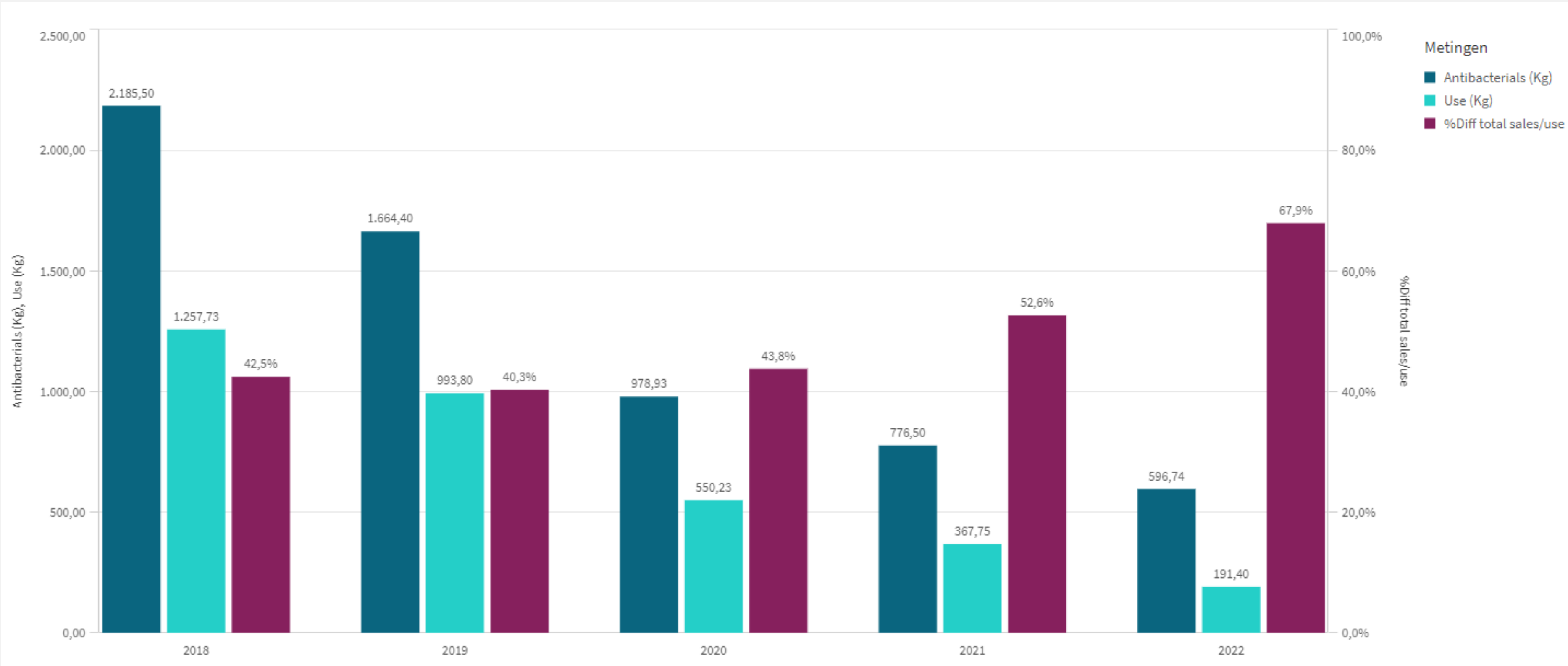


Figure A5. Total Sales quantity (kg) and total Use quantity (kg) of the 'Other' antibacterials and % difference between the two quantities, from 2018 to 2022.

Penicillins

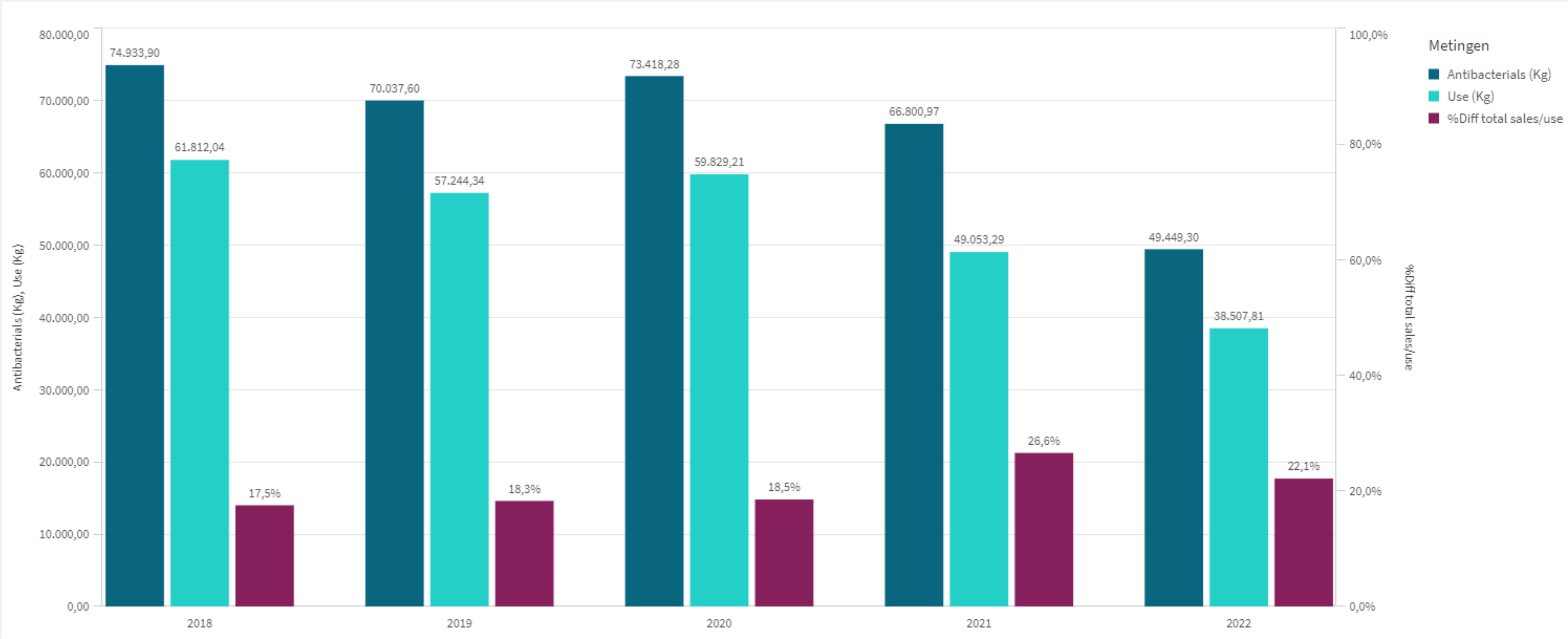


Figure A6. Total Sales quantity (kg) and total Use quantity (kg) of Penicillins and % difference between the two quantities, from 2018 to 2022.

Phenicols

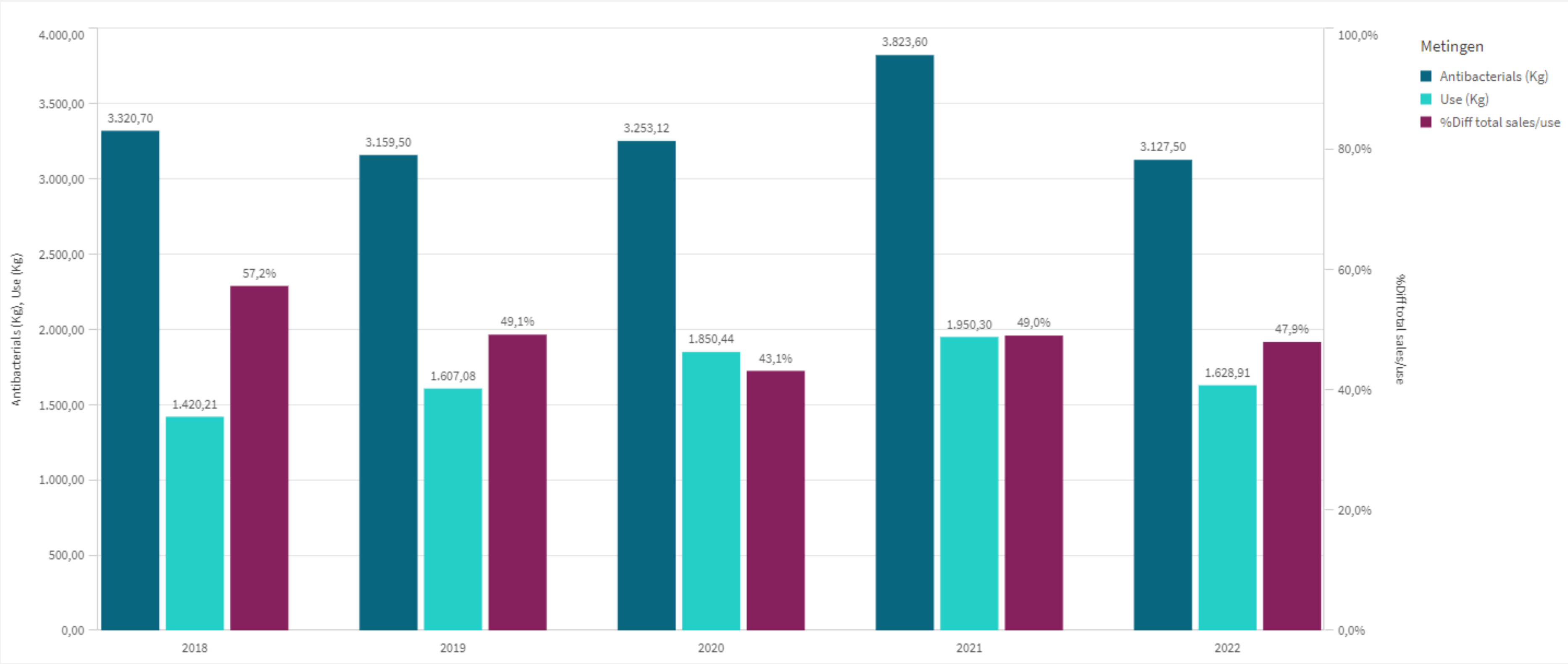


Figure A7. Total Sales quantity (kg) and total Use quantity (kg) of Phenicols and % difference between the two quantities, from 2018 to 2022.

