New Zealand Food Safety

Haumaru Kai Aotearoa

Antibiotic Sales Analysis 2018

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Further information on antimicrobial resistance is available on the MPI website: https://www.mpi.govt.nz/processing/agricultural-compounds-and-vet-medicines/antimicrobial-resistance/

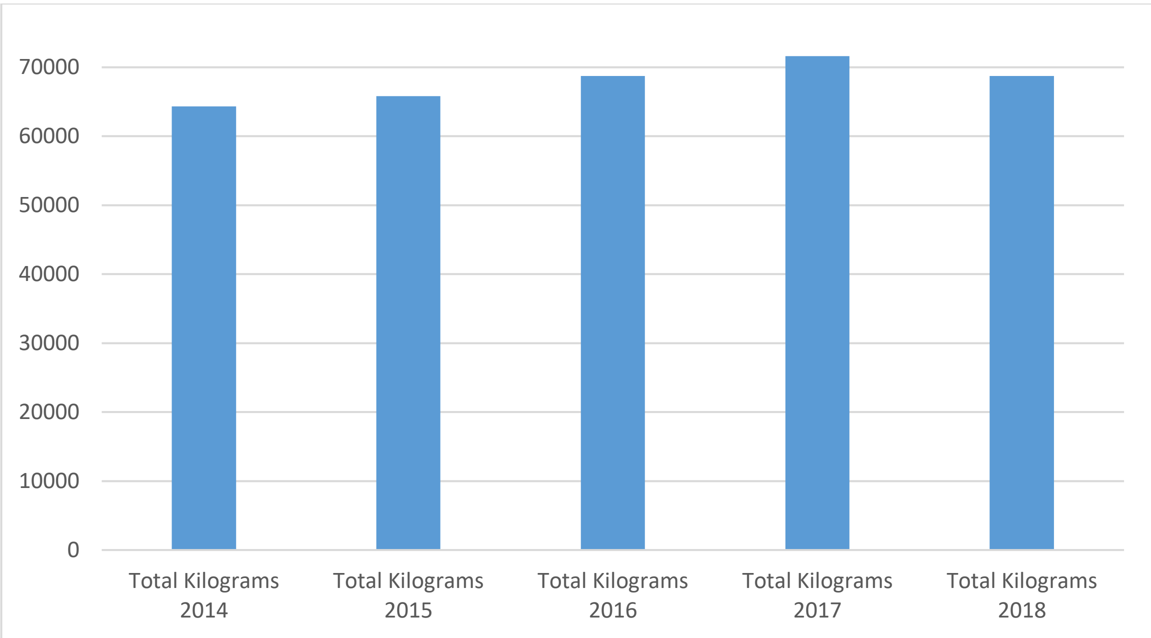
Contents

1 Summary

MPI has been collecting data on sales of antimicrobials of significance to human health used as agricultural compounds (veterinary medicines and agricultural chemicals) since 2004. These data are used to monitor trends in antimicrobial use by class, species and route of administration on a kilogram of active ingredient basis. This reporting period covers the calendar year of 1 January 2018 to 31 December 2018 and is part of the ongoing monitoring programme of antimicrobial sales by MPI. Interpretation of use is based on the sales data collected, along with feedback on antimicrobial use from the agricultural sectors and veterinarians in the field. Data from 247 trade name products (TNPs) containing one or more antibiotics as active ingredients were registered and therefore analysed for the 2018 reporting period. This represents a slight reduction in the number registered compared to 2017, when 251 antibiotic-containing TNPs were registered. Thirty-four of the trade name products containing antibiotics registered zero sales during this reporting period. All antibiotics with zero sales were penicillins.

Compared to the 2017 reporting period, total antimicrobial sales have decreased by 4% and totalled 68,765 kg.

Fig 1**. Total Kilograms by Reporting Year**



This report identifies a reduction in quantities of antibiotic sold in four of the six classes of antibiotic identified by the World Health Organization (WHO) to be of critical importance to human health. Third generation cephalosporins decreased in sales by 23% while fourth generation cephalosporins decreased by 27%. Macrolides decreased in sales by 15% and fluoroquinolone sales decreased by 4%. Penicillin sales decreased compared to 2017 by 13%. The two critically important classes of antibiotic which did increase during this reporting period included aminoglycosides, which increased by 22%, and polymyxin which increased by 25% (from a total of 0.4 kg to 0.5 kg). Overall, critically important antibiotic sales decreased by 13.7%.

Fig 2. **Antibiotic Sales by Antibiotic Class** (range: ~5,000-30,000 kg)

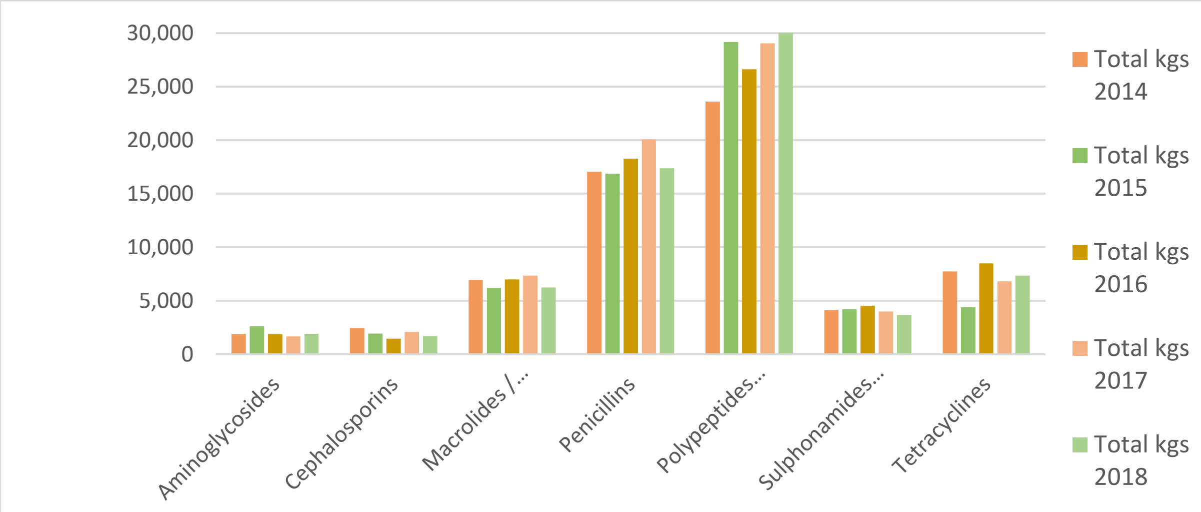
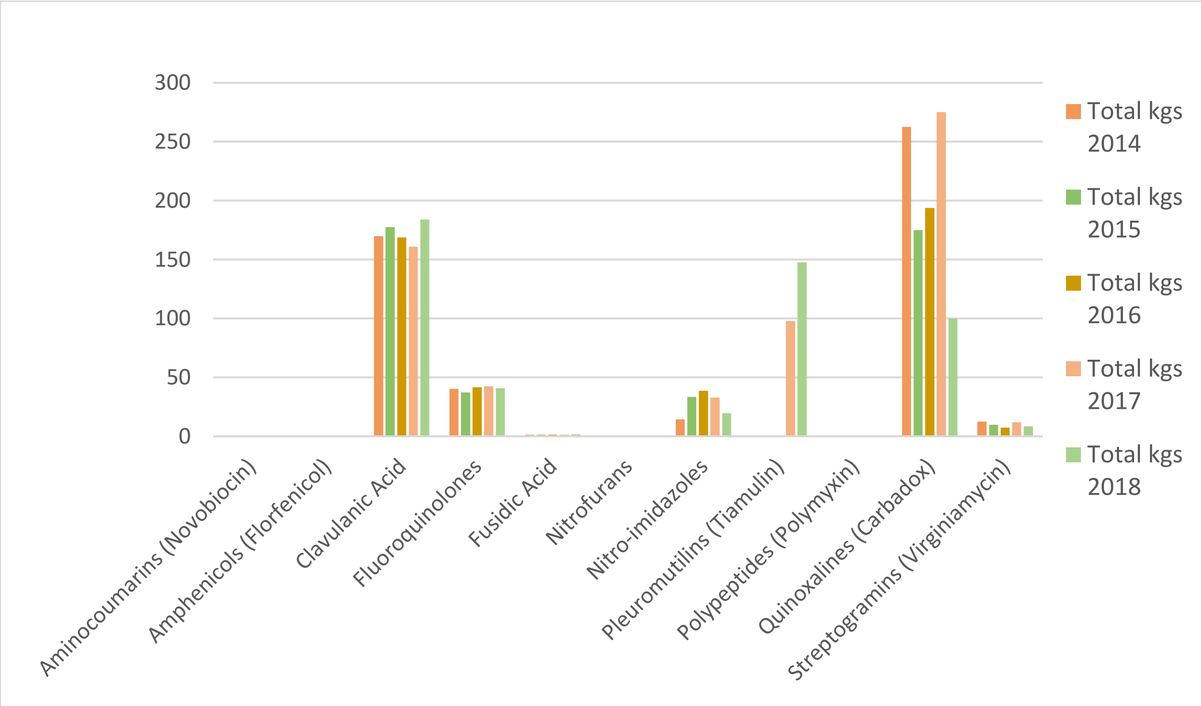


Fig 3. **Antibiotic Sales by Antibiotic Class** (range: 0-300 kg)



The majority of antibiotics sold continue to be those registered for use by administration in feed (55%). Eighty percent of product in this category contained zinc bacitracin, which is registered for use in pigs and poultry. Injectable products remained the second most common type of antibiotic sold at 22%. Seventy-one percent of injectables sold contained penicillins as the active ingredient.

When looking at the sales data per species, half of the antibiotics sold were products registered for use in pigs/poultry (46%), a slight decline from 49% in 2017. Products registered for use in multiple animal species were the second largest group of sales at 16% of the total, a slight reduction compared to 2017, when products in this category accounted for 20% of sales.

The 4% reduction in antibiotic sales may be due to an overall reduction in the animal population. The sheep, pig and dairy cattle population decreased, while the beef cattle and poultry populations increased.

MPI was informed in 2019 by two registrants that data they had submitted in previous years had been incorrectly reported, in one case as far back as 2015. This means that some numbers in previous reports are incorrect, specifically relating to aminoglycosides, cephalosporins, fusidic acid, macrolides, penicillins, streptogramins, sulphonamides/trimethoprim and tetracyclines. In most cases, the data originally submitted was less than for what should have been reported. This is discussed in more detail at the end of this report.

2 Introduction

Antimicrobial resistance (AMR) continues to be of global public and animal health concern as it threatens the ability to prevent and treat infectious disease caused by microbes. While AMR is a natural consequence of antimicrobial use, inappropriate practices hasten its evolution and spread. Resistance is present throughout the world in pathogens that are known to cause common diseases.

The most recent report outlining the antimicrobials of greatest importance to human health that was available during 2018 was published by the WHO in 2016.

The purpose of this sales analysis is to identify an up to date list of 'critically important' antimicrobials, and to ensure their prudent use in both human and veterinary medicine. The report will use the 2016 WHO classification system.

MPI is currently undertaking a series of reviews to determine a New Zealand-based classification system for antibiotics. This system will take into account the importance of each antibiotic to both human and animal health, as well as the AMR risks posed by their use in human and veterinary medicine, and assign important, highly important, and critically important status to individual compounds in each antibiotic family. The first review was completed in November 2019, with classifications assigned to all compounds in the penicillin (classed as highly important), later-generation cephalosporin (classed as critically important), and macrolide (classed as critically important) families. The review report is available on the MPI website.

The completed reviews will be followed by a reassessment of each registered trade name product containing these antibiotics to ensure the regulatory controls reflect the new classifications. The MPI classifications will be referred to going forward, as the review work is completed, and AMR classification is assigned to each antibiotic compound.

Three categories of antimicrobials are named in the 2016 WHO report: critically important, highly important, and important. Antimicrobials **critically important** for human health meet both Criterion 1 and Criterion 2. Those antimicrobials that meet either Criterion 1 or Criterion 2 are categorised as **highly important**, while antimicrobials that meet neither Criterion are ranked as **important**. The two criteria are:

> **Criterion 1**: Antimicrobial class which is the sole agent, or one of limited available therapies, to treat serious bacterial human disease.
> **Criterion 2**: Antimicrobial class used to treat human disease caused by either (1) bacteria that may be transmitted to humans from non-human sources or (2) bacteria that may acquire resistant genes from non-human sources.

The critically important antimicrobials in the 2016 WHO report were prioritised into **'highest priority critically important'** and **'high priority critically important'**. Antimicrobial classes in the 'highest priority critically important' group that were registered for veterinary use in New Zealand during 2018 included fluoroquinolones, polymyxins, macrolides and third and fourth generation cephalosporins. Antimicrobial classes in the 'high priority critically important' group registered in New Zealand included aminoglycosides and some penicillins. Aminoglycosides were registered in New Zealand during 2018 for use in both horticulture and as veterinary medicines. Some penicillins (natural, aminopenicillins and antipseudomonal) were classified as critically important.

Antimicrobial sales have been reported in units appropriate to each individual product and converted to weight in kilograms using the active ingredient concentration expressed on the product label. Overages used in manufacturing and non-active salts are not included in the final mass.

