Veterinary Medicines Directorate

UK Veterinary Antibiotic Resistance and Sales Surveillance Report

UK-VARSS 2024

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Foreword

Robust, transparent, and actionable data is central to our efforts to tackle antimicrobial resistance (AMR). As we report on antibiotic sales, use and resistance data in animals from the first year of the UK's second National Action Plan on AMR (2024-2029), the VARSS report continues to evolve - not only in the breadth and depth of surveillance but in the quality and usability of the data it presents.

This year, we have introduced new metrics for reporting antibiotic sales and use, which means that the familiar mg/kg figures will look different. These changes reflect our commitment to regional harmonisation, enabling more meaningful comparisons across neighbouring countries. While the absolute figures may differ, the underlying trends remain the same and are key to evaluating progress over time, highlighting progress or challenges, within individual animal sectors.

However, mg/kg figures are not well suited for comparing antibiotic use across different animal sectors. This is in part because the number of animals included in the population weight is influenced by the lifecycle of the sector's animals. Sectors with shorter lifecycles contribute many more animals to their denominator weight than those with longer lifecycles. This skews comparisons between sectors, making mg/kg data more appropriate for tracking trends within individual sectors rather than making comparisons between them.

Examining this year's data, overall antibiotic sales for food producing animals have remained stable, with the use of highest-priority critically important antibiotics staying at very low levels. Sector-level data reveals both encouraging progress and persistent challenges within different sectors. Notable reductions have been achieved in several areas, with trout recording their lowest antibiotic use to date. At the same time, several sectors have seen some increase in use, with pigs and gamebirds recording upticks in use over the last two years, resulting in these sectors missing their RUMA Targets Task Force (TTF) 2024 targets. These stewardship challenges underscore the importance of maintaining a strong focus on biosecurity and disease control, as disease pressures continue to be a key driver for increases in use.

Another new introduction to this year's report is presenting 10 years of clinical surveillance data for each animal species, offering a longer-term perspective on resistance trends in bacteria causing disease in animals. In most animal species, we see clear declines in resistance, reflecting the sustained efforts to reduce antibiotic use across the farming sector and mirroring the overall reduction in AMR carried by animals entering the food chain. More detailed data also enables us to detect areas where trends are going in the other direction; for example, increasing neomycin resistance in pigs, which correlates with increasing aminoglycoside usage over the last 10 years.

Like the usage data, our key indicators for resistance from the harmonised monitoring programme in poultry present a nuanced picture in 2024. For the first time, we have

observed a notable drop in the level of full susceptibility in *E.coli* in broilers, despite decreasing antibiotic use in this sector. However, it is reassuring to see that the remaining key indicators for resistance remain stable, with no increases to the levels of multi-drug resistance or resistance to highest-priority critically important antibiotics. We will be watching results from coming years closely to see how this develops.

The complexity of AMR is further highlighted as we continue to see other resistance patterns that cannot be explained by usage data alone. *Campylobacter* resistance to fluoroquinolones remains high in broilers, despite minimal use. This is an example of how resistance can persist if there is no evolutionary fitness cost for the bacteria - once it's established in a population, it can be hard to reverse. It is a clear reminder that prevention is better than cure. We have also detected resistance to antibiotics not used in animals, highlighting the need to better understand transmission routes, including those from humans, wildlife, and the environment. These findings reinforce the importance of maintaining a broad and integrated surveillance approach, capable of capturing both expected and unexpected trends in resistance and emerging issues and informing potential mitigating actions within and beyond animal health.

In parallel to the work conducted in livestock, we are seeing encouraging progress in the companion animal sector. For the first time we have been able to report on equine antibiotic usage, with data collected from approximately 25% of the sector. Stewardship is also moving in the right direction, with sales of antibiotics for dogs and cats showing a sustained downward trend. These developments are supported by work led by the VMD to close long-standing AMR data gaps in companion animals. The *Healthy Cats and Dogs* pilot project, commissioned by VMD and delivered by SRUC, is generating baseline AMR data in pets for the first time. Under the *Private Laboratories Initiative*, the VMD is working to develop new public-private partnerships to capture AMR data, including from companion animals, held in private veterinary labs in our national clinical surveillance outputs. This will improve our understanding of AMR in animals and our ability to respond to emerging threats. Together, these strands of work represent a strong and coordinated effort to ensure companion animals are fully embedded in the UK's One Health response to AMR.

Alongside our national efforts, the UK continues to champion coordinated global action on antimicrobial resistance and remains committed to playing a leading role in the global response to antimicrobial resistance, including supporting implementation of the 2024 UN General Assembly (UNGA) commitments on AMR. The closure of the Fleming Fund at the end of this financial year - previously the UK's flagship programme supporting AMR surveillance and capacity-building in low- and middle-income countries - represents a significant shift in the international landscape for AMR. We are working across government to identify and prioritise international work that can continue to deliver impact globally. Currently, a key area of focus is our active support for the establishment of the *Independent Panel on Evidence for Action* (IPEA) in 2025. This new panel will strengthen global AMR governance by providing multisectoral, policy-relevant scientific evidence to support Member States in addressing AMR.

As we look ahead to the next phase of the UK's response to antimicrobial resistance, our focus turns to the actions and commitments that will shape progress over the coming years. We look forward to the publication of the new *RUMA Targets Task Force* targets for 2025–2029, which will build on progress to date and drive improvements in stewardship across key livestock sectors. By the end of 2026, the ruminant sector is expected to publish its new roadmap, providing a clearer framework for improving antibiotic stewardship and generating better, more actionable data. In government, we are taking forward the recommendations made by the *Public Accounts Committee* for UK action on AMR, which highlight the need for stronger accountability, improved data sharing across sectors, and sustained international leadership. These priorities align closely with our commitment to delivering measurable impact through the UK's second National Action Plan on AMR and supporting the UK's Biological Security Strategy.

Surveillance can be described as "evidence for action", and the VARSS report allows us to take stock of our UK antibiotic and antimicrobial resistance data in this light. Taken together, the findings presented in this year's report once more reinforce the need for a coordinated One Health approach. The protection of animal health, human health, and the environment are deeply interconnected in the fight against antimicrobial resistance.

Dr Kitty Healey BVSc PhD MRCVS
Head of Surveillance Division, Head of Antimicrobial Resistance

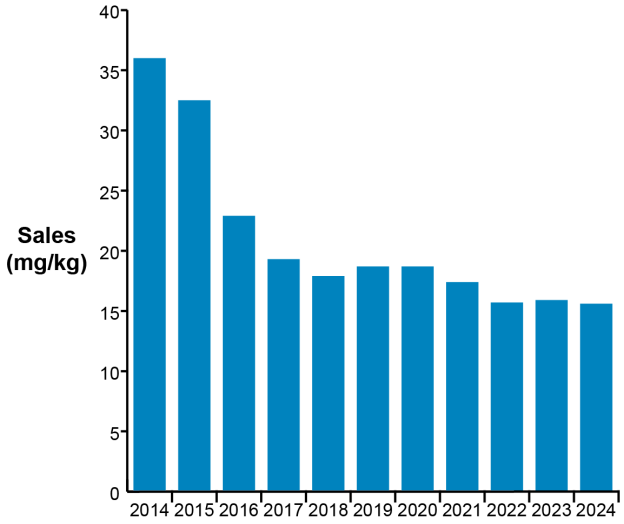
Antibiotic use and resistance 2014-2024

Key trends in antibiotic use and resistance since 2014

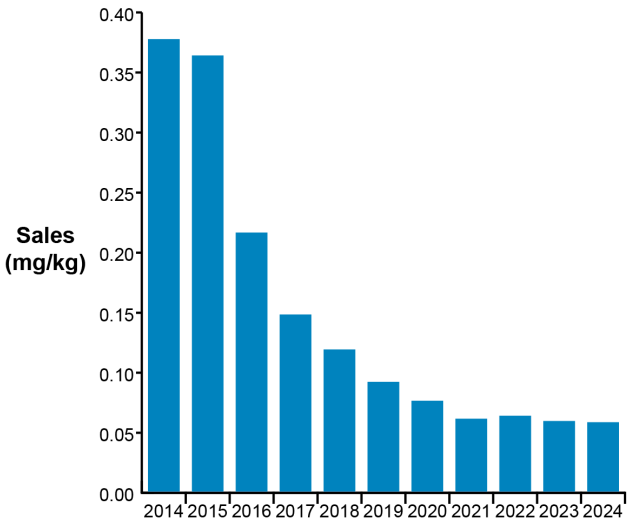
The UK-VARSS report brings together data on antibiotic sales, use and resistance. This allows us to show long term trends and acts as an early warning sign for emerging changes in antibiotic use and resistance.

Sales for all animals (mg/kg)

Sales of antibiotics in food-producing animals 2014-2024

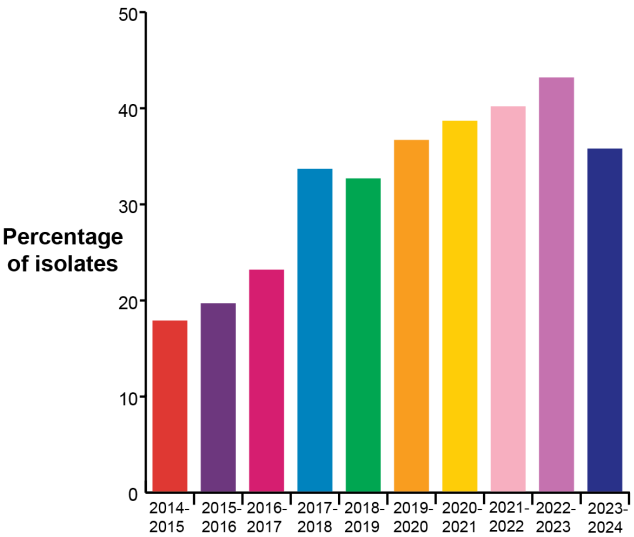


Sales of highest priority critically important antibiotics (HP-CIAs) in food-producing animals 2014-2024

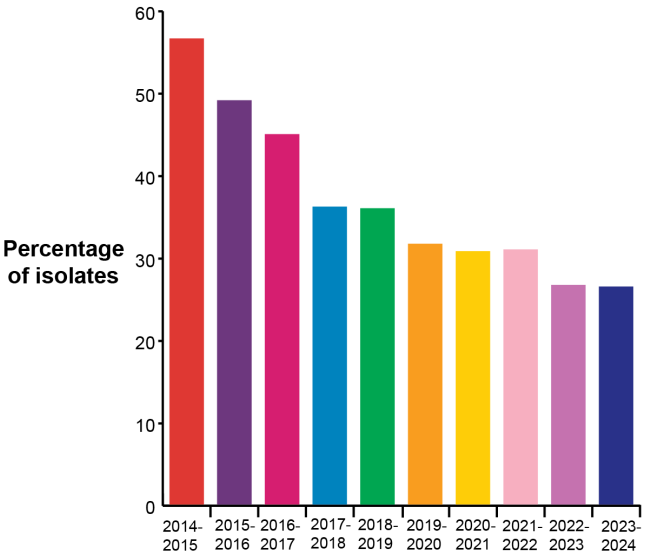


Resistance indicators for pigs and poultry

Percentage of fully susceptible *E. coli* isolates 2014-2024



Percentage of multi-drug resistant *E. coli* isolates 2014-2024



Indicators are an important tool for interpreting and comparing results of antibiotic use (AMU) and antimicrobial resistance (AMR) monitoring programmes.The indicators for sales are adjusted for population size. *E. coli* is the indicator organism for resistance. The outcome indicators for resistance are averaged over two years, due to the alternating schedule for AMR pig and poultry sampling, and are weighted by population size.

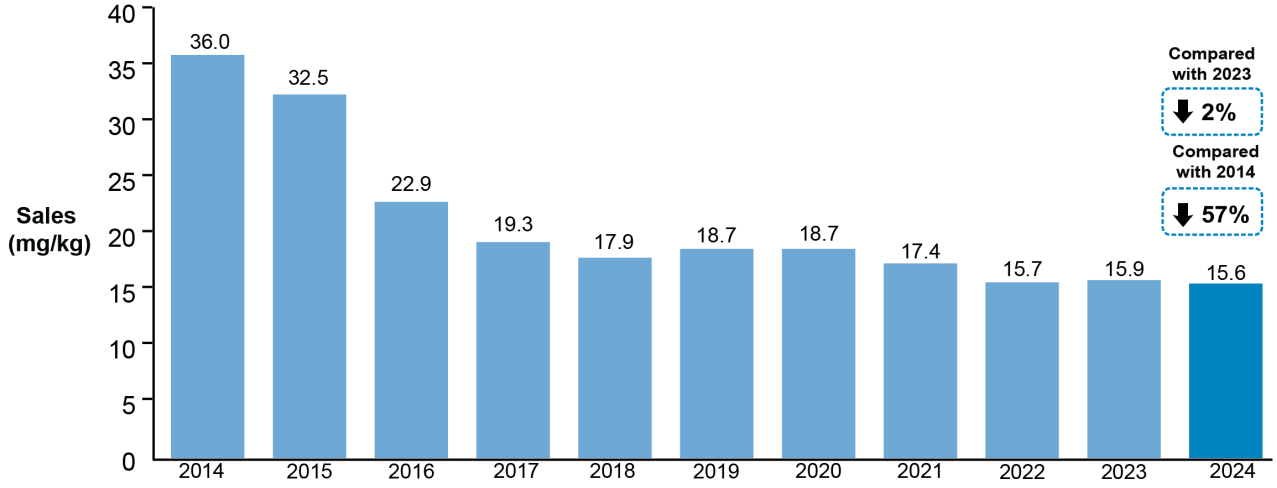
Antibiotic sales

New harmonised mg/kg metric for all animals

Antibiotic sales for food-producing animals are presented as weight of antibiotic active ingredient used in food animals (in mg) compared with the weight of the food population (in kg). This population weight is calculated by multiplying the number of animals in each category by a standardised weight. Previously, we used the Population Correction Unit (PCU) method to calculate the weight of the food animal population, but this year we will be adopting a new methodology which was developed and adopted by the EU in their ESUAvet report. It includes more animal categories (for cattle, laying hens, ducks) and therefore better represents the UK population weights. It also uses higher standard weights based on average living or slaughter weight, rather than the average weight at time of treatment, aligning better with the internationally recognised WOAH metric. As a result, the total animal weight is higher, making the mg/kg figure about 40% lower. All data reported as mg/kg now reflects this new metric. Comparisons between the new metric (mg/kg) and the old metric (mg/PCU) are included throughout the report.

Sales for food-producing animals (mg/kg)

Sales of veterinary antibiotics for use in food-producing animals, adjusted for animal population, were 15.6 mg/kg in 2024; this represents a 2% (0.3 mg/kg) decrease since 2023 and a 57% (20.5 mg/kg) decrease since 2014.



Over 50% of all antibiotics were sold were either tetracyclines (31%) or penicillins (26%). Sales of highest priority critically important antibiotics (HP-CIAs) in food-producing animals remain at very low levels at 0.06 mg/kg in 2024 and accounts for 0.4 % of total sales.

	2014 (mg/kg)	2023 (mg/kg)	2024 (mg/kg)	Compared with 2014
Total HP-CIAs	0.38	0.06	0.06	⬇ 84%
Fluoroquinolones	0.20	0.05	0.05	⬇ 74%
3rd/4th generation cephalasporins	0.11	0.01	0.01	⬇ 93%
Colistin	0.07	0.00	0.00	⬇100%

Sales of antibiotics for all animals (tonnes)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Compared with 2014
Tonnes	452	411	299	256	238	243	242	228	205	200	194	⬇ 57%

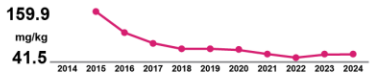
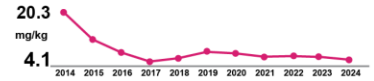
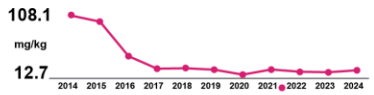
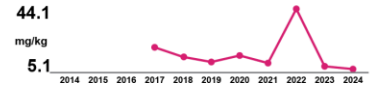
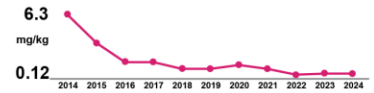
Total amount of HP-CIAs sold in 2024 was 0.79 tonnes representing a decrease of 3% (0.03 tonnes) since 2023 and an 83% decrease (4 tonnes) since 2014. Sales of HP-CIAs continue to represent a very small proportion (0.4%) of total veterinary antibiotic sales in tonnes.

Please note there has been some amendments to historic tonnes and mg/kg figures following a data correction relating to a product authorised for use in horses. For further details, please see the VARSS sales chapter.

Antibiotic usage

Antibiotic usage refers to the amount of antibiotics prescribed and/or administered per sector. The data have been collected and provided to the VMD by the animal industry on a voluntary basis. Coverage is at least 85% for all sectors shown and calculated to represent the entire population.

Antibiotic usage by food-producing animal species

	2024 tonnage (● = 1 tonne)	2024 use	Change since 2023	Annual trends (scales differ beween graph starting with lowest figure reported)	% change from date first published
Pigs		50.0 mg/kg	⬆ 0.84 mg/kg		⬇69%
Broilers		4.7 mg/kg	⬇ 0.92 mg/kg		⬇77%
Gamebirds		10.3 tonnes	⬆ 0.47 tonnes		⬇48%
Laying hens		0.28 % bird days	⬆ 0.06 % bird days		⬇58%
Turkeys		19.7 mg/kg	⬆ 3.2 mg/kg		⬇82%
Salmon		8.1 mg/kg	⬇ 16.7 mg/kg		⬇49%
Trout		5.1 mg/kg	⬇ 1.8 mg/kg		⬇73%
Ducks		0.24 mg/kg	⬆ 0.08 mg/kg		⬇96%

Highest priority critically important antibiotics by food-producing animal species

	2024 kg (○ = 1 kg)	2024 use	Change since 2023	Annual trends (scales differ beween graph starting with lowest figure reported)	% change from date first published
Gamebirds		45.1 kg	⬆ 17.5 kg		⬇30%
Trout		1.5 mg/kg	⬇ 0.29 mg/kg		⬇78%
Pigs		0.005 mg/kg	⬆ 0.001 mg/kg		⬇99%
Laying hens		0.0007 % bird days[1]	⬆0.0007 % bird days		⬇98%
Meat Poultry		0.0009 mg/kg	⬇ 0.001 mg/kg		⬇99.8%

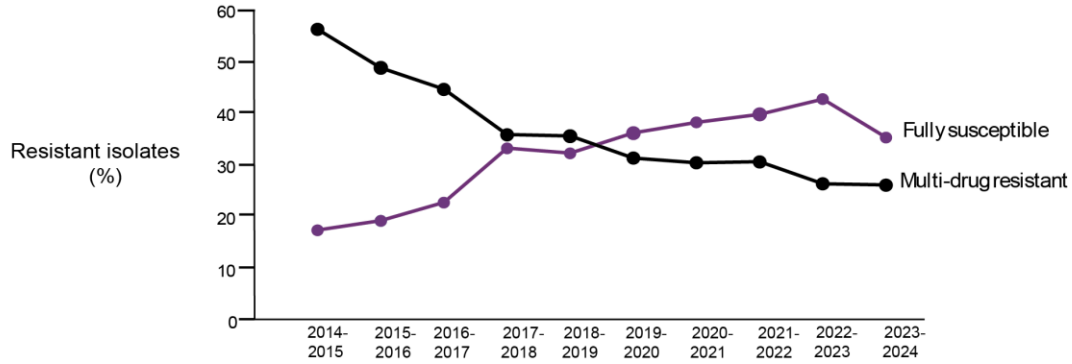
indicates different metric for usage

[1] BEIC have indicated that this relates to a single course of treatment adminstered to a breeder flock and not for birds producing eggs for the food chain

Antibiotic resistance - harmonised monitoring

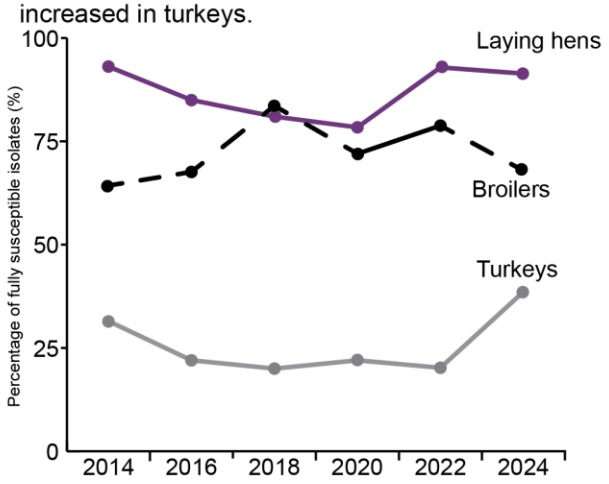
Key resistance outcome indicators: *E. coli*

The harmonised monitoring outcome indicators combine results from healthy pigs and poultry at slaughter to give an overall picture of antimicrobial resistance (AMR), and are internationally comparable. Results show a decrease in fully susceptible *E. coli* from 43% in 2022/2023 to 36% in 2023/2024. This is the first substantial decrease since harmonised monitoring began in 2014 and is attributable to increased resistance in broilers. The percentage of multi-drug resistant isolates (resistant to three or more antibiotic classes) continues to decrease and remains at the lowest recorded level of 27%.



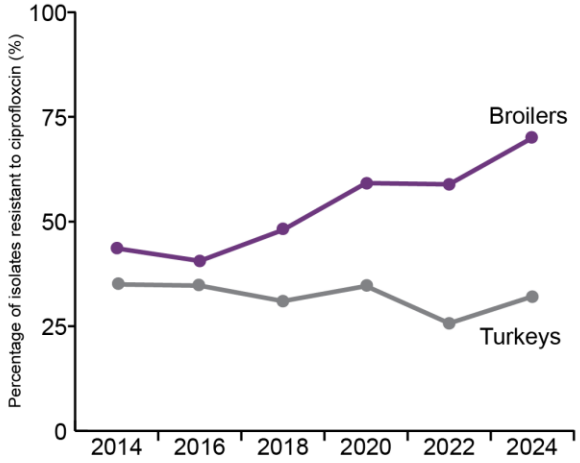
Full susceptibility in *Salmonella*

In 2024, fully susceptible *Salmonella* isolated from broilers and laying hens decreased, but increased in turkeys.



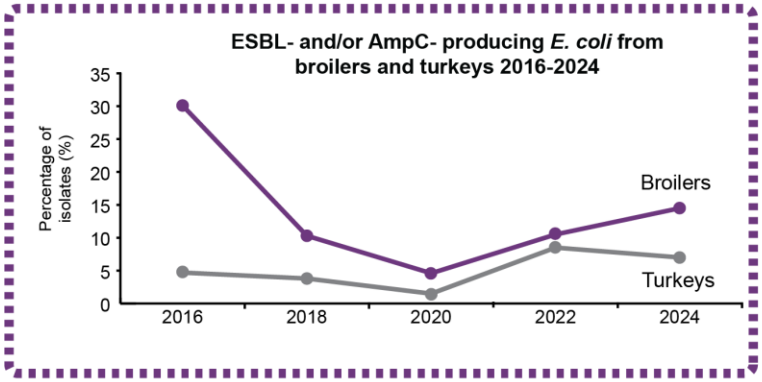
Resistance in *Campylobacter*

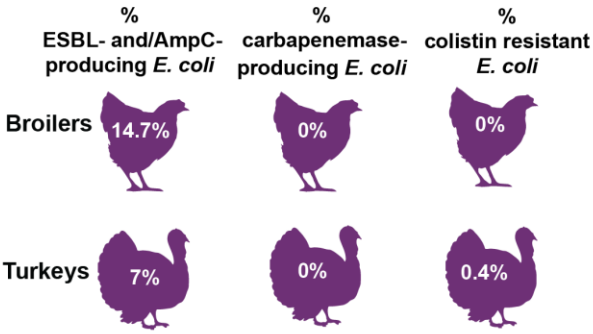
Resistance to ciprofloxacin in *Campylobacter jejuni* from broilers and turkeys has increased since 2022 despite minimal use by these sectors.



Using selective media to *detect E. coli*

We also perform a more sensitive type of testing using selective media which inhibits the growth of susceptible bacteria but allows bacteria with specific resistances to multiply, making them easier to detect. This tells us the percentage of individual samples containing resistance to the HP-CIAs, even when present in very low numbers. In 2024, carriage of ESBL-/AmpC- producing *E. coli,* which are resistant to third and fourth generation cephalosporins and penicillins, increased in broilers and decreased in turkeys.





Antibiotic resistance - clinical surveillance

Clinical surveillance is a programme of passive surveillance which evaluates AMR in bacteria isolated from diagnostic samples some of which also have zoonotic potential. As this kind of scanning surveillance is subject to biases and differences in the number of samples, the results are not representative of the UK's wider animal populations.

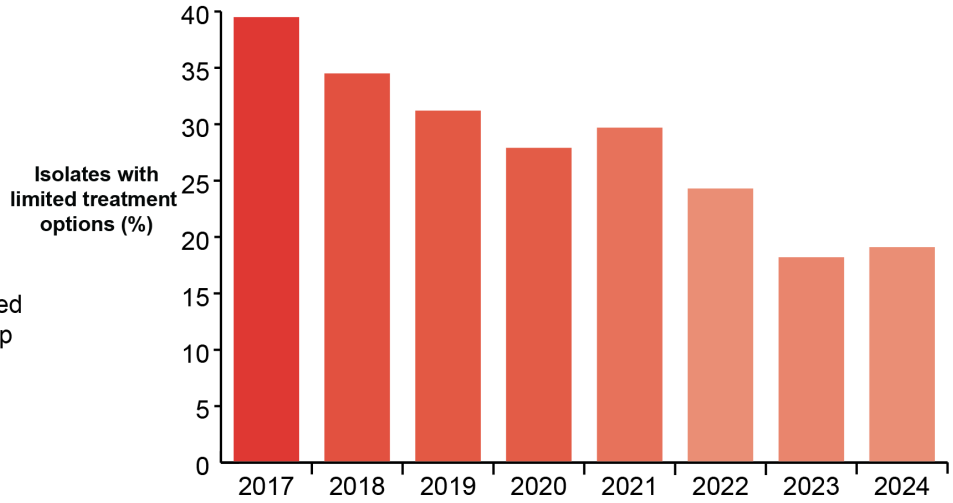
Overview of sampling

6,921 isolates were tested for AMR in England and Wales in 2024.The percentages of isolates tested by main animal species were: poultry (30% of isolates), pigs (17%), cattle (15%), sheep (9%), and dogs (7.4%).

Percentage of *E. coli* with limited treatment options

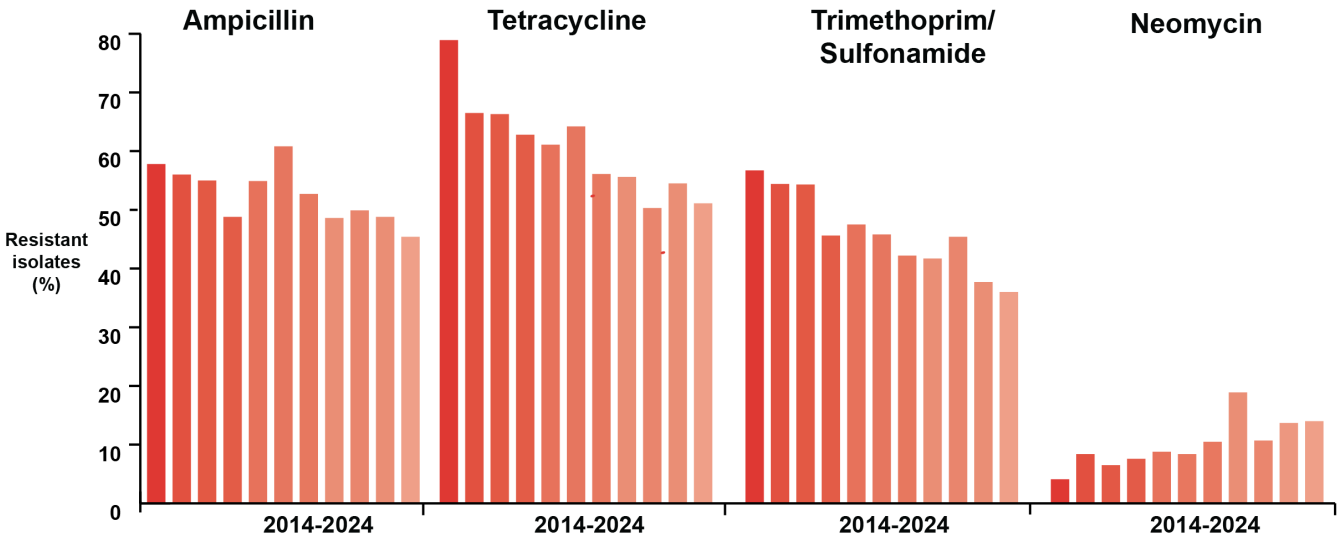
In 2024, 19% of all clinical *E. coli* isolated from animals had limited treatment options, meaning they were resistant to four or more individual antibiotics. This has reduced significantly from 40% since 2017.

The percentage of isolates with limited treatment options declined substantially in pigs, cattle and sheep between 2017-2024.



Resistance to selected antibiotics in *E. coli* isolates from pigs 2014-2024

In *E. coli* isolated from pigs in 2024, the highest levels of resistance were detected to the antibiotic classes that are most commonly used in the pig sector: penicillins, trimethoprim/sulfonamide, tetracyclines and aminoglycosides. Resistance of clinical *E. coli* to antibiotics in the first three classes has reduced since 2014, mirroring reductions in antibiotic use. Resistance to neomycin has increased significantly from 3.9% in 2014 to 14% in 2024. This aligns with antibiotic use data for aminoglycosides in pigs, which has increased from 2 mg/kg in 2015 to 6.8 mg/kg in 2024.



Private Laboratories Initiative (PLI)

Most AMR data from animals in the UK is generated and held by private veterinary laboratories (PVLs) and does not feed into government surveillance programmes. This gap limits our understanding of AMR in animals and our ability to respond to emerging threats to animals and humans. The VMD set up the PLI to address this gap by improving the sharing of AMR data held by PVLs with government. In 2025 it covers four major animal streams: farm animals, companion animals, horses, and fish

Introduction

The Veterinary Antibiotic Resistance and Sales Surveillance report of the United Kingdom (UK-VARSS) presents combined data on veterinary antibiotic sales, use and resistance in bacteria from animals in the UK.

The antibiotic sales data from 2014 to 2024 are presented in **Chapter 1** and are based on sales of antibiotic veterinary medicinal products authorised for use in animals in the UK. Sales data are generally used as an estimate for antibiotic usage. These figures are provided by the veterinary pharmaceutical companies marketing these products, and this is a statutory requirement.

However, many antibiotics are authorised for use in multiple animal species, and it is not possible to determine from sales data how much is used in each species. In addition, sales data does not include antibiotics imported through the Special Import Scheme. The UK-VARSS report therefore also includes data on usage in different animal sectors and the VMD works in partnership with the livestock and companion animal sectors to develop, facilitate and coordinate antibiotic usage data collection systems. These data are reported voluntarily and presented in **Chapter 2.**

While the term antimicrobial resistance (AMR) encompasses resistance of different types of organisms (bacteria, viruses, fungi, and parasites) to the drugs used to treat them, it is used throughout this report to refer to bacterial resistance to antibiotics specifically. The VMD collates data from government laboratories on antibiotic resistance in bacteria obtained from food-producing animals. This includes zoonotic bacteria, which are an integral part of AMR surveillance, due to the potential for resistant bacteria and/or resistance genes to transfer between animals and people. This antimicrobial resistance data is collected under the framework of two surveillance schemes – harmonised monitoring and clinical surveillance.

In 2024, the harmonised monitoring scheme is a UK wide programme in which bacteria from the gut of healthy poultry (broiler and turkey) at slaughter is tested, giving us a representative picture of resistance in key livestock species entering the food chain. Results from this are presented in **Chapter 3**.

Clinical surveillance involves testing of bacteria that have been isolated from clinical samples submitted by farmers and private veterinary surgeons to government laboratories in England and Wales. These results are published in **Chapter 4**, which also features a collaboration with private veterinary laboratories.

For the first time this year, some of the VARSS data is presented in an interactive data dashboard. This allows users to interrogate data on antibiotic sales and key AMR indicators from 2014-2024. Sales, usage, and resistance data presented in the report are also available in a downloadable spreadsheet format for the first time, making these results more accessible to researchers.

Details on methodology and results not presented in the report are included in the Supplementary Materials. The Supplementary Materials and previous UK-VARSS reports are available to download at veterinary antimicrobial resistance and sales surveillance.

For additional context whilst reading the report, please see below Table 1 containing a list of all antibiotics referred to throughout the report, split by those authorised and not authorised for use in animals. Table 2 lists descriptions used throughout the resistance chapters to categorise resistance levels. Please also see the glossary of terms within the annexes.

Table 1: Antibiotics referred to throughout the report or Supplementary Materials, grouped by antibiotic class.

Antibiotic class	Authorised for use in animals	Not authorised for use in animals
Aminoglycosides	Apramycin, framycetin, gentamicin, kanamycin, neomycin, paromomycin, spectinomycin, streptomycin	Amikacin
Amphenicols	Florfenicol	Chloramphenicol
Beta-lactams: 1st generation cephalosporins	Cefalexin, cefalonium, cefapirin	
Beta-lactams: 2nd generation cephalosporins		Cefoxitin
Beta-lactams: 3rd generation cephalosporins	Cefoperazone, cefovecin, cefquinome, ceftiofur	Cefotaxime, cefpodoxime, ceftazidime
Beta-lactams: Carbapenems		Ertapenem, imipenem, meropenem
Beta-lactams: Penicillins	Amoxicillin, amoxicillin/clavulanate, ampicillin, benzylpenicillin, cloxacillin, phenoxymethylpenicillin	Temocillin, methicillin
Glycopeptides		Teicoplanin, vancomycin
Glycyclines		Tigecycline
Lincosamide	Clindamycin, lincomycin, pirlimycin	
Lipopeptide		Daptomycin
Macrolides	Erythromycin, gamithromycin, spiramycin, tildipirosin, tilmicosin, tulathromycin, tylosin, tylvalosin	Azithromycin
Oxazolidinones		Linezolid
Pleuromutilins	Tiamulin	
Polymyxins	Colistin	
Quinolones	Danofloxacin, enrofloxacin, marbofloxacin, oxolinic acid (Special Import Scheme only), pradofloxacin	Nalidixic acid, ciprofloxacin

Streptogramins		Quinupristin/dalfopristin
Tetracyclines	Chlortetracycline, doxycycline, oxytetracycline, tetracycline	
Trimethoprim/ sulfonamides	Sulfadiazine, sulfadimidine, sulfadoxine, sulfamethoxazole, trimethoprim	
Other	Metronidazole, novobiocin, fusidate	Furazolidone, mupirocin, rifampin

Table 2: Descriptions of percentage resistance levels referenced in this report, using the EFSA definitions.

Description of resistance level	Equivalent percentage resistance range
Rare	<0.1%
Very low	0.1% to 1%
Low	>1% to 10%
Moderate	>10% to 20%
High	>20% to 50%
Very high	>50% to 70%
Extremely high	>70%

CHAPTER 1

Sales of veterinary antibiotics

Important - Data Corrections Since 2023 VARSS Report

Please note that there have been some amendments to historic tonnes and mg/kg figures, which affect all years and, for this reason, both the tonnes (for all species) and mg/PCU (for food producing animals) figures are now higher than published in previous reports. The difference is shown in the table below:

		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	% Change since 2014
Tonnes (all species)	Published in VARSS 2023	447	406	293	246	223	229	227	212	193	189	**-59%**
	Corrected data	451	411	299	256	238	243	242	228	205	200	**-56%**
Mg/PCU (food-producing animals)	Published in VARSS 2023	62.3	56.5	39.0	32.1	29.0	30.4	30.2	28.3	25.7	25.7	**-59%**
	Corrected data	62.8	57.0	39.9	33.6	31.1	32.5	32.3	30.3	27.2	27.7	**-56%**

These differences relate to amended sales data for a product authorised in horses. The VMD requested the number of sachets but, in error, received data reflecting the number of boxes (which each contain 10 sachets). Therefore, the data published underestimated sales for this product by a factor of 10. After discovering this error, we have carried out a detailed investigation into all other products and are assured that this is an isolated incident.

As standard practice we have also made some minor historical corrections to the denominator to reflect updated national figures. For example, 2023 equine numbers were updated to reflect the recent data from the British Equestrian Trade Association UK.

1.1 Introduction

Pharmaceutical companies have reported the quantity of authorised veterinary antibiotics sold throughout the UK to the VMD since 1993; this has been a statutory requirement since 2005 (see section S1.1 in Supplementary Material 1 for further details).

The data reported in this chapter do not take into account special imports of veterinary antibiotics not authorised for sale in the UK market but authorised elsewhere (see section 1.1.2), and some medicines sold may not be used in the same year (or at all if the products

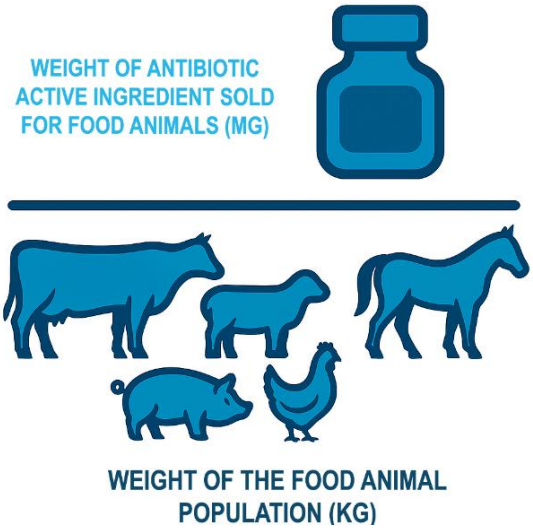
go out of date before being used). However, they serve as the best currently available approximation of the quantity of antibiotics administered to all animal species within the UK.

Note that, for ease of reading, the data has in most cases been rounded to one decimal place. However, the percentage changes have been calculated using the exact number. Antibiotics were considered HP-CIAs if they are within the equivalent category of the WHO List of Medically Important Antimicrobials, i.e. third- and fourth- generation cephalosporins, polymyxins (e.g. colistin) and quinolones/fluoroquinolones (which also aligns with "Category B" in the European Antimicrobial Expert Group report categorisation (AMEG)). Note that the only quinolones authorised to be used in animals are fluoroquinolones, so the latter are referred to throughout this chapter. Data has been presented graphically throughout, but raw data and further detail about the methodology used can also be found in S1.1 of Supplementary Material 1.

1.1.1 New metrics

When presenting antibiotic sales data in the VARSS report, we seek to provide data in an accessible and relevant format for all readers.

For food producing animals, antibiotic sales are presented as weight of antibiotic active ingredient used in food animals (in mg) compared with the weight of the food animal population (in kg):



The weight of the food animal population is calculated by multiplying the number of animals (e.g. number of dairy cows, number of slaughtered broilers etc.) within a particular category by a standardised weight (in kg). *Please note: horses are included as food producing animals for the purposes of these calculations.*

Previously, we have used the PCU methodology to calculate these figures, which was a methodology published in 2009 that enabled regional harmonization within Europe and was included in the ESVAC reports.

However, a new mg/kg methodology for food producing animals has now been adopted by the EU, using different weights and categories and this metric is being used to report antibiotic sales data in the ESUAvet report.

This has many similarities to the original metric:

- Both are used to estimate overall use in food producing animals during a calendar year
- Both look at the amount of active ingredient in mg relative to the overall population weight of the food animal population (in kg), and therefore enable the assessment of relative use
- By taking into account fluctuations in the population, both metrics allows for national trend monitoring and comparison of usage between countries (although country comparisons should be interpreted with caution due to the variations in type of livestock production systems as well as disease incidence and outbreaks).

The main differences to the original metric are:

- The standardised weights used to calculate the weight of the food animal population are higher. These weights now represent the average living weight or weight at slaughter, whereas the original PCU methodology used standard weights that represented the average weight at time of treatment. Average weight at time of treatment is lower than average living weight or weight at slaughter, as it considers that younger animals are often at a higher risk of receiving antibiotics
- The new methodology includes new food animal categories, including laying hens, ducks and a far more comprehensive list of cattle categories

By using higher weights and more animal categories in some sectors, the weight of the animal population at risk used in the new mg/kg calculation for 2024 is 74% higher and **therefore, as highlighted in Table 1.1, the resulting mg/kg calculation is 43% lower**. **Table 1.1** outlines the differences between the overall weight of the food animal population in 2024 using the old and the new metric. A table showing the individual weights assigned to each animal category for both metrics is included in section 1.2 of Supplementary Material 1.

Table 1.1: Differences between the overall weight of the food animal population in 2024 using the old and the new metric.

Sector	Weight of food animal population (1000 Tonnes)		% Change	Reason for difference
	Old Metric	New Metric		
Cattle	1772.0	4288.1	142%	- More comprehensive cattle categories included - Weight assigned to each living dairy cow increased from 425kg to 595kg
Sheep and goats	2586.6	2710.5	5%	- Weight assigned to each slaughter sheep increased from 20kg to 29kg - Goats now included
Pigs	740.5	1301.0	76%	- Weight assigned to each slaughter pig increased from 65 to 120kg
Poultry	1213.6	3035.3	150%	- Weight assigned to each slaughter broiler increased from 1kg to 2.4kg - Weight assigned to each slaughter turkey increased from 6.5kg to 13.2kg - Ducks and laying hen categories now included
Horses and fish	477.3	477.3	0%	No change
Total	**6790.1**	**11812.3**	**74%**	

In this report we will be adopting this new metric for 2024 and have converted all previous years data to maintain the ability to monitor data trends. This is because the new metric has the following advantages:

- With the additional categories of species (cattle, laying hens and ducks), the metric better represents the UK weight of the food animal population
- It allows for comparison of antibiotic sales data with the European data published in the ESUAvet report
- By using weights that represent the average living weight/ weight at slaughter, it aligns more closely with the WOAH methodology, which is an internationally recognized metric for comparing antibiotic sales data.

All data reported as mg/kg in this report refers to the new metric, unless it is specifically noted as mg/PCU, which refers to the old metric.

1.1.2 Special Import products

Veterinary medicines are authorised for specific conditions and for specific target species, based on assessed data. Veterinary medicines with a Marketing Authorisation for an indication concerning a certain species valid in GB or the UK should always be considered first. Where there is no available veterinary medicine authorised in GB or the UK for the specific indication or condition in the animal being treated, and to avoid unacceptable suffering, veterinary surgeons are permitted on a case-by-case basis under the prescribing cascade to import veterinary medicines from outside GB or UK. In order to do this, a Special Import Certificate from the VMD is required (see S1.5 in Supplementary Material 1 for further details).

Antibiotics imported under the special import scheme are not included in the sales data. However, as reported in chapter 2, the pig, meat poultry, laying hen, gamebird, salmon and trout sectors collect antibiotic use data which represents at least 85% of their sector, and this does include antibiotics imported under the Special Import Scheme. **Table 1.2** shows the amount of active ingredient imported through the Special Import Scheme reported by these industry systems, alongside the mg/kg (new metric) and mg/PCU (old metric) that this would represent if it was added to the sales data.

Table 1.2: Amount of active ingredient imported through the Special Import Scheme and the mg/kg (new metric) and mg/PCU (old metric).

	2020	2021	2022	2023	2024
Active Ingredient (tonnes)	2.2	1.6	1.1	5.3	9.6
Mg/kg (new metric)	0.2	0.1	0.1	0.4	0.8
Mg/PCU (old metric)	0.3	0.2	0.1	0.8	1.4

Table 1.2 demonstrates that there has been a substantial increase in the amount of active ingredient coming in under the special import scheme between 2022 and 2024. This is attributed primarily to a 7.5 tonne increase in the amount of premix containing trimethoprim-sulphonamide for pigs. See section 2 for further details.

Please also note that the data within **Table 1.2** is an underestimate of the amount of active ingredient coming in under the special import scheme, as it doesn't include sectors where there is no or lower coverage of antibiotic use data, such as ruminants and companion animals.

1.2 Summary

UK sales of veterinary antibiotics for food-producing animals in 2024 (which in this calculation includes horses) were 15.6 mg/kg. This represents a decrease of 2% since 2023 and 57% since 2014**.** Sales of Highest Priority Critically Important Antibiotics (HP-CIAs) for food-producing animals remain very low at 0.06 mg/kg, a reduction of 84% since 2014 and accounting for less than half a percent of the total antibiotic sales. This represents essentially no change (0.001 mg/kg reduction) since 2023.

The overall quantity of antibiotics sold for all animals (which includes both food-producing and companion animals) was 194 tonnes, a decrease of 3% since 2023 and 57% over the last 10 years. In 2024, sales of HP-CIAs for all animals were 0.79 tonnes, representing a reduction of 3% since 2023 and 83% since 2014. For the fourth year in a row, no colistin was sold for use in animals.

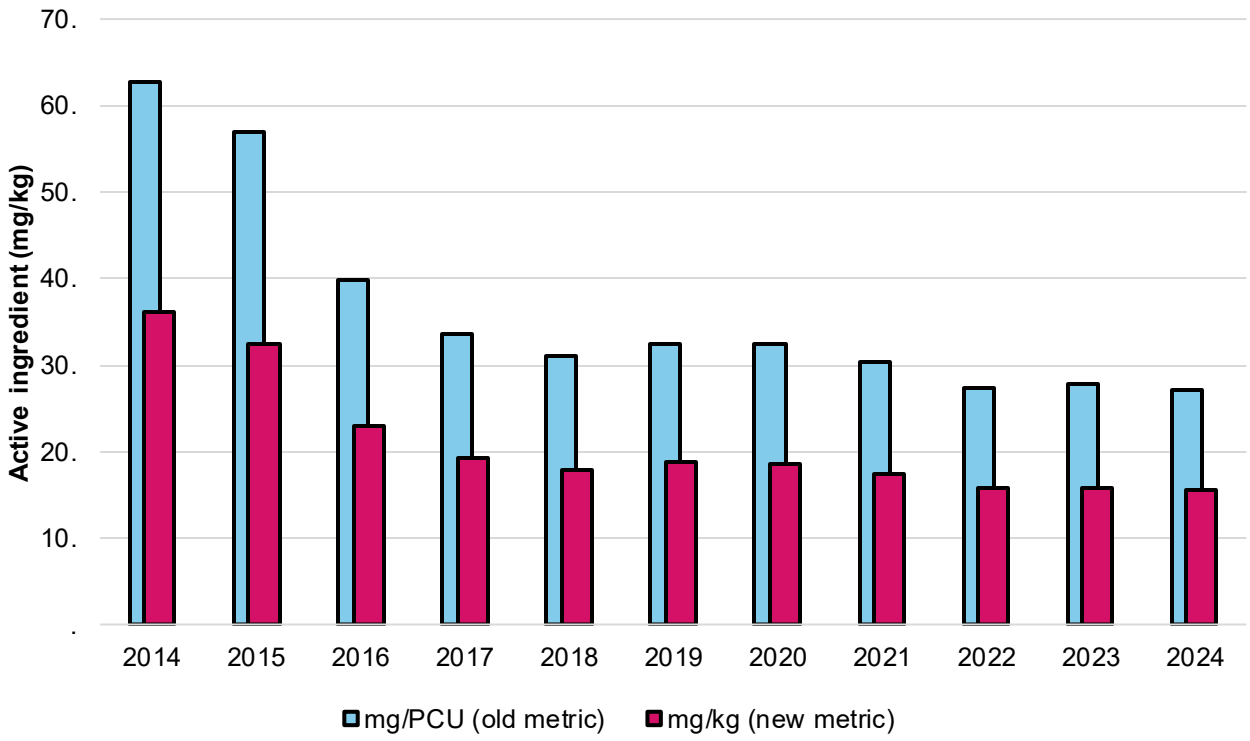
1.3 Results

1.3.1 Sales of antibiotics for food-producing animal species (mg/kg)

1.3.1.1 Sales for food-producing animals (mg/kg)

Antibiotic sales for food-producing animal species in 2024 were 15.6 mg/kg, which is a small decrease of 2% since 2023. This represents a reduction of 57% (20.5 mg/kg) since 2014 (**Figure 1.1**). As explained in section 1.1.1, the value for the new metric (mg/kg) is around 43% lower than the old metric (mg/PCU). However, the trends are equivalent.

