Autoriteit Diergeneesmiddelen

Usage of Antibiotics in Agricultural Livestock in the Netherlands in 2019

Trends and benchmarking of livestock farms and veterinarians

June 2020
(revision Aug. 2021)

Preface

This is a copy of the report *Usage of Antibiotics in Agricultural Livestock in the Netherlands in 2019* drawn up by the Netherlands Veterinary Medicines Institute (SDa). With this year's report, the SDa expert panel provides insight into the usage of antibiotics at Dutch livestock farms for the ninth consecutive year. In contrast to the previous annual reports, the current report consists of two separate parts: a concise overview of the main findings regarding the usage of antibiotics in the Dutch livestock sector, and a more detailed online Appendix.

This is the first SDa report in which livestock farms' performance with respect to the amounts of antibiotics used is assessed by means of the SDa's new benchmarking method for livestock farms. A new benchmarking method for veterinarians is currently in development.

The SDa will continue its efforts to provide insight into livestock farmers' and veterinarians' performance in terms of their antibiotic usage levels and prescription patterns, respectively.

Utrecht, June 2020

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Summary

The SDa expert panel reports annually on the usage of antibiotics at livestock farms in the Netherlands. The data for 2019 show that the veal farming sector managed to reduce the amount of antibiotics used by 2.1 $DDDA_{NAT}$ (11,3%) compared to 2018. The amount of antibiotics used in the pig farming sector is low and characterized by a steady decline throughout the years. The 0.7 $DDDA_{NAT}$ (8.2%) reduction observed for 2019 was in line with this trend. Antibiotic use in the cattle and broiler farming sectors has been low and relatively stable over the last four years. Compared to 2018, the cattle and broiler farming sectors reduced their antibiotic use by 4.9% (0.11 $DDDA_{NAT}$) and 2.2% (0.2 $DDDA_{NAT}$), respectively. High $DDDA_{NAT}$ values were recorded for the turkey farming sector and the rabbit farming sector (i.e. meat rabbit farms). The goat farming sector is working towards implementing a monitoring system, but additional efforts are required to achieve full transparency regarding the amounts of antibiotics used.

Sector-specific usage patterns of first-, second- and third-choice antibiotics can be observed. While the relative contributions of the three categories of antibiotics initially varied considerably from year to year, livestock sectors' usage patterns have become relatively stable. In the poultry farming sector, second-choice antibiotics represent a relatively large proportion of the sector's overall antibiotic use. As 2019 saw another slight increase in colistin use for the pig farming sector and the "Other poultry farming subsectors" category, the SDa expert panel urges both livestock sectors to reduce the amount of colistin used. The SDa's 2019 data demonstrate that as a result of the collective efforts of the government, livestock farmers and veterinarians in the Netherlands, sales of antibiotics intended for animals have dropped by nearly 70% over the 2009-2019 period.

In light of the WHO's recent decision to move polymyxins to the "Highest Priority Critically Important Antimicrobials" classification, the SDa expert panel has included polymyxins in its "Third-choice antibiotics" category. Consequently, the SDa expert panel feels that as of 2021, livestock farms' target value for polymyxin use should be 0 $DDDA_F$, in line with target values for other third-choice antibiotics (fluoroquinolones and third- and fourth-generation cephalosporins).

This is the first report in which the SDa's new benchmark thresholds have been used to assess livestock farms' performance in terms of their antibiotic usage levels. Livestock farms are benchmarked by means of one of the following types of benchmark thresholds:

- Benchmark thresholds representing acceptable use, which will not be adjusted at short notice; or
- Provisional benchmark thresholds, which might be adjusted on a regular basis over the next few years.

As a result of the implementation of the SDa's new benchmark thresholds, 2019 saw an expected rise in the number of livestock farms included in the action zone. Each type of farm or production category within a livestock sector is characterized by a different $DDDA_F$ distribution, which means a targeted approach will be required for the individual types of farms and production categories to achieve any additional usage level reductions. Several types of farms and production categories (e.g. broiler farms with conventional breeds, rosé veal fattening farms, and all of the pig farming sector's production categories) exhibit a long-tailed $DDDA_F$ distribution characterized by many farms with low $DDDA_F$ values and a number of farms with high $DDDA_F$ values. For these types of farms and production categories usage level reduction efforts should be focused primarily on the farms with (persistently) high usage levels. Some of the other types of farms and production categories (e.g. turkey farms, rabbit farms and all types of veal farms except for rosé veal fattening farms) exhibit a wide $DDDA_F$ distribution, which calls for measures aimed at reducing antibiotic usage levels across the board. Usage level improvements in smaller livestock sectors such as the turkey and rabbit farming sectors are relatively slow, and the SDa expert panel advises these sectors to find a way to speed up this process.

2019 saw an increase in the number of veterinarians being assigned a higher Veterinary Benchmark Indicator (VBI). This increase was expected given the implementation of the new, more stringent benchmark thresholds for livestock farms in 2019. This has also led to a rise in the number of veterinarians included in the action zone. Similar to previous years, the data revealed systematic prescription pattern differences between individual veterinarians. A new benchmarking method for veterinarians is currently being developed. This new benchmarking method will be more intuitive and the results will be easier to interpret, as veterinarians will be benchmarked by means of the $DDDA_{VET}$ value, the average usage of a vet for all contracted farms within an animal category. Specifics regarding the new benchmarking method for veterinarians are expected to be presented later in 2020.

Autoriteit Diergeneesmiddelen

Terms and definitions

$DDDA_F$	The defined daily dose animal used to express the amount of antibiotics used at a particular livestock farm. The $DDDA_F$ is determined by first calculating the total number of treated kilograms at a particular livestock farm for a specific year, and then dividing this number by the average number of kilograms of animal present at the livestock farm concerned. It represents the amount of antibiotics used at a particular livestock farm, and is used for benchmarking individual livestock farms. This is the unit of measurement used by the SDa since 2011 (see the Standard Operating Procedure *Berekening van de DDDA voor antimicrobiële middelen door de SDa* [SDa method for calculating DDDA values for antimicrobial agents]). The $DDDA_F$ data of all individual livestock farms within a particular livestock sector or subsector (i.e. a particular production category or type of farm) are used to determine the sector's or subsector's mean and median $DDDA_F$ values (*unweighted*, i.e. with all livestock farms contributing equally). Theoretically speaking, the weighted mean of the $DDDA_F$ (with weighting based on the value of the denominator, i.e. the number of kilograms of animal) is equal to the mean $DDDA_{NAT}$ based on all livestock farms within the livestock sector or subsector concerned. In practice, however, $DDDA_F$ - $DDDA_{NAT}$ conversions are not possible, as the $DDDA_F$ and $DDDA_{NAT}$ denominators are based on different data sources. The $DDDA_F$ is expressed in DDDA/animal-year. In the initial SDa reports, the unit of measurement ADDD/Y was used.
$DDDA_{NAT}$	The defined daily dose animal used to express the amount of antibiotics used within a particular livestock sector in the Netherlands. The $DDDA_{NAT}$ is determined by first calculating the total number of treated kilograms within a particular livestock sector for a specific year, and then dividing this number by the average number of kilograms of animal present within the livestock sector concerned. This unit of measurement is used to assess the amount of antibiotics used within a particular livestock sector, irrespective of the types of livestock farms or production categories included in the livestock sector concerned. When multiplied by 1,000/365, it is similar to the unit of measurement DDD per 1,000 person-days, which is used in human medicine. The $DDDA_{NAT}$ is expressed in DDDA/animal-year.

$DDDA_{VET}$	The defined daily dose animal used to express the antibiotic prescription pattern of a particular veterinarian in one of the livestock sectors or subsectors for a particular year. To determine the $DDDA_{VET}$, the first step is to calculate the total number of treated kilograms for which a particular veterinarian prescribed antibiotics during a specific year (the overall number of treated kilograms for all livestock farms that had a registered one-to-one relationship with this veterinarian in the year concerned). This number is then divided by the average number of kilograms of animal present based on all of the livestock farms that had a registered one-to-one relationship with the veterinarian concerned. The $DDDA_{VET}$ reflects a particular veterinarian's prescription pattern in absolute terms, and is used to identify inter-veterinarian variability in prescription patterns.
DDD_{VET}	The active-substance-based defined daily dose for veterinary medicinal products. The DDD_{VET} is the assumed average dose administered to a particular type of livestock in Europe, in mg/kg body weight. This unit of measurement is used to determine DDD_{VET}/live weight values, which facilitate comparison with $DDDA_{NAT}$ data.
EUROSTAT	The statistical office of the European Union. Its task is to provide the European Union with statistics at European level that enable comparisons between countries and regions.
Mass balance	A comparison between the number of kilograms of active substances sold according to recorded sales data and the number of kilograms of the active substances used according to veterinarian-reported delivery data (delivery records).
PCU	Population Correction Unit, a unit of measurement for the number of kilograms of animal, used by the European Medicines Agency. The PCU is calculated using the number of animals slaughtered in a particular year (adjusted for imported and exported animals), unless the animals present within the livestock sector concerned are not kept for meat production (e.g. dairy cattle), in which case the number of live animals is used. Consequently, depending on the livestock sector concerned, the PCU is a production-driven unit of measurement (more kilograms produced will result in a lower value), in contrast to the denominator in the SDa's $DDDA_{NAT}$ calculations, which is a unit of measurement for the number of kilograms of animal that is based solely on the average number of live animals present in the year concerned.
Treated kilograms	The number of kilograms of a particular type of livestock that, according to the SPC, can be treated with a single packaging unit of the antibiotic concerned.