Polymyxins

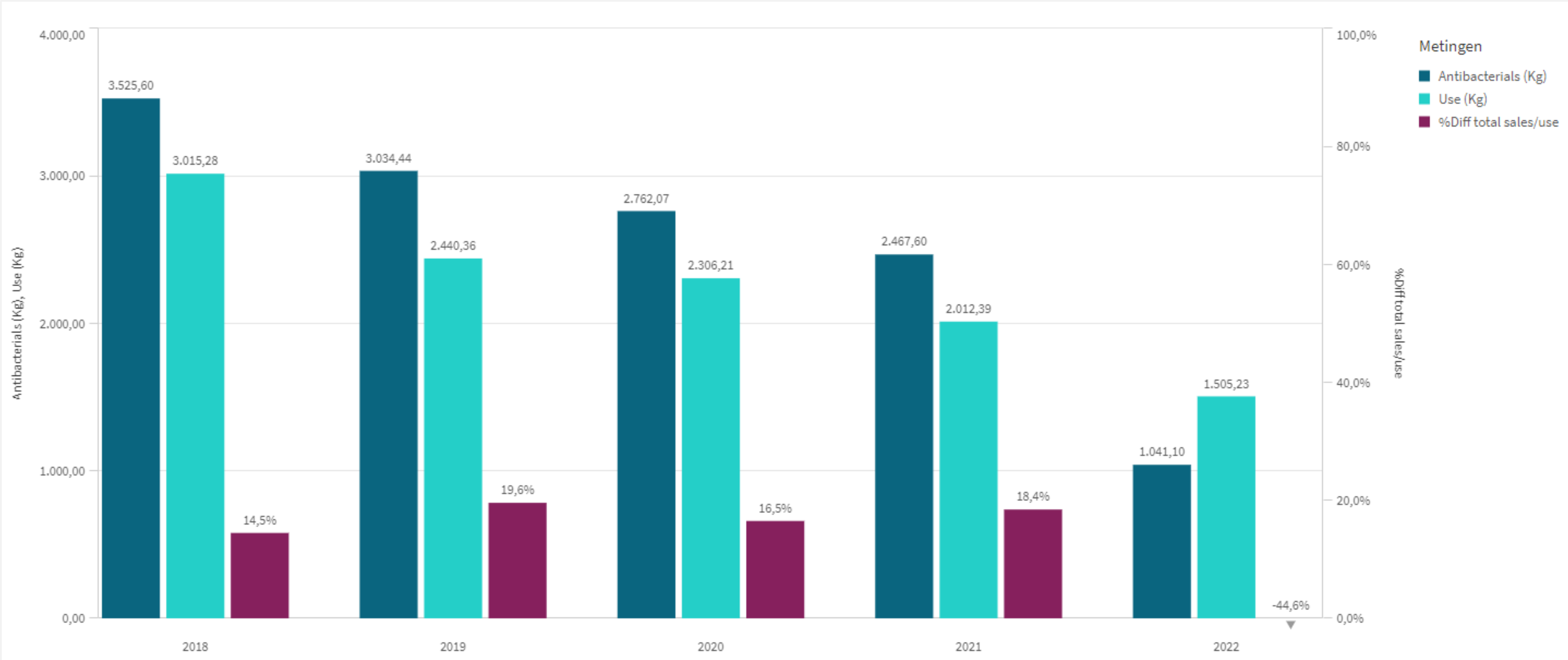


Figure A8. Total Sales quantity (kg) and total Use quantity (kg) of Polymyxins and % difference between the two quantities, from 2018 to 2022.

Quinolones

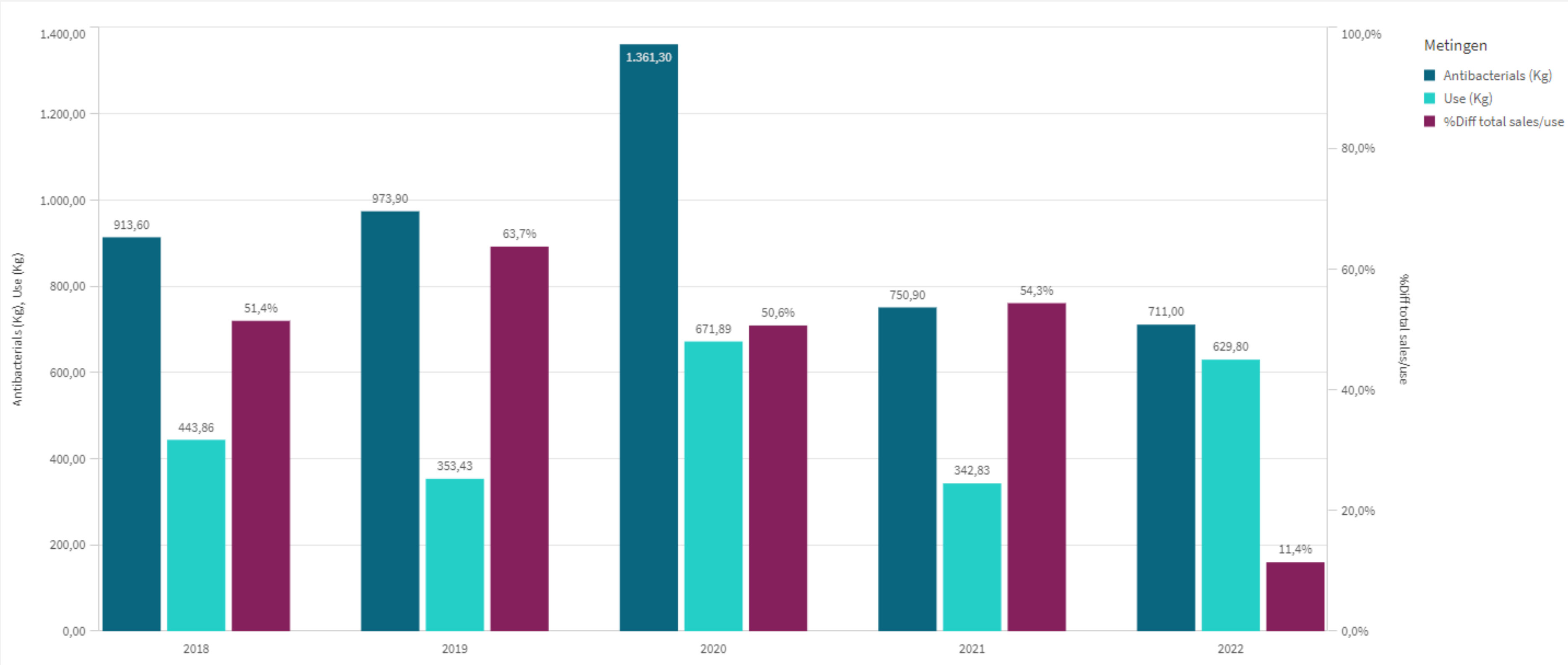


Figure A9. Total Sales quantity (kg) and total Use quantity (kg) of Quinolones and % difference between the two quantities, from 2018 to 2022.

Sulphonamides

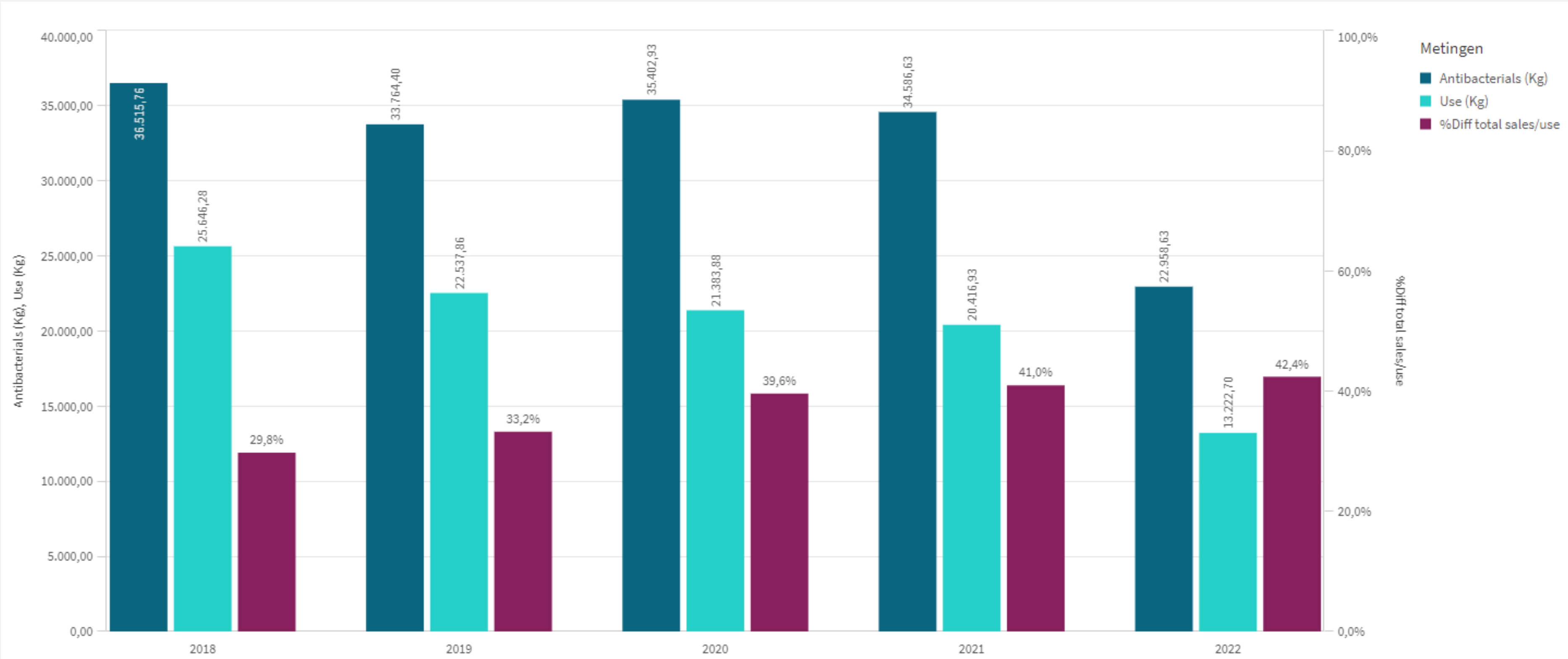


Figure A10. Total Sales quantity (kg) and total Use quantity (kg) of Sulphonamides and % difference between the two quantities, from 2018 to 2022.