Figure 1.1: Antibiotic active ingredient sold for use in food-producing animals adjusted for population using the new metric (mg/kg) and the old metric (mg/PCU), 2014 to 2024.



1.3.2 Sales by antibiotic class for food-producing animals (mg/kg)

The top five antibiotic classes sold in 2024 for food-producing animals as a percentage of overall use were tetracyclines (31%), penicillins (26%), trimethoprim-sulfonamides (11.1%), aminoglycosides (10.5%) and macrolides (10.2%) (**Figure. 1.2**).

Penicillin sales increased by 4% (0.17 mg/kg) whereas the sales of tetracyclines decreased by 9% (0.46 mg/kg) since 2023. This increase in penicillin sales for 2024 predominantly relates to in-water amoxicillin products authorised for the pig and poultry sectors. Since 2014, penicillins have reduced by 37% (2.4 mg/kg) whereas tetracyclines have reduced to a greater degree by 68% (10.1 mg/kg) **(Figure 1.2A)**. The decrease in tetracycline use since 2014 primarily relates to an 83% (10.6 mg/kg) decrease in the sales of in-feed products, whereas tetracyclines authorised for in-water/ milk use have increased over this period.

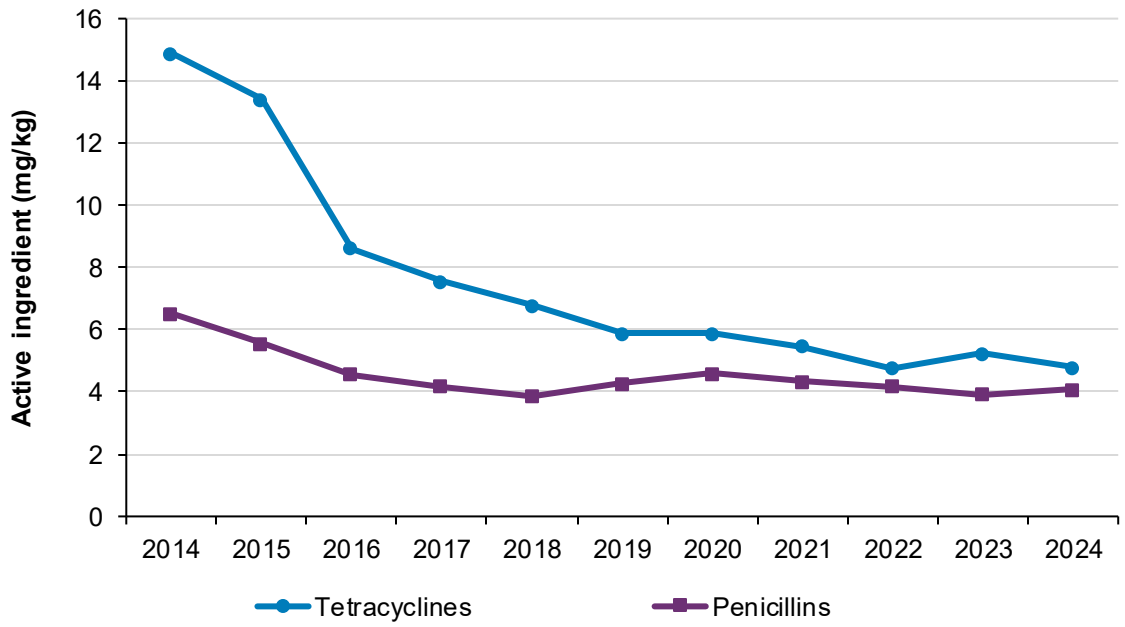
Since 2023, trimethoprim-sulfonamide sales reduced by 4% (0.08 mg/kg), and have now reduced by 72% (4.4 mg/kg) since 2014 (**Figure 1.2B**). However, as highlighted in section 1.2.2, the licensed in-feed trimethoprim-sulfonamide products for pigs have now become discontinued. This has resulted in a substantial quantity of in-feed trimethoprim-sulfonamide being imported through the Special Import Scheme in 2023 and, to an even greater extent, in 2024. These quantities are not captured in the antibiotic sales data.

Aminoglycoside sales have remained stable in the last year but have reduced by 21% (0.43 mg/kg) since 2014.

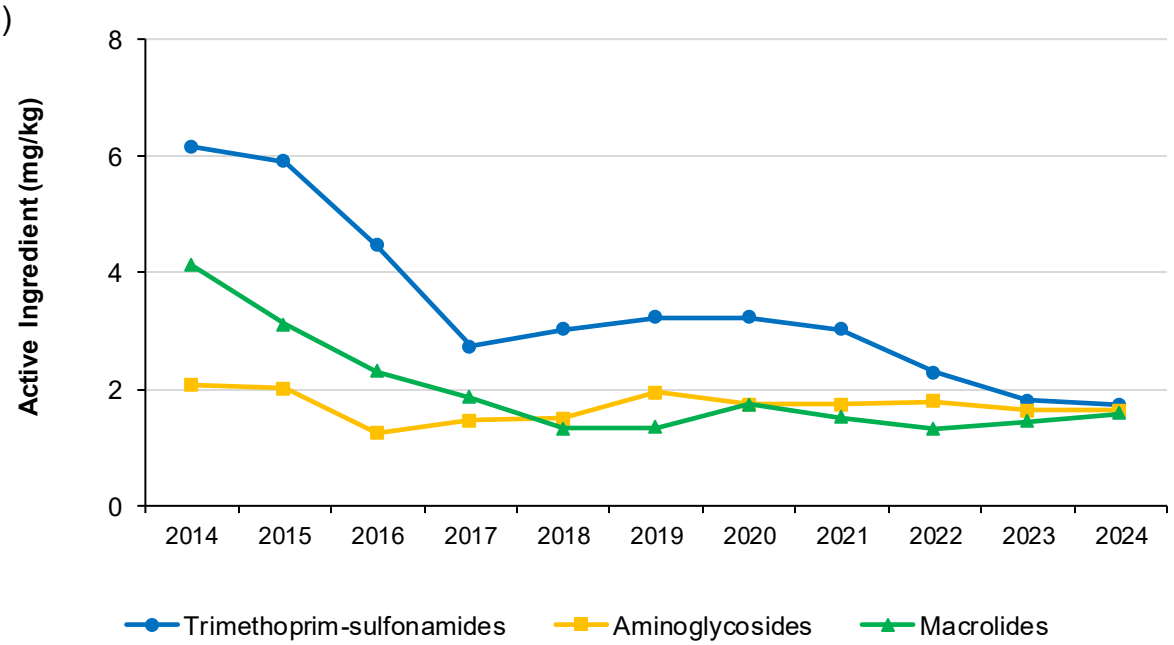
Macrolide sales notably increased by 9% (0.14 mg/kg) between 2023 and 2024, although their use has reduced by 62% (2.5 mg/kg) since 2014. The increase between 2023 and 2024 relates to an increase in sales of tylosin oral solution products approved for use in cattle, poultry and pigs, whereas the long-term reductions primarily relate to a decrease in in-feed use.

Figure 1.2: A) Sales of the top two antibiotic classes (mg/kg) and B) The next three of the five highest selling antibiotic classes for food-producing animals, 2014 to 2024. Note: Different scales present on graphs

A)



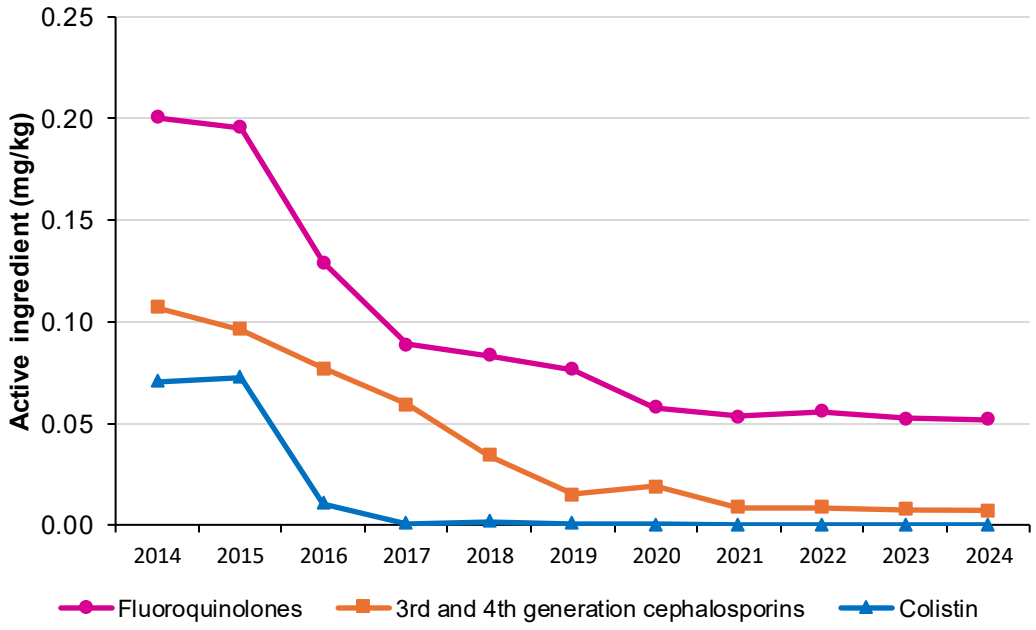
B)



Sales of HP-CIAs for food-producing animals are shown in **Figure 1.3**. Sales remain very low at 0.06 mg/kg and are essentially unchanged (0.001 mg/kg reduction) since 2023, and 84% (0.32 mg/kg) lower than 2014. In 2024, HP-CIAs accounted for 0.4% of the total antibiotic sales for food-producing animals.

In 2024, fluoroquinolones accounted for the majority (88%) of the HP-CIAs sold for use in food-producing animals, with the remaining being 3rd or 4th generation cephalosporins. For the fourth year in a row, no colistin was sold in the UK for use in animals.

Figure 1.3: Active ingredient adjusted for population (mg/kg) of HP-CIAs sold for use in food-producing animals, 2014 to 2024.

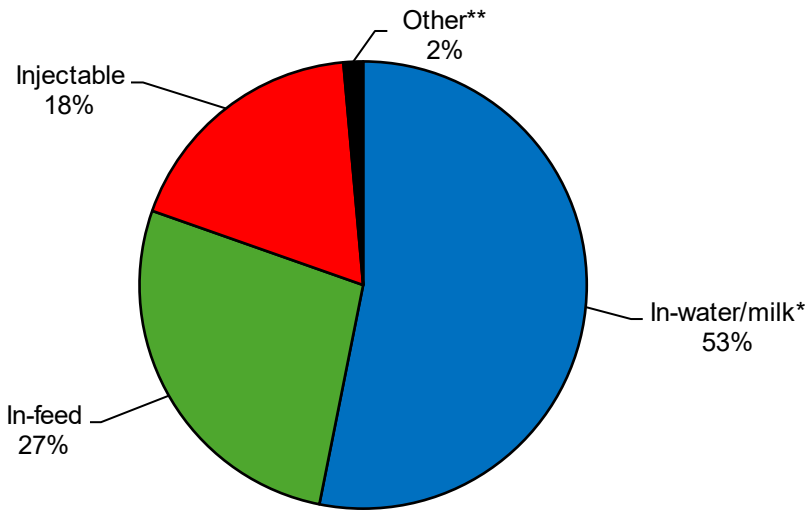


1.3.3 Sales by route of administration for food-producing animals (mg/kg)

In 2024, 53% of antibiotic sold for food-producing animals was indicated for in-water/milk use, 27% was for in-feed use, and 18% for injectable use (**Figure 1.4**). In-water/milk product sales rose by 3% since 2023 and have exceeded in-feed sales for the fifth year running. By contrast, in-feed and injectable sales reduced by 10% and 2% respectively over this period. However, as highlighted in section 1.1.2, due to the discontinuation of an in-feed trimethoprim-sulfonamide product for pigs, there has been substantial quantity of an equivalent product imported under the special import scheme, and this isn't captured within the sales data. In addition, there have been intermittent availability issues over the last 2 years with an injectable product containing penicillin and streptomycin, which is authorised for cattle, pigs, sheep and horses. This has also resulted in an equivalent product being imported under the special import scheme (**Figure 1.5**).

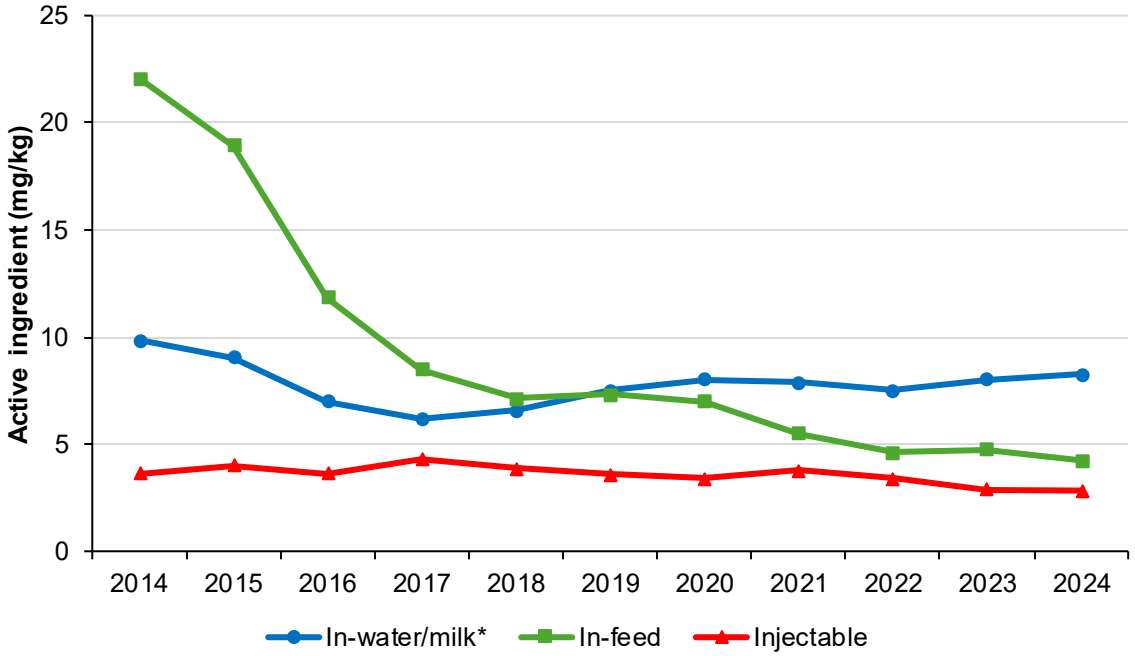
The long term trend away from in-feed antibiotics towards in-water/ milk antibiotics is consistent with the focus of the pig, poultry and gamebird sectors to support more targeted treatment, which in turn reduces the risk of development and spread of AMR. Although both in-feed and in-water antibiotics are given orally to groups of animals, in-water makes it possible to start treatments quicker (without waiting for the feedmill to incorporate the antibiotic product/ deliver the medicated feed) and tailor treatments according to clinical need. In addition, sick animals are more likely to drink than eat, and are therefore more likely to receive the correct antibiotic dose.

Figure 1.4: Antibiotic active ingredient sold for use in food-producing animals by route of administration (% weight), 2024.



*Includes oral powders and oral solutions. **Includes intramammary dry and lactating cow, intrauterine, bolus and oral pastes.

Figure 1.5: Active ingredient (mg/kg) of antibiotics by main routes of administration sold for use in food-producing animals, 2014 to 2024.



* Includes oral powders and oral solutions

1.3.4 Sales of intramammary products authorised for cattle

Sales of dry and lactating cow products analysed using the defined course dose methodology (DCDvet) are shown in **Figure 1.6**. The DCDvet represents the average number of courses per dairy cow using a standard course dose of four tubes for dry cow and three tubes for lactating cow treatments.

In 2024, dry cow intramammary sales were 0.49 DCDVet, a reduction of 12% (0.07 DCDVet) since 2023 and 21% (0.13 DCDVet) since 2014. Sales of lactating cow intramammary antibiotic products were lower at 0.36 DCDVet, a reduction of 5% (0.02 DCDVet) since 2023 and 60% (0.53 DCDVet) since 2014. The reductions in intramammary lactating cow tube sales are consistent with recent reports, which suggest that the rate of mastitis and average Somatic Cell Count has reduced over recent years. The reduction in the sales of dry cow tubes is encouraging, although the rate of reduction is slower than for lactating cow tubes. This is despite the industry focus away from blanket dry cow therapy, i.e. where all dairy cattle in a group are administered prophylactic antibiotics at drying off without an individual risk assessment, towards selective dry cow therapy, where antibiotic use is based on an individual risk assessment. It is encouraging that the dairy Red Tractor standards were updated in February 2025 and now require a specific reference to dry cow therapy in both the health plan and the health and performance review. This is to ensure that dry cow

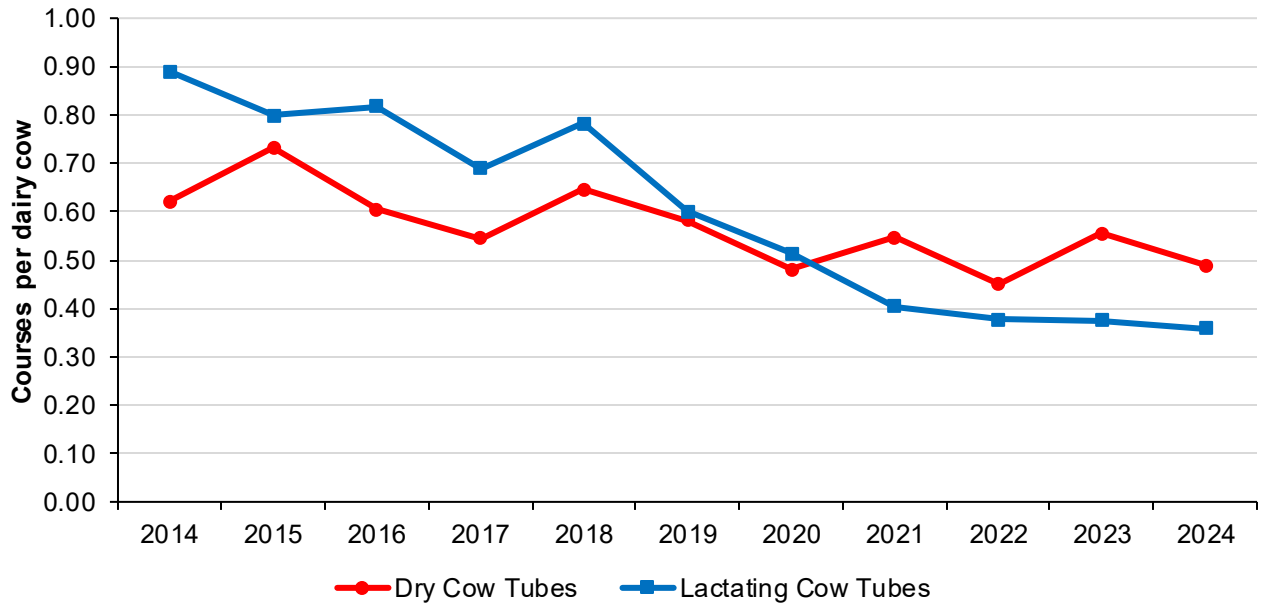
therapy is regularly discussed with farmers, helping to keep strategies for managing dry periods robust while supporting antibiotic stewardship.

Sales of HP-CIA intramammary products are very low (0.008 DCDVet) in 2024, a reduction of 0.002 DCDvet since 2023 and 98% (0.36 DCDVet) since 2014 (**Figure 1.6B)**. No sales of HP-CIA intramammary dry cow products occurred in 2024 for the first time.

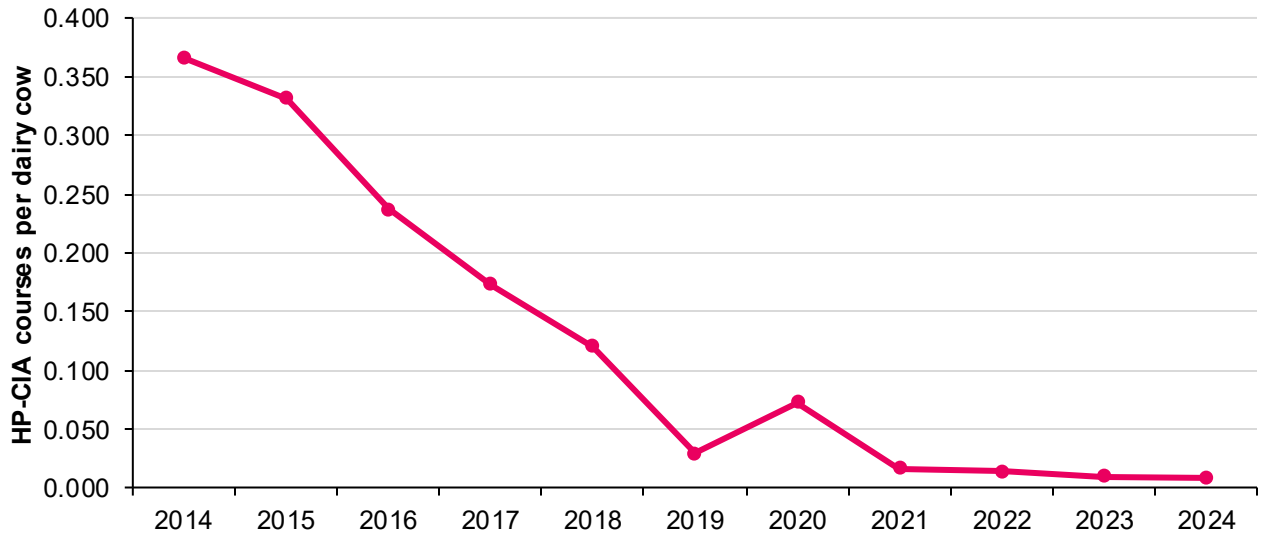
As described in section 1.1.2, if the available products are considered clinically unsuitable by the veterinary surgeon, alternative products authorised outside the UK can be imported on a case-by-case basis under the Special Import Scheme. The use of these products is not captured in the sales data. When considering intramammary products, VMD data shows that this occurs much more commonly for lactating cow than dry cow products. In the antibiotic usage data for 2023 and 2024 (representing 30 and 39% coverage respectively), imported products accounted for 10% and 8% of the total intramammary lactating cow tubes respectively. This is due to an equivalent lactating cow product being discontinued from the UK in 2022.

Figure 1.6: Sales of (A) Dry and lactating cow intramammary products (courses per dairy cow) and (B) Sales of HP-CIA intramammary products by year.

(A)



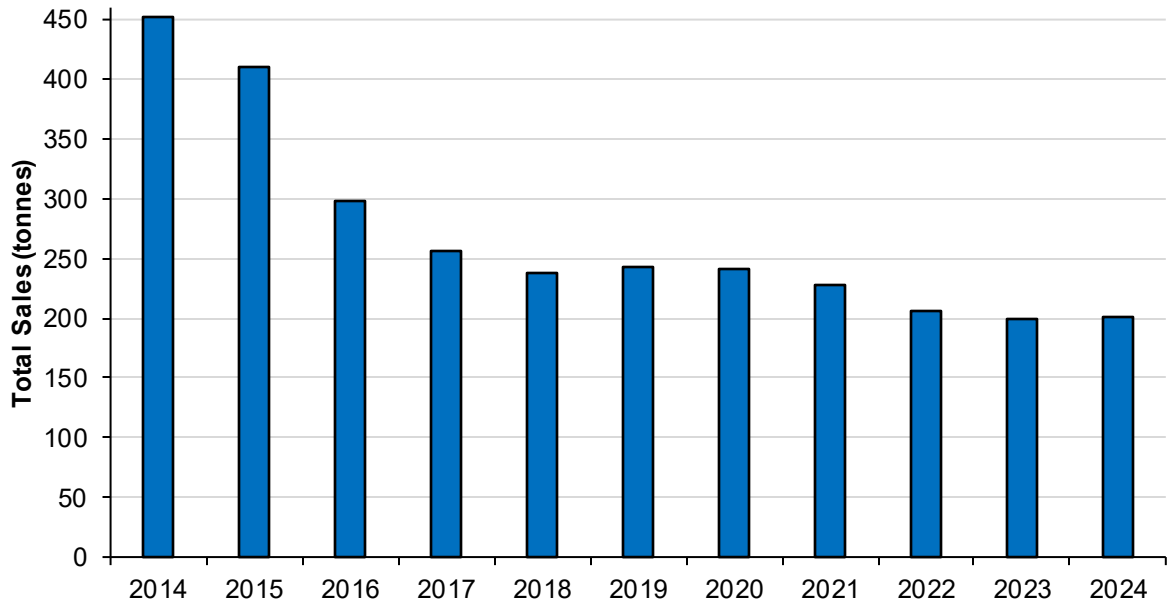
(B)



1.3.5 Total sales of antibiotics for all animals (tonnes)

Total sales of antibiotics for all animals (food-producing animals and companion animals) are measured in total weight of active ingredient (tonnes). Results are shown in **Figure 1.7**. The total quantity of antibiotic active ingredient sold in 2024 was 194 tonnes, which is a 3% (6.4 tonnes) decrease since 2023 and a 57% (258 tonnes) decrease since 2014.

Figure 1.7: Active ingredient (tonnes) of antibiotics sold for use in all animals, 2014 to 2024.



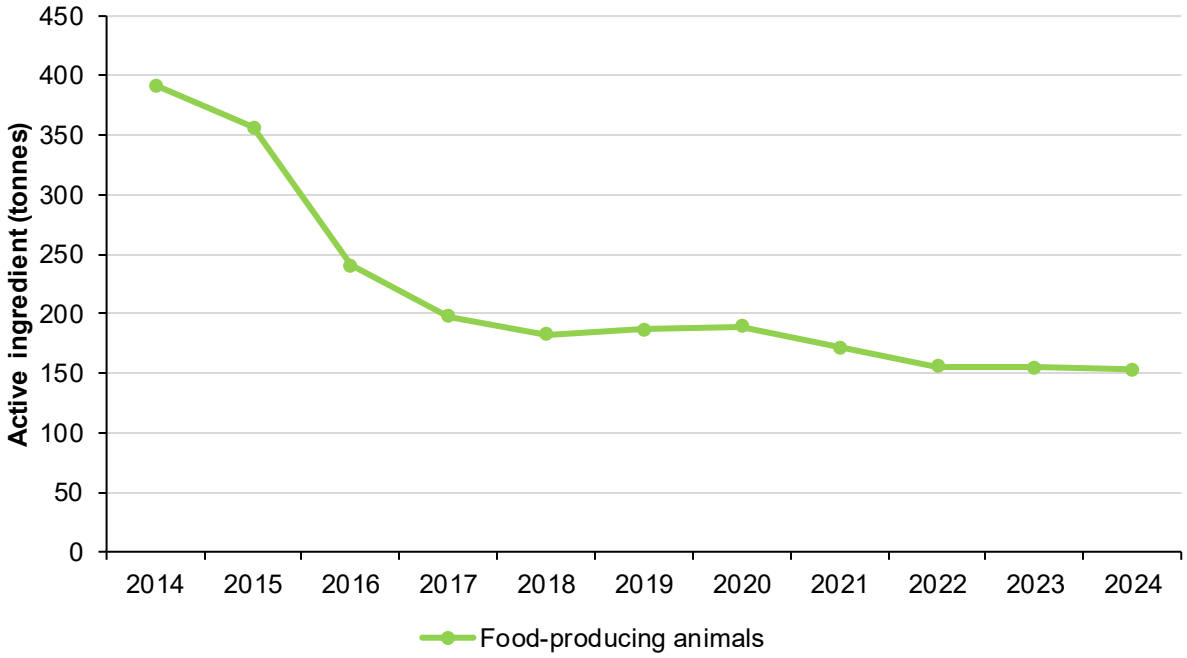
1.3.5.1 Total sales of antibiotics by species (tonnes)

Veterinary antibiotics can be licensed for use in one or multiple species. Some products are authorised for food-producing animals only, some for companion animals (which for this analysis includes dogs, cats and horses), and others for a combination of both food producing and companion animals.

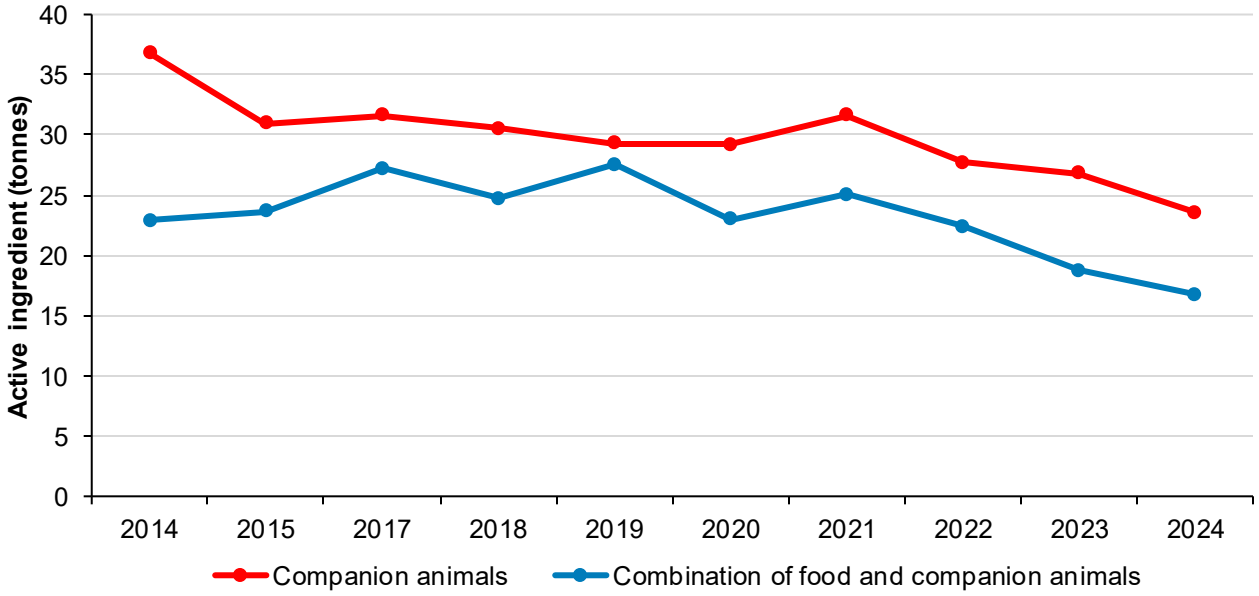
In 2024, 79% (153 tonnes) of total antibiotic sold were attributed to products authorised for food-producing animal species only and this has remained stable since 2023 (**Figure 1.8A**). Conversely, sales of products authorised for companion animals (which account for 12% of total sales) reduced by 12% (3.2 tonnes) during this period. In addition, sales of products licensed for both food-producing and companion animals (which account for 9% of total sales) decreased by 11% (2.0 tonnes) between 2023 and 2024 and this category is comprised of 99% injectable products (**Figure 1.8B)**.

Figure 1.8: Active ingredient (tonnes) of (A) antibiotics sold for food-producing animals, (B) companion animals and a combination of food and companion animals, 2014 to 2024.

(A)



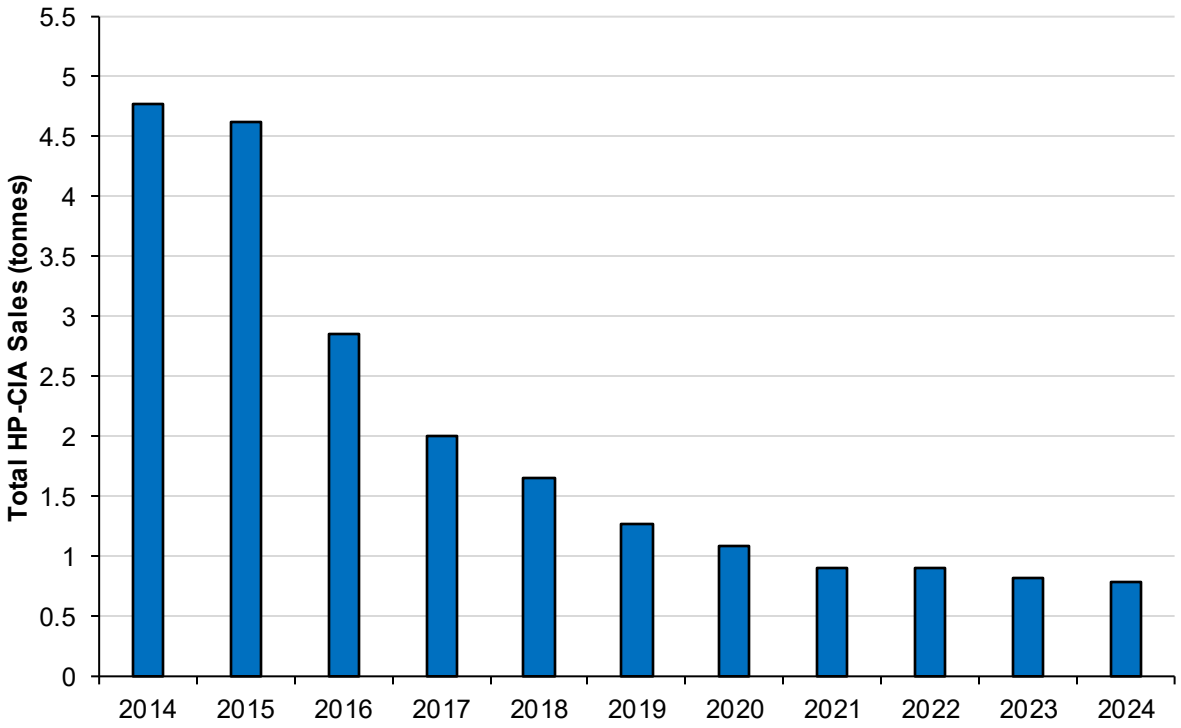
(B)



1.3.6 Total sales of antibiotics of HP-CIA (tonnes)

Total sales of HP-CIAs in 2024 were 0.79 tonnes (**Figure 1.9**), representing a reduction of 3% (0.03 tonnes) since 2023 and 83% (4 tonnes) since 2014. The total weight of HP-CIA sales accounted for less than half a percent of the total weight of antibiotics sold in 2024. For the fourth year in a row, no colistin was sold for use in animals.

Figure 1.9: Active ingredient (tonnes) of HP-CIA sold for use in all animals, 2014 to 2024.



1.3.7 Harmonised outcome indicators for antibiotic use

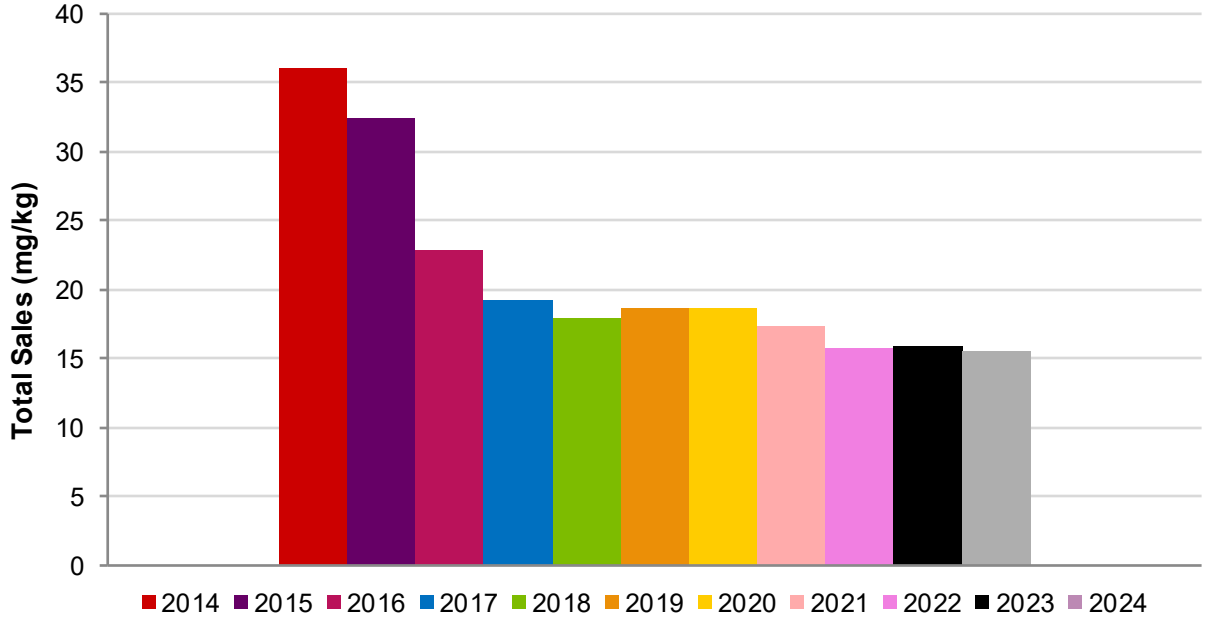
Harmonised indicators are important to monitor trends in a consistent way, and in a way that is comparable across different regions and countries. A number of different indicators for monitoring antibiotic sales in animals have been developed globally. For consistency with previously published data and harmonisation with other countries in the European region, the data are reported using the EU harmonised indicators. These were published by the European Centre for Disease Prevention and Control (ECDC), European Food Safety Authority (EFSA) and EMA in 2017.

The primary indicator is “the overall sales of veterinary antibiotics in milligram of active substance per kilogram of estimated weight at treatment of livestock and of slaughtered animals in a country”. Secondary indicators are the sales in mg/kg of 3rd and 4th generation cephalosporins, quinolones (and percentage of fluoroquinolones) and polymyxins, which measures HP-CIA use. In the UK, all quinolones sold for use in food-producing animals are fluoroquinolones (although the quinolone oxolinic acid is imported under the Special Import Scheme for use by the trout sector; see **Chapter 2.3.5.2**). Colistin is the only polymyxin that

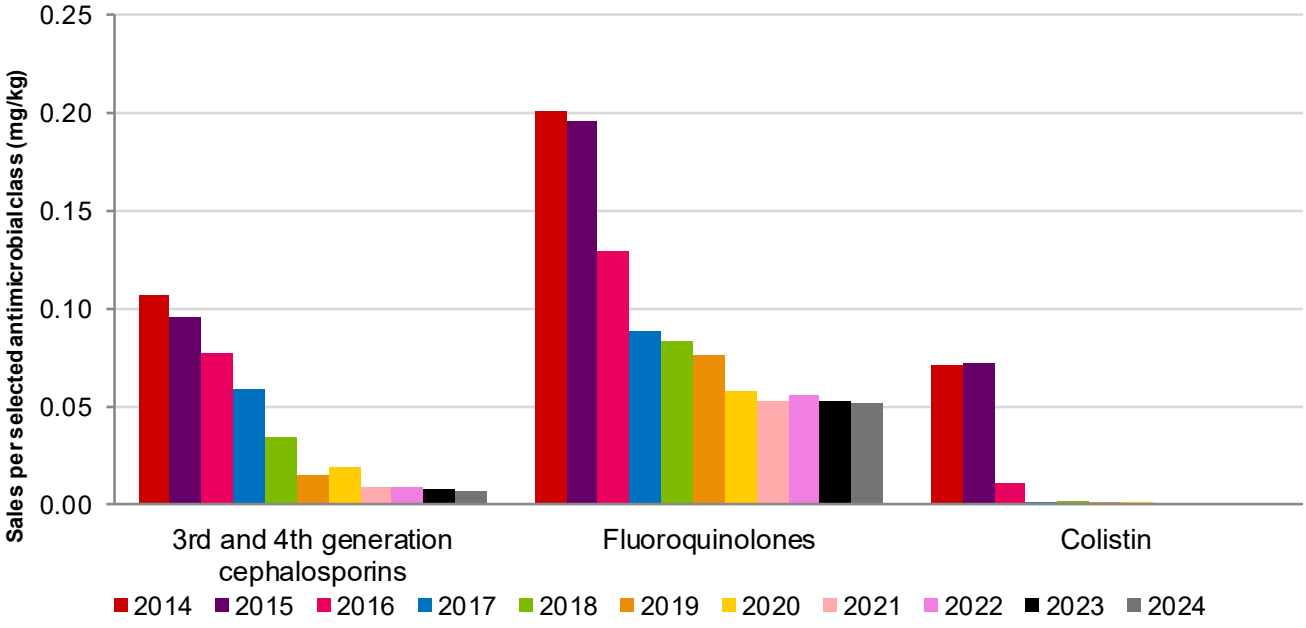
has been on sale for use in food-producing animals but has not been used in the last four years. Both primary and secondary indicators have shown a decreasing trend since 2014 (**Figure 1.10**).

Figure 1.10: Harmonised outcome indicators for antibiotic consumption in food-producing animal species in the UK; Primary indicator (A) and Secondary indicators (B), 2014 to 2024.

(A)



(B)



A number of different indicators for monitoring antibiotic sales in animals have been developed globally, and overarching global indicators are described in more detail in the S1.1 of Supplementary Material 1

CHAPTER 2

Use of veterinary antibiotics by animal species

2.1 Introduction

All antibiotics used in UK animals must be prescribed by a veterinary surgeon. Antibiotic use refers to the amount of antibiotics administered or intended to be administered (for example prescribed, dispensed, and/or delivered to the animal owner/ vets) for a defined animal species or production sector. This is different from sales data, which is collected from Marketing Authorisation holders and cannot be split by species or sector, as many antibiotics are authorised for use in multiple animal species. In addition, unlike sales data, antibiotic use data includes products imported under the special import scheme (see section 2.1.2 for further details).

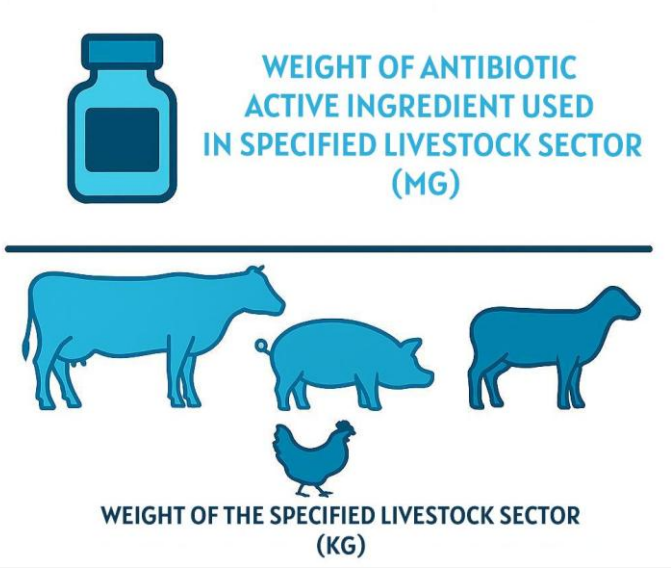
Capturing antibiotic use data by animal species provides a baseline against which trends and the impact of interventions, such as those designed to reduce antibiotic use, can be measured. The data can also be used to explore any correlation between antibiotic use and antibiotic resistance. Additionally, data collection systems allow for benchmarking, enabling vets and farmers to discuss antibiotic use, identify and share good practice and provide a stimulus for implementing effective stewardship interventions.

The VMD is working in partnership with all major animal sectors to develop, facilitate and coordinate antibiotic use data collection systems. This chapter describes the progress achieved so far. Data and commentary are provided by the animal sectors. Data has been presented graphically throughout, but full datasets can be found in Supplementary Material 1. Methodology is also detailed in Section 2.5.

Where antibiotic usage data is available per species or sector and represent a high proportion of the industry (e.g. pigs, meat poultry, laying hens, gamebirds, trout and salmon, see **Chapter 2**), the use of each product can be extrapolated and compared with the antibiotic sales. For 2024, the sales and use data for these products are showing a comparable trend.

2.1.1 New Metrics

When presenting data in the VARSS report, we seek to provide data in an accessible and relevant format for all readers. In most livestock sectors, antibiotic use data is presented as weight of antibiotic active ingredient used (in mg) compared with the weight of the total sector population (in kg):



The weight of the livestock sector population is calculated by multiplying the number of animals (e.g. number of dairy cows, number of slaughtered broilers etc.) within a particular category by a standardised weight (in kg).

Previously, sectors have aligned with the PCU methodology to calculate these figures, which was a methodology published in 2009 to enable regional harmonization of antibiotic sales data within Europe. However, a new mg/kg methodology has now been adopted by the EU for reporting on antibiotic use data, which uses different weights and categories and this metric will be used to report antibiotic use data in the ESUAvet report. A full list of the weights and categories used can be found in S1.2 of Supplementary Material 1.

The new mg/kg metric has many similarities to the original mg/PCU metric as:

- Both are used to estimate overall use in each sector during a calendar year
- Both look at the amount of active ingredient in mg relative to the overall population weight of the food animal sector (in kg), and therefore enable the assessment of relative use
- By taking into account fluctuations in the population, both metrics allows for national trend monitoring

The main differences to the original metric are that:

- The standardised weights used to calculate the weight of the food animal population are higher, as they now represent the average living weight or weight at slaughter, whereas the original PCU methodology used standard weights that represented the average weight at time of treatment. Average weight at time of treatment is lower than average living weight or weight at slaughter, as it considers that younger animals are often at a higher risk of receiving antibiotics
- The new methodology includes new food animal categories and, in particular, a far more comprehensive list of cattle categories

The benefits of using this new metric are that:

- It better reflects the true biomass of the sectors, particularly in cattle
- It allows for more meaningful comparisons across neighbouring countries, reflecting our commitment to regional harmonisation, as:
    - It allows for comparison of antibiotic use data with European data, which will be published in the ESUAvet report
    - It aligns more closely with the WOAH methodology, which is an internationally recognized metric for comparing antibiotic sales data.

However, by using higher weights +/- more animal categories in most sectors, the weight of the animal population at risk with the new mg/kg calculation is higher and therefore the resulting mg/kg calculation is lower. The overall impact this has on the mg/kg is shown in **Table 2.1 and 2.2**. The exceptions to this are the salmon and trout sectors, which use the same weights (biomass of live weight produced) for the new metric (mg/kg) and the old metric (mg/PCU).

Table 2.1 Comparison of weights used for the old metric (mg/PCU) and new metric (mg/kg), alongside the overall effect on the metric for 2024.

Category	Weight assigned per slaughter animal (old metric)	Weight assigned per slaughter animal (new metric)	Percentage difference between mg/PCU and mg/kg value
Pigs slaughtered	65 kg	120 kg	42% ↓
Turkeys slaughtered	6.5 kg	13.2 kg	51% ↓
Broilers slaughtered	1 kg	2.4 kg	58% ↓
Ducks slaughtered	1.75 kg*	4.2 kg	58%↓

*Figure produced by British Poultry Council (BPC) as previous methodology (mg/PCU) had no defined weight

Table 2.2: Comparison of weights and categories used for the old metric (mg/PCU) and new metric alongside the overall effect on the metric for 2024.