3 Background

To manage the risks associated with the development of antimicrobial resistance, registrants of restricted veterinary medicines (RVMs) and horticultural products containing antimicrobials important to human medicine must provide an annual report of sales by month to MPI as a condition of registration. A preliminary sales data report is presented to industry in order to allow each sector to comment on the significance of the findings relevant to their field. Industry comment is important to the evaluation of the sales data as it provides insight into specific disease challenges that might have occurred over the period, and highlights changes in management practices and the animal population for each species. These sales data, along with industry input, are used to monitor for significant trends that may indicate changes in antibiotic use in the field and thereby provide some insight into the potential for development of antimicrobial resistance.

3.1 Last public report

The last public report on antibiotic sales was a summary of the data collated from 1 January 2014 to 31 December 2017: (ref: https://www.mpi.govt.nz/dmsdocument/37886-antibiotic-sales-analysis-2017).

3.2 Ongoing reporting of antibiotic sales

This report is focused on antimicrobial products used in horticulture and those that are classed as RVMs and used in animals.

MPI will continue to seek registrant and industry input regarding the use of antimicrobials to provide context and inform the data analysis. The resultant report will continue to provide a reliable indication of actual antibiotic use rather than sales data alone.

It is recognised globally that collecting use information per species adds considerable value in the establishment of trends that can be used to inform resistance strategies. While a move to recording use per species rather than sales is problematic, it will give a clearer picture of which species these products are being used in and why. MPI will continue to look at methods for collecting use per species data for future reports.

3.3 Data limitations

Sales data as an indicator of antibiotic use and thereby risk of the development of antimicrobial resistance is inherently limited due to a number of variables. The amount of antibiotic sold within the evaluated time period might not be used within that same time period and therefore may not be representative of current use patterns. In addition, sales data do not take into consideration the amount of product lost during administration or transport, non-compliance if owners do not administer a full course, or stock held for future use. While sales can approximate use over the nominated period, actual use can encompass product sold one or two years prior to and following that nominated period.

Data limitations are more pronounced in antibiotics used in animals than in plants. For example, there is more variability in approved uses of antibiotics in animals, and many products are approved for use in both food-producing and companion animal species. In addition, veterinarians have the authorisation to employ discretionary use for products not limited to 'on label' use patterns (such as the case for antibiotics used in horticulture), target species, dose rates and treatment regimes. Because of the use of products 'off label', total antibiotic use cannot be accurately predicted by the sales data.

Sales data also do not give any indication of the fluctuations of animal numbers within the New Zealand herd, the health of individual animals, or emergent disease trends. Increases and decreases of sales can therefore be representative of population changes and/or changes in disease prevalence within that population just as readily as they can be of changes in antibiotic use.

There is no direct monitoring of the sales of human preparations used as veterinary medicines, or the sale and use of compounded veterinary medicines, as their use is at the discretion of the attending veterinarian in specific cases. This is especially important when considering the impact of the sales of antibiotics on the emergence of antimicrobial resistance, as compounded and non-veterinary medicines may be used when available veterinary antibiotics either fail to cure the infection or when the veterinarian determines that multi-modal therapy incorporating non-veterinary medicines is indicated.

Sales data in kilograms of active ingredient does not take into account dose rates. Certain antimicrobial classes might require more or less active ingredient that amounts to one dose of product.

The analysis is based on the weight of antibiotic active ingredient sold, but the sales are reported to MPI in amount of product sold. Product sales are mathematically converted by MPI to active ingredient weights and evaluated based on the sum in kilograms of active ingredient, often from multiple products. MPI is still working with the registrants of antibiotic veterinary medicines to eliminate errors that creep in during the process of that conversion. While there may be some discrepancies in the statistics, MPI believes that any discrepancies that may occur are unlikely to significantly alter the analysis.

Finally, MPI is aware that a proportion of antibiotics sold in New Zealand may be used in other countries including the Pacific islands. The information passed on from registrants does not specify how much product is sold for use in New Zealand and how much is supplied for overseas use.

4 Glossary

Species and administration definitions remain the same as in the previous report to ensure consistent reporting:

Species or **species group** are defined as:

- **Cattle** – dairy and /or beef cattle.
- **Companion** – cat and /or dog.
- **Horses and Sheep** – horses and sheep have been identified separately from those classed as 'other'.
- **Pigs/Poultry** – pigs and /or chickens, turkeys and game birds. Where possible, particular classes and active ingredients will be discussed as they pertain to either pigs or poultry.
- **Multiple Species** – all products registered for use in multiple species including companion animals. This category includes products with claims for deer as there are few examples of antibiotics registered with use claims specific to deer.
- **Multiple Production Species** – all products registered for use in multiple production species. This category has been added to gain insight into products used in food-producing species.
- **Other** – this category includes products used in caged birds, pigeons, ornamental fish and plants.
- **Plants** – products registered for use in plants.

Administration route

- **Oral** – tablets, capsules, pastes, powders and suspensions for individual dosing.
- **Injectable** – intravenous, subcutaneous, and intramuscular preparations for individual dosing.
- **Feed** – in dedicated animal feed for the treatment of animals where other administration methods are not appropriate.
- **Water** – in dedicated animal water supply for the treatment of animals where other administration methods are not appropriate.
- **Intramammary** – lactating and dry cow products administered via the teat canal for individual dosing.
- **Topical** – superficially applied solutions, gels, ointments, creams and aerosols for individual dosing.
- **Other** – products for ophthalmic, intra-aural, intrauterine or spray–on (plant) use, or products where more than one administration route is possible.

5 Sales Trends 2018

The total quantity of antibiotics sold during 2018 amounted to 68,765 kg. This is a reduction in sales of 4% compared to the 2017 reporting year. Over the past 5 year period, sales increased annually between 2014 and 2017 by 2%, 4%, and 4% respectively, before decreasing over the 2018 period to levels slightly less than reported for 2016.

Aminoglycoside sales increased by 13% compared to 2017. The increase occurred in sales of products registered for use in plants as well as in animals. While the horticultural sector feedback that the rise in sales between 2017 and 2018 was not due to an increase in use (see section 9), no feedback was offered for the 12% increase noted in aminoglycoside sales registered for use in animals. The 5 year trend demonstrates fluctuations of sales of products containing these actives. In 2014, 1,911 kg was sold, which increased by 36% in 2015 to 2,611 kg. Sales then decreased for the following two years, but have increased in 2018 back to levels seen in 2014.

Overall cephalosporin sales decreased in 2018 by 18% to a total of 1,695 kg. Overall sales in this category decreased, as well as sales of the critically important 3rd and 4th generation cephalosporins, which reduced by 14% and 2.5% respectively. The trend over the last 5 years is that sales reduced in 2015 by 22%, then again in 2016 by 24% when compared to the previous year. In 2017 sales then jumped by 43% before decreasing in 2018.

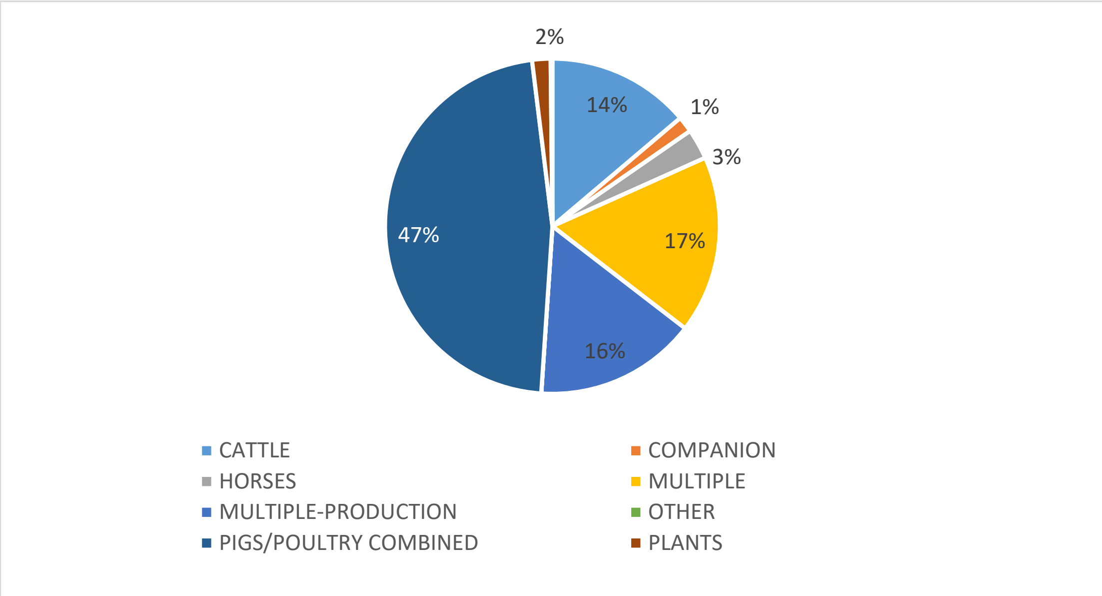
Fluoroquinolone sales decreased in 2018 compared to the previous reporting period by 4% to a total of 41 kg. Sales of this class have remained low over the last 5 years with quantities sold between 37 kg (2015) and 42.5 kg (2017).

The quantity of macrolides/lincosamides sold during 2018 was 6,248 kg. This has decreased by 15% since 2017 when 7,355 kg was sold. As with the previous reporting period, over 95% of the sales in this class were attributed to the sales of products containing tylosin, the majority of which was registered for administration in either feed or water. Over the last 5 years, sales in this category have fluctuated with 2017 being the highest period of sales with 7,355 kg sold. Sales in 2015 were the lowest with 6,188 kg sold. Compared to 2014, sales have reduced by 10%.

Penicillin sales during 2018 amounted to 17,373 kg. This is a decrease of 13% compared to 2017, at which time 20,062 kg was sold. Over the last 5 years, sales of penicillins have fluctuated between 25% and 28% of overall antibiotics sold annually. The 2015 period had the lowest total quantity of 16,881 kg sold, which equated to 26% of overall sales, while 2018 had the lowest percentage (25%) of penicillins sold compared to overall sales during each year. We are aware that prescribing behaviours have changed over the last 4 to 5 years away from critically important antibiotics and this initially increased the quantity of penicillins sold. Reclassification of penicillins by WHO as critically important antibiotics in 2016 may have filtered through to authorising veterinarians, resulting in a reduction of penicillin sales during 2018. However, the reduction in sales of penicillins will have to be monitored over a longer period of time to determine whether this is a true downward trend.

6 Antibiotic Sales by Species

Fig 4. **Percentage Used per Species Total 2018**



Just under half (47%) of all antibiotics sold during this reporting period were registered for use in either pigs, poultry, or pigs and poultry. This is a reduction compared to 2017 when products sold for use in these species amounted to 49%. The majority (93%) sold for use in pigs and poultry contained the active ingredient zinc bacitracin. Five percent of sales registered for use in pigs and/or poultry included the active ingredient tylosin, while the remaining 2% included the actives tiamulin, tilmicosin, carbadox, spectinomycin or lincomycin. The products containing tilmicosin and carbadox are registered for use in pigs only.

Products registered for use in 'multiple' species comprised 17% of overall sales during 2018. Multiple species include products that are registered for use in both companion and production animal species. This has decreased from 20% of sales during 2017. The majority sold remained as injectable penicillins, followed by tylosin containing products for administration via feed. The remainder included products for oral administration, topical administration and for intramammary administration.

Products registered for use in 'multiple production' species accounted for 16 % of overall sales during 2018. This is a slight change from 13% sold during 2017 for use in production animal species. Forty-seven percent of these products were for administration via feed, 41% were injectable products and 12% were for oral administration. The remainder were topical or intra-uterine products.

Fourteen percent of products sold during 2018 were registered for use in cattle only. In terms of overall percentage sold, this is a slight reduction compared to 15% of overall sales for products registered in cattle during the 2017. As with the previous year, the majority of products sold were injectables which included the active penicillin.

Products registered for use in horses accounted for 3% of overall sales. All were oral medications containing the actives trimethoprim and sulphamethazine, or sulphamethazine alone, or virginiamycin.

Quantities sold for use in plants amounted to 1.7% of overall sales. This has increased from 1.5% of overall sales during 2017 and probably reflects the increase in the land area used for produce such as kiwifruit. As with 2017, there are only two products registered for use in plants and both contain aminoglycosides.

Products registered for use in companion animals only amounted to 1.5% of overall sales in 2018, an increase compared to the previous reporting year when they accounted for 1.12% of sales. Most are for oral administration with some for topical or injectable administration. Sixty-two percent sold contained the active ingredients amoxicillin and clavulanic acid, and 26% were first generation cephalosporins.

Sales of antibiotics registered for use in sheep only remained very low at 0.17%, compared to the 0.14% sold during 2017. There is one product registered specifically for use in sheep only and it contains penicillin as the active ingredient.

7 Production Animals: Population and Antibiotic Use

The national sheep population decreased from 27.5 million wintered in 2017 to 27.3 million wintered in 2018. The New Zealand sheep population has been steadily declining for many years. Compared to 2014 when 29.8 million sheep wintered in New Zealand, the population has decreased by 8%.

