Autoriteit Diergeneesmiddelen

Usage of Antibiotics in Agricultural Livestock in the Netherlands in 2020

Trends and benchmarking of livestock farms and veterinarians

June 2021

Preface

This is a copy of the report *Usage of Antibiotics in Agricultural Livestock in the Netherlands in 2020* 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 tenth consecutive year. Similar to last year's report, it consists of two separate parts: a main report summarizing the most important findings regarding the usage of antibiotics in the Dutch livestock sector, and a more detailed online appendix.

This is the second 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. The SDa's benchmarking method for veterinarians has been updated too, and as of 2021, the new benchmarking method is being used to assess veterinarians' prescription patterns. This report will explore the implications of this newly implemented benchmarking method for veterinarians.

The objectives of the SDa's benchmarking efforts and annual report remain unchanged: providing insight into livestock farmers' and veterinarians' performance in terms of their antibiotic usage levels and prescription patterns, respectively.

Utrecht, June 2021

Prof. D.J.J. Heederik, PhD
Chair of the SDa expert panel

Colophon:
Members of the SDa expert panel:
Prof. M.J.M. Bonten, PhD, medical microbiologist
I.M. van Geijlswijk, PhD, hospital pharmacist - clinical pharmacologist
Prof. D.J.J. Heederik, PhD, epidemiologist
Prof. emeritus D.J. Mevius, DVM, PhD, veterinary microbiologist (temporarily replacing Prof. J.A. Wagenaar, DVM, PhD, veterinary microbiologist)

Research staff:
P. Sanders, ir., data analyst

Contents

Summary

The SDa expert panel publishes its annual report to provide information on the amounts of antibiotics used and sold within the Dutch livestock sector. Antibiotic use in all of the monitored livestock sectors combined (i.e. the number of kilograms of active substances prescribed) declined slightly in 2020, by 2.9%. The number of kilograms of active substances sold, however, was 2.1% higher than the year before, bringing the current overall reduction from the government-specified reference year of 2009 to 69.0%.

Following the distinct downward trends initiated in 2009, the usage patterns observed for the dairy cattle, pig and broiler farming sectors have been stable over the last five years. Antibiotic use in the dairy cattle farming sector has been approximately 3 $DDDA_{NAT}$ per year since 2016. Over the last five years, antibiotic use in the pig and broiler farming sectors remained between 8 and 9 $DDDA_{NAT}$ and between 9 and 10 $DDDA_{NAT}$, respectively.
In 2020, the veal farming sector managed to reduce the amount of antibiotics used by 1.2 $DDDA_{NAT}$, representing a 7.3% reduction from its 2019 $DDDA_{NAT}$ value. The veal farming sector's mean antibiotic use still exceeds the levels of the four other main livestock sectors (i.e. the dairy cattle, non-dairy cattle, pig and broiler farming sectors), but has shown a steady decline over the previous five years. Over the 2013-2020 period, the veal farming sector recorded a 28.8% (6.2 $DDDA_{NAT}$) reduction in the amount of antibiotics used, resulting in its current $DDDA_{NAT}$ value of 15.3. The SDa expert panel expects this downward trend to continue and wants the veal farming sector to take additional measures to further reduce the amounts of antibiotics used.
The turkey farming sector managed to achieve a steep 38.8% (8.6 $DDDA_{NAT}$) decline from its 2019 level, resulting in a $DDDA_{NAT}$ value of 13.6. In 2021, this livestock sector is going to initiate a coaching program for turkey farmers and their veterinarians and feed consultants in an effort to help turkey farmers realize additional usage level reductions. The SDa expert panel welcomes the sector's distinct $DDDA_{NAT}$ improvement recorded for 2020 and expects the coaching program to result in additional improvements.
At 42.4 $DDDA_{NAT}$, antibiotic use in the rabbit farming sector (i.e. meat rabbit farms) was high and exceeded the level recorded for 2016, the year in which monitoring efforts in this livestock sector were initiated. The rabbit farming sector has drawn up an action plan aimed at reducing its antibiotic use. The SDa expert panel expects it will not take long for the effects of these efforts to become noticeable.
Antibiotic use in the 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, was low and stable. The goat farming sector is working towards implementing an antibiotic monitoring system. The SDa expert panel expects to start receiving

antibiotic usage data in 2021. This would mean the goat farming sector could be included in the SDa expert panel's next monitoring report.

Sector-specific usage patterns can be observed with regard to livestock sectors' relative contributions of first-, second- and third-choice antibiotics. 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. The turkey farming sector was the only livestock sector recording a substantial decline in its relative contribution of second-choice antibiotics for 2020. The relative contribution of second-choice antibiotics in the broiler farming sector remained relatively high.

Colistin use continued to rise in 2020. As colistin is critically important for human medicine, its use in veterinary medicine should be limited as much as possible. Colistin use has been on the rise since 2017, amounting to an overall 62.1% increase over the 2017-2020 period. The SDa expert panel feels urgent measures are required to avert this unfavorable development. Of the kilograms of colistin used in 2020, 97.6% could be attributed to the pig farming sector and the "Other poultry farming subsectors" category (i.e. layer farms, layer rearing farms, rearing farms for layer or broiler parent/grandparent stock, and production farms for layer or broiler parent/grandparent stock). The amount of colistin used in the other poultry farming subsectors did show a 4.0% decline from the 2019 level, however, while colistin use in the pig farming sector was 9.3% higher than the year before. Colistin use was highest in weaner pigs and layers. While the majority of farms with weaner pigs or layers reported no colistin use, the farms that did had a mean $DDDA_F$ value >5, indicating colistin was administered relatively frequently. The SDa expert panel urges pig and layer farmers to reduce their use of colistin. The SDa expert panel expects the results of sector-specific efforts aimed at promoting prudent use of colistin at farms currently recording regular colistin use to become apparent in 2022.

This is the second report in which livestock farms' antibiotic usage levels have been assessed by means of the new SDa-defined benchmark thresholds. Compared to 2019, most types of farms/production categories had slightly fewer farms exceeding their assigned action threshold. For some types of farms and production categories, persistently high usage levels (i.e. $DDDA_F$ values that have exceeded the action threshold two years in a row) are a frequent occurrence. This situation has to be addressed and reduction efforts should be aimed primarily at reducing the amounts of antibiotics used at farms with persistently high usage levels, which include broiler farms with conventional breeds, rosé veal fattening farms, and all of the pig farming sector's production categories. The types of farms and production categories concerned each 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.

Some of the other types of farms and production categories (turkey farms, rabbit farms and all types of veal farms except for rosé veal fattening farms) exhibit a wide $DDDA_F$ distribution, indicating measures aimed at reducing antibiotic usage levels across the board are called for in addition to measures aimed at reducing the number of farms with persistently high usage levels.

As of 2021, a new benchmarking method is being used for the cattle farming sector. The new benchmarking method for the cattle farming sector is equivalent to the method used for the other livestock sectors in that only a single benchmark threshold is used, representing acceptable use. The various cattle farming subsectors are characterized by low $DDDA_F$ values and relatively few farms recording action zone usage levels.
2021 will also see the implementation of a new benchmark threshold for turkey farms. The new threshold is intended to facilitate a continuation of the turkey farming sector's initiated decline in antibiotic use. The turkey farming sector and the Ministry of Agriculture, Nature and Food Quality have agreed on the application of intermediate benchmark thresholds, which will help turkey farmers move towards their new benchmark threshold gradually.
The rabbit farming sector has been assigned a provisional benchmark threshold with a two-year duration, which will be implemented in 2021. This provisional benchmark threshold should help address the high usage levels characterizing this livestock sector. Exploring the role of antimicrobial resistance at a sample of rabbit farms might also be beneficial, as this could help instill rabbit farmers with a sense of urgency regarding the need to reduce their antibiotic usage levels.

As of 2021, veterinarians' prescription patterns are going to be monitored by means of a new, DDDA-based benchmarking method, comparable to the $DDDA_F$-based method used for benchmarking livestock farms. While the new method closely resembles the $DDDA_{VET}$-based method described in previous SDa reports, it has been decided that farms with persistently high usage levels are not to be included in benchmarking calculations. Livestock sectors and veterinarians have already agreed to utilize a targeted approach aimed a farm with persistently high usage levels, but the specifics are still to be determined. Assessment of veterinarians' 2020 prescription patterns were still performed according to the original benchmarking method, with the VBI representing 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. The 2020 VBI results show that the proportion of veterinarians in the action zone is small for all livestock sectors except the veal farming sector. According to the veal farming sector's VBI results, almost 1 in 2 veterinarians is included in the action zone. The SDa expert panel expects that together, veal farmers and veterinarians will be able to continue the downward trend in this livestock sector's usage of antibiotics, and that this will result in fewer veterinarians being assigned an action zone level VBI.

This report also gives an impression of how VBI results will be affected by the introduction of the new benchmarking method for veterinarians, with the implementation of new benchmark thresholds for livestock farms expected to be the main driver for VBI effects.

Terms and definitions

Cattle farming sector	The term "cattle farming sector" includes the dairy cattle farming sector (i.e. dairy cattle farms) and the non-dairy cattle farming sector (i.e. suckler cow farms, rearing farms, and beef farms). Veal farms are not included when referring to the cattle farming sector, unless stated otherwise.
$DDDA_F$	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. 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. 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, including those with persistently high usage levels (which are not included when determining the new VBI).
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.

EUROSTAT	The statistical office of the European Union.
Livestock farms with persistently high usage levels	Livestock farms whose $DDDA_F$ values have exceeded the SDa-defined action threshold two years in a row.
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.
Poultry farming sector	The term “poultry farming sector” includes all of the monitored poultry farms (i.e. turkey farms, broiler farms, layer farms, layer rearing farms, rearing farms for layer or broiler parent/grandparent stock, and production farms for layer or broiler parent/grandparent stock).
Rabbit farming sector	The term “rabbit farming sector” refers to meat rabbit farms, and rabbit farming sector data are based on all of the rabbits at meat rabbit farms (i.e. breeding does with kits, weaned meat rabbits, and replacement breeding does).
Treated kilograms	The number of kilograms of a particular type of livestock that can be treated with a single packaging unit of the antibiotic concerned.
VBI (used until the end of 2020)	The original Veterinary Benchmark Indicator, which represents 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.
VBI (implemented in 2021)	The new Veterinary Benchmark Indicator, which represents the antibiotic prescription pattern of a particular veterinarian in one of the livestock sectors or subsectors. The new VBI is calculated by first determining the total number of treated kilograms for which the 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) and then dividing this number by the average number of kilograms of animal present based on all of the livestock farms concerned. Livestock farms with persistently high usage levels are not included in these VBI calculations.