Categories	Weight (kg) assigned (Old Metric)	Weight (kg) assigned (New Metric)	Percentage difference between mg/PCU and mg/kg value
Living Dairy Cattle	425	595	52% ↓
Female Calves (Less than 1 year)	Excluded	314	
Breeding Heifer (1-2 years)	Excluded	440	
Breeding Heifer (2 years)	Excluded	564	

It is important to recognise that mg/kg calculations are not well suited for making comparisons between animal sectors. This is because there are differences in how each sector is represented. For example, the cattle metric is based on average number of living animals, the meat poultry metric is based on the number of animals slaughtered, whereas the pig and sheep sectors use a combination of the two. In addition, the number of slaughter animals per year is impacted by the life-cycle length, meaning that sectors with shorter life-cycles contribute more animals to the denominator than those with longer life-cycles.

In this report, we are using the new metric (mg/kg) as the main metric to publish species usage data and have converted all previous years data also to this new metric. **All data reported as mg/kg in this report refers to the new metric, unless it is specifically noted as mg/PCU, which refers to the old metric.**

2.1.2 Special Import Products

Veterinary medicines are authorised for specific conditions and for specific target species, based on assessed data. Veterinary medicine with a Marketing Authorisation for an indication concerning a certain species valid in GB or the UK should always be considered first. Where there is no available veterinary medicine authorised in GB or UK for the specific indication or condition in the animal being treated, to avoid unacceptable suffering, veterinary surgeons are permitted on a case-by-case basis under the prescribing cascade to import

veterinary medicines from outside GB or the UK. In order to do this, then a Special Import Certificate from the VMD is required (see S1.5 in Supplementary Material 1 for further details).

The meat poultry, laying hen, gamebird, salmon and trout sectors collect antibiotic use data which represents at least 85% of their sector, and this includes antibiotics imported under the special import scheme. Special import data reported in this chapter is obtained from antibiotic use data.

2.2 Summary

The key trends are as follows:

- **Pigs –** Antibiotic use increased by 2% (0.8 mg/kg) between 2023 and 2024, from 49.2 mg/kg to 50.0 mg/kg. This represents a total reduction of 69% since data was first published in 2015. Use of HP-CIAs increased from 0.004 mg/kg in 2023 to 0.005 mg/kg in 2024, which represents a 99% reduction since 2015. In 2024, HP-CIAs accounted for 0.01% of total use in the pig sector.
- **Broilers –** Antibiotic use decreased by 16% (0.9 mg/kg) between 2023 and 2024, from 5.6 mg/kg to 4.7 mg/kg. This represents a 77% reduction since data was first published in 2014. There were no HP-CIAs used in meat broilers in 2024.
- **Turkeys –** Antibiotic use increased by 19% (3.2 mg/kg) between 2023 and 2024, from 16.6 mg/kg to 19.7 mg/kg. This represents an 82% reduction since data was first published in 2014. The only HP-CIAs used in turkeys are fluoroquinolones, and their use increased from 0.020 mg/kg in 2023 to 0.022 mg/kg in 2024. In 2024, HP-CIA use represented 0.1% of total use in the turkey sector.
- **Ducks –** Antibiotic use increased by 0.08 mg/kg between 2023 and 2024 from 0.16 mg/kg to 0.24 mg/kg, but use remains very low. This represents a 96% reduction since data was first published in 2014. There have been no HP-CIAs used in ducks in the last 10 years.
- **Laying Hens** – Antibiotic use increased by 0.06% bird days between 2023 and 2024 from 0.22 to 0.28% bird days. This represents a 58% reduction since data was first published in 2016. The HP-CIA fluoroquinolone accounted for 0.0007% bird days (0.2% of total use). This is the first time HP-CIAs have been used in the laying hen sector since 2016. The British Egg Industry Council (BEIC) have indicated that this relates to a single course of treatment administered to a breeder flock and not for birds producing eggs for the food-chain.
- **Gamebirds –** Antibiotic use in the gamebird sector is not adjusted by population size, so trends need to be interpreted with caution. Overall use increased by 5% (0.47 tonnes) between 2023 and 2024, from 9.9 tonnes to 10.3 tonnes. This

represents an overall reduction of 48% (9.7 tonnes) since data was first published in 2016. Use of HP-CIAs increased by 63% from 27.7 kg in 2023 to 45.1 kg in 2024, although use of these antibiotics has reduced by 30% (18.9 kg) since 2016. HP-CIA use now accounts for 0.4% of overall use.

- **Salmon –** Antibiotic use decreased by 67% (16.7 mg/kg) between 2023 and 2024, from 24.8 mg/kg to 8.1 mg/kg. This is the second lowest figure reported and represents a 49% (7.9 mg/kg) reduction since 2017. There have been no HP-CIAs used in the salmon sector since 2021. **Please note that these figures are different from those originally published due to a data correction from Salmon Scotland, which we were informed about on 7th January 2026. See section 2.3.5.1 for further information.**

- **Trout –** Antibiotic use decreased by 26% (1.8 mg/kg) between 2023 and 2024, from 6.9 mg/kg to 5.1 mg/kg. This is the lowest figure seen since data was first published in 2017 and represents a 73% (14.1 mg/kg) reduction. The only HP-CIA used by the sector is the quinolone, oxolinic acid, and its use decreased by 17% from 1.8 mg/kg in 2023 to 1.5 mg/kg in 2024. This is the lowest figure recorded and represents a reduction of 78% (5.1 mg/kg) since 2017. HP-CIA use represents 29% of total use in the trout sector.

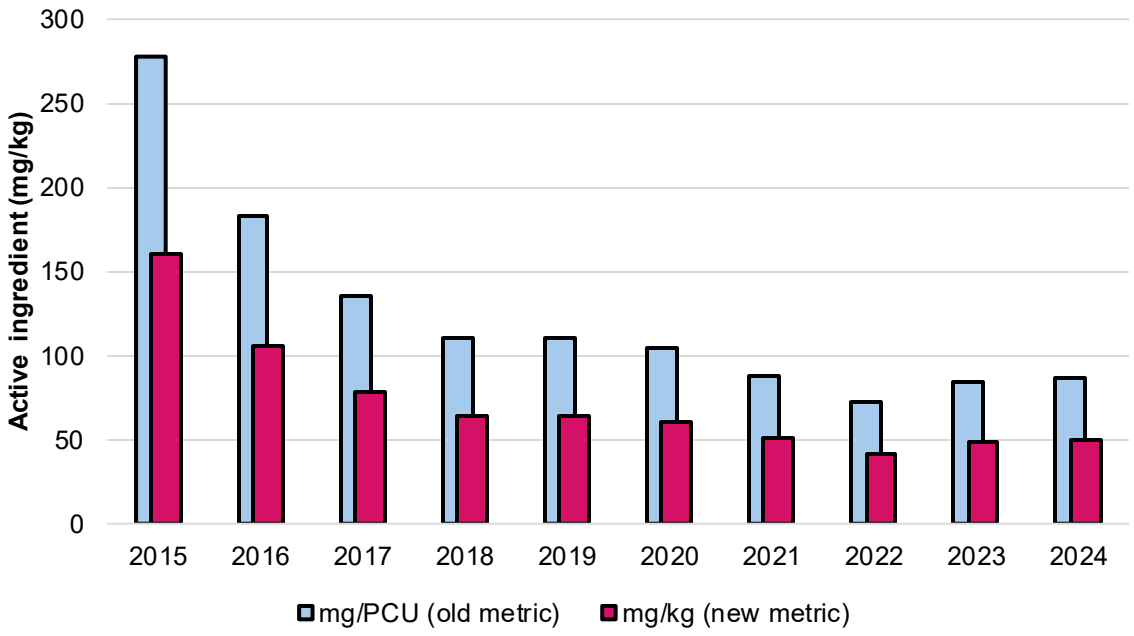
2.3 Results

2.3.1 Pigs

2.3.1.1 Antibiotic use data

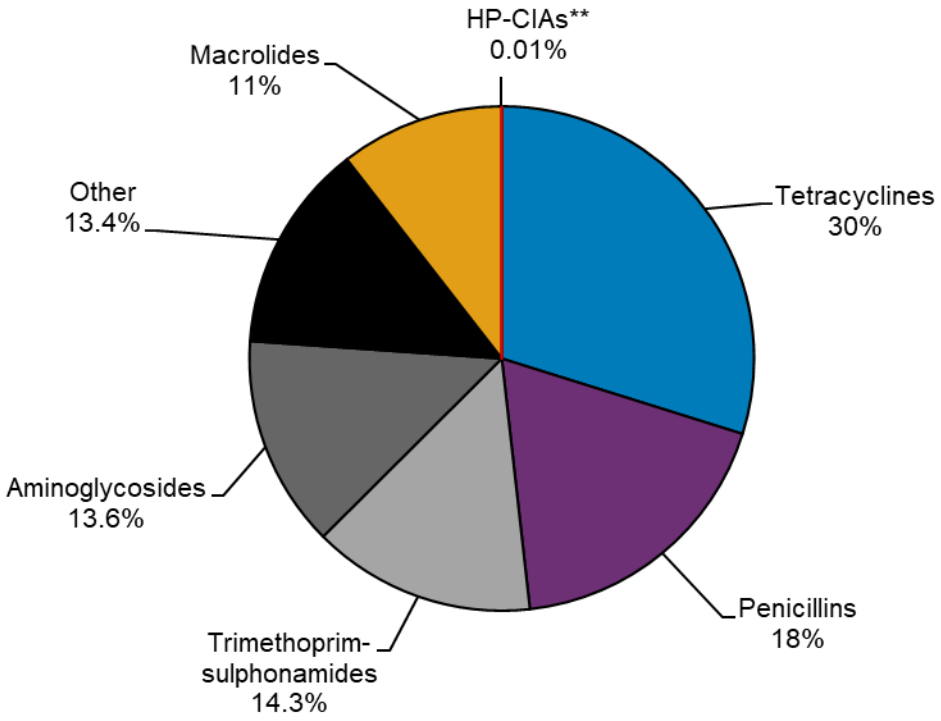
Data from the electronic Medicines Book for Pigs (eMB Pigs), representing 97% of UK pig production (9.6 million pigs produced for the food chain) show that in 2024, the total antibiotic use in pigs was 63.0 tonnes, or 50.0 mg/kg (86.2 mg/PCU) when adjusted for population. This is an increase of 2% (0.8 mg/kg) since 2023 and a total reduction of 69% (109.9 mg/kg) since data was first reported in 2015 (**Figure 2.1**). The RUMA target on antibiotic use was to achieve a national pig annual antibiotic usage figure of 42.7 mg/kg (73.5mg/PCU) by 2024.

Figure 2.1: Active ingredient adjusted for population (mg/kg (new metric) and mg/PCU (old metric)) of antibiotics reported in eMB pigs, 2015 to 2024.The change in the metric methodology means that the mg/kg value in 2024 is 42% lower than the old mg/PCU value.



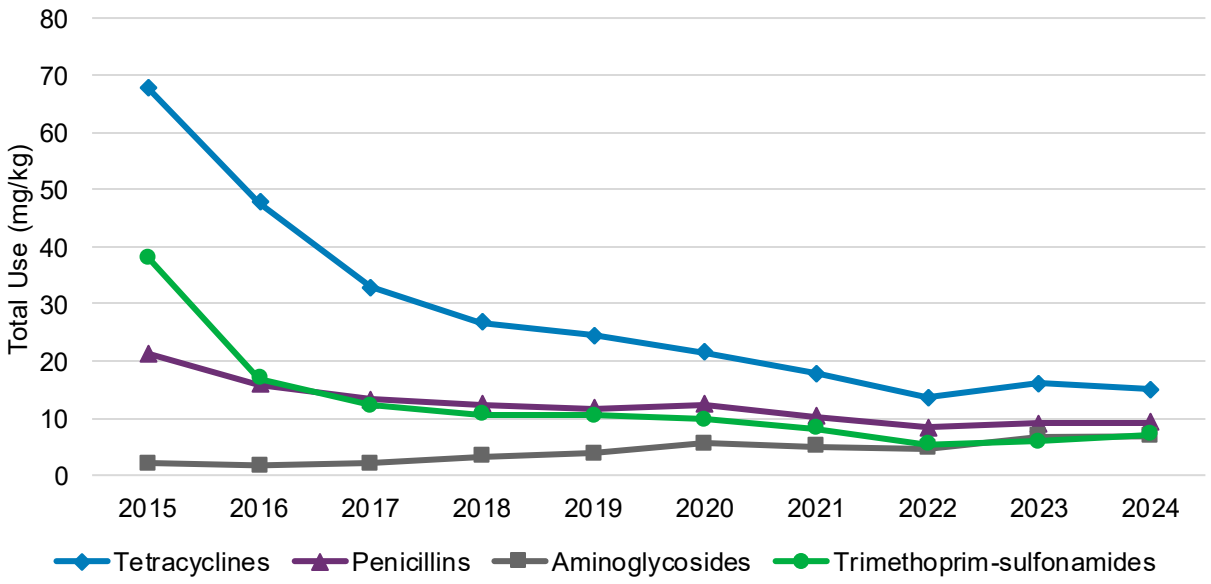
Almost half (48%) of all antibiotics used in pigs were either tetracyclines (30%), which reduced by 7% since 2023, or penicillins (18%), which increased by 1% over the same period. (**Figure 2.2**). In 2024, trimethoprim-sulfonamides (14.3%) (**Figure 2.3**) were the third most-used antibiotic class by active ingredient, increasing by 23% from 5.8 mg/kg in 2023 to 7.2 mg/kg in 2024. Aminoglycosides were the fourth most commonly used antibiotic class (13.6%), increasing by 2% since 2023, and are also the only one of the top four antibiotic classes which have increased since 2015, by 235% (4.8 mg/kg). The only other antibiotic class that has increased since 2015 are lincosamides; these account for 8% of overall use and their use has increased by 47% (1.2 mg/kg) since 2023.

Figure 2.2: Active ingredient (% weight) of antibiotics by antibiotic class reported in eMB pigs, 2024.



*The category 'Other' contains the following antibiotics classes (% of total): lincosamides (8%), pleuromutilins (5%) and amphenicols (1%).
**HP-CIAs used were fluroquinolones or 3rd and 4th generation cephalosporins represented < 0.01% of the weight (kg) of active ingredients used.

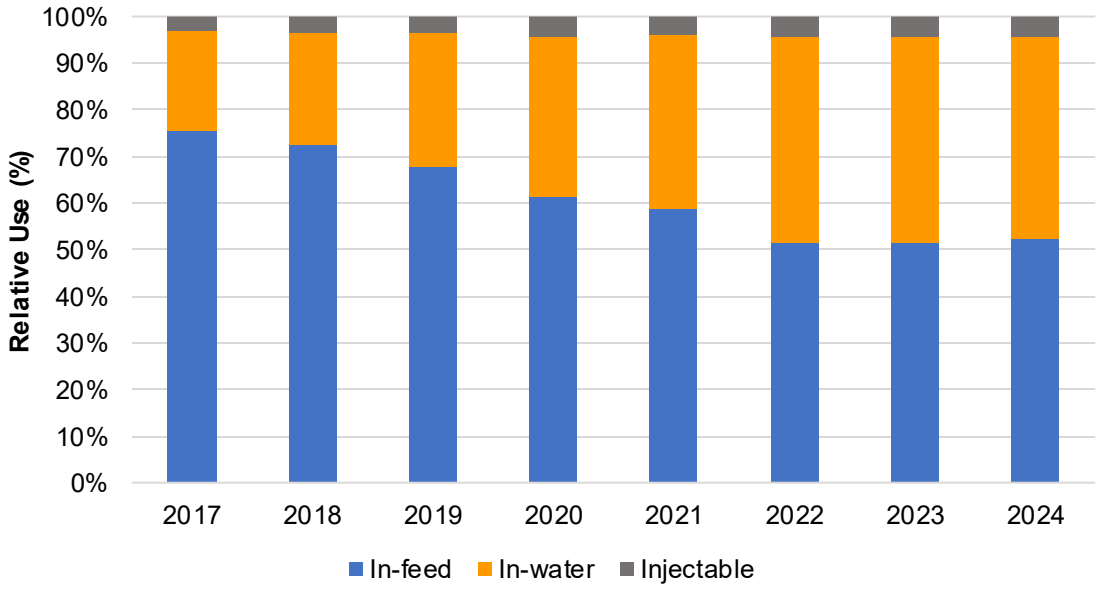
Figure 2.3: Active ingredient (mg/kg) of the top four antibiotic classes reported in eMB Pigs, 2015 to 2024.



Products imported under the Special Import Scheme accounted for 15% of active ingredient used in 2024 (9.6 tonnes), compared to 7% (4.4 tonnes) in 2023 and 0.02% (0.01 tonnes) in 2022. The majority of this (78% in 2024 and 96% in 2023) relates to the import of premixes containing trimethoprim-sulfonamide, due to the equivalent UK licensed product being discontinued, with no sales since 2022. Products imported under the Special Import Scheme are excluded from the sales data but are included in the usage data.

In-feed remains the most common route of antibiotic administration in pigs, accounting for around half (52%) of antibiotic use (**Figure 2.4**). However, relative use of in-feed antibiotics has notably decreased since 2017, when it accounted for 75% of overall use. Conversely, relative in-water use has increased from 22% in 2017 to 43% in 2024. The shift in route of administration, which primarily took place between 2017 and 2022, reflects the pig sector's work to encourage in-water administration over in-feed, to allow for more targeted administration of antibiotics. Since 2022, the volume of antibiotics administered in-feed relative to in-water has remained stable.

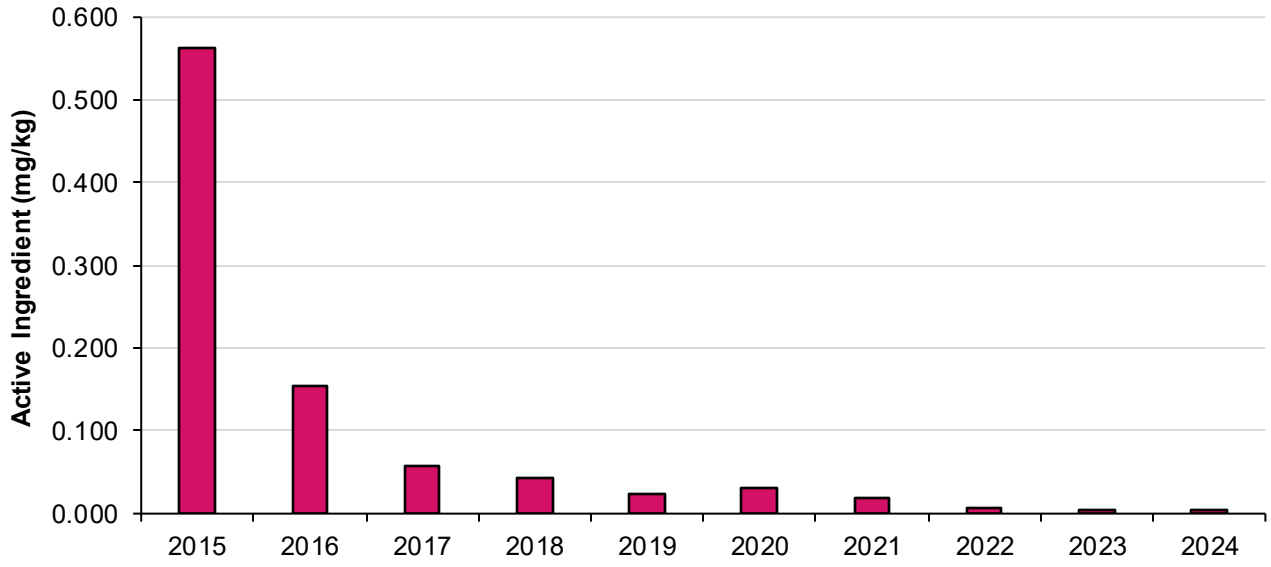
Figure 2.4: Active ingredient (% weight) of antibiotics by route of administration reported in eMB Pigs, 2017 to 2024.



The use of HP-CIAs in pigs is shown in **Figure 2.5**. In 2024, 6.2 kg of HP-CIAs were used, which represents 0.005 mg/kg, or 0.01% of antibiotics by weight. This represents a very slight increase of 0.001 mg/kg between 2023 and 2024. Fluoroquinolones accounted for 94% HP-CIA use, with the remainder being third and fourth generation cephalosporins. All HP-CIAs prescribed to pigs were administered by injection, which means that the use is targeted to individual animals. No products containing colistin have been used by the pig sector in the last five years.

In-feed remains the most common route of antibiotic administration in pigs, accounting for around half (52%) of antibiotic use (**Figure 2.4**). However, relative use of in-feed antibiotics has notably decreased since 2017, when it accounted for 75% of overall use. Conversely, relative in-water use has increased from 22% in 2017 to 43% in 2024. The shift in route of administration, which primarily took place between 2017 and 2022, reflects the pig sector's work to encourage in-water administration over in-feed, to allow for more targeted administration of antibiotics. Since 2022, the volume of antibiotics administered in-feed relative to in-water has remained stable.

Figure 2.5: Active ingredient (mg/kg) of HP-CIAs reported in eMB Pigs, 2015 to 2024.



2.3.1.2 Statement from Pig Health and Welfare Council (PHWC) Antimicrobial Usage Subgroup

"In 2024, the UK pig sector saw a slight rise in antibiotic use and, although this still represents a reduction of 18% since 2020, we have not met our ambitious target to reduce use by 30% over this period. However, it is still 69% lower than the use levels reported in 2015, when data was first collected.

The sector faced multiple challenges in 2024, which may have increased the need for antibiotic use. These include the withdrawal of zinc oxide for the management of post-weaning diarrhoea and vaccine availability issues including against PRRS virus, which can result in secondary bacterial infection in immunocompromised pigs, and *Salmonella*. In addition, diagnostic submissions to the Great Britain (GB) scanning surveillance network (including APHA and SRUC laboratories) showed an increase in the diagnostic rate of enteric disease due to *Escherichia coli* and the number of diagnoses of swine dysentery in 2024. Whilst these data may not be representative of prevalence data, they suggest an increase in enteric disease challenges for the pig industry.

The biggest increases in usage seen between 2023 and 2024 were in the trimethoprim-sulfonamide (23%) and lincosamide (47%) antibiotic classes. Although lincosamides only account for 8% of overall use, this increase may reflect an increase in swine dysentery cases in 2024. The use of Highest-Priority Critically Important Antibiotics (HP-CIAs) in pigs remains very low (accounting for 0.01% of overall use) and there has been no colistin used for the last five years.

We continue to focus on reducing use further, but it is important that antibiotics are still available to be used when necessary. The recognition and engagement with persistently high users identified through eMB benchmarking data has been a focus of the sector. This has enabled persistently high users to improve their antibiotic stewardship and initiate improvements on farm. In addition, the sector has and will continue to focus on improving biosecurity on farms to reduce the need to use antibiotics and reduce the use of in-feed medication to enable more targeted administration. The pig sector is setting new 4-year targets as part of RUMA targets taskforce in 2025 and continues to strive towards antimicrobial stewardship improvements."

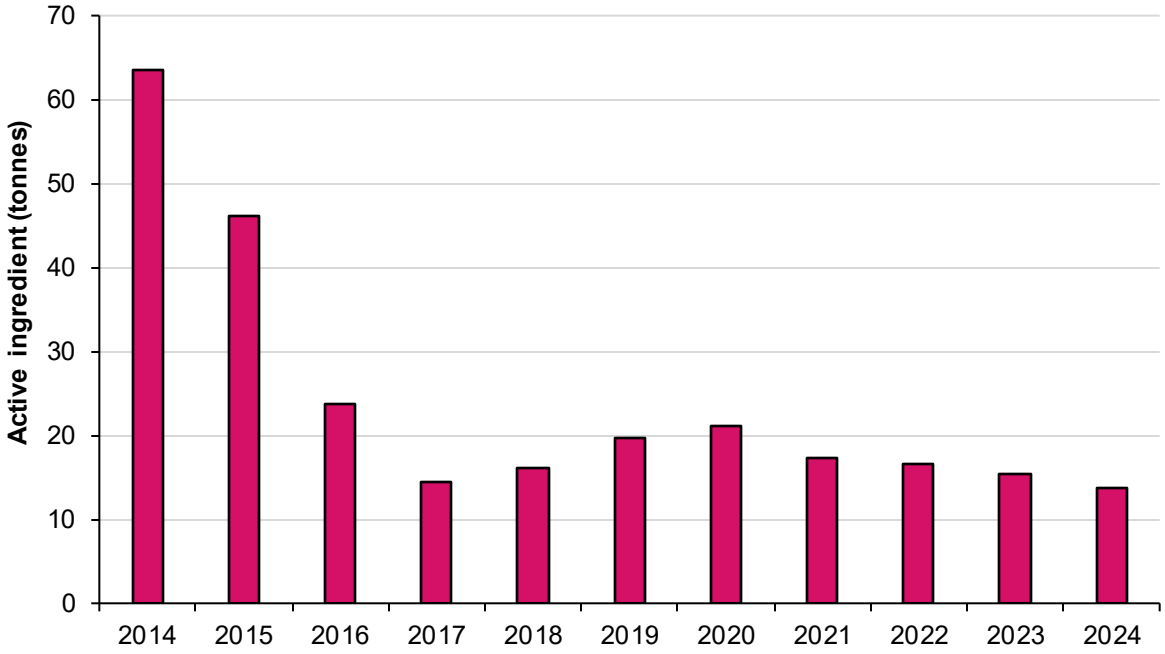
2.3.2 Meat poultry

2.3.2.1 Antibiotic usage data

Data from the British Poultry Council (BPC) Antibiotic Stewardship, representing around 86% of the meat poultry industry (990 million broilers, 7.5 million turkeys and 10.4 million ducks entering the food chain and including breeding birds), reported the use of 13.7 tonnes of active ingredient in 2024. This is the lowest usage since data was first published in 2014, representing an 11% (1.7 tonnes) decrease since 2023 and a 78% (49.8 tonnes) decrease since 2014 (**Figure 2.6**). When considering HP-CIAs, colistin has not been used by any of the meat poultry sectors since 2016 and use of third- and fourth- generation cephalosporins has never been reported. In 2024, the meat poultry sector used 2.2 kg of fluoroquinolones, which is a reduction of 57% (2.9 kg) since 2023 and represents 0.02% of overall antibiotic use by weight. HP-CIA use has now reduced by 99.8% (1.2 tonnes) since 2014.

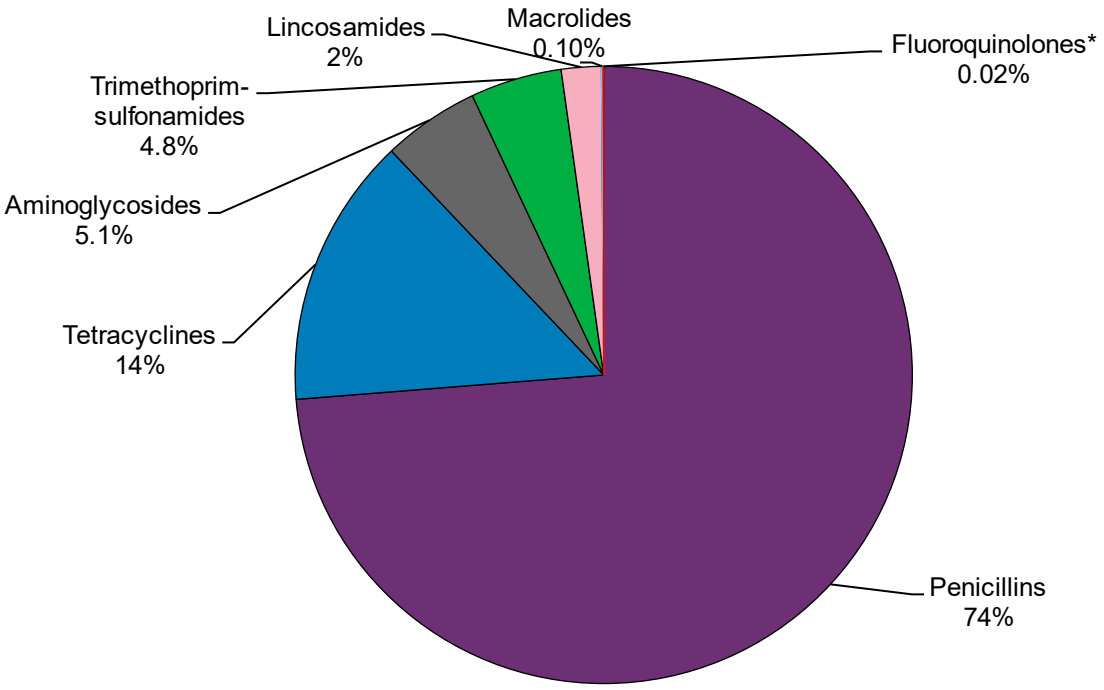
Products imported under the Special Import Scheme accounted for 23kg of active ingredient (0.2% of total use) in 2024, and this is due to a lack of a UK licensed premix containing paromomycin for turkeys.

Figure 2.6: Active ingredient (tonnes) of antibiotics used by all meat poultry (Broilers, Turkeys and Ducks) members of BPC Antibiotic Stewardship, 2014 to 2024.



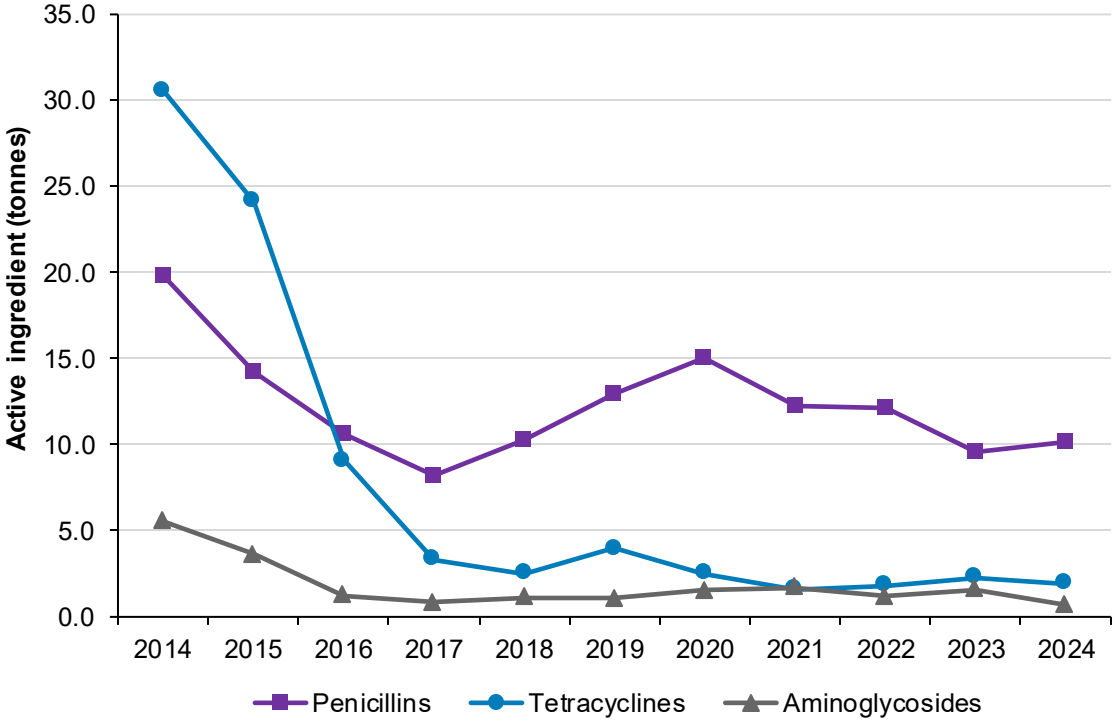
In 2024, 74% of active ingredients used in meat poultry were penicillins (all of which was amoxicillin) (**Figure 2.7**), compared with 62% in 2023. This is because the use of penicillins increased by 5% (0.47 tonnes) between 2023 and 2024, whereas all other antibiotic classes reduced in use. Since 2014, the top three antibiotic classes (penicillins, tetracyclines and aminoglycosides) used in meat poultry have reduced by 49%, 94% and 87% respectively (**Figure 2.8**).

Figure 2.7: Active ingredient (% weight) of antibiotics by antibiotic class used by all meat poultry (Broilers, Turkeys and Ducks) members of BPC Antibiotic Stewardship, 2024.



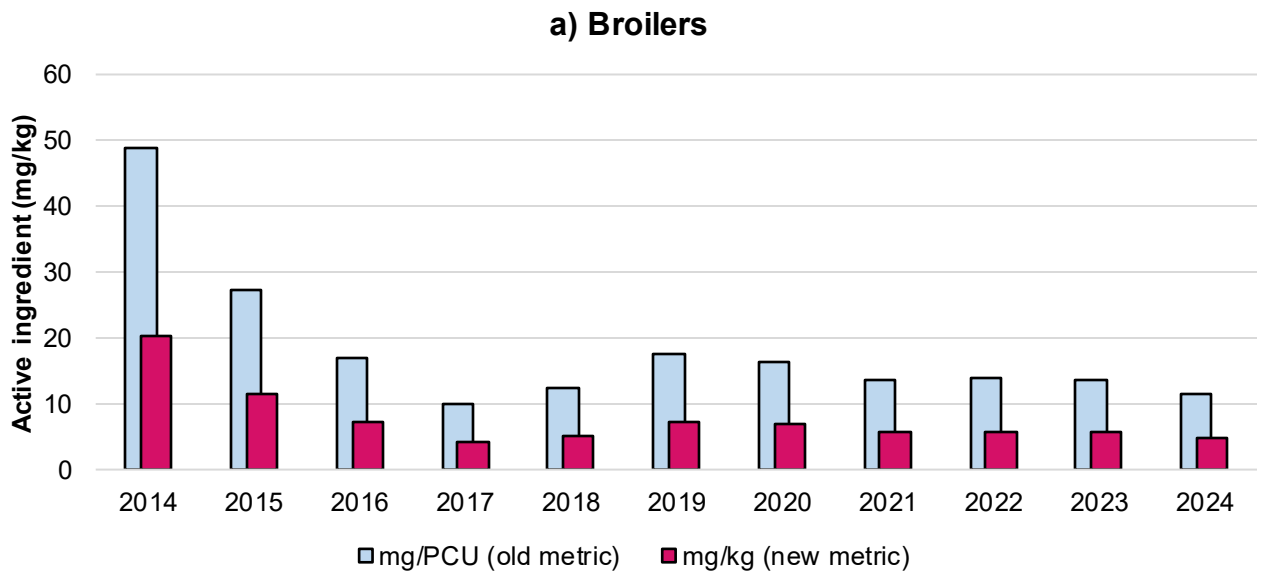
* Fluoroquinolones fall under the category of an HP-CIA

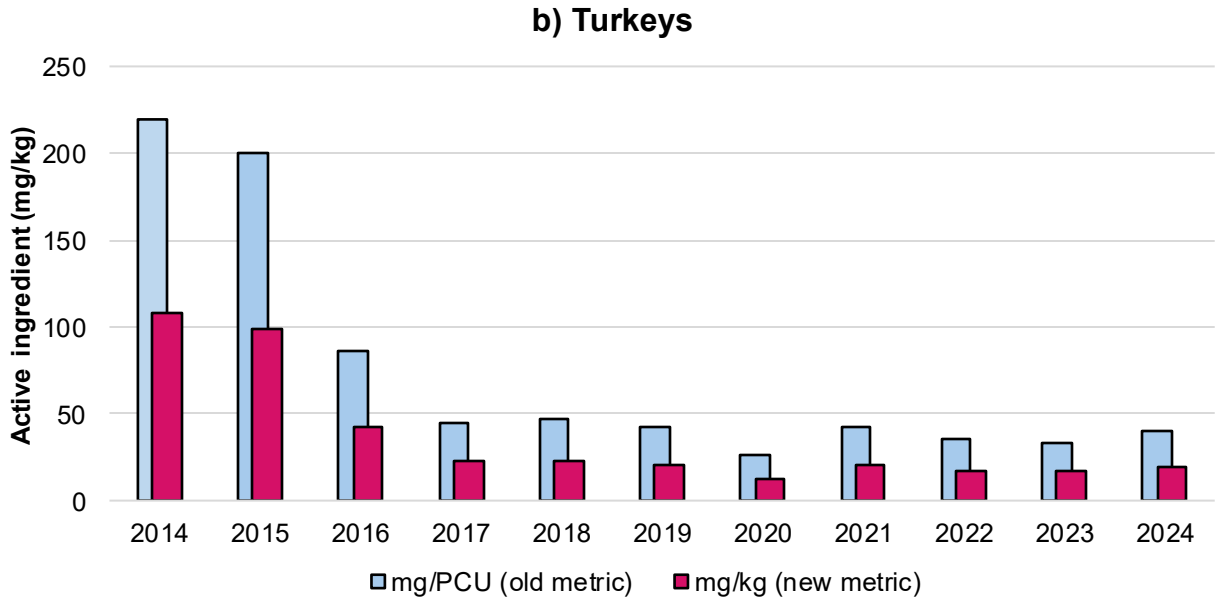
Figure 2.8: Active ingredient (tonnes) of the top three antibiotics by antibiotic class used by all meat poultry (Broilers, Turkeys and Ducks) members of BPC Antibiotic Stewardship, 2014 to 2024.

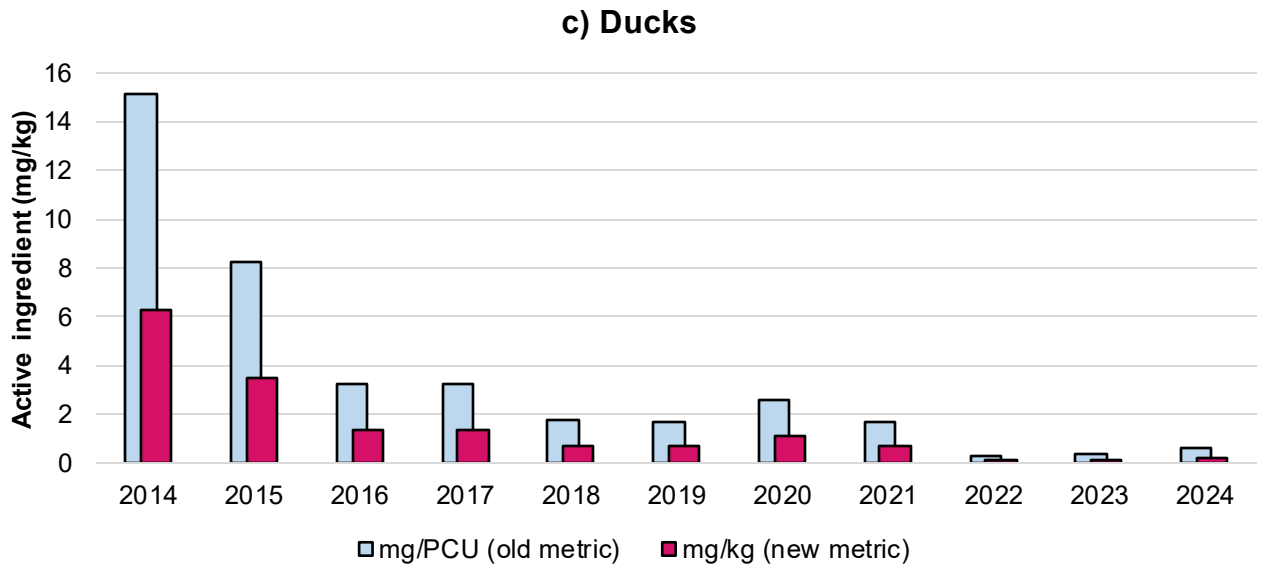


When adjusting for the size of the animal population (and excluding breeding birds), antibiotic usage in the chicken sector decreased by 16% (0.9 mg/kg) in 2024 to 4.7 mg/kg (11.3 mg/PCU) (**Figure 2.9**). This represents a 77% (15.6 mg/kg) decrease since data was first published in 2014 and remains below the sector target of 10.4 mg/kg (25 mg/PCU) (**Figure 2.9**). Antibiotic use in the turkey sector increased by 19% (3.2 mg/kg) to 19.7 mg/kg (40.0 mg/PCU) in 2024. It has, however, reduced by 82% (88.4 mg/kg) since 2014 and remains below the sector target of 24.6 mg/kg (50 mg/PCU) (**Figure 2.9**). The duck sector demonstrated an increase of 0.08 mg/kg to 0.24 mg/kg (0.58 mg/PCU), which remains a very low level, and antibiotic use has now decreased by 96% (6.1 mg/kg) since 2014.

Figure 2.9: Active ingredient (mg/kg) of antibiotics by species used by members of BPC Antibiotic Stewardship, 2014 to 2024. (a) Broilers, (b) Turkeys, and (c) Ducks. Note that the mg/kg is lower than the mg/PCU for broilers, ducks, and turkeys. See section 2.1 for further details.







When looking at HP-CIAs, there was no fluoroquinolone use in slaughter broilers in 2024, whereas use was 0.001 mg/kg in 2023, and once again there was no fluoroquinolone use in ducks. Fluoroquinolone use in slaughter turkeys increased very slightly from 0.020 mg/kg in 2023 to 0.022 mg/kg in 2024.

2.3.2.2 Statement from British Poultry Council

“Antibiotic use in broilers and turkeys remains below sector targets - a testament to the leadership and collaboration of BPC Antibiotic Stewardship members. The group meets several times a year to discuss challenges and shared learnings and experience, as well as support appropriate research into AMR.

Challenging weather conditions resulted in increased number of outbreaks of Blackhead Disease in turkeys caused by the protozoan parasite *Histomonas meleagridis*. Currently there is no licenced product in the UK for prevention or treatment of Histomonas meleagridis and thus the only option for turkey producers is targeted antibiotic use, prescribed by vets to manage bird health and welfare. Despite the slight increase in antibiotic use in the turkey sector due to these Blackhead episodes, overall use across the meat poultry sector continues to fall.

The BPC Antibiotic Stewardship continues to demonstrate that responsible antibiotic use is a deliberate, health-led choice. Driven by continuous improvement, our industry’s commitment to transparency is safeguarding our antibiotics and strengthening the foundations of UK food security.”

2.3.3 Laying hens

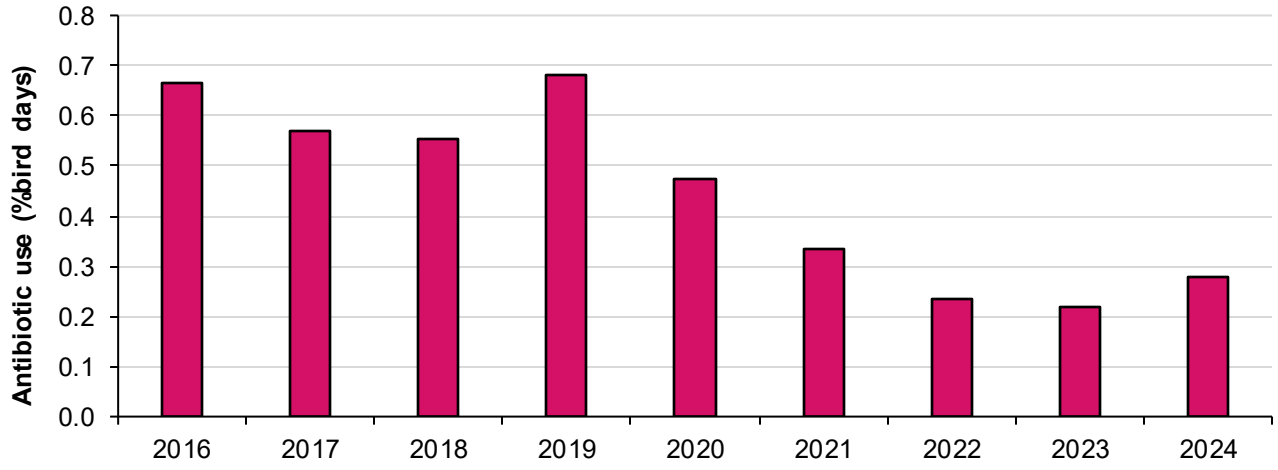
2.3.3.1 Antibiotic use data

In 2024, data collected by the British Egg Industry Council (BEIC), represented around 90% of the laying hen industry. Unlike the other sectors, the laying hen sector collect detailed information on the actual number of days each bird receives an antibiotic and present this as % bird days, which represents the average number of days of treatment administered per chicken over a 100-day period (see section 2.5 for the full methodology). The sector considers that this metric is more accurate for the purpose of trend monitoring than alternative approaches (e.g. mg/kg and Defined Daily Dose metrics) as it doesn't rely on standardised assumptions for bodyweight and dose rates.

Overall the sector reported that a total of 2.0 tonnes of antibiotic active ingredient was used, which represents 0.28% bird days (actual bird days treated/100 total bird days on the farm). This is an increase of 0.06% bird days since 2023 but a decline of 58% (0.39% bird days) since data was first published in 2016 (**Figure 2.11).**

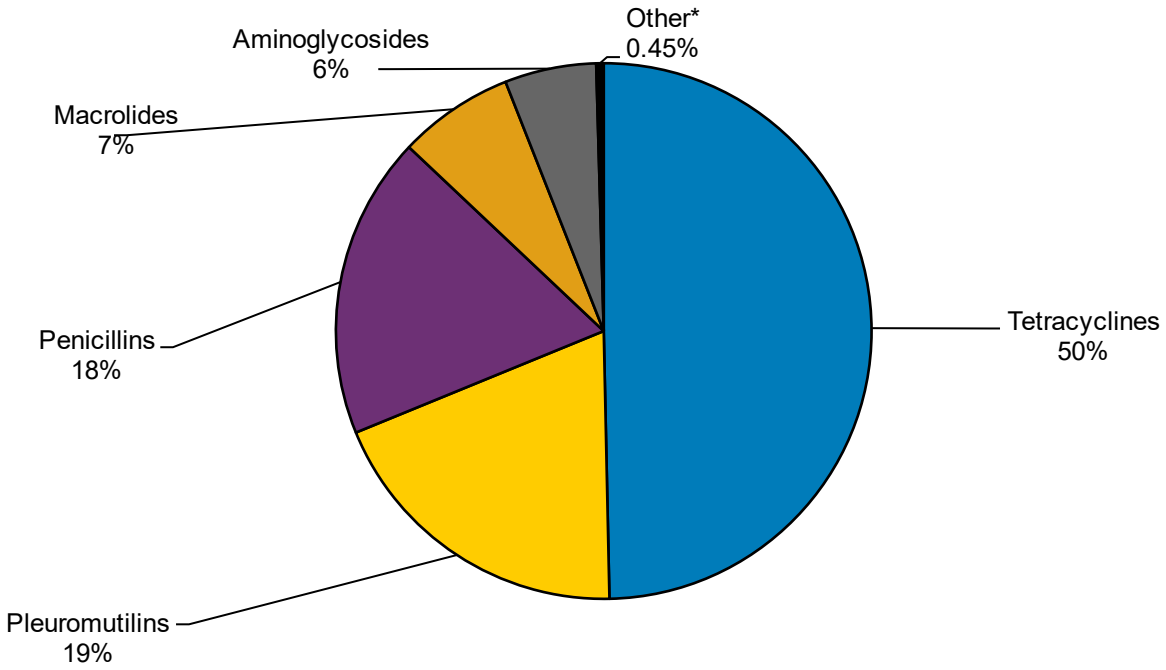
Products containing oxytetracycline imported under the Special Import Scheme accounted for 1 tonne of active ingredient (53% of total use). This is necessary due to the lack of a UK licensed in-water oxytetracycline product for laying hens.