The number of dairy cattle in New Zealand, including young stock and milking cows for 2018 was 6.4 million animals. This is a decline in population of 2% compared to 2017 when 6.5 million dairy animals were present. Dairy cattle numbers have fluctuated somewhat over the previous 5 years. They decreased in number between 2014 and 2015 but then increased during 2016. The populations during 2017 and 2018 both declined compared to the previous year. Since 2015, the national dairy cattle population has decreased by 5%.

The national beef herd increased by 3% in 2018 to reach 3.7 million cattle, compared to 3.6 million in 2017. The beef population has increased by approximately 100,000 animals for two years running between 2016 and 2018. For the three years prior to 2016, population numbers were steadily declining. The difference in population when comparing 2014 to 2018 amounts to a 1.4% increase.

The national pig herd has been estimated based on the number of pigs slaughtered at licenced premises over a calendar year. In 2018, a total of 643,093 were slaughtered. This is a decrease compared to the 2017 calendar year when 661,089 pigs were slaughtered. Over the last 5 year period, pig numbers, as estimated by changes in the numbers of pigs slaughtered, have been steadily declining except for 2017 when an increase in the population was noted. Compared to September 2014, the national pig herd has decreased from 672,108 (a reduction of 4%).

The national poultry population was wrongly reported in the 2017 report as 127 million when it was in fact 124.8 million. In 2018, the population increased to 131.7 million and included meat chickens, meat breeder chickens, layers, layer breeders, turkeys and ducks.

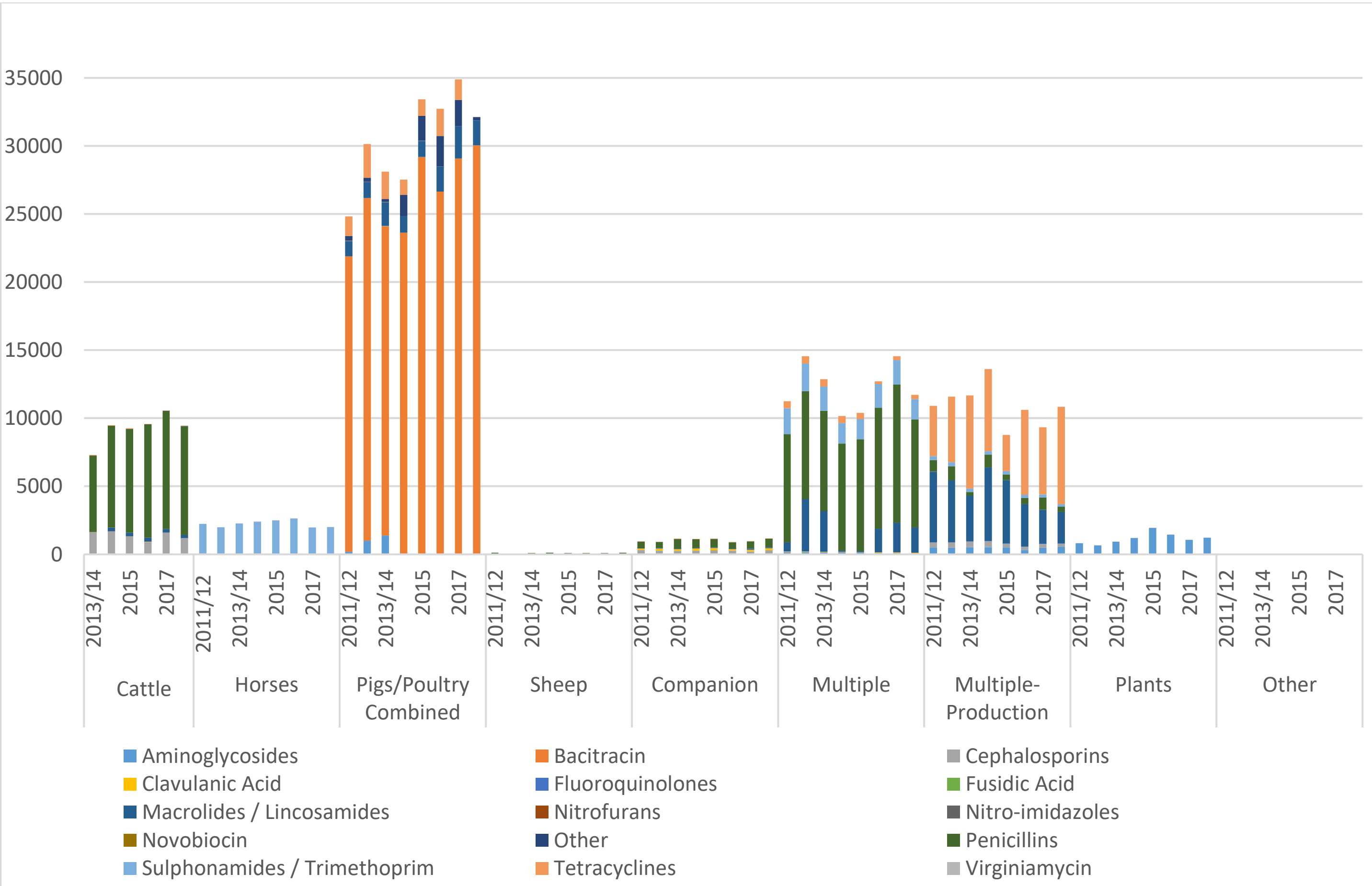
Table 1. **New Zealand Poultry Population**

Category	2017	2018
Meat chickens	118.3 million	125.5 million
Meat breeder chickens	1.5 million	1.5 million
Layers	3.9 million	3.6 million
Layer breeders	60,000	60,000
Turkeys	250,000	250,000
Ducks	800,000	800,000
Total Poultry Population	**124,789,000**	**131,760,000**

The 2018 population increased by 5.5% compared to 2017. The number of layer chickens decreased compared with 2017 by 7% to ~3.6 million. The trend over the last 5 years is that the poultry population has increased annually and is 23% larger than 2014 when it was reported as 107.4 million.

As with previous reports, the pig, poultry, and dairy cattle industries use the greatest quantities of antibiotics in New Zealand agriculture. These production systems are far more intensive compared to beef cattle and sheep farming, with animals generally in much closer proximity. This results in a greater incidence of bacterial disease and a need for more antibiotic use. Dairy cattle also have a greater biomass and therefore require more antibiotic mass per animal during treatment when compared to smaller species such as sheep.

Fig 5**. Antibiotic Sales by Antibiotic Class and Species (kg)**



8 Companion Animals: Population and Antibiotic Use

Data on the population of companion animals in New Zealand has not been updated since 2016 when it was reported by the New Zealand Animal Council[1]. At that time, the companion animal population included 683,000 dogs, 1.1 million cats and 116,000 rabbits.

The quantity of antibiotic sold during 2018 specifically registered for use in companion animals was 1,052 kg. Sales in this category have increased by 22% compared to 2017 when 860 kg was sold. MPI is not able to comment on why this change occurred. While industry feedback was requested on reasoning behind the changes in sales, no information was given. The quantity sold accounted for 1.5% of overall sales, a 0.5% increase compared to 2017.

Classes of antibiotic registered for use in companion animals included aminoglycosides (gentamicin), amphenicols (florfenicol), polypeptide (polymyxin), cephalosporins (1st and 3rd generation), clavulanic acid, fluoroquinolones (enrofloxacin, marbofloxacin and orbifloxacin), fusidic acid, macrolides/lincosamides (clindamycin and spiramycin), nitroimidazoles (metronidazole), penicillins (amoxicillin), sulphonamides/trimethoprim (silver sulfadiazine) and tetracyclines (doxycycline).

The categories of antibiotic that increased in sales during this reporting period included cephalosporins (↑ 48%), clavulanic acid (↑24%), fluoroquinolones (↑ 13%), fusidic acid (↑ 15.6%) and penicillins (↑ 26%). The amphenicol class of antibiotic also increased in that there had previously been no sales in this class. The 48% increase in cephalosporins was all due to an increase in sales of first generation cephalosporins which increased by 58% compared to 2017. Sales of critically important 3rd generation cephalosporins registered for use in companion animals decreased by 12% compared to 2017.

Those classes of antibiotics registered for use in companion animals that decreased in sales compared to the previous reporting period included aminoglycosides (↓48%), macrolides/lincosamides (↓ 33%), nitroimidazoles (↓ 49%) and tetracyclines (↓ 10%).

Fig 6**. Antibiotic Sold for Use in Companion Animals by Class (50-650 kg)**

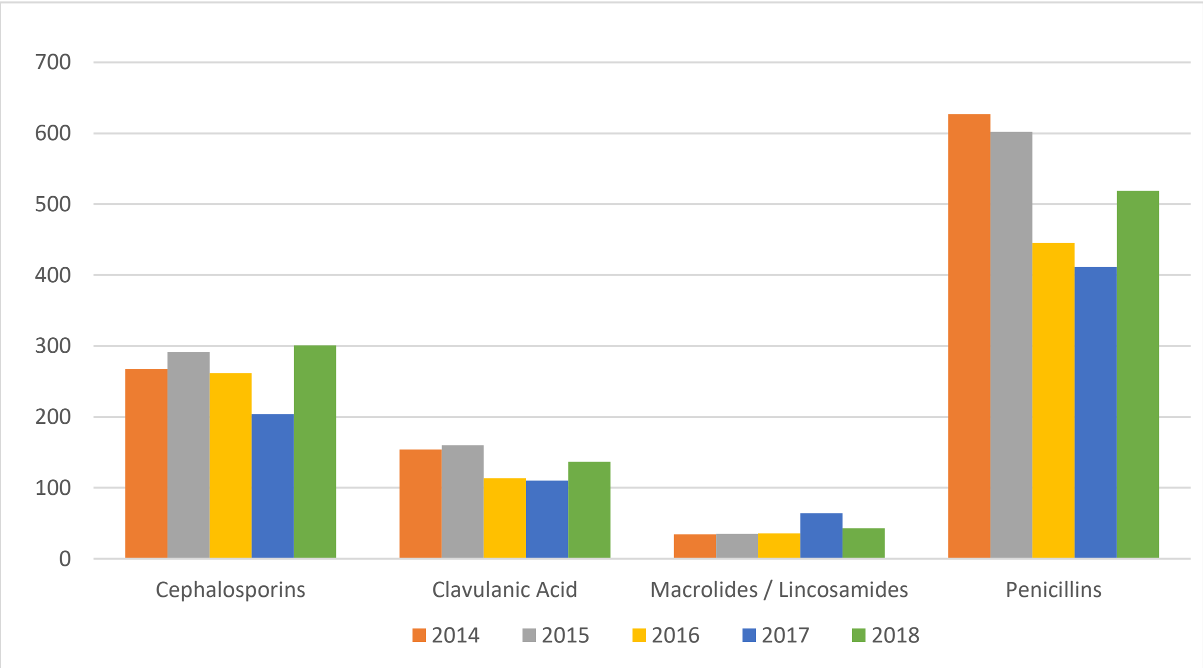
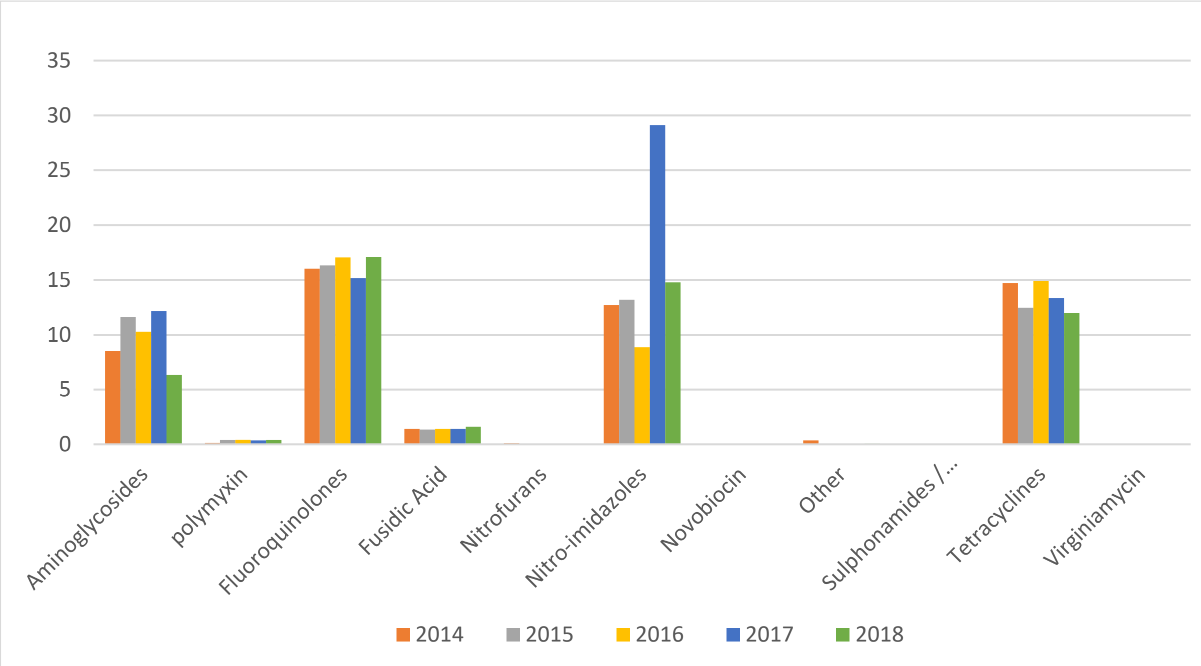


Fig 7. **Antibiotic Sold for Use in Companion Animals by Class (0-35 kg)**



As with previous reports, the majority of antibiotic classes sold for use in companion animals continued to be penicillins followed by first generation cephalosporins, then clavulanic acid based products.