Tetracyclines

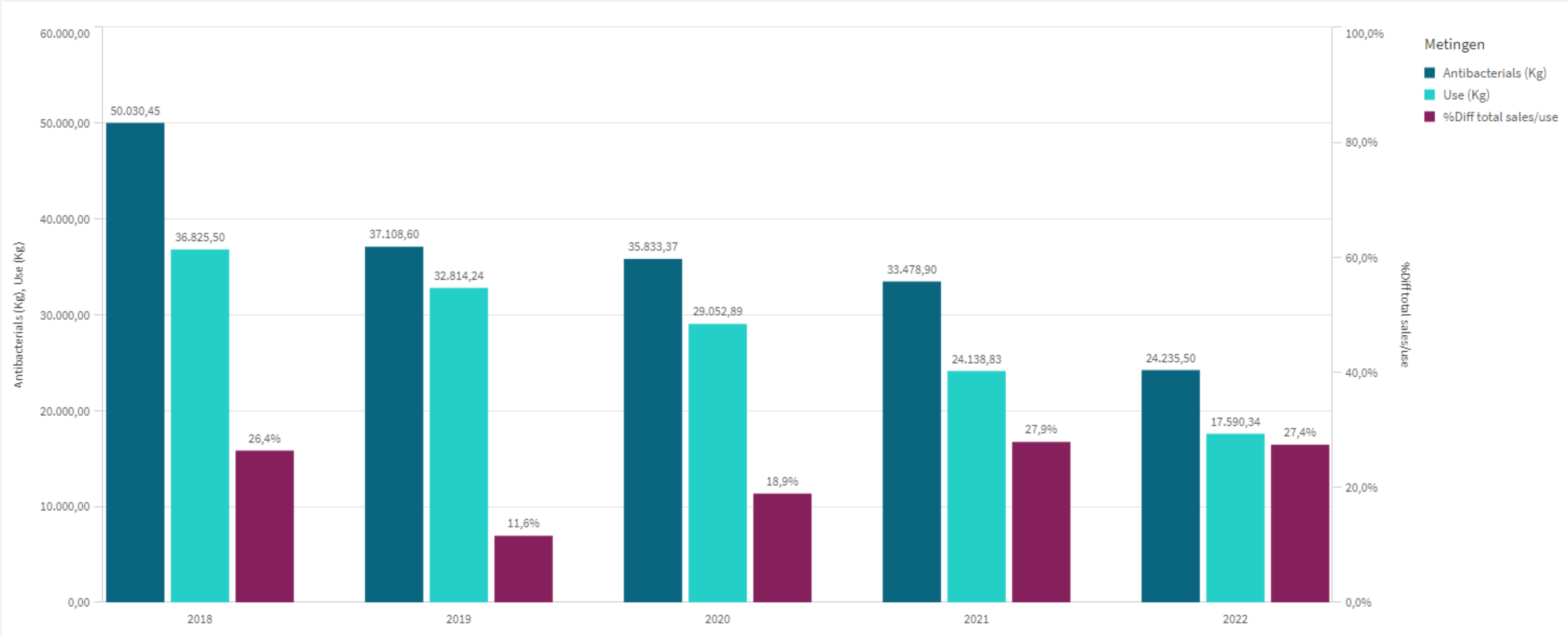


Figure A11. Total Sales quantity (kg) and total Use quantity (kg) of Tetracyclines and % difference between the two quantities, from 2018 to 2022.

As noted in the text and can be deduced from the graphs above, there are three antibacterial classes for which the result in 2022 markedly differs from the preceding years: the macrolides, polymyxins and quinolones. Below more details are provided, focussing on the underlying active substances and products involved. The results shown below are based on the comparison at the product (cti-ext code) level.

- The **macrolides** class as defined in the 'sales' section includes the macrolides and lincosamides, not only from products that contain one of these as a single active substance but also from those that contain them as one of multiple active substances, hence, also the lincomycin-component (a lincosamide) of the lincomycin-spectinomycin products. Both macrolides 'sensu strictu' (i.e. products with gamithromycin, spiramycin, tildipirosin, tilmicosin, ulathromycin, tylosin or tylvalosin), and more specifically tylosin and tilmicosin, and lincomycin-spectinomycin are widely used in the species covered by Sanitel-Med. When looking into the Sales and Use data of the products with these active substances, a combination of factors seems to explain the observed excess of total usage over total sales (Figure A4):
    - In 2022 the kg Used of Macrolides 'sensu strictu' was 5% higher than the kg Sold (Figure A12). Previously, there always was an excess of Sold kg, except for 2019 when the quantities were almost equal. Remarkably, the excess in 2021 was much higher than in the previous years.

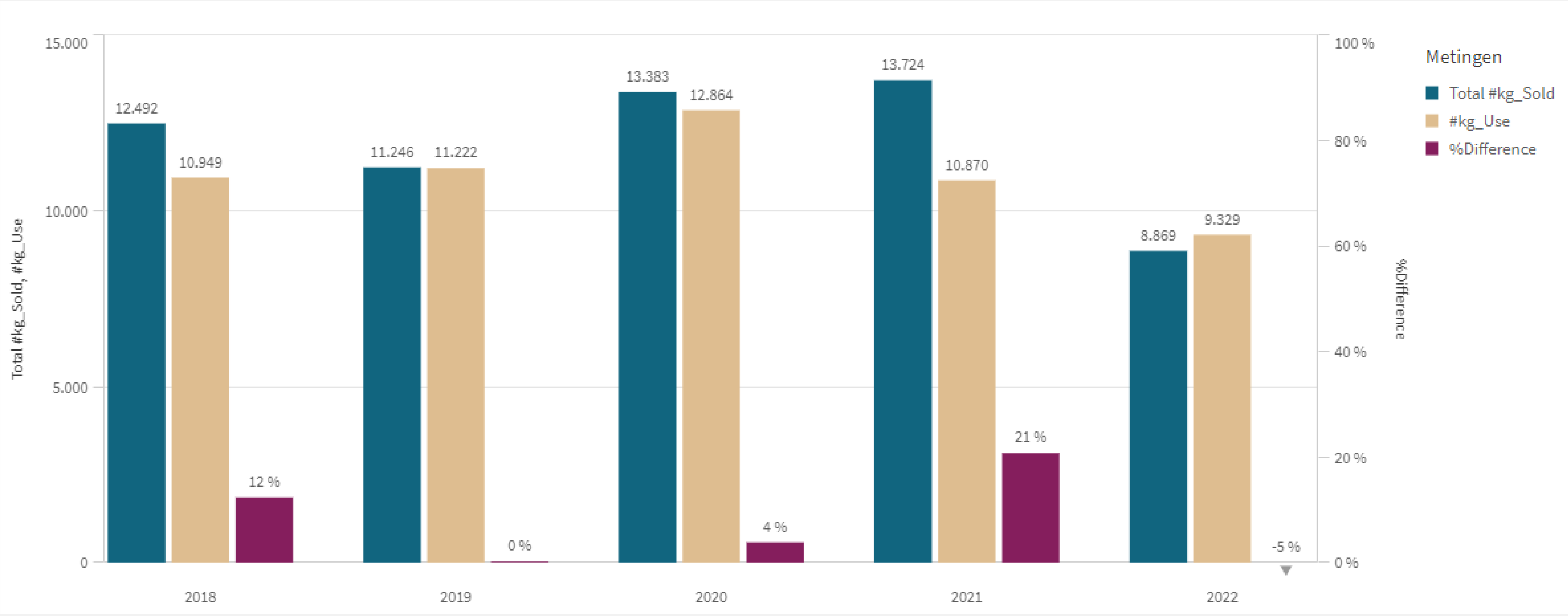


Figure A12. Total Sales quantity (kg) and total Use quantity (kg) of Macrolides 'sensu strictu' and % difference between the two quantities, from 2018 to 2022.

- A most remarkable result of a single product, within the macrolides, comes from PHARMASIN 100% gran. oplosb. po 1,1 kg (tylosin), which is authorised for use in poultry (Av), bovines (Bo),and pigs (Su), and was more used than sold in 2022 for the first time since the start of Sanitel-Med (Figure A13), due to a drastic decrease in the sold quantities. The Used quantities also decreased but less spectacularly than the Sold quantities.

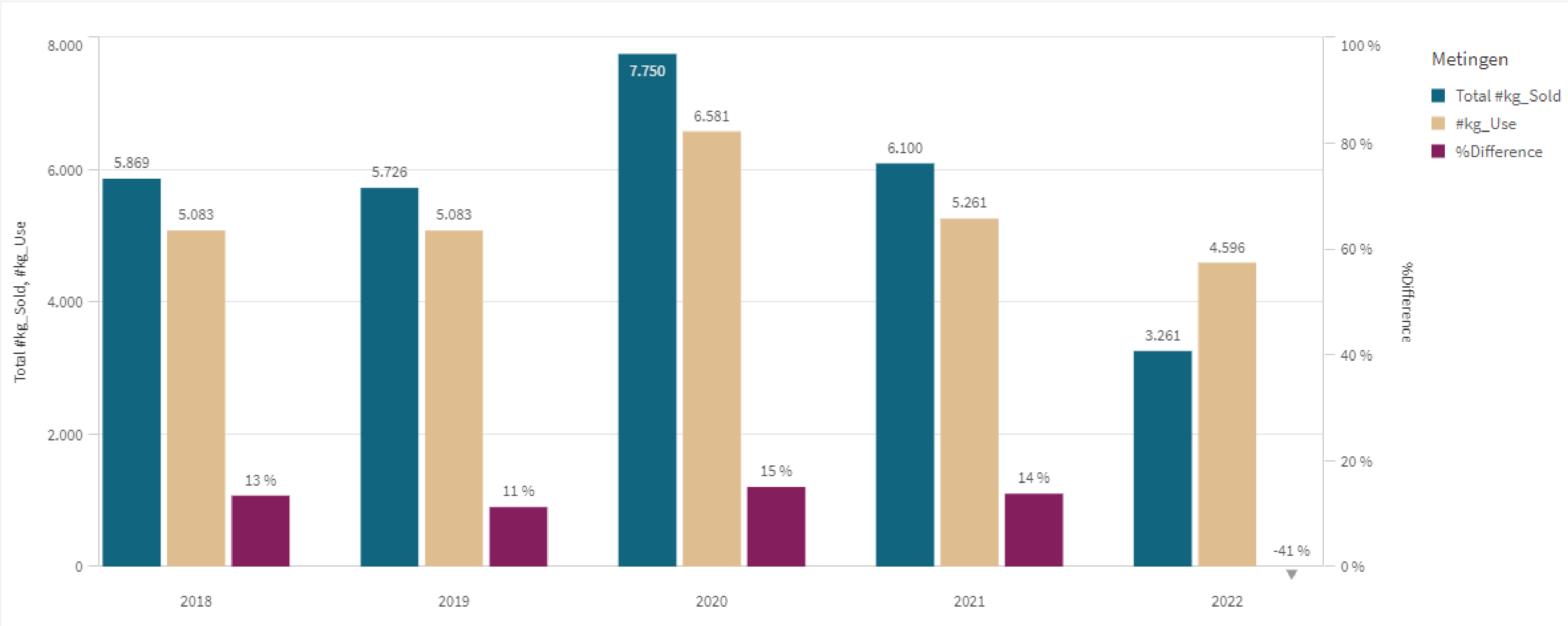


Figure A13. Total Sales quantity (kg) and total Use quantity (kg) and % difference between the two quantities of PHARMASIN 100% gran. oplosb. po 1,1 kg from 2018 to 2022.

- In 2022 the kg Used of Lincomycin-spectinomycin almost equalled the kg Sold of Lincomycin-spectinomycin ((Figure A14).