Figure 2.10: Antibiotic use (% bird days) by members of the BEIC Lion Code, 2016 to 2024



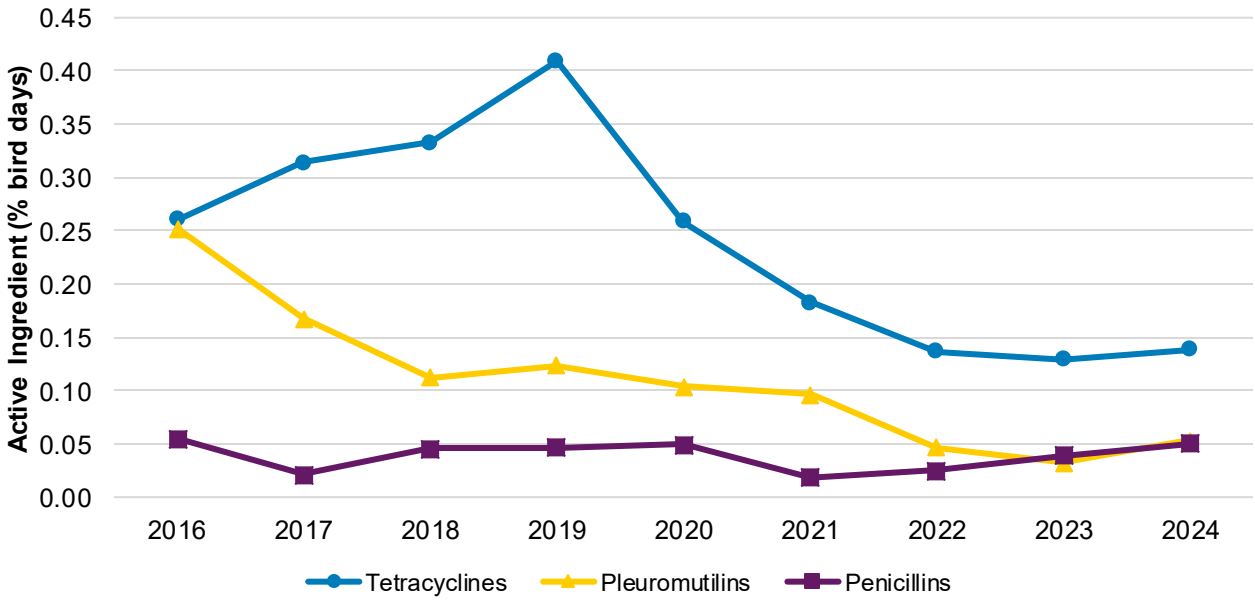
Tetracyclines, pleuromutilins and penicillins accounted for 87% of total use in 2024 **(Figure 2.12)** and these increased by 0.01, 0.02 and 0.01% bird days respectively between 2023 and 2024 **(Figure 2.13).** When considering HP-CIAs, 3 kg of fluoroquinolones were used in 2024 which equates to 0.0007% bird days (0.2% of total use). This is the first time HP-CIAs have been used in the laying hen sector since 2016. BEIC have indicated that this relates to a single course of treatment administered to a breeder flock and not for birds producing eggs for the food-chain **(Figure 2.12)**.

Figure 2.11: Antibiotic use (% of total bird days) by antibiotic class by members of the BEIC Lion Code, 2024.



*Other includes fluroquinolones (0.24%) and lincosamides (0.21%).

Figure 2.12: Antibiotic use (% bird days) of the top three antibiotics by antibiotic class by members of the British Egg Industry Council Lion code, 2016 to 2024.



2.3.3.2 Statement from the British Egg Industry Council (BEIC)

"The antibiotic use data from members of the British Egg Industry Council (BEIC) Lion Scheme for 2024 continues to be below the target of 1% bird days, and 0.05% bird days for HP-CIAs and the laying hen sector remains a very low user of antibiotics.

The Lion standard focuses on bird health through good biosecurity and hygiene, as well as feed and water quality. Version 8 of the Scheme (which was launched in June 2023) covers the majority of the sector and demands enhanced veterinary supervision of sites, with a strong focus on identifying heavy users of antibiotics and building in preventative programmes. There is also widespread vaccination within the sector, and it is not uncommon for a 16 week pullet to have had 20 different vaccinations from hatching.

BEIC only permit the use of fluoroquinolone in the treatment of significant cases of disease, where other treatments have failed to achieve the required outcome and where the case has been reviewed and a derogation for treatment issued.

The industry is continuing the trend for retail supply away from enriched colony cage production and towards free-range production as well as longer lived birds. We are confident that we will continue to remain below our current antibiotic use target of 1% bird days, and 0.05% bird days for HP-CIAs."

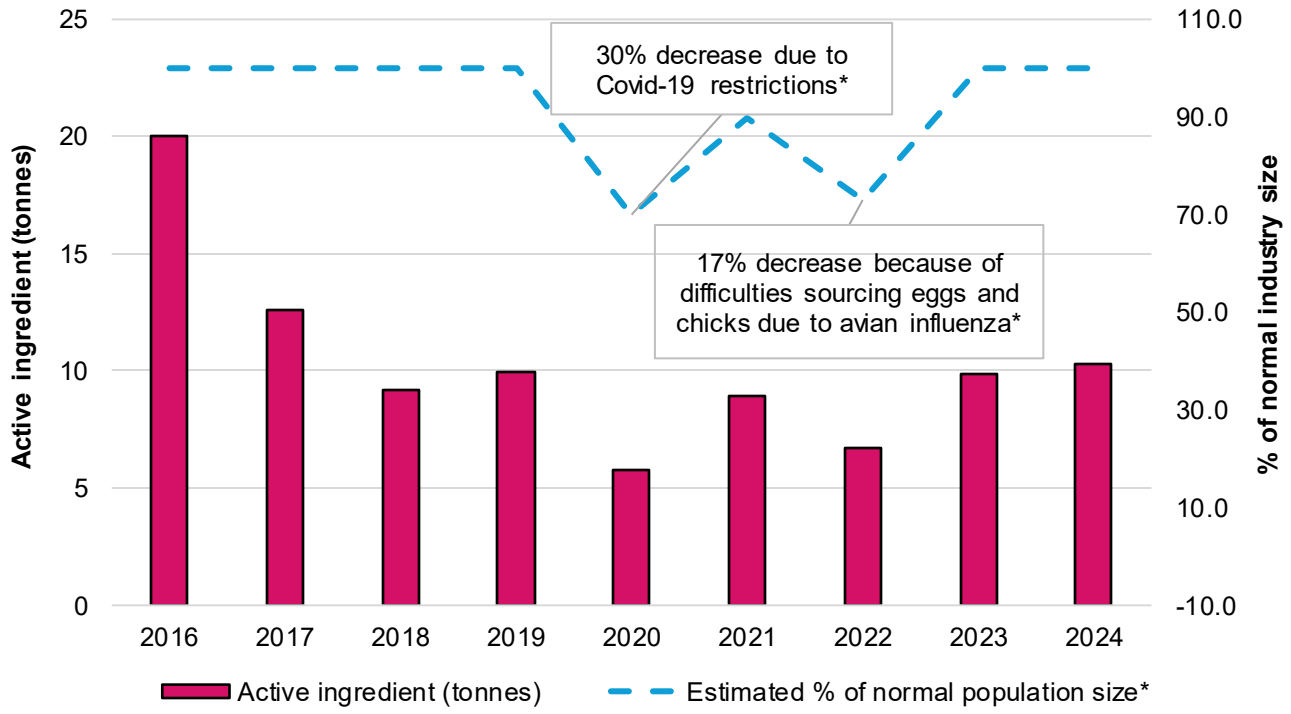
2.3.4 Gamebirds

2.3.4.1 Antibiotic use data

In 2024, 10.3 tonnes of active ingredient were reported through the Game Farmers' Association (GFA) and British Veterinary Poultry Association (BVPA) gamebird subcommittee data collection programme, which represents around 90% of the industry. The antibiotic use metric is not equivalent to that used in other sectors as the gamebird sector does not adjust antibiotic use for the underlying population. This means that changes in the yearly figure are influenced by changes in the gamebird population. However, when comparing 2023 and 2024, it is estimated that approximately the same number of gamebirds were reared while antibiotic use increased by 5% (0.47 tonnes). This still represents a reduction of 48% (9.7 tonnes) since data was first published in 2016. This overall reduction is mainly due to the reductions that took place between 2016 and 2018 (**Figure 2.15)**.

Products imported under the Special Import Scheme accounted for 0.1 tonnes active ingredient (1% of total use) in 2024, and this is due to a lack of a UK licensed in-water product containing oxytetracycline.

Figure 2.13: Active ingredient (tonnes) of antibiotics used in gamebirds, collected by the GFA and BVPA data collection programme, 2016 to 2024 and estimated population size (% of normal population size).

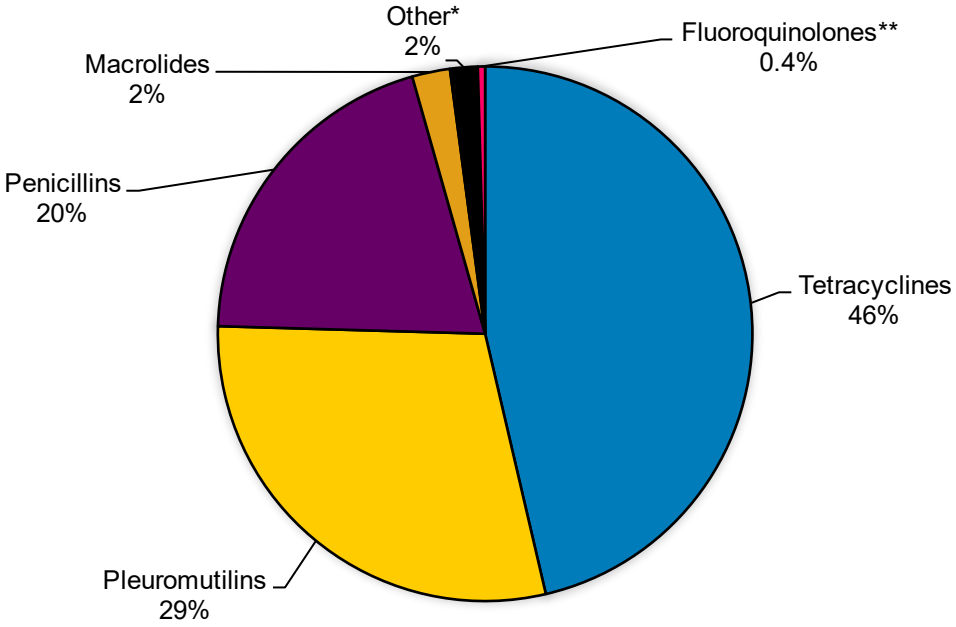


*% change in population size as estimated by the Game Farmers Association

The use of antibiotics broken down by active ingredient is shown in **Figures 2.14** and **2.15.**

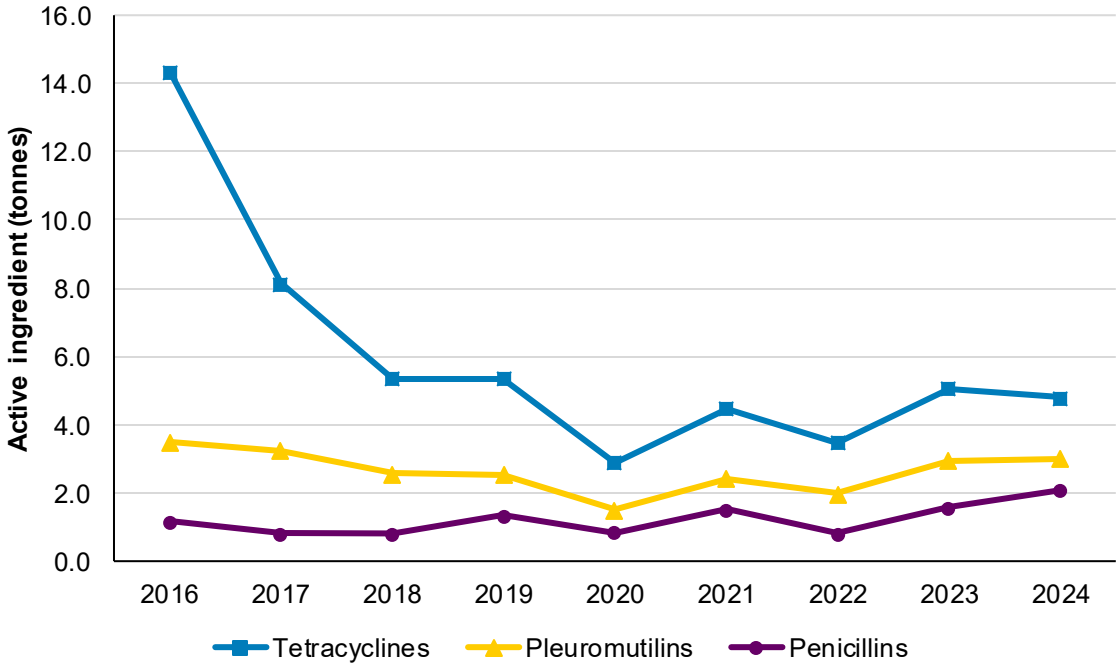
Tetracyclines remain the most used active ingredient, representing 46% of total antibiotic use in 2024. Since 2016, the use of this antibiotic has dropped by 67% (9.6 tonnes). By contrast, pleuromutilins have reduced to a lesser degree by 14% (0.5 tonnes) and penicillins have increased by 77% (0.9 tonnes) over the same period. The increase in antibiotic use between 2023 and 2024 is primarily attributed to a 33% (0.5 tonne) increase in the use of penicillins.

Figure 2.14: Active ingredient (% weight) of antibiotics by antibiotic class used in gamebirds, collected by the GFA and BVPA data collection programme, 2024.



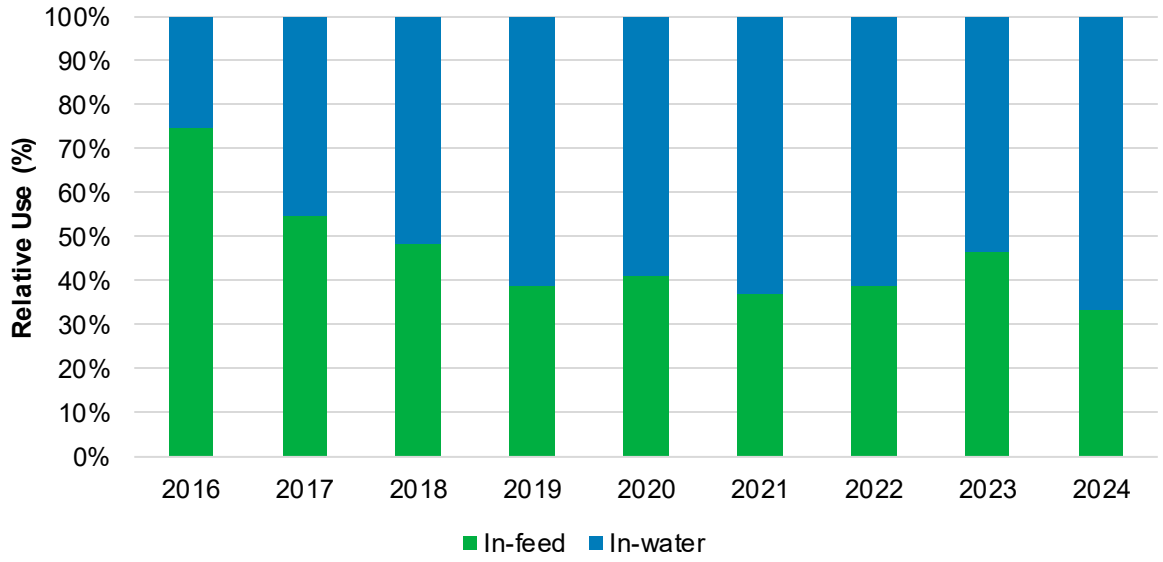
* Aminoglycosides, lincosamides, amphenicols and trimethoprim-sulfonamides
** Fluoroquinolones fall under the category of an HP-CIA

Figure 2.15: Active ingredient (tonnes) of top three antibiotics by antibiotic class used in gamebirds, collected by the GFA and BVPA data collection programme, 2016 to 2024.



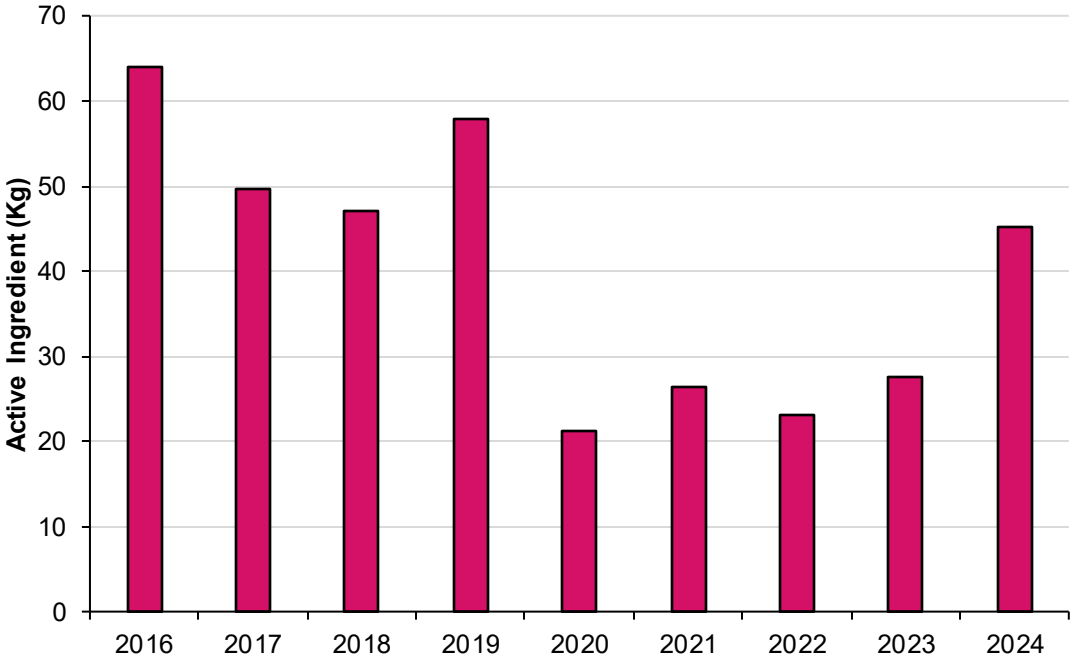
Analysis by route of administration shows that in-feed use reduced by 25% (1.1 tonnes) between 2023 and 2024 whereas in-water use increased by 31% (1.6 tonnes). Therefore, relative use of in-feed has decreased from 47% in 2023 to 33% in 2024 and has dropped considerably since 2016, when it accounted for 75% of antibiotic use (**Figure 2.16)**. The reduction of in-feed use is in line with the industry's focus on moving from in-feed to in-water medication where possible, which allows for more targeted treatment.

Figure 2.16: Active ingredient (% relative use) by route of administration used in gamebirds, collected by the GFA and BVPA data collection programme, 2016 to 2024.



The fluoroquinolone enrofloxacin is the only HP-CIA used by the gamebird sector. Its use has increased by 63% from 17.5kg in 2023 to 45.1kg in 2024, accounting for 0.4% of overall use. However, HP-CIA use is still 30% (18.9kg) lower than when data was first published in 2016 (**Figure 2.17**).

Figure 2.17: Active Ingredient of HP-CIAs (kg) used in gamebirds, collected by the GFA and BVPA data collection programme, 2016 to 2024.



2.3.4.2 Statement from the Game Farmers' Association and the British Poultry Veterinary Association (BVPA) gamebird subcommittee

"The small (5%) rise in overall antibiotic use to 10.3 tonnes of antibiotic active ingredient means that the gamebird sector has not met their target of reducing antibiotic use by 40% between 2019 and 2024 to 6.24 tonnes. Following the significant reductions seen between 2016 and 2018, antibiotic use has effectively flattened out (with changes between 2020 and 2022 largely relating to differences in the number of birds reared).

The 25% fall of in-feed antibiotic use between 2023 and 2024 is encouraging. In-feed antibiotic use tends to occur more in the post-release period (which accounts for a disproportionately high percentage of total use). In addition, the sector is voluntarily moving away from the use of in-feed antibiotics on rearing sites. The increase of 33% in in-water antibiotic use during this period partly relate to the adverse weather conditions during the rearing and releasing periods. For example, 10 counties experienced their wettest September on record (Met Office Data) which increases the risk of the hexamitasis at release. In addition, warmer winters mean that coccidia/ protozoa are more likely to survive over winter, increasing the risk of enteric disease. Therefore the increase of in-water antibiotic use may primarily be due to the treatment of enteric conditions with the aim of controlling the bacterial infection triggered by the enteritis. Another area which can require this type of antibiotic use is poor chick health.

The increase in enrofloxacin use (an HP-CIA) between 2023 and 2024 largely relates to use for septicaemia in chicks. The gamebird sector will renew their efforts to ensure that these

antibiotics are only used as a last resort and with good reason, e.g. where culture and sensitivity tests suggest it is the only suitable option, and emphasis will be placed on returning to levels of HP-CIA use seen in 2022 and 2023.

Going forward, the gamebird sector is currently focusing on developing a comprehensive communications strategy, continuing to develop and encourage engagement with veterinary and game-feed industry led training initiatives and increasing the promotion of self-regulation and auditing. This includes through the Trusted Game initiative which has a strong focus on welfare standards and antibiotic use. It will also continue to encourage the raising of standards within the release environment, including use of the GFA pen-scoring matrix. The sector is also trialling and refining a per unit calculation (mg/kg) for gamebirds over the next two years, to help benchmarking and raising awareness at farm and shoot level."

2.3.5 Aquaculture

2.3.5.1 Salmon

2.3.5.1.1 Antibiotic use data

Please note that these figures as well as the industry statement are different from those originally published. Salmon Scotland has provided this statement to explain further: "We identified an error in the previously reported 2024 antibiotic use figure and have taken steps to correct all public records. We have introduced additional verification checks within our data collection and reporting systems, to help ensure this doesn't happen in the future".

In data collected by Salmon Scotland representing 100% of the industry, 1.6 tonnes of antibiotic active ingredient were used in 2024, representing 8.1 mg/kg **(Figure 2.18).** This is a decrease of 67% (16.7 mg/kg) since 2023 and 49% (7.9 mg/kg) compared with 2017, when data was first published. It is also the second lowest usage seen in the salmon sector since data was first published in 2017 and below the RUMA target set by the sector. The 2024 usage figures are based on production figures, as published in the Marine Production Survey 2024.

In 2024, 13% of use was oxytetracycline and 87% florfenicol. Between 2023 and 2024, oxytetracycline use reduced by 91% (11.3 mg/kg) and florfenicol use reduced by 43% (5.3 mg/kg). Since 2017, oxytetracycline use has reduced by 92% (12.7 mg/kg) and the use of florfenicol has increased by 225% (4.9 mg/kg) (**Figure 2.19).**

Figure 2.18: Antibiotic active ingredient (mg/kg) used in salmon, 2017 to 2024.

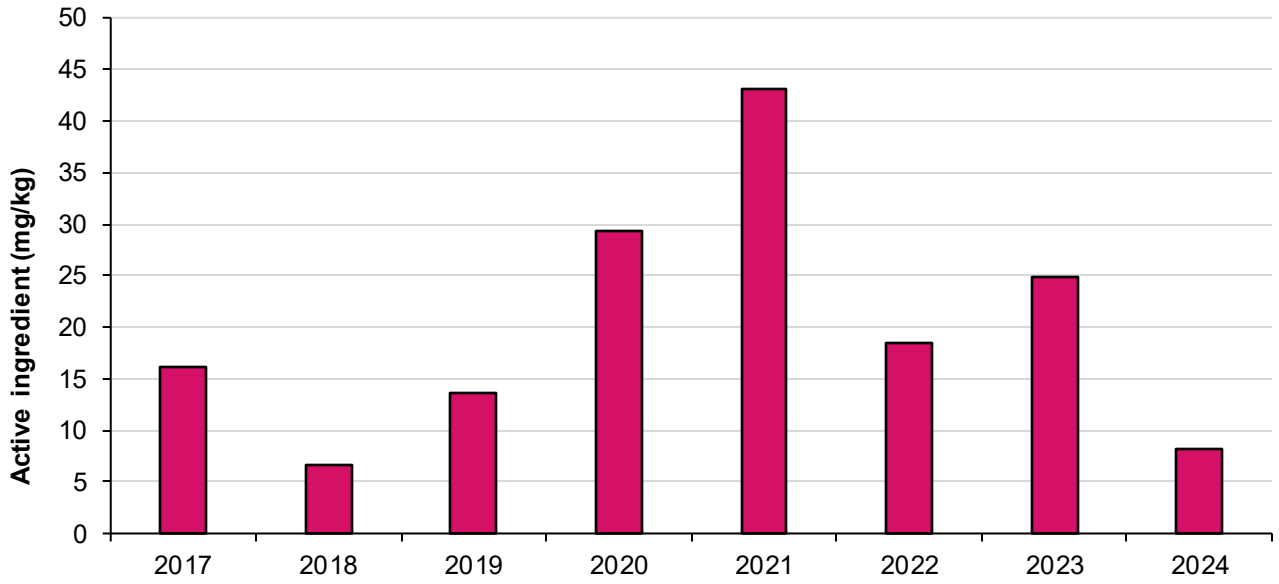
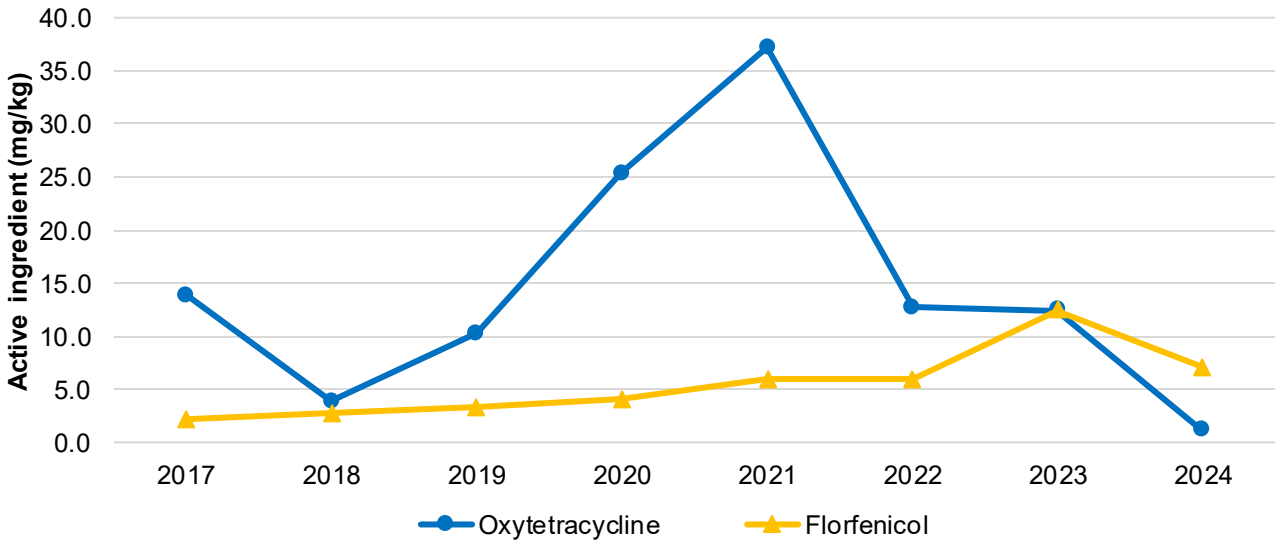


Figure 2.19: Antibiotic active ingredient (mg/kg) by antibiotic class used in salmon, 2017 to 2024.



2.3.5.1.2 Statement from Salmon Scotland

"The data records a decrease in antibiotic use compared 2023, with use the second lowest since detailed, sector wide statistics were first published in 2017. Antibiotic treatments continue to be relatively infrequent in the salmon farming sector, with only 10.6% of freshwater farms and 9.0% of marine farms treated in 2024. Antibiotics are only ever used in response to the clinical presentation of bacterial infection: there is no prophylactic use of antibiotics, and any use is supported by appropriate sensitivity testing. Similar to previous years, there was no use of the HP-CIA oxolinic acid in 2024.

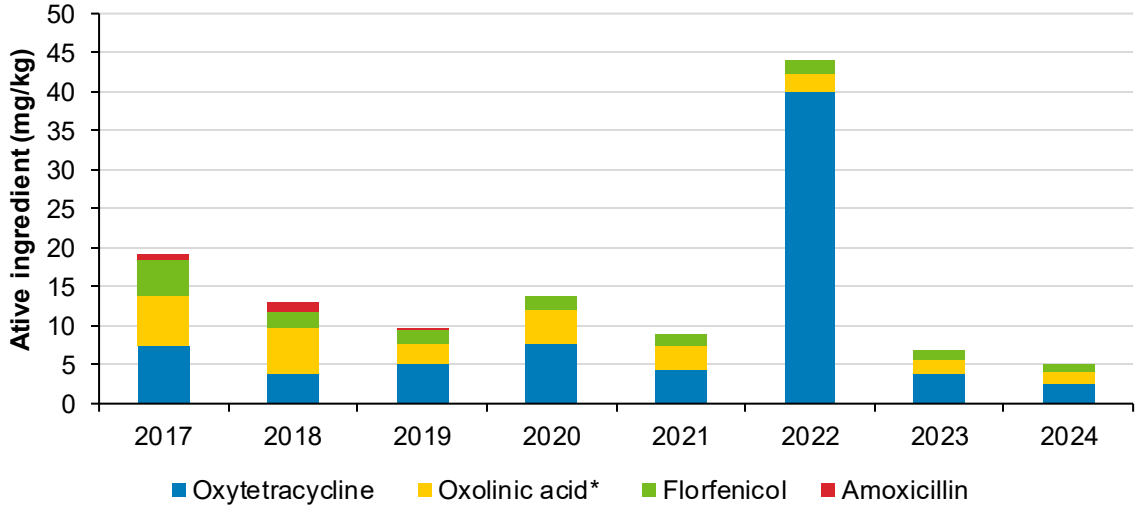
The Salmon sector continues to focus on a holistic and preventative approach to health management, including vaccination, antibiotic stewardship, biosecurity and health and welfare planning. The sector also continues to support the development of innovative approaches to fish health management, which could support antibiotic stewardship in the future. Furthermore, antibiotic use and stewardship are routinely discussed within a dedicated Prescribing Vets forum. It should also be noted that the overall production cycle for Salmon is 3 years, so single year mg/kg figures can be difficult to interpret. The sector remains committed to responsible use of antibiotics, balancing a drive to reduce use against the need to safeguard fish health and welfare."

2.3.5.2 Trout

2.3.5.2.1 Antibiotic use data

The UK trout industry data was obtained from veterinary practices that treat approximately 90% of UK trout production and demonstrates that a total of 0.05 tonnes of antibiotic active ingredient was used in 2024. This represents 5.1 mg/kg, which is a reduction of 26% (1.8 mg/kg) since 2023. This is the lowest usage seen in the trout sector since data was first published in 2017 (see **Figure 2.20**).

Figure 2.20: Active ingredient (mg/kg) of antibiotics by antibiotic class used in trout, 2017 to 2024.



*Oxolinic acid falls under the category of an HP-CIA

When considering usage by class, oxytetracycline and florfenicol account for 71% of antibiotic use and, between 2023 and 2024, their use decreased by 31% (1.2 mg/kg) and 25% (0.4 mg/kg) respectively.

In 2024, use of the HP-CIA oxolinic acid (a quinolone which is imported under the Special Import Scheme and commonly used for the treatment of *Yersinia ruckeri,* Enteric Redmouth) accounted for 29% of overall use (14.8 kg) and, between 2023 and 2024, this decreased by 17% from 1.8 mg/kg to 1.5 mg/kg, the lowest level recorded. It has now decreased by 78% (5.1 mg/kg) since 2017.

Note that the large increase seen in 2022 was linked to an outbreak of *Aeromonas salmonicida* on a small number of production sites, which has since resolved.

2.3.5.2.2 Statement from the British Trout Association

"It is encouraging to see overall antibiotic use and the use of the HP-CIA oxolinic acid reduce in 2024 to the lowest levels seen since data was first recorded in 2016. In the trout sector antibiotics are only used in response to disease. These reductions are testament to the trout sector's ongoing commitment to reducing antibiotic use through disease prevention, including vaccination, and promoting best practice through the Quality Trout UK standard. The sector continues to promote best practices, with health and welfare courses regularly run by vets for farm staff and a strong focus on veterinary health plans. These reductions are particularly impressive given the supply issues associated with Enteric Redmouth vaccines which occurred in 2024.

The sector is heavily involved in projects aimed at monitoring resistance and looking at innovative solutions to help detect disease early and combat disease challenges. The sector is also keen to encourage the development of new and improved vaccines to further reduce the need to use antibiotics."

2.3.6 Ruminants

2.3.6.1 Medicine Hub

The Medicine Hub is a centralised national industry database for the collection and collation of antibiotic use data in UK dairy, beef and sheep. It is a voluntary industry initiative launched by the Agriculture and Horticulture Development Board (AHDB) in 2021 and published its first data, covering 2022, in 2023.

Currently, a low proportion of each ruminant sector is captured within the Medicine Hub compared to other livestock sectors included in this report (which have coverage of 85-100%). The data cannot therefore be interpreted as 'national' antibiotic use figures for these sectors.

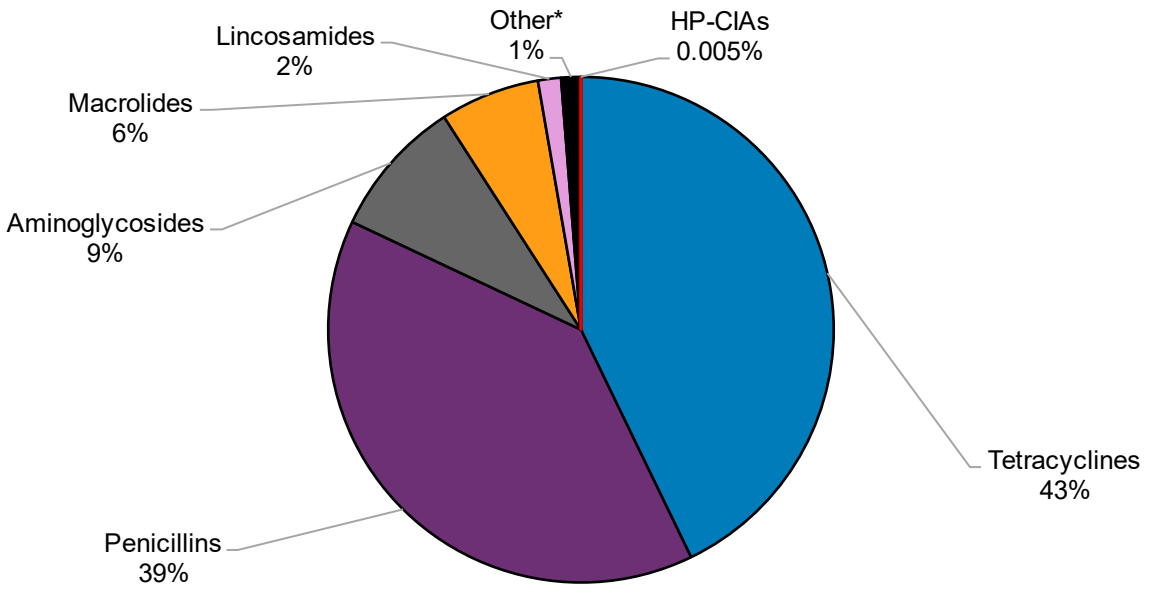
Antibiotic use data from the beef sector was not provided for inclusion in this report. This is because the large variety of beef farm types within the UK (suckler, dairy beef, calf rearers and finishers) mean that the low coverage within this sector results in a higher chance of the mg/kg data not being indicative of the national picture compared to other ruminant sectors (see the RUMA sector target reports for further details).

The mg/kg figures presented for ruminants, unless otherwise stated, are calculated using the new mg/kg methodology for dairy and sheep (see section 2.4 of this report for further details).

2.3.6.2 Sheep antibiotic use data

Antibiotic use data representing 8% of the UK finished lambs in the sheep sector was collected in 2024. The overall use was 0.6 tonnes, which represented 6.3 mg/kg (6.9 mg/PCU). 82% of the antibiotic classes used were either penicillins or tetracyclines (**Figure 2.21**) and 95% were injectables. HP-CIA use was very low, accounting for 0.0003 mg/kg (0.005% of total use). Products imported under the Special Import Scheme accounted for 40kg active ingredient (6% of total use) and this was predominantly injectable products containing penicillin and streptomycin and caused by product shortages for the licensed equivalent product, which occurred in both 2023 and 2024. However, it should be noted that, due to only representing a small percentage of the industry, this data may not be reflective of the overall use in the sheep sector.

Figure 2.21: Active ingredient in (mg/kg) of antibiotic by active ingredient/antibiotic class for sheep in 2024.



*Other includes trimethoprim-sulfonamides, amphenicols, 1st and 2nd generation cephalosporins and aminocoumarins.

2.3.6.2.1 Statement from the Sheep Antibiotic Guardian Group

“The sheep sector continues to encourage responsible antibiotic use while maintaining good health and welfare. It does this through a collaborative approach, working with vets, farmers, diagnostic laboratories and industry representatives.

At the time of writing, 2024 antibiotic use data from flocks representing 8% of UK lamb production were uploaded onto the industry Medicine Hub. This data provides evidence that the UK lamb sector is a low user of antibiotics. Review of this data indicates responsible antibiotic stewardship with antibiotic classes representing the lowest risk to humans accounting for the greatest proportion used (82% being tetracyclines and penicillins) and very low use of HP-CIAs. In addition, antibiotics are predominately being given by injection, demonstrating selected and targeted use in individual animals.

The sheep sector continues to focus on engagement, with initiatives such as Arwain DGC and veterinary prescribing champions in Wales and the Farm Vet Champion network providing medicine training within veterinary practices across the rest of the UK. Active encouragement of increased collaboration between sheep farmers and their vets is a core principle of the Animal Health and Welfare Pathway in England, the Preparing for Sustainable Farming programme in Scotland and the Animal Health Improvement Cycle in Wales.

As an ongoing part of engagement, the sheep sector is looking to further develop a national lambing survey to both collate sheep sector data and raise further awareness regarding medicine stewardship during a key period in the sheep calendar year.

We continue to proactively explore how to further promote and demonstrate responsible stewardship of antibiotics. The cattle and sheep guardian groups, SAGG and CAGG are combining forces with farming and veterinary associations, under the leadership of the transdisciplinary network AMAST and RCVS Knowledge to collaborate with all stakeholders in the ruminant sectors to co-create a UK Ruminant Antibiotic Stewardship Roadmap. This one-year initiative will aim to build on regional successes and better understand the barriers, and therefore enablers, to the effective demonstration of responsible stewardship within UK ruminants.”

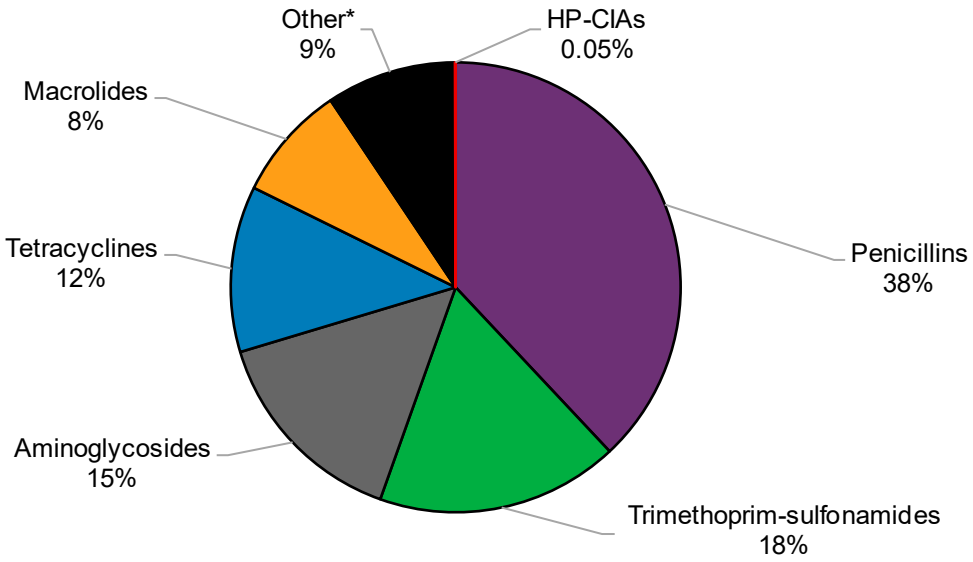
2.3.6.3 Dairy antibiotic use data

Data collected in 2024 represented 39% of the dairy sector. Overall, the use in this sample of the dairy sector was 4.3 tonnes, which represented 6.8 mg/kg (14.2 mg/PCU). The most commonly used antibiotic class was penicillins, representing 38% of total antibiotics used (**Figure 2.22**). Trimethoprim-sulfonamides, aminoglycosides and tetracyclines represented 18%,15% and 12% of use respectively.

The main route of administration by active ingredient was injection (77%), followed by intramammary (13%) and in-water/milk (10%).

Products imported under the Special Import Scheme accounted for 0.2 tonnes of active ingredient, 76% of which were injectable products containing penicillin and streptomycin. This is due to product shortages for the licensed equivalent product, which occurred in both 2023 and 2024. Imported products also accounted for 8% of intramammary lactating cow active ingredient used and 0.5% of intramammary dry cow tubes used, again due to the equivalent products being discontinued (for lactating cow) or in short supply (for dry cow).

Figure 2.22: Active ingredient in (mg/kg) of antibiotic by active ingredient/antibiotic class for dairy cows in 2024.



* includes 1st & 2nd generation cephalosporins, amphenicols, lincosamides, aminocoumarins, and pleuromutilins.

2.3.6.4 Using sales to estimate use in cattle

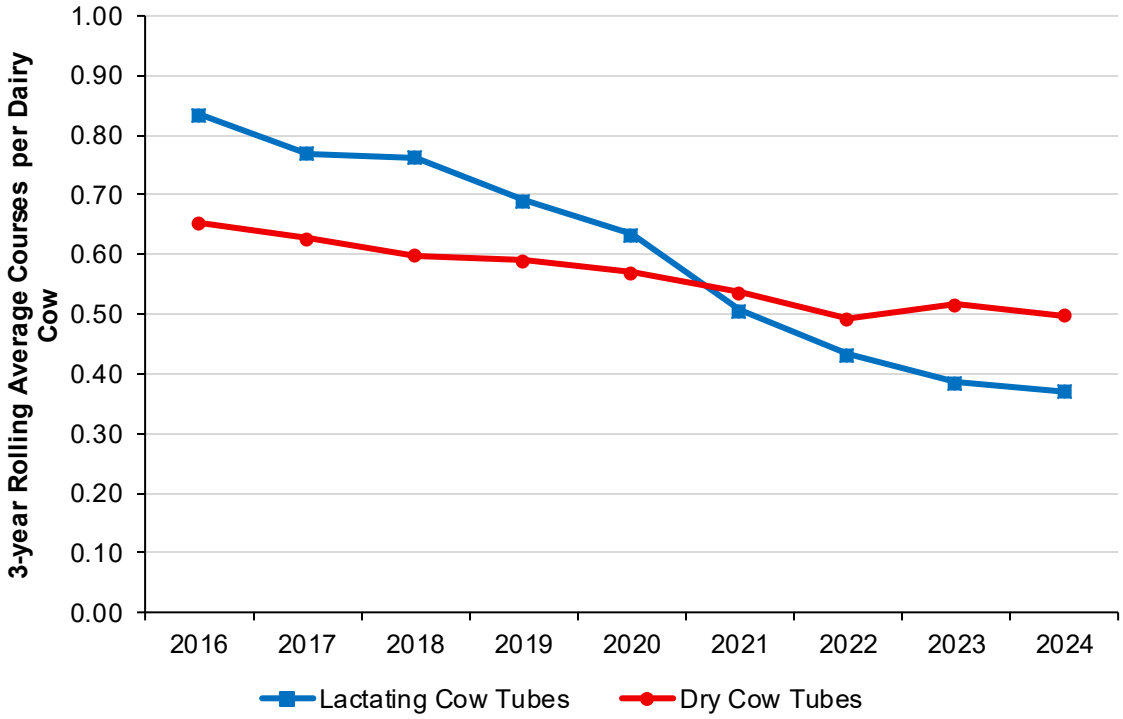
Due to the low level of antibiotic use data collection for the cattle sector, it is useful in some circumstances to look at sales data to provide an estimate of overall use in the cattle sectors, and this data is included here.

2.3.6.4.1 Rolling 3-year average of intramammary sales

The cattle sector monitor usage of intramammary sales using a 3-year rolling average of sales of intramammary products for both lactating and dry cow products. In 2024, the 3-year rolling average was 0.50 DCDVet for dry cow tubes. This represents a 4% (0.02 DCDVet) decrease on the previous 3-year average. For lactating cow intramammary tubes the 3-year rolling average was 0.37 DCDVet, which is also a reduction of 4% (0.02 DCDvet) on the previous 3-year average. Since 2016, three 3-year average for dry cow tubes has reduced

by 24% and lactating cow tubes by 56%. Further detail regarding yearly sales of intramammary products are presented in Chapter 1 (Section 1.3.4).

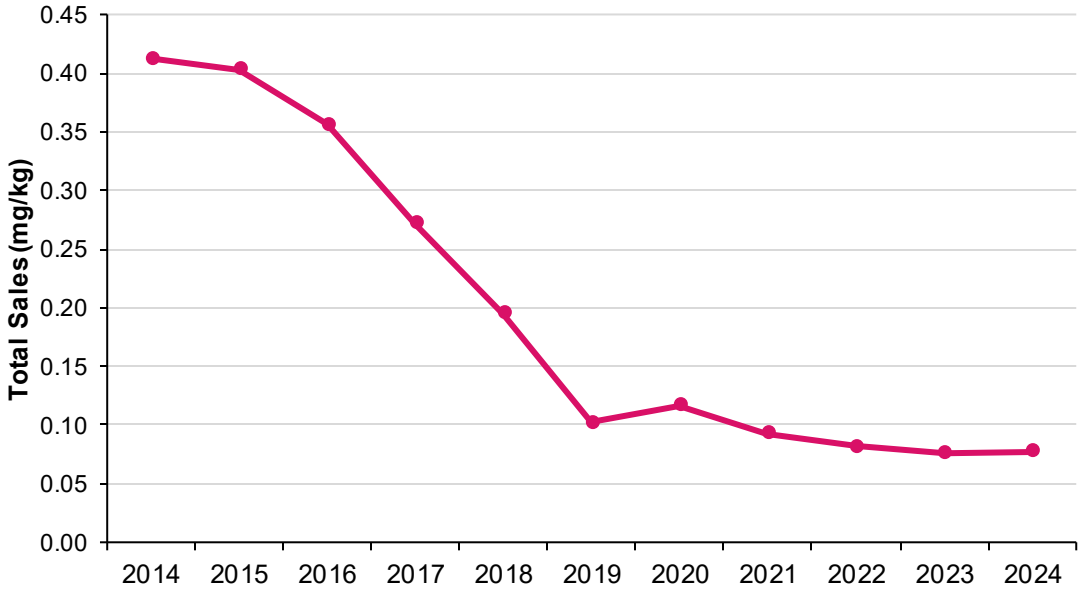
Figure 2.23: 3-year rolling average of lactating and dry cow tubes (DCDVet)



2.3.6.4.2 Sales of injectable HP-CIA products authorised for use in cattle

The majority of HP-CIA injectable products (over 80%) are either authorised for cattle alone, or for cattle and pigs. The high coverage and confidence of antibiotic use data for the pig sector shows that the use of these products is very low. It is therefore reasonable to assume that the vast majority of these products are used in cattle. As shown in **Figure 2.24**, sales in 2024 were the same as 2023 at 0.08 mg/kg (0.19 mg/PCU) and have now fallen by 81% (0.34 mg/kg) since 2014.