Introduction

This is the second 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 benchmarking method is based on two types of benchmark thresholds: benchmark thresholds representing acceptable use, and provisional benchmark thresholds.
As of 2021, a new benchmarking method for veterinarians is being used. Although the 2020 prescription pattern assessment has been performed according to the original benchmarking method, this report also shows the results based on the newly implemented benchmarking method to indicate how the new VBI method will impact veterinarians' assessment results. The new VBI is based on data regarding the livestock farms with which the veterinarian concerned has a one-to-one relationship, excluding those with persistently high usage levels. The decision not to include livestock farms with persistently high usage levels was based on the rationale that these farms require specific, targeted measures, and livestock sectors and veterinarians have agreed to address the amounts of antibiotics prescribed at farms with persistently high usage levels. Due to the introduction of this new benchmarking method for veterinarians, several additional tables have been included in this report.

The use of colistin has been assessed in more detail in this report by also comparing colistin use on the farm level, next to the sector level comparison based on the EMA benchmark threshold.

Antibiotic usage trends

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

Figure 1 shows the usage trends for the monitored livestock sectors. Following the distinct downward trends initiated in 2009, the usage patterns observed for the **dairy cattle**, **pig** and **broiler farming sectors** have been stable over the last five years (Tables B1 and B2 in the online appendix). Antibiotic use in the dairy cattle farming sector has been approximately 3 $DDDA_{NAT}$ per year since 2016. Over the last five years, antibiotic use in the pig and broiler farming sectors remained between 8 and 9 $DDDA_{NAT}$ and between 9 and 10 $DDDA_{NAT}$, respectively.

Of the five main livestock sectors (i.e. the dairy cattle, non-dairy cattle, pig, veal and broiler farming sectors), antibiotic use is highest in the **veal farming sector**, although the sector's $DDDA_{NAT}$ values have shown a steady decline over the previous five years. During 2020 antibiotic use in the veal farming sector declined by 7.3% (1.2 $DDDA_{NAT}$). Over the 2013-2020 period, this livestock sector has recorded a 28.8% (6.2 $DDDA_{NAT}$) reduction in the amount of antibiotics used. The SDa expert panel expects this decline to continue.

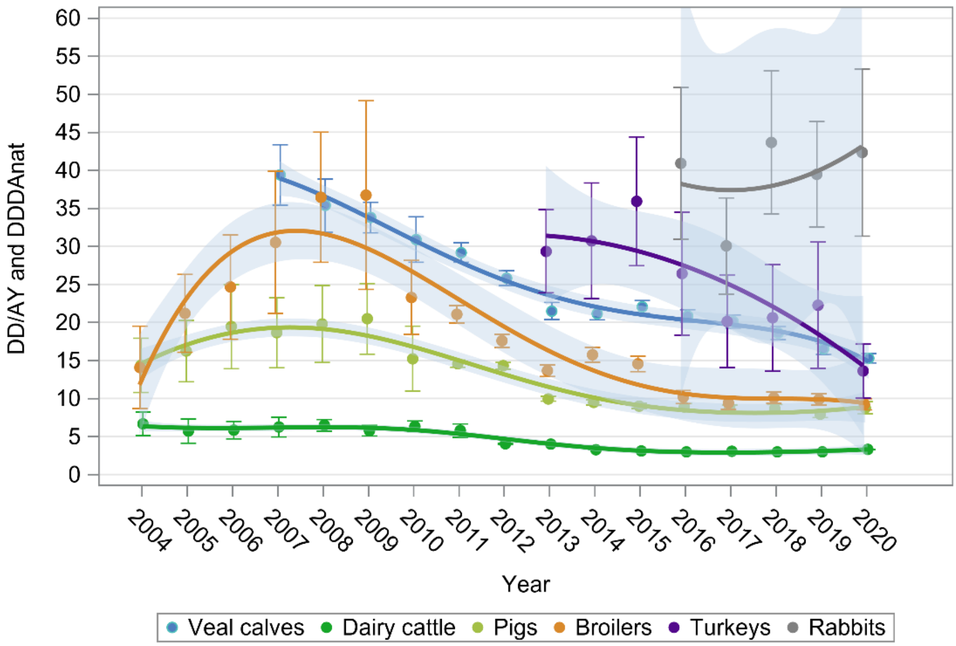
The **turkey farming sector** managed to achieve a steep 38.8% (8.6 $DDDA_{NAT}$) decline from the level recorded for 2019. The SDa expert panel welcomes this development, and expects it to continue. As the turkey farming sector's antibiotic use did not improve over the 2017-2019 period, the sector has decided to implement a coaching program in 2021. This program is intended to help turkey farmers realize additional usage level reductions.

The usage pattern recorded for the **rabbit farming sector** is high and characterized by pronounced year-to-year fluctuations. Its $DDDA_{NAT}$ value for 2020 exceeds the one recorded for 2016, the year in which the SDa started monitoring this livestock sector's antibiotic use. The amount of antibiotics used in 2020 represented a 7.2% (2.8 $DDDA_{NAT}$) increase compared to the sector's 2019 level. The rabbit farming sector has drawn up an action plan aimed at reducing its antibiotic use. The SDa expert panel expects it will not take long for the effects of these efforts to become noticeable. Exploring the role of antimicrobial resistance at individual rabbit farms might also be considered, as this could help instill rabbit farmers with a sense of urgency regarding the need to reduce their antibiotic usage levels.

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**, was low and stable.

Please refer to the online appendix for detailed information on livestock sectors' antibiotic usage pattern trends (Table B1) and to see livestock sectors' annual reductions from the 2009 $DDDA_{NAT}$ levels (Table B2). The appendix also includes data on livestock sectors' antibiotic use in terms of DDD_{VET}/animal-year (Table B60).

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 2020), as spline curves with point estimates and 95% confidence intervals for each year. Please refer to the online appendix for the computational basis



Unmonitored sectors

The **goat farming sector** is working towards implementing a monitoring system to keep track of the amounts of antibiotics used at goat farms. Antibiotic usage data from the majority of goat farms are already being recorded. However, due to incomplete reporting on the numbers of animals present at some of the goat farms, the sector's antibiotic usage data for 2020 could not be processed in accordance with the SDa's calculation method. The sector has been advised by the SDa expert panel to start using external data sources for obtaining information on the numbers of animals present at individual goat farms, and to do so as soon as possible. Collecting this information through self-reporting by goat farmers has shown to be too unreliable. The SDa expert panel expects data entry into the goat farming sector's database to have commenced by April 1, 2021, after which data analysis would still have to be performed. Consequently, the goat farming sector's 2020 results could not be included in the current report. The SDa expert panel assumes it will be able to include data on the sector's antibiotic use during (part of) 2021 in next year's report.

No surveys of unmonitored sectors, e.g. the **companion animal and horse sectors**, were conducted in 2020.

Implications of Regulation (EU) 2019/6 for monitoring efforts in the Netherlands

Regulation (EU) 2019/6 of the European Parliament and of the Council of 11 December 2018 on veterinary medicinal products will enter into force on January 28, 2022. It will repeal the current directive on the Community code relating to veterinary medicinal products, Directive 2001/82/EC. Regulation (EU) 2019/6 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 requires more extensive monitoring efforts, as data on the use of antifungals, coccidiostats and antivirals will also have to be collected. The Regulation does allow for a progressive stepwise approach regarding its monitoring obligations. 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 horses intended for human consumption (with the data pertaining to antimicrobial use during the preceding year) will have to be reported too. 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. The additional categories of antimicrobials referred to above will be incorporated into the *Diergeneesmiddelen* database over the next couple of years. The SDa will provide regular progress updates during this period.

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 trade 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 2021, the SDa expert panel will publish an overview of the changes that are to be implemented, and present its implementation suggestions. These suggestions will then be discussed with the relevant stakeholders.

Amounts of antibiotics sold

In 2020, the number of kilograms of active substances sold increased by 2.1% compared to the 2019 level, to 153,521 kg (Figure 2). Figure B1 in the online appendix shows (by pharmacotherapeutic group) how the amounts sold have changed over the 2011-2020 period. The 2020 sales data reveal a 69.0% reduction from the government-specified reference year of 2009. Of the number of kilograms sold in 2020, 7.0% could not be attributed to recorded antibiotic use in the monitored livestock sectors. This discrepancy between the numbers of kilograms sold and used exceeds the discrepancy recorded in last year's report. In contrast to the number of kilograms sold, the number of kilograms of active substances used in 2020 showed a 2.9% reduction (Figure 3). The reasons for these year-to-year fluctuations in the discrepancy between the numbers of kilograms sold and used are still unclear. They could be due to variations in the amounts kept in stock, although it is possible that other factors are involved. At the time of writing this report, an external consulting agency is exploring this matter more in depth. Their assessment is expected by mid-2021.
Over the 2009-2020 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 1999-2020 period, in number of kilograms of active substances sold (x1,000) (source: FIDIN), by main pharmacotherapeutic group

