Antibiotic Use In Cattle

Dairy Trend Data and Usage by Beef Farm Type 2015-2019

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The aim of this report is to provide some new trend analysis for antibiotic use in the dairy sector covering the period 2015-2019, and also to better understand antibiotic use in different beef farm types.

Summary:

This report looks at antibiotic usage data from a sample of dairy and beef farms. The key findings are that:

- Overall antibiotic use has reduced across dairy and beef sectors between 2015 and 2019, and there is a particularly marked reduction for the Highest Priority Critically Important Antibiotics
- All sectors show a skewed distribution, with a high percentage of lower users and a relatively small number of farms accounting for a high percentage of antibiotic use. This is particularly marked for beef, especially in the rearer and finisher farms
- Within the beef sector, relative use is highest in the rearer farms
- The use of oral products and tetracyclines is significantly higher in rearer and finisher farms than other farm types, and the use of oral powders has increased in both of these farm types between 2015 and 2019
- The use of products that are known to be used for antibiotic footbaths under the cascade has decreased across both the dairy and beef farms

Statement from the Cattle Antibiotic Guardian Group

The trend analysis highlights the reductions in antibiotic use that have been achieved in the dairy and beef sectors, which have been particularly marked for the Highest Priority Critically Important Antibiotics. This is testament to the hard work of the veterinary and farming sectors and the focus on improving antibiotic stewardship.

The skewed distribution demonstrated for both dairy and beef farms, with a relatively small proportion of farms accounting for a high percentage of use, is in common with other sectors. Reasons for some farms and farm types using more are complex and this report didn't look into the farm or disease specific factors which can contribute to this. However, it does show the importance of improving the collection of antibiotic usage data through the Medicines Hub to allow for farm level benchmarking. This will make it possible for farmers to better understand how their antibiotic use compares with other farms, and help to facilitate the important vet-farmer communication on issues surrounding antibiotic use.

For the beef sector, the relatively higher use in the rearer farms supports the specific focus with the Sector targets on calf management and improving data collection for calf rearers.

Methodology:

The data from dairy and beef farms presented in this report were taken from FarmVet Systems (FVS), a software company which extracts and analyses sales data from Vet Practice Management Systems.

Farm type was determined using information provided from movement records (British Cattle Movement Service [BCMS] for England, Wales and Scotland, and Animal Plant Health Inspection Service [APHIS] for Northern Ireland).

Farms were assumed to be dairy if they had greater than or equal to 15 calves born to dairy dams. Although not perfect, this formula has been validated and shown to be broadly accurate. Farms which had fewer than 15 calves born to dairy dams were considered beef. In addition, beef farms were removed if Radar GB Census Survey data indicated the presence of sheep or if data showed 'sheep-only' products had been used on the farm. This is because it is not currently possible to easily distinguish usage between sheep and beef cattle from practice management data. Note that it was only possible to carry out this sheep analysis for farms from Great Britain, so no farms in Northern Ireland were included in the beef dataset.

Beef farms were also split into different 'farm types' according to the criteria shown in table 1.

Table 1: Criteria used to determine beef farm type using movement records

Beef Category	Births	Animals moving on to the farm	Animals leaving the farm for slaughter
Smallholder	≤10	≤10	
Suckler	>10	≤10	
Suckler mixed	>10	>10	
Rearer	≤10	>10	≤10
Finisher	≤10	>10	>10

It should be noted that there is currently no validated approach for determining beef farm type using movement records, and the above criteria were created following discussion with a range of industry experts and considered to be broadly accurate. However, some beef farms will have a combination of enterprise types e.g. some of the farms categorised as finishers could also be rearers as well.

Antibiotic usage was provided to the Veterinary Medicines Directorate in an anonymised, aggregated format and analysed using industry agreed 'mg/kg' methodologies - https://www.ruma.org.uk/measuring-antibiotic-use/, where mg relates to the weight of antibiotic active ingredient and kg relates to the weight of animals. It should be noted that the methodologies differ between dairy and beef. In particular:

- The dairy metric is based on the 'Population Correction Unit (PCU)' methodology, where the weight in kg is the average number of dairy cows multiplied by 425kg (a weight that represents the average weight at time of treatment)

- The beef metric is based on the average category weight across the year and takes into account all cattle on the farm. It is not possible to use the PCU methodology for comparing beef farms as this only looks at slaughter animals, whereas many beef farms (e.g. calf rearers and many suckler farms) do not rear to slaughter

For this reason, the beef 'mg/kg' methodology (which considers more animal categories and uses relatively higher animal weights) will produce a relatively lower figure than the dairy PCU methodology. The figures published are therefore aimed at understanding relative use/ trend monitoring within a sector, but do not allow for a direct comparison between the dairy and beef sectors. Products that did not include 'cattle' in the target species in the SPC were excluded from the main analysis. However, it is possible that some of the products excluded were used in cattle via the cascade system, and a separate analysis of products commonly used under the cascade for footbaths in cattle is included. It is also possible that products licenced for multiple species – but including cattle – may have been used in other species kept on the farm.

For the farms where FVS held animal data, FVS were also able to carry out a mg/kg analysis for each of these farms, and this anonymised data will also be presented in the report.

To summarise, there are five different (but in some cases overlapping) samples that were analysed during this study as shown on table 2.

Table 2: The five different samples analysed and the number of farms included in each:

Analysis	Number of farms
Dairy Trends – 2015-2019	2,464
Dairy Distribution – 2019	3,180
Beef Use – 2019	4,188
Beef Trends – 2015-2019	2,265
Beef Distribution - 2019	3,380

Limitations – there are a number of limitations. For example, this is a convenience sample (based on data held within FVS) and is a relatively small sample (in particular for beef). It may therefore not be representative of the national picture. In addition, as outlined earlier, classifying farms based on movement records has not been validated and may not classify all farms correctly, especially if they have multiple enterprise types on the same farm.

Results:

This section will report on the key findings. More detailed data tables are included in Appendix One.

Dairy Usage Trend Analysis 2015-2019

Data was analysed for 2464 UK farms, which were chosen if they had data recorded in FVS for each of the years 2015 to 2019, and this represents 25% of UK dairy cattle (see table 3):

Table 3: Comparison of national coverage (% coverage*) of adult dairy cows (over 2 years of age) included in the FarmVet Systems sample; 2019

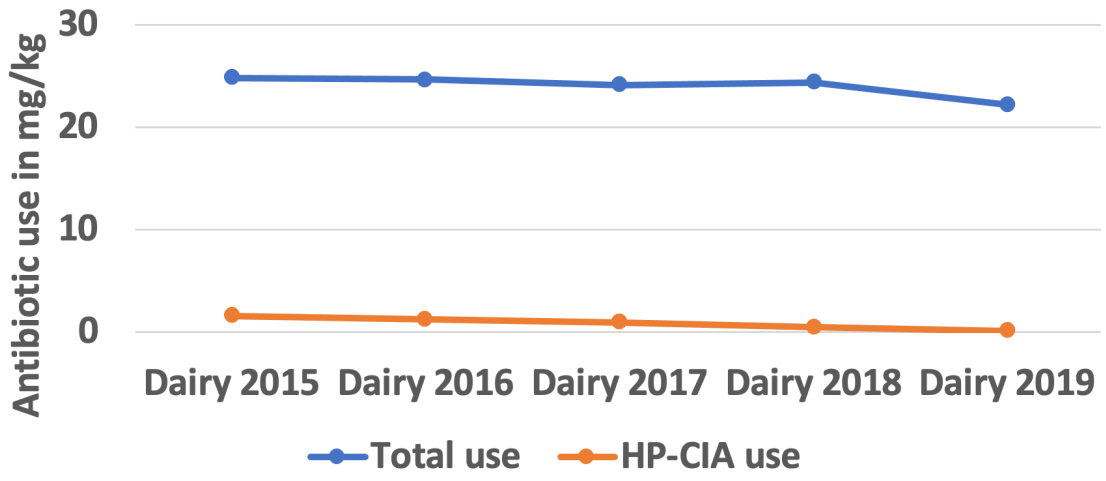
Country	% Coverage (2019)
England	28
Wales	21
Scotland	15
Northern Ireland	26

*Calculated by comparing the number of dairy cattle >2 years of age in the sample with national records of number of dairy cows >2 years of age (with and without offspring).

The mean herd size in the sample is 215 dairy breed animals over 2 years of age, 30% higher than the overall UK mean. Given this level of coverage, and the fact that it is a convenience sample, the antibiotic usage and the trends demonstrated may not be representative of the whole UK dairy population.

In this sample of dairy farms, overall usage remained flat between 2015 and 2018, but reduced 10% in 2019 to 22mg/kg. However, when considering the sales of Highest Priority Critically Important Antibiotics, these reduced by 93% from 1.5mg/kg in 2015 to 0.1mg/kg in 2019 (see Figure 1). HP-CIA use in 2019 is evenly split into 0.05mg/kg for fluoroquinolones and 0.05mg/kg for third and fourth generation cephalosporins.

Figure 1: Trends in total antibiotic use and use of Highest Priority Critically Important Antibiotics in this sample of dairy farms



When considering antibiotic class, around three quarters is represented by beta-lactams, penicillin-streptomycin combination products, tetracyclines and trimethoprim-sulphonamides. All antibiotic classes decreased between 2015-2019 except for trimethoprim-sulphonamides which increased by 22%.

The majority of active ingredient was either administered by injection (71%) or orally (17%) and between 2015-2019 reductions were seen across all administration routes, except oral powders which increased by 1.5%.

Dairy Distribution Analysis 2019

In a separate analysis looking at 3180 dairy farms (identified in the same way as before) where FVS had both antibiotic usage and animal number data available for 2019, the mg/kg was determined for each farm and the usage distribution analysed.

As shown in Figures 2 and 3, there is a skewed distribution, where 80% of the farms use less than 20 mg/kg, accounting for 85% of the animal weight but only 63% of the antibiotic active ingredient. Farms in the top 5% were using over 39 mg/kg, and while only representing 6% of the total dairy cow population, account for 25% of antibiotic active ingredient used. As shown on figure 3, there is no clear link between antibiotic use (in mg/kg) and farm size.