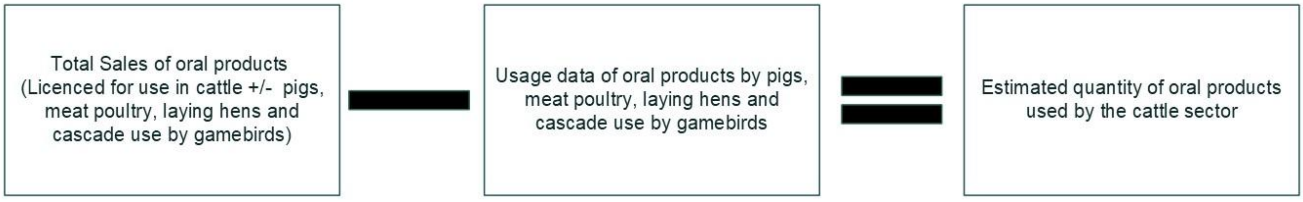
Figure 2.24: Sales of injectable HP-CIA products authorised for cattle (mg/kg), 2014 to 2024.



2.3.6.4.3 Sales of oral calf products authorised for use in cattle and livestock species

Estimations of in-milk use in calves can be made using antibiotic sales data, and this can be used to support cattle industry initiatives. These products are either licensed for cattle only or for cattle alongside pigs and/or poultry. In other livestock sectors, pigs, poultry (meat and laying hens) and gamebirds (where poultry products are used under the prescribing cascade), there is usage data collected which has at least 85% coverage. It is therefore possible to estimate use in calves by deducting the use of these products in pigs, poultry and gamebirds from the overall sales data, as outlined in **Figure 2.25**.

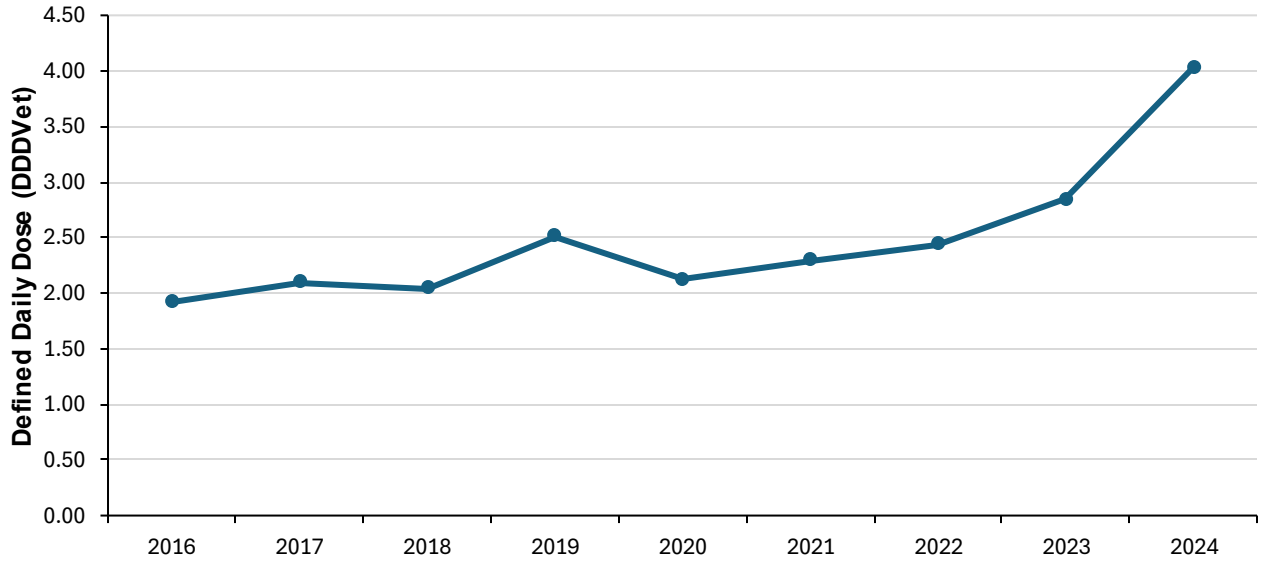
Figure 2.25: Outline of methods used to calculate the estimated quantity of oral products used by the cattle sector.



It is then possible to use the Defined Daily Dose (DDDVet) methodology to provide an estimate of the average number of days that each calf receives an antibiotic. The full methodology can be found in section 2.4. This method is recognised as an estimate but enables monitoring of trends by year for the calf sector and is only possible due to the high coverage of antibiotic use data collected by the pig, meat poultry, laying hen and gamebird sectors.

In 2024, the estimated DDDVet for oral calf products was 4.03 DDDVet **(Figure 2.26)**, an increase of 42% (1.19 DDDVet) since 2023 and 110% (2.11 DDDVet) since 2016. In 2024, 77% of active ingredient used in these products are tetracyclines and aminoglycosides, with the remainder being macrolides and sulphonamides. All antibiotic classes have seen an increase in use since 2016 and 2023.

Figure 2.26: Sales of oral products licenced for calves analysed by Defined Daily Dose (DDDVet), 2016 to 2024.



2.3.6.5 Statement from the Cattle Antibiotic Guardian Group (CAGG)

"The cattle sectors have been working hard to voluntarily collate antibiotic use data through a centralised, industry owned, standardised antibiotic use data collection system for ruminants, the Medicine Hub. As a result of this, the coverage of antibiotic use data collected in dairy, and available at the time of writing, increased from 30% to 39% in 2024, with data collected from across 2,917 enterprises.

Collecting usage data is an important contribution to responsible antibiotic stewardship. Encouragingly, antibiotic classes representing the lowest risk to humans account for the greatest proportion used in cattle with low use of HP-CIAs. In addition, antibiotics are predominantly being given by injection or intramammary routes, demonstrating selected and targeted use in individual animals. As data are not randomly collected, they may not be representative of the UK dairy population as a whole, however this subset of farms allows us to continue to track the progress being made. For beef, the large variety of beef farm types within the UK (suckler, dairy beef, calf rearers and finishers) combined with low coverage across this sector makes it more difficult to assess whether the mg/kg calculated is representative of the national picture. Beef figures are therefore not provided in this report (see the RUMA website for further details).

The cattle sectors continue to focus on encouraging responsible use of antibiotics to prevent the development of resistance, important for both animal and human health, without compromising animal health and welfare. The CAGG group recognises the growing use of oral antibiotics in calves in recent years and are keen to ensure that these products are being responsibly prescribed and used appropriately. For this reason, the group has advised that reducing use in calves should be included as a new sector target within the RUMA TTF3 report. To aid in this, active encouragement of increased collaboration between cattle farmers and their vets are also core principles of the Animal Health and Welfare Pathway in England, the Preparing for Sustainable Farming programme in Scotland and the Animal Health Improvement Cycle in Wales.

The cattle sectors continue to support uptake of national reporting mechanisms to monitor overall antibiotic use while focusing on stewardship measures on farms. In relation to this, we are excited to work with the sheep sector over the next four years to develop a UK Ruminant Antibiotic Stewardship Roadmap. The Cattle and Sheep Antibiotic Guardian Groups - SAGG and CAGG - are leading the strategic development of the Roadmap, while representing and cultivating support from stakeholders across the UK ruminant sectors."

2.3.7 Companion Animals

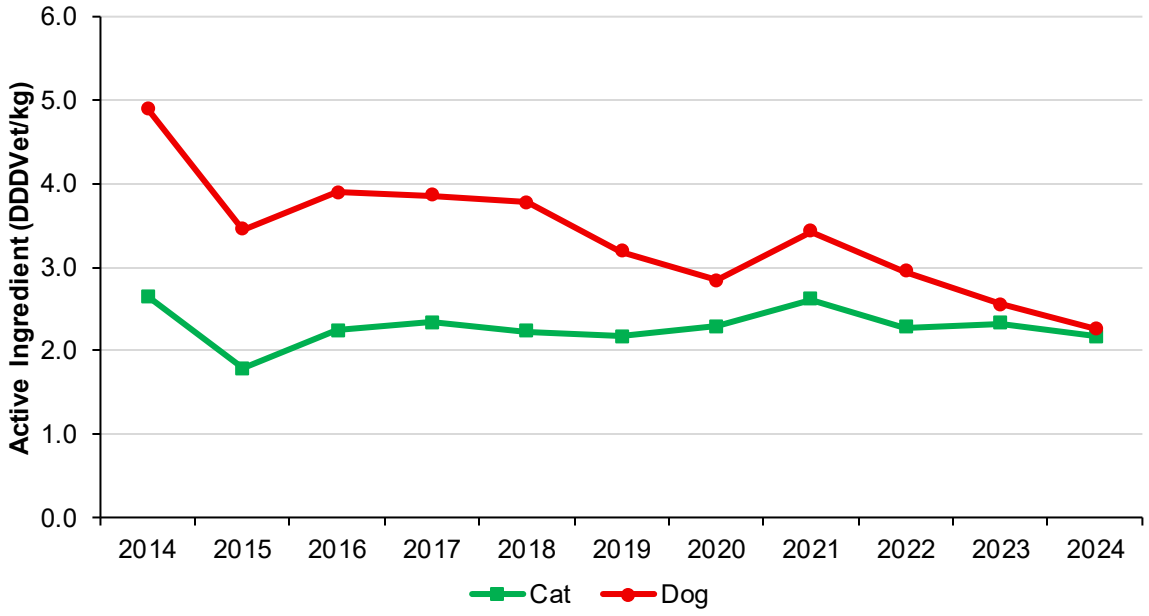
2.3.7.1 Antibiotic use in dogs and cats

Antibiotic use data is not available in the dog and cat sector. Therefore, antibiotic use in dogs and cats is estimated by stratifying the sales data reported by veterinary pharmaceutical companies; the full methodology was developed in conjunction with the Responsible use of Medicines Alliance - Companion Animal and Equine (RUMA CA&E) and further details can be found in section 2.4 of this report and in Supplementary Material 1.

In 2024, antibiotic use in dogs and cats was estimated to be 48 mg/kg for dogs and 31 mg/kg for cats, and use of HP-CIAs was 0.36 mg/kg for dogs and 0.56 mg/kg for cats. However, mg/kg metrics underestimate the use of long-acting injectable products (which are commonly used, particularly in cats) and so a different metric (DDDVet/animal) is preferable for monitoring trends. DDDVet/animal relates to the average number of days that each dog or cat in the UK has received an antibiotic throughout the year.

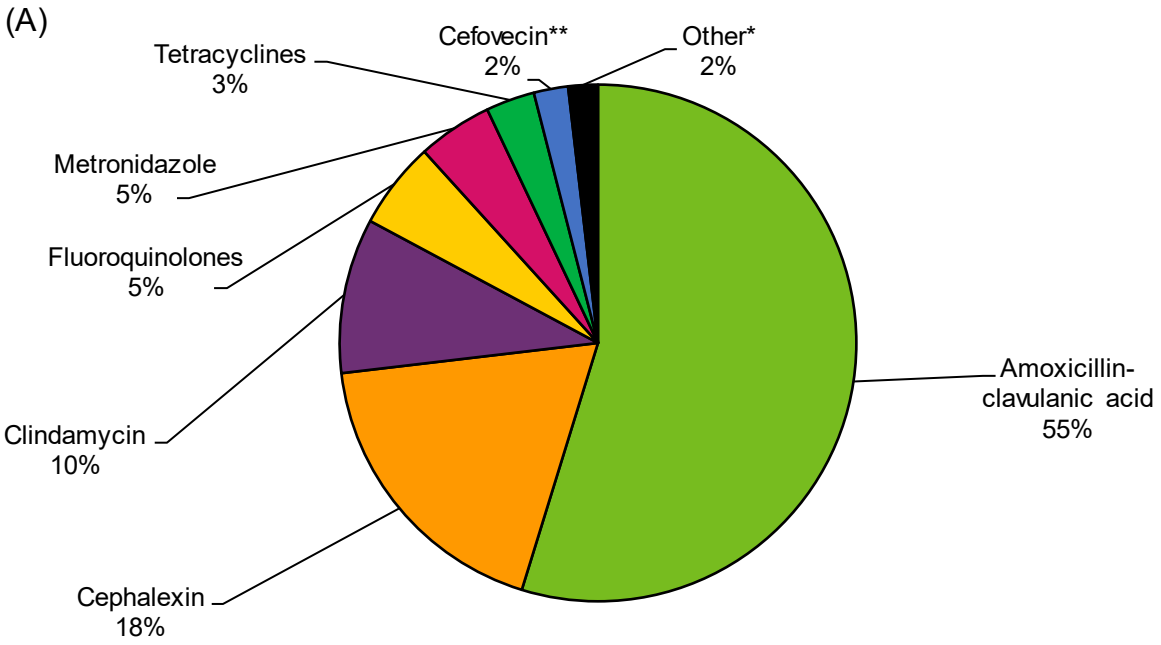
In 2024, the DDDVet was 2.26 for dogs and 2.21 DDDVet for cats. Sales of antibiotic products for dogs in 2024 have decreased by 12% (0.3 DDDvet) since 2023 and 54% (2.6 DDDvet) since 2014 **(Figure 2.27).** Sales of antibiotic products for cats decreased by 5% (0.12 DDDvet) since 2024 and have decreased by 17% (0.44 DDDvet) since 2014.

Figure 2.27: Active ingredient (DDDvet/animal) of antibiotics sold for use in dogs and cats, 2014 to 2024.

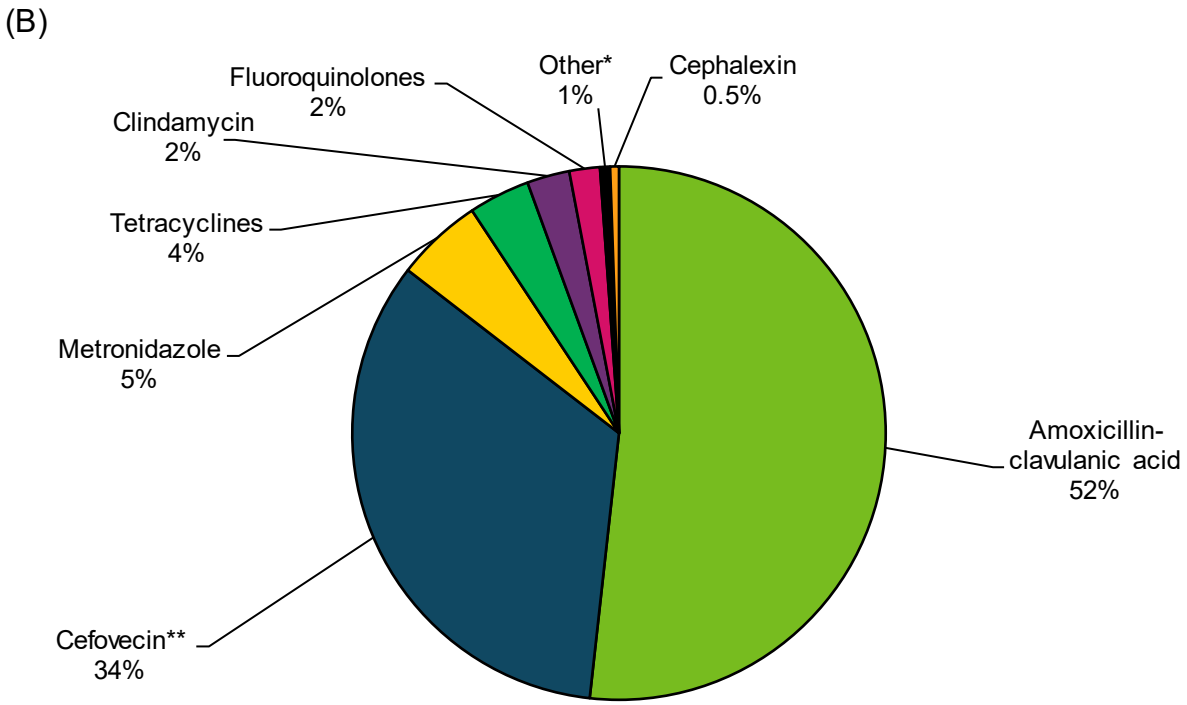


In dogs, products containing amoxicillin combined with the beta-lactamase inhibitor (clavulanic acid) were the most sold active ingredient in 2024 (**Figure 2.28),** representing 55% of total sales. This was followed by cephalexin (a 1st generation cephalosporin), which represented 18% of total sales. In cats, amoxicillin-clavulanic acid was also the most sold active ingredient in 2024, representing 52% of total sales, followed by the 3rd generation cephalosporin cefovecin (an HP-CIA) which represented 34% of total sales (**Figure 2.28).**

Figure 2.28: Active ingredient (DDDVet/animal) of antibiotics by active ingredient/antibiotic class sold for use in (A) dogs and (B) cats, 2024.



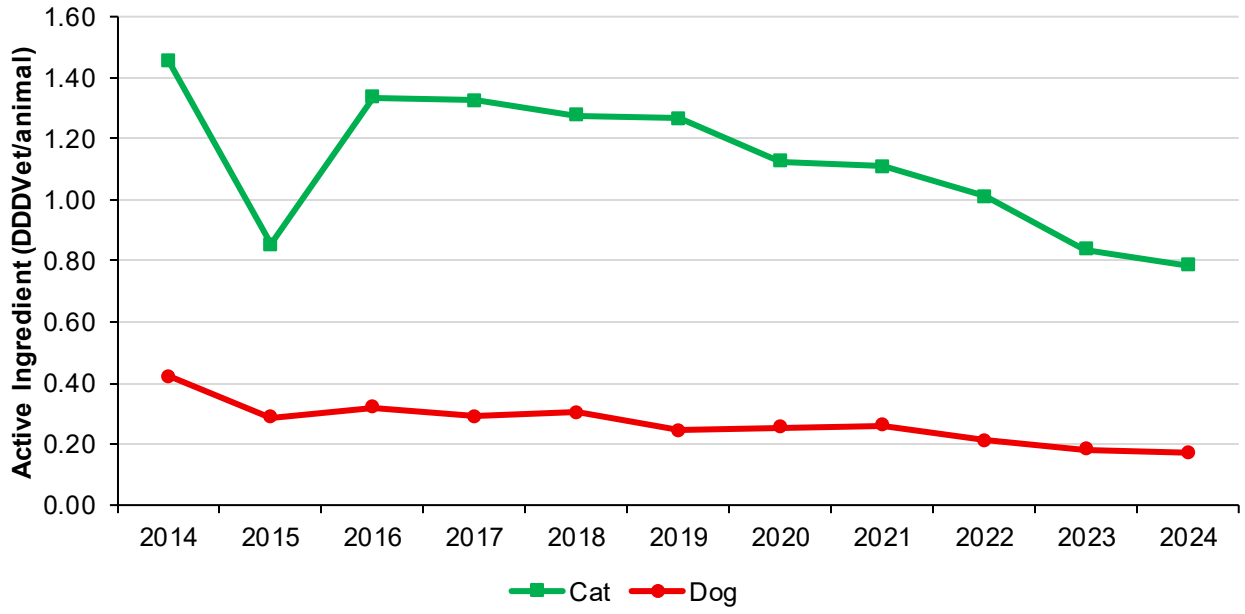
*Other includes aminopenicillins (amoxicillin and ampicillin) (1.58%), metronidazole-spiramycin (0.27%)
**Fluoroquinolones and the 3rd generation cephalosporin (cefovecin) fall under the category of an HP-CIA



*Other includes aminopenicillins (amoxicillin and ampicillin) (0.34%), metronidozole-spiramycin (0.27%)
** Fluoroquinolones and the 3rd generation cephalosporin cefovecin fall under the category of an HP-CIA

In dogs and cats, sales of HP-CIAs (**Figure 2.29)** accounted for 8% and 36% of total sales respectively. In both cases, this represents a reduction of 6% since 2023 and, since 2014, use has fallen by 59% and 46% in dogs and cats respectively. Fluoroquinolones represented 72% of HP-CIA use in dogs, whereas in cats, 95% of HP-CIA sales were of the 3rd generation cephalosporin, cefovecin. Note that the large reductions of HP-CIAs that were recorded in cats in 2015 are thought to be anomalous and related to supply issues.

Figure 2.29: Active ingredient (DDDVet/animal) of HP-CIAs, sold for use in dogs and cats, 2014 to 2024.



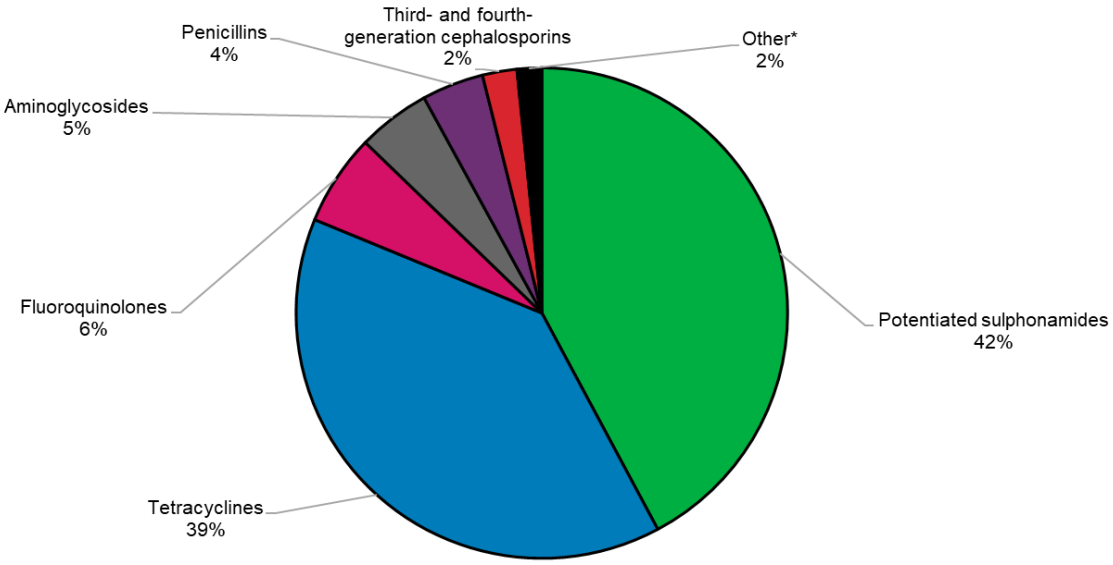
2.3.7.2 Antibiotic use in horses

Antibiotic use data was this year collected by the British Equine Veterinary Association (BEVA) as part of the Monitor ME scheme, with the aim of providing a UK figure and allowing practices to benchmark their antibiotic use relative to the national usage figure. Each submitting practice extracts data from their Practice Management System, including total mg used for each antibiotic class as well as the number of horses seen during the calendar year (not just those that received antibiotics) and their average weight if available. Once collected, this data was analysed using the mg/kg calculation (using a standard weight of 500kg where average weights weren't provided) as well as the number of Defined Daily Dose metric, which uses standard equine dose rates to estimate the average number of days per year that each horse has received an antibiotic. This methodology is described further in the section 2.4 DDDVet is considered to be a more useful metric for the sector than mg/kg, as daily dose rates can vary widely (for example, the daily dose rate of injectable ceftiofur, which is an HP-CIA, is 2.2 mg/kg whereas the daily dose for oral trimethoprim-sulfonamide is 30 mg/kg).

The data presented here comes from 44 veterinary practices and represents over 180,000 horses (around 25% of the total UK population). This sample shows that antibiotic use was

3.97 tonnes of active ingredient, which represents 42.7 mg/kg and 1.2 DDDVet/animal. HP-CIA use was 0.10 DDDVet/animal, which is 8% of overall use, with 73% of these related to fluoroquinolones and the remaining being 3rd and 4th generation cephalosporins (see **Figure 2.30**).

Figure 2.30: Active ingredient (DDDvet) of antibiotics by active ingredient/antibiotic class used in horses in 2024.



*Nitroimidazoles, chloramphenicol, polymyxin B, rifampicin, lincosamides, 1st and 2nd generation cephalosporins, and macrolides.

2.3.7.3 Companion Animal Sector Updates

The Responsible use of Medicines Alliance – Companion Animal and Equine (RUMA CA&E)

"The reductions in total antibiotic use and the use of HP-CIA use in dogs and cats between 2023 and 2024 is testament to the extensive industry activities, many of which we summarise annually in our report. This demonstrates how antibiotic stewardship is now part of everyday conversations within companion animal and equine practice. RUMA CA&E has continued to meet regularly and discuss initiatives aimed at improving how antibiotics are used in the companion animal sectors. In addition, a Targets and Measures working group has been looking into which targets (both national and condition specific) might be appropriate to set for the companion animal and equine sectors and we have created a number of condition-specific working groups, focusing on developing guidelines and resources for those conditions where there is considered to be the highest levels of unnecessary antibiotic use. Furthermore, the Antibiotic Amnesty of 2024 was once again a

great success and provided an excellent opportunity for veterinary practices to engage with clients on the importance of responsible antibiotic disposal alongside responsible antibiotic use. For 2025, the amnesty campaign will be evolved to encourage the return of any unused or out of date veterinary medicines for safe disposal and will be called The Animal Medicines Amnesty moving forwards; antibiotics will still form a core part of the campaign messaging but we recognise the need to educate owners on the safe use and disposal of all medicines not just antibiotics. Some of the campaign's focus for example, will not be on the safe use of parasiticides. We will also be developing a parasiticides resources area on our website to ensure the profession has access to the latest research and resources on the responsible use of parasiticides. Further detail about RUMA CA&E's work can be found in the Alliance's annual report which is released every Autumn (Reports – RUMA CA&E).

RCVS Knowledge

"In 2024, veterinary teams across the UK continued to make steady progress in antimicrobial stewardship (AMS), supported by resources such as the VetTeamAMR online learning platform. With over 20 hours of free CPD content tailored for companion animal and equine teams, the platform has helped thousands of veterinary professionals access practical, bite-sized training to support responsible antibiotic use in clinical practice.

The uptake of the Antibiotic Guardian initiative reflects growing engagement across the sector. RCVS Knowledge has issued a nationwide challenge: every veterinary practice in the UK should have at least one Gold Antibiotic Guardian leading the charge. Practices are increasingly recognising the value of having a designated AMS lead, and participation continues to grow. Over 100 Gold Antibiotic Guardian certificates had been awarded by the end of 2024, with this increasing to 184 by 1st September 2025.

The Antimicrobial Stewardship category in the RCVS Knowledge Awards continues to shine a spotlight on the dedication of UK veterinary teams on antimicrobial stewardship (AMS) and celebrate their successes. The 2024 winners, CVS South 4 Region, embraced the 'Plan, Prevent, Protect' framework to reimagine their approach to antibiotic use. They achieved a remarkable **70% reduction in long-acting antibiotics** for treating bite wounds and superficial skin infections in cats—without compromising patient welfare.

The 2025 winners, Animal Trust Dewsbury CIC, focused on their use of highest-priority, critically important antibiotics (HPCIAs) and made changes within their practice including an increased use of culture and sensitivity testing, and new stock control measures. Through these incremental changes and team-led meetings, they **reduced their rate of HPCIA prescriptions from 3% to 0.46%** of all consultations and stopped stocking several HPCIAs —without compromising patient welfare.

These examples show how veterinary teams are applying AMS principles in day-to-day practice. The changes are often incremental, and collectively they reflect a growing commitment to responsible antibiotic use and collaborative problem-solving across the profession."

British Equine Veterinary Association

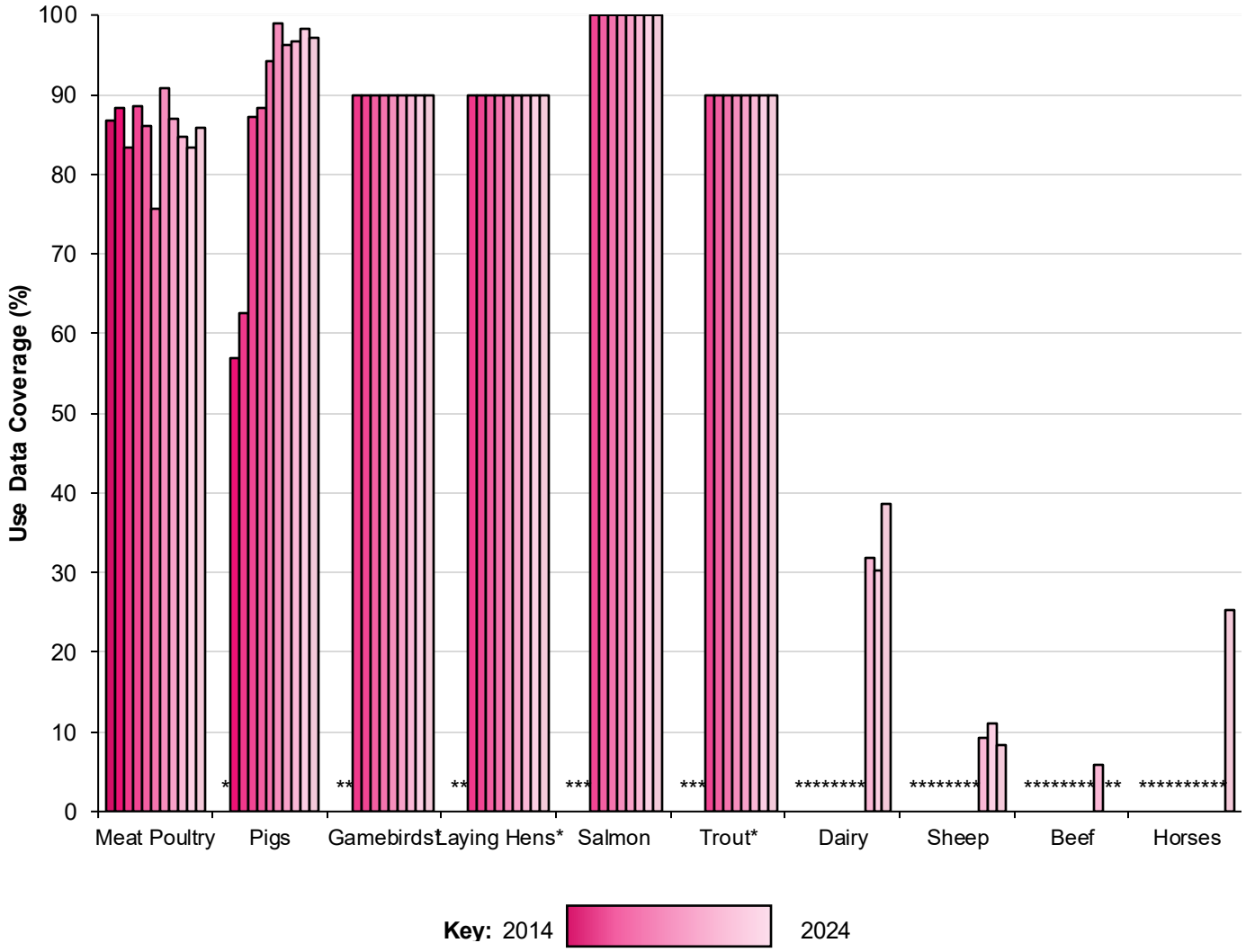
”BEVA have been delighted with the engagement from the veterinary practices with the MonitorME initiative. Antibiotic resistance threatens the efficacy and availability of these vitals medicines upon which we rely, and we therefore need to use them wisely or lose them forever. Equine antibiotic usage might be a small part of veterinary medicine usage, but it is important that we record and publish our antibiotic usage data so that we can demonstrate that our usage of these vital drugs is responsible and proportionate. It also makes it possible to monitor and evaluate the impact of responsible antibiotic use initiatives, such as ProtectMe. In addition, allowing veterinary practices to monitor their own use, and benchmark against the national average, can help drive conversations around reducing unnecessary antibiotic use. BEVA would like the acknowledge the involvement of EVSNET from the University of Liverpool.”

2.3.8 Antibiotic Use Coverage

The VMD’s work with different livestock sectors means that antibiotic use data representing 85% or more of the pig, meat poultry, laying hen, trout, salmon and gamebird sectors can be published. The Medicine Hub for ruminants is also up and running with the aim of bringing together antibiotic use data for the dairy, beef and sheep sectors. However, all this data is still collected on a voluntary basis. RUMA Companion Animal and Equine group are working with sector stakeholders to look into similar systems for collecting antibiotic use data for dogs, cats and horses.

In 2024, the GB Veterinary Medicines Regulations (the legal framework regulating veterinary medicines) were revised and these included new provisions relating to antibiotic use. This includes a provision allowing the Secretary of State to require vets and keepers of food-producing animals to provide antibiotic use data on request. Given the progress highlighted, there are no plans to apply the above legal provisions to require antibiotic use data reporting at this time. However more progress is needed, particularly for the ruminant and companion animal sectors, and the decision on whether to make antibiotic reporting mandatory may change if, upon review, it is considered that the voluntary model for antibiotic use collection does not deliver the desired outcomes. With this in mind, estimated coverage of antibiotic use data available in the different sectors is reported (see **Figure 2.31**).

Figure 2.31: Availability and estimated coverage of antibiotic use data in the different sectors, 2014 to 2024.



*Estimated figures

2.4 Methods

Pigs

The antibiotic use data in pigs were extracted from the electronic Medicines Book for Pigs (eMB), developed by the pig sector with support from the VMD, and launched by the Agriculture and Horticulture Development Board Pork (AHDB-Pork) in 2016.

The scope and limitations of the data (as provided by AHDB-Pork) are presented below:

- These data are national, aggregated figures for antibiotic use calculated from individual unit data held in the eMB for pig farms across the UK.
- eMB uptake to date has been voluntary and this sample may not be representative for the whole of the UK.

- In terms of pig production, this eMB data covers English slaughter pigs only for 2015 and 2016, and UK slaughter pigs for 2017 to 2024.
- The eMB data as a percentage of the total clean pig slaughter figures for the relevant region are:

2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
57%	63%	87%	88%	94%	99%	96%	97%	98%	97%

- The data are input by producers and, although clear outliers have been identified and queried, AHDB is not able to validate every individual producer's data. However, at a national, aggregated level, the data provide an estimation of national use and allow year on-year comparisons to be made.
- The data for 2024 were extracted from eMB on 29 May 2025 and these figures will now be fixed as the reference levels for 2024.
- The eMB database and the calculations within it are subject to a series of quality assurance checks to ensure national aggregated figures are as accurate as possible. As a result of this process, the eMB system is continuing to develop and work to further improve data accuracy is ongoing.

Meat poultry

The British Poultry Council (BPC) provided antibiotic use data for the poultry meat (chicken, turkey and duck) sectors. BPC runs BPC Antibiotic Stewardship, which covers around 85% of UK poultry meat production. This process of data collection started in 2012, and producers are responsible for submitting quarterly (chicken, duck) or annual (turkey and all breeders) antibiotic use data in the form of an aggregate spreadsheet. BPC then collate the data and report use by sector in their annual report. This includes the overall annual amount of active ingredient used (in tonnes), which covers both breeders and producers.

For the producers, this is then compared with the population at risk of treatment to create a mg/kg use figure. BPC calculates the population at risk of treatment by using annual slaughter numbers. The process of calculating the quantity of antibiotic active ingredient has been validated by the VMD.

Laying hens

The collection of antibiotic use data for the laying hen industry is organised by the British Egg Industry Council (BEIC). Sharing these data with BEIC is mandatory through the Lion Scheme, a farm assurance scheme which represents over 90% of the UK laying hen industry.

All egg producers, pullet rearers and breeding companies are required to report any use of an antibiotic to their subscriber. This is then reported to the BEIC on a quarterly basis. The BEIC collated aggregate annual antibiotic pack level data and provided it to the VMD, who carried out the calculations and validation of the use by active ingredient using ESVAC

methodology. Denominator data are available from monthly records of the total number of birds in the scheme, averaged over the year.

The data published here as 'actual daily bird days/100 bird days at risk' represent the average number of days treatment administered per chicken over a 100-day period.

Gamebirds

The Game Farmers' Association (GFA) and the British Veterinary Poultry Association (BVPA) gamebird subcommittee coordinated a comprehensive, voluntary data collection exercise to measure the use of antibiotics throughout the sector for 2024. This involved the collection of in-feed medication records from game feed producers (which supply 95% of game farmers and rearers) and prescribing records from specialist gamebird vets (of which 75% of game farmers and rearers are clients).

Each company was asked to provide a spreadsheet showing the amount of antibiotics used in 2024. GFA aggregated the results and provided them to the VMD, who then used ESVAC methodology to calculate the amount of antibiotic active ingredient administered by the game sector.

Note that a 'mg/kg' figure has not been included, as the European methodology does not include a standardised method for gamebirds.

Aquaculture

The trout data was collected from the main veterinary practices dealing with trout in England and Scotland and represent approximately 90% of UK trout production. The salmon use data were collected by Salmon Scotland from all veterinary practices treating salmon in Scotland and therefore represent 100% of Scottish salmon production. The aggregated data was analysed as mg/kg using ESVAC methodology, where kg represents the weight of slaughtered fish as live weight.

It is important to note that around 30% of trout are reared for restocking waters for angling rather than directly for food production. Antibiotic use on these restocking fish will be captured in the weight of active ingredient, but not in the weight denominator, leading to a potential overestimate of the mg/kg. It should also be noted that salmon have a three-year production cycle, so the tonnes of fish produced in any one year do not fully represent the overall salmon population that may require treatment.

Dairy and Sheep

The antibiotic use data for sheep and dairy were extracted from the Medicine Hub for Ruminants, which was developed by the ruminant industry with support from the VMD and launched by the Agriculture and Horticulture Development Board (AHDB) in 2021.

The scope and limitations of the data (as provided by Medicine Hub) are presented below:

- For dairy and sheep, these data are aggregated figures for antibiotic use calculated from individual enterprise data held in the Medicine Hub for participating sheep flocks and dairy herds across the UK.
- Medicine Hub uptake to date has been voluntary and this sample may not be reflective of the antibiotic use situation across the whole of the UK
- The data are supplied by farmers, their vets, or bulk data holders and, although clear outliers have been identified and queried, AHDB is not able to validate every individual farmer's data. However, at an aggregated level, the data provide an initial indication of usage within the sample provided.
- The data for 2024 were extracted from Medicine Hub on 20th August 2025.
- The Medicine Hub database and the calculations within it are subject to a series of quality assurance checks to ensure aggregated antibiotic use figures are as accurate as possible. The Medicine Hub system is continuing to develop and work to further improve data accuracy is ongoing.

Calf antibiotic sales analysis methodology

The antibiotic sales in calves reviews sales of products documented as either oral powder or oral solution that are specifically licensed for use in pre-ruminant calves. In the UK, we have antibiotic sales data that covers 100% products sold from Marketing Authorisation Holders and usage data for 80-90% of the following livestock sectors: laying hen, pigs, gamebirds and meat poultry.

The methodology involves removing the extrapolated use data of the livestock sectors from the sales data for these products.

To determine the biomass of calves under 6 months of age:

- The average number from the June and December consensus are taken for both male and female calves <1 year. Note this approach is taken as the number of calves under 6 months is not published
- This is then divided by 2 (to provide an estimate of the number of male and female calves <6 months) and multiplied by the average weight for male and female calves <6 months (taken from the CHAWG AMU metric)

	Dairy Sired	Beef Sired	Average
Male	118	133	125.5
Female	108	112	110

To estimate the number of daily doses:

- The average calf dose rate per day was extracted using calf dose rates in the product's SPC. Where there was a range of dose rates, a mean was taken

To determine the average number of daily doses per calf, the following calculation was completed for each product and then added together:

$$\frac{\text{Total amount of active ingredient (in mg)}}{\text{(Daily dose rate (mg/kg) * Average weight of estimated calf population(kg))}}$$

The limitations of this methodology are summarised below:

- This approach assumes that the use in the farms where data isn't captured usage is equivalent to the farms where data is collected for that sector/ species
- Some products may be used under the cascade in sectors where no or a low coverage of use data is available, and these won't be taken into consideration
- Products may be sold one year but not used, and therefore the sales figure may not correctly reflect usage
- The number of calves < 6 months is estimated based on the number of calves <12 months. This is likely to be an underestimate
- The dose rates on the SPC may not represent actual dose rates used in practice
- The calculation assumes the average weight of animals < 6 months is also the average weight at time of treatment, which may be incorrect

Companion animals

Mg/kg for dogs and cats

In this metric, mg refers to the weight of antibiotic active ingredient sold for use in dogs and cats. As with the mg/PCU metric, topical products (e.g. those for treating eye, ear and skin infections) are excluded. The denominator is the estimated weight of the whole dog and cat population at risk. The total number of dogs and cats in the UK is estimated using statistics from the PDSA PAW report, which is a survey that is representative of the UK pet-owning population. This is then multiplied by the average weight of a dog and cat, which has been provided by the Royal Veterinary College using the VetCompass system (see S1.2 in Supplementary Material 1 for further details).

The metric is calculated separately for dogs and cats, with the amount of antibiotic active ingredient separated by dog and cat. For products authorised for more than one species, the relative amount of total product sold which is consumed by dogs and cats have been estimated. Estimates are obtained by the VMD from stratification data provided by the Market Authorisation Holder (MAH) for each product. The stratification data indicates the percentage of each product which is estimated to have been used in dogs and in cats, respectively, in any given year. Only products which were authorised for dogs and/or cats +/- other species commonly seen in small animal practice (e.g. rabbits, rodents and exotics)

were considered. Products indicated for dogs and/or cats alongside horses and/or food producing animals were not considered, as it is harder to accurately provide stratification estimates for these products, which are primarily injectables and are used increasingly in food producing animals. Therefore, the figures reported will slightly underestimate overall use.

The average number of Daily Defined Doses per animal per year (DDDVet/animal) for dogs and cats

The main issues with using mg/kg for trend monitoring in dogs and cats are that it underestimates the use of long acting injectables (which are very commonly used in cats) and there are also some big variations in dose rate. For example, marbofloxacin has a dose rate of 2 mg/kg/day, whereas metronidazole has a dose rate of 50 mg/kg/day. For this reason, dog and cat (companion animal) trend sales data for systemic antibiotics is presented and calculated using the average number of Daily Defined Doses (DDDVet) per animal per year (DDDVet/animal). This metric has been developed alongside, and with the support of, the RUMA Companion Animal and Equine group.

The DDDVet is defined as the assumed average dose per kg animal treated per species per day. These standard daily doses are extracted from the Summary of Product Characteristics (SPC) for each antibiotic product. If there is a dose range, then the lowest dose was chosen, and where the dose rate varies between products with the same active ingredient/ route of administration, then the median dose rate was selected. For long-acting products, the DDDVet is calculated by dividing the daily dose rate with the length of activity for that product. A full list of the DDDVet figures used for each active ingredient/ route of administration can be found in S1.3 of Supplementary Material 1.

The DDDVet/animal is calculated (for each active ingredient/ route of administration and for both dogs and cats) using the method below:

$$\frac{\text{Total amount of active ingredient (mg)}}{\text{(DDDVet (mg/kg/day) * total animal population weight at risk (kg))}}$$

The results are then added together to get the total figure. The mg of antibiotic active ingredient and total weight of animal population at risk is calculated in the same way as described above for the mg/kg calculation.

Equine DDDVet Methodology

Data presented in the report is collected by the British Equine Veterinary Association (BEVA) as part of the Monitor ME scheme. The DDDVet is defined as the assumed average dose per kg animal treated per species per day. In the 2024 calculations, 183194 horses represented a sample of the equine population (12% of total UK population). Standard equine dose rates that are considered to be used in the field were used to estimate the average number of days per year that each horse received an antibiotic for the Defined Daily Dose metric. This data is available in section S1.3 of Supplementary Material 1

To determine the DDDVet submitting practices extracted anonymised data from their Practice Management System to provide the following data:

- Total mg used for each antibiotic class active ingredient by route of administration
- To provide the average weight of the population – the number of horses treated during the calendar year (including horses that did not receive antibiotics) and their average weight if available was used. A standard weight of 500kg was applied where average weights of animals were not provided.

The equine DDDVet/animal is calculated using the method below (for each active ingredient/route of administration):

$$\frac{\text{Total amount of active ingredient(mg)}}{\text{(DDDVet x average weight of reviewed equine population)}}$$

The results of each active ingredient are then added together to total the DDDVet Equine value.

CHAPTER 3

Harmonised monitoring of antibiotic resistance

3.1 Introduction

This programme was originally developed to harmonise monitoring and reporting of antimicrobial resistance (AMR) in the food chain across Europe. It involves testing for resistance in zoonotic and commensal bacteria from healthy food-producing animals at slaughter, on-farm *Salmonella* isolates from the poultry National Control Programmes (NCP), and food products at retail. This surveillance is designed to be representative of food-producing animal populations, providing up-to-date data on AMR in chickens and pigs throughout the UK, and turkeys in Great Britain. Continuity of data from this long-term programme gives the ability to interrogate trends, identify emerging issues, and monitor the impact of the work to tackle AMR. Maintaining international harmonisation in this area also facilitates comparability of AMR data with other countries across Europe, which means the UK situation can be better contextualised and risks more accurately understood.

Key livestock species are monitored in alternating years: poultry in even-numbered years and pigs in odd-numbered years. These are the major sources of animal-origin meat in the UK and in Europe. The 2024 data presented here originates from healthy poultry (broilers and turkeys at slaughter) and poultry farm environments (broilers, layers, and turkeys). Key outcome indicators for AMR in food-producing animals are generated by combining results from pigs, broilers, and turkeys over two successive years. These indicators are weighted by the size of the animal populations, thereby providing an overall measure of AMR for these species in the UK.

Standard testing involves isolating bacteria on non-selective media, identifying them, and testing individual isolates for antimicrobial sensitivity. A second type of testing uses selective media to inhibit the growth of sensitive bacteria but allows the resistant bacteria to multiply, making them easier to detect. This can be used to determine the proportion of individual samples containing specific resistances, even in very small amounts within individual birds. This type of testing focuses on identifying the carriage of resistance to specific highest priority critically important antibiotics (HP-CIAs) or last-resort antibiotics with human health relevance. Selective media was used to detect the presence of extended spectrum beta lactamase (ESBL)-, AmpC-, and carbapenemase-producing *Escherichia coli,* which are resistant to the third and fourth generation cephalosporins and carbapenems, as well as to detect resistance to colistin.

The majority of results are reported in this chapter as the percentage of individual bacterial isolates that are resistant to specific antibiotics. The term resistance has been used to describe those bacterial isolates which showed reduced susceptibility to an antibiotic as determined by epidemiological cut-off values (ECOFFs). ECOFFs are used for surveillance purposes because they are more sensitive than clinical breakpoints (CBPs) for detecting emerging resistance issues. They represent the point at which bacteria have an identifiably higher level of resistance to an antibiotic than the background level of resistance for that bacterial species. Therefore, the results in this chapter do not necessarily indicate that a ‘resistant’ isolate would correspond to a clinical treatment failure (drug-resistant infection).