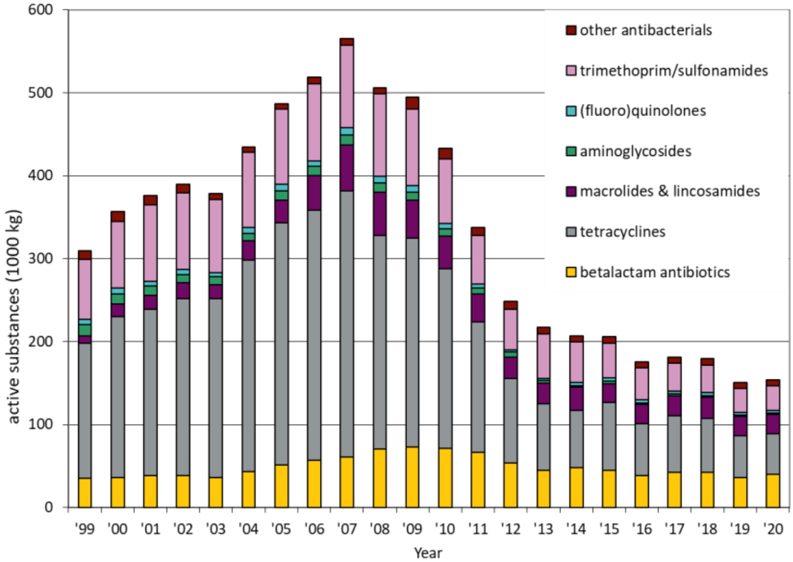
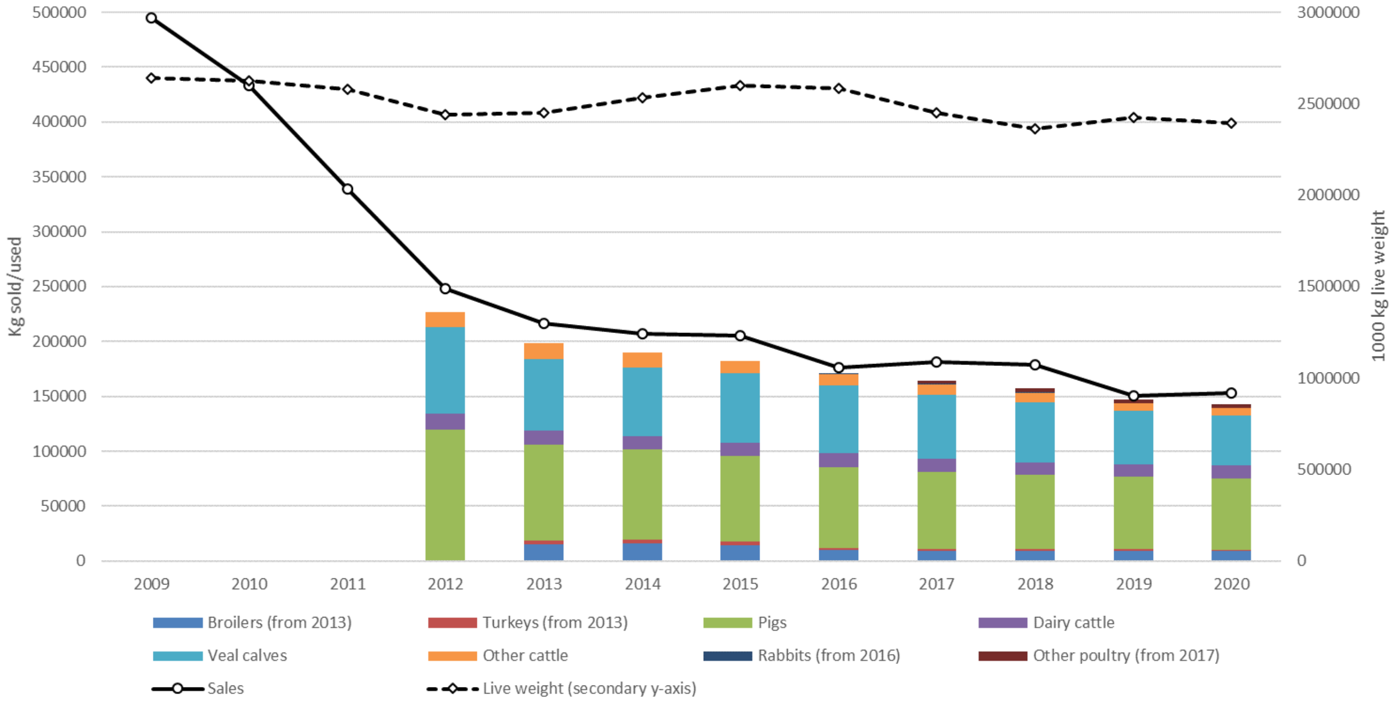


Figure 3 shows the long-term developments in both the amount of antibiotics sold (in kilograms, solid line) and the amount of antibiotics used (in kilograms, bars) in monitored livestock sectors. It also shows the annual numbers of kilograms of live weight of agricultural livestock present in the monitored 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 en pig farming sectors. This is in part due to the mere size of the animals in these two livestock sectors, as veal calves and pigs require higher doses of antibiotics than smaller animals. However, the number of kilograms of antibiotics used is not a great indicator of the level of exposure to antibiotics in a particular type of livestock. 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 bars include the numbers of kilograms used in the individual monitored livestock sectors, and the dotted line reflects the annual numbers of kilograms of live weight for the livestock sectors that were subjected to SDa monitoring in 2020



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 these categories of antibiotics initially varied from year to year, they are currently relatively stable for most of the livestock sectors (Table B1 in the online appendix). In the pig farming sector, the cattle farming sector (i.e. the dairy cattle, veal and non-dairy cattle farming sectors) and the rabbit farming sector, first-choice antibiotics accounted for 70% to 85%, second-choice antibiotics for about 15% to 25%, and third-choice antibiotics (primarily polymyxins) for 0% to approximately 5% of their overall antibiotic use in 2020. The pig, dairy cattle, non-dairy cattle and veal farming 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. The relative contribution of first-choice antibiotics in the rabbit farming sector has increased over time, and no third-choice antibiotic use has been recorded for 2020.

The broiler and turkey farming sectors have managed to substantially reduce the relative contribution of third-choice antibiotics to 0.9% and 3.4%, respectively. With second-choice antibiotics accounting for 71.6% and 35.5% of the broiler and turkey farming sector’s overall antibiotic use in 2020, respectively, there is still room for improvement in this respect. The turkey farming sector did, however, record a marked increase in its relative contribution of first-choice antibiotics, which rose from 47.9% in 2019 to 61.1% in 2020. These percentages were calculated using the livestock sectors’ $DDDA_{NAT}$ values, which are based on standardized body weights, while broiler and turkey farms’ $DDDA_{F}$ values are based on body weight at the time of treatment according to growth curves. A $DDDA_{F}$-based approach is more precise and results in different relative contributions of first-, second- and third-choice antibiotics (more on this can be found in the sector-specific subsections of this report). 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 an EU-level in the near future will also be based on average body weights.

Fluoroquinolone use and use of third- and fourth-generation cephalosporins remained low in most of the livestock sectors. The turkey farming sector was the only livestock sector whose fluoroquinolone use exceeded 0.1 $DDDA_{NAT}$. However, over the past five years it has managed to reduce its use of fluoroquinolones from 1.6 $DDDA_{NAT}$ to 0.5 $DDDA_{NAT}$.

Colistin use

Overall colistin use in the Dutch livestock sector rose by 96 kg (7.3%) during the 2020 reporting year. Colistin use has been on the rise since 2017, amounting to an overall 62.1% increase over the 2017-2020 period. The SDa expert panel feels urgent measures are required to avert this unfavorable development. As colistin is critically important for human medicine, its use in veterinary medicine should be limited as much as possible.

With a 100.2 kg increase, colistin use in the pig farming sector was the main driver for the rise in overall colistin use recorded for 2020 (Table 1). In the pig farming sector, colistin is used primarily in the treatment of enteropathogenic *E. coli* infections. Of the amount of colistin used in the pig farming sector, 91.0% could be attributed to use in weaner pigs, 6.4% to use in suckling piglets, and 2.6% to use in fattening pigs. In 2020, 504 farms with weaner pigs (28.7%) reported colistin use. Mean colistin use for all farms with weaner pigs combined amounted to 1.91 $DDDA_F$, while mean colistin use for the 504 farms with reported colistin use in weaner pigs was 6.71 $DDDA_F$ (Table B55 in the online appendix). The majority of colistin doses (6.06 $DDDA_F$) were administered in the context of group treatment. Colistin use in sows and suckling piglets also occurred quite regularly, with 483 farms with this production category (30.7%) reporting colistin use for 2020. However, with 0.27 $DDDA_F$, mean colistin use at these 483 farms was low. Group treatments accounted for 0.11 $DDDA_F$ of their overall mean colistin use.
The other main contributor to the amount of colistin used in 2020 was the "Other poultry farming subsectors" category. Colistin use in these subsectors remained high, even though it represented a 4.0% decline from 2019. Use in layers accounted for 96.8% of the amount of colistin used in these other poultry farming subsectors, which can be attributed to colistin's zero day withdrawal period for eggs. In layers, colistin is used exclusively in the context of group treatment. Mean colistin use for all 818 layer farms combined amounted to 1.06 $DDDA_F$. Mean colistin use for the 128 layer farms reporting colistin use for 2020 (15.6% of layer farms), amounted to 6.75 $DDDA_F$, indicating colistin was administered relatively frequently (Table B55 in the online appendix).
The SDa expert panel urges pig and layer farmers to reduce their use of colistin. The SDa expert panel expects the results of sector-specific efforts aimed at promoting prudent use of colistin at farms currently recording regular colistin use to become apparent in 2022.
Use of colistin in the dairy cattle, non-dairy cattle, veal and broiler farming sectors was low, but vigilance is indicated as it was slightly higher (8 kilograms in total) than the 2019 level. The main reasons for colistin use in cattle are enteropathogenic *E. coli* infections (diarrhea) infections in young calves at dairy cattle and suckler cow farms, and diarrhea in young beef bulls during early rearing. The SDa expert panel wants the cattle farming sector to phase out colistin use in beef bulls, in line with the measures taken in the veal farming sector. No colistin use was recorded for the rabbit and turkey farming sectors.

None of the livestock sectors included in Table 2 exceeded the EMA's 1 mg/PCU benchmark threshold (EMA, 2016a). The SDa expert panel does note, however, that it is not entirely in favor of the application of this indicator in colistin use calculations. In livestock sectors with meat-producing animals, the denominator (PCU; please refer to the Terms and definitions for more information) is production based, and the SDa expert panel feels production is a suboptimal measure for the denominator in colistin use calculations and suspects it will result in systematic underestimation of the amount of colistin used. In addition, this measure cannot provide any insight into the amount of colistin used at individual livestock farms. Once again, the amount of colistin used in layers had to be estimated by the SDa expert panel, as the ESVAC population correction unit template does not include standardized body weights for layers. Layers were assumed to weigh 1.6 kg, the standardized body weight used within the sector. Estimates based on a body weight of 1.6 kg suggest colistin use in layers still exceeded the 1 mg/PCU level, as was the case in 2018 and 2019. This observation underlines the need for an action plan aimed at reducing usage levels in this livestock sector.