VBI	The Veterinary Benchmark Indicator. A veterinarian's VBI expresses the probability that livestock farms for which the veterinarian concerned is responsible will fall within the action zone for livestock farms as a result of their antibiotic use.

Introduction

This SDa report on the usage of antibiotics in agricultural livestock in the Netherlands consists of two parts: the actual report in which the main trends and findings are presented, and an extensive online Appendix containing more detailed information. The SDa has opted for this approach to improve the readability of its annual report, considering that the level of detail increased throughout the years, so did the report's complexity. The current report contains fewer tables and figures than previous reports, but the tables and figures that are included will be more informative to the reader, as they more clearly depict the current state of affairs and trends.

This is the first report in which livestock farms' antibiotic usage levels have been assessed by means of the new benchmark thresholds defined by the SDa expert panel. The new benchmark thresholds are to be regarded as a distant goal, especially for those livestock sectors for which benchmark thresholds representing acceptable use were derived. In some cases, livestock sectors and the Ministry of Agriculture, Nature and Food Quality have agreed on transitional benchmark thresholds, which will be applied during a negotiated transitional period. This allows the livestock sectors concerned to gradually move towards their SDa-defined benchmark threshold that represents acceptable use. In cases where such a transitional period has been agreed upon, the 2019 $DDDA_F$ data of the livestock farms concerned have also been assessed using the sector-negotiated transitional benchmark threshold.

The antibiotic usage patterns of some livestock sectors turned out to be too high and too variable for the SDa expert panel to derive benchmark thresholds that represent acceptable use. In those cases, provisional benchmark thresholds have been assigned by the SDa expert panel.

As the benchmarking method for veterinarians has not yet been revised, veterinarians' prescription patterns for 2019 have been assessed by means of the Veterinary Benchmark Indicator (VBI). Veterinarians' VBIs were calculated using the 2019 $DDDA_F$ benchmark thresholds for the various types of farms and production categories.

Antibiotic usage trends

Antibiotic use in the main livestock sectors, in $DDDA_{NAT}$

Figure 1 shows the usage trends for several monitored livestock sectors. Following the downward trends which started in 2009, the usage patterns observed for the **broiler farming sector** and the **dairy cattle farming sector** have been fairly stable over the last four years. The broiler and dairy cattle farming sectors reduced their antibiotic use by 2.2% (0.2 $DDDA_{NAT}$) and 1.7% (0.05 $DDDA_{NAT}$), respectively, compared to 2018. They seem to have reached a new equilibrium, only showing minor year-to-year fluctuations. The **veal farming sector**, however, managed to reduce its antibiotic use by 22% (4.6 $DDDA_{NAT}$) over the past five years, and about half of this reduction (2.1 $DDDA_{NAT}$; 11.3%) was realized in 2019. Antibiotic use the **pig farming sector** is low, and declined by 0.7 $DDDA_{NAT}$ (8.2%) in 2019.

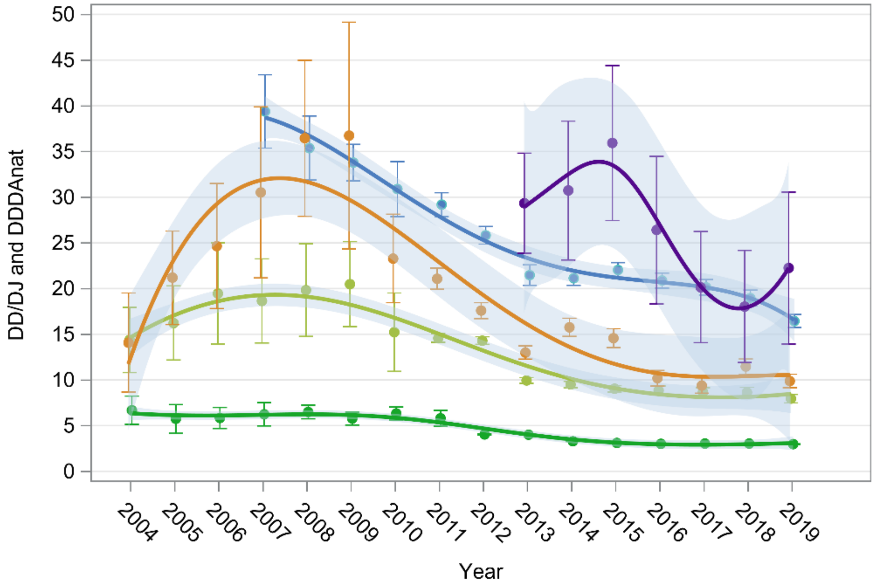
Antibiotic use in the **turkey farming sector** rose by 7.9% (1.6 $DDDA_{NAT}$) during the 2019 reporting year. A potential underestimation of the number of turkeys in the 2019 data provided by Statistics Netherlands (CBS) may have contributed to the higher $DDDA_{NAT}$ value for 2019, as the number of turkeys reported by the livestock sector itself was considerably higher. The latter number is the one used to determine the turkey farming sector's $DDDA_F$ values. The $DDDA_F$ data do not reflect the recorded $DDDA_{NAT}$ increase. The turkey farming sector's mean $DDDA_F$ for 2019 was 10.5% lower than its 2018 mean $DDDA_F$ value. The wide confidence intervals shown in Figure 1 indicate the presence of considerable usage level differences between individual turkey farms. As stated previously, the SDa expert panel deems it desirable for the turkey farming sector to reduce this between-farm variability and stabilize its usage pattern.

The **rabbit farming sector** (not included in Figure 1) is also characterized by pronounced year-to-year fluctuations in its usage pattern. For 2019, it recorded a 9.6% (4.2 $DDDA_{NAT}$) decline in the amount of antibiotics used. Usage level differences between individual rabbit farms are substantial. The SDa expert panel and the rabbit farming sector are currently discussing the reliability of provided data that may have contributed to the variations observed (i.e. delivery record data and body weights). The expert panel urges the rabbit farming sector to initiate efforts aimed at improving its data quality.

Antibiotic use in other livestock sectors and production categories, such as **layers**, **layer pullets**, **layer parent/grandparent stock**, **broiler parent/grandparent stock** and the **non-dairy cattle farming sector**, is low and stable.

Please refer to the Appendix for detailed information on livestock sectors' antibiotic usage pattern trends (Table A1) and to see the development of livestock sectors' $DDDA_{NAT}$ reductions since 2009 (Table A2). The Appendix also includes data on livestock sectors' antibiotic use in terms of DDD_{VET}/animal-year (Table A56).

Figure 1. Long-term developments in antibiotic use according to LEI Wageningen UR data (in DD/AY, for 2004 to 2010) and SDa data (in $DDDA_{NAT}$, for 2011 to 2019), as spline curves with point estimates for each year with 95% confidence interval. Please refer to the Appendix for the computational basis. Purple: turkey farming sector; blue: veal farming sector; orange: broiler farming sector; light green: pig farming sector; dark green: dairy cattle farming sector. 2018 $DDDA_{NAT}$ data for the broiler, turkey, veal and pig farming sectors have been adjusted following a revision of the numbers of animals by Statistics Netherlands (CBS)



Unmonitored sectors

The **goat farming sector** is working towards implementing a monitoring system. Although antibiotic usage data from the majority of goat farms are already being recorded, no systems are in place to make sure goat farmers regularly update the numbers of animals present at their farms. As a result, it is not yet possible to process their antibiotic usage data in accordance with the SDa's calculation method. The SDa expert panel advises the goat farming sector to start using available external data sources for obtaining information regarding the numbers of animals present at individual goat farms, and to do so as soon as possible. A system based on self-reported numbers of animals is too vulnerable. Another concern is that antibiotic usage data monitoring within the context of the goat farming sector's quality management system is voluntary. The SDa expert panel wants to stress the importance of sector-wide usage data monitoring for large or fastgrowing livestock sectors like the goat farming sector. The expert panel therefore feels the goat farming sector should make such monitoring a compulsory component of its quality management system.