There has been a change in how results are presented graphically this year. Graphs were previously divided into two: one for non-HP-CIAs, and one for HP-CIAs, according to AMEG categorisation for use in animals (Annex A). However, there are several antibiotic classes - such as carbapenems - that have been designated by the World Health Organisation (WHO) as human-only, and therefore are not categorised as HP-CIAs. Because of their importance to human medicines, these results are presented alongside HP-CIAs on the second graph.

The Food Standards Agency (FSA) lead on the testing and reporting of AMR in retail meat, which is published elsewhere.

Box 3.1: Updates and corrections

Data updates and corrections since UK-VARSS Report 2022

Please note that some results for previous years, as shown in this chapter and Supplementary Material 5, differ from previous reports. This is because of updates to the ECOFFs used to interpret resistance in certain cases, and some corrections to historical data. The bacteria and antibiotics affected by these changes are outlined below.

- ECOFF changes applied to historic data:

Bacteria	Antibiotic	ECOFF (mg/L) applied in UK-VARSS 2022	ECOFF (mg/L) applied in UK-VARSS 2024
Escherichia coli	Ceftazidime	>0.5	>1
Escherichia coli	Meropenem	>0.125	>0.06
Enterococcus faecium	Ciprofloxacin	>4	>8
Salmonella spp.	Ampicillin	>8	>4

- Data corrections:

In UK-VARSS 2024, the antibiotic ertapenem is not included in the calculations of the percentage of *C. jejuni* and *C. coli* isolates with full susceptibility and multidrug resistance (MDR). This is because there is still some uncertainty as to the suitability of ertapenem to represent the carbapenem class, and recent changes made to the EUCAST cut-off value. This approach has also been taken by other countries, allowing comparability of results. In UK-VARSS 2022, ertapenem was inadvertently included in the full susceptibility calculations.

3.2 Summary

- Key harmonised outcome indicators are generated from *E. coli* results. These indicators are weighted by population size, and give an overall measure of AMR in UK meat poultry and pigs:
    - The primary key outcome indicator, percentage of *E. coli* with full susceptibility, has decreased substantially for the first time since the programme began. This is attributed to an increase in resistant *E. coli* isolates in broilers.
    - The secondary indicators were unchanged or improved since last year: Prevalence of multi-drug resistant (MDR) *E. coli* and ciprofloxacin-resistant *E. coli* was similar to last year, while carriage of ESBL-/AmpC-producing *E. coli* has dropped.
- Enterococci are indicator species for the detection of AMR in Gram positive bacteria. They were added to the programme in 2022. For the first time, vancomycin-resistant enterococci (VRE) were detected in *Enterococcus faecium* in broilers (1.7%) and *Enterococcus faecalis* in turkeys (0.7%). VRE are of concern to public health as they carry a higher associated mortality than vancomycin sensitive enterococci.
- Resistance to key antibiotics in *Campylobacter* in broilers has increased since 2022. This includes resistance to ciprofloxacin in *C. jejuni*, which has increased from 59% to 70%. Resistance to these same antibiotics in turkeys has remained stable or decreased since 2022.
- Full susceptibility in *Salmonella* decreased from 79% to 68% in isolates from broilers and from 93% to 91% from layer farms, whilst it increased from 20% to 39% in isolates from turkeys
- Selective media was used to detect carriage of specific resistances, even in very small amounts within individual birds. Presence of ESBL-/AmpC-producing *E. coli* in broiler samples increased from 11% to 15% in 2024, predominantly due to an increase in AmpC-producing *E. coli*. In turkeys, carriage of ESBL-/AmpC-producing *E. coli* in individual birds decreased slightly from 8.5% to 7.0%. For the first time, a colistin-resistant organism was detected in turkeys using selective media (0.4% of turkeys). The isolate possessed the *mcr-1* gene.

3.3 Methods

3.3.1 Sample collection and culture

The sampling plans were randomised, stratified, and weighted by slaughter throughput. Broiler samples were obtained from Great Britain and Northern Ireland, whereas turkey samples were sourced from Great Britain only. In 2024, samples were collected from slaughterhouses processing 62% of domestically produced broilers, and 82% of fattening turkeys. Caecal samples were taken in abattoirs from healthy broilers and fattening turkeys at slaughter for the isolation of *Escherichia coli*, *Campylobacter coli*, *Campylobacter jejuni*, *Enterococcus faecium* and *Enterococcus faecalis* as described in Decision (EU) 2020/1729.

Caecal material from ten broilers was pooled to form each sample, whereas for turkeys, each sample was taken from a single bird. For the first time, surveillance of enterococci was extended to Northern Ireland, specifically of *E. faecium* isolates from broilers.

Boot/dust swabs were collected for the isolation of *Salmonella* in accordance with the National Control Programmes (NCP) for broilers, layers, and turkeys, and a random selection of isolates obtained underwent antibiotic susceptibility testing (AST). **Figure 3.1 A** and **B** provide a summary of the bacterial isolates examined.

All bacterial isolates were cultured using standardised methods on non-selective media and underwent routine antimicrobial susceptibility testing (AST; see Section 3.3.2).

Figure 3.1 A: Bacterial species isolated on non-selective media, and origin of samples.

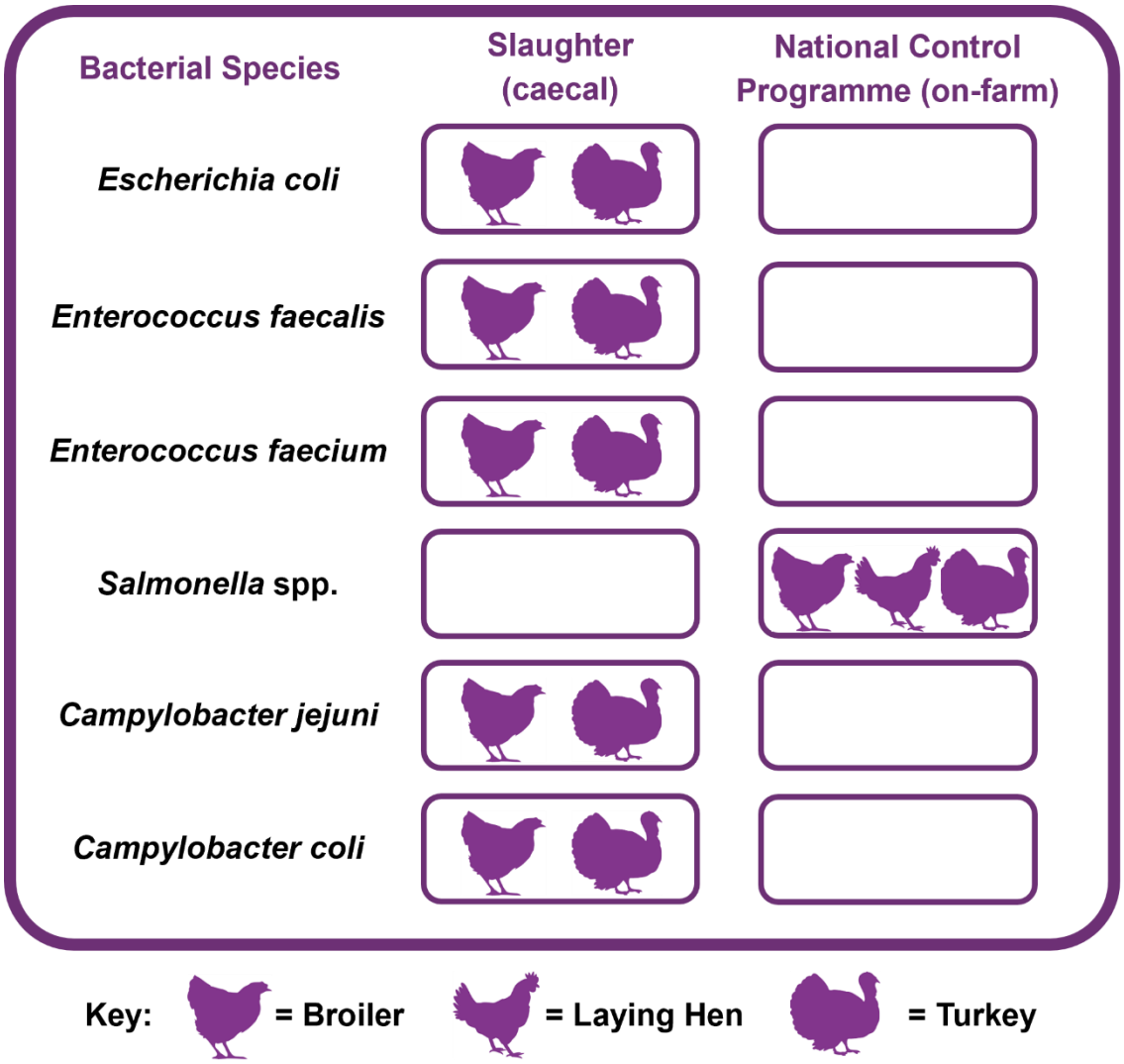
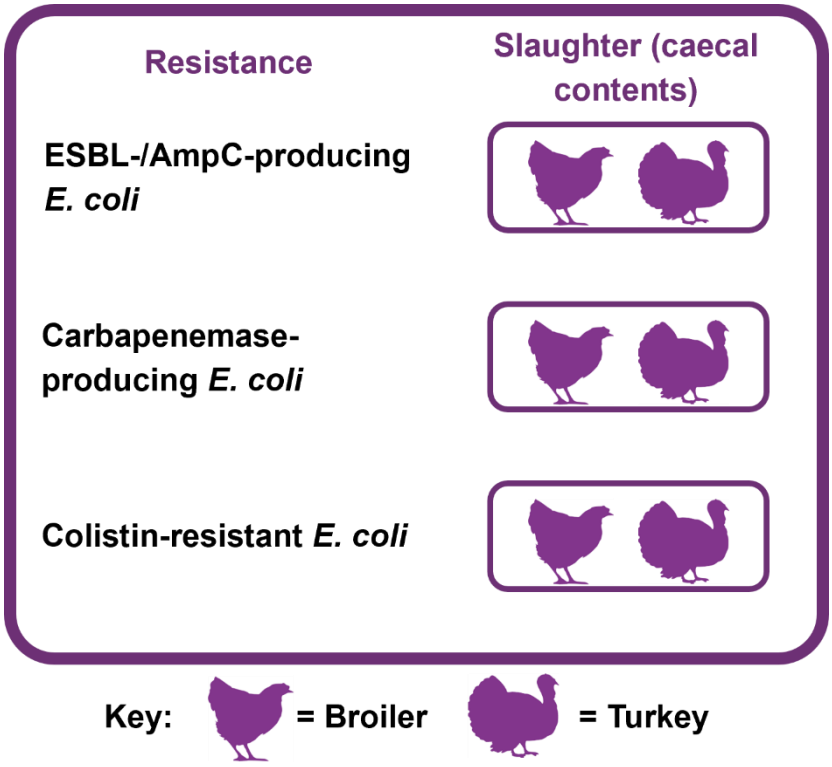


Figure 3.1 B: Specific resistances in *Escherichia coli* identified by selective media.



3.3.2 Antibiotic susceptibility testing (AST)

AST was carried out by the national reference laboratories (NRLs) using European Committee on Antimicrobial Susceptibility Testing (EUCAST) methodology. Single typical colonies were selected for speciation and susceptibility testing. Standardised broth microdilution was used to determine the minimum inhibitory concentration (MIC) against a panel of antibiotics. The antibiotics used are listed in Table S4.2 of Supplementary Material 4 and include those authorised for use in food producing animals, those important to human health, and others which are considered representative of an antibiotic class or resistance mechanism.

3.3.3 Interpretation of results

The European Committee on Antimicrobial Susceptibility Testing (EUCAST) methodology for epidemiological cut-off values (ECOFFs) was used in this report. Where possible, EUCAST ECOFF values (sourced April 2025) were used to interpret the MIC results. These are regularly reviewed and updated as new data emerges. Where no EUCAST ECOFF values were available, European Food Safety Authority (EFSA) recommended cut-off values were used. Where neither defined EUCAST nor EFSA ECOFF values were available, tentative EUCAST ECOFF values were applied.

ECOFFs represent the point at which bacteria have developed a higher level of resistance to an antibiotic than the background level of resistance that exists naturally for that bacterial species. ECOFFs are used for this surveillance because they are more sensitive than clinical breakpoints (CBPs) for detecting emerging resistance issues. CBPs define whether an

infection caused by a bacterium is likely to be treatable using the antibiotic tested. The results in this chapter, therefore, do not necessarily mean that a 'resistant' isolate would correspond to clinical treatment failure (i.e. a drug-resistant infection). Readers interested in looking at comparative human clinical breakpoints can find the full set of results in Table S4.3 in Supplementary Material 4.

Historical data presented in this report has been updated to reflect cut-off values used in 2024 (**Box 3.1**). ECOFFs used are in Table S4.2 Supplementary Material 4. In this chapter, multi-drug resistance (MDR) is defined as resistance to three or more antibiotic classes.

3.3.4 Using selective media to detect resistance

Targeted testing using selective media was performed to detect carriage of resistance to selected antibiotics, even when present in very small amounts within individual samples. Each sample represented ten broilers or one turkey. Selective media inhibits the growth of sensitive bacteria in a sample and therefore preferentially allows the resistant bacteria to multiply, making them easier to detect. This type of testing focuses on identifying the presence of resistance to specific highest priority critically important antibiotics (HP-CIAs) or other antibiotics with human health relevance. Caecal samples were cultured on selective media using standardised methods to identify ESBL-, AmpC- and/or carbapenemase-producing and colistin-resistant *E. coli* (see S3.3 in Supplementary Material 4).

3.3.5 Polymerase chain reaction

Polymerase chain reaction (PCR) was performed following the detection of colistin-resistant isolates on selective media to identify *mcr* genes associated with colistin resistance in *E. coli* (see S3.6 in Supplementary Material 4).

3.3.6 Whole genome sequencing

Whole genome sequencing (WGS) and *in silico* bioinformatic tools were used to detect the antibiotic resistance determinants present in the isolates with ESBL, AmpC or carbapenem phenotypes (see S3.7 in Supplementary Material 4).

3.3.7 Statistical analysis

Confidence intervals (CIs) are used to ascertain how much uncertainty there is around the results presented in this chapter. The Wilson Score method was used to determine 95% CIs in this report, which means there is a 95% chance the true value is within the calculated range. When the CIs for two prevalence estimates do not overlap, this indicates a statistically significant difference. Confidence intervals are provided in full in Supplementary Material 5.

3.3.8 Harmonised AMR outcome indicators

This report includes one primary and three secondary outcome indicators from the ongoing harmonised monitoring for AMR in pigs and meat poultry. The primary outcome indicator of complete susceptibility in *E. coli* is widely recognised. The secondary outcome indicators of percentage of MDR *E. coli*, percentage of *E. coli* resistant to the quinolone ciprofloxacin, and the percentage of samples carrying ESBL- and/or AmpC-producing *E. coli* are also well documented. *E. coli* is the indicator organism due to its ubiquitous nature in animals, food, and humans, and its ability to readily develop or transfer resistance. The outcome indicators are combined over two years due to the alternating schedule for AMR pig and meat poultry sampling and are weighted by population size, expressed in Population Correction Unit (PCU) (Annex A).

3.4 Results

Classification of resistance as low, moderate, high etc. throughout the report is consistent with the European Food Safety Authority (EFSA) definitions for these terms (**Table 4.2**).

Table 3.1: Definitions used for classification of resistance

Description of resistance level	Equivalent percentage resistance range
Rare	<0.1%
Very low	0.1% to 1%
Low	>1% to 10%
Moderate	>10% to 20%
High	>20% to 50%
Very high	>50% to 70%
Extremely high	>70%

Where a figure in this chapter shows no data for certain antibiotics or years, this is either because no resistance was detected, or that antibiotic was not tested (indicated with a ^).

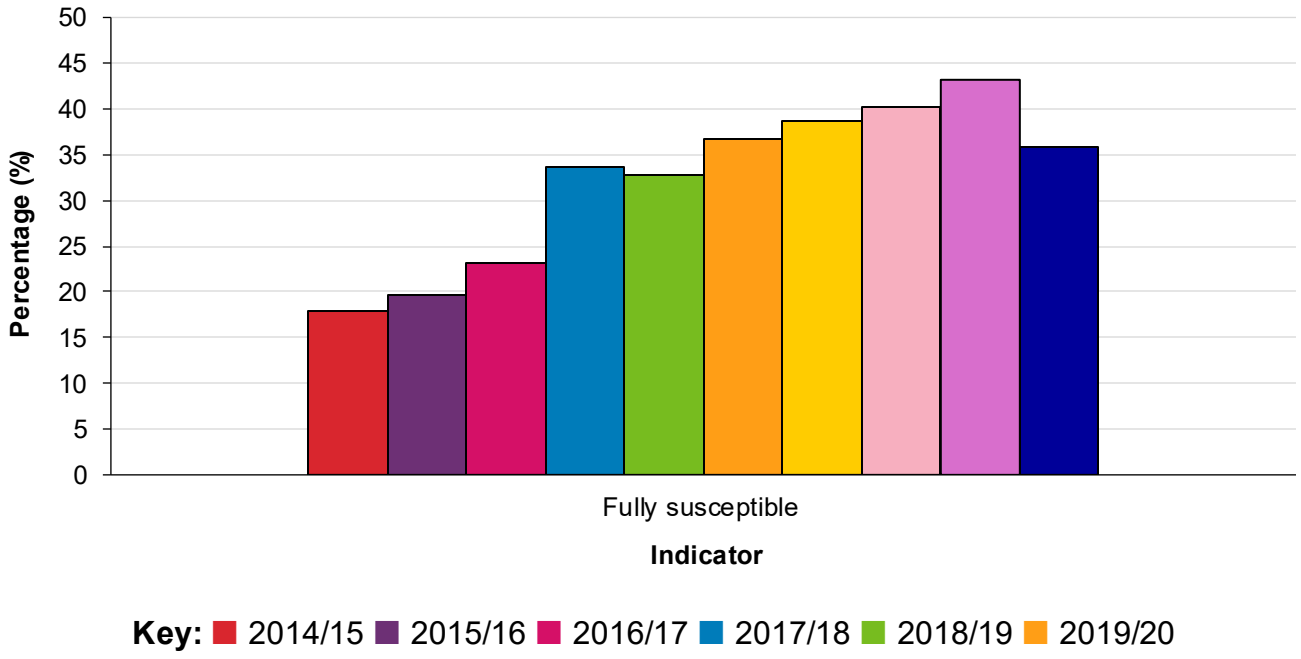
For the first time this year, the complete dataset is available in downloadable Excel format in Supplementary Material 5.

3.4.1 Key AMR outcome indicators

Key outcome indicators are standardised measures used across different countries and sectors to ensure consistency in data collection and reporting. This facilitates the assessment of trends and enables international comparison in a transparent way. This report includes one primary and three secondary key outcome indicators from the ongoing harmonised monitoring for AMR. These results therefore give an indication of the UK's progress in combatting AMR in pigs and meat poultry.

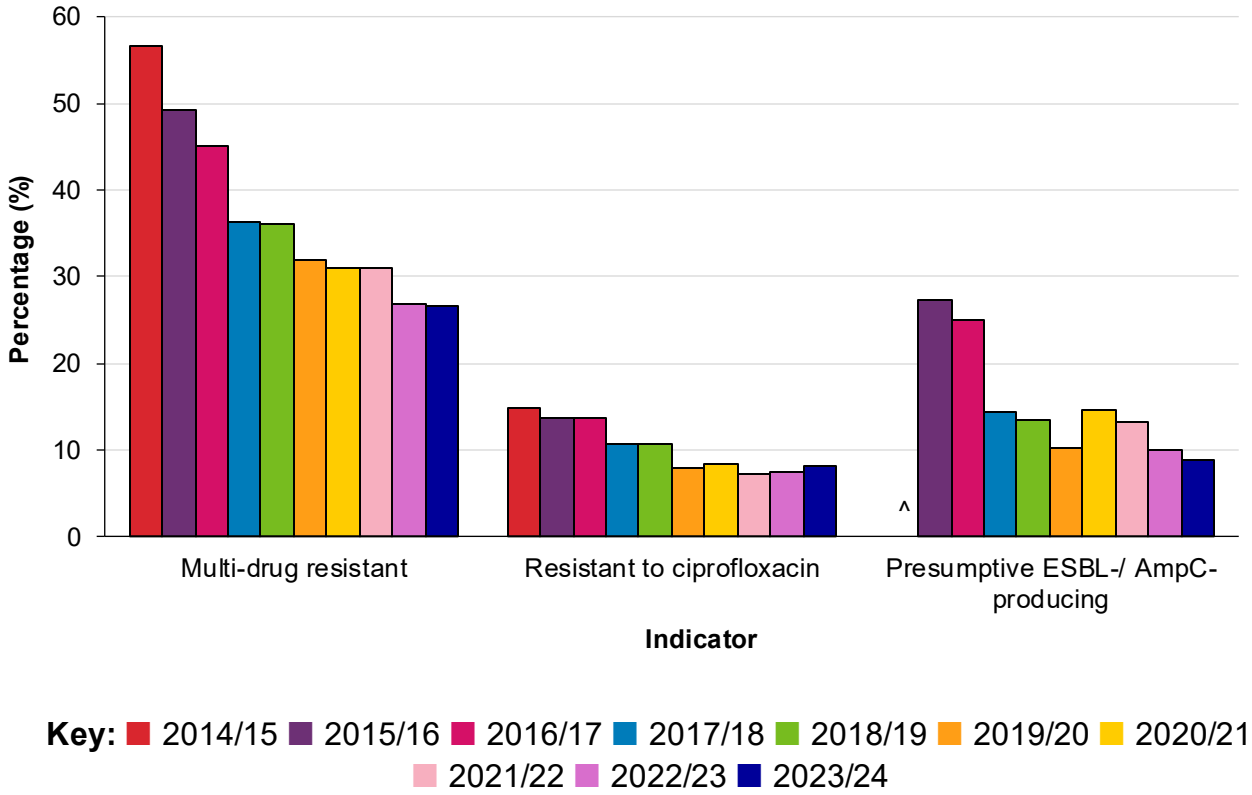
The primary key outcome indicator (**Figure 3.2**) of full susceptibility in *E. coli* has decreased from 43% in 2022/2023 to 36% in 2023/2024. This is the first substantial drop since the programme began in 2014. Full susceptibility in pigs (2023) and turkeys (2024) has risen since the last sampling period so this decrease is attributable to a decrease in full susceptibility in broilers from 45% [95% CI: 38-53%] in 2022 to 32% [95% CI: 26-40%] in 2024 (Section 3.4.2.1). This has happened despite decreasing antibiotic usage in this sector since 2020 (Section 2.4.2).

Figure 3.2: Primary key outcome indicator: percentage of fully susceptible *Escherichia coli* isolates from broilers, turkeys and pigs, weighted by PCU, combined over two years.



For the secondary key outcome indicators in 2023/2024, there is a more positive picture. The percentage of MDR isolates (27%) is similar to that found in 2022/2023; the percentage of isolates resistant to the quinolone ciprofloxacin (8.0%) has remained relatively stable since 2019/2020; and the percentage of samples containing presumptive ESBL-/AmpC-producing *E. coli* (8.8%) has decreased to a new low in 2023/2024 (**Figure 3.3**).

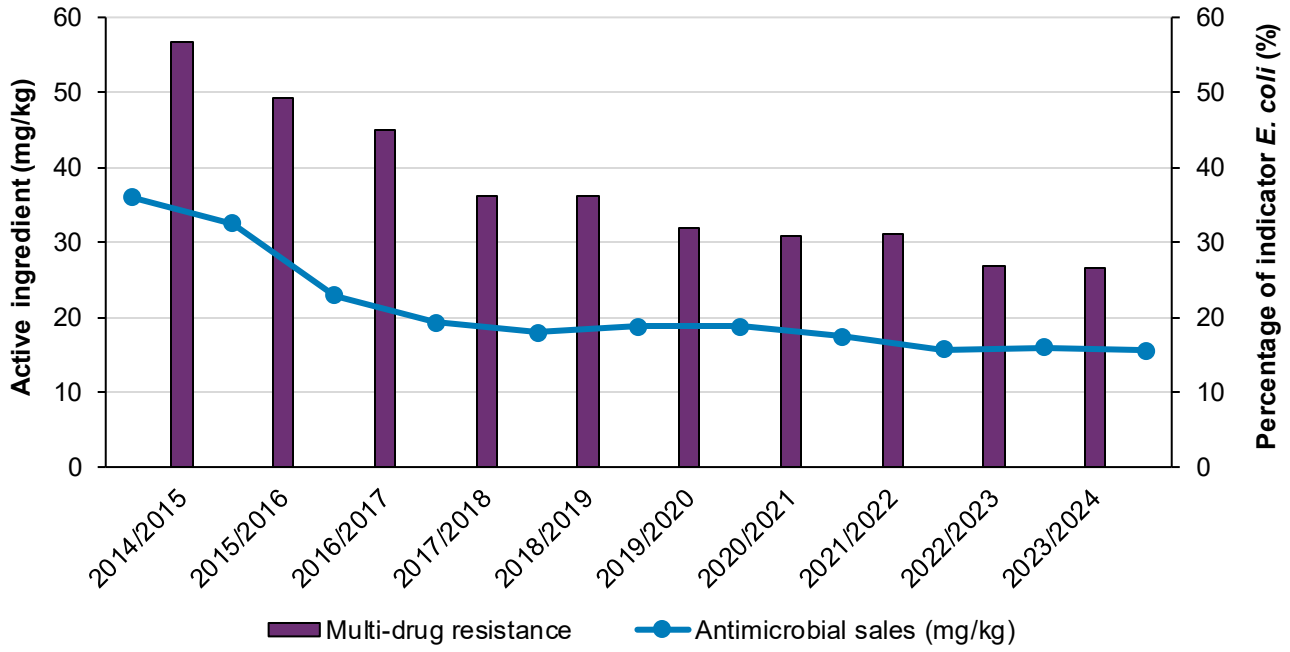
Figure 3.3: Secondary key outcome indicators: percentage of *Escherichia coli* from broilers, turkeys and pigs weighted by PCU, combined over two years. ESBL/AmpC results refer to caecal samples, all other indicators refer to isolates.



^ Data not available

Harmonised outcome indicators are also measured for antibiotic sales (Section 1.3.7). Overlaying indicators for sales with those for resistance illustrates how reductions in antibiotic sales since 2014 are reflected in reductions in resistance over the same time period (**Figure 3.4**).

Figure 3.4: Antibiotic active ingredient sold for use in food-producing animals adjusted for population (mg/kg; primary indicator) and percentage of multi-drug resistant *Escherichia coli* isolates from broilers, turkeys and pigs weighted by PCU (secondary indicator), combined over two years.

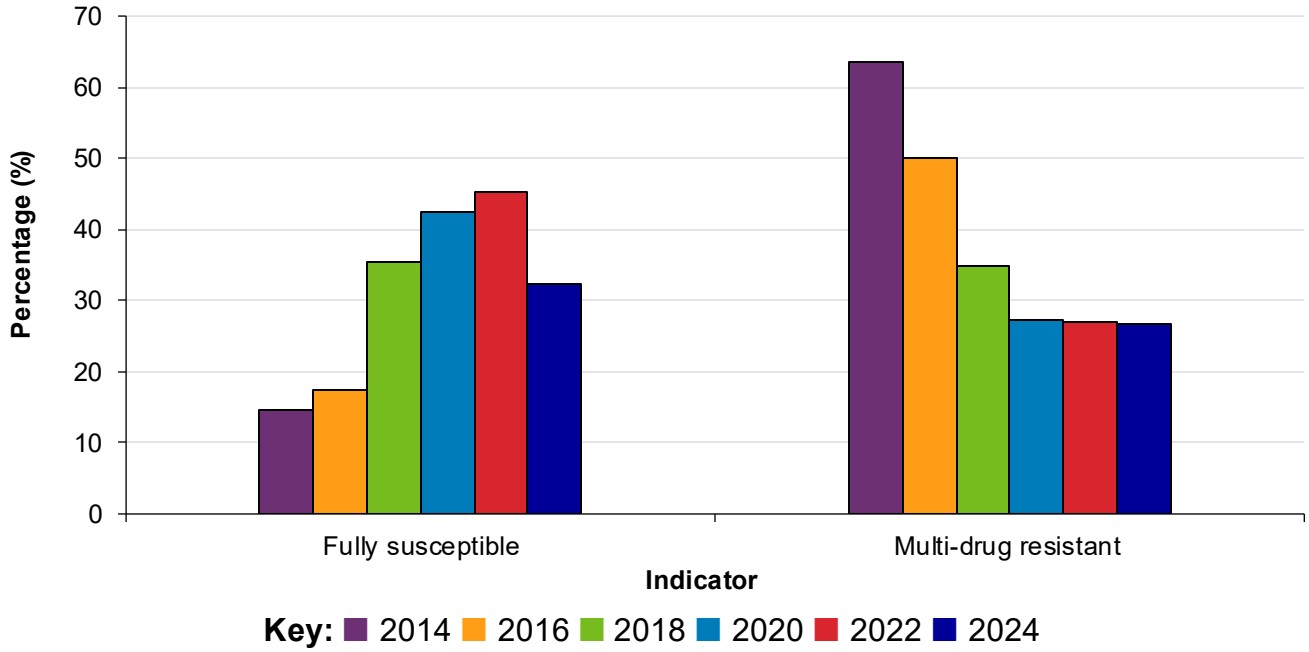


3.4.2 *Escherichia coli*

3.4.2.1 Broilers

In 2024, antibiotic susceptibility testing was conducted on 176 *E. coli* isolates obtained from broiler caecal samples. Full susceptibility decreased from 45% [95% CI: 38-53%] in 2022 to 32% [95% CI: 26-40%] in 2024 (**Figure 3.5**). This is mostly attributable to increases in resistance to ampicillin and sulfamethoxazole (**Figure 3.6 A**). This is the first decrease in full susceptibility since testing started in 2014 and has occurred despite year-on-year reductions in antibiotic use in this sector since 2020 (Section 2.4.2). The percentage of MDR isolates remained stable at 27% [95% CI: 21-34%].

Figure 3.5: Percentage of fully susceptible and multi-drug resistant *Escherichia coli* isolated from healthy broilers at slaughter between 2014 and 2024 (n=176 in 2024).



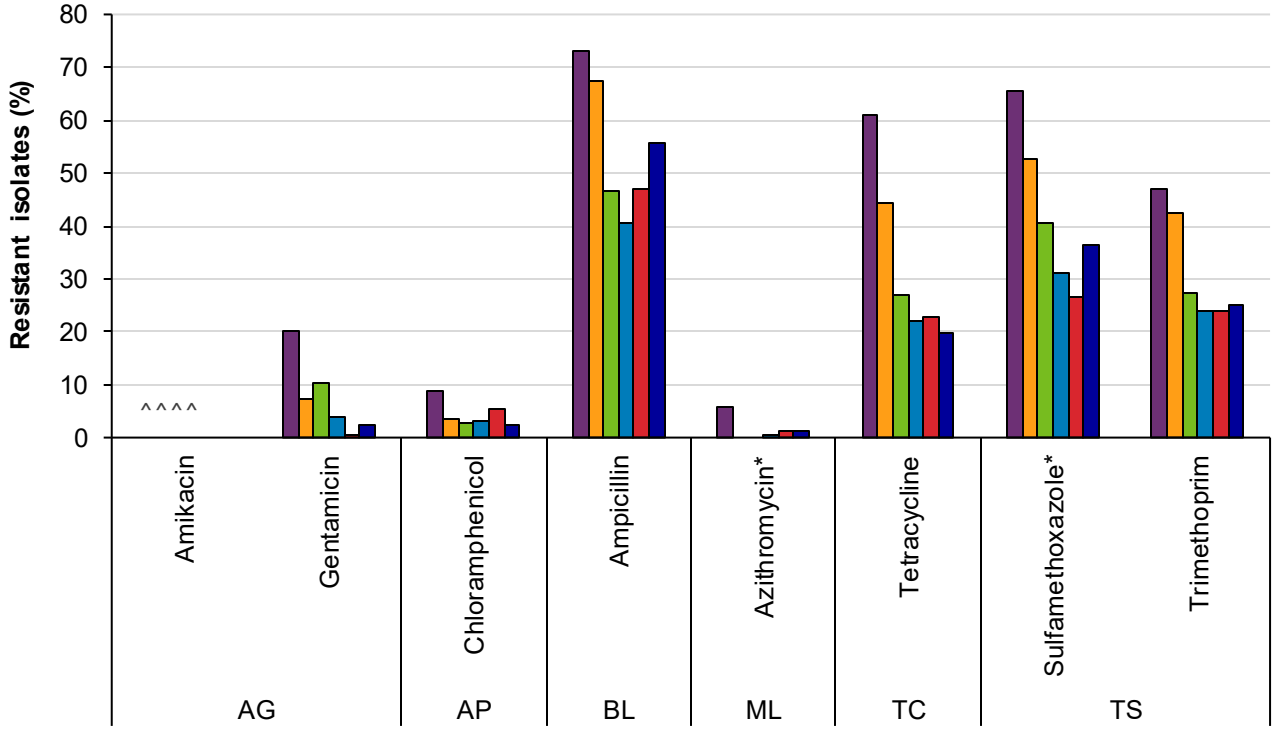
For non-HP-CIA antibiotics (**Figure 3.6 A**), resistance to the majority of antibiotics remains significantly lower in 2024 than in 2014. However, there have been recent increases in resistance to some antibiotics. Resistance to ampicillin increased from 47% [95% CI: 39-55%] in 2022 to 56% [95% CI: 48-63%] in 2024. Resistance to sulfamethoxazole was steadily decreasing between 2014 (65% [95% CI: 58-72%]) and 2022 (27% [95% CI: 20-34%]) but increased in 2024 (36% [95% CI: 30-44%]). Likewise, resistance to gentamicin fell to 0.6% [95% CI: 0.1-3.3%] in 2022 but increased to 2.3% [95% CI: 0.9-5.7%] in 2024. Between 2023 and 2024, use of penicillins in the meat poultry sector increased from 62% to 74% although use of other antibiotics decreased.

Resistance to HP-CIAs (**Figure 3.6 B**) was either low or not detected. For the first time since 2016, there was no resistance detected to the third-generation cephalosporins cefotaxime and ceftazidime. Colistin resistance remains undetected in broilers in this programme.

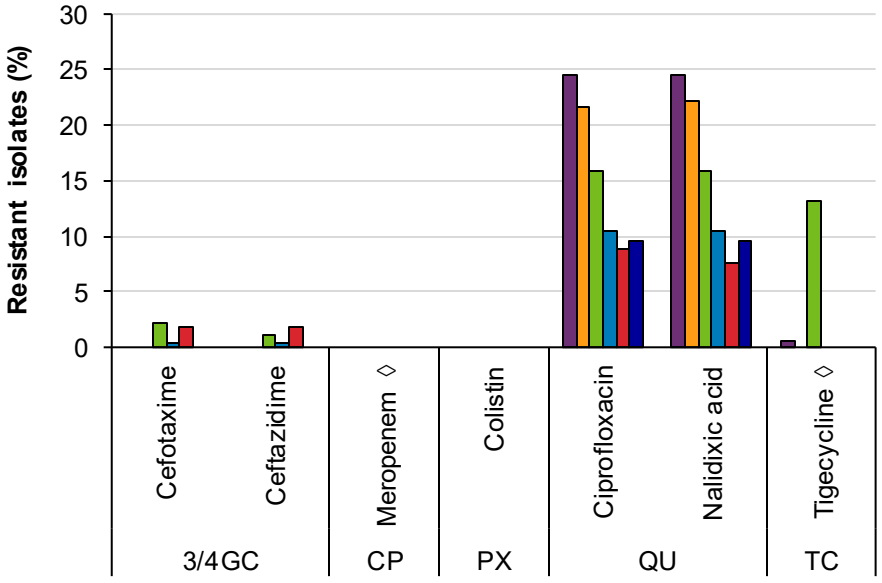
Resistance to the quinolones ciprofloxacin and nalidixic acid decreased between 2014 and 2022; however, both have increased slightly in 2024 to 9.7% [95% CI: 6.1-15%]. One isolate expressed high-level resistance (MIC ≥4.0 mg/L) to ciprofloxacin in 2024. This is despite fluoroquinolones not being used in broilers in 2022 and 2024, and only very low use in 2023 (0.001 mg/kg).

Figure 3.6: Resistance to (A) non-HP-CIAs and (B) HP-CIAs and human-only antibiotics in *Escherichia coli* isolated from healthy broilers at slaughter between 2014 and 2024 (n=176 in 2024). Interpreted using EUCAST ECOFFs unless otherwise indicated. Note scale differs between graphs.

(A) Non-HP-CIAs



(B) HP-CIA and human-only antibiotics



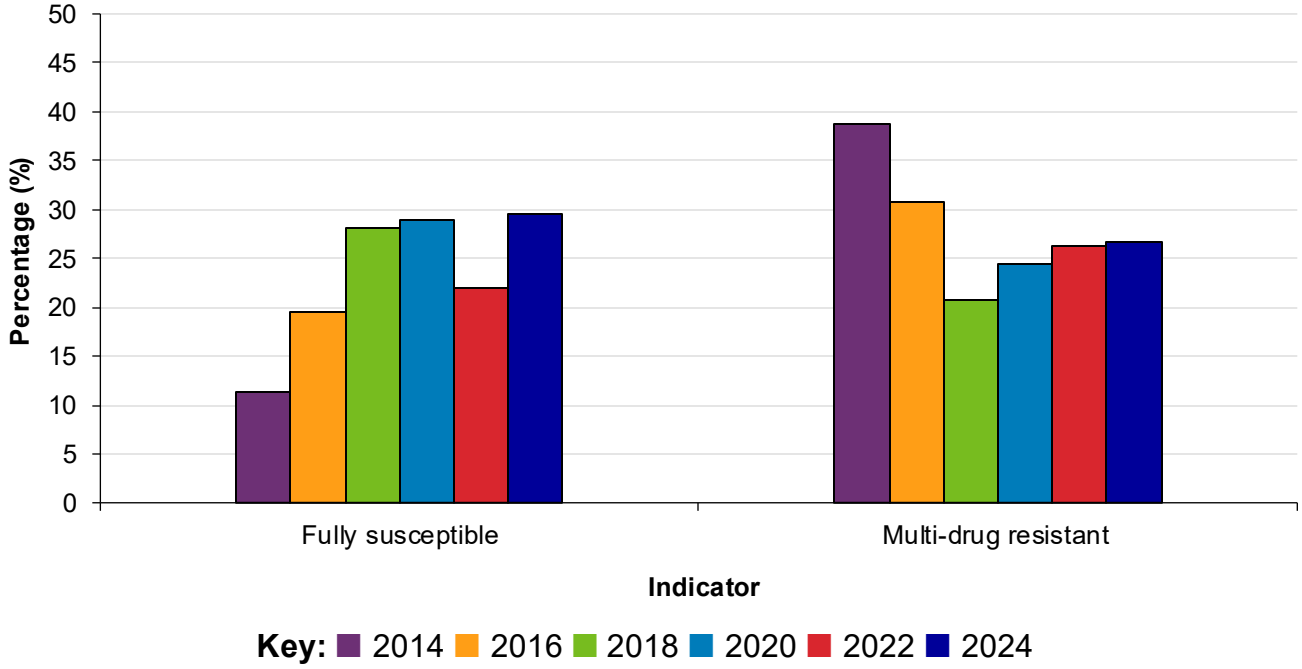
Key:
^ Not tested
* Interpreted using an EFSA-recommended ECOFF
◊ Human-only antibiotics
AG: aminoglycosides,
AP: amphenicols,
BL: beta-lactams,
CP: carbapenems
ML: macrolides,
PX: polymyxins,
QU: quinolones,
TC: tetracyclines,
TS: trimethoprim/ sulfonamides,
3/4GC: third- and fourth-generation cephalosporins

2014 2016 2018
2020 2022 2024

3.4.2.2 Turkeys

In 2024, antibiotic susceptibility testing was conducted on 176 *E. coli* isolates obtained from turkey caecal samples. Full susceptibility to the panel of antibiotics was observed in 30% [95% CI: 23-37%] of isolates (**Figure 3.7**). This brings the percentage of fully susceptible *E. coli* back in line with 2018/2020 levels following a dip in 2022. The percentage of MDR isolates has been increasing slightly year-on-year since 2018. This trend continued in 2024 with 27% [95% CI: 21-34%] of *E. coli* isolates from turkeys showing MDR.

Figure 3.7: Percentage of fully susceptible and multi-drug resistant *Escherichia coli* isolated from healthy turkeys at slaughter between 2014 and 2024 (n=176 in 2024).

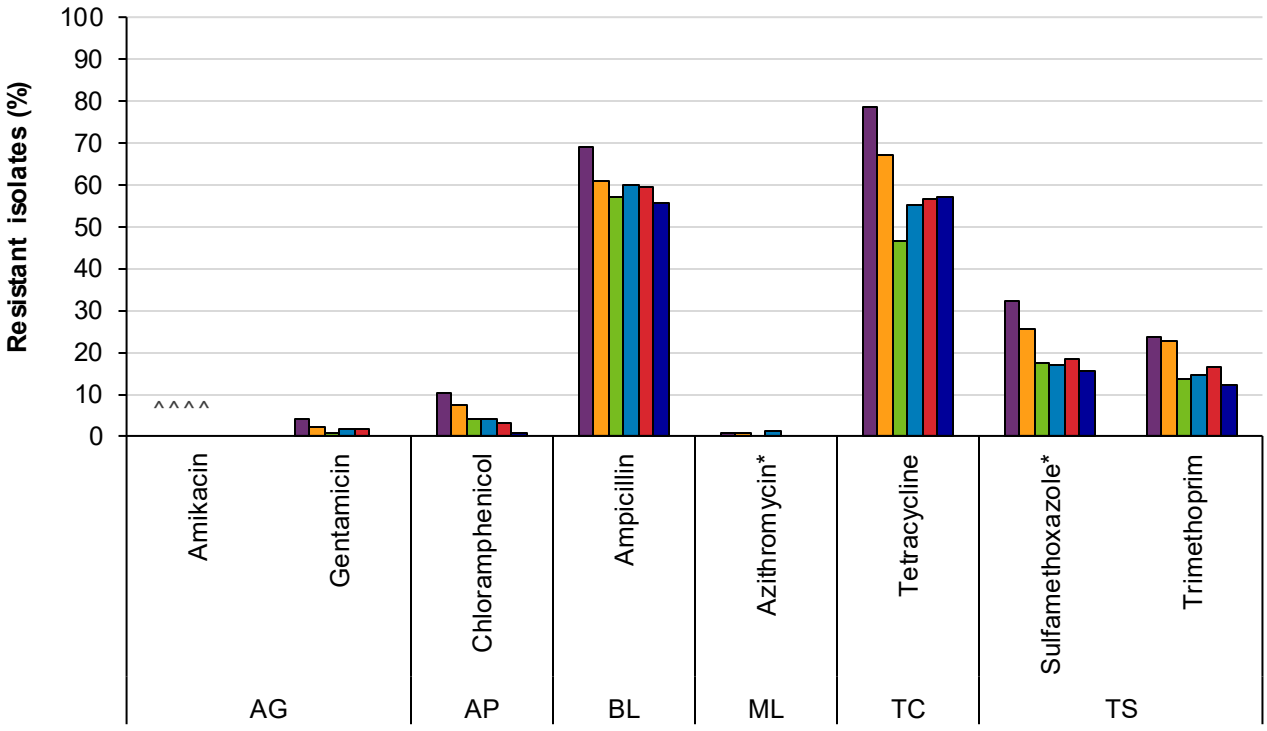


For non-HP-CIAs (**Figure 3.8 A**), resistance has mostly remained stable for several years. Resistance to ampicillin (56% [95% CI: 48-63%]) and tetracycline (57% [95% CI: 49-64%]) remain very high. While ampicillin and tetracycline are not used in the meat poultry sectors, penicillins and tetracyclines are the most commonly used antibiotic classes.

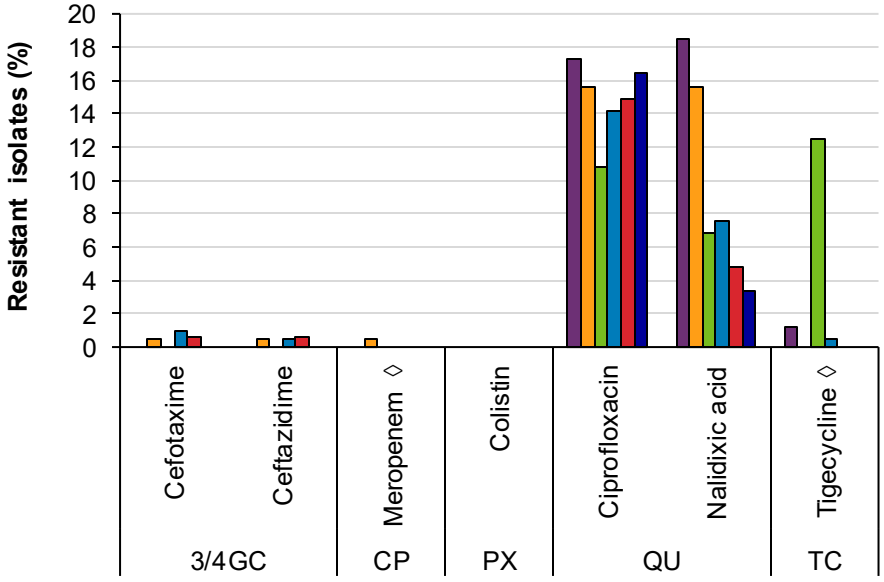
For the HP-CIAs (**Figure 3.8 B**), no resistance was detected to the third generation cephalosporins cefotaxime and ceftazidime in 2024. Resistance to individual quinolone antibiotics is diverging: resistance to the fluoroquinolone ciprofloxacin increased from 11% [95% CI: 7-16%] in 2018 to 17% [95% CI: 12-23%] in 2024 (despite use of the fluoroquinolone enrofloxacin reducing in turkeys from 0.11 to 0.02 mg/kg during this period), whilst resistance to nalidixic acid decreased significantly from 19% [95% CI: 13 to 25%] in 2014 to 3.4% [95% CI: 1.6-7.2%] in 2024. No resistance was detected to colistin.

Figure 3.8: Resistance to (A) non-HP-CIAs and (B) HP-CIAs and human-only antibiotics, in *Escherichia coli* isolated from healthy turkeys at slaughter between 2014 and 2024 (n=176 in 2024). Interpreted using EUCAST ECOFFs unless otherwise indicated. Note scale differs between graphs.

(A) Non-HP-CIAs



(B) HP-CIA and human-only antibiotics



Key:
^ Not tested
* Interpreted using an EFSA-recommended ECOFF
◊ Human-only antibiotics
AG: aminoglycosides,
AP: amphenicols,
BL: beta-lactams,
CP: carbapenems,
ML: macrolides,
PX: polymyxins,
QU: quinolones,
TC: tetracyclines,
TS: trimethoprim/ sulfonamides,
3/4GC: third- and fourth-generation cephalosporins

2014 2016 2018
2020 2022 2024

3.4.3 *Enterococcus* spp.

E. faecalis and *E. faecium* were added to the AMR surveillance programme in Great Britain in 2022 as indicator species for resistance in Gram-positive bacteria. *E. faecium* is commonly found in the gut of poultry and has the ability to acquire and transfer resistance. *E. faecalis* is the leading cause of human enterococcal infections. Their inclusion enabled testing against an expanded antibiotic panel, including vancomycin and linezolid, and other human-only antibiotics used to treat MDR infections in people.

Vancomycin-resistant enterococci (VRE) pose a particular public health concern due to high associated mortality in people, and linezolid is one of the remaining treatment options for MRSA and VRE in human patients.