Table 1. Colistin use in $DDDA_{NAT}$ and in kilograms of active substance from 2016 to 2020, by animal species

	$DDDA_{NAT}$					Kilograms of active substance				
Animal species	**2016**	**2017**	**2018**	**2019**	**2020**	**2016**	**2017**	**2018**	**2019**	**2020**
Broilers	0.04	0.03	0.04	0.05	0.05	6.8	5.2	7.4	8.2	8.7
Turkeys	0.61	*	*	0.02	*	10.3	*	*	0.2	*
Pigs	0.28	0.26	0.31	0.34	0.39	871.7	767.1	935.4	1075.3	1175.5
Dairy cattle	0.01	0.00	0.00	0.00	0.00	19.4	12.4	7.7	3.5	5.0
Veal calves	0.07	0.02	0.02	0.01	0.02	49.7	12.7	15.0	10.5	13.1
Non-dairy cattle	0.00	0.00	0.00	0.00	0.00	10.3	2.1	8.5	4.3	7.9
Rabbits	0.09	*	0.28	0.57	*	0.2	*	1.2	2.6	*
Other poultry	-	-	-	-	-	-	79.6	165.4	224.4	215.3

0.00 refers to a usage level < 0.005 $DDDA_{NAT}$; * refers to no use.

Table 2. Colistin use in mg/PCU from 2015 to 2020, by livestock sector

Livestock sector	2015	2016	2017	2018	2019	2020
Broiler farming sector	0.027	0.019	0.017	0.021	0.023	0.026
Pig farming sector	0.817	0.557	0.495	0.609	0.670	0.744
Dairy cattle farming sector	0.033	0.025	0.018	0.012	0.005	0.007
Non-dairy cattle farming sector	0.075	0.039	0.009	0.039	0.025	0.042
Veal farming sector	0.675	0.233	0.060	0.066	0.046	0.060

WHO classification and new benchmark threshold for colistin use

The SDa expert panel wants to reiterate that polymyxins should be regarded as third-choice antibiotics. After all, in the 6th revision of the WHO List of Critically Important Antimicrobials for Human Medicine (the WHO CIA List), published in 2019, the WHO moved polymyxins to the “Highest Priority Critically Important Antimicrobials” classification. 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). 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 given 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 the current target values for other third-choice antibiotics (fluoroquinolones and third- and fourth-generation cephalosporins).

Benchmarking of livestock farms

This is the second report in which the SDa expert panel's new benchmark thresholds have been applied. The SDa's 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 following their implementation, whereas provisional benchmark thresholds have to 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, and limited between-farm and year-to-year variations in the amounts of antibiotics used. However, a limited number of livestock farms may 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/production categories still have relatively wide $DDDA_F$ distributions, indicative of substantial and 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/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 be reevaluated after two to three years. The SDa expert panel intends to reassess its current provisional benchmark thresholds towards the end of next year.

Table 3 shows which type of benchmark threshold (i.e. provisional or representing acceptable use) has been assigned to each type of farm/production category. Compared to 2019, most types of farms/production categories had slightly fewer farms exceeding their assigned action threshold. The benchmark thresholds representing acceptable use are intended as a distant goal for the types of farms/production categories concerned to work towards, while the provisional benchmark thresholds will be reevaluated within several years after their implementation. Persistently high usage levels (i.e. $DDDA_F$ values that have exceeded the SDa-defined action threshold two years in a row) are a frequent occurrence for some types of farms and production categories, such as broiler farms with conventional breeds, rosé veal fattening farms, and all of the pig farming sector's production categories. The types of farms and production categories concerned each 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 high or persistently high usage levels, i.e. the farms included in the tails of the distributions.

Some of the other types of farms and production categories (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. So while the long-tailed distributions referred to above require usage level reductions from the livestock farms with high or persistently high usage levels in particular, these wide distributions indicate a need for all livestock farms included in the $DDDA_F$ distribution concerned to reduce their amounts of antibiotics used. The benchmarking results for the various types of farms and production categories are summarized in Table 3 below.

Table 3. Summary of 2019 and 2020 benchmarking results by livestock sector and type of farm/production category. Included in the far right column are the absolute number and proportion of livestock farms with persistently high usage levels (i.e. livestock farms that exceeded the SDa-defined action threshold in both years)

Livestock sector	Type of farm/ production category	Type of benchmark threshold	Action threshold	Number of farms in action zone		Proportion of farms in action zone		Farms with persistently high usage levels	
				2019	2020	2019	2020	n	%
Broiler farming sector	All broiler farms	Acceptable use	8	300	265	36.6%	32.5%	183	22.4%
	Farms with conventional breeds*	Acceptable use	8	258	233	56.7%	59.1%	174	44.2%
	Farms with alternative breeds*	Acceptable use	8	46	38	9.8%	7.2%	11	2.1%
Turkey farming sector	Turkey farms	Original method	31	5	1	11.6%	2.3%	0	0.0%
Pig farming sector	Sows/suckling piglets	Acceptable use	5	372	347	22.4%	22.1%	203	12.9%
	Weaner pigs	Provisional	20	478	486	26.1%	27.6%	284	16.1%
	Fattening pigs	Acceptable use	5	1,084	865	27.1%	23.7%	493	13.5%
Veal farming sector	White veal farms	Provisional	23	244	200	29.6%	24.6%	65	8.0%
	Rosé veal starter farms	Provisional	67	132	111	62.9%	56.3%	77	39.1%
	Rosé veal fattening farms	Acceptable use	4	251	220	34.3%	32.4%	150	22.1%
	Rosé veal combination farms	Provisional	12	54	48	71.1%	64.9%	35	47.3%
Cattle farming sector	Dairy cattle farms	Original method	6	31	45	0.2%	0.3%	16	0.1%
	Rearing farms	Original method	2	17	22	3.0%	3.5%	10	1.6%
	Suckler cow farms	Original method	2	383	370	4.6%	4.7%	264	3.3%
	Beef farms	Original method	2	169	149	6.1%	5.5%	133	4.9%

* Broiler farms with alternative as well as conventional breeds are included in both broiler farm subgroups. As a result, the numbers of farms in the two subgroups combined exceed the total number of broiler farms in the Netherlands.

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 the $DDDA_{NAT}$-based equivalents (Tables B1 and B5 in the online appendix). Second-choice antibiotics accounted for only 45% of overall antibiotic use in terms of $DDDA_F$, while they accounted for 72% 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 $DDDA_F$ distribution with a long tail representing broiler farms with relatively high usage levels. Usage of antibiotics at broiler farms with conventional breeds has not declined over the past five years. It has remained relatively stable at a level of 12 to 14 $DDDA_F$ on average.

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. Over the years there has been a rise in the number of broiler farms with alternative breeds. As a result, farms with alternative breeds are currently the most common type of broiler farm. This development has contributed to the broiler farming sector's overall mean $DDDA_F$ value reduction.

Benchmarking

In 2019, the broiler farming sector's benchmark threshold representing acceptable use was set at 8 $DDDA_F$, regardless of the type of breed. This threshold should be regarded as a distant goal to work towards, particularly for broiler farms with conventional breeds. The Ministry of Agriculture, Nature and Food Quality and the broiler farming sector have agreed on a phased implementation process for both types of broiler farms. For the 2020 reporting year, sector-negotiated signaling and action thresholds still applied. The signaling and action thresholds for broiler farms with conventional breeds were 14 and 26 $DDDA_F$, respectively, and for broiler farms with alternative breeds they were 8 and 15 $DDDA_F$, respectively. More information on the phased implementation of the new benchmark thresholds for the broiler farming sector can be found in the online appendix (Tables B64 and B65).

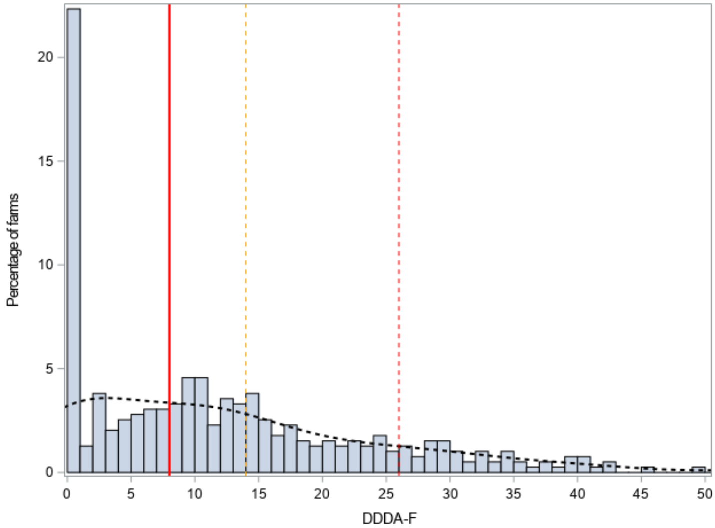
In 2020, the proportion of broiler farms with conventional breeds exceeding the SDa-defined action threshold rose from 57% to 59%. The majority of these farms also recorded action-zone usage levels for 2019 (Table 3). The number of farms exceeding the sector-negotiated signaling threshold for 2020 was substantial as well (38%). 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. The farms concerned are required to take additional steps to further reduce their usage levels.

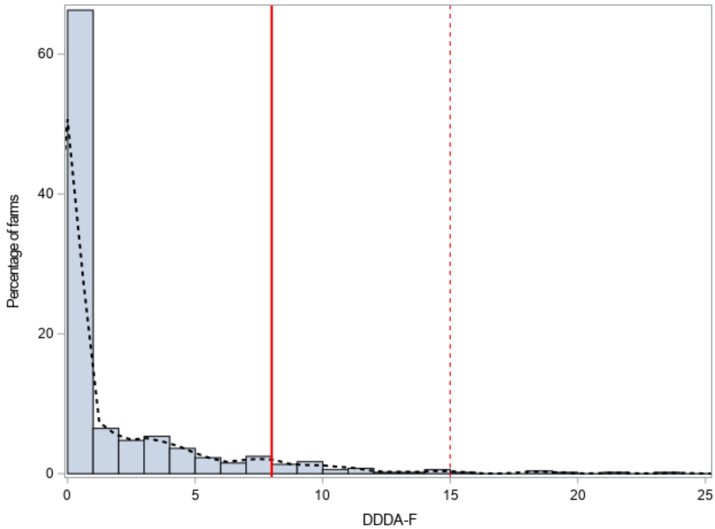
Very low usage levels were observed for broiler farms with alternative breeds. The SDa-defined action threshold was exceeded by 7% of these farms, and only 2.1% turned out to have a persistently high usage level in 2020 (Table 3). These figures show the positive effect introduction of alternative broiler production systems has had on the usage of antibiotics in the broiler farming sector. In fact, alternative broiler production systems currently are the most common broiler production system in the Netherlands.