Figure 2: Distribution of antibiotic use across the sample of dairy farms

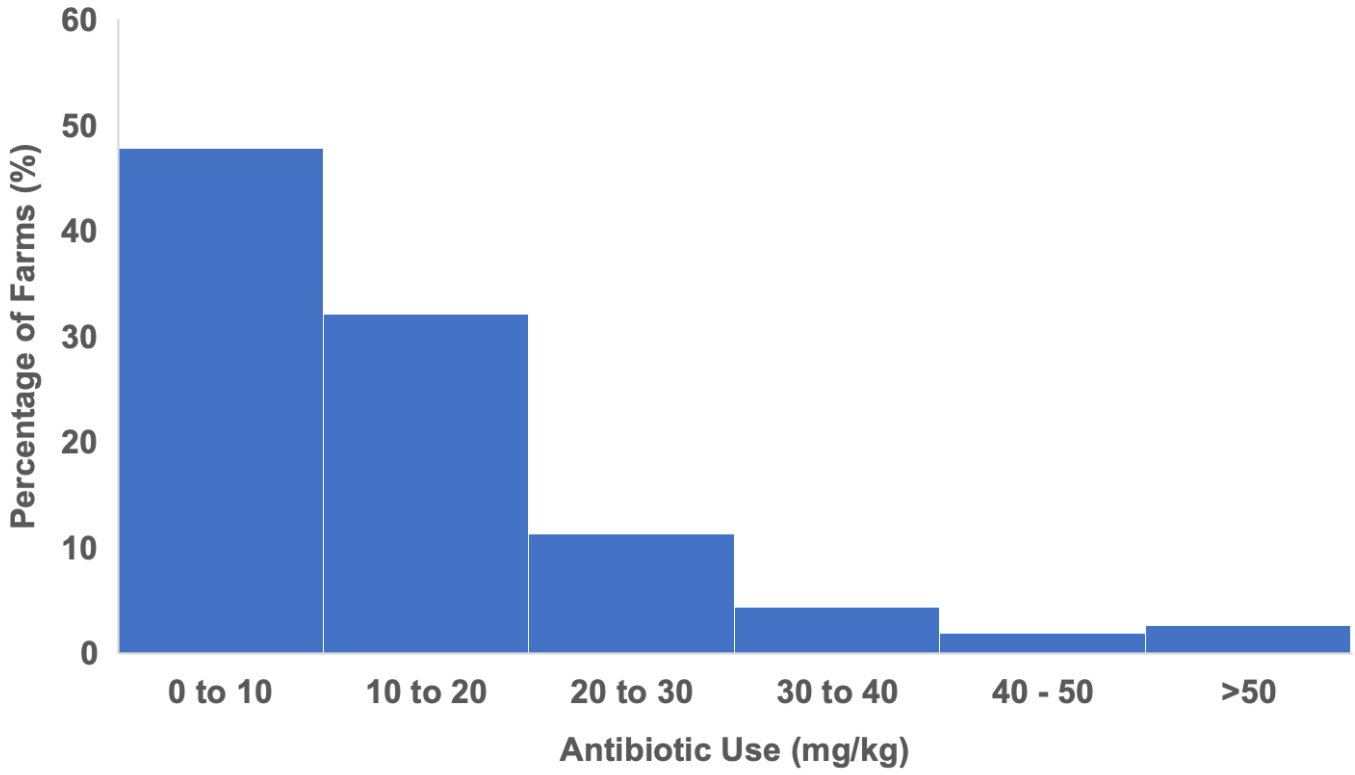
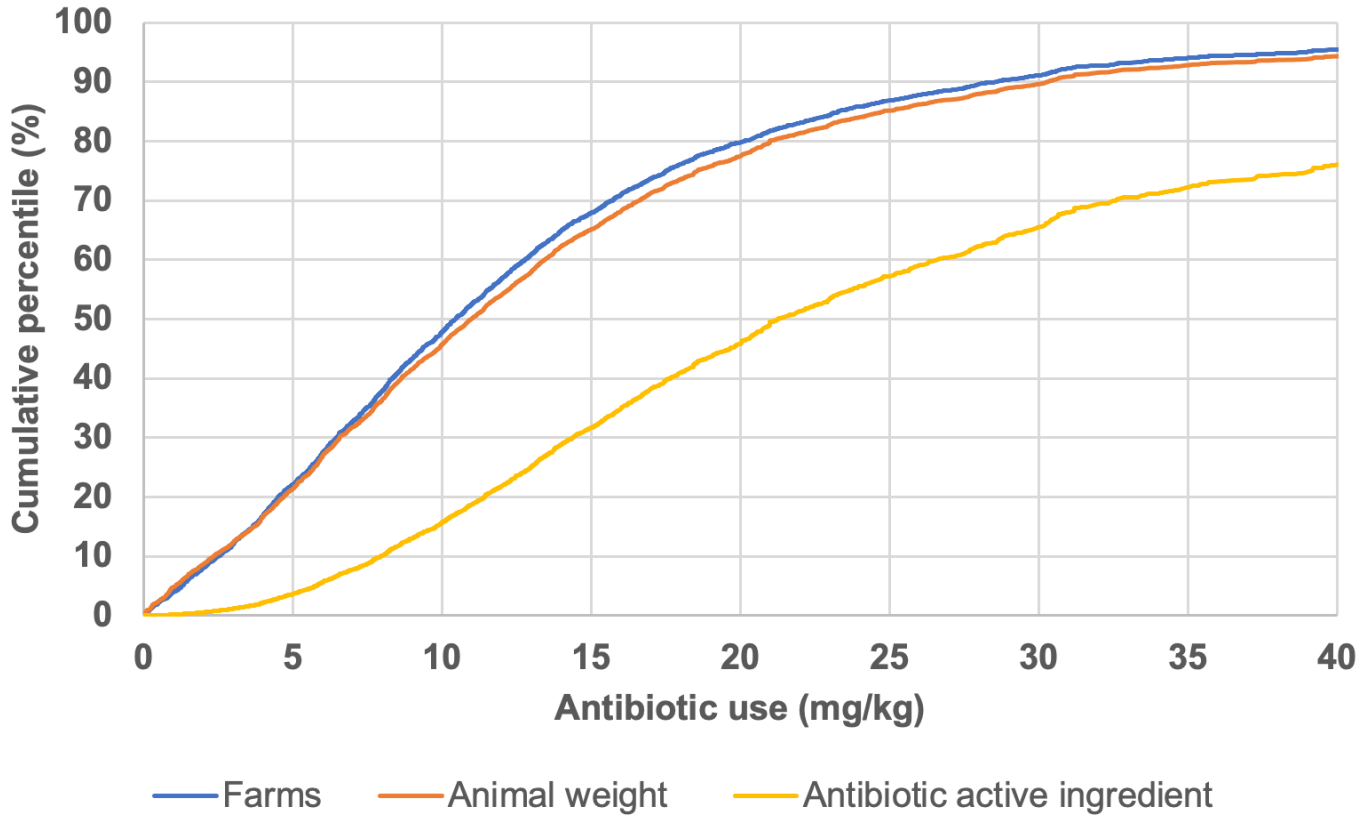


Figure 3: Cumulative percentile distribution for dairy relating to antibiotic use (mg/kg) for farms, animal weight and antibiotic active ingredient. For example, at an antibiotic use level of 10mg/kg, the cumulative percentile for farms is 48%, which means 48% of farms use antibiotics at 10mg/kg or lower. However, at 10mg/kg, the cumulative percentile for animal weight is 46% and for antibiotic active ingredient is 16%, meaning that these farms account for 46% of the dairy cows and 16% of the antibiotic active ingredient.



Beef Usage by Farm Type 2019

The 2019 sample looks at the same farms analysed in the UK-VARSS report (4,188 farms, covering 7.2% of farms and 9.6% of slaughter animals for GB). However, these were split (using movement records as described earlier) into different farm types. It should be noted that, given this is a convenience sample with <10% GB coverage, and only includes beef farms without sheep, the results reported may not be representative. However, as shown in table 4, the mix of farm types within this sample is fairly similar to the national picture, except that smallholders are under-represented.

Table 4: how the farms in the sample compare with all beef farms across Great Britain*

	% farms in sample	% farms across GB
Smallholder	20	33
Suckler	35	28
Suckler-mixed	20	16
Rearer	13	13
Finisher	13	10

* Beef farm types determined using movement records (as described)

The antibiotic usage results (table 5) show that rearer farms have the highest relative antibiotic use (20.5 mg/kg) and sucklers the lowest (4.7 mg/kg). Smallholder farms were relatively the second highest user (9.2 mg/kg) although given their small size these only contribute to 4% total active ingredient used within this sample. When considering HP-CIAs, use is relatively the highest in the smallholders (0.033 mg/kg) and lowest in the sucklers and rearers (both 0.008 mg/kg).

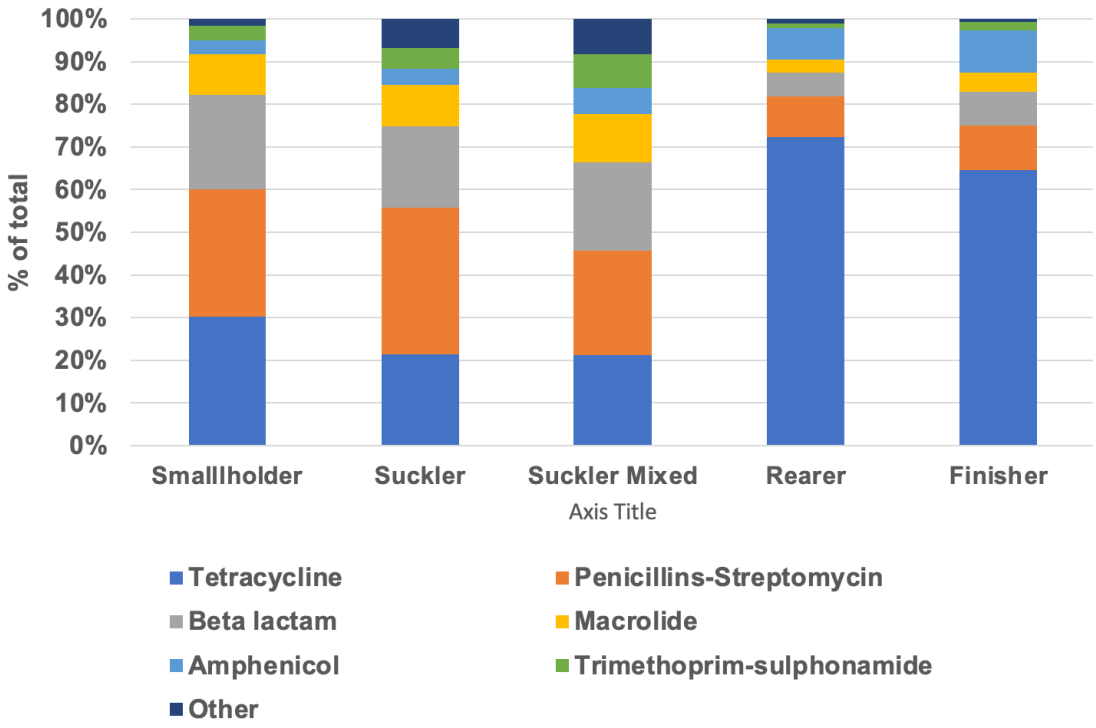
Table 5: total tonnes and mg/kg of antibiotic, as well as mg/kg for HP-CIA's

	Total active Ingredient (tonnes)	Total mg/kg	HP-CIA mg/kg
Smallholder	0.08	9.2	0.033
Suckler	0.41	4.7	0.008
Suckler mixed	0.62	7.3	0.016
Rearer	0.28	20.5	0.008
Finisher	0.32	6.7	0.013
Overall	1.71	7.0	0.013

Even though it is the same sample, the overall mg/kg (7 mg/kg) is 3.5 times lower than the figure reported in UK-VARSS (24.4 mg/kg). This is because, in the UK-VARSS report, the PCU methodology is used – where only the number of animals slaughtered is counted and the weights represent the average weight at time of treatment. In this calculation, all animals on the farm are counted and the weights used represent the average category weight, which explains why the figure is lower.