No surveys of unmonitored sectors such as the **companion animal and horse sectors** were performed in 2019.

Implications of Regulation (EU) 2019/6

Regulation (EU) 2019/6 of the European Parliament and of the Council of 11 December 2018 on veterinary medicinal products and repealing Directive 2001/82/EC will enter into force on January 28, 2022. This Regulation sets out that all EU member states are to collect data on the use of antimicrobial medicinal products used in animals and subsequently report their data to the European Medicines Agency (EMA). This means that data on the use of antifungals and antivirals will also have to be collected. The Regulation does allow for a progressive stepwise expansion of the monitoring efforts. As of 2024, data on the use of antimicrobial medicinal products in the main livestock populations will have to be reported. This concerns data on antimicrobial use in all types of cattle (with at least data regarding veal calves having to be reported separately), pigs, broilers and turkeys during the preceding year. As of 2027, data on the use of antimicrobials in goats, sheep, ducks, geese, layers, farmed fish and food-producing horses (i.e. data pertaining to use during the preceding year) will have to be reported as well. As a result of the current monitoring infrastructure in the Netherlands, we are relatively well prepared for the initial stage of this process, even though some adjustments are needed. The 2027 reporting obligations demand more extensive administrative preparations. Given the more elaborate monitoring process set out in the Regulation, the "Diergeneesmiddelenstandaard" database will see the addition of the other types of antimicrobials (i.e. antifungals, antimycotics, coccidiostats/anti-protozoals).

As of 2023, sales data reporting has to include data on all antimicrobials sold, including antimicrobials made available under an exceptional provision (e.g. small pack sizes of antimicrobial veterinary medicinal products intended for doves or certain other non-food-producing animals), antimicrobials purchased in other EU countries for use under the cascade (e.g. veterinary medicinal products not authorized in the Netherlands) and antimicrobial-containing preparations prepared for individual animals (veterinary medicinal products prepared extemporaneously in accordance with the terms of a veterinary prescription, used in accordance with Regulation (EU) 2019/6, Articles 112-114; primarily intended for use in companion animals). Regular sales data for veterinary medicinal products authorized for use in the Netherlands, including those with a parallel importation marketing authorization, are already available. As of 2023, however, alternative distributors (i.e. producers of small pack sizes intended for doves or certain other non-food-producing animals; pharmacies or persons preparing magistral formulas;

wholesalers distributing imported products) will also be required to report sales data. In the autumn of 2020, the SDa expert panel will publish an overview of the changes that are to be implemented, and present its implementation suggestions. These suggestions will be discussed with the relevant stakeholders.

Amounts of antibiotics sold

In 2019, the number of kilograms of active substances sold declined by 16.0%, to 150,419 kg (Figure 2). The 2019 sales data reveal a 69.6% reduction from the government-specified reference year of 2009. 2.3% of the number of kilograms sold could not be attributed to recorded antibiotic use in the monitored livestock sectors, a substantial improvement on 2018. It is not clear why the extent of this discrepancy between the number of kilograms sold and used varies from year to year. There are plans to have an external consulting agency, together with the federation of the Dutch veterinary pharmaceutical industry (FIDIN) and the SDa, look into this. They are to assess the completeness and reliability of the provided sales figures.
Over the 2009-2019 period, the collective efforts of the Dutch stakeholders, as reflected in the SDa-reported amounts of antibiotics used and sold, have resulted in a nearly 70% reduction in sales of antibiotics for animals.

Figure 2. Developments in sales of antibiotics over the 1999-2019 period, in number of kilograms of active substances sold (x1,000) (source: FIDIN), by main pharmacotherapeutic group

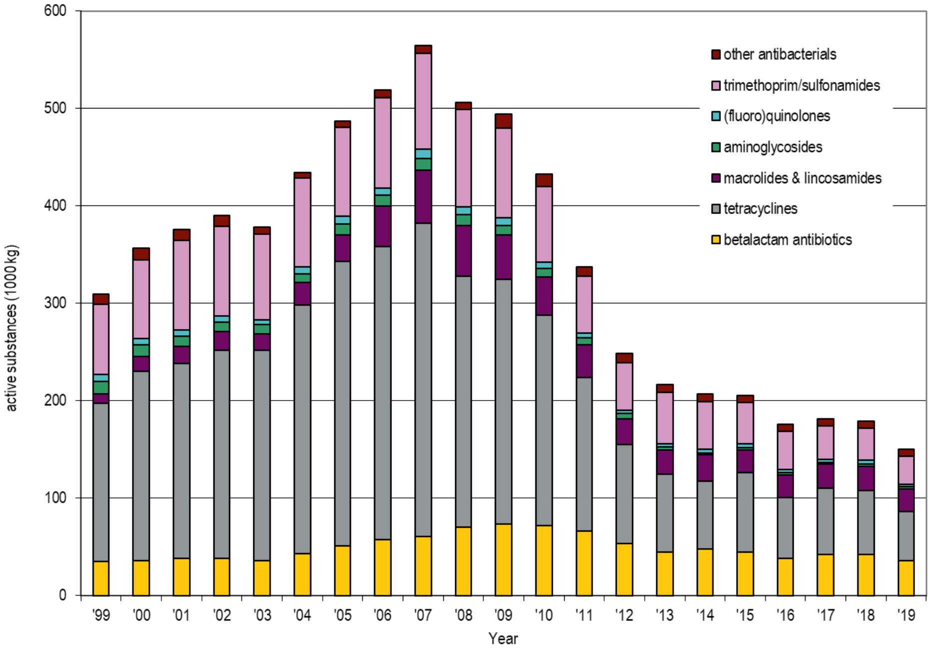
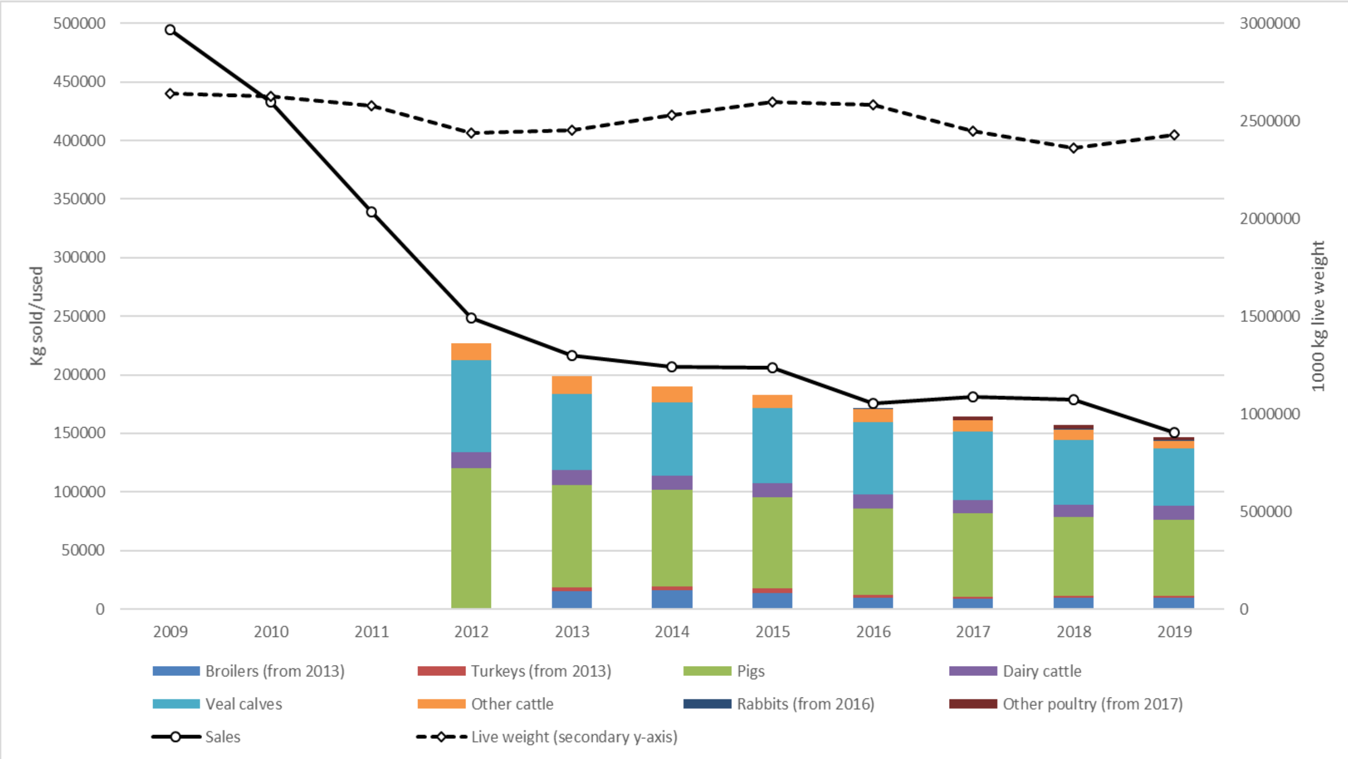