Table 4. Descriptive statistics and benchmarking data on the broiler farming sector in 2020. Broiler farms with alternative as well as conventional breeds are included in both broiler farm subgroups. As a result, the numbers of farms in the two subgroups combined exceed the total number of broiler farms in the Netherlands

		Type of farm	
		Broiler farms with conventional breeds	**Broiler farms with alternative breeds**
$DDDA_F$ values	**N**	394	525
	Mean	13.4	2.1
	Median	10.2	0.0
	P75	19.7	2.3
	P90	30.9	6.9
Benchmarking data	**# in SDa-defined action zone**	233 (59%)	38 (7%)
	# in sector-negotiated signaling zone	85 (22%)	28 (5%)
	# in sector-negotiated action zone	63 (16%)	10 (2%)

Figures 4a and 4b. 2020 DDDA$_F$ distributions for broiler farms with conventional breeds (N = 394, Figure 4a) and broiler farms with alternative breeds (N = 525, 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





Turkey farms

In 2020, the amount of antibiotics used in the turkey farming sector dropped substantially by 50.4%, to a mean $DDDA_F$ of 9.3. This $DDDA_F$-based reduction (50.4%) exceeds the calculated $DDDA_{NAT}$-based reduction (38.8%). The more substantial $DDDA_F$ reduction is in part the result of an increase in average body weight at the time of treatment, which is not accounted for in the standardized body weight-based $DDDA_{NAT}$ calculations. The numbers of turkeys reported by the livestock sector, used in $DDDA_F$ calculations, were another contributing factor. These sector-provided numbers were considerably higher than the numbers provided by Statistics Netherlands (CBS), which used for $DDDA_{NAT}$ calculations.

Between-farm usage level variations declined in 2020, as did the amounts of antibiotics used at turkey farms with high or persistently high usage levels. In spite of these improvements, turkey farms still exhibit too much variation in the amounts of antibiotics used. In 2021, the turkey farming sector will initiate a targeted 1 to 1.5-year coaching program for turkey farmers, veterinarians and feed consultants (AVINED, 2020). The SDa expects this initiative to facilitate additional usage level reductions, in particular at turkey farms currently or persistently recording high $DDDA_F$ values, and a decline in year-to-year usage level fluctuations.

Benchmarking

The turkey farming sector has been assigned a provisional benchmark threshold of 10 $DDDA_F$, to be applied as of the 2021 reporting year. Recently, the sector has negotiated intermediate benchmark thresholds to help turkey farmers move towards the 10 $DDDA_F$ benchmark threshold determined by the SDa (Table B66 in the online appendix). These intermediate benchmark thresholds will also be included in next year's SDa report. The turkey farming sector's usage of antibiotics in 2020 was still assessed using the original benchmarking method, with its 19 $DDDA_F$ signaling threshold and 31 $DDDA_F$ action threshold. Table 5 shows how turkey farms performed according to both the current, original benchmarking method and the new benchmarking method. In 2020, the proportion of turkey farms with usage levels corresponding to the newly defined action zone was markedly lower than the year before (37% versus 63%).

Figure 5. 2020 DDDA_F distribution for turkey farms (N = 43). The red line represents the SDa's provisional benchmark threshold, to be implemented in 2021

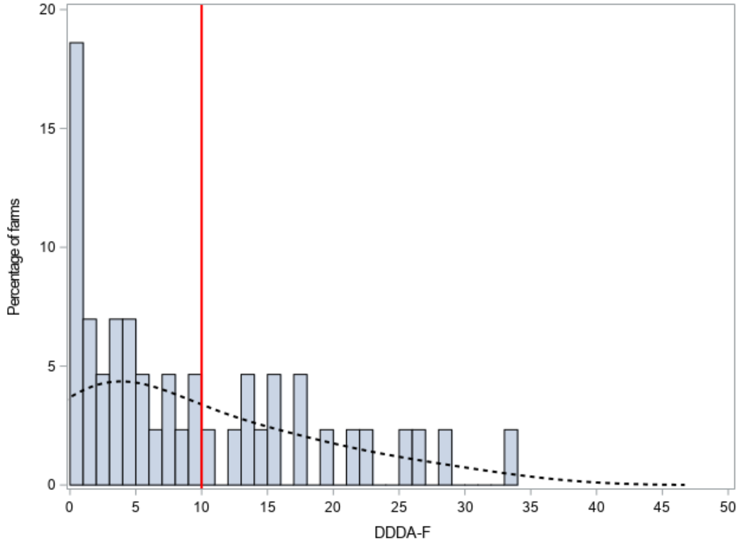


Table 5. Descriptive statistics and benchmarking data on the turkey farming sector in 2020

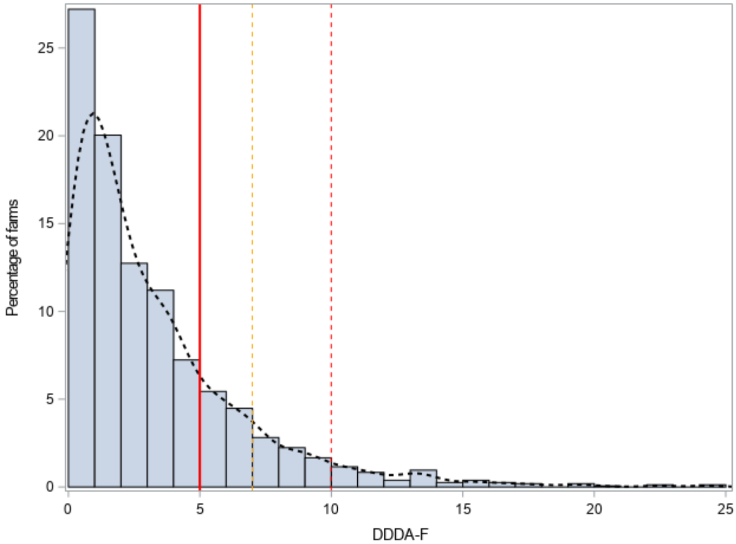
		Turkey farms
DDDA$_F$ values	**N**	43
	Mean	9.3
	Median	6.1
	P75	15.7
	P90	22.2
Benchmarking data	**# in new SDa-defined action zone**	16 (37%)
	# in current SDa-defined signaling zone	6 (14%)
	# in current SDa-defined action zone	1 (2%)

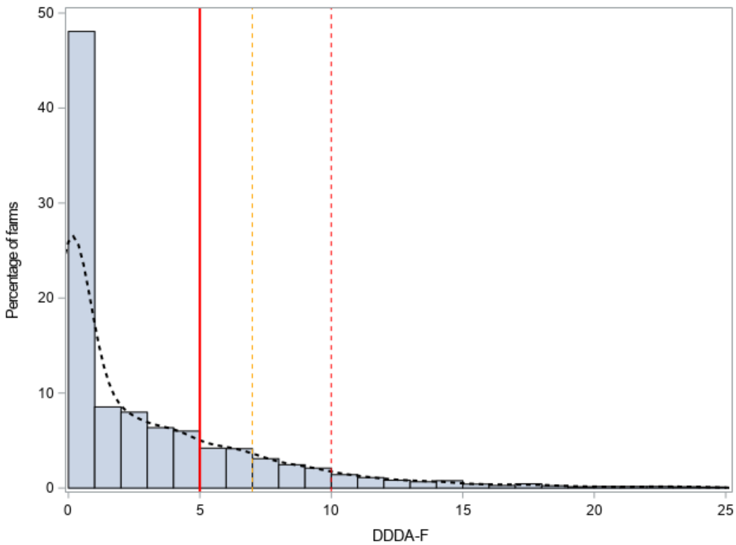
Pig farms

Farms with sows and piglets and farms with fattening pigs
Although mean antibiotic use at farms with sows and piglets and farms with fattening pigs was low, the 2020 $DDDA_F$ distributions for the two production categories are characterized by long tails (Figures 5a and 5b). These long-tailed distributions indicate there were still pig farms whose antibiotic use was several times higher than the mean $DDDA_F$ value for the production category concerned. Consequently, the SDa expert panel feels further action is required to reduce the amounts of antibiotics used at the farms comprising the tail ends of the distributions.

Benchmarking
The SDa-defined benchmark threshold representing acceptable use has been set at 5 $DDDA_F$ for both production categories. The pig farming sector and the Ministry of Agriculture, Nature and Food Quality have agreed upon the application of intermediate benchmark thresholds as part of a phased implementation process with regard to the SDa-defined benchmark threshold. The intermediate signaling and action thresholds for the 2020 reporting year are 7 $DDDA_F$ and 10 $DDDA_F$, respectively, and 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 online appendix (Tables B61 and B62, respectively).
Figures 6a and 6b include both the SDa-defined benchmark threshold and the two sector-negotiated intermediate benchmark thresholds. Usage levels exceeding the sector-negotiated signaling threshold were still observed quite regularly for both production categories (Table 6). Over 20% of farms with these production categories exceeded the benchmark threshold representing acceptable use, as was the case in 2019 (Table 3). The SDa expert panel requests the pig farming sector to step up its efforts in order to further reduce the amounts of antibiotics used in sows/piglets and fattening pigs at farms recording high usage levels for these production categories.

Figures 6a and 6b. 2020 DDDA$_F$ distributions for farms with sows and piglets (N = 1,572, Figure 6a) and farms with fattening pigs (N = 3,650, Figure 6b). 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





Farms with weaner pigs

Antibiotic use in the weaner pigs production category rose from a median $DDDA_F$ value of 8.5 in 2019 to a median $DDDA_F$ value of 9.5 in 2020. At 20.5 $DDDA_F$, the mean $DDDA_F$ value for farms with weaner pigs was higher than the median value, reflecting the farms' skewed $DDDA_F$ distribution. Their $DDDA_F$ distribution is characterized by a strikingly long tail, which is indicative of numerous farms with very high usage levels due to the presence of infectious diseases. The farms recording antibiotic usage levels in the upper 10% for this production category had usage levels over 40 $DDDA_F$. On the other hand, however, very low usage levels (<1 $DDDA_F$) were a frequent occurrence as well. There was a strong correlation between the 2020 $DDDA_F$ values for farms with weaner pigs and their 2019 $DDDA_F$ values (correlation coefficient of 0.74), resulting in a relatively large number of farms with persistently high usage levels (Table 3, and Figure B21 in the online appendix). The pig farming sector should remain focused on improving pig health and reducing the occurrence of high and persistently high usage levels at farms with weaner pigs in order to address the substantial between-farm usage level variations.