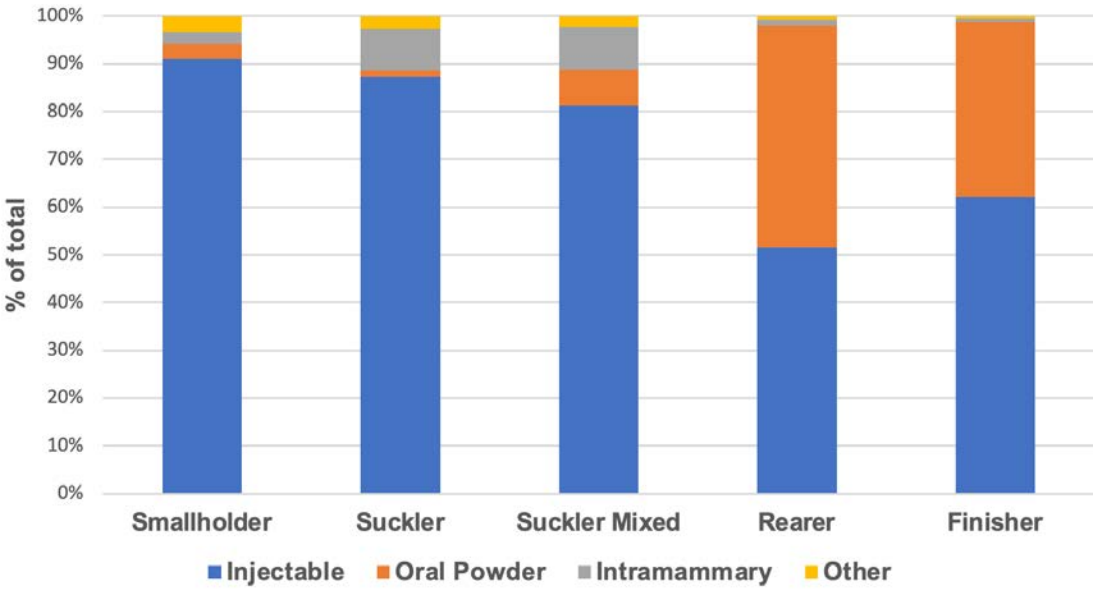
When considering antibiotic class, a significantly greater proportion of tetracyclines are used in rearer and finisher farms (see figure 4).

Figure 4: Antibiotic classes used by the main beef farm types



In addition, while injectables remain the most common route of administration for all farm types, there is a significantly greater proportion of oral use in rearer and finisher farms (see figure 5). This is likely to represent usage in pre-weaned cattle (and reflects the likelihood that many of the finisher farms also rear calves).

Figure 5: Antibiotic routes of administration for the main beef farm types

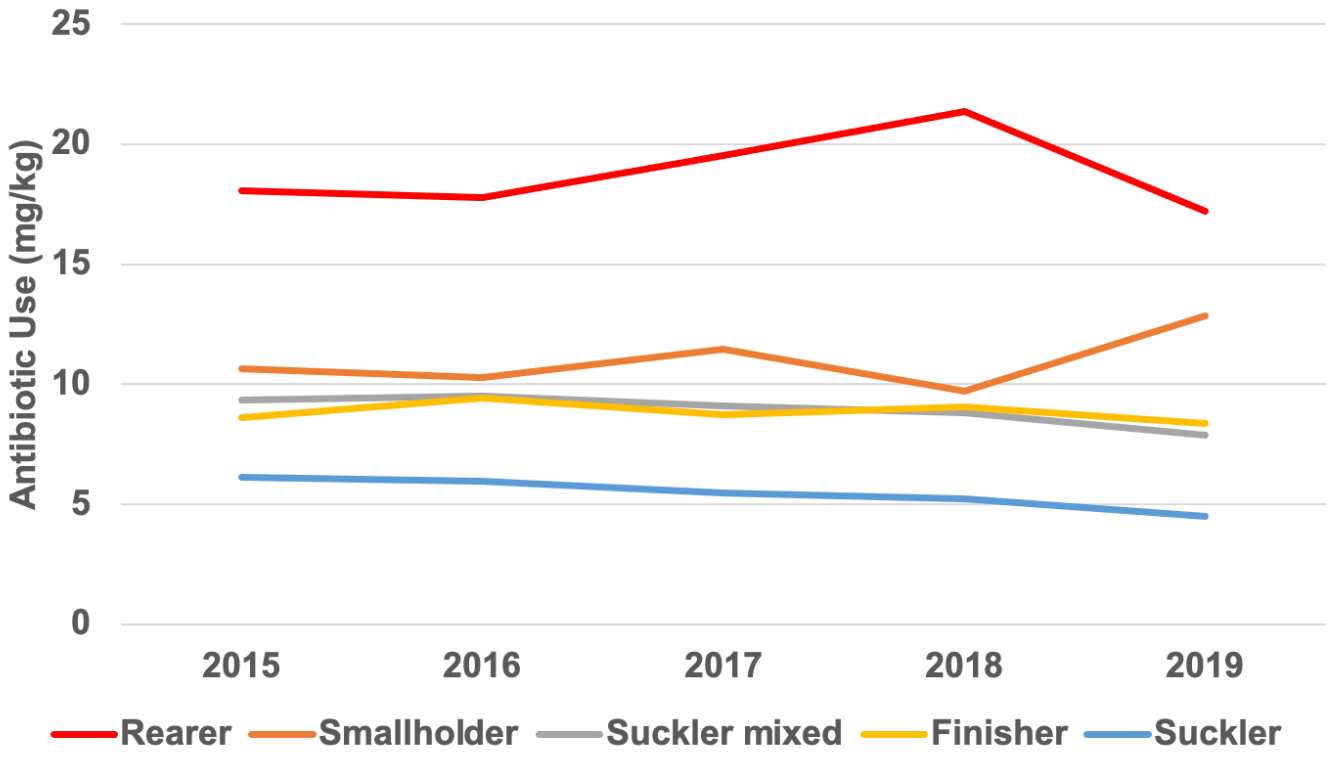


Beef Usage Trend Analysis 2015-2019

In the UK-VARSS report, a subset of 2,265 GB farms (representing 5.6% of GB), where antibiotic usage data was available for all years between 2015 and 2019, was analysed to understand possible trends. In this study, this same sample was analysed to look at the trends for the different farm types identified earlier.

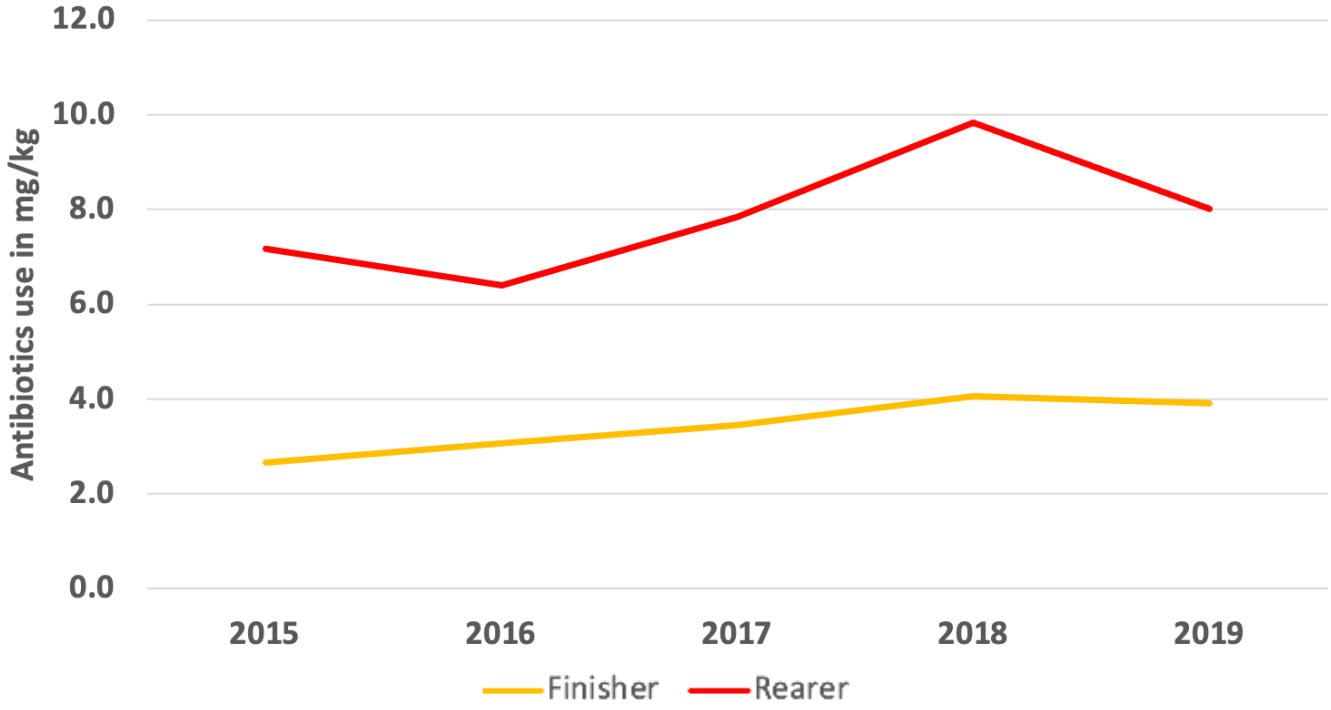
When looking at total use, this reduced between 2015 and 2019 in all farm types, except smallholders where it increased by 20%. Reductions were particularly marked in the suckler farms (27%) and the suckler mixed farms (15%) and less marked for the rearer (5%) and finisher farms (3%), see figure 6.