Figure 3 shows the long-term developments in both the amount of antibiotics sold (in kilograms, solid line) and the amount of antibiotics used (in kilograms, bars) in monitored livestock sectors. It also shows the annual numbers of kilograms of live weight of agricultural livestock present in the monitored livestock sectors (in tonnes, dotted line). The bars reflect the total amount of antibiotics used (in kilograms), with the different colors representing the amounts used in the individual livestock sectors.
The dotted line demonstrates that the number of kilograms of live weight has remained stable at about 2,500,000,000 kg throughout this period, indicating that the downward trends in the amounts sold and used are the result of an actual reduction in antibiotic use, and do not reflect changes in the size of the livestock population. The bars in Figure 3 show individual livestock sectors' relative contribution to the total number of kilograms used. Close to 80% of the total number of kilograms sold is used in the veal and pig farming sectors. This is no surprise, as veal calves and pigs are relatively large animals and consequently require higher doses of antibiotics than smaller animals. This is why the number of kilograms of antibiotics used is not a great indicator of the level of exposure to

antibiotics in animals at at-risk livestock farms. One cannot conclude, for instance, that given the small number of kilograms used in the broiler farming sector according to Figure 3, antibiotic exposure in broilers must have been limited. Given these limitations of kg-based data, livestock sectors' defined daily doses animal ($DDDA_{NAT}$ values) are better suited to express the average level of exposure to antibiotics. As shown in Figure 1, antibiotic exposure in broilers has stabilized at approximately 10 $DDDA_{NAT}$, and is similar to the level recorded for the pig farming sector.

Figure 3. Long-term developments in the numbers of kilograms of active substances sold and used. The numbers of kilograms used in the individual monitored livestock sectors are shown. Also included are the annual numbers of kilograms of live weight for the livestock sectors that were subjected to SDa monitoring in 2019



Developments in usage of the main first-, second- and third-choice antibiotics

The relative contributions of first-, second- and third-choice antibiotics differ from livestock sector to livestock sector. While the relative contributions of the three categories of antibiotics initially varied from year to year, they are currently relatively stable for most of the livestock sectors. In the pig farming sector and the cattle farming sectors (i.e. the dairy cattle, veal and non-dairy cattle farming sectors), first-choice antibiotics accounted for about 80%, second-choice antibiotics accounted for about 20%, and third-choice antibiotics (primarily polymyxins) accounted for 0.1% to approximately 4% of overall antibiotic use in 2019. Both livestock sectors have seen a steady increase in the relative contribution of first-choice antibiotics since the start of the monitoring process, even though the absolute amount of first-choice antibiotics used was reduced. A different pattern is observed for the poultry farming sector. In 2019, the broiler and turkey farming sectors both were able to reduce the relative amount of third-choice antibiotics used, resulting in relative contributions of 0.9% and 2.7%, respectively. Second-choice antibiotics accounted for 73% of the broiler farming sector's overall antibiotic use, and for 49% of the turkey farming sector's overall antibiotic use. These percentages were calculated using the livestock sectors' $DDDA_{NAT}$ values, which are based on standardized body weights, while poultry farms' $DDDA_F$ values are based on body weight at the time of treatment. A $DDDA_F$-based approach is more precise and results in different relative contributions of first-, second- and third-choice antibiotics. This is addressed in more detail in the section on benchmarking of broiler farms. However, to facilitate data comparisons, the SDa expert panel has opted for the less precise $DDDA_{NAT}$-based approach. After all, all of the other livestock sectors' data are based on average body weights rather than body weight at the time of treatment, and the data to be collected on a EU-level in the near future will also be based on average body weights. In the rabbit farming sector, first-choice antibiotics accounted for approximately 75% of overall antibiotic use and third-choice antibiotics (primarily polymyxins) accounted for little over 1% of overall antibiotic use.

Fluoroquinolone use and use of third- and fourth-generation cephalosporins remained low in most of the livestock sectors. The poultry farming sector managed to reduce its fluoroquinolone use from 183 kg to 64 kg.

Colistin use

Colistin use rose by 189 kg (16.5%) during the 2019 reporting year. The 2019 usage level represents a 47.0% increase from the 2017 level. Colistin use increases in the pig farming sector and the "Other poultry farming subsectors" category were the main drivers for this rise, with 140 kg and 59 kg, respectively. The cattle farming sector and the veal farming sector, on the other hand, reduced their colistin use by 8 kg and 4 kg, respectively. Together, the pig farming sector and the "Other poultry farming subsectors" category were responsible for 97.8% of the kilograms of polymyxins used in 2019. Therefore, the SDa expert panel urges the pig farming sector and the other poultry farming subsectors to reduce the amount of colistin used.

For each of the livestock sectors included in the table below, the amount of colistin used did not exceed the most stringent EMA benchmark threshold (EMA, 2016a). Just like the year before, the SDa expert panel had to estimate the amount of colistin used in layers, as the ESVAC population correction unit template does not include standardized body weights for layers. Layers were assumed to weigh 1-2 kg, as the SDa expert panel deemed this to be a realistic estimate for layers in the Netherlands. Estimates based on these body weights suggest colistin use in layers again exceeded the 1 mg/PCU level, as was the case in 2018. The SDa expert panel calls on the livestock sectors to rapidly reduce their use of colistin. It is up to the livestock sectors themselves to decide on how to make this happen.

Table 1. Colistin use in mg/PCU from 2015 to 2019, by livestock sector

Livestock sector	**2015**	**2016**	**2017**	**2018**	**2019**
Broiler farming sector	0.027	0.019	0.017	0.021	0.023
Pig farming sector	0.814	0.558	0.490	0.598	0.666
Dairy cattle farming sector	0.033	0.025	0.018	0.012	0.005
Non-dairy cattle farming sector	0.075	0.039	0.008	0.039	0.028
Veal farming sector	0.675	0.233	0.060	0.062	0.046

New WHO classification and new benchmark threshold for colistin use

In 2018, the WHO decided to classify polymyxins as Highest Priority Critically Important Antimicrobials in its WHO List of Critically Important Antimicrobials for Human Medicine (the WHO CIA List), which was subsequently published in 2019. This decision was made in light of associations between usage of colistin in particular and the presence of genes that confer transmissible resistance to colistin (*mrc-1*) being identified in animals and animal products (Liu, 2016). Considering the WHO's decision to move polymyxins to this "Highest Priority Critically Important Antimicrobials" classification, the SDa expert panel has included polymyxins in its "Third-choice antibiotics" category. Polymyxins obtained their last-resort antibiotic status in 2019, and their new WHO classification did not come as a surprise. Usage of colistin to treat infections in humans is on the rise in many parts of the world (WHO, 2019). In light of the above and considering that colistin data, fluoroquinolone data and third- and fourth-generation cephalosporin data are all assessed similarly in ESVAC reports. The SDa expert panel feels livestock farmers are to aim for a polymyxin usage level of 0 $DDDA_F$, similar to other third-choice antibiotics (fluoroquinolones and third- and fourth-generation cephalosporins).

Benchmarking of livestock farms

This is the first report in which the SDa expert panel's new benchmark thresholds have been applied. The SDa's new benchmarking method for livestock farms is based on two different types of benchmark thresholds: benchmark thresholds representing acceptable use, and provisional benchmark thresholds. Benchmark thresholds that represent acceptable use of antibiotics will not be adjusted for several years, while provisional benchmark thresholds will be adjusted on a regular basis. Benchmark thresholds representing acceptable use are used for types of farms or production categories whose antibiotic usage patterns are characterized by very low usage levels, limited between-farm variation in amounts of antibiotics used, and limited usage level fluctuations over time. However, a limited number of livestock farms might still record high usage levels, which could result in a long-tailed $DDDA_F$ distribution for the type of farm or production category concerned.

Some types of farms and production categories still have relatively wide $DDDA_F$ distributions, indicative of substantial (structural) usage level and prescription pattern differences between individual livestock farms and veterinarians, respectively, as well as a relatively high degree of variation over time. For these types of farms and production categories, the SDa expert panel has not yet been able to derive benchmark thresholds that are consistent with acceptable use. In those cases, provisional benchmark thresholds are used, which are based on pragmatic considerations and will need adjusting after two to three years.