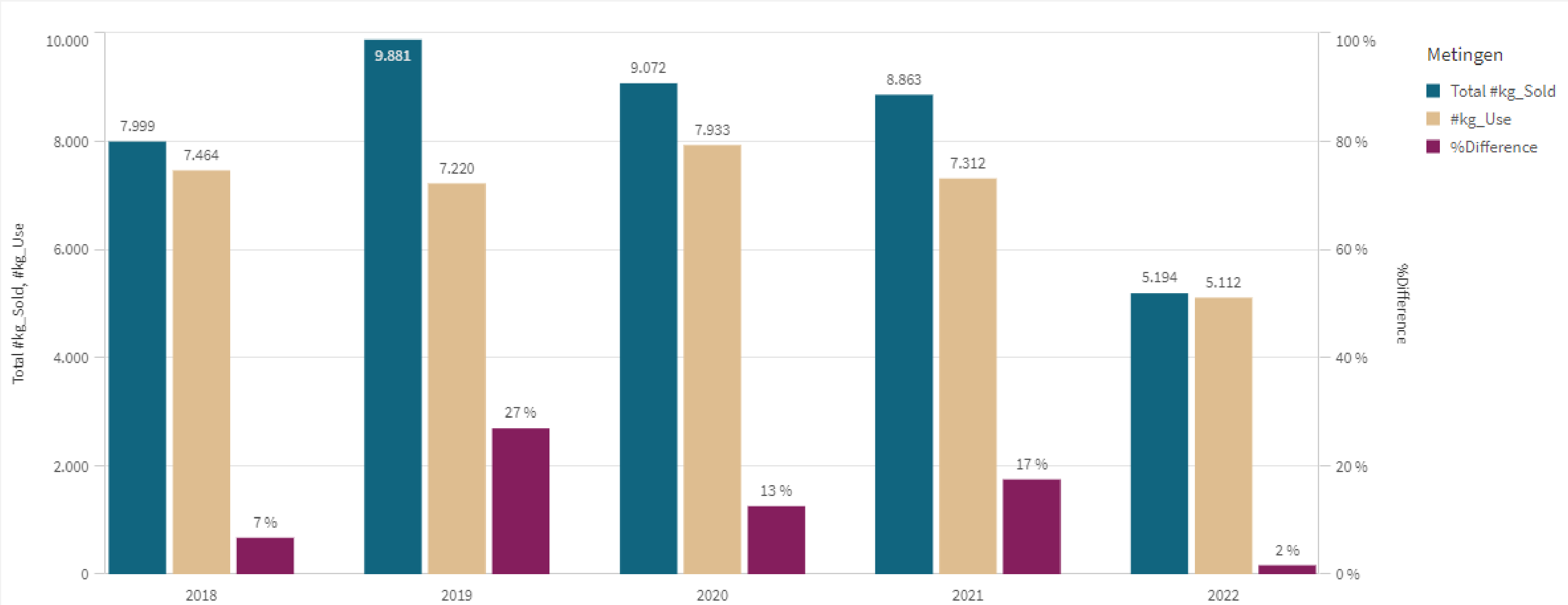


Figure A14. Total Sales quantity (kg) and total Use quantity (kg) and % difference between the two quantities of products containing Lincomycin-spectinomycin from 2018 to 2022.

- It is difficult to pinpoint this result to one or some specific Lincomycin-spectinomycin product(s), although the change in the balance of sales-use of the frequently used product SPECTOLIPHEN 100 pdr oplosb. po 1,5 kg – going from a typical 'sales-surplus' to a 'sales-deficit' in 2022 (Figure A15), will have played a role.

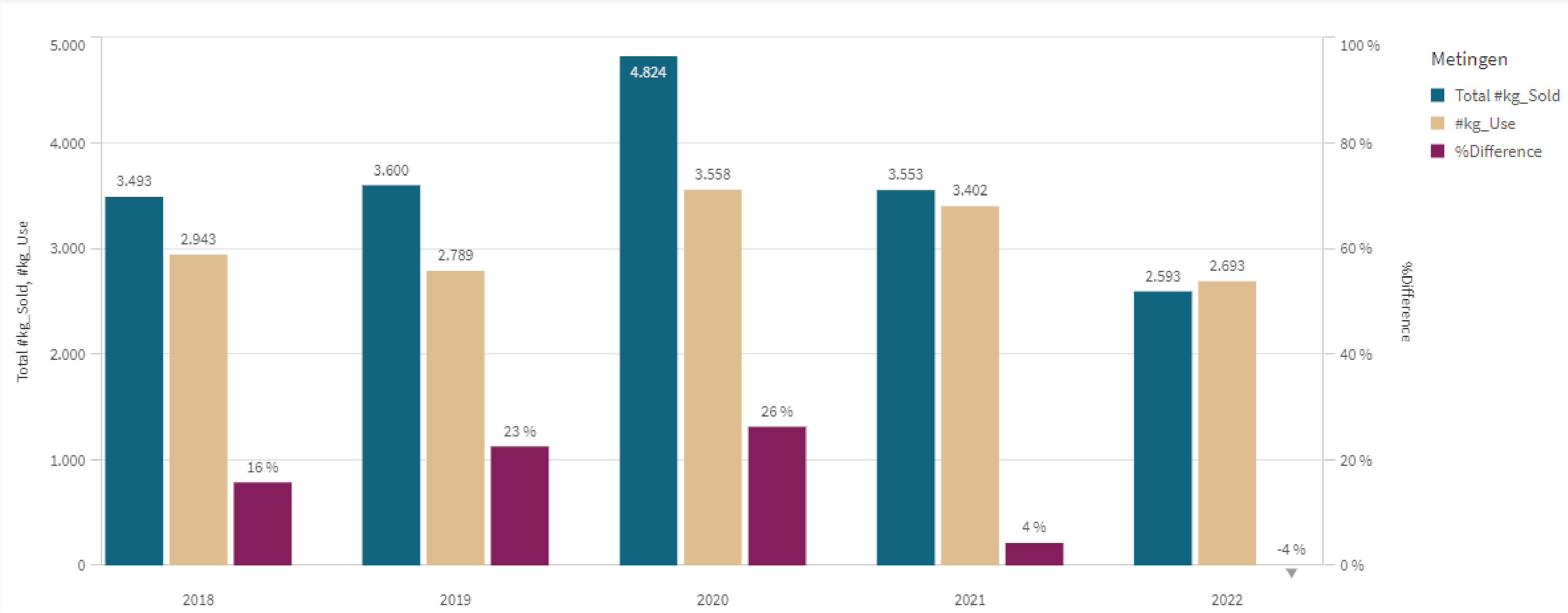


Figure A15. Total Sales quantity (kg) and total Use quantity (kg) and % difference between the two quantities of SPECTOLIPHEN 100 pdr oplosb. po 1,5 kg from 2018 to 2022.

In conclusion for the macrolides, two rather exceptional events in itself occurred simultaneously, explaining why in 2022 there was an excess of Macrolides Use over Sales. It is likely that stock-related phenomena have played a role, considering that for macrolides 2021 was a year of an exceptional 'Sales-surplus'.

- The **polymyxins** class includes colistin and polymyxin B products, of which colistin is by far the most important substance and in the following text these will be used as synonyms. As can be seen in Figure A8, compared to the four previous years, the result of 2022 is very exceptional because there was an excess of 45% in Use over Sales for colistin. This distinct result is quite easy to explain, as it comes down to a remarkable change in the pattern of two products: first and foremost COLDOSTIN 4800000 IE/g pdr oplosb. po 1 kg (Figure A16) and to a lesser extent PROMYCINE PULVIS 4,800 IE/mg pdr oplosb. po 1 kg (Figure A17).

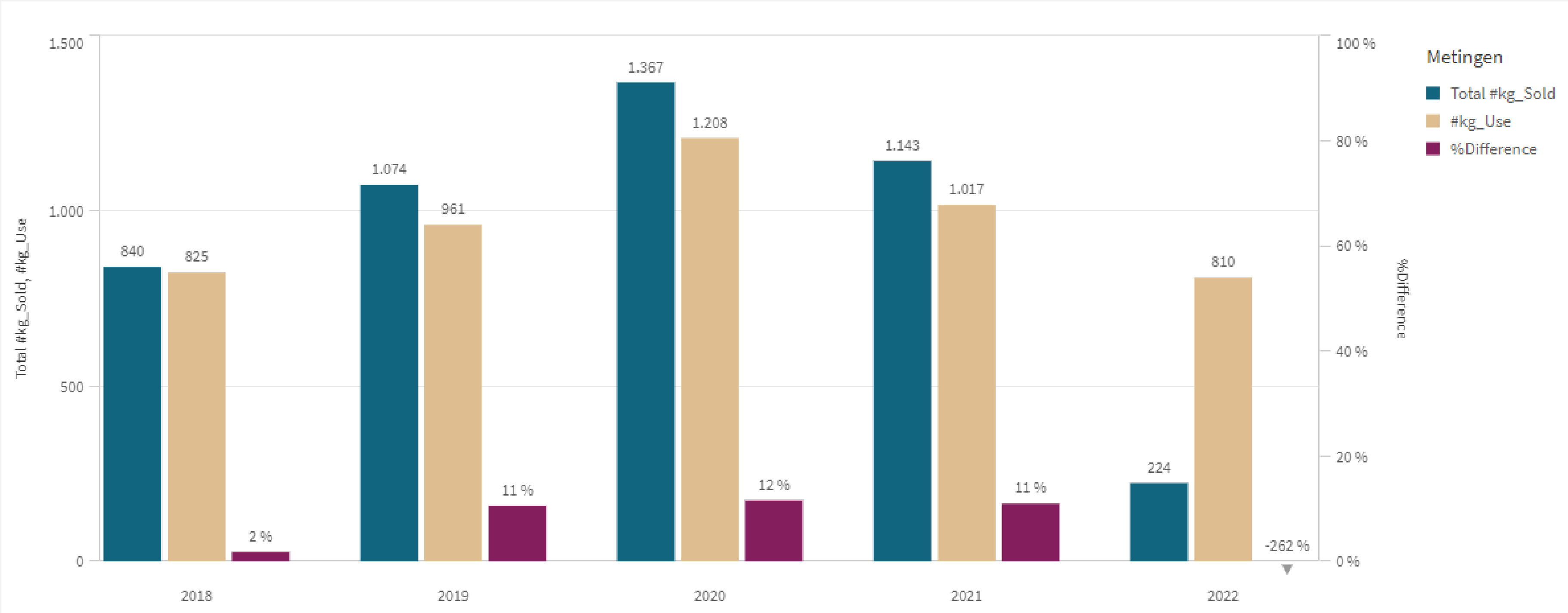


Figure A16. Total Sales quantity (kg) and total Use quantity (kg) and % difference between the two quantities of COLDOSTIN 4800000 IE/g pdr oplosb. po 1 kg from 2018 to 2022.