Figure 6: Trends in antibiotic use 2015-2019 by beef farm type



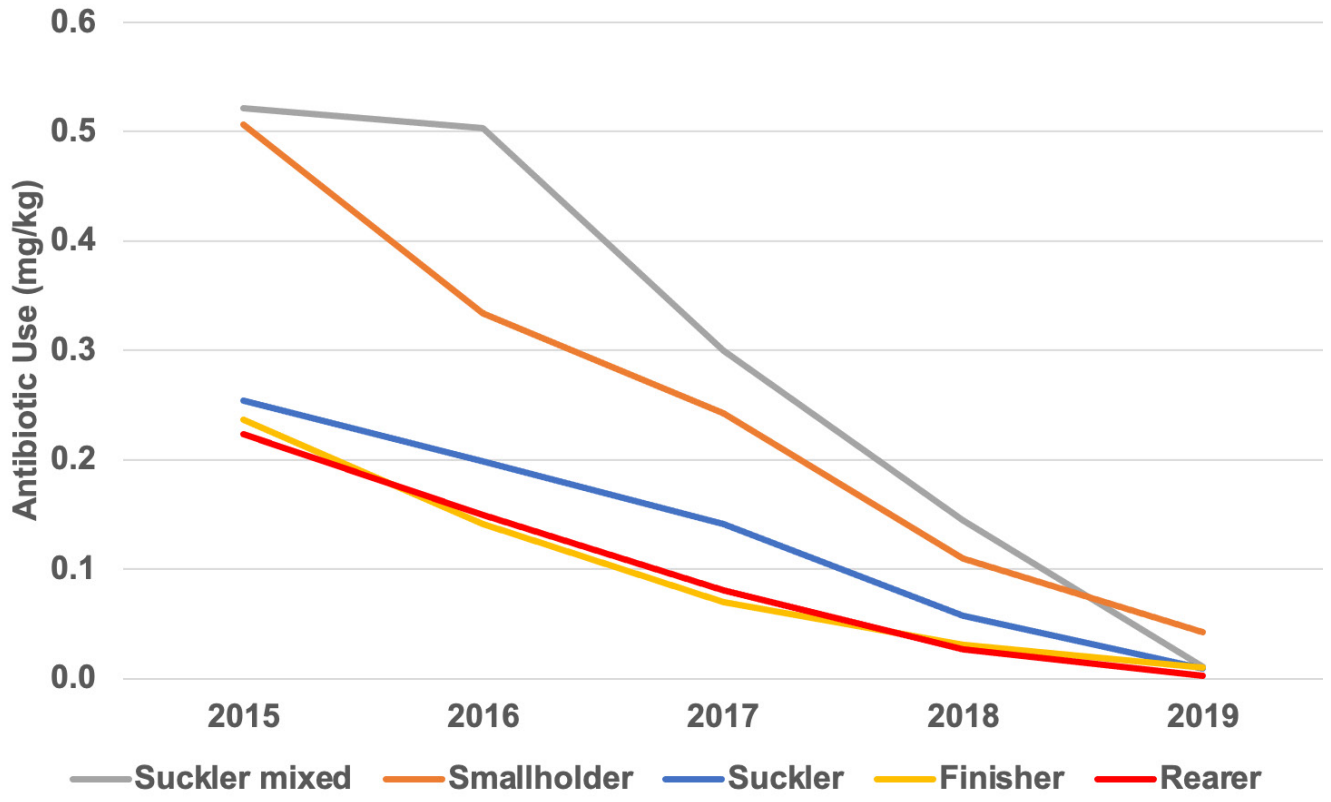
When looking at rearer and finisher farms specifically, although total use did reduce, the use of oral powders (which are licensed for use in pre-weaned calves) increased by 12% and 47% respectively, see figure 7.

Figure 7: Trends in use of oral powders 2015-2019 for rearer and finisher farms



However, when looking at HP-CIA's, all beef farms types have reduced their use significantly, see figure 8. In 2019, smallholders overtook suckler mixed as the relatively highest user of HP-CIA's for beef (where usage is 0.043mg/kg versus 0.011mg/kg for beef as a whole).

Figure 8: Trends in HP-CIA use 2015-2019 by beef farm type



Beef Distribution Analysis 2019

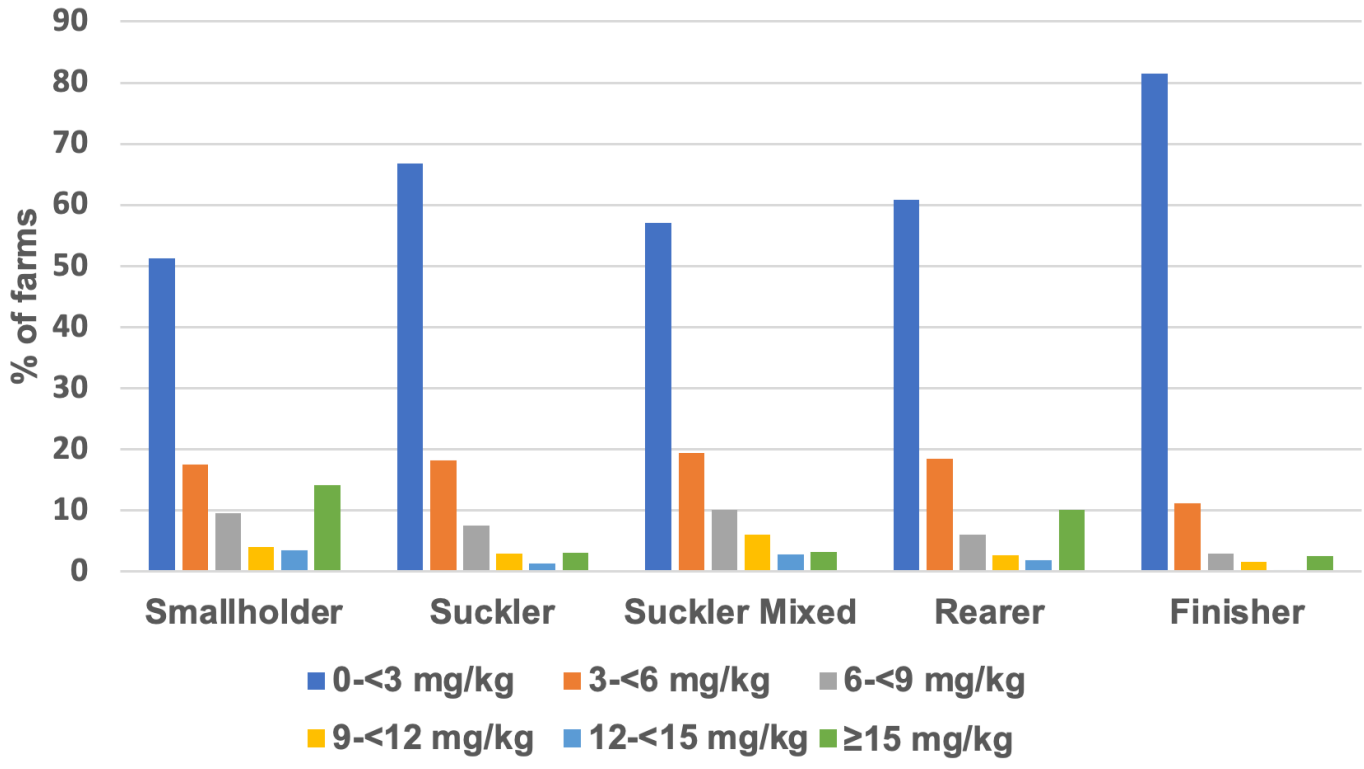
In a separate analysis looking at 3380 beef farms (identified in the same way as before) where FVS had both antibiotic usage and animal number data available for 2019, mg/kg was calculated for each farm and this made it possible to assess the distribution.

This data showed that the distributions are highly skewed (to an even greater degree than for dairy) with a relatively small proportion of higher-using farms accounting for a high percentage of total use. This is particularly marked for the rearer and finisher farms, where the top 5% of farms (in mg/kg) account for 6.4% and 1.7% of the animal weight, but 56% and 42% of the antibiotic active ingredient respectively (see table 6 and figure 9):

Table 6: 95th centile mg/kg figures and the proportion of animal weight and antibiotic active ingredient that farms above this figure represent