9 Antibiotic Use in Horticulture

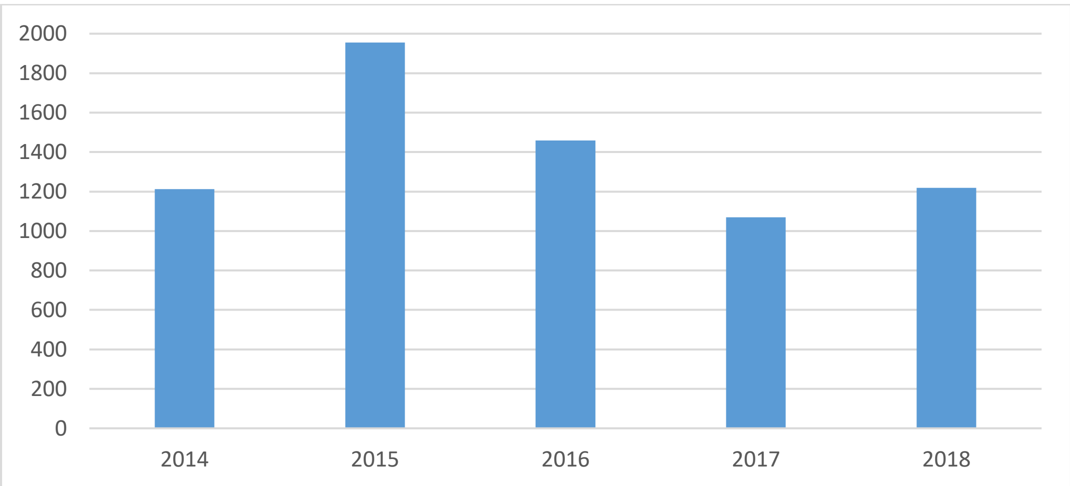
During 2018, there were two products registered for use in plants, both in the aminoglycoside class of antibiotics including streptomycin and kasugamycin. Kasugamycin is registered for use in kiwifruit to treat *Pseudomonas syringae PV. actinidiae* (Psa) infections, while streptomycin is registered for use in pip fruit, stone fruit, and tomatoes to treat fireblight and other bacterial diseases, and kiwifruit to treat Psa . Psa, which was first detected in New Zealand kiwifruit in 2010, has continued to be an issue with this crop with 90% of kiwifruit orchards confirmed as Psa positive during this sales period.

In the pipfruit industry, streptomycin is used to control fire blight which infects new tissue, most importantly blossoms. Streptomycin applications are applied during high risk infection periods, which is over the spring season. A 2016 fire blight outbreak will take a few years of good management to bring under control, including a higher number of blocks requiring treatment and higher number of applications per block being needed.

The kiwifruit industry report that kasugamycin use has been relatively stable over the last 3 reporting periods, especially when considering approximately 350 new Ha was planted during 2018. Disease pressure early in the 2018 year was low, but colder than average temperatures and higher rainfall in the spring and early summer resulted in high seasonal disease pressure.

Total quantities of antibiotics sold for use in plants during 2018 amounted to 1,218 kg, a 14% increase compared to the previous reporting period. Kasugamycin sales increased by 34% while sales of streptomycin increased by 3% compared to 2017. Industry have commented that the 37% reported reduction in kasugamycin sold during 2017 was not due to a decrease in industry use but instead due to product already in the market. This means that comparing product sold between 2017 and 2018 gives an inaccurate impression of increased use. In this case it is valuable to look at trending over a longer time period. Removing the 2017 sales period and comparing 2018 sales to 2016, quantities sold decreased by 16% for kasugamycin and 17% for streptomycin.

Fig 8. **Total Horticultural Sales (kg)**



10 Sales Analysis by Route of Administration

Antibiotics registered for administration via feed accounted for 37,336 kg or 55% of all antibiotics sold during 2018. This is a decrease in quantity sold for use in feed by 0.3% compared to quantities sold in 2017. Looking at the trend over the last 5 years, antibiotics sold for administration via feed have accounted for 49%-56% of totals sold.

In 2018, 80% of antibiotics sold and registered for administration in feed contained the active ingredient zinc bacitracin and was registered for use primarily in poultry, but approximately 7% of this active that was sold was registered for use in both pigs and poultry. Products containing tetracyclines accounted for 10% of antibiotics sold and administered via feed, while macrolides/lincosamides accounted for 9% of these products. The remaining 1% of products registered for use in feed included quinoxalines and pleuromutilins.

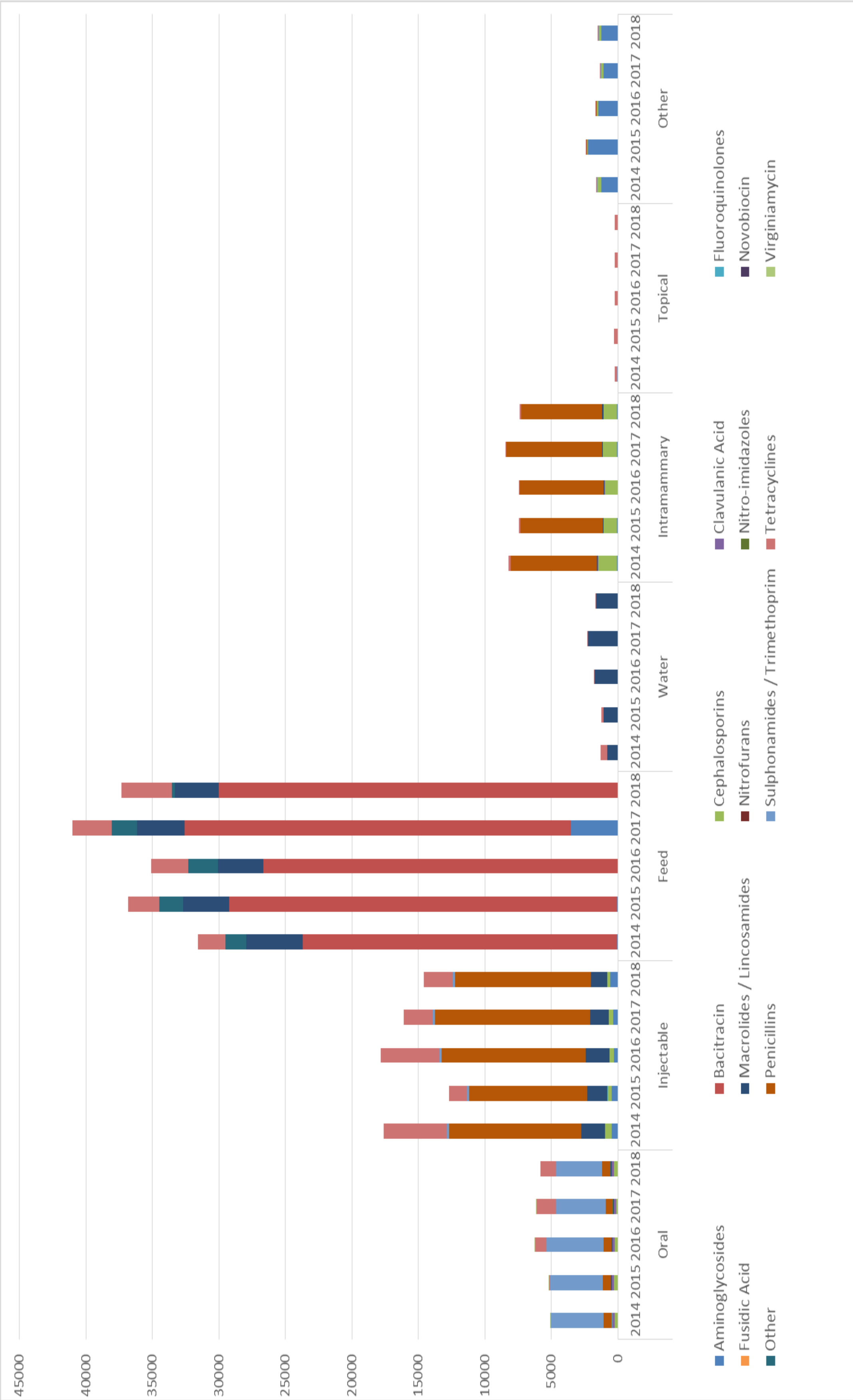
As with previous years, injectable products were the second largest mass of antibiotics sold and accounted for 22% of total sales (14,827 kg). This is a decrease by 13% in terms of quantities sold compared to 2017. Over the last 5 reporting years, injectable products have accounted for between 21% and 27% with an average of 24% of overall sales. During the 2018 reporting period, 71% of injectable product sold contained penicillin, 14% contained tetracycline, 9% contained macrolide/ lincosamide, 4% contained aminoglycoside, 1.5% contained cephalosporin, and 1.5% sulphonamides/trimethoprim.

Intramammary products were the third highest quantity sold per route of administration and accounted for 7,390 kg or 11% of the total quantity of antibiotic sold. Over the last 5 years, intramammary antibiotic quantities sold has ranged between 11% and 13% of total antibiotics sold on an annual basis, with an average of 12% each year. By far the majority of intramammary products sold during 2018 were penicillin-based at 83%, followed by cephalosporin-based products at 14%. The remainder contained tetracyclines, aminoglycosides, macrolides/lincosamides or clavulanic acid, all at less than 1% of total sales. It should be noted that the mass required for treatment with penicillin-based products is generally higher than the mass required for treatment with non-penicillin based products, so the correlation between sales and use in the case of intramammaries is somewhat skewed.

The fourth highest group of sales by administration were oral medications. In 2018, 5,821 kg were sold and accounted for 8% of all sales, similar to the previous year. Over the last 5 years oral antibiotics sold have ranged between 8% and 9% of total sales. The majority of oral antibiotics sold contained sulphonamide/trimethoprim active ingredients at 59%, followed by products containing tetracyclines at 21%, then penicillin at 11% and cephalosporins at 5%.

The remainder of antibiotics sold include those administered via water, by topical administration or other administration routes including intra-aural, intrauterine or horticultural application. These groups comprised 5% of total antibiotics sold during 2018.Ninety-eight percent of product sold for administration in water were tylosin-based products registered for use in pigs and poultry.

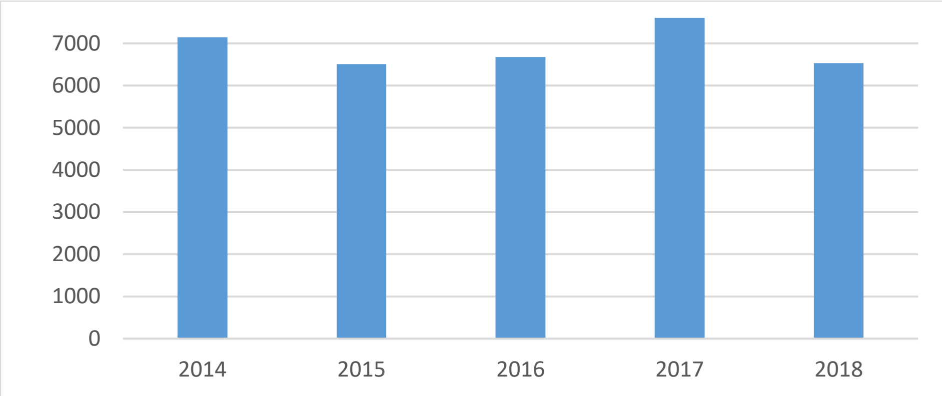
Fig 9. **Antibiotic Sales (kg) by Antibiotic Class and Route of Administration**



11 Dry Cow Therapies

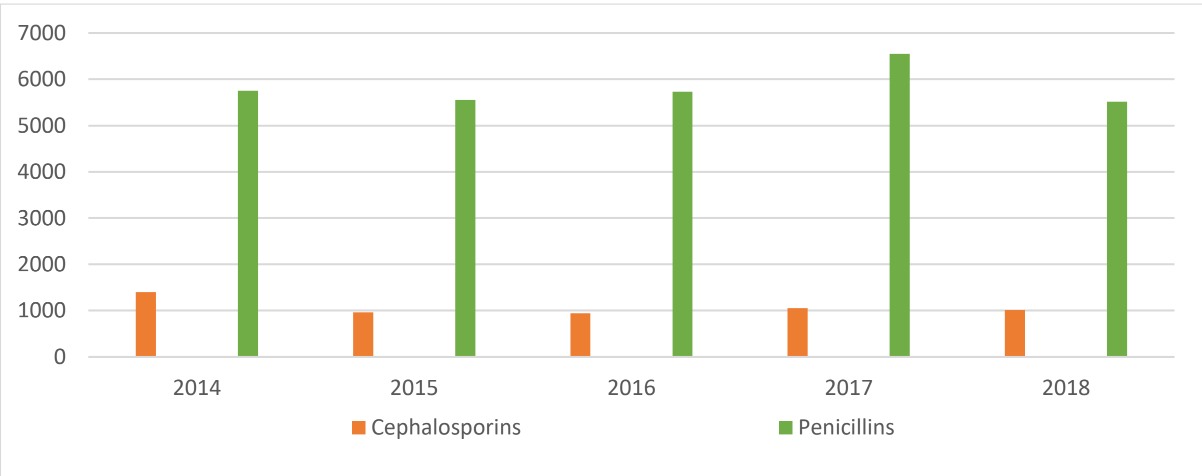
Dry cow therapies (DCTs) are known to fluctuate from year to year with use being dependant on farm finances, on-farm practices, environmental conditions and clinical requirements. During 2018, a total of 6,528 kg of product was sold. This is a reduction of 16% compared to 2017 when 7,748 kg was sold. DCTs sold during this period accounted for 9.5% of overall sales. All DCTs registered are registered for use in cattle only.