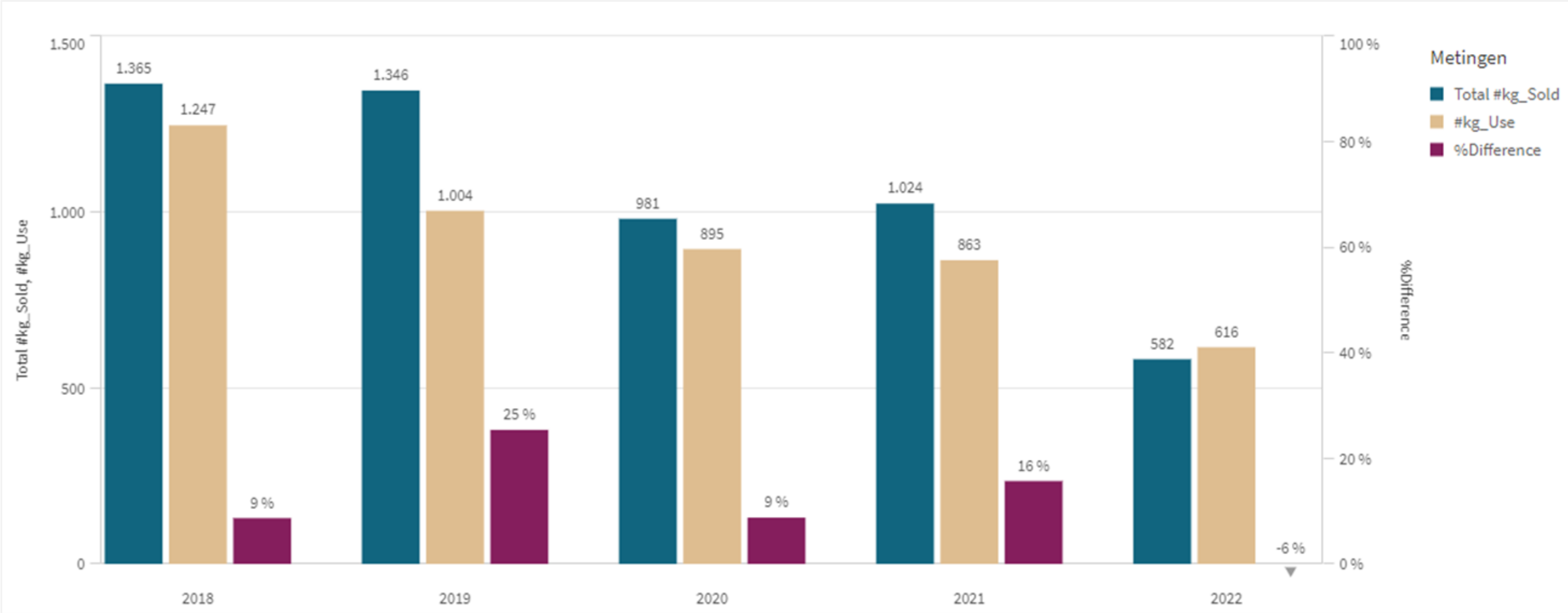


Figure A17. Total Sales quantity (kg) and total Use quantity (kg) and % difference between the two quantities of PROMYCINE PULVIS 4,800 IE/mg pdr oplosb. po 1 kg from 2018 to 2022.

- Concerning the **quinolones**, in previous years the Used kg never exceeded 49% of the Sold kg. In 2022 this increased to an astonishing 89% (Figure A9). This remarkable result can be pinpointed to a sole active substance and even a single product. Indeed, the two most frequently used classes of quinolones in animals have always been enrofloxacin and flumequine. Whereas the former shows a 2022 pattern that is in line with the previous years (Figure A18), the result of the latter is markedly different (Figure A19).

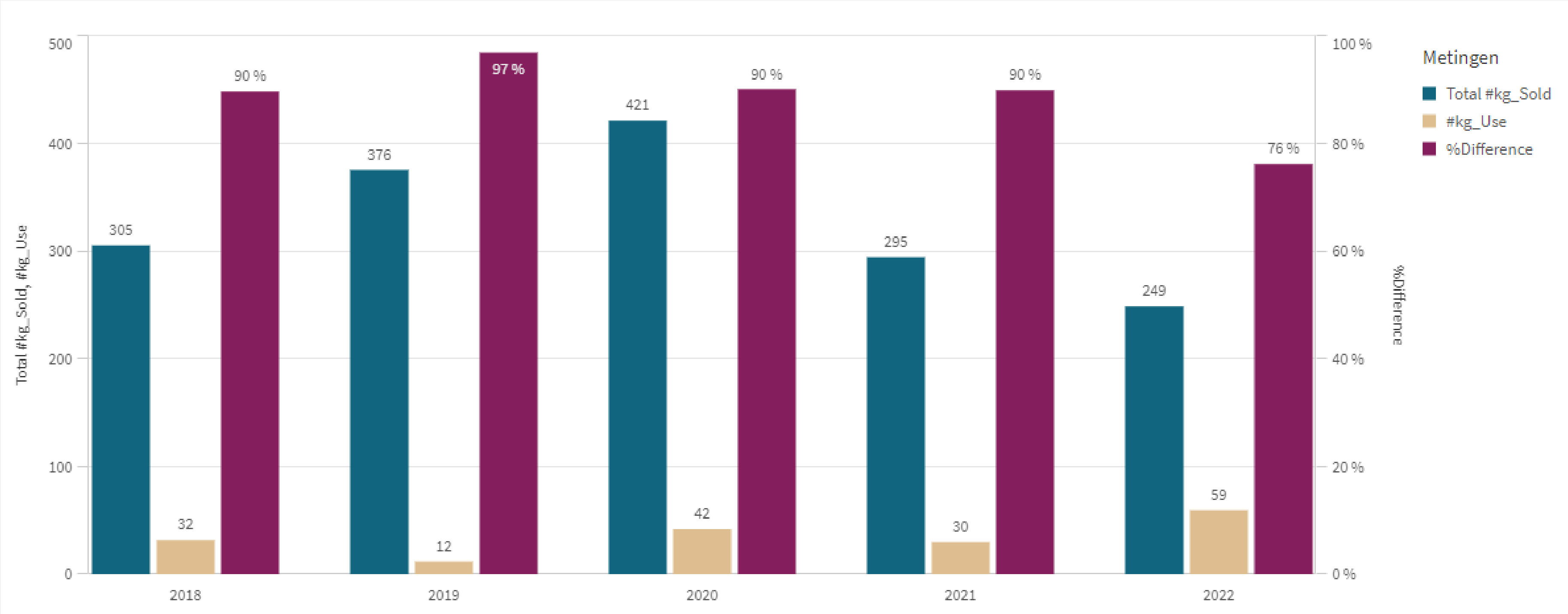


Figure A18. Total Sales quantity (kg) and total Use quantity (kg) and % difference between the two quantities of Enrofloxacin from 2018 to 2022.

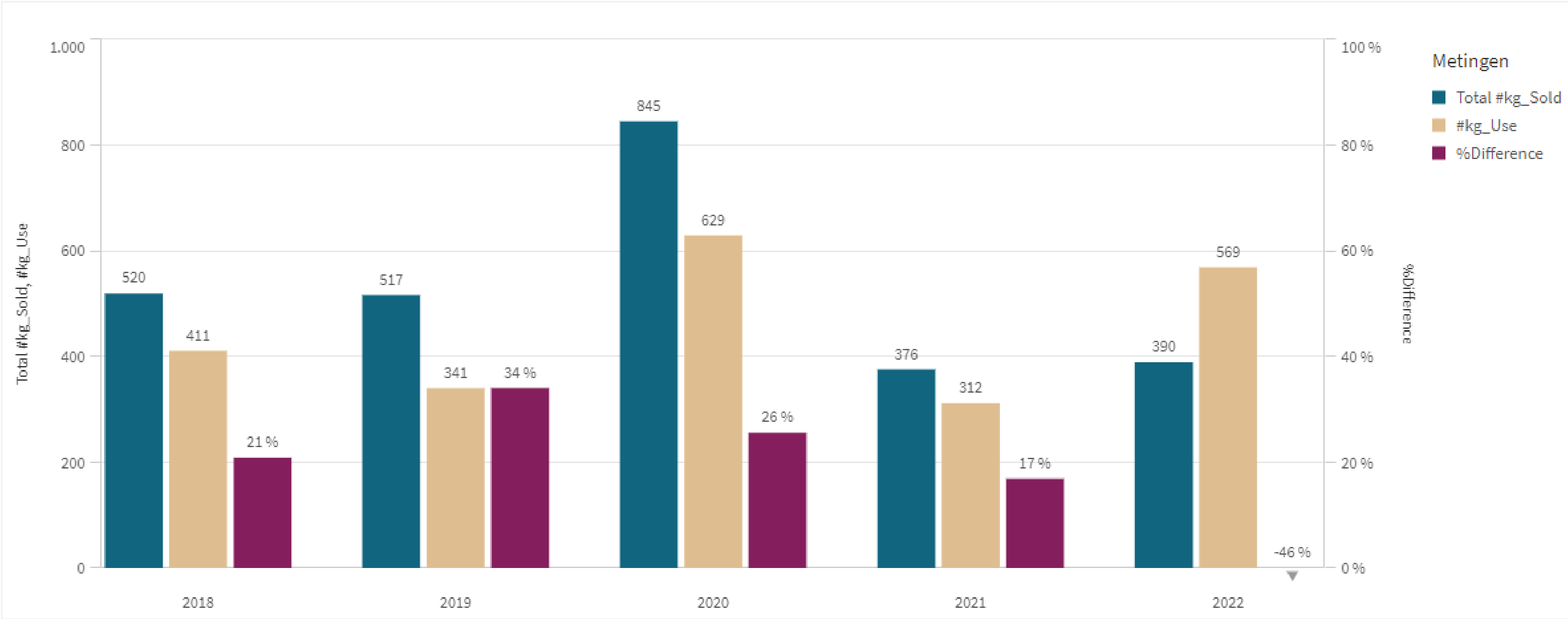


Figure A19. Total Sales quantity (kg) and total Use quantity (kg) and % difference between the two quantities of Flumequine from 2018 to 2022.

Analysis at the product level reveals that this difference is situated in the distinctly different pattern of Enterflume 50% pdr oplosb. po 1 kg in 2022 compared to the previous years (Figure A20).