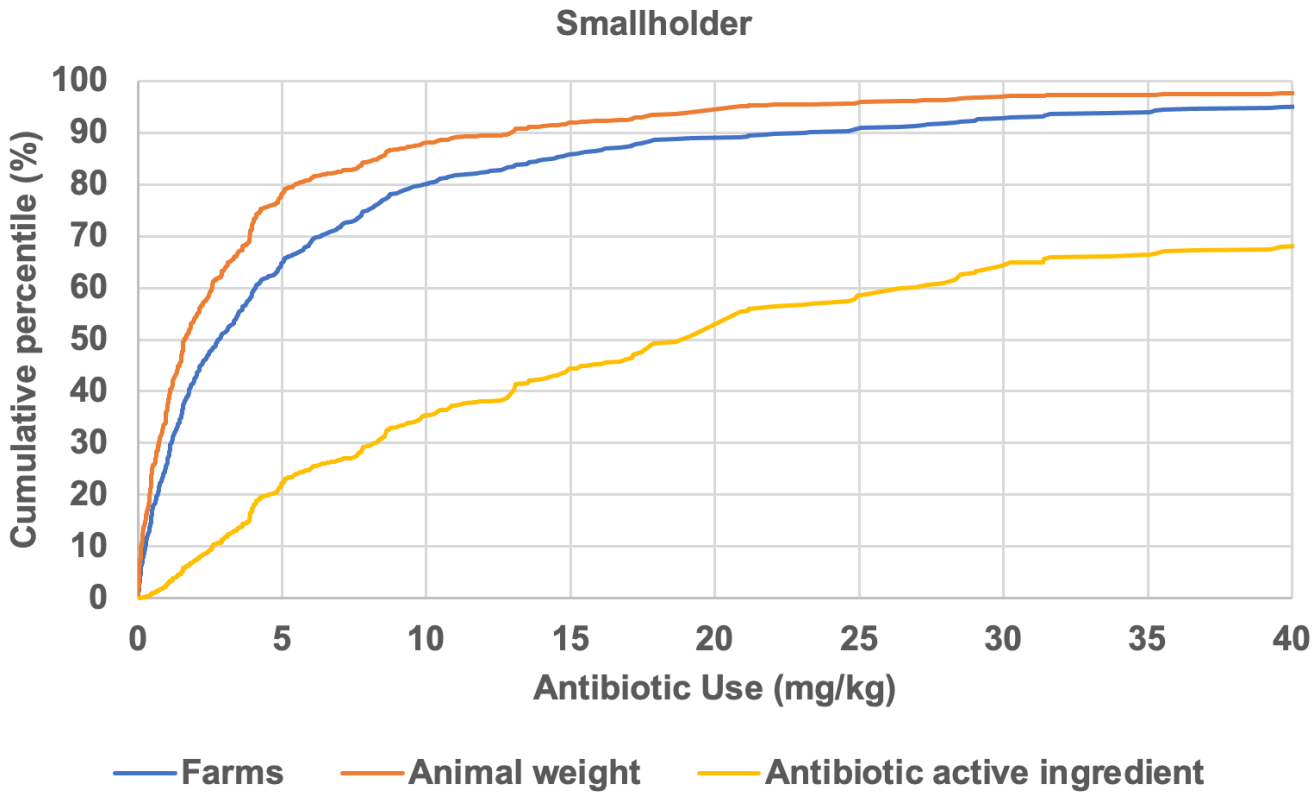
	Highest using 5% farms are greater than or equal this figure (mg/kg)	% Total animal weight for highest using 5% farms	% Total active ingredient for highest using 5% farms
Smallholder	40.3	2.4	32
Suckler	11.2	4.2	26
Suckler mixed	13.9	4.2	28
Rearer	29.6	6.4	56
Finisher	8.1	1.7	42
Total	17.4	2.1	27

Figure 9: Distribution of antibiotic use (mg/kg) across the sample of beef farms



As shown in figure 7 there is no clear link between farm size and antibiotic use (in mg/kg), except for the smallholders where it appears antibiotic use is highest in the smaller farms within this category e.g. 80% of the smallholders used less than 10mg/kg, but these farms account for 88% of the animal weight – and this difference is maintained throughout.

Figure 10: Cumulative percentile distributions for smallholders relating to antibiotic use (mg/kg) for farms, animal weight and antibiotic active ingredient (equivalent graphs relating to other beef farm types are included in the Appendix Two)



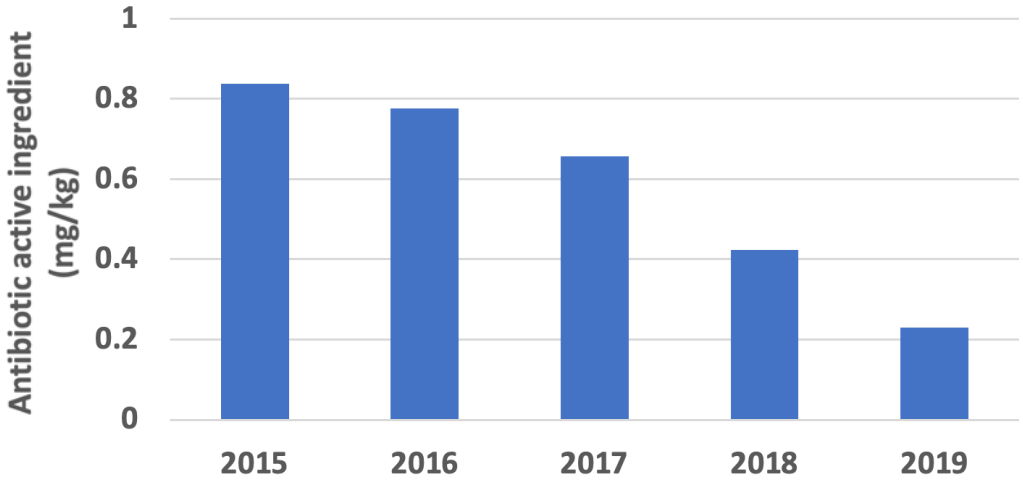
Dairy and Beef Footbath Use Cascade Trend Analysis 2015-2019

Previous studies for the dairy sector have highlighted that some products not licensed for cattle are used under the cascade as antibiotic footbaths, and that these can significantly contribute to antibiotic use on farms. These products are:

- Erythrocin 16.5% w/w Soluble powder for Oral Solution
- Lincocin Soluble Powder 400mg/g Powder for Oral Solution
- Linco-Sol 400mg/g Powder for Use in Drinking Water for Pigs and Chickens
- Linco-Spectin 100 Soluble Powder for Oral Solution

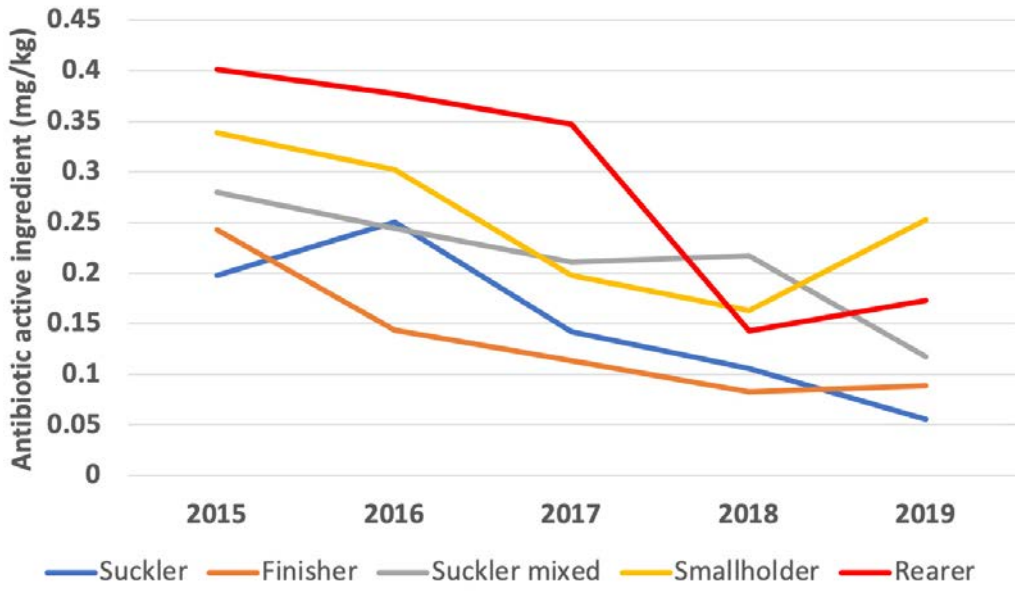
However, data from this study suggests that usage of these products has fallen by 72% in the dairy sector between 2015 and 2019, see figure 11.

Figure 11: Use of cascade oral "footbath" products in the dairy sector



Analysis for the beef farms shows a similar decreasing trend for the use of these products (Figure 12).

Figure 12: Use of cascade oral "footbath" products in the beef sector



Appendix One – data tables

Dairy Usage Trend Analysis 2015-2019

Antibiotic Use by Class (mg/kg)

	2015	2016	2017	2018	2019	Change (mg/kg)
Beta lactams	5.3	5.5	5.1	5.1	4.8	-8.6
Penicillin-Streptomycin	4.9	4.8	4.7	4.9	4.5	-8.3
Tetracyclines	4.7	4.7	4.8	5.1	4.4	-7.5
Trimethoprim-sulphonamides	2.4	2.3	2.4	2.7	3.0	21.8
Macrolides	3.9	3.7	3.4	3.0	2.1	-46.5
Multiple actives*	1.9	1.9	1.8	1.9	1.7	-7.7
Amphenicols	1.0	1.0	0.9	0.9	1.0	-0.3
Other**	0.7	0.7	0.8	0.8	0.7	3.7

*Products with more than one active ingredient (not including penicillin-streptomycin or trimethoprim-sulphonamides)
**Aminoglycosides, fluoroquinolones, lincosamides, polymyxins

Total Antibiotic Use and Use of HP-CIAs (mg)

	2015	2016	2017	2018	2019	Change (%)
Total use	24.8	24.7	24.1	24.4	22.2	-10.5
HP-CIA use:	1.5	1.3	0.9	0.5	0.1	-93.6
Fluoroquinolones	0.56	0.45	0.34	0.19	0.05	-90.7
3rd and 4th generation cephalosporins	0.98	0.80	0.58	0.28	0.05	-95.2

Antibiotic Use by Route of Administration (mg/kg)

	2015	2016	2017	2018	2019	Change (%)
Injectable	17.16	17.28	16.84	16.80	15.81	-7.8
Oral Powder	3.33	3.19	3.50	3.97	3.38	1.5
Intramammary Dry Cow	1.70	1.69	1.53	1.53	1.37	-19.4
Intramammary Lactating Cow	1.31	1.28	1.23	1.23	1.09	-16.7
Oral Solution	0.86	0.79	0.59	0.50	0.26	-70.4
Intrauterine	0.23	0.22	0.21	0.20	0.18	-23.5
Bolus	0.21	0.19	0.16	0.13	0.10	-54.8
Premix	0.00	0.01	0.01	0.01	0.01	-

Dairy Distribution Analysis 2019

Mg/kg	% farms	% animal weight	% active ingredient
0 - ≤5	20	20	4
5 - ≤10	24	23	12
10 - ≤15	19	18	16
15 - ≤20	19	18	16
20 - ≤25	7	7	11
25 - ≤30	4	4	8
30 - ≤35	3	3	7
35 - ≤40	1	1	4
40 - ≤45	1	1	2
45 - ≤50	1	1	4
≥ 50	2	3	17

Beef Usage by Farm Type 2019

Antibiotic Use by Class (mg/kg)

	Suckler 2019	Finisher 2019	Suckler Mixed 2019	Smallholder 2019	Rearer 2019
Tetracycline	1.00	4.32	1.56	2.79	14.82
Penicillins-Streptomycin	1.60	0.69	1.80	2.75	1.95
Beta lactam	0.89	0.53	1.52	2.05	1.13
Macrolide	0.46	0.30	0.83	0.87	0.64
Amphenicol	0.17	0.66	0.45	0.30	1.50
Trimethoprim-sulphonamide	0.23	0.14	0.59	0.32	0.22
Other*	0.32	0.05	0.61	0.15	0.22

*Aminoglycosides, fluoroquinolones, products with multiple active ingredients (excluding penicillin-steptomycin and trimethoprim-sulphonamides), lincosamides