E. faecium from broilers from Northern Ireland were tested for the first time in 2024. Other results in this Section are from samples from Great Britain only.

3.4.3.1 *Enterococcus faecalis*

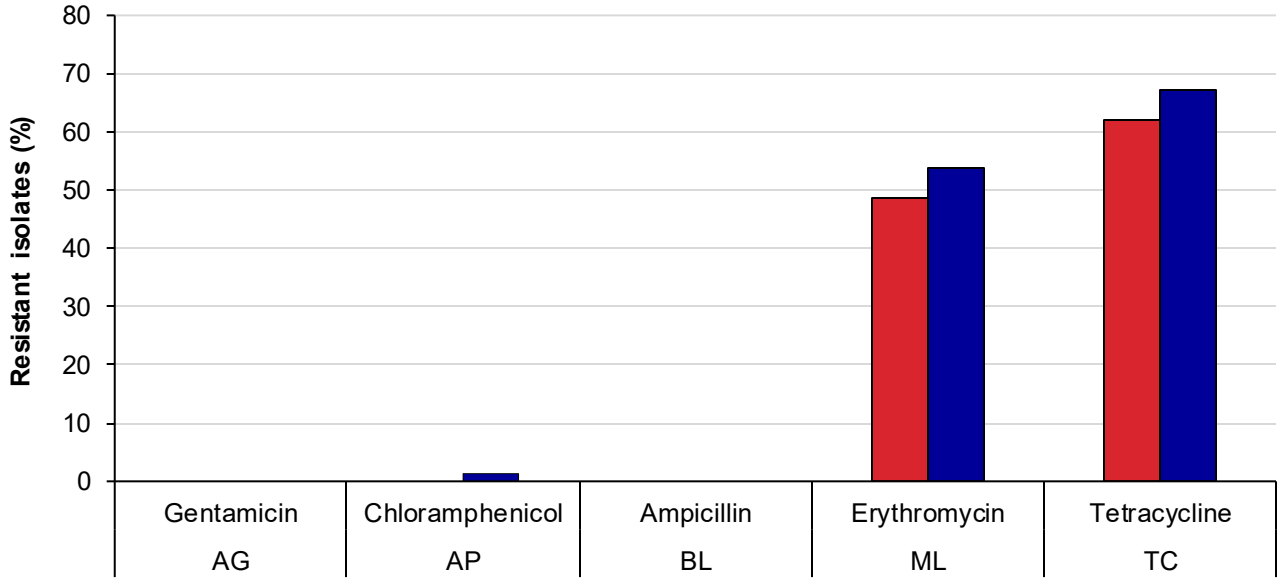
Broilers

A total of 76 *E. faecalis* isolates were tested from broilers in Great Britain (**Figure 3.9**). Of these, 20% [95% CI: 12-30%] were sensitive to all of the antibiotics in the panel and one isolate was MDR (1.3% [95% CI: 0.2-7.1%]). Very high resistance were seen to erythromycin (54% [95% CI: 43-65%]) and tetracycline (67% [95% CI: 56-77%]) with 40% of isolates exhibiting resistance to both antibiotics. While neither erythromycin or tetracycline are used in the meat poultry sectors, other antibiotics in the macrolide and tetracycline classes accounted for 0.1% and 14% of antibiotics used in 2024, respectively. Resistance to the amphenicol chloramphenicol was detected for the first time in one isolate (1.3% [95% CI: 0.2-7.1%]), despite no antibiotics in this class being authorised for use in broilers.

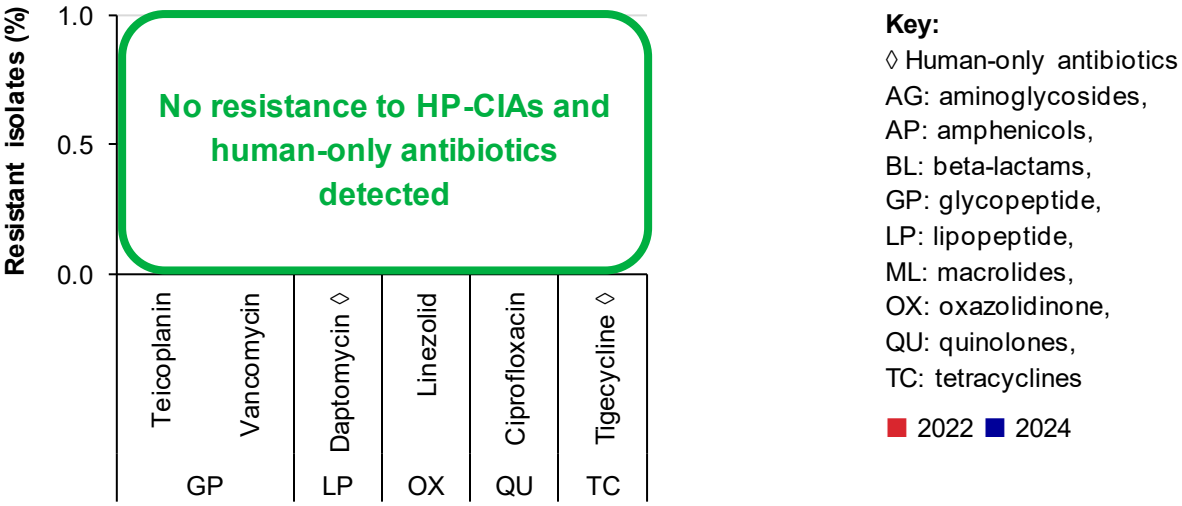
No resistance to the HP-CIA ciprofloxacin was detected. No resistance was detected to the human-only antibiotics tested, meaning neither VRE nor linezolid resistant enterococci (LRE) were detected.

Figure 3.9: Resistance to (A) non-HP-CIA and (B) HP-CIAs and human-only antibiotics in *Enterococcus faecalis* isolated from broilers at slaughter in 2022 and 2024 in Great Britain (n=76 in 2024). Interpreted using EUCAST ECOFFs unless otherwise indicated. Note scale differs between graphs.

(A) Non-HP-CIAs



(B) HP-CIA and human-only antibiotics

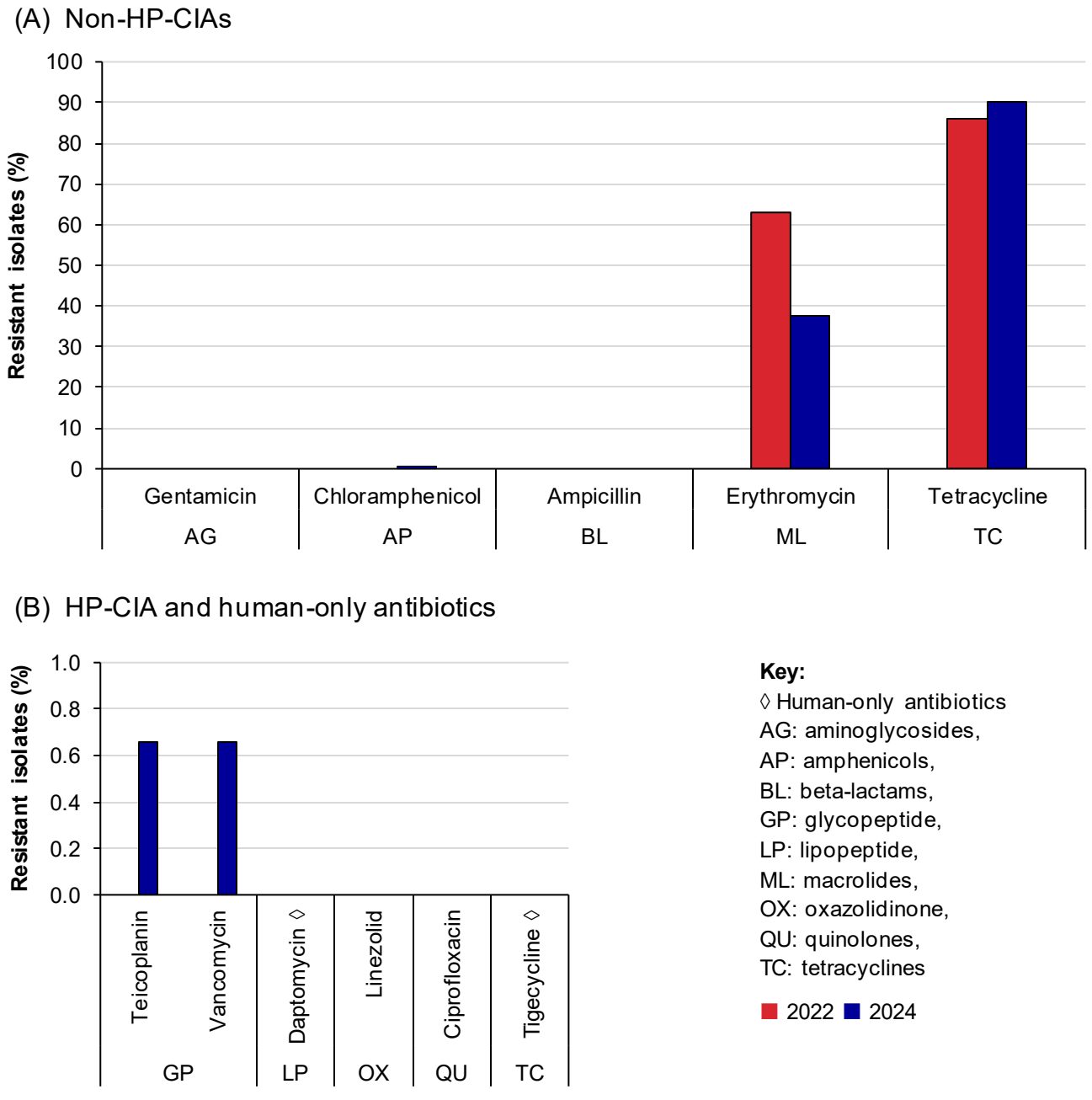


Turkeys

A total of 152 *E. faecalis* isolates were tested from turkeys in Great Britain in 2024 (**Figure 3.10**). Of these, only 7.9% [95% CI: 4.6-13%] were susceptible to all antibiotics tested and one isolate (0.7% [95% CI: 0.1-3.6%]) was MDR. Resistance to tetracycline continues to be extremely high (90% [95% CI: 84-94%]). Resistance to erythromycin decreased significantly from 63% [95% CI: 53-72%] in 2022 to 38% [95% CI: 30-45%] in 2024. Use of macrolides in the turkey sector has been reducing since 2018, and none were used in 2024. Co-resistance to both tetracycline and erythromycin was detected in 35% [95% CI: 28-43%] of isolates.

In 2024, VRE was identified for the first time in turkeys (0.7% of isolates [95% CI: 0.1-3.6%], **Figure 3.10 B**), with a single isolate exhibiting high-level resistance to both vancomycin (MIC ≥128.0 mg/L) and teicoplanin (MIC ≥32 mg/L). These MIC values are higher than the human clinical breakpoints, implying clinical resistance. This resistance pattern suggests *vanA*-mediated resistance. The *vanA* gene enables the bacterium to evade both antibiotics and is known to be transferable between strains. This VRE was also resistant to tetracycline and erythromycin and was therefore MDR. Linezolid resistant enterococci (LRE) were not detected, nor was there any resistance to other human-only antibiotics, or to the HP-CIA ciprofloxacin.

Figure 3.10: Resistance to (A) non-HP-CIAs and (B) HP-CIAs and human-only antibiotics in *Enterococcus faecalis* isolated from turkeys at slaughter in 2022 and 2024 (n=152 in 2024). Interpreted using EUCAST ECOFFs unless otherwise indicated. Note scale differs between graphs.



3.4.3.2 *Enterococcus faecium*

Broilers

A total of 180 *E. faecium* isolates were tested from broilers (**Figure 3.11**). For the first time testing of *E. faecium* was UK-wide, with Northern Ireland (NI) contributing 32 isolates (18%). Of the 180 isolates, 18% [95% CI: 13-25%] were susceptible to all antibiotics tested, and 19% [95% CI: 14-26%]) exhibited multidrug resistance (MDR).

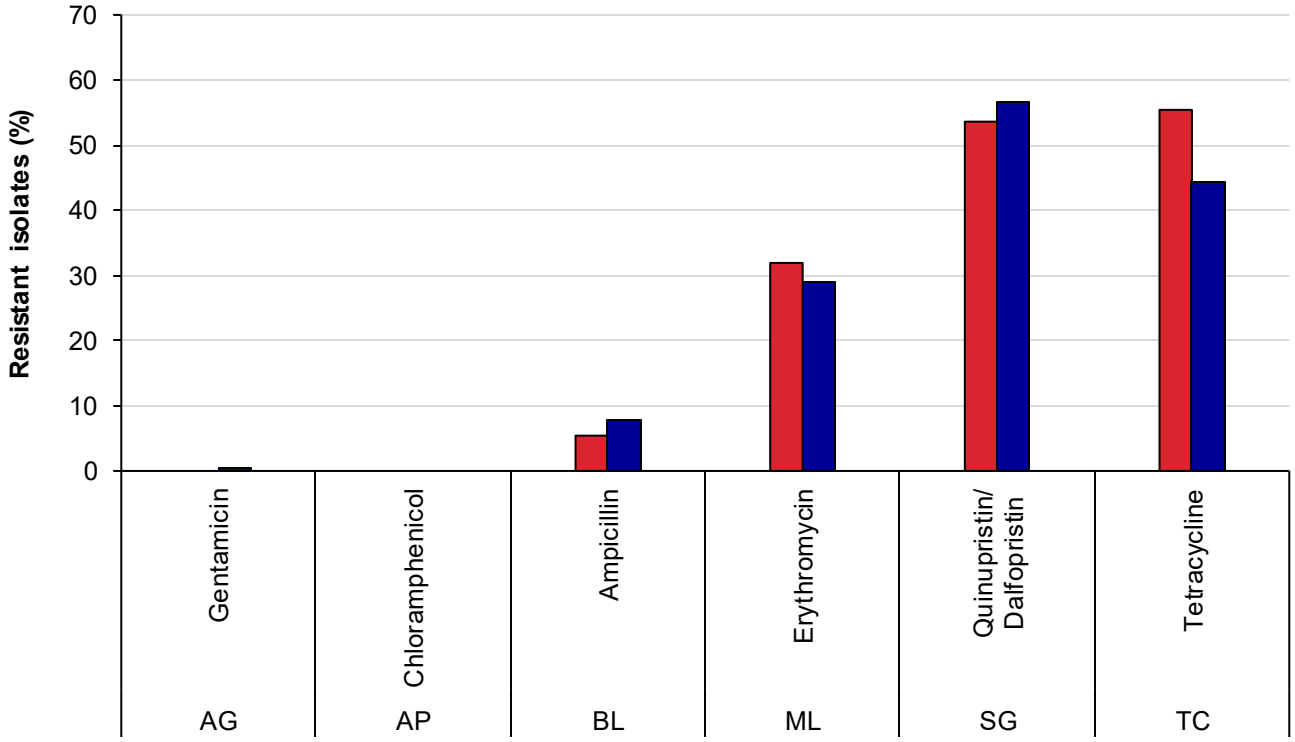
Highest resistance was seen to quinupristin-dalfopristin (57% [95% CI: 49-64%]), tetracycline (44% [95% CI: 37-52%]) and erythromycin (29% [95% CI: 23-36%]) (**Figure 3.1 A**). Whilst tetracyclines were the second most commonly used antibiotic class in the meat poultry sectors in 2024, quinupristin-dalfopristin is only used in humans. Resistance to this antibiotic has been reported in multiple countries and may be related to historical use of a similar streptogramin antibiotic, virginiamycin, as a growth promoter in livestock feed before this was banned in the UK and EU in 1999. Erythromycin is also not used in the meat poultry sectors, and other antibiotics in the macrolide class only accounted for 0.1% of overall use.

VRE were detected for the first time in three isolates (1.7% [95% CI: 0.6-4.8%]) (**Figure 3.11 B**), two of which were MDR. These isolates had low level resistance to vancomycin (MIC = 8 mg/L) and were sensitive to teicoplanin, which suggests the VanB phenotype - this tends to have more treatment options than the VanA phenotype. Resistance was also detected in very low numbers of isolates to gentamicin (0.6% [95% CI: 0.1-3.1%]), daptomycin (2.2% [95% CI: 0.9-5.6%]) and tigecycline (0.6% [95% CI: 0.1-3.1%]). The gentamicin-resistant isolate exhibited very high-level resistance (MIC > 1024 mg/L), implying clinical resistance. These isolates are being investigated further using whole genome sequencing (WGS). Gentamicin is not used in the meat poultry sectors, with other aminoglycosides accounting for 5% of overall use.

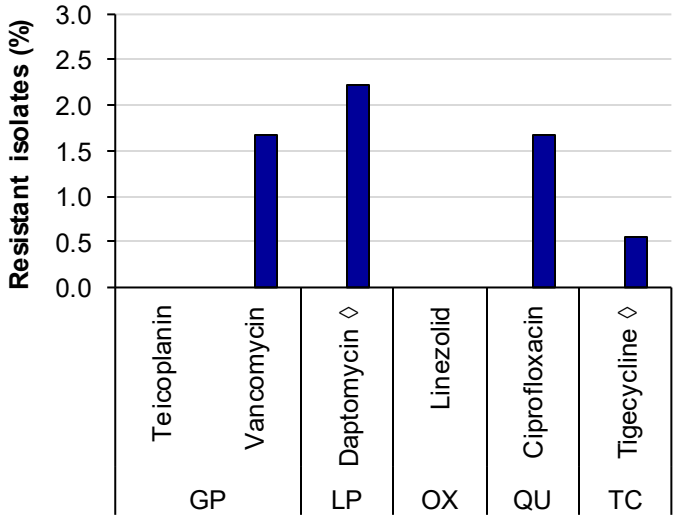
For the HP-CIA ciprofloxacin, the ECOFF used to interpret ciprofloxacin resistance has changed since 2022. Results presented in (**Figure 3.11 B**) are interpreted using this new ECOFF for both 2022 and 2024. Using the new ECOFF, 1.7% [95% CI: 0.6-4.8%] of isolates were resistant, compared to 0.0% [95% CI: 0.0-2.0%] in 2022.

Figure 3.11: Resistance to (A) non-HP-CIAs and (B) HP-CIAs and human-only antibiotics in *Enterococcus faecium* isolated from broilers at slaughter in 2022 and 2024 (n=180 in 2024). Interpreted using EUCAST ECOFFs unless otherwise indicated. Note scale differs between graphs.

(A) Non-HP-CIAs



(B) HP-CIA and human-only antibiotics



Key:
◊ Human-only antibiotics
AG: aminoglycosides,
AP: amphenicols,
BL: beta-lactams,
GP: glycopeptide,
LP: lipopeptide,
ML: macrolides,
OX: oxazolidinone,
QU: quinolones,
SG: streptogramins,
TC: tetracyclines

2022 2024

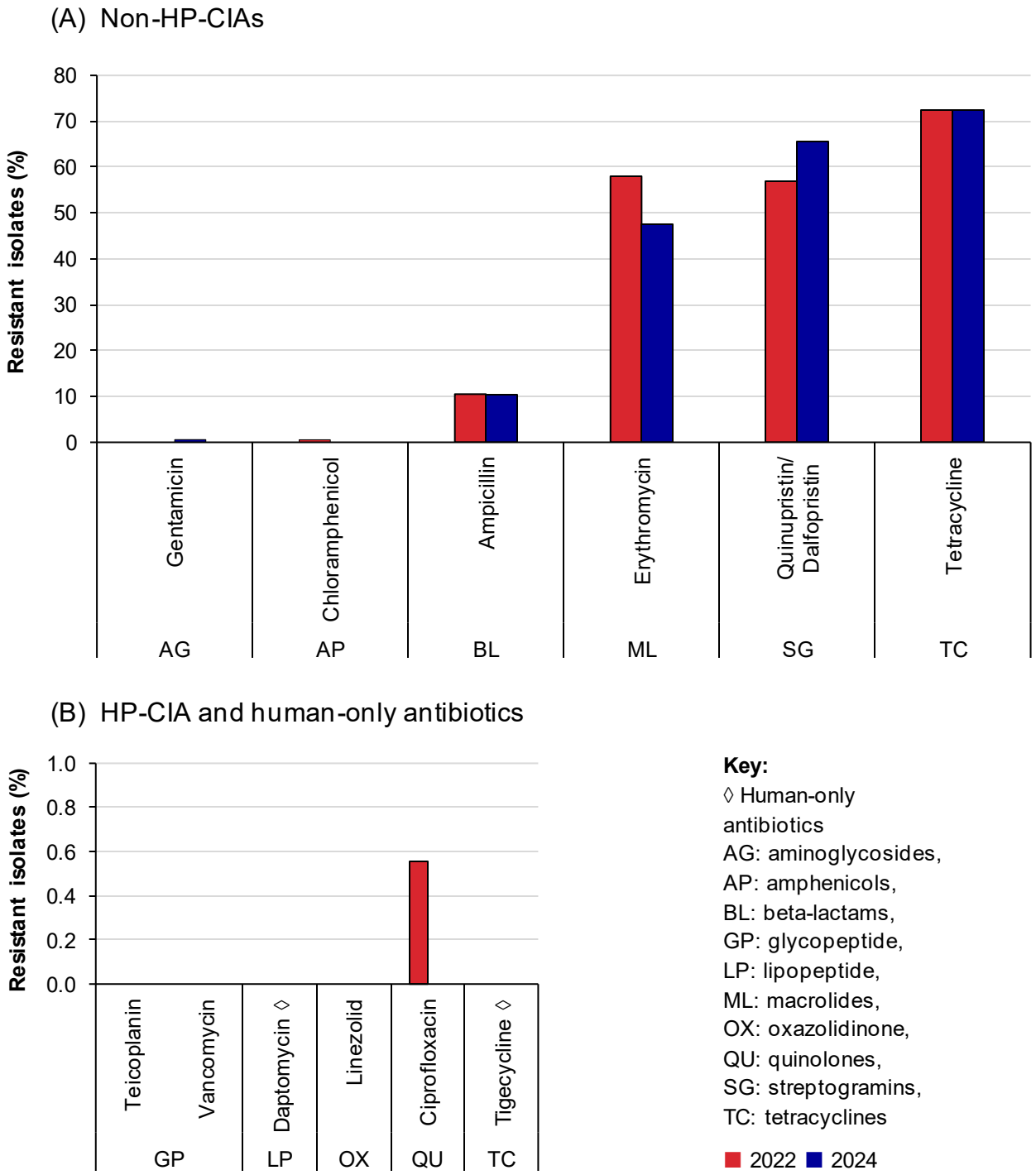
Turkeys

A total of 171 *E. faecium* isolates were tested from turkeys (**Figure 3.12**). Of the 171 isolates, 11% [95% CI: 7-17%] were susceptible to all antibiotics tested, and 37% [95% CI: 30-44%] exhibited multidrug resistance (MDR).

Resistance to non-HP-CIAs remained largely similar to 2022 (**Figure 3.12 A**), with resistance to tetracycline (73%) [95% CI: 65-79%] remaining at very high levels. Resistance to quinupristin-dalfopristin increased from 57% [95% CI: 50-64%] to 65% [95% CI: 58-72%] whilst resistance to erythromycin decreased from 58% [95% CI: 51-65%] to 47% [95% CI: 40-55%]. For the first time, resistance to gentamicin was detected in a single isolate (0.6% [95% CI: 0.1-3.2%]). This isolate showed high-level resistance (MIC > 1024 mg/L) to gentamicin and was MDR, being resistant to ampicillin, erythromycin, tetracycline and quinupristin/dalfopristin. In the event of human infection, this pattern of resistance would reduce available treatment options.

Neither VRE nor LRE were detected in 2024. Resistance to other human-only antibiotics, or to the HP-CIA ciprofloxacin, was not detected in 2024 (**Figure 3.12 B**).

Figure 3.12: Resistance to (A) non-HP-CIAs and (B) HP-CIAs and human-only antibiotics in *Enterococcus faecium* isolated from turkeys at slaughter in 2022 and 2024 (n=171 in 2024). Interpreted using EUCAST ECOFFs unless otherwise indicated. Note scale differs between graphs.

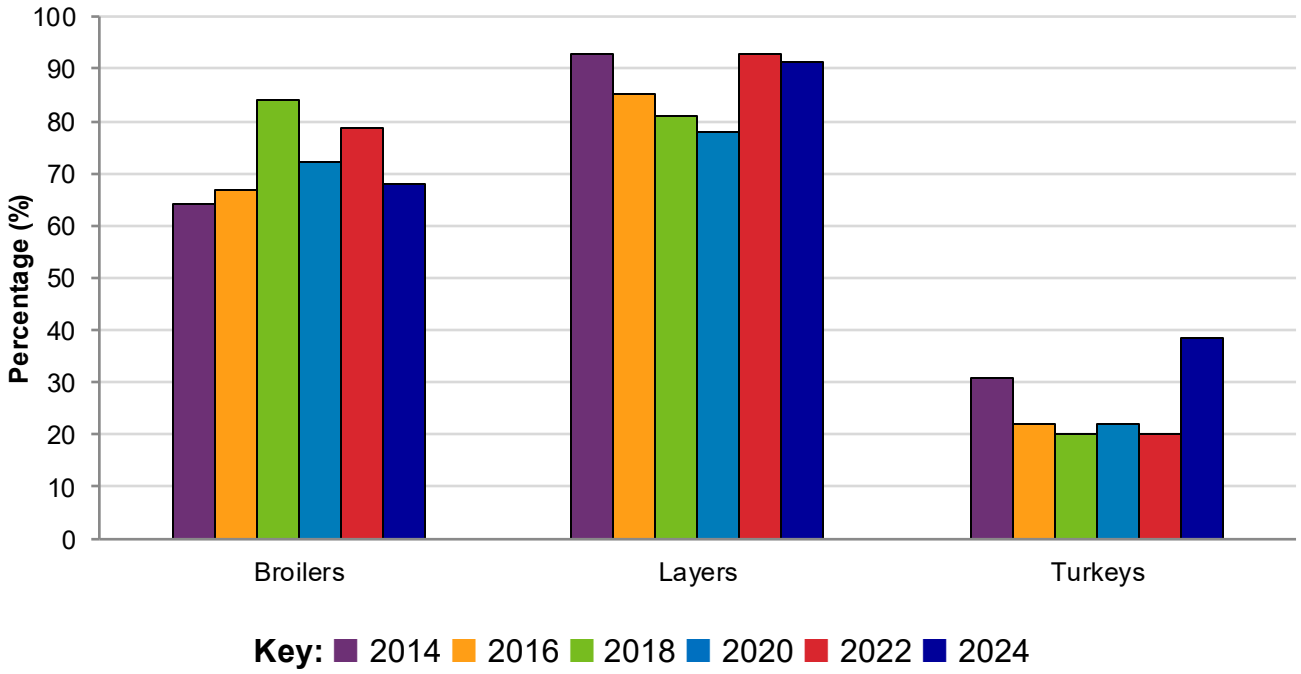


3.4.4 *Salmonella* spp.

Salmonella is an important cause of foodborne disease in people and can cause disease in animals. The *Salmonella* National Control Programme (NCP) ensures effective surveillance of the UK's poultry industry for *Salmonella* that are considered to be a public health risk. The Harmonised Monitoring programme for AMR utilises UK-wide representative samples taken under the NCP.

An important indicator is the number of *Salmonella* isolates fully sensitive to the panel of antibiotics tested. This can be seen in **Figure 3.13** for broilers, layers, and turkeys. The percentage of fully susceptible *Salmonella* from broilers decreased from 79% [95% CI: 72-84%] in 2022 to 68% [95% CI: 60-75%] in 2024 and from layers from 93% [95% CI: 83-97%] in 2022 to 91% [95% CI: 78-97%] in 2024. Conversely, the number of fully susceptible isolates from turkeys increased to 39% [95% CI: 28-50%] in 2024 from 20% [95% CI: 14-28%] in 2022. This is the highest level recorded to date within this programme. These results don't correlate with overall antibiotic use, which decreased in broilers between 2022 and 2024, whereas small increases were seen in layers and turkeys during this period.

Figure 3.13: *Salmonella* spp. isolates susceptible to all tested antibiotics, from broilers, layers and turkeys between 2014 and 2024.



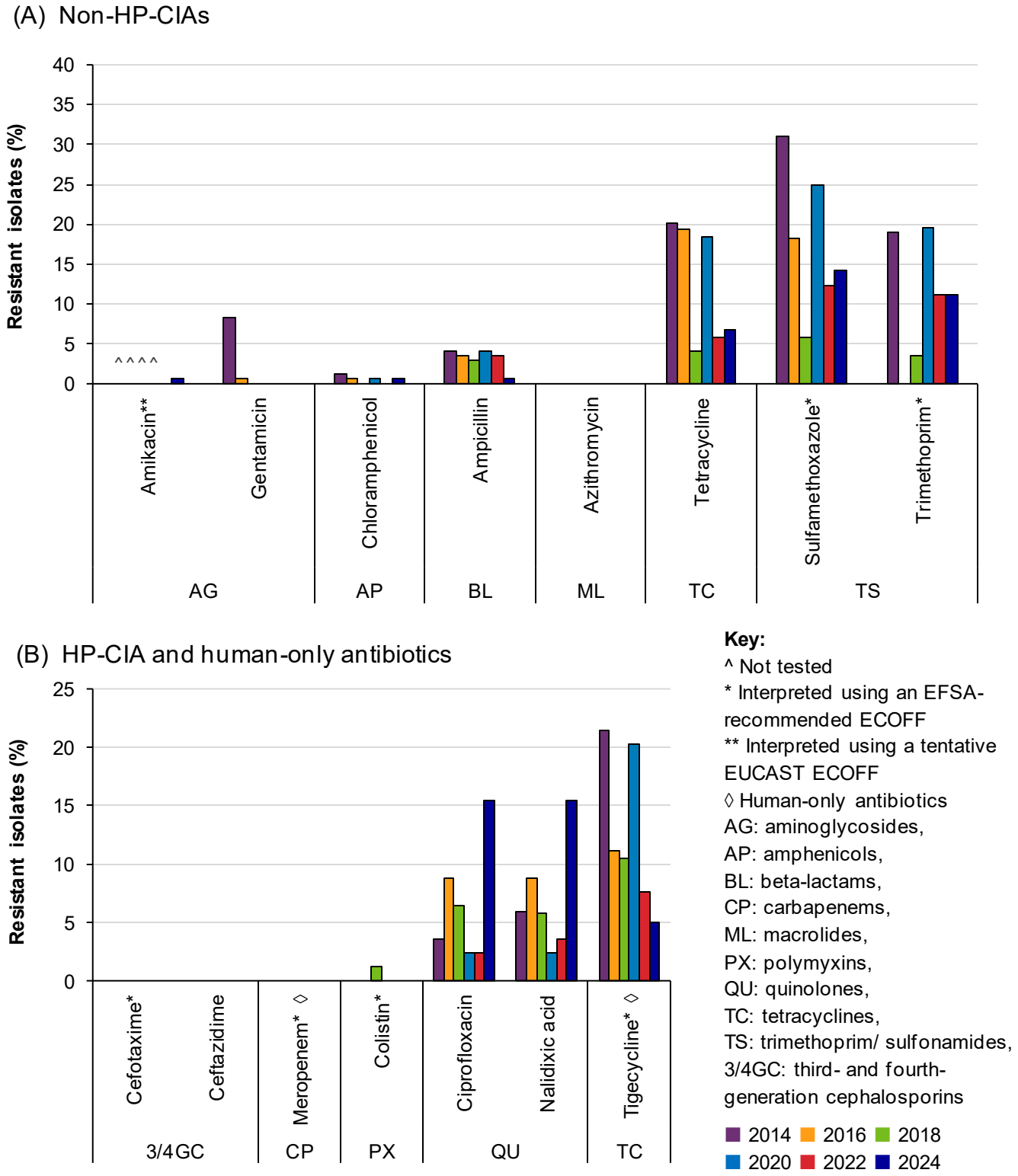
3.4.4.1 Broilers

A total of 162 *Salmonella* isolates were tested from broiler flocks (**Figure 3.14**). The most tested serovars included *S*. Idikan (29%), *S*. Kedougou (15%), and *S*. Mbandaka (13%). No isolates of *S*. Enteritidis or *S*. Typhimurium were present in the samples selected. Of the broiler *Salmonella* isolates, 3.7% [95% CI: 1.7-7.8%] were MDR.

For the non HP-CIAs (**Figure 3.14 A**), resistance to ampicillin decreased from 3.5% [95% CI: 1.6-7.5%] in 2022 to a very low level of 0.6% [95% CI: 0.1-3.4%] in 2024. Resistance to tigecycline reduced from 7.6% [95% CI: 4.5-12.6%] in 2022 to 4.9% [95% CI: 2.5-9.4%] in 2024. Resistance to amikacin was identified in a single isolate (0.6% [95% CI: 0.1-3.4%]) in 2024. No resistance was detected to azithromycin, gentamicin or meropenem.

Of the HP-CIAs and human-only antibiotics (**Figure 3.14 B**), the highest resistance in *Salmonella* from broiler farms in 2024 was to the quinolones ciprofloxacin and nalidixic acid (15% [95% CI: 10.7-21.8%] for both antibiotics). Resistance increased significantly in 2024 from the low levels seen in 2022 (2.4% [95% CI: 0.9-5.9%] and 3.5% [95% CI: 1.6-7.5%], respectively). This is despite fluoroquinolones not being used in broilers in 2022 and 2024, and only very low use in 2023 (0.001 mg/kg). This increase in resistance is ascribed to an increase in the number of *S*. Idikan isolates in 2024 that were resistant to both ciprofloxacin and nalidixic acid. Full susceptibility to the third-generation cephalosporins, cefotaxime and ceftazidime, was maintained between 2014 and 2024. No resistance to colistin was detected in 2024.

Figure 3.14: Resistance to (A) non-HP-CIAs and (B) HP-CIAs and human-only antibiotics in *Salmonella* isolated from broiler flock NCP samples between 2014 and 2024 (n=162 in 2024). Interpreted using EUCAST ECOFFs unless otherwise indicated. Note scale differs between graphs.



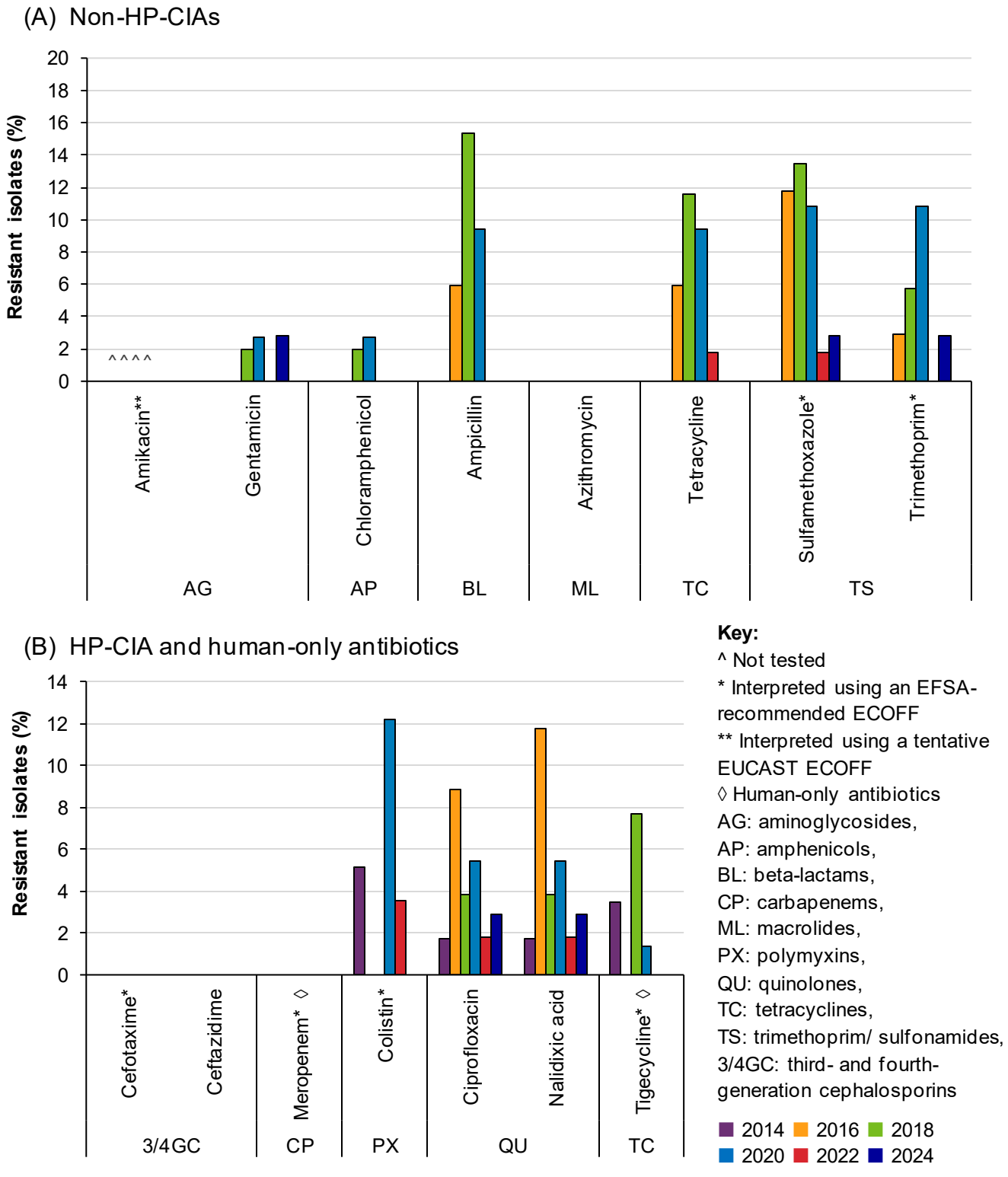
3.4.4.2 Layers

A total of 35 *Salmonella* isolates were tested from laying hen flocks (**Figure 3.15**). The most tested serovars included *S.* Typhimurium (20%), serovar 61:k:1,5,7 (11%) and *S*. Newport (11%). There were no MDR isolates.

For the non-HP-CIAs (**Figure 3.15 A**), resistance remains low or not detected. A single isolate (2.9% [95% CI: 0.5-14.5%]) was resistant to the aminoglycoside gentamicin in 2024. Gentamicin is not used in the laying hen sector, although other aminoglycosides accounted for 6% of overall use in 2024.

Of the HP-CIAs and human-only antibiotics (**Figure 3.15 B**), full susceptibility to the third-generation cephalosporins, cefotaxime and ceftazidime, was maintained between 2014 and 2024. One *S.* Typhimurium isolate was resistant to both ciprofloxacin and nalidixic acid (2.9% [95% CI: 0.5-14.5%]) in 2024. Colistin resistance was not detected.

Figure 3.15: Resistance to (A) non-HP-CIAs and (B) HP-CIAs and human-only antibiotics in *Salmonella* isolated from layer flock NCP samples between 2014 and 2024 (n=35 in 2024). Interpreted using EUCAST ECOFFs unless otherwise indicated. Note scale differs between graphs.



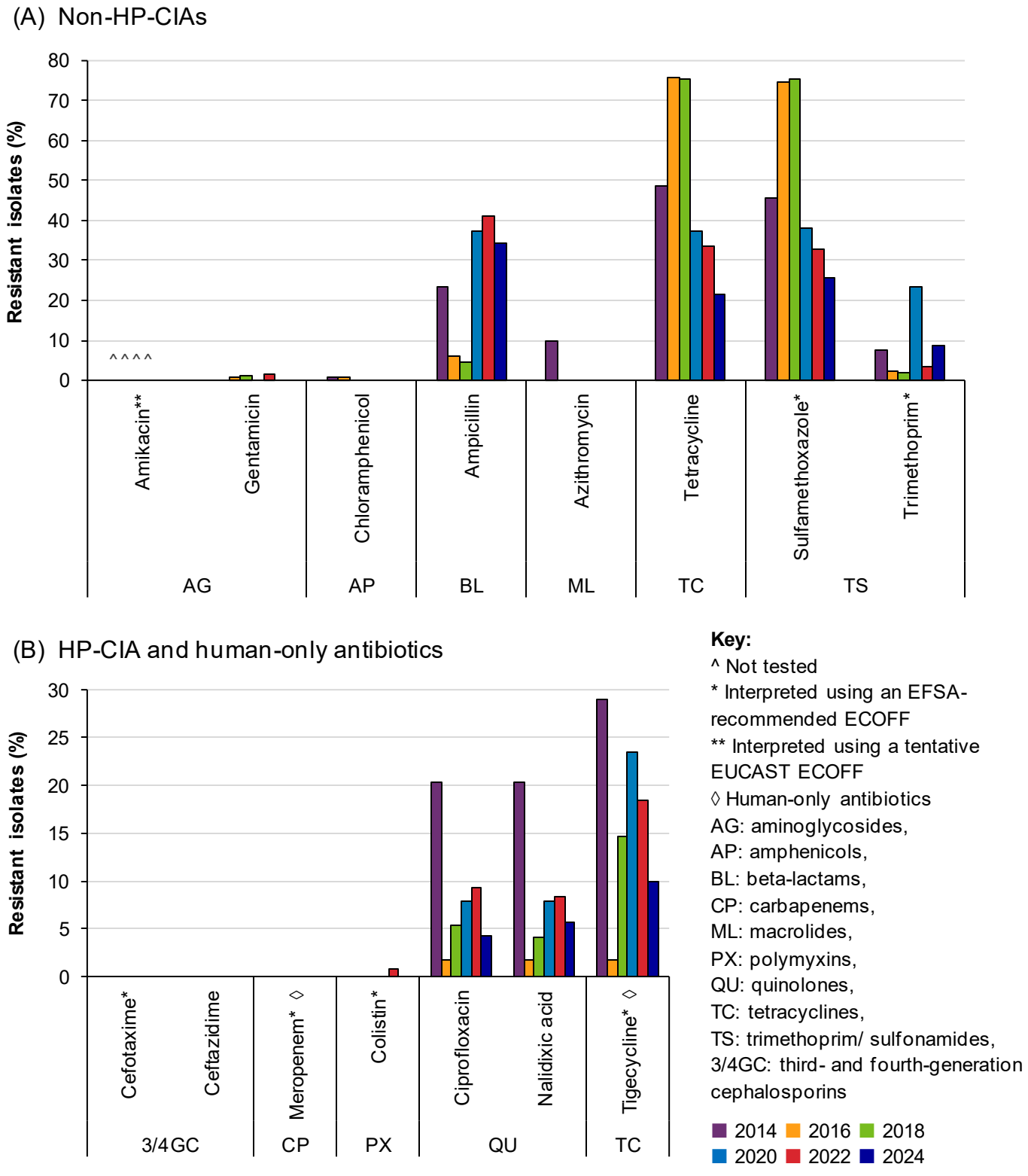
3.4.4.3 Turkeys

A total of 70 *Salmonella* isolates were tested for AMR from turkey flocks (**Figure 3.16**). The most tested serovars included *S.* Anatum (30%), *S.* Kedougou (23%), and *S.* Indiana (13%). Seven (10%) *S.* Typhimurium were detected, 71% of which were fully susceptible to the panel of antibiotics. One (1.4%) fully susceptible monophasic *S.* Typhimurium isolate was detected. The proportion of MDR turkey *Salmonella* isolates was 5.7% [95% CI: 2.2-13.8%].

For the non-HP-CIAs, (**Figure 3.16 A**), resistance to trimethoprim has increased from 3.4% [95% CI: 1.3-8.3%] in 2022 to 8.6% [95% CI: 4.0-17.5%] in 2024 but remains low. Since 2018, resistance to tetracycline (21% [95% CI: 13-32%]) and sulfamethoxazole (26% [95% CI: 17-37%]) has decreased significantly. There was no resistance detected to amikacin, azithromycin, chloramphenicol, gentamicin or meropenem.

Of the HP-CIAs and human-only antibiotics (**Figure 3.16 B**), full susceptibility to the third-generation cephalosporins, cefotaxime and ceftazidime, was maintained between 2014 and 2024. Resistance to the quinolones ciprofloxacin (4.3% [95% CI: 1.5-11.9%]) and nalidixic acid (5.7% [95% CI: 2.2-13.8%]) remains low and has decreased significantly since 2014. The isolates resistant to ciprofloxacin were also resistant to nalidixic acid. No resistance to colistin was detected.

Figure 3.16: Resistance to (A) non-HP-CIAs and (B) HP-CIAs and human-only antibiotics in *Salmonella* isolated from turkey flock NCP samples between 2014 and 2024 (n=70 in 2024). Interpreted using EUCAST ECOFFs unless otherwise indicated. Note scale differs between graphs.



3.4.5 *Campylobacter spp.*

Campylobacter is the most common cause of food poisoning in humans in the UK. The majority of human *Campylobacter* infections are acquired from food, direct contact with animals, or environmental cross-contamination. *C. jejuni* is the most prevalent species in poultry. *C. coli* is often more resistant than *C. jejuni* to several important antimicrobials and may transfer resistance genes to *C. jejuni*.

3.4.5.1 *Campylobacter jejuni*

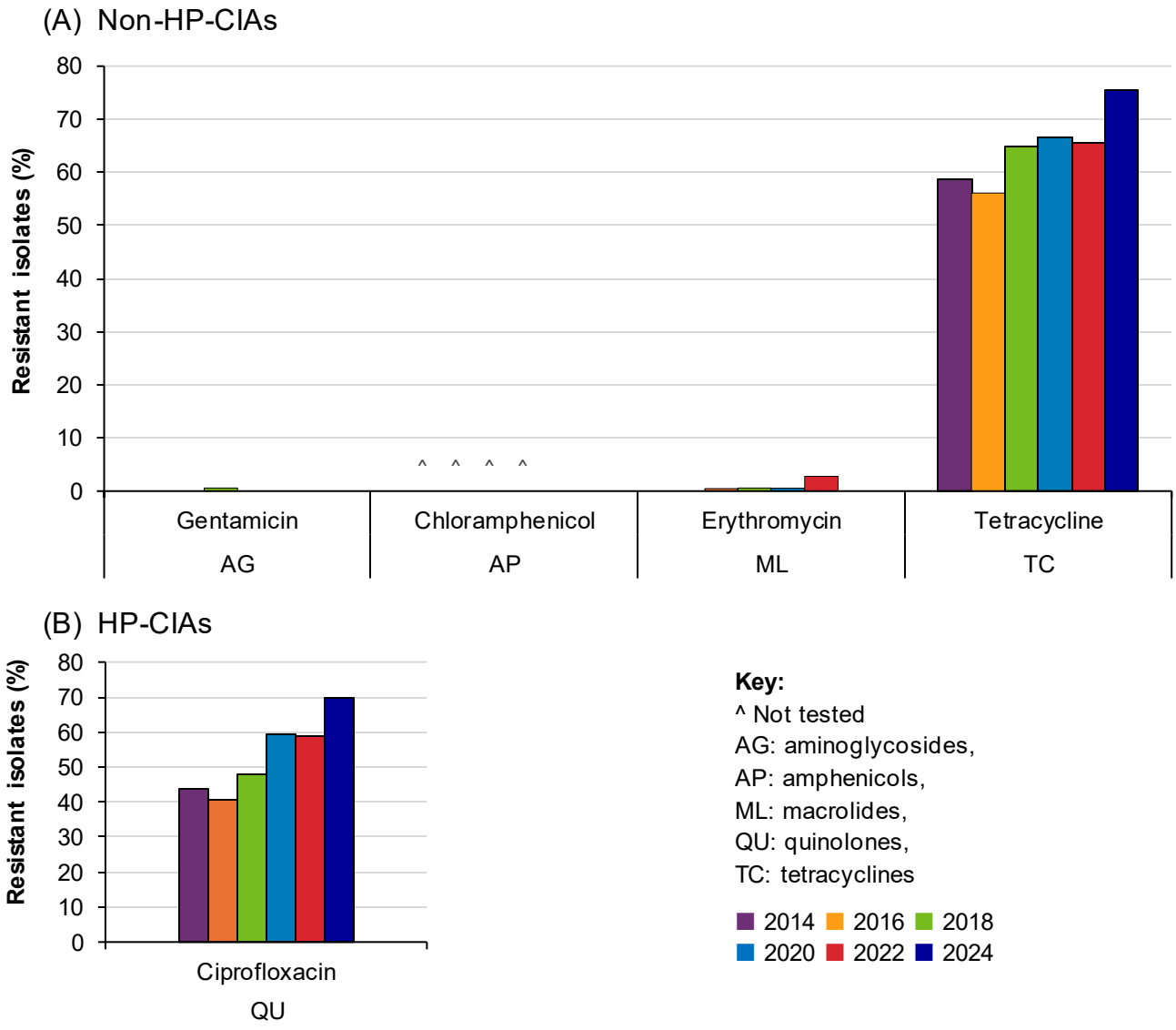
Broilers

A total of 180 *C. jejuni* isolates were tested from broilers (**Figure 3.17**), of which 21% [95% CI: 16-28%] were fully susceptible to the panel of antibiotics tested and none (0.0% [95% CI: 0.0-2.0%]) were MDR.