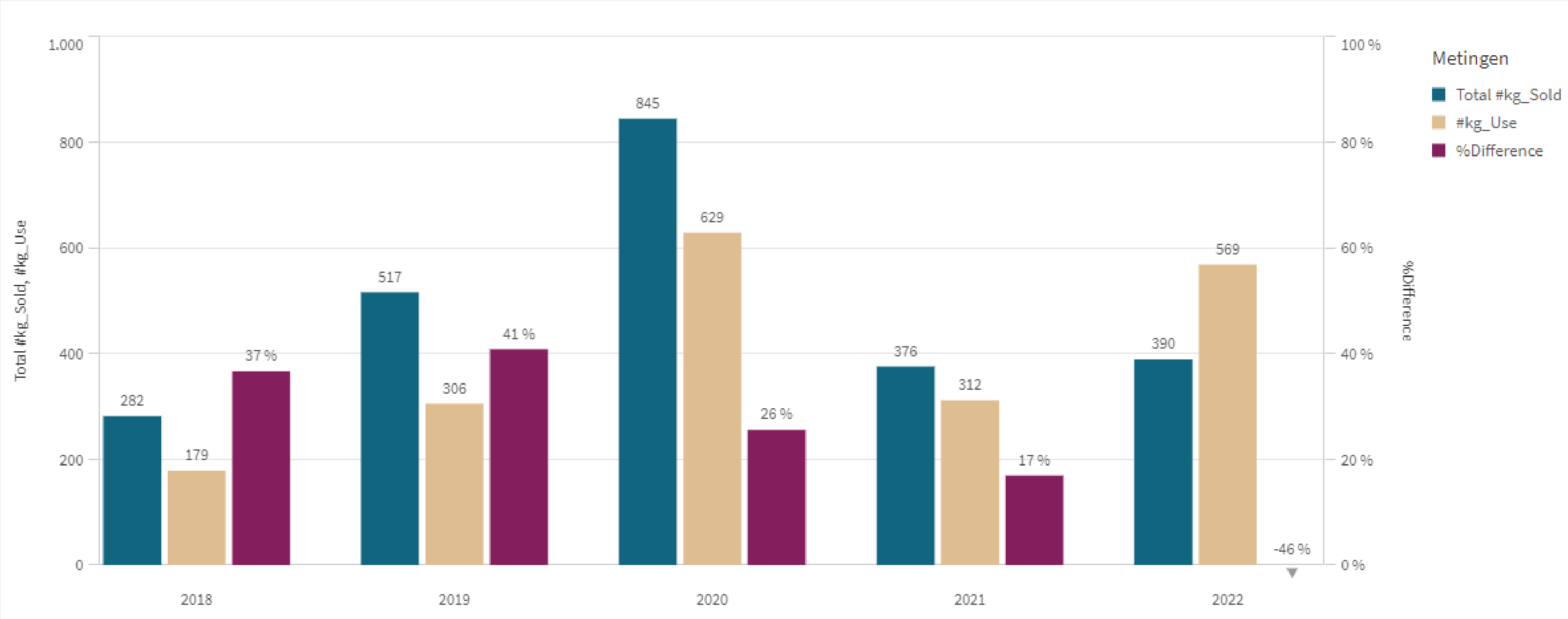


Figure A20. Total Sales quantity (kg) and total Use quantity (kg) and % difference between the two quantities of ENTERFLUME 50% pdr oplosb. po 1 kg from 2018 to 2022.

EVALUATION OF THE RELATIONSHIP BETWEEN SALES AND USE FOR THE ('VRAC') PRODUCTS SOLELY AUTHORISED FOR AV AND/OR SU

'Vrac' products are defined as products for oral administration and with a package size of minimum 500 g or ml (but typically at least 1 kg or l). When considering only products authorised for Av and/or Su (Figure A21), and more specifically the 'vrac' products out of these (Figure A22), it was remarkable that the Used quantity was (slightly) higher than the Sold quantity in 2022, for the first time since the start of Sanitel-Med.

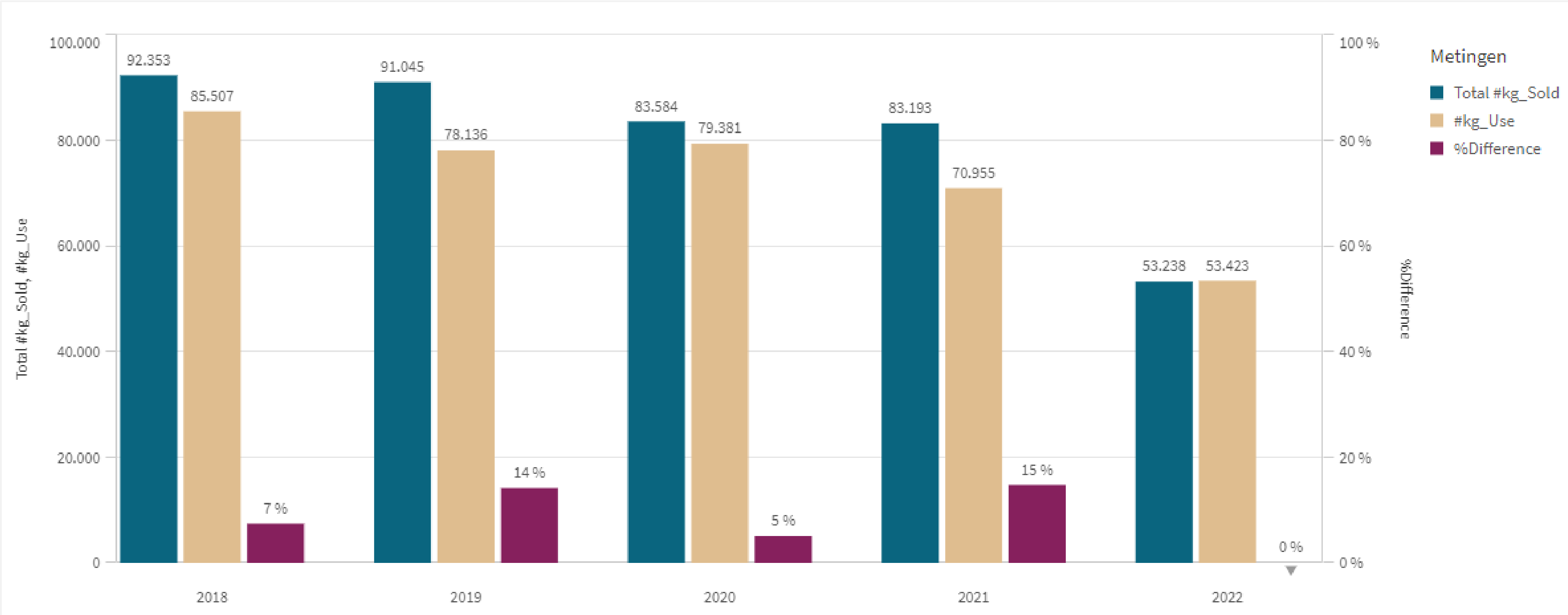


Figure A21. Total Sales quantity (kg) and total Use quantity (kg) and % difference between the two quantities of all products authorised only for Su and/or Av from 2018 to 2022.

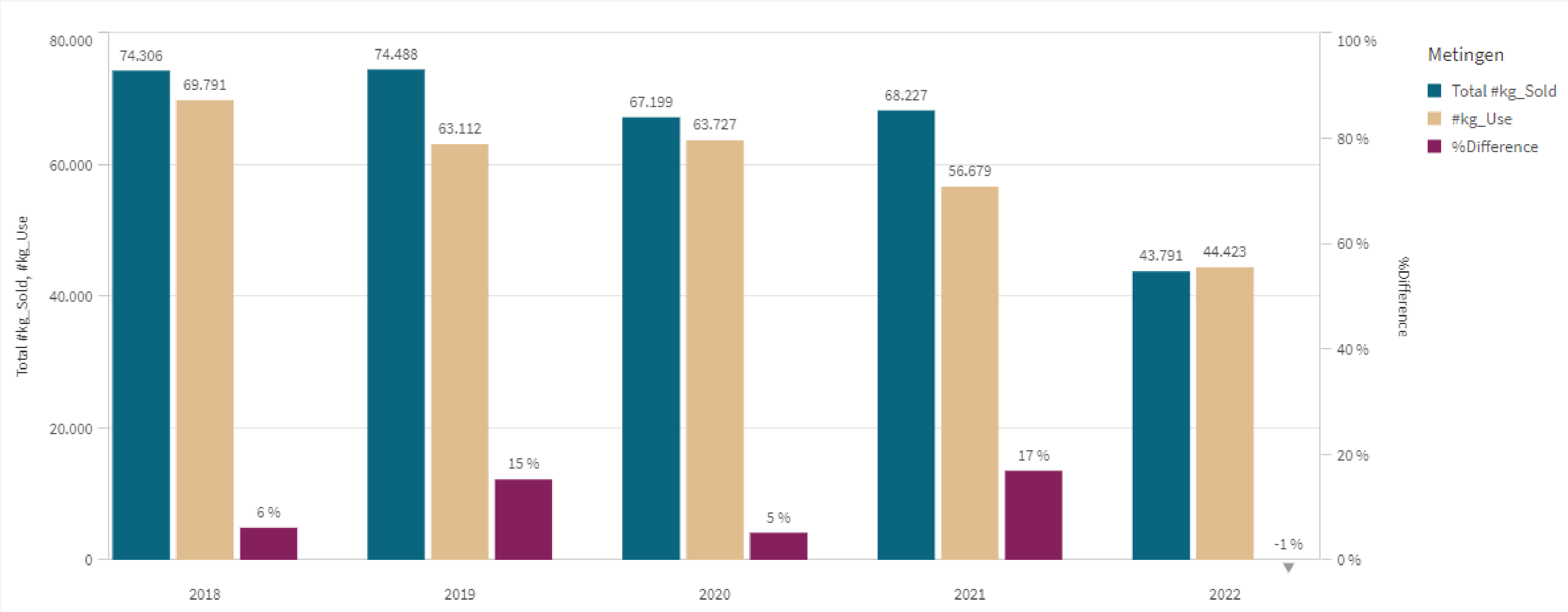


Figure A22. Total Sales quantity (kg) and total Use quantity (kg) and % difference between the two quantities of 'vrac' products authorised only for Su and/or Av from 2018 to 2022.

Below we describe some of the most remarkable observations in regard to these 'vrac' products.

- For the first time since the start of data collection in Sanitel-Med, the used quantity of 'vrac' **<u>florfenicol</u>** products equalled the sold quantity of 'vrac' florfenicol products (Figure A23).

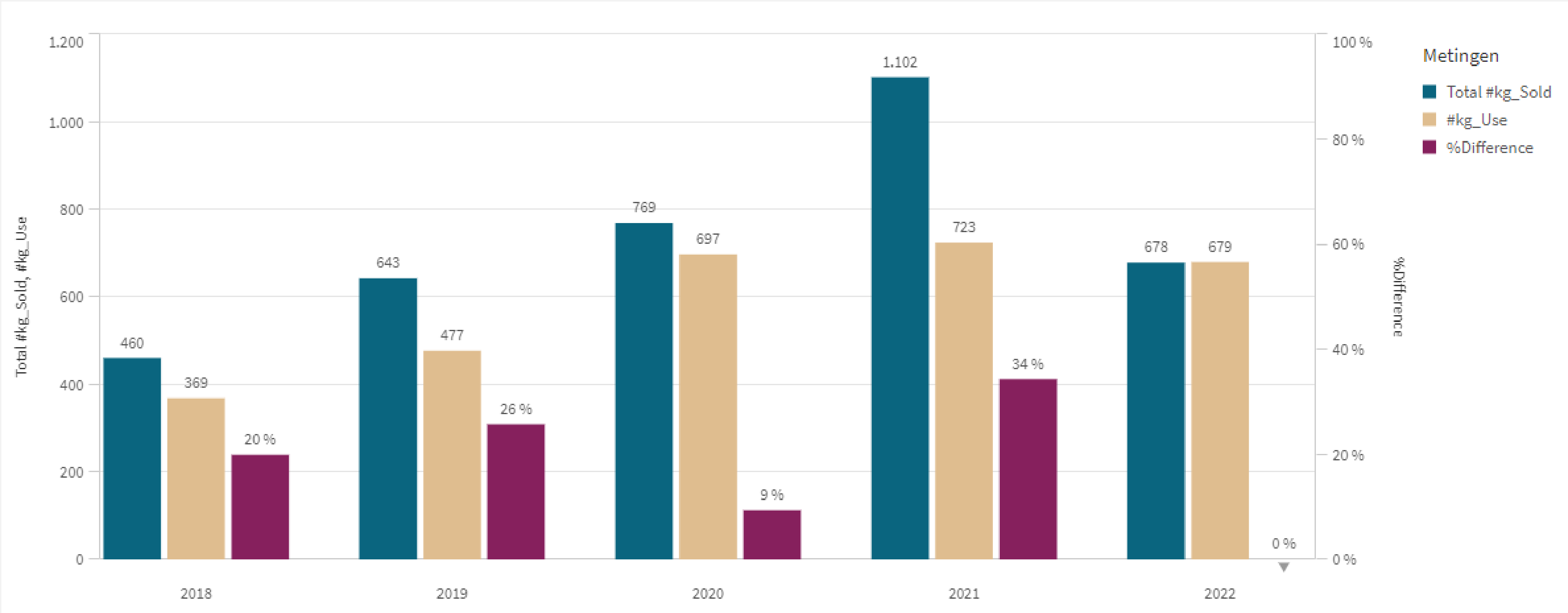


Figure A23. Total Sales quantity (kg) and total Use quantity (kg) and % difference between the two quantities of 'vrac' florfenicol products authorised only for Su and/or Av from 2018 to 2022.