As the two types of benchmark thresholds have been derived differently, benchmarking results for livestock farms with benchmark thresholds representing acceptable use and benchmarking results for livestock farms with provisional benchmark thresholds are set out in separate sections of this report. For some types of farms or production categories, results based on sector-negotiated transitional benchmark thresholds are presented in addition to the results based on SDa-defined benchmark . Transitional benchmark thresholds are benchmark thresholds agreed upon by the Dutch Ministry of Agriculture, Nature and Food Quality and the livestock sector concerned. These benchmark thresholds are valid for several years and are intended to help livestock farms move towards a usage level consistent with acceptable use of antibiotics. Transitional benchmark thresholds have been negotiated for broiler farms, farms with sows and piglets, and farms with fattening pigs.

Benchmarking of livestock farms with benchmark thresholds representing acceptable use

The types of farms and production categories that are benchmarked using benchmark thresholds representing acceptable use, are characterized by low or very low usage levels, limited variation in $DDDA_F$ values between individual livestock farms, and limited usage level fluctuations over time. The $DDDA_F$ distributions and benchmarking results for these types of farms and production categories are summarized below.

Broiler farms

$DDDA_F$ data for the broiler farming sector are based on the amount of antibiotics used and the animals' body weight at the time of treatment according to growth curves. The findings show that the broiler farming sector's $DDDA_F$-based relative contributions of first-, second- and third-choice antibiotics are not in line with its $DDDA_{NAT}$-equivalent (see Appendix, Tables A1 and A5). Second-choice antibiotics account for 50% of overall antibiotic use in terms of $DDDA_F$, while they account for 73% of overall antibiotic use in terms of $DDDA_{NAT}$. This discrepancy can be explained by broilers' body weight at the time of treatment. Compared with first-choice antibiotics, second-choice antibiotics are associated with a higher body weight at the time of treatment.
In the broiler farming sector, the amount of antibiotics used greatly depends on the type of breed. Conventional breeds are mainly produced for the foodservice industry (e.g. restaurants, catering operations, institutions) and for export, while alternative, slower growing breeds are mainly produced for supermarkets in the Netherlands. Broiler farms with conventional breeds are characterized by a wide and long-tailed $DDDA_F$ distribution, with relatively high usage levels. For broiler farms with conventional breeds to reach a usage level consistent with acceptable use, over half of these farms would have to reduce their $DDDA_F$ values within the next few years. Broiler farms with alternative breeds, on the other hand, are characterized by a more narrow $DDDA_F$ distribution and fewer broiler farms with action-zone usage levels.
As the new benchmark thresholds for broiler farms with conventional breeds and broiler farms with alternative breeds are to be regarded as a distant goal, the Ministry of Agriculture, Nature and Food Quality and the broiler farming sector have agreed on a phased implementation process. For the 2019 reporting year, transitional signaling thresholds have been used, which are set at 14 $DDDA_F$ for broiler farms with conventional breeds and 8 $DDDA_F$ for broiler farms with alternative breeds. More information on the phased implementation of the new benchmark thresholds for the broiler farming sector can be found in the Appendix (Tables A59 and A60). In 2019, 57% of broiler farms with conventional breeds exceeded the SDa-defined benchmark threshold, and the number of farms exceeding the sector-negotiated signaling threshold was also substantial (40%). The

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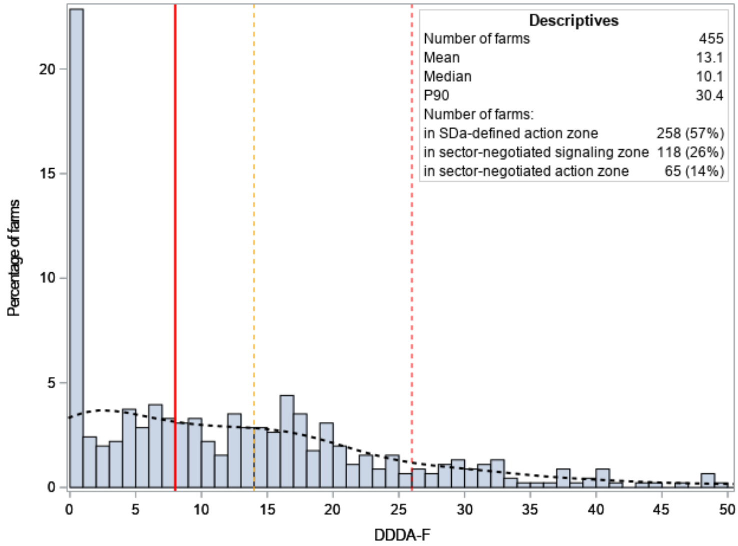
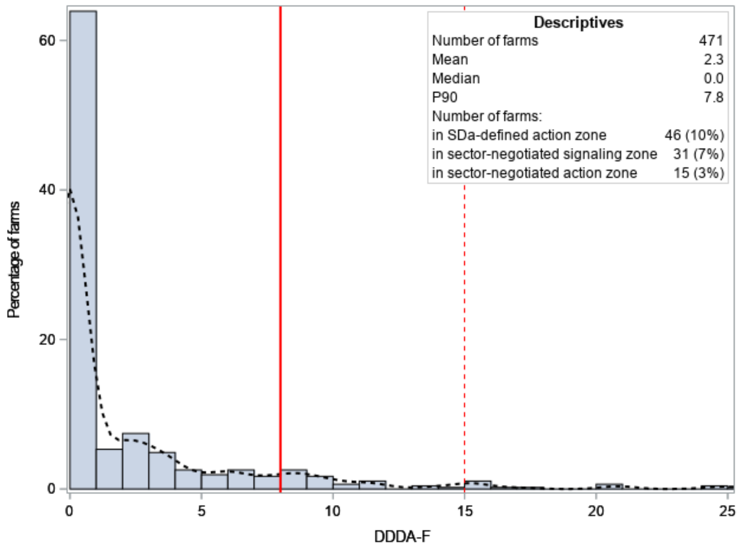
broiler farms concerned are required to take additional steps to further reduce their usage levels. Usage levels at broiler farms with alternative breeds were low, 10% of broiler farms with alternative breeds exceeded the SDa-defined action threshold.

Figures 4a. and 4b. DDDA$_F$ distributions for broiler farms with conventional breeds (Figure 4a.) and broiler farms with alternative breeds (Figure 4b.). The red solid line represents the SDa's new benchmark threshold. The orange and red dotted lines represent the sector-negotiated signaling and action thresholds, respectively. At 8 DDDA$_F$, the sector-negotiated signaling threshold for broiler farms with alternative breeds equals the SDa-defined action threshold for these farms