Benchmarking

The provisional benchmark threshold for farms with weaner pigs is 20 $DDDA_F$. In 2020, 28% of farms with this production category exceeded this SDa-defined benchmark threshold. To help the farms move towards the SDa-defined benchmark threshold, the pig farming sector and the Ministry of Agriculture, Nature and Food Quality have agreed upon intermediate benchmark thresholds for farms with weaner pigs (Figure 7, and Table B63 in the online appendix). Table 6 shows how farms with this production category performed based on both the SDa-defined benchmark threshold and the two sector-negotiated intermediate benchmark thresholds.

Figure 7. 2020 $DDDA_F$ distribution for farms with weaner pigs (N = 1,759). The red solid line represents the SDa-defined benchmark threshold. The orange and red dotted lines represent the sector-negotiated signaling and action thresholds, respectively. The sector-negotiated signaling threshold equals the SDa-defined action threshold

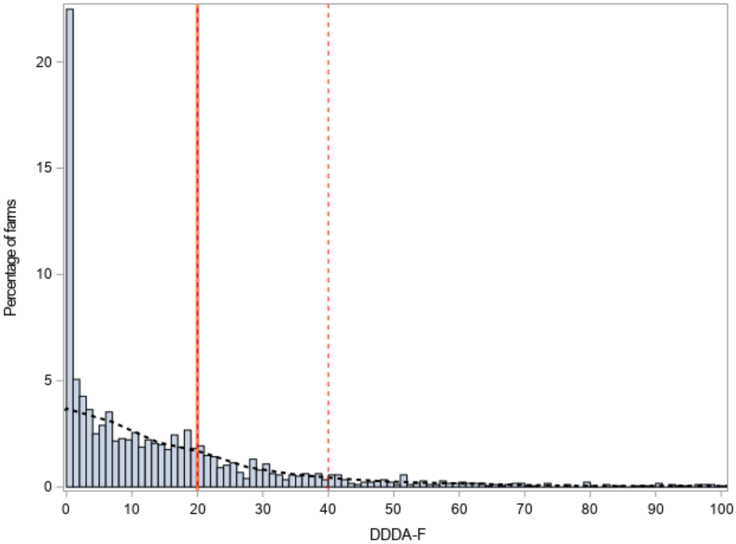


Table 6. Descriptive statistics and benchmarking data on the pig farming sector in 2020

		Production category		
		Sows and piglets	**Fattening pigs**	**Weaner pigs**
$DDDA_F$ values	**N**	1,572	3,650	1,759
	Mean	3.6	3.5	20.5
	Median	2.2	1.2	9.5
	P75	4.5	4.8	21.3
	P90	7.7	9.0	41.3
Benchmarking data	**# in SDa-defined action zone**	347 (22%)	865 (24%)	486 (28%)
	# in sector-negotiated signaling zone	105 (7%)	277 (8%)	298 (17%)
	# in sector-negotiated action zone	87 (6%)	286 (8%)	188 (11%)

Veal farms

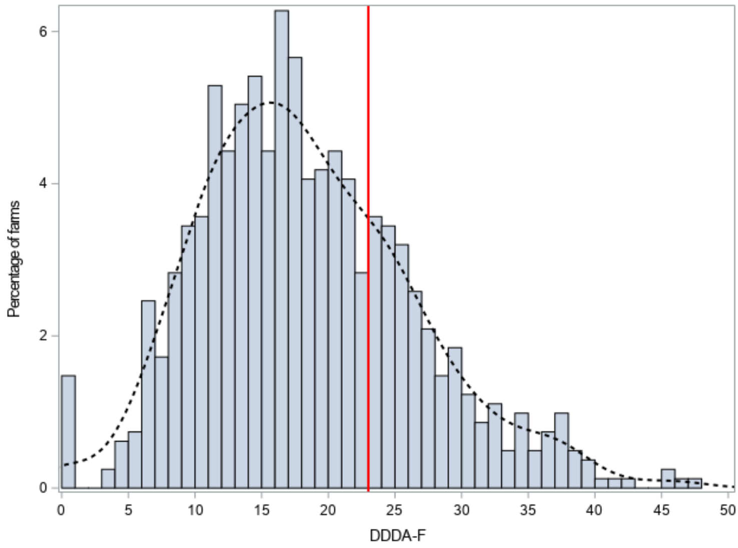
White veal farms

White veal farms reduced their mean $DDDA_F$ value by 4.0% in 2020, and their usage levels have shown a downward trend over the past six years (Table B37 in the online appendix). This has resulted in a wide, near-Gaussian $DDDA_F$ distribution for 2020, indicating that rather than focusing on outliers in the tail end of the distribution, improvement measures for white veal farms should remain focused on sustained infection control and hygiene improvements across the board, both at the farm and the supply chain level. Such an approach should lead to additional reductions and refinement of the use of antibiotics throughout all white veal farms and across the production chain in which they operate. In addition to the infection control- and hygiene-related technical factors, phase 2 of the critical success factor study (KSF2) also identified several other key factors contributing to the $DDDA_F$ performance of veal farmers with persistently low usage levels: an expert's eye, a calf-oriented focus, well-structured management processes, strategic use of group treatments, and effective problem management (Bokma-Bakker et al., 2019).

Benchmarking

White veal farms are benchmarked by means of a provisional benchmark threshold of 23 $DDDA_F$. In 2020, 25% of farms exceeded this threshold. Relatively few white veal farms had persistently high usage levels (Table 3), in part because of the weak correlation between the 2020 and 2019 $DDDA_F$ values (correlation coefficient of 0.07). Individual white veal farms show pronounced year-to-year usage level fluctuations (Figure B26 in the online appendix). In light of the above, efforts to reduce the number of white veal farms with action zone usage levels should continue to be aimed at the white veal farming sector as a whole.

Figure 8. 2020 DDDA$_F$ distribution for white veal farms (N = 813). The red line represents the SDa's provisional benchmark threshold



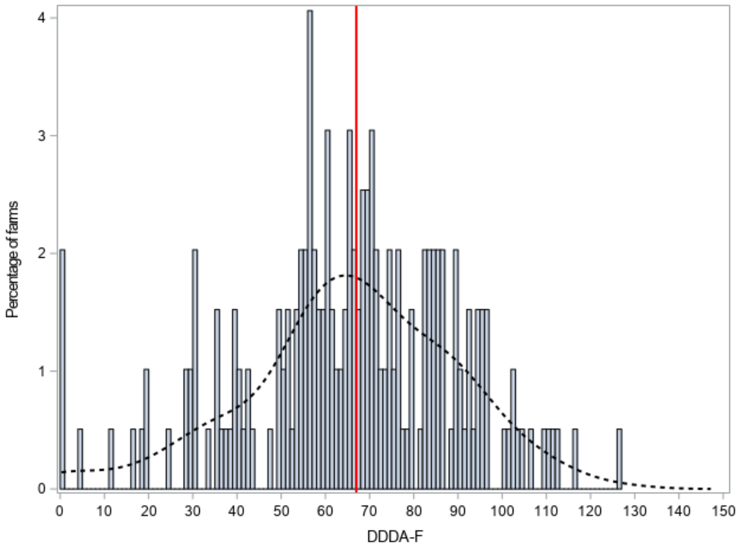
Rosé veal starter farms

Antibiotic use at rosé veal starter farms was very high in 2020, resulting in a mean DDDA$_F$ value of 69.1. Usage levels differed substantially between individual farms (Figure 9). Compared to the 2019 antibiotic usage data, mean antibiotic use declined by 8.9% and the DDDA$_F$ distribution has obtained a more narrow shape (Figure B27 in the online appendix). In 2021, the SDa expert panel is going to examine whether there are any technical reasons for this wide range of results, by analyzing data from the Dutch government's livestock identification and registration (I&R) system. If deemed desirable in light of its findings, the expert panel will suggest changes to refine the DDDA$_F$ calculation method for rosé veal starter farms. The SDa expert panel has already been granted access to the I&R system for this purpose. Irrespective of any future findings, the SDa expert panel urges rosé veal starter farms to step up their reduction efforts, as the extent of systematic between-farm usage level differences suggests there is still room for farm-level improvements as well.

Benchmarking

Rosé veal starter farms are benchmarked by means of a provisional benchmark threshold of 67 $DDDA_F$. The majority of farms (56%) recorded action zone usage levels for 2020. The proportion of rosé veal starter farms with persistently high usage levels was large, with 39% recording action zone usage levels for both 2019 and 2020.

Figure 9. 2020 $DDDA_F$ distribution for rosé veal starter farms (N = 197). The red line represents the SDa's provisional benchmark threshold



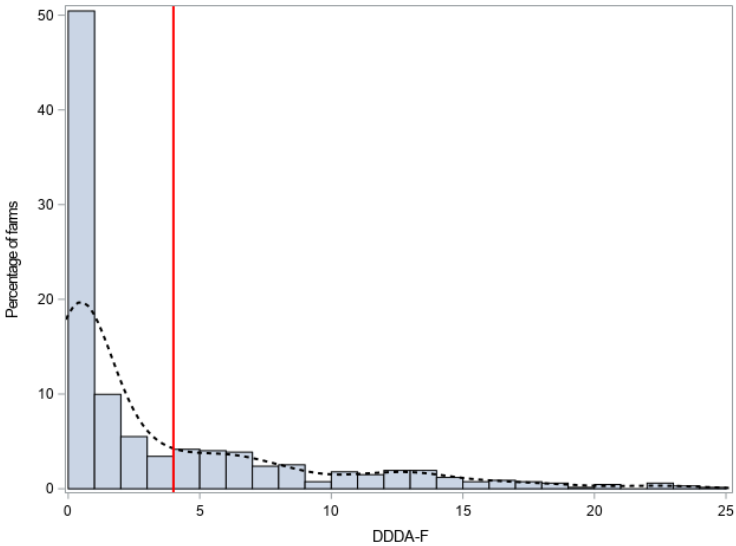
Rosé veal fattening farms

Median antibiotic use at rosé veal fattening farms in 2020 was low, but the $DDDA_F$ distribution still exhibits a long tail. Usage levels of more than twice the 4 $DDDA_F$ benchmark threshold were recorded regularly (Figure 10).