This could be traced to an altered pattern in the sales of Flordofen 100 mg/ml 1 and 5 l (figure A24).

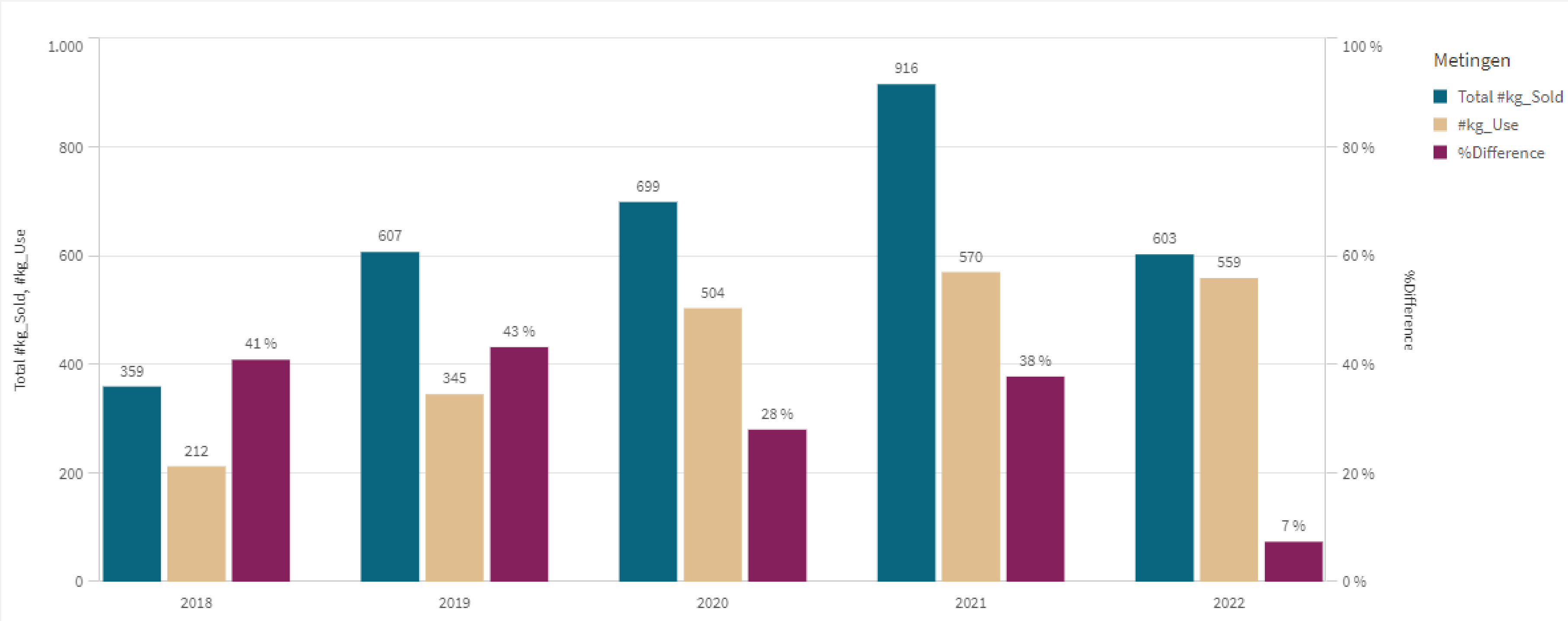


Figure A24. Total Sales quantity (kg) and total Use quantity (kg) and % difference between the two quantities of Flordofen 100 mg/ml 1 and 5 l from 2018 to 2022.

- Among the **quinolones**, in addition to the remarkable results of flumequine, also the pattern of 'vrac' enrofloxacine products authorised only for Av and/or Su is notable, as there appears to be a yearly large amount Sold but apparently not Used, at least not in the Sanitel-Med animal categories (Figure A25). It involves a single product: ENRO-K 10% opl. po 1l (Figure A26). Possibly, this product is used in the poultry categories that are currently not covered by Sanitel-Med, for example turkeys.

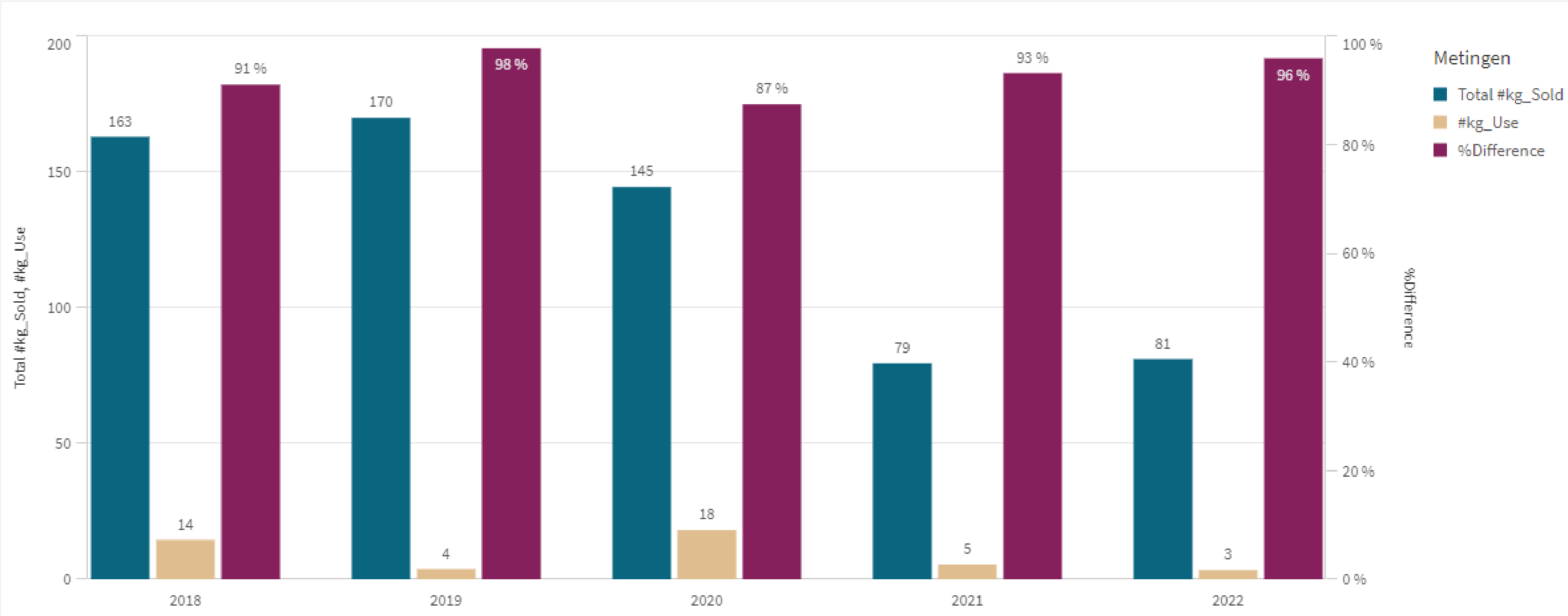


Figure A25. Total Sales quantity (kg) and total Use quantity (kg) and % difference between the two quantities of enrofloxacine from 2018 to 2022.

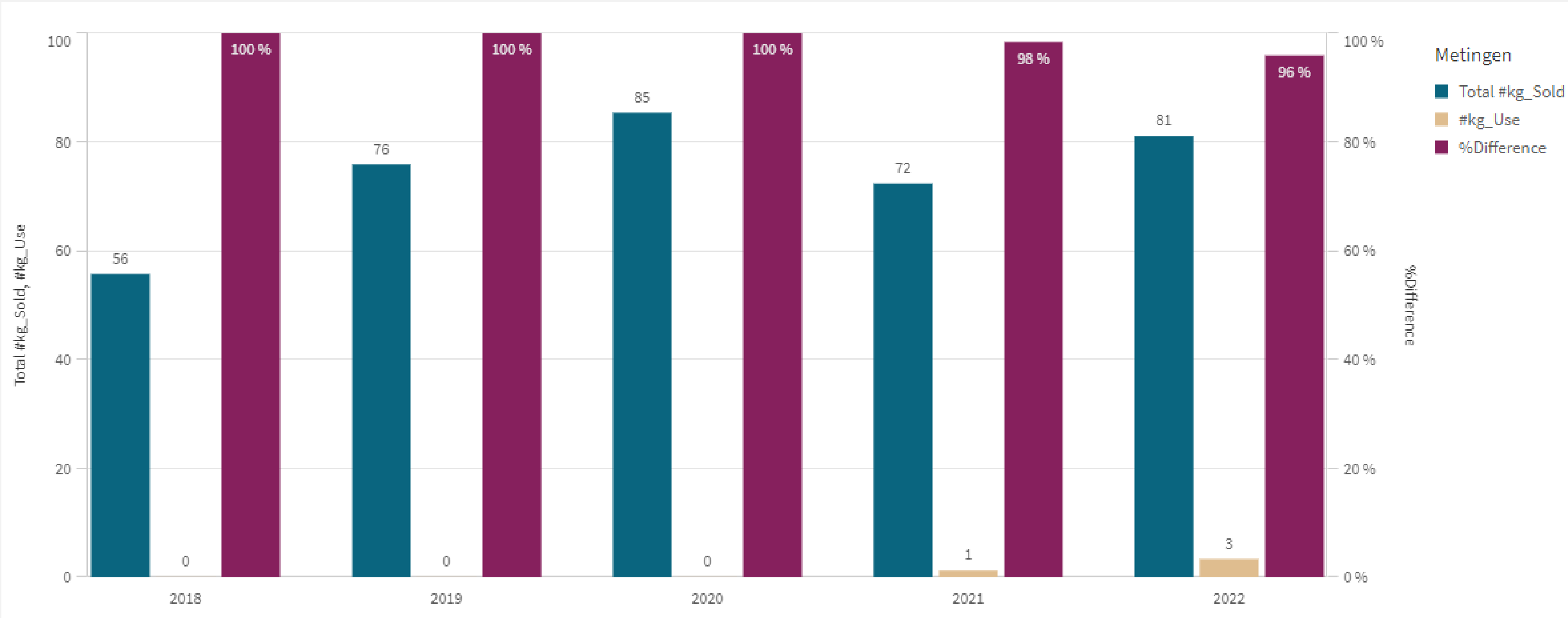


Figure A26. Total Sales quantity (kg) and total Use quantity (kg) and % difference between the two quantities of ENRO-K 10% opl. po 1l from 2018 to 2022.