Total Antibiotic Use and Use of HP-CIAs (mg/kg)

	Suckler 2019	Finisher 2019	Suckler Mixed 2019	Smallholder 2019	Rearer 2019
Total use	4.65	6.68	7.35	9.23	20.47
HP-CIA use:	0.008	0.013	0.016	0.033	0.008
Fluoroquinolones	0.0047	0.0061	0.0089	0.0188	0.0075
3rd and 4th generation cephalosporins	0.0036	0.0070	0.0073	0.0147	0.0005

Antibiotic Use by Route of Administration (mg/kg)

	Suckler 2019	Finisher 2019	Suckler Mixed 2019	Smallholder 2019	Rearer 2019
Injectable	4.06	4.14	5.97	8.40	8.98
Oral Powder	0.06	2.45	0.56	0.29	8.10
Intramammary Dry Cow	0.22	0.02	0.36	0.11	0.10
Intramammary Lactating Cow	0.18	0.02	0.30	0.12	0.09
Oral Solution	0.06	0.03	0.05	0.20	0.05
Bolus	0.03	0.01	0.06	0.04	0.08
Intrauterine	0.03	0.00	0.05	0.06	0.02
Premix	0.00	0.00	0.00	0.00	3.06

Beef Distribution Analysis 2019

Smallholder

Mg/kg	% farms	% animal weight	% active ingredient
0 - ≤3	51	63	11
3 - ≤6	17	18	14
6 - ≤9	10	6	8
9 - ≤12	4	3	5
12 - ≤15	3	3	6
≥ 15	14	8	56

Suckler

Mg/kg	% farms	% animal weight	% active ingredient
0 - ≤3	67	70	27
3 - ≤6	18	17	23
6 - ≤9	8	8	18
9 - ≤12	3	2	8
12 - ≤15	1	1	3
≥ 15	3	3	22

Suckler mixed

Mg/kg	% farms	% animal weight	% active ingredient
0 - ≤3	57	64	20
3 - ≤6	19	17	17
6 - ≤9	10	9	16
9 - ≤12	6	5	13
12 - ≤15	3	3	12
≥ 15	5	3	22

Rearer

Mg/kg	% farms	% animal weight	% active ingredient
0 - ≤3	65	10	61
3 - ≤6	19	13	19
6 - ≤9	4	4	6
9 - ≤12	2	3	3
12 - ≤15	1	2	2
≥ 15	10	67	10

Finisher

Mg/kg	% farms	% animal weight	% active ingredient
0 - ≤3	86	34	81
3 - ≤6	10	21	11
6 - ≤9	1	4	3
9 - ≤12	1	8	2
12 - ≤15	0	0	0
≥ 15	1	32	3

All beef

Antibiotic Use (mg/kg)	0-≤10	10-≤20	20-≤30	≥30
Farms (% of total)	76.63	13.22	4.08	6.07
Dairy Cattle (% of total)	83.93	9.86	3.22	3.00
Antibiotic active ingredient (% of total)	36.23	20.91	11.68	31.19

Suckler Usage Trend Analysis 2015-2019

Antibiotic Use by Class (mg/kg)

	2015	2016	2017	2018	2019	Change (%)
Penicillin-Streptomycin	1.42	1.52	1.52	1.52	1.30	-8.2
Tetracyclines	1.91	1.64	1.41	1.25	1.06	-44.3
Beta lactams	1.14	1.11	1.08	1.02	0.90	-20.7
Macrolides	0.80	0.76	0.66	0.61	0.52	-35.6
Trimethoprim-sulphonamides	0.26	0.28	0.25	0.30	0.23	-13.7
Multiple actives*	0.26	0.27	0.25	0.28	0.27	2.1
Other**	0.32	0.37	0.28	0.27	0.22	-33.5

*Products with more than one active ingredient (not including penicillin-streptomycin or trimethoprim-sulphonamides)
**Aminoglycosides, fluoroquinolones

Total Antibiotic Use and Use of HP-CIAs (mg/kg)

	2015	2016	2017	2018	2019	Change (%)
Total use	6.12	5.95	5.46	5.24	4.50	-26.5
HP-CIA use:	0.254	0.199	0.142	0.057	0.009	-96.4
Fluoroquinolones	0.0713	0.0557	0.0378	0.0169	0.0065	-90.9
3rd and 4th generation cephalosporins	0.1828	0.1430	0.1039	0.0405	0.0027	-98.5

Antibiotic Use by Route of Administration (mg/kg)

	2015	2016	2017	2018	2019	Change (%)
Injectable	4.81	5.02	4.73	4.56	3.92	-18.5
Intramammary Dry Cow	0.26	0.24	0.22	0.22	0.21	-19.5
Intramammary Lactating Cow	0.22	0.21	0.19	0.17	0.15	-30.1
Oral Powder	0.60	0.23	0.12	0.08	0.09	-85.6
Oral Solution	0.11	0.09	0.08	0.09	0.06	-46.5
Bolus	0.08	0.07	0.05	0.08	0.03	-57.0
Other*	0.04	0.09	0.06	0.03	0.03	-24.8

* intrauterine and premix

Finisher Usage Trend Analysis 2015-2019

Antibiotic Use by Class (mg/kg)

	2015	2016	2017	2018	2019	Change (%)
Tetracyclines	4.29	5.15	5.40	6.13	5.99	39.54
Amphenicols	1.13	0.97	0.78	0.82	0.62	-44.52
Beta lactams	0.81	0.98	0.82	0.77	0.61	-25.05
Penicillin-streptomycin	0.96	1.12	0.84	0.68	0.55	-43.34
Macrolides	0.80	0.67	0.55	0.44	0.36	-54.64
Trimethoprim-sulphonamides	0.35	0.34	0.23	0.13	0.17	-51.02
Other*	0.25	0.19	0.11	0.08	0.05	-80.25

*Aminoglycosides, fluoroquinolones, products with multiple active ingredients (excluding penicillin-steptomycin and trimethoprim-sulphonamides)

Total Antibiotic Use and Use of HP-CIAs (mg/kg)

	2015	2016	2017	2018	2019	Change (%)
Total use	8.60	9.42	8.73	9.05	8.36	-2.9
HP-CIA use:	0.237	0.142	0.070	0.031	0.010	-95.7
Fluoroquinolones	0.1013	0.0723	0.0458	0.0233	0.0091	-91.1
3rd and 4th generation cephalosporins	0.1354	0.0693	0.0243	0.0072	0.0011	-99.2

Antibiotic Use by Route of Administration (mg/kg)

	2015	2016	2017	2018	2019	Change (%)
Injectable	5.52	6.00	5.07	4.83	4.36	-20.9
Oral Powder	2.66	3.07	3.45	4.07	3.91	47.0
Oral Solution	0.19	0.15	0.08	0.06	0.03	-83.2
Intramammary Dry Cow	0.07	0.07	0.04	0.03	0.02	-65.4
Intramammary Lactating Cow	0.11	0.10	0.06	0.04	0.02	-78.2
Bolus	0.048	0.025	0.013	0.007	0.005	-89.7
Intrauterine	0.021	0.013	0.012	0.007	0.005	-77.0

Suckler Mixed Usage Trend Analysis 2015-2019

Antibiotic Use by Class (mg/kg)

	2015	2016	2017	2018	2019	Change (mg/kg)
Beta lactams	1.8	1.9	1.9	1.9	1.8	1.7
Tetracyclines	1.9	2.1	2.0	1.8	1.7	-13.9
Penicillin-Streptomycins	2.2	2.1	2.0	1.9	1.6	-26.5
Macrolides	1.3	1.3	1.2	1.2	1.0	-26.9
Trimethoprim-sulphonamides	0.6	0.6	0.7	0.8	0.8	29.9
Amphenicols	0.6	0.7	0.5	0.5	0.4	-26.8
Other*	1.0	0.8	0.7	0.7	0.7	-30.1

*Aminoglycosides, fluoroquinolones, products with multiple active ingredients (excluding penicillin-steptomycin and trimethoprim-sulphonamides), lincomycins

Total Antibiotic Use and Use of HP-CIAs (mg/kg)

	2015	2016	2017	2018	2019	Change (%)
Total use	9.34	9.51	9.09	8.83	7.90	-15.47
HP-CIA use:	0.522	0.503	0.300	0.145	0.011	-97.85
Fluoroquinolones	0.231	0.230	0.133	0.066	0.008	-96.49
3rd and 4th generation cephalosporins	0.2907	0.2728	0.1668	0.0788	0.0031	-98.93

Antibiotic Use by Route of Administration (mg/kg)

	2015	2016	2017	2018	2019	Change (%)
Injectable	7.18	7.65	7.26	7.10	6.25	-13.0
Oral Powder	0.70	0.58	0.76	0.74	0.77	9.0
Intramammary Dry Cow	0.58	0.46	0.40	0.45	0.39	-33.2
Intramammary Lactating Cow	0.41	0.37	0.35	0.33	0.32	-22.8
Bolus	0.14	0.12	0.11	0.06	0.07	-47.0
Intrauterine	0.05	0.07	0.06	0.06	0.06	20.2
Oral Solution	0.28	0.25	0.15	0.08	0.04	-84.4

Smallholder Usage Trend Analysis 2015-2019

Antibiotic Use by Class (mg/kg)

	2015	2016	2017	2018	2019	Change (mg/kg)
Penicillin-streptomycin	2.2	2.1	2.7	2.3	3.9	74.8
Tetracyclines	3.1	3.1	3.7	3.1	3.9	22.9
Beta-lactams	2.0	1.9	1.9	2.0	2.6	30.3
Macrolides	1.4	1.6	1.4	1.1	1.4	-1.7
Amphenicols	0.5	0.5	0.7	0.5	0.4	-24.5
Trimethoprim-sulphonamides	0.6	0.5	0.5	0.4	0.5	-9.7
Other*	0.8	0.5	0.5	0.3	0.2	-73.8

*Aminoglycosides, fluoroquinolones, products with multiple active ingredients (excluding penicillin-steptomycin and trimethoprim-sulphonamides)

Total Antibiotic Use and Use of HP-CIAs (mg/kg)

	2015	2016	2017	2018	2019	Change (%)
Total use	10.66	10.26	11.47	9.71	12.85	20.5
HP-CIA use:	0.507	0.334	0.242	0.109	0.043	-91.6
Fluoroquinolones	0.2754	0.1515	0.1189	0.0591	0.0318	-88.5
3rd and 4th generation cephalosporins	0.2312	0.1825	0.1232	0.0503	0.0108	-95.3