Fig 10. **Dry Cow Product (kg)**



All registered DCTs continue to contain either penicillin (cloxacillin ± ampicillin) or first generation cephalosporins (cephalonium or cephapirin). As with previous years, the majority of DCTs sold contained penicillins as active ingredients.

Fig 11. **Dry Cow by Antibiotic Class (kg)**



In 2018, 84% of DCTs contained penicillin, with 28% of the penicillins as ampicillin and 72% as cloxacillin by weight of active ingredient. DCTs containing cephalonium sold in 2018 made up 15% of total DCTs sales while products containing cephapirin benzathine comprised less than 1% of total DCTs. No new DCTs were registered during the 2018 reporting period. Four new DCTs were registered in 2017, but none of these products have contributed to the 2018 reporting period.

Fig 12. **Dry Cow Therapy- By Individual Antibiotic (500-5000 kg)**

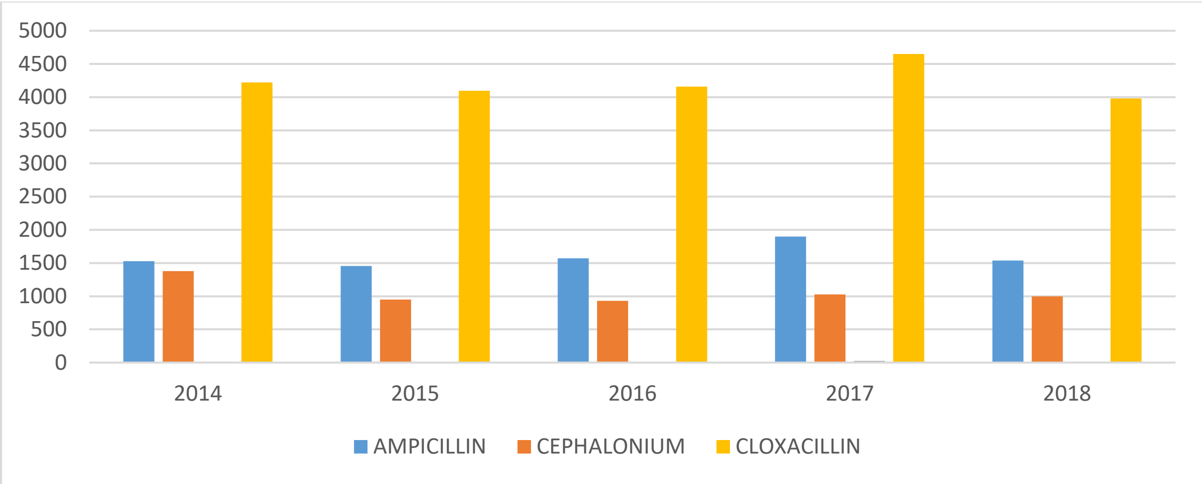
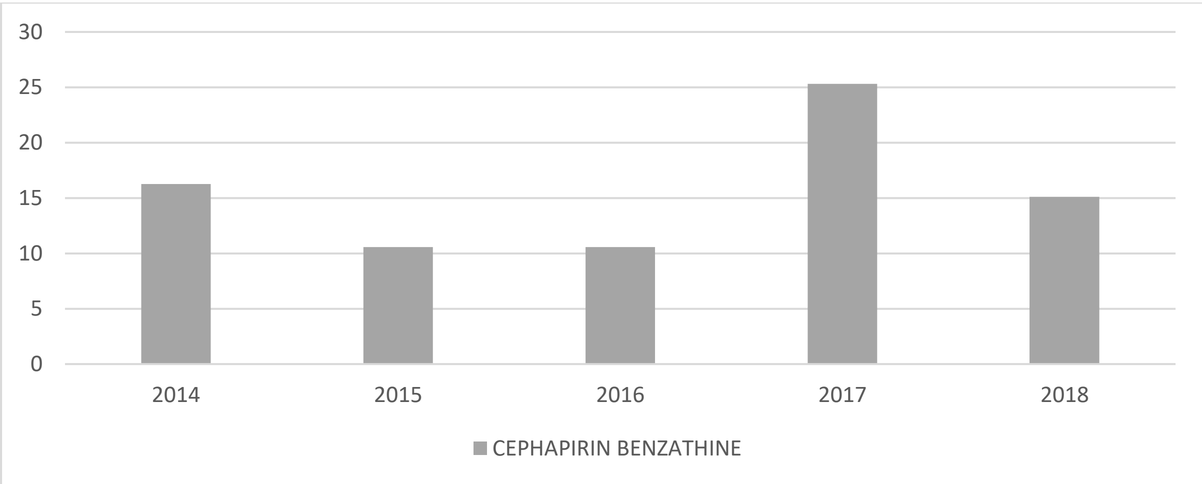


Fig 13. **Dry Cow Therapy- By Individual Antibiotic (5-30 kg)**

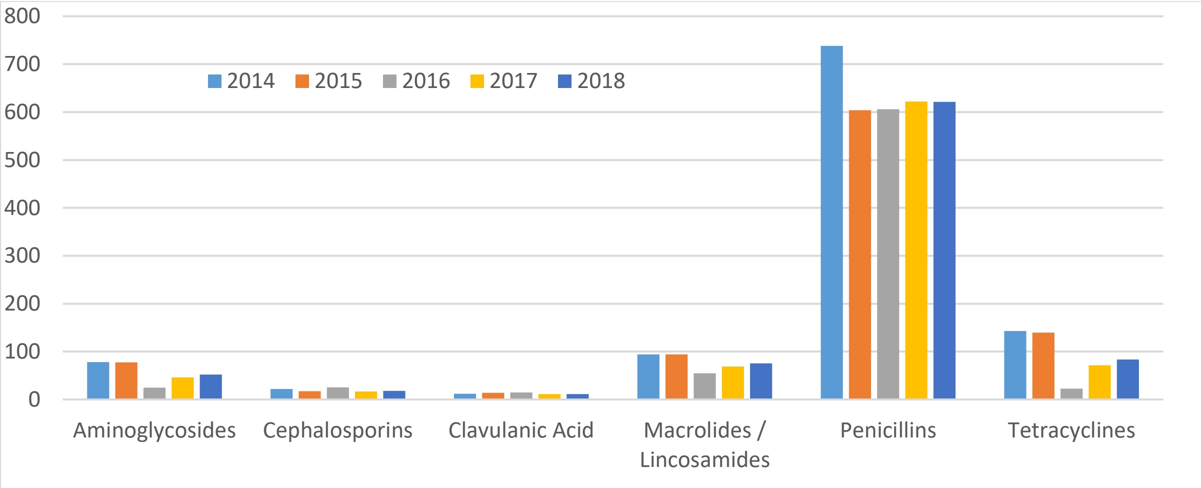


12 Lactating Cow Therapies

Lactating cow therapies (LCTs) are for the treatment of mastitis during lactation and are administered via the teat canal. A total of 862 kg was sold during the 2018 reporting period. This is a 3% increase in quantities of LCTs sold compared to 2017.

Active ingredients used in LCTs remain the same as previously reported and include aminoglycosides, cephalosporins, clavulanic acid, macrolides/lincosamides, penicillins and tetracyclines. Penicillins comprised 78% of all LCTs sold while tetracyclines made up 8.2%, macrolides/lincosamides made up 8%, aminoglycosides accounted for 5% of sales, cephalosporins accounted for 2.3% of sales and clavulanic acid 1.3%. Ninety-eight percent of cephalosporin sales in this category were 1st and 2nd generation, while the remainder was 4th generation.

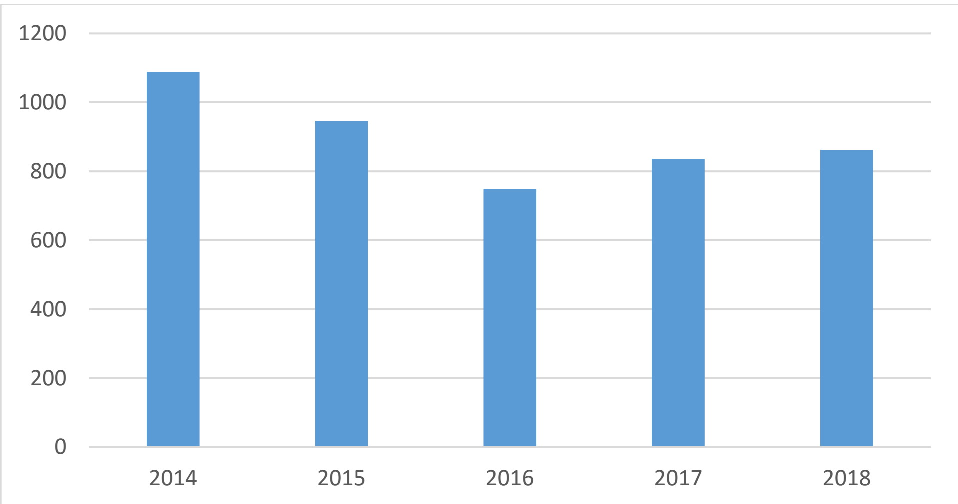
Fig 14. **Lactating Cow Therapies by Antibiotic Class (kg)**



Of note is that one of the lactating cow products is also registered for use as a topical preparation in cats and dogs, although it is unlikely that much product was used in these species.

Between 2014 and 2016, sales of LCTs decreased annually, but in 2017 increased before increasing again in 2018. The overall difference in sales compared to 2014 when 1,088 kg of LCT was sold is a reduction in sales of 21%.

Fig 15. **Lactating Cow- Total Sales of Active (kg)**



13 Total Quantity Sold

The total quantity of antibiotic sold during 2018 was 68,765 kg. This is a decrease of 4% compared to 2017 at which time 71,636 kg was sold.

Table 2: **Total Antibiotic Sales by Class (in kilograms active ingredient)**

Antibiotic Class	2014	2015	2016	2017	2018	Difference 2017-2018 (%)
Aminocoumarins (Novobiocin)	Nil	Nil	Nil	Nil	Nil	
Aminoglycosides	1, 911	2,611	1,870	1,673	1,897	↑ 13
Amphenicols (Florfenicol)	Nil	Nil	Nil	Nil	0.06	
Cephalosporins (Total)	2,457	1,923	1,458	2,080	1,695	↓18.5
Cephalosporins 3rd gen	466.5	288.1	262.2	302.7	233.6	↓23
Cephalosporins 4th gen	3.3	2.7	2.5	3.3	2.4	↓27
Clavulanic Acid	170	178	169	161	184	↑ 14
Fluoroquinolones	40	37	42	42.5	40.9	↓4
Fusidic Acid	1.4	1.4	1.4	1.4	1.6	↑ 14
Macrolides/ Lincosamides	6,946	6,188	6,994	7,355	6,248	↓15
Nitrofurans	0.1	Nil	Nil	0.6	0.45	↓ 25
Nitroimidazoles	14.5	33	39	33	19.7	↓ 40
Penicillins	17,047	16,881	18,275	20,062	17,373	↓ 13
Pleuromutilin (Tiamulin)	Nil	Nil	Nil	98	147.5	↑ 51
Polypeptides (Bacitracin)	23,599	29,172	26,637	29,052	30,031	↑ 3
Polypeptides (Polymyxin)	0.4	0.5	0.5	0.4	0.5	↑ 25
Quinoxalines (Carbadox)	263	175	194	275	100	↓ 64
Streptogramins (Virginiamycin)	13	10	7.5	12	8.5	↓29
Sulphonamides / Trimethoprim	4,153	4,213	4,545	3,991	3,660	↓ 8
Tetracyclines	7,737	4,393	8,503	6,800	7,358	↑ 8
Total	**64,351**	**65,816**	**68,734**	**71,636**	**68,765**	**↓4**

13.1 AMPHENICOLS

There are two products belonging to the amphenicol class of antibiotics registered for use in animals, and both contain the active ingredient florfenicol. 2018 saw the first sales of amphenicols in recent years, and very small quantities were sold. There are two products registered for use in this class, one as an intra-aural solution for use in companion animals, and one for use as an oral medication in pigs.

13.2 AMINOGLYCOSIDES

Aminoglycosides accounted for 2.8% of the total antibiotic sales during 2018 with 1,897 kg sold. This is an increase in sales of 13% compared to 2017.