Benchmarking

Rosé veal fattening farms are benchmarked by means of a 4 $DDDA_F$ benchmark threshold representing acceptable use. The wide $DDDA_F$ distribution results in a large proportion of farms (32%) being included in the action zone, although the proportion of farms with action zone usage levels was slightly smaller than in 2019 (34%).

Figure 10. 2020 $DDDA_F$ distribution for rosé veal fattening farms (N = 680). The red line represents the SDa's benchmark threshold



Rosé veal combination farms

The number of rosé veal combination farms has dropped from 186 in 2018 to 74 in 2020. The SDa and the veal farming sector previously 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. For a minority of rosé veal combination farms, this change has not yet been fully implemented, an issue already highlighted in last year's report. The $DDDA_F$ distribution for rosé veal combination farms remains wide (Figure 11), although not as wide as the 2019 distribution with several outliers recording usage levels nearing 50 $DDDA_F$ (Figure B31 in the online appendix).

Benchmarking

65% of rosé veal combination farms exceeded the SDa-defined provisional benchmark threshold in 2020, and almost half the farms (47%) had persistently high usage levels (Table 3). The veal farming sector should take action in order to further reduce the amounts of antibiotics used at rosé veal combination farms.

Figure 11. 2020 DDDA$_F$ distribution for rosé veal combination farms (N = 74). The red line represents the SDa's provisional benchmark threshold

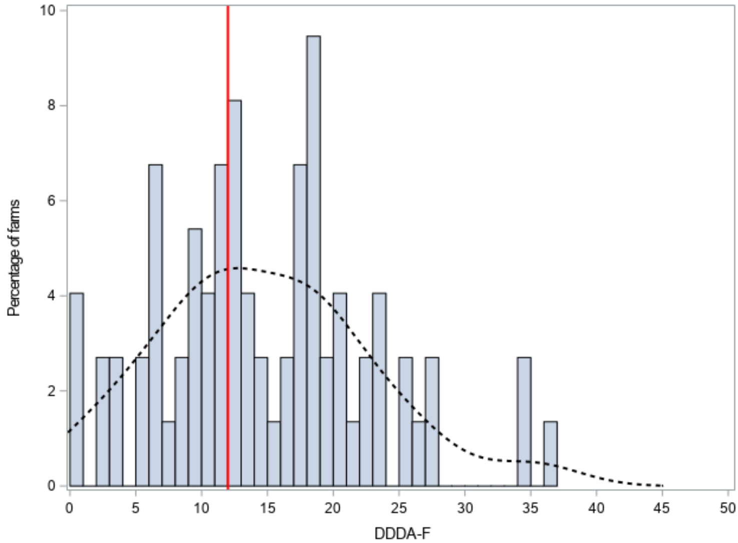


Table 7. Descriptive statistics and benchmarking data on the veal farming sector in 2020

		Type of farm			
		White veal farms	**Rosé veal starter farms**	**Rosé veal fattening farms**	**Rosé veal combination farms**
DDDA$_F$ values	**N**	813	197	680	74
	Mean	19.1	69.1	4.1	16.0
	Median	18.5	69.7	1.7	15.7
	P75	22.9	83.2	5.9	21.3
	P90	27.9	95.0	11.9	25.2
Benchmarking data	**# in SDa-defined action zone**	200 (25%)	111 (56%)	220 (32%)	48 (65%)

Cattle farms

The cattle farming sector is characterized by low, acceptable levels of antibiotic use and little between-farm variation in the amounts of antibiotics used. In 2020, mean antibiotic use at dairy cattle farms was 2.4 $DDDA_F$, a 8.3% increase compared to 2019. This is unexpected considering the dairy cattle farming sectors' very stable $DDDA_F$ values over the last five years, but given the low absolute usage levels no immediate action is required. At approximately 1 $DDDA_F$, mean antibiotic use at non-dairy cattle farms (i.e. rearing farms, suckler cow farms and beef farms) was even lower. The majority of non-dairy cattle farms did not use any antibiotics at all.

Benchmarking

As of 2021, the benchmarking method for the cattle farming sector is equivalent to the method used for the other livestock sectors in that only a single benchmark threshold is used: the action threshold. This newly introduced action threshold has been set at 5 $DDDA_F$ for dairy cattle farms, and at 2 $DDDA_F$ for non-dairy cattle farms. As the current SDa report concerns usage of antibiotics in 2020, the cattle farming sector's data in this report are still benchmarked according to a different method, which demands action to be taken if a particular cattle farm's usage level has exceeded the signaling threshold two years in a row. According to the 2020 benchmarking results obtained using the latter method, the proportion of farms with action zone usage levels was small (≤5%) for each type of cattle farm. The table below shows how cattle farms performed according to both benchmarking methods.

Table 8. Descriptive statistics and benchmarking data on the cattle farming sector in 2020

		Type of farm			
		Dairy cattle farms	**Rearing farms**	**Suckler cow farms**	**Beef farms**
DDDA$_F$ values	**N**	15,522	634	7,914	2,728
	Mean	2.4	0.9	0.6	0.9
	Median	2.3	0.0	0.0	0.0
	P75	3.3	0.2	0.6	0.2
	P90	4.2	1.6	2.0	1.4
Benchmarking data	**# in new SDa-defined action zone**	737 (5%)	52 (8%)	755 (10%)	219 (8%)
	# in current SDa-defined signaling zone	182 (1%)	30 (5%)	385 (5%)	70 (3%)
	# in current SDa-defined action zone	45 (0%)	22 (3%)	370 (5%)	149 (5%)

Rabbit farms

The rabbit farming sector is characterized by a very high mean $DDDA_F$ value and prominent between-farm and year-to-year variations in the amounts of antibiotics used. The rabbit farming sector has not managed to reduce its antibiotic usage levels over the last five years (Table B53 in the online appendix). Its mean $DDDA_F$ value recorded for 2020 was the highest in its five-year monitoring history. Extremely high usage levels (>100 $DDDA_F$) were a regular occurrence in 2020. Between-farm housing system and rabbit population differences may have contributed to the prominent usage level differences observed between individual rabbit farms.

Benchmarking

The SDa expert panel has set a 30 $DDDA_F$ provisional benchmark threshold with a two-year duration. This provisional benchmark threshold was derived from the rabbit farming sector's median $DDDA_F$ value for 2017, the year preceding the observed rise in usage levels. Application of this benchmark threshold to the 2020 usage level data would result in 69% of rabbit farms being included in the action zone. The SDa expert panel urges the rabbit farming sector to start implementing its action plan for reducing antibiotic usage levels soon. Exploring the role of antimicrobial resistance at a sample of rabbit farms might also be considered, as this could help convey a sense of urgency regarding the need for rabbit farmers to reduce their usage levels.

Figure 12. 2020 $DDDA_F$ distribution for rabbit farms

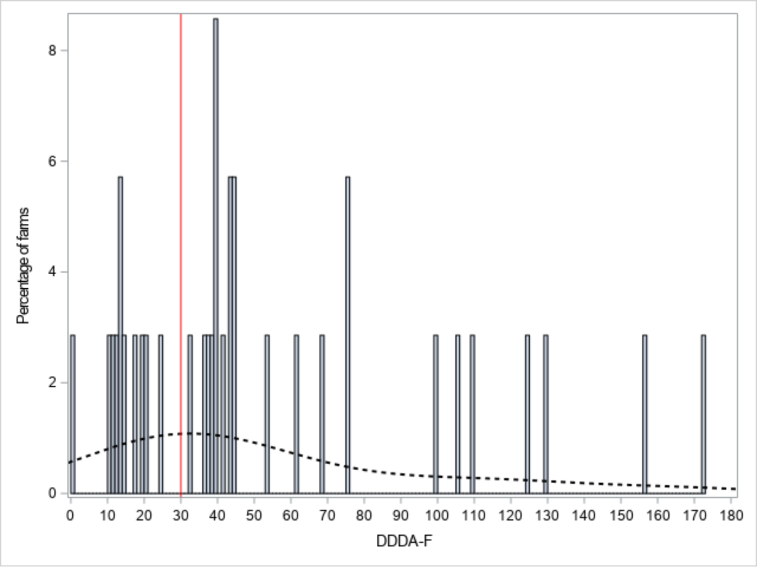


Table 9. Descriptive statistics and benchmarking data on the rabbit farming sector in 2020

		Rabbit farms
$DDDA_F$ values	**N**	35
	Mean	53.5
	Median	39.9
	P75	75.3
	P90	124.4
Benchmarking data	**# in SDa-defined action zone***	24 (69%)

* According to the benchmark threshold to be applied as of 2021.

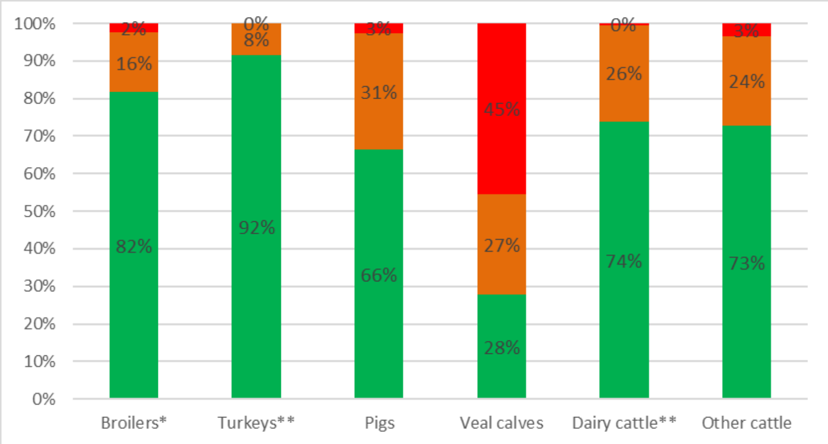
Benchmarking of veterinarians

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). Currently, VBIs are livestock sector specific and can range from 0 to 1. As of 2021, veterinarians' prescription patterns are going to be monitored by means of a new, DDDA-based benchmarking method.