Antibiotic Use by Route of Administration (mg/kg)

	2015	2016	2017	2018	2019	Change (%)
Injectable	8.40	8.18	9.26	8.05	11.44	36.3
Oral Powder	0.75	0.71	1.03	0.79	0.61	-18.1
Oral Solution	0.62	0.61	0.40	0.25	0.31	-49.0
Intramammary Dry Cow	0.31	0.28	0.26	0.22	0.19	-39.2
Intramammary Lactating Cow	0.37	0.29	0.26	0.22	0.17	-54.6
Intrauterine	0.10	0.08	0.08	0.09	0.09	-9.0
Bolus	0.12	0.11	0.17	0.09	0.03	-78.0

Rearer Usage Trend Analysis 2015-2019

Antibiotic Use by Class (mg/kg)

	2015	2016	2017	2018	2019	Change (mg/kg)
Tetracyclines	10.6	10.3	12.4	14.5	12.1	14.2
Penicillin-streptomycin	1.8	1.8	2.0	2.0	1.8	1.8
Amphenicols	1.5	1.5	1.4	1.9	1.1	-26.2
Beta lactams	1.3	1.2	1.4	1.4	1.1	-17.4
Macrolides	1.6	1.9	1.3	1.0	0.6	-59.7
Trimethoprim-sulphonamides	0.8	0.7	0.7	0.4	0.2	-71.9
Other*	0.4	0.4	0.3	0.3	0.2	-44.8

*Aminoglycosides, fluoroquinolones, products with multiple active ingredients (excluding penicillin-steptomycin and trimethoprim-sulphonamides)

Total Antibiotic Use and Use of HP-CIAs (mg/kg)

	2015	2016	2017	2018	2019	Change (%)
Total use	18.05	17.76	19.51	21.36	17.21	-4.6
HP-CIA use:	0.224	0.150	0.080	0.026	0.003	-98.7
Fluoroquinolones	0.1035	0.0596	0.0495	0.0117	0.0026	-97.5
3rd and 4th generation cephalosporins	0.1200	0.0899	0.0309	0.0147	0.0004	-99.7

Antibiotic Use by Route of Administration (mg/kg)

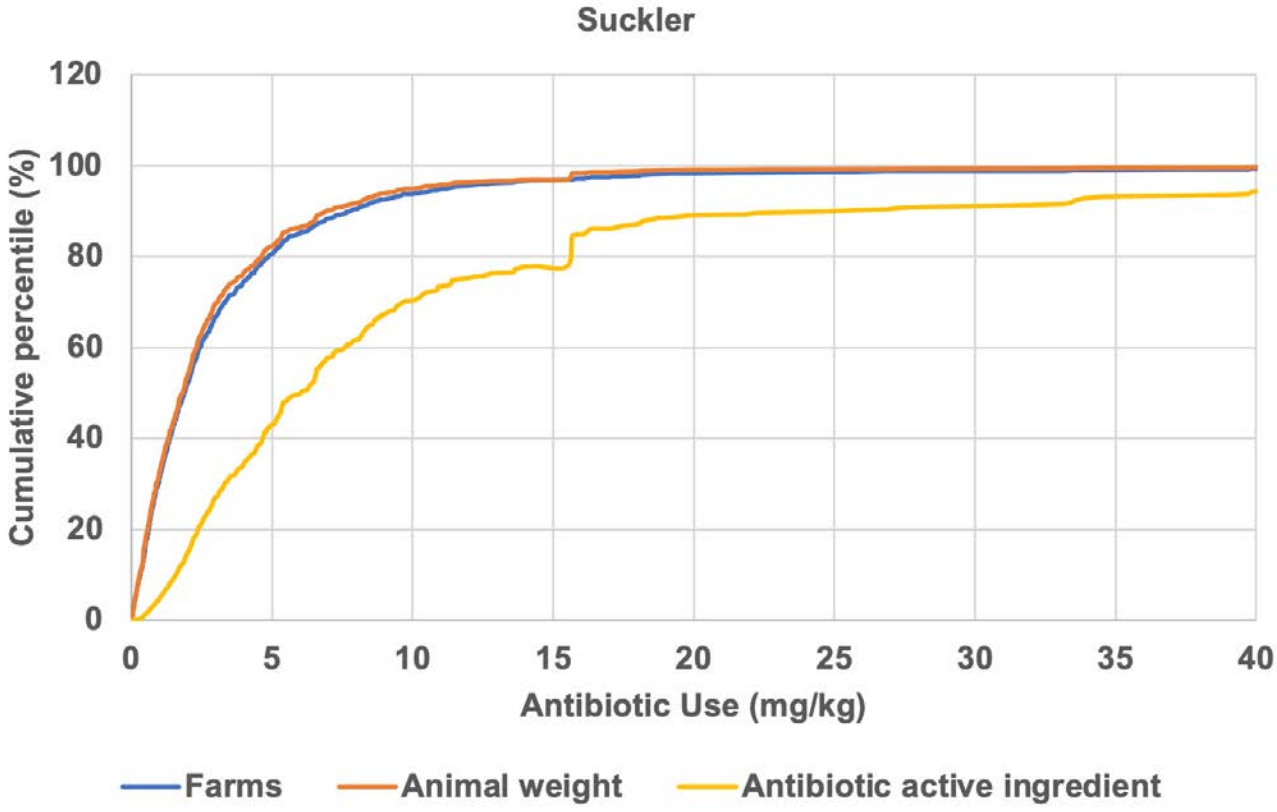
	2015	2016	2017	2018	2019	Change (%)
Injectable	10.11	10.61	11.00	11.01	8.82	-12.8
Oral Powder	7.17	6.41	7.84	9.85	8.02	11.9
Bolus	0.13	0.10	0.14	0.08	0.09	-29.9
Intramammary Lactating Cow	0.25	0.22	0.18	0.10	0.08	-66.9
Oral Solution	0.14	0.12	0.06	0.07	0.08	-46.5
Intramammary Dry Cow	0.20	0.20	0.18	0.12	0.07	-65.5
Other*	0.05	0.11	0.09	0.12	0.06	23.4

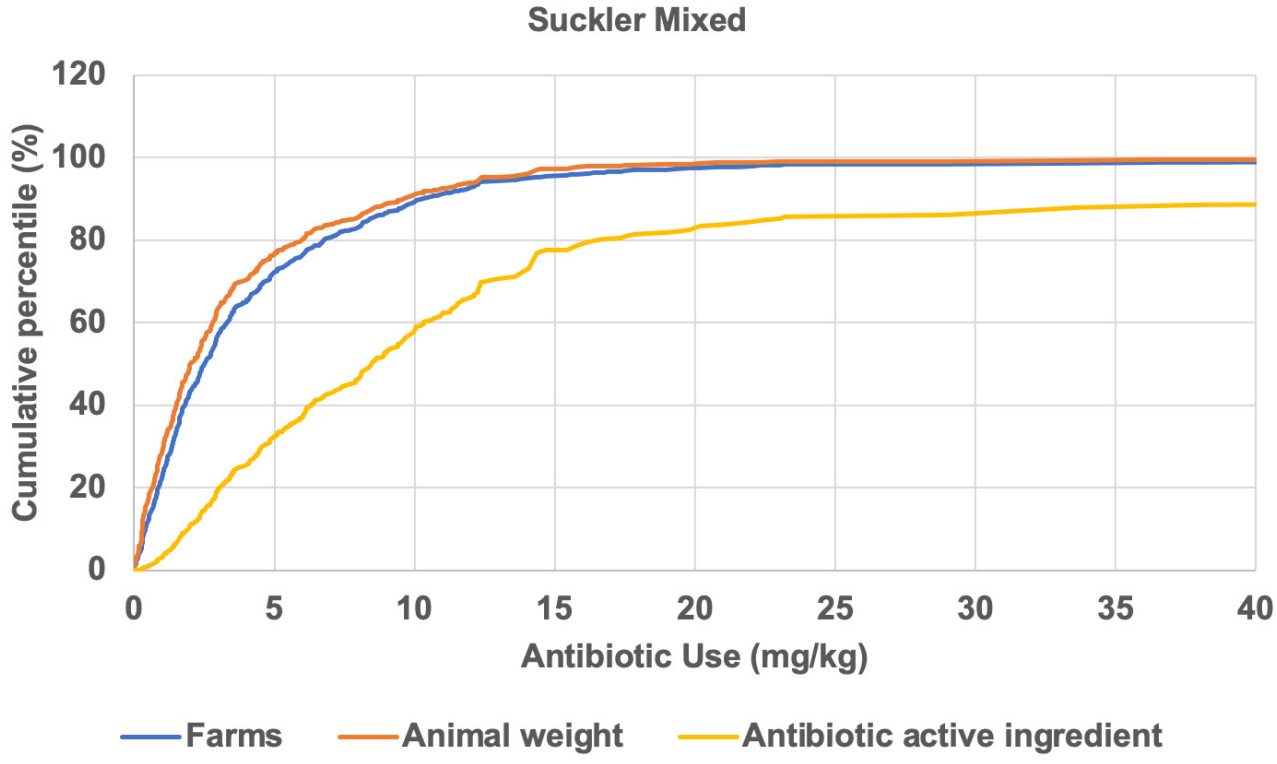
Antibiotic Use by Route of Administration (mg/kg)