The largest category of sales was products registered for use in plants and accounted for 64% of aminoglycosides sold, which is an increase of 14% compared to 2017. Industry feedback suggests the increase in sales between 2017 and 2018 was not representative of an increase in use, but due to a reduction in sales during 2017 caused by product already sitting in the market during that time.

The reporting period also saw an increase by 12% in the sale of aminoglycosides that are registered for use in animals . MPI is not able to comment on why this change occurred. While industry feedback was requested on reasoning behind the changes in sales, no information was given.

The second highest category of aminoglycosides were products sold for use in multiple production species, which accounted for 30% of aminoglycoside sales. All products sold in this category are injectable and are registered for use in pigs, sheep and cattle. Compared to 2017, there has been a 15% increase in sales in this category.

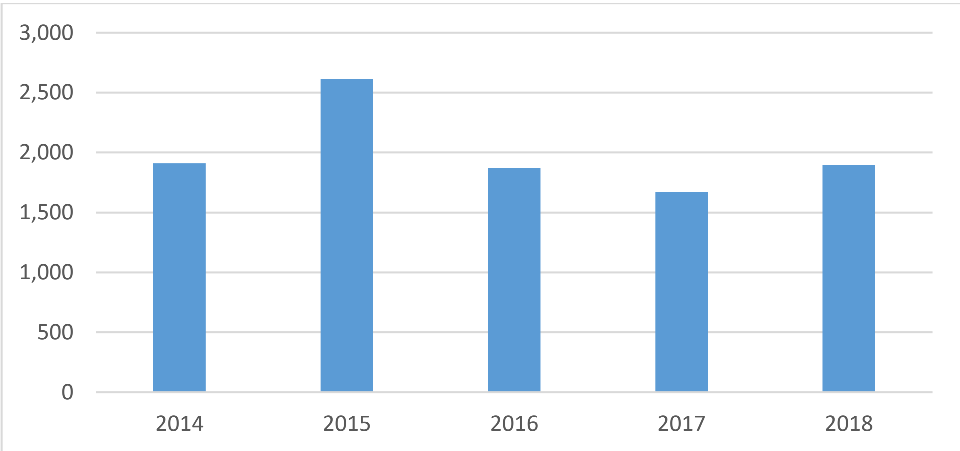
The third highest category of aminoglycoside sales were from products sold for use in multiple species and accounted for 4.4% of aminoglycosides sold. Approximately half of the active sold in this category were lactating animal intramammary products, while the remainder were injectable products registered for use in cats, dogs and horses. Quantities sold in this category increased by 14% compared to 2017.

Products registered for use in companion animals only, pigs/poultry only, and cattle only, individually made up less than 1% of aminoglycoside sales.

The quantities sold that are registered for use in animals have increased across the board apart from those products registered for use in cattle only, companion animals only, and pigs only. The quantities of aminoglycosides sold in companion animals only, decreased by almost half to 6.3 kg while those products registered for use in pigs/poultry also decreased by 17% to 18 kg compared to 2017.

The majority of aminoglycosides sold on an active ingredient basis included streptomycin at 53%, followed by kasugamycin at 26% of sales. Products containing these two actives are predominantly registered for use in plants, however, 28% of streptomycin sold was from products registered for use in multiple production species. Dihydrostreptomycin accounted for 15% of sales and consisted of products registered for use in multiple production species. Individually, the actives neomycin, gentamycin, spectinomycin and framycetin made up less than 5% of aminoglycoside sales.

Fig 16. **Aminoglycosides (kg)**



13.3 CEPHALOSPORINS

Cephalosporins accounted for 2.5% of overall sales in 2018 with a total of 1,695 kg sold. This is a decrease of 18% compared to 2017. Due to the quantity of first generation cephalosporins used in DCTs, the amount of cephalosporins sold is known to fluctuate from year to year.

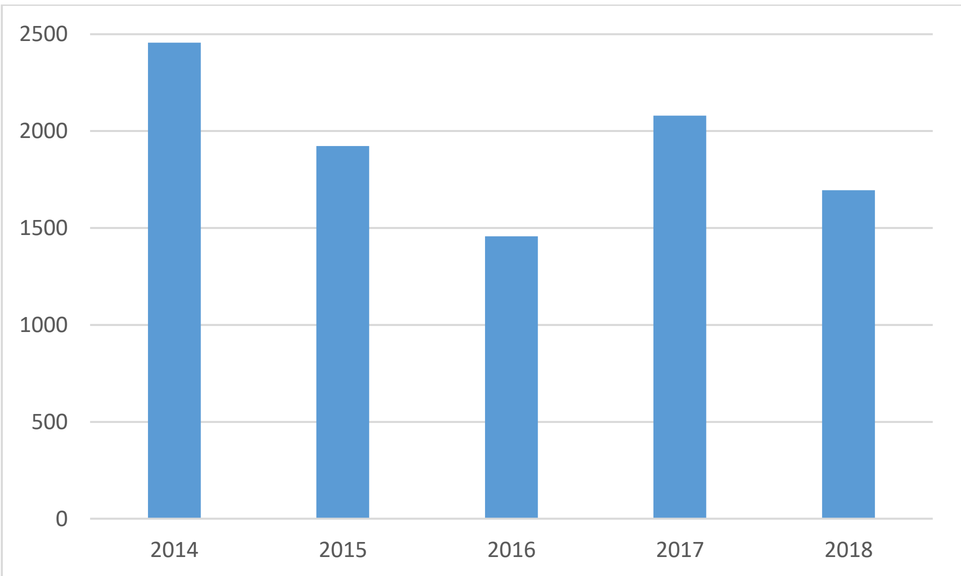
The majority of products sold in this class (85%) contained the first generation cephalosporins; cephapirin, cephalexin or cephalonium. Sales of first generation cephalosporins decreased by 17.5% compared to the previous reporting period to 1, 447 kg. Cephalonium, accounted for 59% of all cephalosporins sold in this class. All products containing cephalonium are DCTs, registered for use in cattle. Sales containing the active ingredient cephalexin accounted for 16% of cephalosporin sales. The cephalexin products sold during this period were all registered for use in companion animals.

Second generation cephalosporin sales decreased by 40% compared to 2017 and totalled 11.6 kg. All second generation cephalosporins registered were intramammary products for treatment of mastitis in cattle during lactation.

Third generation cephalosporins registered for use included the actives ceftiofur, cefpodoxime and cefovexin. Total sales of this group amounted to 234 kg or 14% of all cephalosporins. A decrease in third generation sales of 23% occurred compared to 2017. Eighty-nine percent sold were products containing ceftiofur, all of which are injectable and registered for use in multiple production species. The remainder sold contained the actives cefpodoxime or cefovexin, both of which are registered for use in companion animals. The decrease in sales of third generation cephalosporins compared to 2017 occurred with all three active ingredients. Sales of products containing ceftiofur declined by 24% while sales of cefpodoxime and cefovexin containing produced reduced by 12% and 10% respectively.

Fourth generation cephalosporins accounted for less than 0.1% of overall cephalosporin sales. Compared to 2016, sales decreased by 2.5%. Very small quantities of approximately 2 kg were sold.

Fig 17. **Cephalosporins (kg)**



13.4 FLUOROQUINOLONES

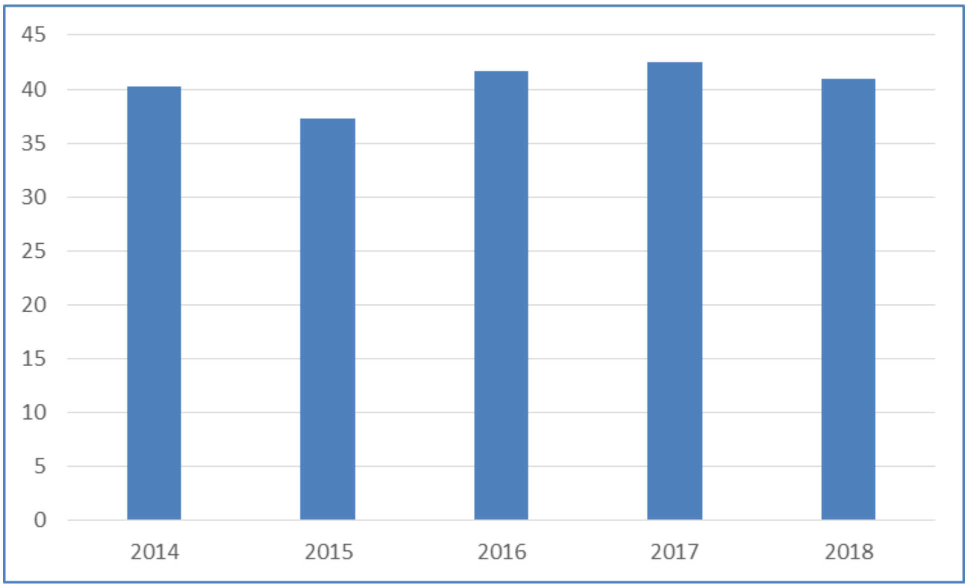
A total of 40.9 kg of antibiotic classed as fluoroquinolones was sold during 2018. This amounted to 0.05% of overall antibiotic sales during this period and was a 4% decrease in sales compared to 2017.

Fluoroquinolones registered for use in companion animals amounted to 17 kg or 42% of fluoroquinolones sold. This is a 13% increase in sales of fluoroquinolones sold for use in companion animals compared to 2017. Actives registered for use in companion animals include enrofloxacin, marbofloxacin and pradofloxacin. The majority sold continue to be oral medications (17.7 kg), with small quantities of product administered by injection or aural administration.

Antibiotics specifically registered for use in cattle include the active marbofloxacin and accounted for 16% fluoroquinolone sales. Sales of fluoroquinolones in this category have increased by 30% compared to 2017. This follows on from an increase of 28% noted between 2016 and 2017. The products registered in this category have treatment claims for respiratory infections and acute mastitis.

Fluoroquinolones registered for use in multiple production species (pigs and cattle) accounted for 42% of sales in this class. The actives include enrofloxacin and marbofloxacin. Sales in this category decreased by 22% compared to 2017.

Fig 18. **Fluoroquinolones (kg)**



13.5 MACROLIDES and LINCOSAMIDES

Overall sales of antibiotics in this class decreased by 15% compared to 2017 with 6,248 kg sold.

The actives sold in this class remained the same as previously reported and included clindamycin, erythromycin, lincomycin, oleandomycin, spiramycin, tulathromycin, tilmicosin and tylosin. The lincosamide group, which includes lincomycin and clindamycin, is monitored with macrolides due to the similar mode of action and spectrum of activity, which means that cross resistance can develop against active ingredients in both classes if it develops against a compound in either class.

Lincosamide sales are historically low and this reporting period is no exception with 58 kg sold. This is a 9% increase compared to 2017 when 53 kg of lincosamides were sold. More than half (58%) of lincosamides sold were registered as intramammary treatments for mastitis during lactation. A total of 16% of sales (9 kg) was from product registered for use in pigs and poultry, while the remainder was registered for use in companion animals.

Sales of macrolides and lincosamides registered for use in cattle declined by 15% to 209 kg compared to 2017. This reflects a similar decline in sales of these products when comparing 2016 and 2017 when sales decreased by 13.5%. Products sold during 2018 that were registered for use in cattle included injectable products and intramammary products containing the actives lincomycin, tilmicosin or tylosin.

Macrolides and lincosamides registered for use in pigs or poultry or pigs and poultry decreased by 23% compared to 2017 and totalled 1,832 kg. Products sold during this period were registered for administration in feed or in water, and included the actives tylosin, lincomycin or tilmicosin.

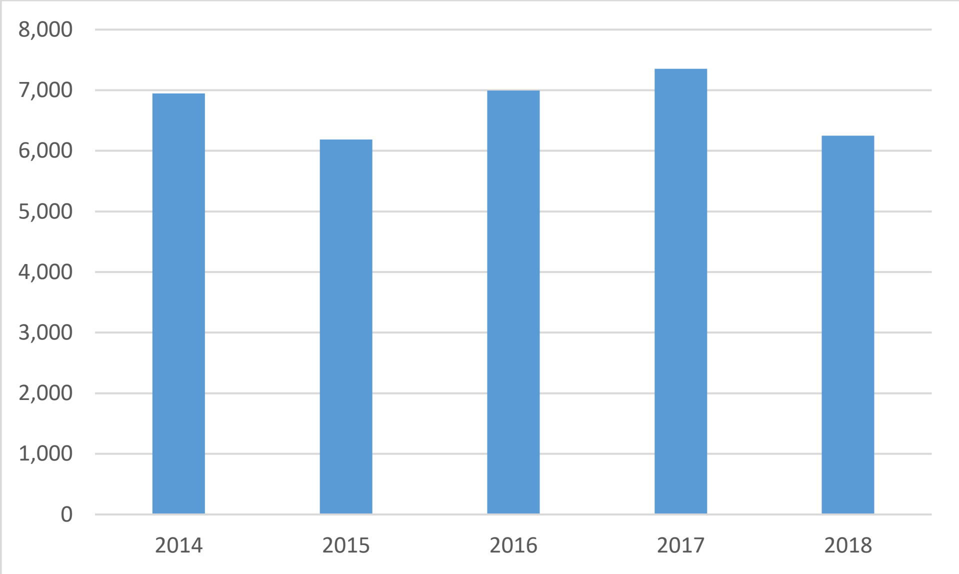
Sales of macrolides and lincosamides registered for use in companion animals decreased by 33% compared to 2017 with a total of 43 kg sold. All of the sales included oral medications with the active ingredient either spiramycin or clindamycin.