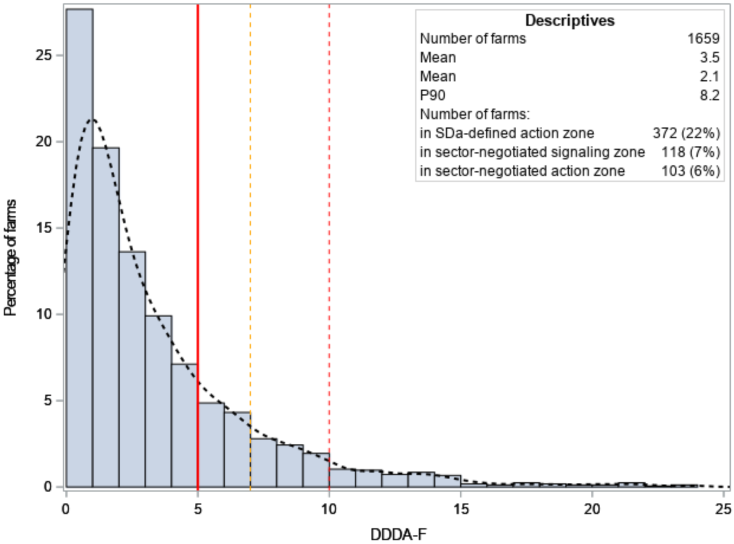


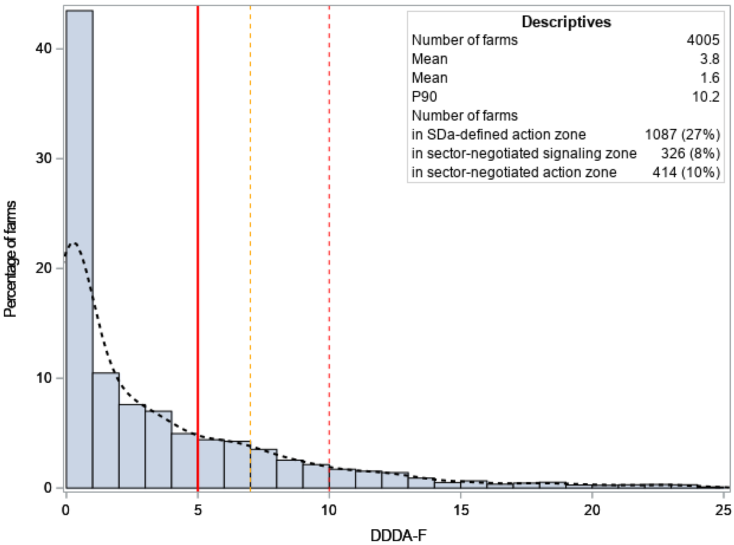


Farms with sows and piglets and farms with fattening pigs

Mean antibiotic use at farms with sows and piglets and farms with fattening pigs was low. The 2019 $DDDA_F$ distributions for these production categories are characterized by long tails, with some farms recording a multifold of that particular production category's mean $DDDA_F$ value. The pig farming sector and the Ministry of Agriculture, Nature and Food Quality have agreed upon the application of transitional benchmark thresholds as part of a phased implementation process with regard to the SDa-defined benchmark threshold. For the 2019 reporting year, the transitional signaling and action thresholds are 7 $DDDA_F$ and 10 $DDDA_F$, respectively, which apply to both production categories. More information on the phased implementation of the new benchmark thresholds for farms with sows and piglets and farms with fattening pigs can be found in the Appendix (Tables A57 and A58). Figures 5a. and 5b. include both the SDa's new benchmark threshold and the sector-negotiated transitional signaling and action thresholds. In 2019, farms with usage levels exceeding the signaling threshold were still a regular occurrence for both production categories. The pig farming sector is requested to reduce the amount of antibiotics used in sows/piglets and fattening pigs at farms recording high usage levels for these production categories.

Figures 5a. and 5b. $DDDA_F$ distributions for farms with sows and piglets (Figure 5a.) and farms with fattening pigs (Figure 5b.). The red solid line represents the SDa's new benchmark threshold. The orange and red dotted lines represent the sector-negotiated signaling and action thresholds, respectively

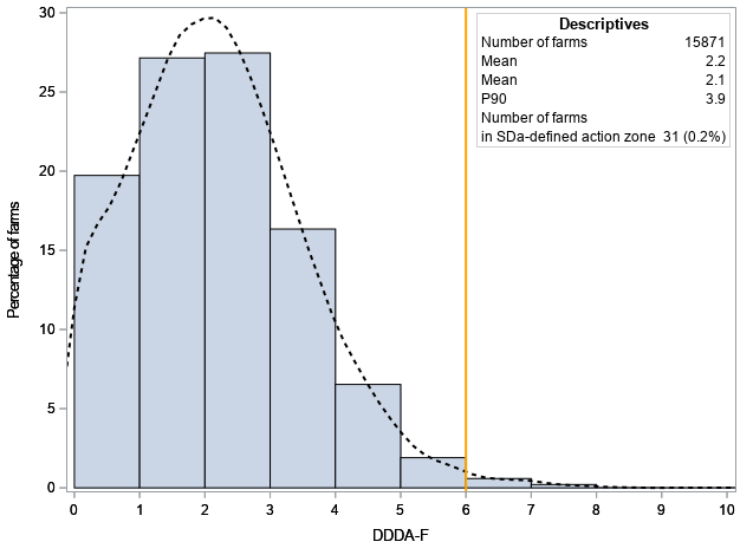




Cattle farms

The cattle farming sector is characterized by low, acceptable levels of antibiotic use and narrow $DDDA_F$ distributions. In 2019, mean antibiotic use at dairy cattle farms was 2.2 $DDDA_F$. Mean antibiotic use at non-dairy cattle farms (i.e. rearing farms, suckler cow farms and beef farms) was approximately 1 $DDDA_F$. The majority of non-dairy cattle farms did not use any antibiotics at all. The benchmarking method for the cattle farming sector deviates from the method used for the other livestock sectors, and is currently under evaluation. In the current situation, action is required if a cattle farm's usage level has exceeded the signaling threshold two years in a row. The SDa aims for harmonization with the new benchmarking method used for other livestock sectors, which is based on just an action threshold.

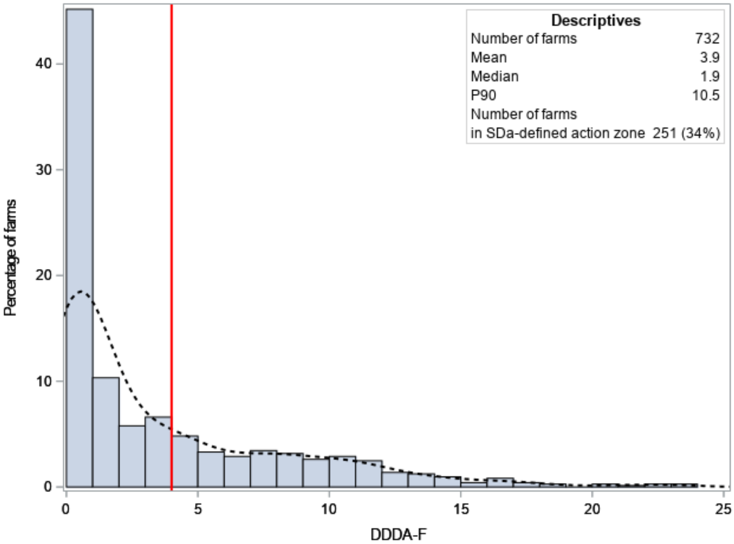
Figure 6. $DDDA_F$ distribution for dairy cattle farms. The orange line represents the SDa's benchmark threshold for inclusion in the signaling zone



Rosé veal fattening farms

Mean antibiotic use at these veal farms was low. Rosé veal fattening farms are characterized by a long-tailed $DDDA_F$ distribution, resulting in a relatively high percentage of farms (34%) being included in the action zone.

Figure 7. $DDDA_F$ distribution for rosé veal fattening farms. The red line represents the SDa's benchmark threshold



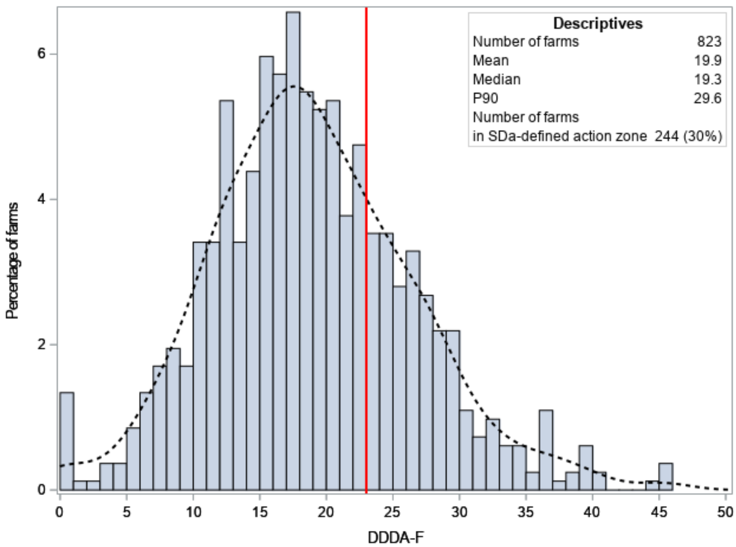
Benchmarking of livestock farms with provisional benchmark thresholds

Types of farms and production categories benchmarked by means of provisional benchmark thresholds are characterized by relatively high mean $DDDA_F$ values, wide $DDDA_F$ distributions and substantial usage level fluctuations over time. The provisional benchmark thresholds assigned by the SDa expert panel are based on pragmatic considerations and will have to be adjusted after two to three years. The expert panel intends to review these benchmark thresholds in 2021.

White veal farms, rosé veal starter farms and rosé veal combination farms
For veal farms with provisional benchmark thresholds, the 2018 signaling threshold has become the SDa's new action threshold. As no transitional benchmark thresholds for these types of veal farms have been negotiated with the Ministry of Agriculture, Nature and Food Quality, this section of the report only includes results based on SDa-defined action thresholds.