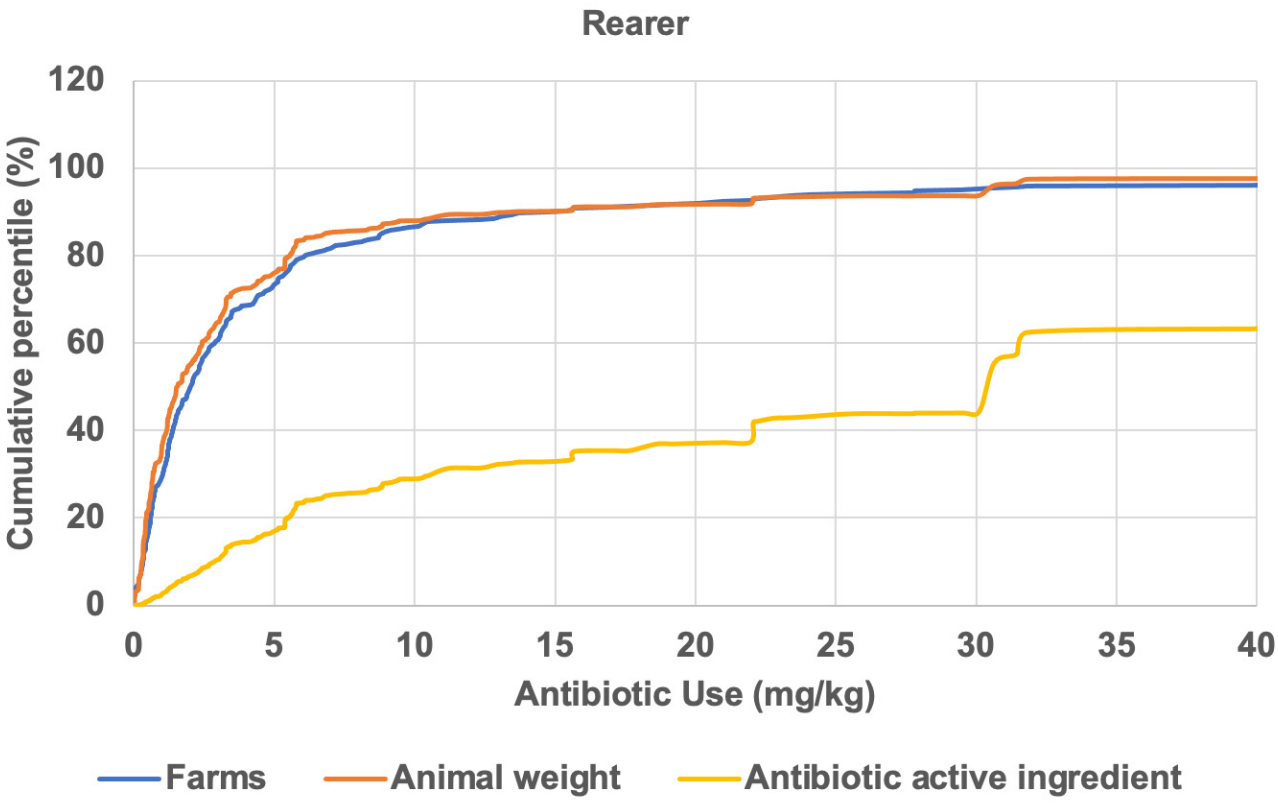
	2015	2016	2017	2018	2019	Change (%)
Dairy	0.84	0.78	0.66	0.42	0.23	-72.4
Suckler	0.20	0.25	0.14	0.11	0.06	-72.0
Finisher	0.24	0.14	0.11	0.08	0.09	-63.6
Suckler mixed	0.28	0.24	0.21	0.22	0.12	-57.9
Smallholder	0.34	0.30	0.20	0.16	0.25	-25.3
Rearer	0.40	0.38	0.35	0.14	0.17	-56.9

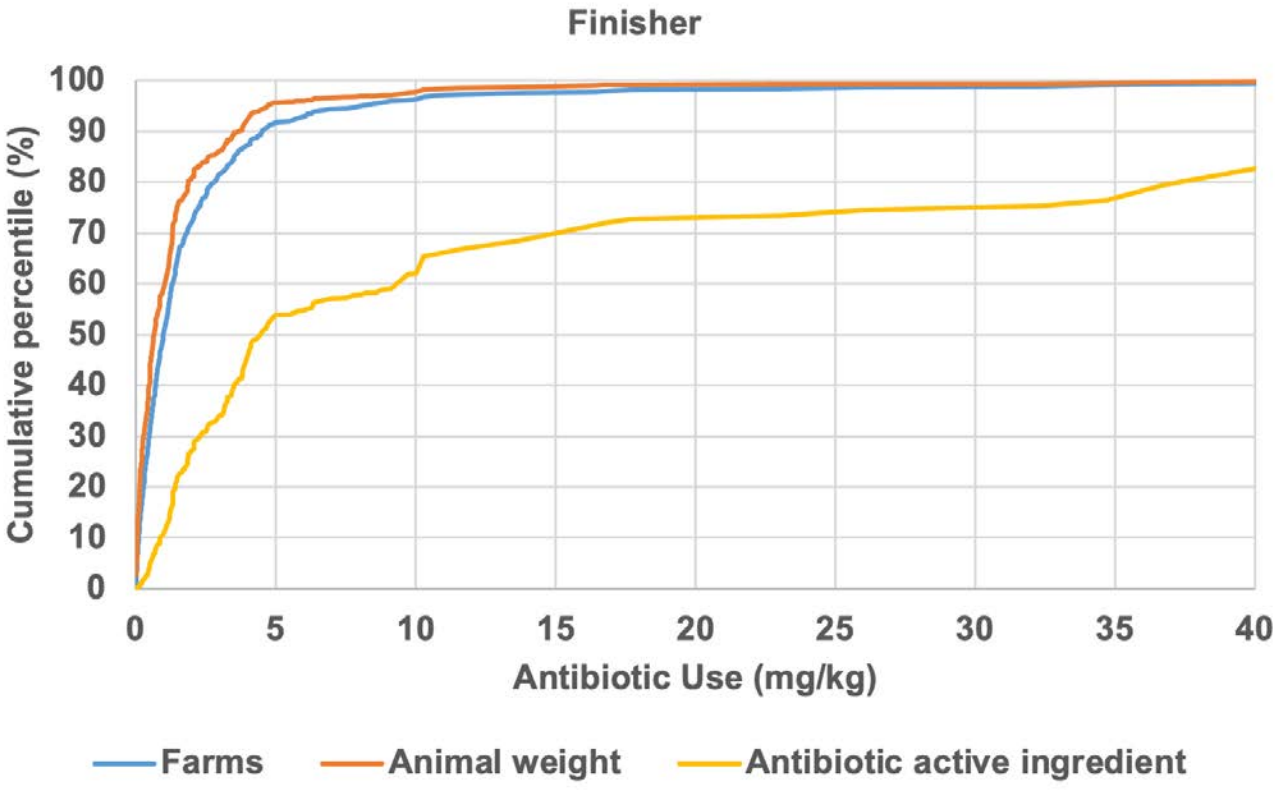
Appendix Two – Beef Cumulative Distributions

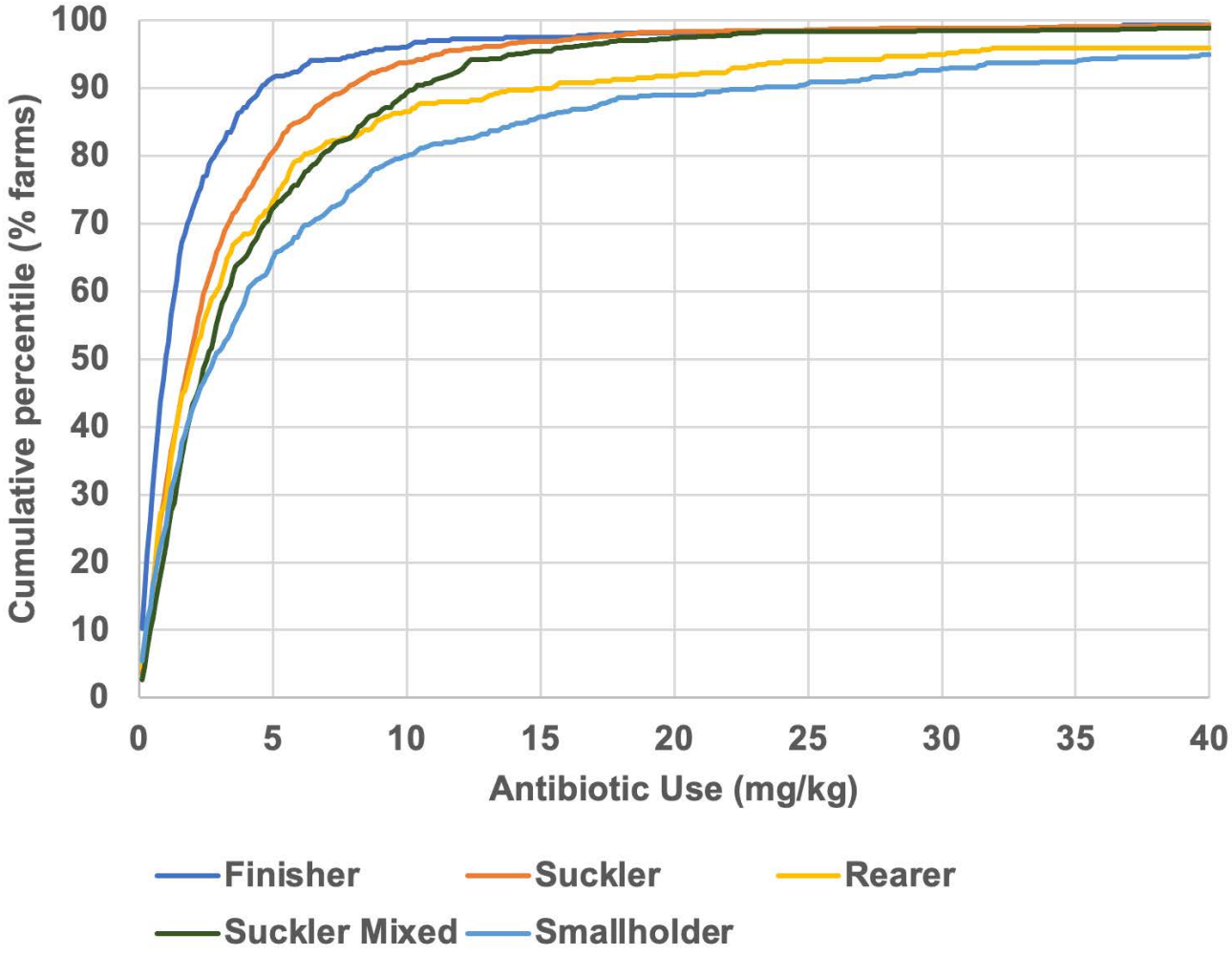
Additional cumulative distribution graphs for the beef sector relating to antibiotic use (mg/kg) for farms, animal weight and antibiotic active ingredient






Rearer
Cumulative percentile (%)
120
100
80
60
40
20
0
0
5
10
15
20
25
30
35
40
Antibiotic Use (mg/kg)
Farms
Animal weight
Antibiotic active ingredient


Finisher
Cumulative percentile (%)
100
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
35
40
Antibiotic Use (mg/kg)
Farms
Animal weight
Antibiotic active ingredient


Cumulative percentile (% farms)
100
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
35
40
Antibiotic Use (mg/kg)
Finisher
Suckler
Rearer
Suckler Mixed
Smallholder

RESPONSIBLE USE OF MEDICINES IN AGRICULTURE ALLIANCE

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