When looking at macrolides only, sales decreased by 15% compared to 2017 with a total quantity of 6,190 kg sold. By far the majority (95%) of macrolides sold included the active ingredient tylosin at 5,906 kg. Products containing this active have decreased in quantities sold by 16% compared to 2017. The majority (52%) of tylosin-based products sold were registered for use in pigs, poultry and cattle, with the remainder registered for use in multiple species and multiple production species. Fifty-two percent of tylosin-based products sold were registered for administration via feed for use in pigs, cattle and poultry, followed by products administered via water for pigs and poultry (28%). The remainder of tylosin-based products are sold as injectable products (20%), for use in cattle only or for use in multiple production species.

The main decrease in sales of macrolides is attributed to a decrease in the sales of the actives spiramycin (↓ 49%) and tylosin (↓16%).

The overall quantities sold for spiramycin, oleandomycin and tulathromycin were small at 28 kg, 42 kg and less than 1 kg respectively.

Fig 19. **Macrolides/Lincosamides (kg)**



13.6 NITROFURANS

There is only one product registered for use containing this class of antibiotics and it is registered for use in tropical fish. Sales in this class amounted 0.445 kg.

13.7 NITROIMIDAZOLES

The total quantity of nitroimidazoles sold during 2018 was 20 kg. Compared to 2017, there was a drop in sales of 39%, which follows on from a decrease of 15% when comparing 2017 to 2016. The active ingredients sold in this class include metronidazole, dimetridazole and ronidazole.

Metronidazole is registered for use in companion animals and accounted for 75% of sales in this class during 2018. Compared to 2017, sales decreased by 49% while during 2017 increased by 231% compared to 2016.

Products containing dimetridazole account for 17% of nitroimidazoles sold during 2018. Sales of this active increased by 52% although overall only very small quantities were sold (less than 5 kg). The increase differs from the previous reporting period at which time sales decreased by around 1000%. Products containing this active are registered for use in pigs, turkeys, chickens and game birds.

A small quantity of product that contains the active ingredient ronidazole was sold for use in pigeons. Compared to the overall mass of antibiotics, the amount of nitroimidazoles sold is very small.

13.8 NOVOBIOCIN

No products containing novobiocin are currently registered for veterinary use in New Zealand.

13.9 OTHER

This category contains antibiotics that cannot be attributed to other classes of antibiotic and includes carbadox, tiamulin and fusidic acid.

During 2018 a total of 249 kg of these active ingredients were sold compared to 2017 when 374 kg were sold. This is a reduction in sales of 33% compared to the previous reporting period, which is in contrast to the 2017 reporting period that had an increase in sales of 185% compared to 2016. Sales in this category accounted for less than 1% of overall sales during 2017.

Sales of carbadox decreased by 64% compared to 2017 with 100 kg sold. This active ingredient is registered solely for use in weaner pigs to prevent swine dysentery and as an antiparasitic.

Tiamulin sales amounted to 147.5 kg in 2018, an increase of 51% compared to the previous reporting period. Products containing this ingredient are registered for use in poultry to treat chronic respiratory disease and in pigs to treat mycoplasma pneumonia. MPI is not able to comment on why this change occurred. While industry feedback was requested on reasoning behind the changes in sales, no information was given.

Fusidic acid sales were incorrectly reported in 2017 as decreasing from 1.4 kg in 2016 to 0.6 kg. Sales were in fact stable with 1.4 kg sold annually for 4 years running between 2014 and 2017. During 2018, sales did increase to 1.6 kg. Products containing this ingredient are registered for use in companion animals as topical medications.

13.10 POLYMYXINS

Polymyxins were added to the WHO list of critically important antibiotics in 2016 to reflect the greater importance of this group for the treatment of Gram negative bacilli. Colistin use is increasing globally to treat serious infections in humans. No products containing colistin are registered for use in New Zealand.

Products containing polymyxins continue to be registered for use in cats, dogs and horses only, as topical, optic or aural medications. A total of 0.5 kg of this ingredient was sold during 2018. Although this is a 12% increase in sales compared to 2017, very small quantities were sold. Due to the relative difference in importance to AMR, the polypeptide zinc bacitracin is considered separately in this report.

13.11 PENICILLINS

During 2018, the most recent WHO report (published 2016), outlining the antimicrobials of greatest human importance, classified the majority of penicillins as critically important. The penicillins in the critically important group registered in New Zealand for use in animals included amoxicillin, ampicillin, penethamate, penicillin G benzathine and penicillin G procaine. Cloxacillin was categorised as highly important.

Total penicillin sales during 2018 amounted to 17,557 kg (including 184 kg of clavulanic acid which has not previously been included in the penicillins group) or 26% of overall sales. Compared to 2017, this is a decrease of 13% (including the 161 kg of clavulanic acid sold during that year).

Amoxicillin and amoxicillin/clavulanic acid sales during to 2018 amounted to 1,450 kg. This is an increase of 13% compared to 2017 when 1,284 kg were sold. The majority sold in this category were registered for use in companion animals (45%), followed by products registered for use in multiples species (41%). Products registered for use in multiple production species accounted for 10% of sales, while those registered for use in cattle made up 4% of sales.

Products sold that contained the active ingredient ampicillin amounted to 1,537 kg during 2018. This is a 20% reduction compared to 2017 when 1,902 kg was sold. All products sold in this category were registered for use in cattle as intramammary preparations.

Cloxacillin sales decreased in 2018 by 10% to 4,359 kg, compared to the previous reporting year, and accounted for 28% of all penicillins sold. Almost all products containing cloxacillin (96%) were registered for use as intramammary treatments, with the remainder being registered as injectable products for use in cattle or as an ocular treatment for use in multiple species.

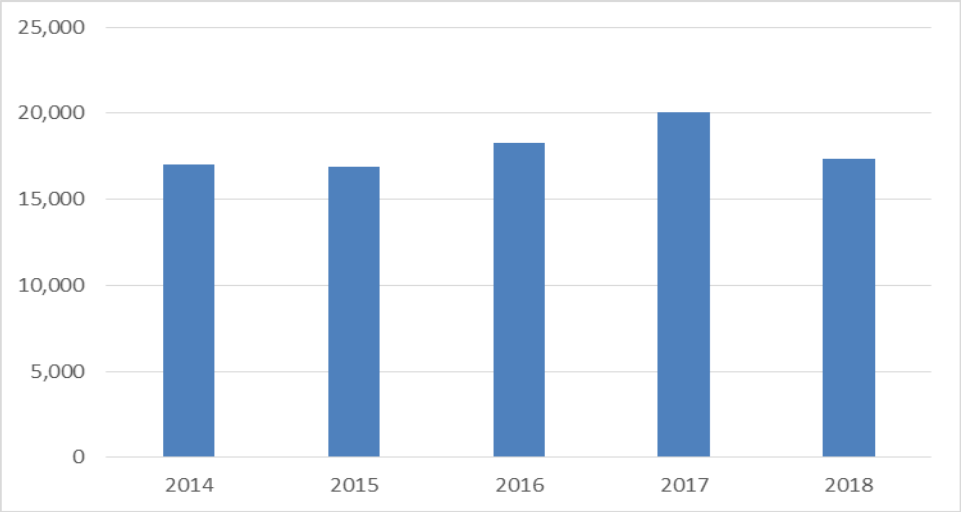
Penethamate accounted for 4% of all penicillins sold in 2018 (674 kg), a 5% decrease in sales compared to 2017 when 711 kg was sold. All products containing this active were registered for administration via injection for multiple production species (77%) or for cattle (23%).

Penicillin G (benzathine and procaine) sales in 2018 decreased compared to the previous reporting year by 18% to a total of 9,536 kg sold. This amounts to 56 % of all penicillins sold during 2018 (not including clavulanic acid) and 14% of overall antibiotic sales. The majority (95%) were for administration via injection with the remainder for intramammary administration. Seventy-seven percent sold was registered for use in multiple species, 21% sold was registered for use in cattle, 1.3% sold was registered for use in sheep, and less than 1% sold was registered for use in multiple production species.

Comparing penicillin sales to the WHO classification system, the critically important penicillin sales amounted to 13,014 kg during 2018 compared to 14,419 kg in 2017, a decrease of 10%. The majority (61%) were injectable products that were registered for use in multiple species. This was followed by sales of products registered for use in cattle (26%), all of which were for administration via injection or as intramammary products. Critically important penicillins used in companion animals accounted for 4% of the overall sales in this category. All were oral medications containing the active ingredient, amoxicillin. There were no penicillins in this category sold that are registered for use in pigs or poultry.

Cloxacillin was the only penicillin registered for use in New Zealand not listed as critically important by WHO. Cloxacillin sales during 2018 amounted to 4,359 kg which accounted for 25% of all penicillins sold, or 6% of overall sales during this period. Almost all products containing cloxacillin (95%) were registered for use as intramammary treatments.

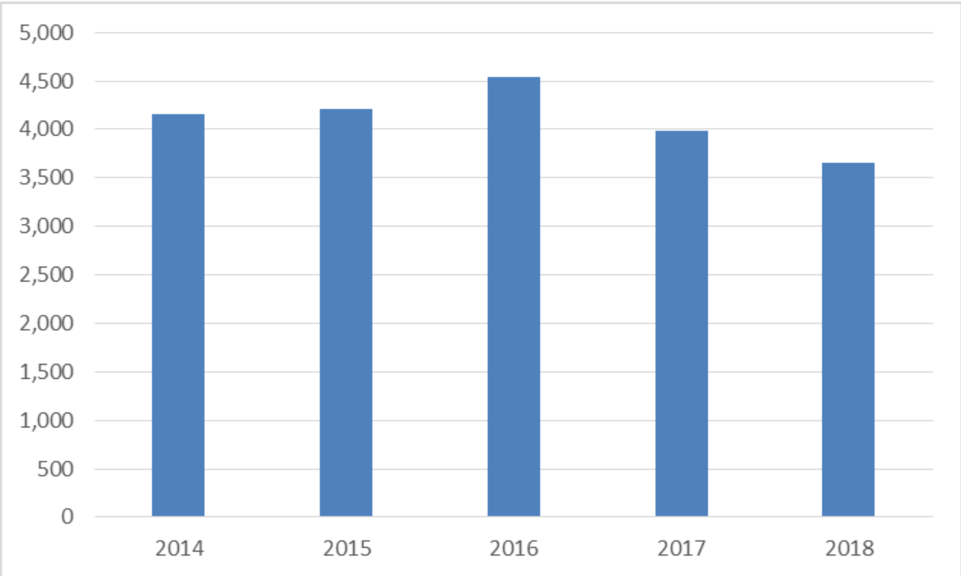
Fig 20. **Penicillins (kg)**



13.12 SULPHONAMIDES/TRIMETHOPRIM

During 2018 sulphonamides/trimethoprim accounted for 3,660 kg or 5% of overall sales. This is an 8% decrease compared to the previous reporting period. The majority of product sold is registered for use in horses (55%), followed by products registered for use in multiple species (40%). Small quantities sold were registered for use in cattle or in multiple production species. There were no sales of products registered for use in companion animals. There are no longer any products containing these actives registered for use in poultry.

Fig 21. **Sulphonamides/Trimethoprim (kg)**



13.13 TETRACYCLINES

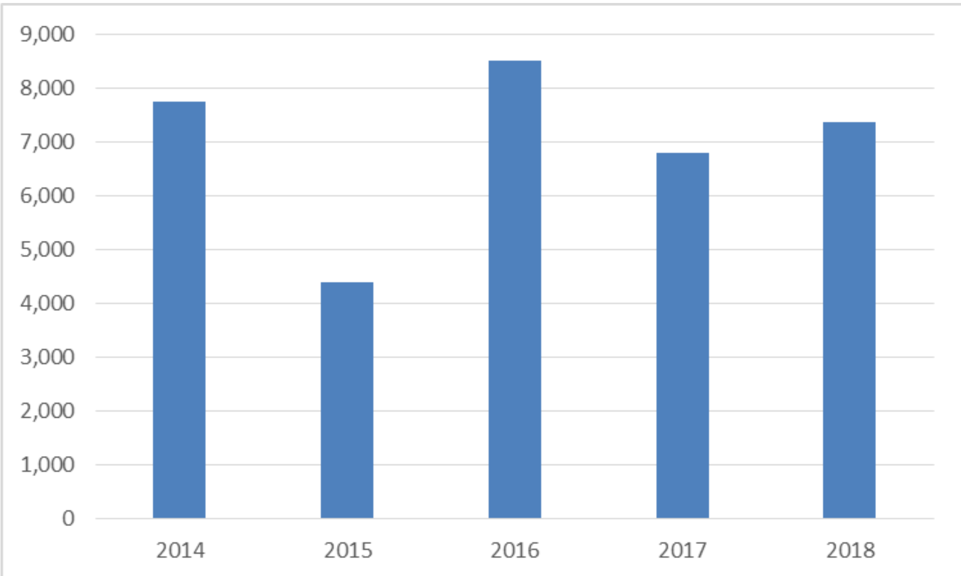
In 2018, 7,358 kg of tetracyclines were sold, which accounted for 11% of overall antibiotics sold. This is an increase in sales of 8% compared to 2017. The increase has resulted from an increase in sales of products registered for use in multiple production species. MPI is not able to comment on why this change occurred. While industry feedback was requested on reasoning behind the changes in sales, no information was given. Sales registered for use in cattle only, companion animals, multiple species and other have remained very similar compared to 2017, while sales of products registered for use in pigs and poultry have dropped to zero.