- Several other Av/Su 'vrac' products show a remarkable 'use-deficit' throughout the years, but most notable are the trimethoprim-sulfonamide products COSUMIX PLUS pdr oplosb. po 2 kg (Figure A27), EMDOTRIM 10% SOL opl. po 5000 ml (Figure A28) and, most notably, TRIMAZIN 90% pdr oplosb. po 1 kg (Figure A29). This indicates either an underreporting of this use in Sanitel-Med or off-label use of these products in other animal categories – or both.

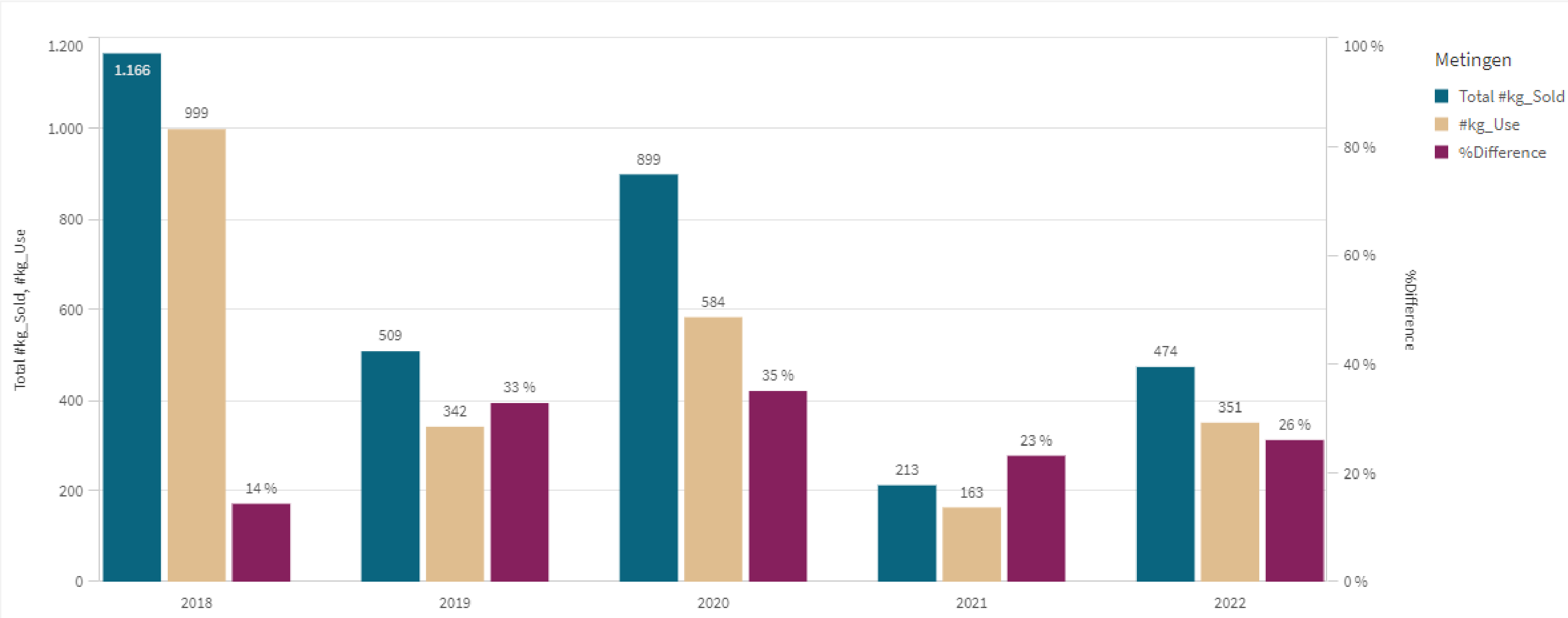


Figure A27. Total Sales quantity (kg) and total Use quantity (kg) and % difference between the two quantities of COSUMIX PLUS pdr oplosb. po 2 kg from 2018 to 2022.

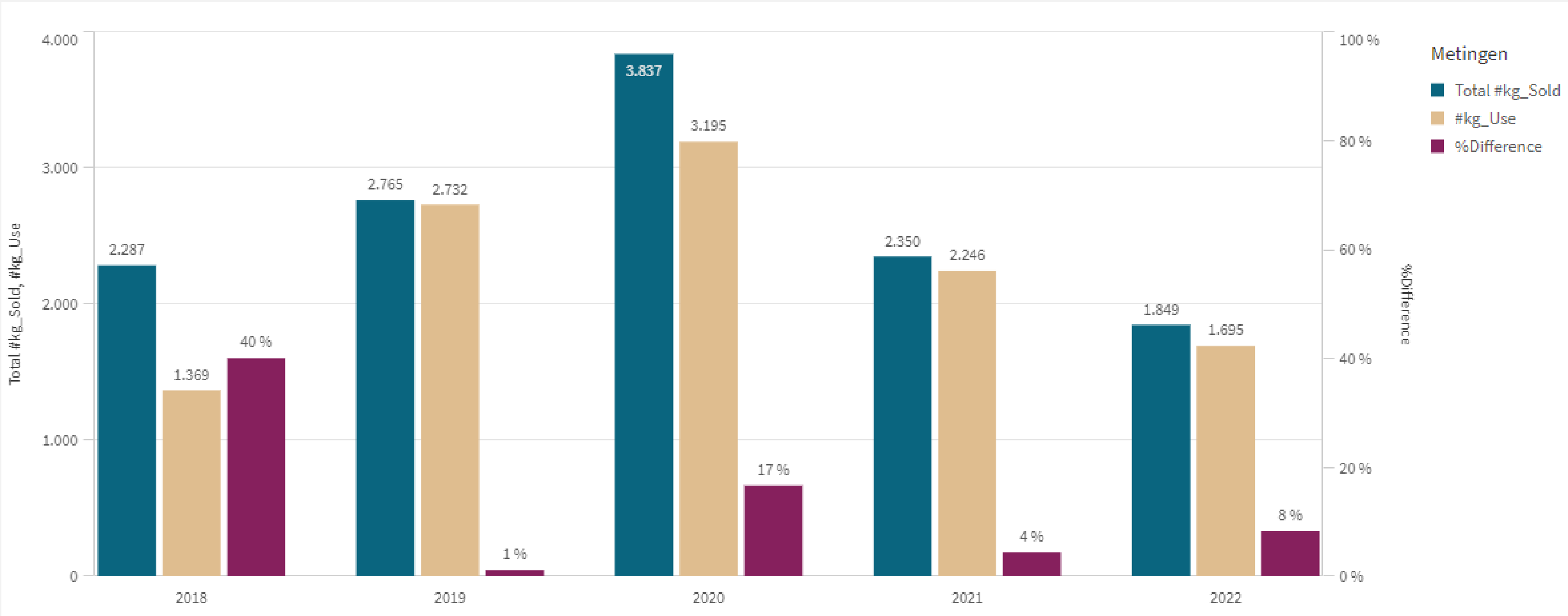


Figure A28. Total Sales quantity (kg) and total Use quantity (kg) and % difference between the two quantities of EMDOTRIM 10% SOL opl. po 5000 ml from 2018 to 2022.

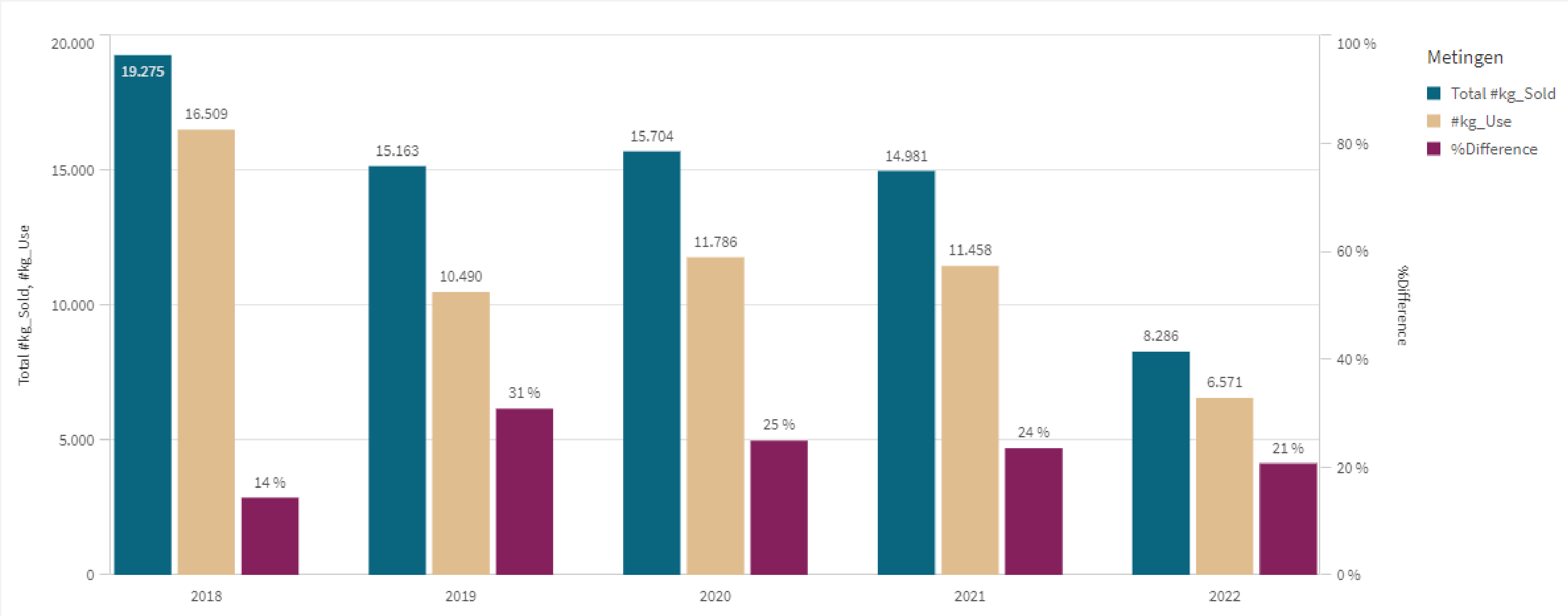


Figure A29. Total Sales quantity (kg) and total Use quantity (kg) and % difference between the two quantities of TRIMAZIN 90% pdr oplosb. po 1 kg from 2018.