The current method: benchmarking based on Relative Prescription Ratios

The current VBI reflects the probability of livestock farms with which the veterinarian has a one-to-one relationship recording action zone usage levels. A veterinarian's VBI is determined by the Relative Prescription Ratio distribution (RPR distribution, i.e. mean RPR and the associated standard deviation) for the veterinarian's contracted livestock farms. The RPR measure is calculated by dividing the amount of antibiotics used at a particular livestock farm (the farm's $DDDA_F$ value) by the action threshold applicable to the livestock farm concerned.
Figure 13 indicates how veterinarians in each of the livestock sectors are distributed over the various benchmark zones according to their (RPR-based) VBIs for 2020. The VBI results were calculated using either the livestock sectors' new benchmark thresholds as implemented in 2019, or the sector-negotiated intermediate benchmark thresholds (for the broiler and pig farming sectors). As the new benchmark thresholds for the turkey and cattle farming sectors were not yet implemented in 2020, the VBI results for these livestock sectors were calculated using their respective old benchmark thresholds. The VBI results show that the proportion of veterinarians in the action zone is small for all livestock sectors except the veal farming sector. According to the veal farming sector's VBI results, almost 1 in 2 veterinarians is included in the action zone. This finding indicates that veterinarians active in the veal farming sector will have a role to play in the veal farming sector's antibiotic reduction efforts.

Figure 13. VBI-based distribution of veterinarians over the various benchmark zones, by livestock sector (results according to the original benchmarking method for veterinarians, in use until the end of 2020)



* This livestock sector's distribution of veterinarians is based on the sector's intermediate benchmark thresholds.

** This livestock sector's distribution of veterinarians is based on the sector's old benchmark thresholds still in use in 2020.

The new method: benchmarking based on DDDA values ($DDDA_{VET}$)

As of 2021, veterinarians' prescription patterns are going to be monitored by means of a new, DDDA-based benchmarking method, similar to the $DDDA_F$-based method used to benchmark livestock farms. While the new method closely resembles the $DDDA_{VET}$-based method described in previous SDa reports, it has been decided that farms with persistently high usage levels are not to be included in VBI calculations, since the new benchmarking method for veterinarians is intended to both address the amounts of antibiotics used at farms with persistently high usage levels and improve the prescription patterns of veterinarians prescribing high volumes of antibiotics overall. Livestock farms are deemed to have persistently high usage levels if their $DDDA_F$ values have exceeded the action threshold two years in a row. The new VBI will reflect a veterinarian's prescription pattern with respect to a particular livestock sector. It is calculated by first determining 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) and then dividing this number 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, with the exception of those with persistently high usage levels. The resulting VBI will then be compared with the benchmark threshold for livestock farms in the sector concerned. Some of the sectors have negotiated an intermediate action threshold with the Ministry of Agriculture, Nature and Food Quality, and in those cases VBI results will be compared with the sector-negotiated intermediate benchmark threshold as well as the SDa-defined action threshold.

To give an idea of what can be expected once veterinarians are being benchmarked according to the new benchmarking method, the 2020 data have also been evaluated using the new VBI method. The results are provided in Tables 10 and 11 below. The benchmarking results included in these tables were calculated according to the new benchmarking method for veterinarians, implemented in 2021. Discrepancies in the numbers of veterinarians between the two tables are the result of cut-off values for persistently high usage levels being based on different benchmark thresholds. Occasionally it might not be possible to assign a new VBI, as veterinarians could potentially only have one-to-one relationships with livestock farms with persistently high usage levels. Tabulated VBI distributions based on the new benchmarking method for veterinarians can be found in the online appendix (Tables B56 and B58). For most livestock sectors, implementation of their new benchmark thresholds will result in a larger proportion of farms being included in the action zone. The proportion of veterinarians included in the action zone is smaller than the proportion of livestock farms with action zone usage levels, in part due to farms with persistently high usage levels not contributing to VBI values. Comparison of Table B56 (VBI distribution, new benchmarking method) and Table 57 ($DDDA_{VET}$ distribution) in the online appendix provides insight into the effect of not including farms with persistently high usage levels in the calculations. For livestock sectors in which a considerable number of farms have persistently high $DDDA_F$ values, there is a substantial discrepancy between the VBI and $DDDA_{VET}$ results. The SDa expert panel wants to stress that livestock sectors are expected to develop, in close consultation with veterinarians, targeted measures to reduce the amounts of antibiotics used at livestock farms with persistently high usage levels.
In 2020, Speksnijder et al. published a study of veterinarians' prescription patterns aimed at identifying critical success factors for patterns characterized by low volumes of antibiotics. This critical success factor study identified a veterinary practice effect on individual veterinarians' prescription patterns. On average, prescription pattern differences between veterinarians within the same veterinary practice turned out to be less pronounced than prescription pattern differences between veterinarians from different practices.

Table 10. Benchmarking results for veterinarians according to the new VBI method (implemented in 2021)

Livestock sector	Type of farm/ production category	Action threshold	Target zone N	Target zone %	Action zone N	Action zone %
Broiler farming sector	Farms with conventional breeds	8	42	67%	21	33%
	Farms with alternative breeds	8	74	100%	0	0%
Turkey farming sector	Turkey farms	10	11	92%	1	8%
Pig farming sector	Sows/suckling piglets	5	176	92%	16	8%
	Weaner pigs	20	172	89%	21	11%
	Fattening pigs	5	209	92%	19	8%
Veal farming sector	White veal farms	23	53	96%	2	4%
	Rosé veal starter farms	67	40	89%	5	11%
	Rosé veal fattening farms	4	94	90%	10	10%
	Rosé veal combination farms	12	16	67%	8	33%
Cattle farming sector	Dairy cattle farms	5	687	99%	6	1%
	Rearing farms	2	193	94%	12	6%
	Suckler cow farms	2	659	97%	19	3%
	Beef farms	2	345	96%	13	4%

Table 11. Benchmarking results for veterinarians active in livestock sectors with intermediate benchmark thresholds, according to the new VBI method (implemented in 2021)

Livestock sector	Type of farm/ production category	Target zone		Signaling zone		Action zone	
		N	%	N	%	N	%
Broiler farming sector	Farms with conventional breeds	45	66%	20	29%	3	4%
	Farms with alternative breeds	74	100%	0	0%	0	0%
Pig farming sector	Sows/suckling piglets	189	97%	5	3%	1	1%
	Weaner pigs	152	79%	32	17%	9	5%
	Fattening pigs	212	93%	12	5%	5	2%

In light of the findings of this critical success factor study, the SDa expert panel feels it would be beneficial to add practice-level prescription pattern monitoring to its current veterinarian-level monitoring efforts, as this would facilitate identification of any inter-practice prescription pattern differences. It also feels that peer learning ("intervision") sessions for veterinary practices might be a suitable intervention to help reduce prescription pattern differences.

Autoriteit Diergeneesmiddelen

Appendix

The online appendix to this report is published on the SDa website.

References

AVINED. 2020. Traject verantwoord antibioticagebruik van start in de kalkoensector (aanmelden kan!) [*Announcement and call to action regarding a coaching program for turkey farmers aimed at reducing antibiotic use in turkeys*]. URL: https://www.avined.nl/nieuws/traject-verantwoord-antibioticagebruik-van-start-in-de-kalkoensector-aanmelden-kan

M.H. Bokma-Bakker, C.C. de Lauwere, J.W. van Riel, M. Kluivers-Poodt, 2019. Succesfactoren voor een laag antibioticumgebruik bij vleeskalveren: resultaat van een verdiepende analyse op vleeskalverbedrijven [*Results of an in-depth analysis aimed at identifying critical success factors for low antibiotic use in veal calves*]. Wageningen Livestock Research, Report No 1212

EMA 2016a. Updated advice on the use of colistin products in animals within the European Union: development of resistance and possible impact on human and animal health. London, 2016. URL: https://www.ema.europa.eu/en/documents/scientific-guideline/updated-advice-use-colistin-products-animals-within-european-union-development-resistance-possible_en-0.pdf

EMA 2016b. Defined daily doses for animals (DDDvet) and defined course doses for animals (DCDvet). London, 2016. URL: http://www.ema.europa.eu/docs/en_GB/document_library/Other/2016/04/WC500205410.pdf

Liu YY, Wang Y, Walsh TR, et al. 2016. Emergence of plasmid-mediated colistin resistance mechanism MCR-1 in animals and human beings in China: a microbiological and molecular biological study. Lancet Infect Dis. 2016;16(2):161–168. doi:10.1016/S1473-3099(15)00424-7

Official Journal of the European Union 7.1.2019, L 4/1. REGULATION (EU) 2019/4 of the European Parliament and of the Council of 11 December 2018 on the manufacture, placing on the market and use of medicated feed, amending Regulation (EC) No 183/2005 of the European Parliament and of the Council and repealing Council Directive 90/167/EEC

Official Journal of the European Union 7.1.2019, L 4/24. REGULATION (EU) 2019/5 of the European Parliament and of the Council of 11 December 2018 amending Regulation (EC) No 726/2004 laying down Community procedures for the authorisation and supervision of medicinal products for human and veterinary use and establishing a European Medicines

Autoriteit Diergeneesmiddelen

Agency, Regulation (EC) No 1901/2006 on medicinal products for paediatric use and Directive 2001/83/EC on the Community code relating to medicinal products for human use

Official Journal of the European Union 7.1.2019, L 4/43. 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

Speksnijder, D., Sanders, P., Bens, D., Meijboom, F., Verheij, T., & Leneman, J. 2020. Onderzoek naar kritische succesfactoren voor een laag antibiotica voorschrijfpatroon van dierenartsen [*A study of veterinarians' prescription patterns aimed at identifying critical success factors for patterns characterized by low volumes of antibiotics*]. Utrecht University

World Health Organization. 2019. Critically important antimicrobials for human medicine, 6th revision. Geneva. License: CC BY-NC-SA 3.0 IGO

SDa, the Netherlands Veterinary Medicines Institute
Yalelaan 114
3584 CM Utrecht
The Netherlands

Telephone: +31 (0)88 03 07 222
Email: info@autoriteitdiergeneesmiddelen.nl
www.autoriteitdiergeneesmiddelen.nl

Usage of Antibiotics in Agricultural Livestock in the Netherlands in 2020
Trends and benchmarking of livestock farms and veterinarians
SDa/1156/2021
The Netherlands Veterinary Medicines Institute, 2021