The active ingredients used in this class include oxytetracycline, doxycycline and chlortetracycline. Oxytetracycline accounted for 99% sold in this class. The majority of this active sold was for administration via feed (52%), followed by injectable products (27%), then products for oral administration (16%). Three percent of products containing oxytetracycline were registered for topical administration via sprays. Doxycycline accounted for only 0.2% of tetracyclines sold and was registered for use in companion animals as well as aviary birds and pigeons. Chlortetracycline accounted for 0.1% of tetracyclines sold and was registered for use as a topical medication in multiple production species and as an intrauterine product for use in cattle. Quantities of chlortetracycline have reduced significantly since the previous reporting period due to a decline in use in products registered for use in pigs and poultry.

The majority of tetracyclines sold was registered for use in multiple production species (95%), followed by products registered for use in multiple species (4%). Less than 1% of tetracyclines sold were registered for use in cattle only, companion animals and aviary birds/pigeons.

When looking at route of administration, the majority of tetracyclines sold were registered for use in feed (52%), followed by injectables (27%), then oral administration (16%). As with 2017, 3% of antibiotics sold in this class were for topical use as sprays and 1% or less were registered for use as intramammary and intrauterine treatments as well as ocular and in water treatments.

Fig 22. **Tetracyclines (kg)**



13.14 Virginiamycin

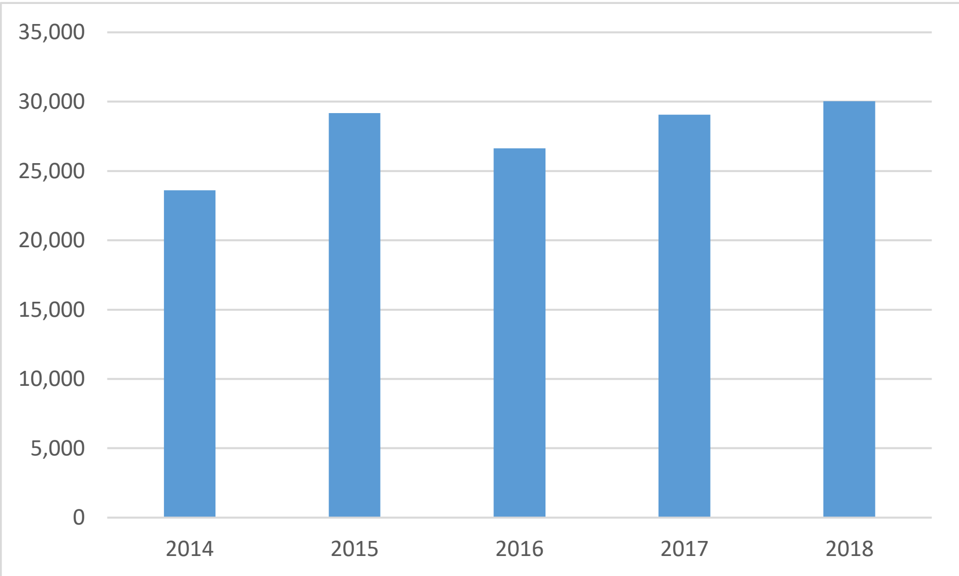
While there are products registered in New Zealand containing virginiamycin for use in horses and poultry, only products registered for use in horses were sold. The amount sold was very low at 8.5 kg and the products sold were registered for treatment of laminitis. The quantity sold decreased by 29% compared to 2017. Aside from 2017 when there was a 60% increase, there has been a downward trend in sales when considering the previous 3 years.

13.15 Zinc Bacitracin

Bacitracins are currently classified by the WHO as 'important' to human health. Zinc bacitracin is registered for use in pigs and poultry to prevent necrotic enteritis, a disease caused by *Clostridium perfringens*. Necrotic enteritis can result in significant loss if not prevented. A small number of products containing the polypeptide, polymyxin, are registered for use in companion animals and multiple species. As reported above, polymyxins accounted for less than 1 kg of total sales in 2018.

Zinc bacitracin represents 44% of the total amount of antibiotic sold during this reporting period. During 2018, 30, 031 kg of Zinc bacitracin was sold. This is an increase of 3% compared to 2017 when 29,072 kg was sold. Over the past 5 year period, sales have steadily increased which somewhat mirrors the increase in the poultry population grown for meat and eggs in New Zealand.

Fig 23. **Polypeptide (Bacitracin) (kg)**



14 Conclusions

The 4.5% reduction in total sales of antibiotics registered for use in plants and animals in New Zealand may be due to an overall reduction in animal population. The sheep, pig and dairy cattle population decreased, while the beef cattle and poultry populations increased. The cause of the decrease in sales is not clear but could have resulted from decreased disease prevalence, stockpiling of product in the previous reporting year, or an increase in prudent use.

A reduction in quantities in four of the six classes of critically important antibiotics may demonstrate prudent use of antibiotics used by veterinarians. Overall, critically important antibiotics decreased by 13.7%**.**

15 Correction of data submitted for previously published report

In 2019 MPI was informed by two registrants that data they had submitted in previous years had been incorrectly reported, in some cases back to 2015. This means that some numbers in previous reports are incorrect, specifically relating to aminoglycosides, cephalosporins, fusidic acid, macrolides, penicillins, streptogramins, sulphonamides/trimethoprim and tetracyclines. In most cases, the data originally submitted was less than what should have been reported. The following table shows the corrected data as highlighted and bracketed. The non-highlighted numbers are the data used in the previous reports.

Table 3. Correct Sales Data

Antibiotic Class	2014	2015	2016		2017	2018	Difference 2017-2018 (%)
Aminocoumarins (Novobiocin)	Nil	Nil	Nil		Nil	Nil	
Aminoglycosides	1, 911	2,611	1,870		1,557) (1,673)	1,897	↑ 13
Amphenicols (Florfenicol)	Nil	Nil	Nil		Nil	0.06	
Cephalosporins (total)	2,457	1,662 (1,923)	1,614 (1,458)		1,677 (2,080)	1,695	↓18.5
Cephalosporins 3rd gen	466.5	288.1	262.2		302.7	233.6	↓23
Cephalosporins 4th gen	3.3	2.7	2.5		3.3	2.4	↓27
Clavulanic Acid	170	178	169		161	184	↑ 14
Fluoroquinolones	40	37	42		42.5	46.8 (40.9)	↓4
Fusidic Acid	1.4	1.4	1.4		0.1 (1.4)	1.6	↑ 14
Macrolides/ Lincosamides	6,946	6,188	6,994		7,316 (7,355)	6,248	↓15
Nitrofurans	0.1	Nil	Nil		0.6	0.45	↓ 25
Nitroimidazoles	14.5	33	39		33	19.7	↓ 40
Penicillins	17,047	15,646 (16,881)	17,803 (18,275)		19,402 (20,062)	17,373	↓ 13
Pleuromutilin (Tiamulin)	Nil	Nil	Nil		98	147.5	↑ 51
Polypeptides (Bacitracin)	23,599	29,172	26,637		29,052	30,031	↑ 3
Polypeptides (Polymyxin)	0.4	0.5	0.5		0.4	0.5	↑ 25
Quinoxalines (Carbadox)	263	175	194		275	100	↓ 64
Streptogramins (Virginiamycin)	13	10	7.5		8 (12)	8.5	↓29
Sulphonamides / Trimethoprim	4,153	4,203 (4,213)	4,544 (4,545)		3,971 (3,991)	3,660	↓ 8
Tetracyclines	7,737	4,267 (4,393)	8441 (8,503)		6,821 (6,800)	7,516 (7,358)	↑ 8
Total	**64,351**	**64,416 (65,816)**	**68,321 (68,734)**		**70,406 (71,636)**	**68,553 (68,765)**	**(↓4)**

16 Acknowledgements

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Dairy NZ
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New Zealand Feed Manufacturers
New Zealand Veterinary Association (NZVA)
NZ Pork
Poultry Industry of New Zealand (PIANZ)
Registrants of antibiotic trade name products in New Zealand

17 Antimicrobial Products Registered in New Zealand under the ACVM Act 2014-2018

DATE REGISTERED		REG'N NUMBER	PRODUCT NAME	REGISTRANT	ACTIVE INGREDIENT(S)	CLASS
2018	11/05/2018	A011554	Tri Sil Oral Powder	Randlab Australia Pty Ltd	Sulphamethazine Trimethoprim	Sulphonamides / Trimethoprim
	13/6/2018	A011574	Ethicillin	Ethical Agents Veterinary Marketing Limited	Penicillin G Procaine	Penicillins
2017	24/01/2017	A011316	Marbocyl P	Ethical Agents Veterinary Marketing Limited	Marbofloxacin	Fluoroquinolones
	28/02/2017	A010955	Metrivet	Agrihealth NZ Limited	Cephapirin benzathine	Cephalosporins
	8/03/2017	A011329	Mastiplan	Schering-Plough Animal Health	Cephapirin sodium	Cephalosporins
	22/05/2017	A011405	Apex Doxy 100 Paste	Apex Laboratories NZ Ltd	Doxycycline	Tetracyclines
	28/06/2017	A011433	Duramast DC 500	Norbrook NZ Ltd	Cloxacillin / ampicillin	Penicillins
	28/06/2017	A011434	Duramast DC 600	Norbrook NZ Ltd	Cloxacillin / ampicillin	Penicillins
	28/06/2017	A011435	Solodox DC 600	Norbrook NZ Ltd	Cloxacillin	Penicillins
	4/07/2017	A011175	Cefaclear	Zoetis	Cephalonium	Cephalosporins
	29/08/2017	A011484	Lincovet	Agrihealth NZ Limited	Lincomycin / Neomycin	Macrolides/ Lincosamides & Aminoglycosides
	6/11/2017	A011416	Osurnia Ear Gel for Dogs	Elanco Animal Health	Florfenicol	Amphenicols
2016	17/02/2016	A011142	Forcyl	Ethical Agents Veterinary Marketing Limited	Marbofloxacin	Fluoroquinolones
	14/03/2016	A011140	Oridermyl	Ethical Agents Veterinary Marketing Limited	Neomycin	Aminoglycosides
	4/11/2016	A011314	Excenel Flow	Zoetis	Ceftiofur	Cephalosporins
	27/04/2016	A011216	Cephalexin 600 Tablets with Beef Flavouring	Apex Laboratories Pty Limited	Cephalexin	Cephalosporins
2015	11/02/2015	A011126	Dryclox Xtra	Bayer NZ Ltd	Cloxacillin + Ampicillin	Penicillins
	11/02/2015	A011125	Dryclox DC	Bayer NZ Ltd	Cloxacillin + Ampicillin	Penicillins
	28/07/2015	A011156	Veraflox 25mg/mL Oral Suspension for Cats	Bayer NZ Ltd	Pradofloxacin	Fluoroquinolones
	18/08/2015	A011069	Furan - 2	Brooklands Aquarium Ltd	Nitrofurazone	Nitrofurans

	24/08/2015	A011195	TilmoVet 300 Injection	Agrihealth NZ Limited	Tilmicosin	Macrolides/Lincosamides
	21/09/2015	A010991	Clinicin	Chanelle Pharmaceuticals Manufacturing Ltd	Clindamycin	Macrolides/Lincosamides
	29/09/2015	A011182	Neotopic H Lotion	Ceva Animal Health (NZ) Ltd	Neomycin	Aminoglycosides
	3/11/2015	A011173	CloxaSeal 600	Norbrook NZ Ltd	Cloxacillin	Penicillins
	13/11/2015	A011130	Apex PMP Ear Suspension for Dogs and Cats	Apex Laboratories NZ Ltd	Polymyxin	Polypeptides
	19/11/2015	A011232	Enro 100 Injectable Solution	Randlab Australia Pty Ltd	Enrofloxacin	Fluoroquinolones
	10/12/2015	A011249	Clindacure	Chanelle Pharmaceuticals Manufacturing Ltd	Clindamycin	Macrolides/Lincosamides
2014	10/01/2014	A010984	Neove 200 Tylosin Injection	Neove Pharma Australia Pty Ltd	Tylosin	Macrolides/Lincosamides
	30/01/2014	A010848	Kelacef	Kela N.V.	Ceftiofur	Cephalosporins
	24/02/2014	A010920	Penethaject RTU	Bayer NZ Ltd	Penethamate	Penicillins
	18/3/20104	A011026	Norocef RTU	Norbrook NZ Ltd	Ceftiofur	Cephalosporins
	8/04/2014	A011025	DC Duo	Bayer NZ Ltd	Cloxacillin + Ampicillin	Penicillins
	29/04/2014	A010792	Ultraclox 24	Bayer NZ Ltd	Cloxacillin	Penicillins