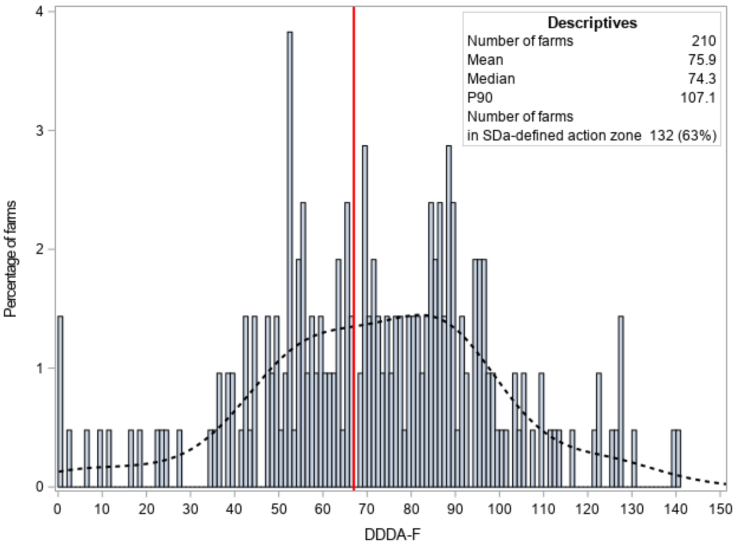
Antibiotic use at white veal farms followed a wide albeit near-Gaussian distribution. Hardly any white veal farms recorded zero usage. So rather than focusing on the outliers in the tail-end of the $DDDA_F$ distribution, improvement measures for white veal farms should focus on implementing infection control and biosafety improvements across the sector in an effort to further reduce and refine the use of antibiotics throughout this veal farming subsector and the production chain in which it operates. White veal farms did manage to reduce their antibiotic use by 1% during the 2019 reporting year. The SDa expert panel welcomes this result and aims for a further decline in the amount of antibiotics used. In 2019, 30% of white veal farms exceeded the SDa-defined provisional benchmark threshold. Those who recorded high usage levels should aim to reduce their use of antibiotics.

Figure 8. $DDDA_F$ distribution for white veal farms. The red line represents the SDa's provisional benchmark threshold



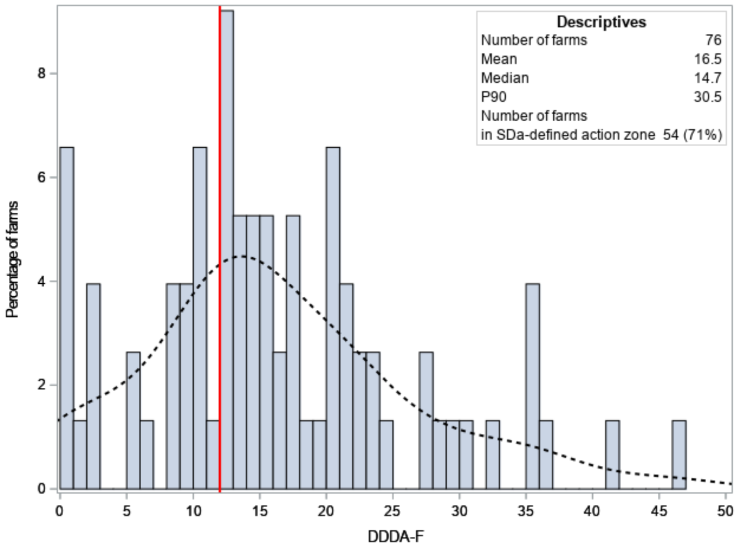
In 2019, mean antibiotic use at rosé veal starter farms was high, 75.9 $DDDA_F$, and usage levels exceeding 100 $DDDA_F$ were no exception. Usage levels differed significantly between individual rosé veal starter farms, and 63% recorded usage levels above the SDa-defined provisional benchmark threshold. The SDa expert panel is going to examine whether there are any technical reasons for this wide range of results. If deemed desirable in light of its findings, the expert panel will suggest changes to refine the $DDDA_F$ calculation and benchmarking methods for rosé veal starter farms. Irrespective of any future findings, the SDa expert panel urges rosé veal starter farms to step up their reduction efforts, as the extent of between-farm variability suggests there is still room for farm-level improvements.

Figure 9. $DDDA_F$ distribution for rosé veal starter farms. The red line represents the SDa's provisional benchmark threshold



The number of rosé veal combination farms has dropped from 186 in 2018 to just 76 in 2019. The SDa and the veal farming sector agreed to discontinue the rosé veal combination farms reporting category, and to record the farms' antibiotic usage data under either the rosé veal starter farms reporting category or the rosé veal fattening farms reporting category. However, for a minority of farms this administrative change had not yet been implemented by the end of 2019, and they were still included in the rosé veal combination farms reporting category. It is expected that next year's SDa report will no longer list any rosé veal combination farms. The 2019 usage level for rosé veal combination farms is wide, with some farms recording usage levels nearing 50 $DDDA_F$. 71% of rosé veal combination farms exceeded the SDa's provisional benchmark threshold. The veal farming sector should increase its efforts to limit the amounts of antibiotics used.

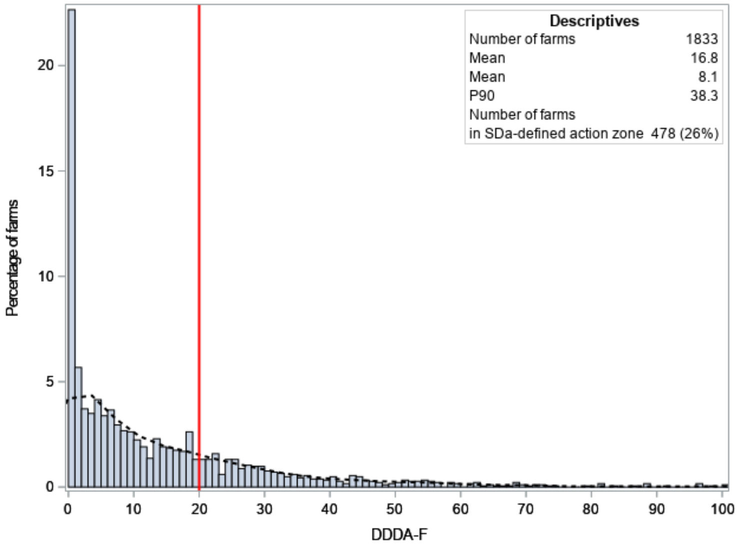
Figure 10. $DDDA_F$ distribution for rosé veal combination farms. The red line represents the SDa's provisional benchmark threshold



Farms with weaner pigs

Antibiotic use in the weaner pigs production category declined by 15.2% in 2019. The long-tailed $DDDA_F$ distribution for farms with weaner pigs shows that even though very low usage levels (<1 $DDDA_F$) were a frequent occurrence, several farms recorded usage levels higher than 50 $DDDA_F$. The pig farming sector needs to address the occurrence of (persistently) high usage levels at farms with weaner pigs. Given that 26% of farms with this production category exceeded the SDa's provisional benchmark threshold, further action is required to reduce the amounts of antibiotics used.

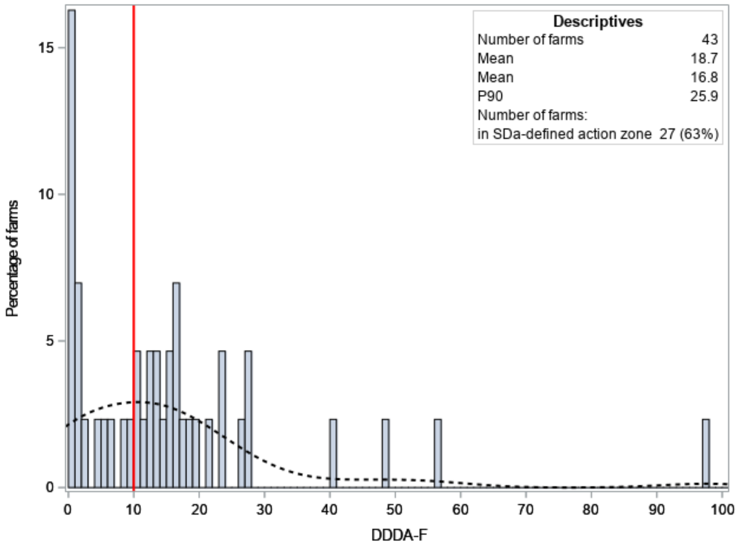
Figure 11. $DDDA_F$ distribution for farms with weaner pigs. The red line represents the SDa's benchmark threshold



Turkey farms

The 2019 $DDDA_F$ distribution for turkey farms is wide and shows many farms with usage levels exceeding the SDa's provisional benchmark threshold and several outliers with usage levels higher than 40 $DDDA_F$. The benchmark threshold for turkey farms has yet to be agreed upon by the turkey farming sector. Usage levels at turkey farms are generally high. The turkey farming sector has initiated a coaching project for turkey farmers and veterinarians. It is the SDa's hope that this will lead to usage level reductions, particularly at those turkey farms currently or persistently recording high $DDDA_F$ values. In 2019, 63% of turkey farms exceeded the SDa's provisional benchmark threshold, indicating that more should be done to limit the amounts of antibiotics used at turkey farms.

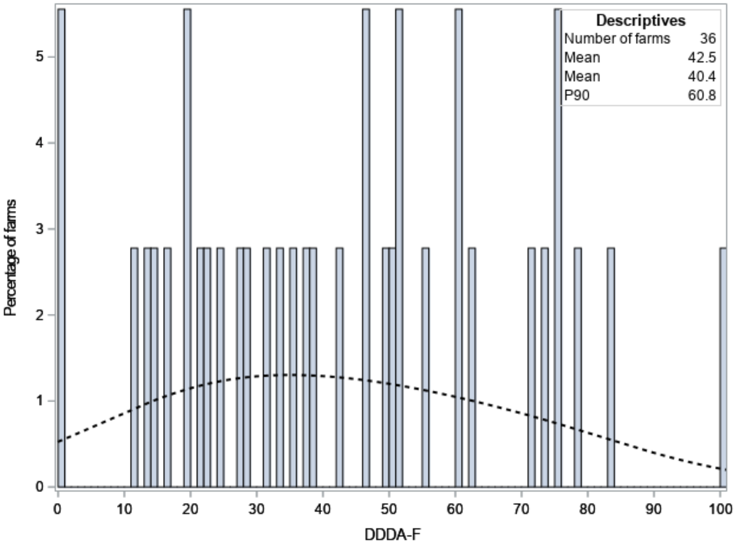
Figure 12. $DDDA_F$ distribution for turkey farms. The red line represents the SDa's provisional benchmark threshold. This benchmark threshold has yet to be agreed upon by the turkey farming sector



Rabbit farms

The rabbit farming sector is characterized by a very high mean $DDDA_F$ value, considerable between-farm differences in usage levels and substantial year-to-year usage levels fluctuations at individual rabbit farms. Changes with regard to the recording of delivery record data and the numbers of rabbits appear to have resulted in more accurate $DDDA_F$ data compared with previous years. Although the $DDDA_F$ data suggest antibiotic use at rabbit farms declined in 2019, this cannot be quantified due to the lack of accurate $DDDA_F$ data for preceding years. Between-farm differences regarding the farm's rabbit population and the fact that several rabbit farms switched from conventional housing to a so-called park system may both have contributed to the usage level differences observed between individual rabbit farms. Pending assessment of critical success factors for realizing usage level reductions, the SDa expert panel has not yet derived any benchmark thresholds for rabbit farms. The rabbit farming sector's distinct between-farm usage level differences do underline the need for a critical success factor study. The SDa expert panel and the rabbit farming sector are currently discussing the recording of average body weights, and the expert panel considers introducing a provisional benchmark threshold before the end of this year in order to avoid any further delays.

Figure 13. $DDDA_F$ distribution for rabbit farms



Benchmarking of veterinarians

Similar to the $DDDA_F$ data used to monitor the amounts of antibiotics used at livestock farms, $DDDA_{VET}$ data can be calculated per veterinarian for each individual type of farm or production category. The $DDDA_{VET}$ unit of measurement represents the average number of defined daily doses animal prescribed by an individual veterinarian, and is in line with the SDa's benchmarking method for livestock farms. The $DDDA_{VET}$ results for the different types of farms and production categories are listed in Table 2.

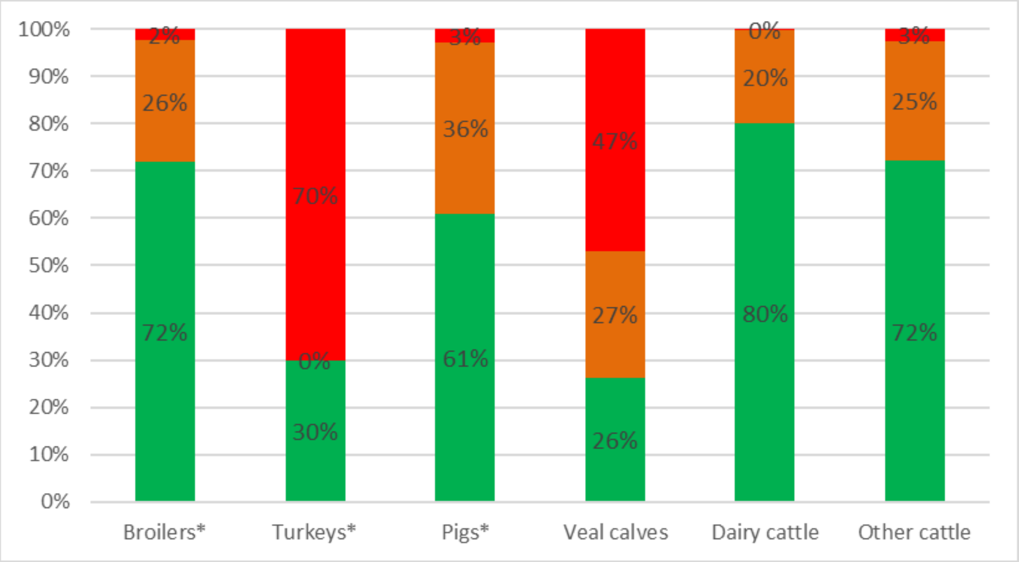
Table 2. $DDDA_{VET}$ data by type of farm/production category

Livestock sector	Type of farm/ production category	N	Mean	Med.	P75	P90
Broiler farming sector	Broiler farms	82	7.8	6.9	12.2	18.8
	- with conventional breeds	72	11.4	10.2	17.8	23.2
	- with alternative breeds	72	1.8	1.2	2.7	4.3
Turkey farming sector	Turkey farms	10	13.1	12.7	20.3	31.2
Pig farming sector	Sows/suckling piglets	212	3.5	2.5	4.6	6.7
	Weaner pigs	209	16.0	11.1	20.3	36.7
	Fattening pigs	241	4.2	4.0	5.7	7.1
Veal farming sector	White veal farms	61	17.7	17.6	19.7	21.3
	Rosé veal starter farms	59	72.8	72.4	82.4	98.3
	Rosé veal fattening farms	121	4.8	3.5	7.2	11.2
	Rosé veal combination farms	39	18.2	17.4	21.9	32.0
Cattle farming sector	Dairy cattle farms	710	2.4	2.3	2.7	3.0
	Rearing farms	196	0.6	0.0	0.6	1.5
	Suckler cow farms	697	0.7	0.4	0.9	1.5
	Beef farms	378	0.7	0.3	0.9	1.7

Table 2 shows that with regard to antibiotics prescribed for dairy cattle, veterinarians' prescription patterns were relatively similar (i.e. a relatively minor difference between the median value and the P90 value). More substantial inter-veterinarian variability in prescription patterns is observed for the other types of farms and production categories.

The current benchmarking method for veterinarians was introduced in March of 2014 and assesses veterinarians' prescription patterns by means of the Veterinary Benchmark Indicator (VBI). All veterinarians can retrieve their VBIs by accessing the quality management systems. A veterinarian's VBI is livestock sector specific and can range from 0 to 1. The VBI reflects the probability of livestock farms with which the veterinarian has a one-to-one relationship recording action zone usage levels. A VBI of 0.22 therefore means that 22% of the livestock farms with which the veterinarian concerned has a one-to-one relationship have been included in the action zone. As the VBI is sector specific, a veterinarian active in various livestock sectors will be assigned several VBI scores. The way in which veterinarians are distributed over the various benchmark zones is primarily determined by the $DDDA_F$ distributions for the sector concerned. Prescription pattern differences between individual veterinarians or veterinary practices are another main driver.
Figure 14 shows how veterinarians in each of the livestock sectors are distributed over the various benchmark zones based on their VBIs for 2019. The VBI results were calculated using either the livestock sectors' new benchmark thresholds as implemented in 2019, or the sector-negotiated transitional benchmark thresholds (for the broiler and pig farming sectors).

Figure 14. VBI-based distribution of veterinarians over the various benchmark zones, by livestock sector



* Transitional benchmark thresholds were used to determine this livestock sector's distribution of veterinarians.

New benchmarking method for veterinarians

A new benchmarking method for veterinarians is being developed. The SDa expert panel is currently taking the final steps in preparation for the implementation of this new, $DDDA_{VET}$-based benchmarking method.

Appendix

The Appendix to this report is published on the SDa website.

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Trends and benchmarking of livestock farms and veterinarians
SDa/1153/2020
The Netherlands Veterinary Medicines Institute, 2020