Resistance has continued to increase, with the highest resistance detected to tetracycline and ciprofloxacin. Resistance to tetracycline (**Figure 3.17 A**) has remained persistently very high since testing started in 2014 and increased from 66% [95% CI: 58-72%] in 2022 to extremely high (76% [95% CI: 69-81%]) in 2024. This is despite usage of tetracyclines remaining relatively stable since 2017.

Likewise, resistance to the HP-CIA ciprofloxacin (**Figure 3.17 B**) has been high, increasing to very high, since the programme began in 2014. In 2024 resistance increased to 70% [95% CI: 63-76%] from 59% [95% CI: 52-66%] in 2022. This was despite minimal or no use of fluoroquinolones in this sector in recent years. This particular type of resistance isn't costly for the bacteria to produce, meaning it can persist in the absence of specific antibiotic selection pressure. This resistance is also associated with some dominant *Campylobacter* strains in UK broiler populations.

Figure 3.17: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Campylobacter jejuni* isolated from broilers at slaughter between 2014 and 2024 (n=180 in 2024). Interpreted using EUCAST ECOFFs unless otherwise indicated.

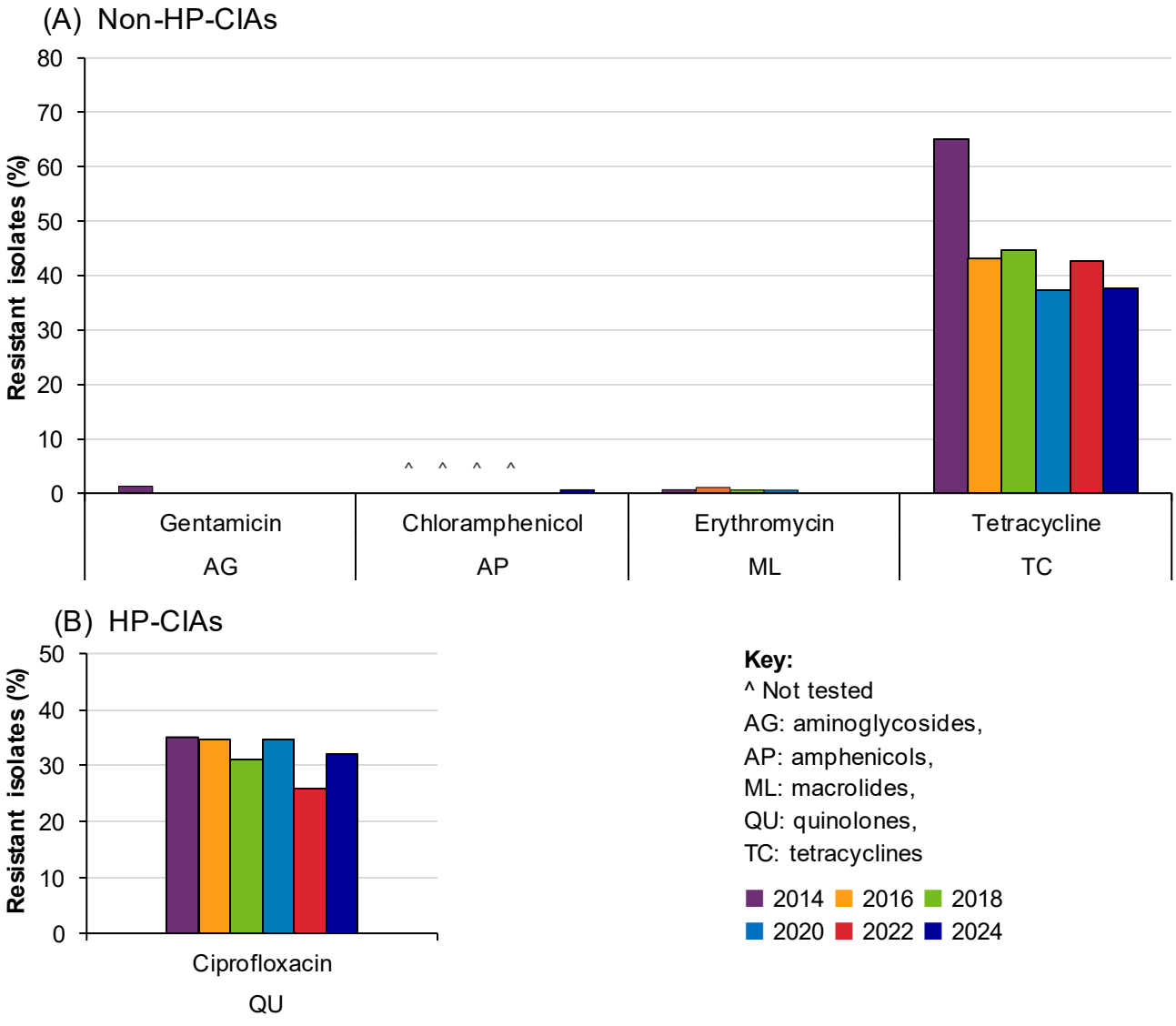


Turkeys

A total of 159 *C. jejuni* isolates were tested from turkeys (**Figure 3.18**), of which 57% [95% CI: 49-64%] were fully susceptible to the panel of antibiotics tested and none (0% [95% CI: 0-2%]) were MDR.

Resistance has remained relatively stable since 2016 and is highest for tetracycline (38% [95% CI: 31-46%]) (**Figure 3.18 A**) and to the HP-CIA ciprofloxacin (32% [95% CI: 25-40%]) (**Figure 3.18 B**). For the first time a single isolate (0.6% [95% CI: 0.1-3.5%]) showed resistance to chloramphenicol, despite no amphenicols being authorised for use in meat poultry. No resistance was detected to gentamicin or to erythromycin.

Figure 3.18: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Campylobacter jejuni* isolated from turkeys at slaughter between 2014 and 2024 (n=159 in 2024). Interpreted using EUCAST ECOFFs unless otherwise indicated. Note scale differs between graphs.



3.4.5.2 *Campylobacter coli*

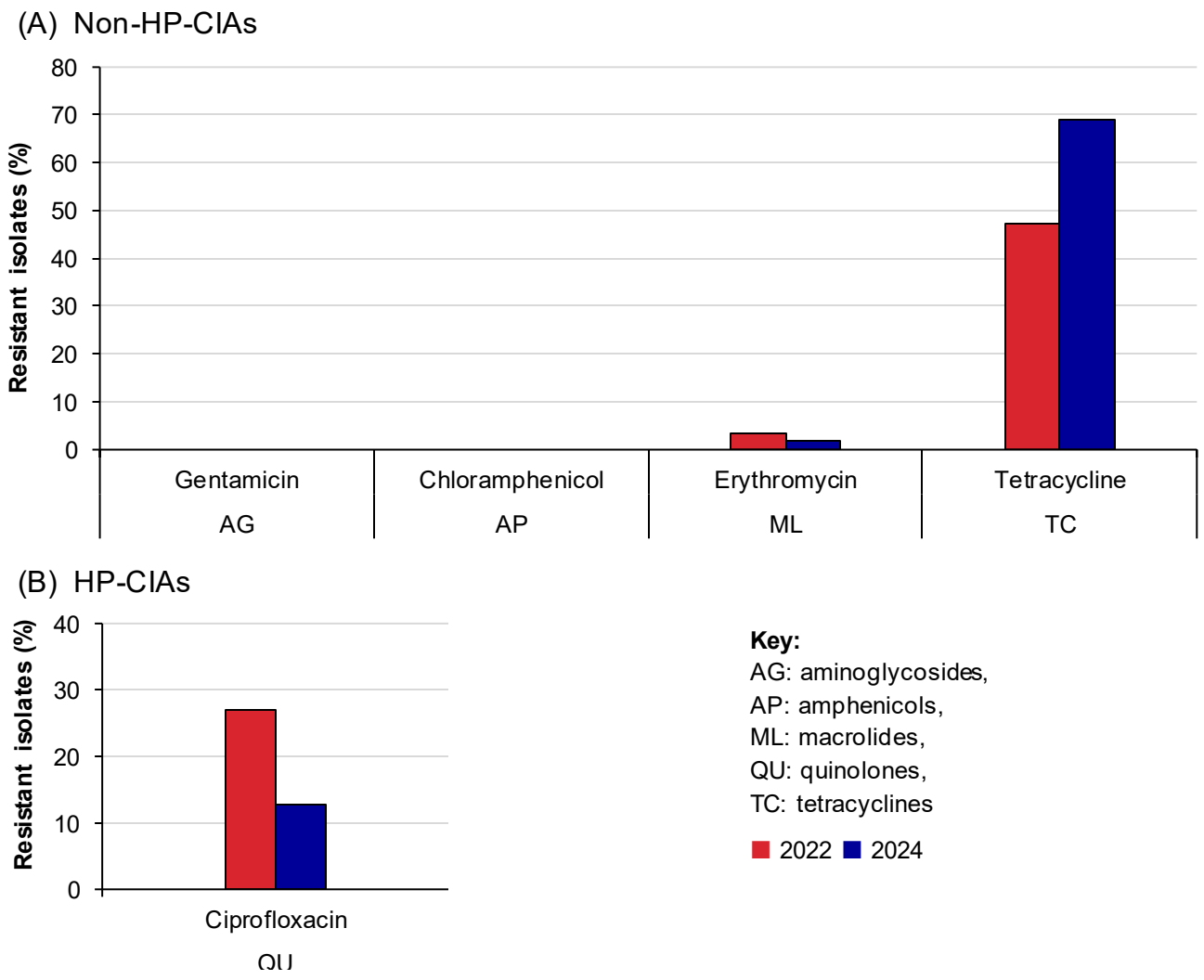
Broilers

A total of 55 *C. coli* isolates were tested from broilers in 2024 (**Figure 3.19**). Of these, 27% [95% CI: 17-40%] were fully sensitive to the panel of antibiotics tested and 0% [95% CI: 0-6%] were MDR.

The highest levels of resistance were seen to tetracycline, which increased from 48% [95% CI: 35-60%] in 2022 to 69% [95% CI: 56-80%] in 2024 (**Figure 3.19 A**), despite decreased used of tetracyclines during this period.

Resistance to the HP-CIA ciprofloxacin fell from 27% [95% CI: 17-40%] in 2022 to 13% [95% CI: 6-24%] in 2024 (**Figure 3.19 B**). A single isolate was resistant to erythromycin (1.8% [95% CI: 0.3-9.6%]). No resistance was observed to gentamicin or chloramphenicol.

Figure 3.19: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Campylobacter coli* isolated from broilers at slaughter in 2022 and 2024 (n=55 in 2024). Interpreted using EUCAST ECOFFs unless otherwise indicated. Note scale differs between graphs.



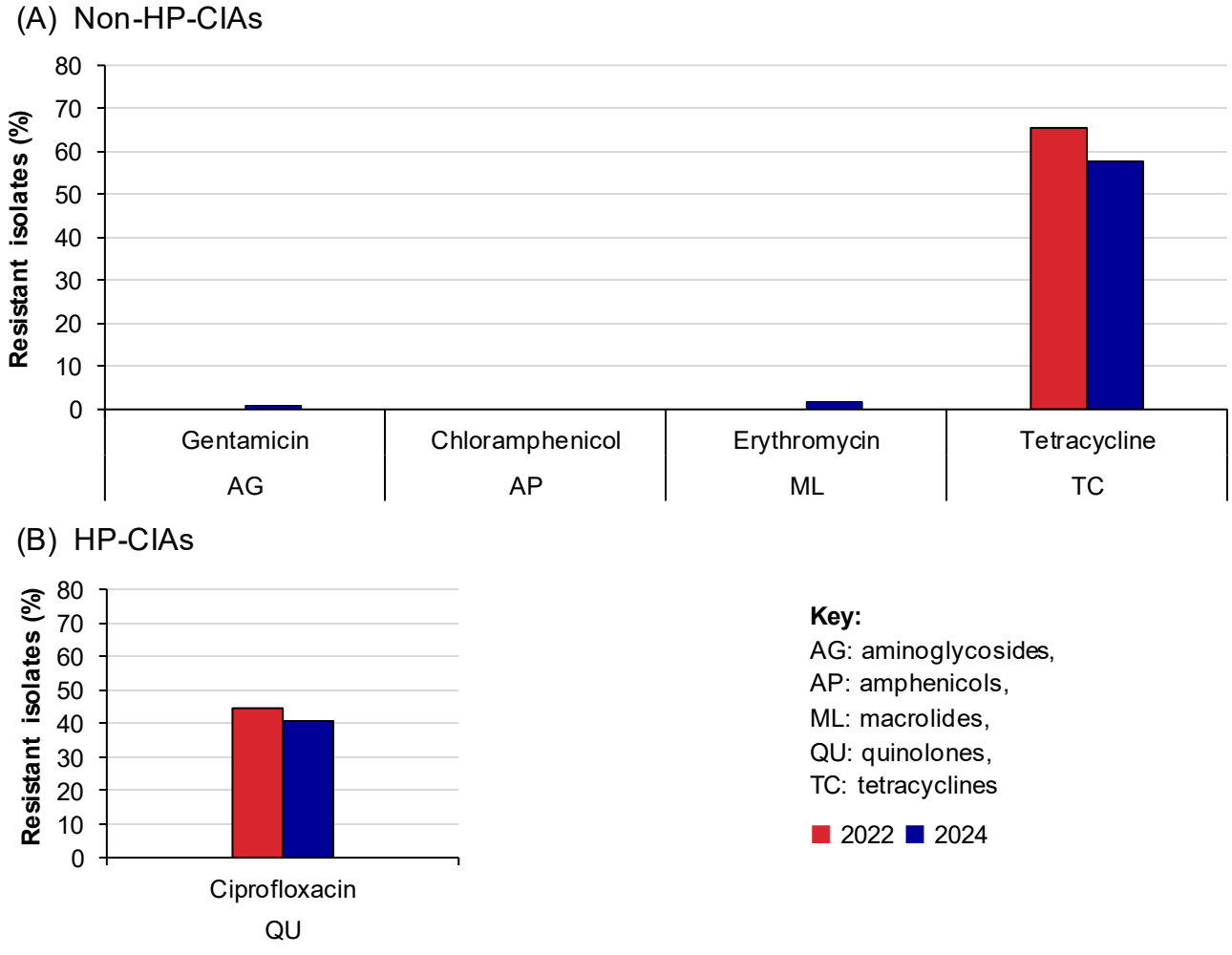
Turkeys

A total of 111 *C. coli* isolates were tested from turkeys (**Figure 3.20**). Of these, 34% [95% CI: 26- 44] were fully sensitive to the panel of antibiotics tested and 1.8% [95% CI: 0.5-6.3] were MDR.

The highest resistance was to tetracycline (**Figure 3.20 A**), to which resistance remains very high, although it decreased from 66% [95% CI: 56-74] in 2022 to 58% [95% CI: 48-66%] in 2024.

Resistance to the HP-CIA ciprofloxacin (**Figure 3.20 B**) decreased slightly to 41% [95% CI: 32-50%] in 2024. For the first time, resistance to erythromycin was detected in 1.8% [95% CI: 0.5-6.3%] of isolates, and to gentamicin in one isolate (0.9% [95% CI: 0.2-4.9%]). No resistance was seen to chloramphenicol.

Figure 3.20: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Campylobacter coli* isolated from turkeys at slaughter in 2022 and 2024 (n=111 in 2024). Interpreted using EUCAST ECOFFs unless otherwise indicated.



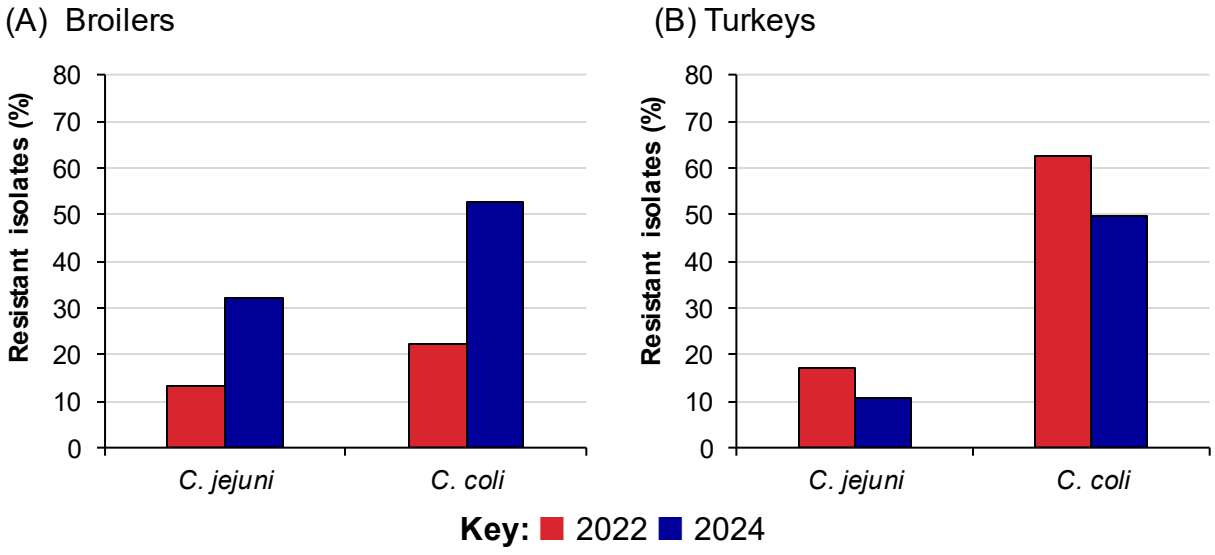
Box 3.2: Ertapenem resistance in *Campylobacter*

Ertapenem has been included in the antibiotic panel for *Campylobacter* species since 2022. Ertapenem is a carbapenem, which are antibiotics of last resort in human health. Ertapenem is used in some countries to treat serious invasive *Campylobacter* infections in humans. It was added to our panel to maintain international harmonisation for this antibiotic class. The EFSA recommended ECOFF of 0.5 mg/L has been used.

Since 2022, resistance to ertapenem in both *C. jejuni* and *C. coli* in broilers has increased significantly (**Figure 3.21 A**). In *C. jejuni*, it has increased from 13% [95% CI: 9-19%] in 2022 to 32% [95% CI: 26-39%] in 2024. This is notably different to results reported in other European countries. In *C. coli*, ertapenem resistance has increased from 22% [95% CI: 13-34%] in 2022 to 53% [95% CI: 40-65%] in 2024. In turkeys (**Figure 3.21 B**), resistance in *C. jejuni* has decreased from 17% [95% CI: 12-24%] in 2022 to 11% [95% CI: 7-17%] in 2024. Resistance in *C. coli* from turkeys has decreased from 63% [95% CI: 53-71%] in 2022 to 50% [95% CI: 40-59%] in 2024.

Carbapenems are categorised as human-only antibiotics by the WHO and are not used in food-producing animals. Third- and fourth-generation cephalosporins, which could potentially contribute to carbapenem resistance, have not been used in UK poultry since usage data was collected. These ertapenem findings therefore cannot be attributed to antibiotic use. It must be noted, however, that the characteristics of *Campylobacter* with respect to ertapenem resistance are still not very well understood and there is currently a concerted program of work being undertaken in the UK and across Europe to better understand these interactions. It may be that ertapenem is not the most suitable member of the carbapenem class to use for surveillance purposes.

Figure 3.21: Resistance to ertapenem in *Campylobacter jejuni* and *Campylobacter coli* isolated from (A) broilers and (B) turkeys at slaughter in 2022 and 2024. Interpreted using an EFSA-recommended ECOFF.



3.4.6 Using selective media to detect resistance

Additional, more sensitive, testing was conducted using selective media (S3.3 in Supplementary Material 4). This inhibits the growth of susceptible *E. coli* in a sample but allows the resistant bacteria to multiply, making them easier to detect. The results below therefore represent the percentage of samples containing any *E. coli* resistant to these antibiotics, even in very small amounts. For turkeys, these results can be interpreted as the percentage of individual birds carrying these resistances. However, for broilers, each sample is taken from 10 birds, and so cannot be interpreted in the same way.

The carriage of resistance to three different HP-CIAs is tested in this way: 3rd and 4th generation cephalosporins (ESBL-/AmpC-producers); carbapenems; and colistin. These resistant bacteria subsequently undergo molecular testing to confirm the genetic mechanisms underlying these resistances (see S5.5 and S5.6 in Supplementary Material 5) and are tested for phenotypic susceptibility against other antibiotics according to the methods described in S3.4 in Supplementary Material 4.

3.4.6.1 Broilers

ESBL- and/or AmpC-producing *E. coli*

The results in Section 3.4.2.1 (including **Figure 3.6 B**) show that no resistance to 3rd generation cephalosporins was detected in *E. coli* isolated from the UK broiler population in 2024, using non-selective media.

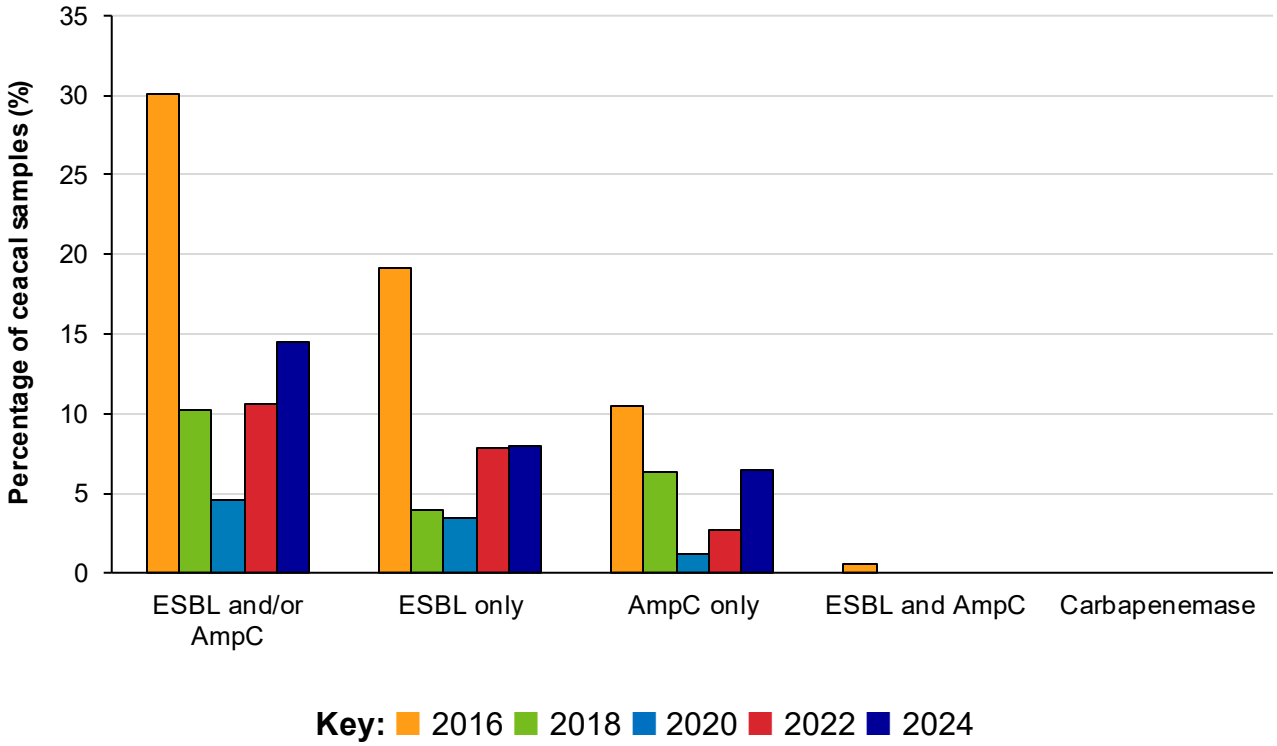
The use of more sensitive selective media shows that of the 325 samples tested, 15% [95% CI: 11-18%] (**Figure 3.21**) contained some *E. coli* expressing ESBL and/or AmpC phenotypes in 2024. This can be interpreted as the percentage of pooled samples (each sample being taken from 10 birds) containing these organisms. This is a statistically significant increase since the lowest prevalence reported in 2020 (4.6% [95% CI: 2.8-7.3%]) and is largely attributable to an increase in the AmpC phenotype.

Both ESBL and AmpC confer resistance to 3rd generation cephalosporins and the penicillins. ESBL genes are more often found on plasmids which enables them to be transmitted readily to other bacteria, and AmpC-producing *E. coli*, whilst less transmissible, are additionally resistant to beta-lactamase inhibitors such as clavulanate. Clavulanate however is not used in meat poultry sectors.

Whole genome sequencing (WGS) was conducted on 47 of the 48 *E. coli* isolates from broilers. Those with an ESBL phenotype represented 13 different sequence types, suggesting they were diverse in origin. The most common antibiotic resistance genes (ARG) were *bla*$_{\text{CTX-M-15}}$ (15%) and *bla*$_{\text{SHV-12}}$ (11%). The other genes detected included *bla*$_{\text{CTX-M-55}}$ (8.5%), *bla*$_{\text{TEM-52c}}$ (6.4%), *bla*$_{\text{TEM-52b}}$ (4.3%), *bla*$_{\text{CTX-M-2}}$ (4.3%), *bla*$_{\text{CTX-M-14}}$ (4.3%) and *bla*$_{\text{CTX-M-1}}$ (2.1%). Of the *E. coli* isolates which expressed the AmpC phenotype, 81% were sequence type (ST) ST155, and all carried the *bla*$_{\text{CMY-2}}$ gene, indicating clonal expansion. This

genotype was also dominant amongst AmpC producers isolated in 2022, suggesting persistence between years.

Figure 3.21: ESBL/AmpC- and carbapenemase-producing *Escherichia coli* cultured on selective media, from caecal samples from healthy broilers at slaughter in the UK between 2016 and 2024.



Of the 47 isolates which grew on ESBL/AmpC selective media, 70% [95% CI: 56-81%] had co-resistance to the HP-CIA fluoroquinolone ciprofloxacin. This implies that 10% [95% CI: 7-14%] of UK broiler samples contain *E. coli* with resistance to two HP-CIA classes (third/fourth-generation cephalosporins and fluoroquinolones), even when present in very small amounts within individual birds. Prevalence of this co-resistance has been rising year-on year since 2018. ESBL/AmpC-producers with high-level ciprofloxacin resistance (MIC greater than 4mg/l), which implies clinical resistance, were found in 2.5% [95% CI: 1.3-4.8%] of broiler samples. Additionally, 1.2% [95% CI: 0.5-3.1%] of samples from UK broilers contained *E. coli* co-resistant to third-generation cephalosporins, the fluoroquinolone ciprofloxacin and the aminoglycoside gentamicin.

A single ESBL/AmpC isolate, representing 0.3% [95% CI: 0.1-1.7%] of UK broiler samples, showed phenotypic resistance to ertapenem and was MDR. This isolate had genes conferring resistance to multiple antibiotic classes, but no known genes encoding carbapenemase enzymes. Ertapenem resistance in this isolate is presumed to be the result of ESBL production in conjunction with impermeability resulting from porin loss or other porin alteration, which is unlikely to spread to other bacteria.

Carbapenemase-producing *E. coli*

No carbapenamase-producing *E. coli* from boilers have been detected on the specific media used to detect carbapenamase-producing *E. coli* since this programme began in 2016.

Colistin-resistant *E. coli*

Broiler samples have been tested for colistin resistance using selective media since 2016. None have been detected in broilers to date.

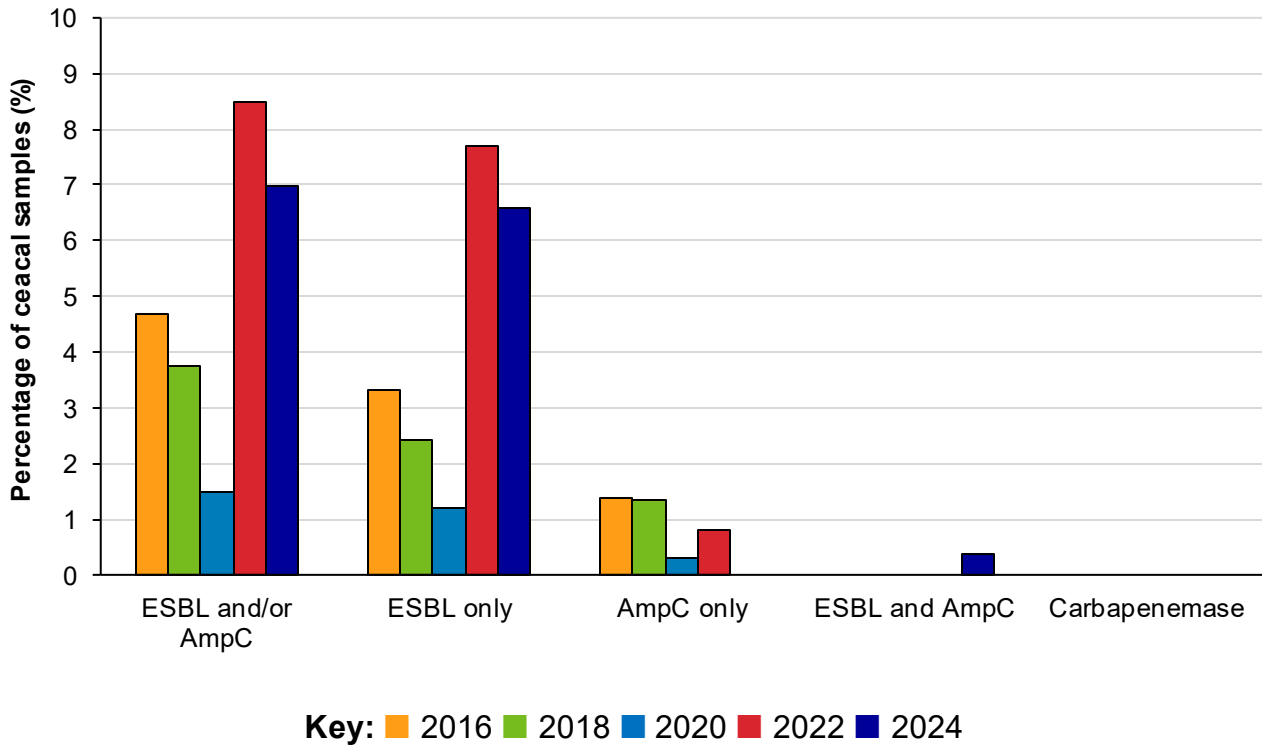
3.4.6.2 Turkeys

Prevalence of ESBL- and/or AmpC-producing *E. coli*

The results in Section 3.4.2.2 (including **Figure 3.8 B**) show that resistance to 3rd generation cephalosporins was not detected in individual isolates of *E. coli* from UK turkeys.

The use of more sensitive selective media shows that of the 258 samples tested, 7% [95% CI: 4-11%] contained *E. coli* expressing ESBL and/or AmpC phenotypes in 2024 (**Figure 3.22**). For the first time, there was a single *E. coli* isolate (0.4% [95% CI: 0.1-2.2%]) that expressed both the ESBL and AmpC phenotypes.

Figure 3.22: ESBL-/AmpC- and carbapenemase-producing *Escherichia coli* cultured on selective media, from caecal samples from healthy turkeys at slaughter in the UK between 2016 and 2024.



Of the 18 isolates which grew on ESBL/AmpC selective media, 39% [95% CI: 20-61%] were co-resistant to the HP-CIA fluoroquinolone ciprofloxacin. This percentage has decreased since 2022 (42% [95% CI: 23-64%]). This implies that 2.7% [95% CI: 1.3-5.5%] of UK turkeys are carrying *E. coli* with resistance to two HP-CIA classes (third/fourth-generation cephalosporins, and fluoroquinolones), even at very low numbers. It is important to note that these results are measured using ECOFFs, so these isolates are not necessarily clinically resistant.

Whole genome sequencing (WGS) was carried out on all 18 *E. coli* isolates from turkeys. There were 8 distinct STs, the most common being ST58 (28%) followed by ST69 (22%). Of those with an ESBL phenotype, the most common ARGs were *bla*$_{\text{SHV-12}}$ (28%), *bla*$_{\text{CTX-M-15}}$ (28%), *bla*$_{\text{CTX-M-55}}$ (22%), *bla*$_{\text{CTX-M-32}}$ (11%) and *bla*$_{\text{CTX-M-1}}$ (11%). The five isolates with the *bla*$_{\text{CTX-M-15}}$ phenotype were all ST58. One isolate had an ESBL/AmpC phenotype but no *ampC* mechanism was detected.

Carbapenemase-producing *E. coli*

Monitoring for carbapenemase-producing *E. coli* in turkeys began in 2016, and none have been detected to date.

Colistin-resistant *E. coli*

For the first time within the harmonised monitoring programme, one colistin-resistant *E. coli* was detected in a turkey (0.4%) using selective media containing colistin. Following molecular testing, the isolate was identified as belonging to ST540 which is associated with MDR and clinical disease in people. The presence of the *mcr-1* gene was confirmed along with the *tetA(B)* gene, which encodes resistance to tetracyclines. Colistin has not been used in meat poultry or laying hens since 2016.

CHAPTER 4

Clinical surveillance of antibiotic resistance

4.1 Introduction

Clinical surveillance is a programme of passive surveillance which evaluates antimicrobial resistance (AMR) in bacteria of relevance to animal and/or human health. The majority of AMR testing of sick animals in the UK is conducted by private veterinary laboratories at the request of private veterinary surgeons and does not feed into government surveillance programmes. The VMD is seeking to address this by engaging with these laboratories through its Private Laboratories Initiative (PLI, see Section 4.3.8). However, some diagnostic samples, as well as carcasses for post-mortem, are submitted by veterinary surgeons to the Animal and Plant Health Agency (APHA) and partner veterinary laboratories in England and Wales. When a bacterial pathogen is isolated from these samples, antimicrobial susceptibility testing is performed to provide the practitioner with relevant information for treatment. Aggregated results from these tests are presented here. In addition, this chapter incorporates results from the susceptibility testing of *Salmonella* isolates recovered by both governmental and private laboratories from animals and their feed in Great Britain, as part of the Zoonoses Order 1989.

The primary aim of the clinical surveillance programme is to provide scanning surveillance of animal disease, enabling early detection, and to inform evidence-based decision-making in animal health. The clinical AMR results, as reported in this chapter, are used to identify new and emerging resistance threats, particularly since treatment failure is a frequent reason for submission of samples. As this is a passive programme, the results in this chapter should not be considered representative of AMR in animal populations and should be interpreted within these limits (see Supplementary Material 4 Section S4.1 for more detail).

Clinical surveillance has historically been carried out using disc diffusion methods. However, broth microdilution testing providing minimum inhibitory concentration (MIC) values has been developed at APHA over the last five years. This enhancement should generate robust susceptibility testing outputs for specific veterinary pathogens. This year, MIC results are featured for *Pasteurella multocida* and *Mannheimia hemolytica* in pigs, cattle, and sheep, and *Actinobacillus pleuropneumoniae, Streptococcus suis* and *Brachyspira hyodysenteriae* in pigs. To further aid interpretation, MIC results are shown in multi-coloured graphs in this chapter; disc diffusion results are shown on a red colour scale.

Similar programmes of clinical surveillance are conducted by Scottish (Scotland's Rural College Veterinary Services, SRUC) and Northern Irish (Agri-Food Biosciences Institute, AFBI-NI) laboratories, using different methods. Results from these countries are included in Supplementary Material 6.

This chapter also includes results from AMR surveillance in diseased trout, which is being piloted by the Centre for Environment, Fisheries and Aquaculture Science (Cefas).

Any findings considered to pose a particular risk to human or animal health are reported to the Defra Antimicrobial Resistance Coordination (DARC) group, and to the Veterinary

Medicines Directorate (VMD) for management in accordance with protocols outlined in the UK government's AMR contingency plan.

Box 4.1: Updates and corrections

Data updates and corrections since UK-VARSS Report 2023

Please note that some results for previous years, as shown in this chapter and the supplementary material, differ from previous reports due to corrections in historical data.

The mastitis data reported from the Private Laboratories Initiative has been updated in UK-VARSS 2024. Previous UK-VARSS reports included a small amount of duplicated data, which has been rectified.

4.2 Summary

Clinical surveillance aims to provide veterinary surgeons with relevant treatment information using AMR results from bacteria isolated from diagnostic samples. This is a passive programme, subject to biases and differences in the numbers of samples, meaning results in this chapter are not necessarily representative of the national animal populations. The exception is *Salmonella* from poultry, almost all of which are derived from systematic on-farm sampling as part of the *Salmonella* National Control Programmes (NCPs).

- 6,921 isolates were tested for AMR in England and Wales in 2024. The percentages of isolates tested by main animal species were: poultry (30% of isolates), pigs (17%), cattle (15%), sheep (9%), and dogs (7.4%). *Salmonella* isolates were also tested from feed (14%) and the environment (4.8%).
- Resistance in *Escherichia coli* from all animal species shows a decreasing trend since 2014. In 2024, 19% of all clinical *E. coli* isolates tested were resistant to four or more individual antibiotics, meaning that treating veterinary surgeons are likely to have reduced treatment options. This was most frequent in isolates from cattle (25%) and pigs (22%), and less frequent in chickens (13%) and sheep (8.7%).
- 73% of *Salmonella* isolates tested were fully susceptible to the panel of antibiotics tested. Full susceptibility was highest in those isolated from ducks (97%), sheep (96%), and cattle (90%), and lowest in *Salmonella* isolated from pigs (17%) and turkeys (54%). Full susceptibility in most animal species show increasing trends since 2014, whereas it has remained fairly stable in cattle and sheep, and appears to be decreasing in *Salmonella* isolated from feed.

This year, the results of clinical surveillance in individual animal species are shown over a ten-year period. This is to demonstrate the long-term trends in AMR from bacteria which cause disease in animals, in addition to AMR in bacteria carried by healthy animals, as shown in Chapter 3. The main findings from this chapter are as follows:

- **Pigs:** the most frequently tested bacteria were *E. coli* (49%) and *Salmonella* (35%). The resistance patterns in these organisms differ. *E. coli* has a much lower frequency of limited treatment options (22%) and its long-term trends show decreasing resistance to most antibiotics tested, including the HP-CIAs. The exception in *E. coli* is resistance to aminoglycosides, including neomycin, which has increased significantly from 3.9% to 14% over the last 10 years. Limited treatment options are much more common in *Salmonella* (75%), and resistance in *Salmonella* has increased in recent years to almost all antibiotics tested, likely due to dominance of the highly-resistant *S.* Typhimurium serovar.
- **Poultry:** the most frequently tested bacteria were *Salmonella* (90%), which are mostly collected through the NCPs, and *E. coli* (9%). In chickens, limited treatment options were more frequent for *E. coli* (13%) than for *Salmonella* (2.8%)**.** This is not unexpected, given the *E. coli* are isolated from clinical submissions, whereas *Salmonella* are predominantly isolated from NCP environmental samples. Resistance in *Salmonella* from turkeys has decreased to most antibiotics since 2014.
- **Cattle:** the most frequently tested bacteria were *E. coli* (43%, predominantly gastrointestinal) and *Salmonella* (33%). Resistance in gastrointestinal *E. coli* has declined substantially since 2014, although the frequency of organisms with limited treatment options remains higher than in other animal species (25%). Resistance in *Salmonella* has decreased in recent years to several antibiotics, and full susceptibility remains extremely high (90%). Data from The Vale Veterinary Laboratory, collected under the Private Laboratories Initiative, shows that resistance in *E. coli* causing mastitis has declined since 2020. MIC testing of the important respiratory pathogen *Pasteurella multocida* shows that resistance has remained stable over time, and whilst resistance to tetracycline is very high, resistance to doxycycline remains undetected.
- **Sheep:** the most frequently tested bacteria were *E. coli* (45%) and *Mannheimia haemolytica* (22%). The overall picture of resistance in *E. coli* from sheep is encouraging, with resistance declining over the last 10 years. However, increased resistance to several antibiotics was noted in neonatal lambs including a significant increase in neomycin-resistant *E. coli* between 2023 and 2024, to 18%. The majority of respiratory pathogens tested by MIC were fully susceptible.
- **Dogs:** Only *Salmonella* bacteria were tested. 84% of *Salmonella* were susceptible to the full panel of antibiotics. 5.1% of *Salmonella* isolates were resistant to four or more antibiotics, limiting treatment options. There appears to have been an overall reduction in resistance in *Salmonella* isolated from dogs over time.

- **Trout:** A limited number of isolates (17) were tested in 2024. 57% of *Aeromonas salmonicida,* which causes furunculosis, were resistant to oxolinic acid. Resistance to the carbapenem meropenem was detected in both *A. salmonicida* and *Yersinia ruckeri.* Carbapenems are not used in animals.

This chapter also includes an update on the Private Laboratories Initiative (PLI), which has expanded to companion animals, horses, and fish sectors, in addition to livestock.

4.3 Methods

4.3.1 Sample sources

Bacteria were isolated from clinical or post-mortem samples submitted to APHA and partner laboratories by practising veterinary surgeons in England and Wales. Results from bacteria isolated by The Vale Veterinary Laboratory as part of the Private Laboratories Initiative are presented in Section 4.3.8. Bacteria from rainbow trout and brown trout produced in GB were recovered from post-mortem or other diagnostic samples submitted to Cefas. Submission of diagnostic material may be more likely in serious cases of disease or those resistant to treatment and may therefore be subject to bias.

Any laboratory, including private veterinary laboratories, isolating *Salmonella* spp. from animals and their environment, is required under the Zoonoses Order 1989 in Great Britain and subsequent Zoonoses (Amendment) Order 2021 to notify and submit an isolate to a Defra-approved laboratory for characterisation, including antibiotic sensitivity testing.

Where total isolate numbers are stated, this refers to the total number of isolates tested against any antibiotic. Individual isolates are not always tested to all antibiotics shown.

4.3.2 Susceptibility testing methodology

For the zoonotic organisms *E. coli* and *Salmonella* spp., and bacteria isolated from bovine mastitis, the disc diffusion method was used, as formerly recommended by the British Society for Antimicrobial Chemotherapy (BSAC). Disc diffusion results are measured by the zone of inhibition (recorded in millimetres).

APHA is in the process of transitioning from disc diffusion to broth microdilution methodology. Broth microdilution is regarded as the gold standard in antibiotic sensitivity testing. Results are measured using minimum inhibitory concentrations (MIC), which are quantitative rather than qualitative. It is a reliable, reproducible method and is also more suited for hard-to-grow bacteria. In 2024, the results for respiratory pathogens *Actinobacillus pleuropneumoniae, Bibersteinia trehalosi, Mannheimia haemolytica,* and *Pasteurella multocida*, along with *Streptococcus suis* and *Brachyspira hyodysenteriae,* were generated by the broth microdilution method.

For bacteria from trout, Clinical and Laboratory Standards Institute (CLSI 2020) MIC protocols were followed.

This year, results generated by disc diffusion are shown on a red colour scale throughout the chapter; those generated by broth microdilution are shown in multi-coloured graphs (**Table 4.1**). Detailed methodology for the susceptibility testing by disc diffusion and broth microdilution testing is presented in Section S4.1 and S4.2 of Supplementary Material 4. Data presented in Section 4.3.8 (The Vale Veterinary Laboratory) used different methods, which are described separately in S4.5 in Supplementary Material 4.

Table 4.1: Summary of bacterial species and AST methods employed

Bacterial species	AST Method	Reported in
Escherichia coli	Disc diffusion	Pigs, chickens, turkeys, cattle, sheep
Salmonella enterica	Disc diffusion	Pigs, chickens, turkeys, ducks, cattle, sheep, dogs, horses, feed
Streptococcus uberis	Disc diffusion	Cattle
Streptococcus dysgalactiae	Disc diffusion	Cattle
Staphylococcus aureus	Disc diffusion	Cattle
Actinobacillus pleuropneumoniae	MIC	Pigs
Bibersteinia trehalosi	MIC	Sheep
Mannheimia haemolytica	MIC	Cattle, sheep
Pasteurella multocida	MIC	Pigs, cattle, sheep
Streptococcus suis	MIC	Pigs
Aeromonas salmonicida	MIC	Trout
Yersinia ruckeri	MIC	Trout

4.3.3 Interpretation

In Chapter 4, terrestrial animal results are interpreted using clinical breakpoints (CBPs). Veterinary-specific CBPs suggest likely treatment success (sensitive) or failure (resistant). In contrast, Chapter 3 uses ECOFFs, which are more sensitive for detecting emerging resistance but do not necessarily indicate treatment failure. Further details are provided in Sections S4.1 and S4.2 of Supplementary Material 4.

Disc diffusion data has been interpreted using BSAC human CBPs. If unavailable, historical veterinary breakpoints from APHA or the Animal Health and Veterinary Laboratory Agency (AHVLA) have been used (Table S4.4 in Supplementary Material 4). These results should be interpreted with caution as breakpoints which indicate an antibiotic is effective in humans does not reliably predict success in an animal.

MIC results have been interpreted using veterinary clinical breakpoints from Clinical and Laboratory Standards Institute (CLSI), or Committé Antibiogramme - Société Française de Microbiologie (CA-SFM) if CLSI were not available. If neither were available, European Committee on Antimicrobial Susceptibility Testing (EUCAST) human clinical breakpoints were used.

For trout, CLSI epidemiological cut-off values were used. However, published cut-off values are not available for all combinations of bacteria and antibiotics. For these combinations, the normalised resistance interpretation (NRI) method was chosen to determine the wild type cut-off value (COwt), which does not necessarily imply clinical resistance.

In this chapter, isolates tested by disc diffusion which were resistant to four or more antibiotics have been classified as having limited treatment options. Multi-drug resistance (MDR) is defined for isolates tested by broth microdilution as resistance to three or more antibiotic classes.

4.4 Results

In this chapter, the summary results for the important zoonotic and multi-host organisms, *E. coli*, *Salmonella spp.*, and livestock-associated methicillin-resistant *Staphylococcus aureus* (LA-MRSA) are presented first, in Section 4.3.1. AMR results for veterinary pathogenic bacteria are then presented by animal species and body system. Results for rarely-tested bacteria are presented in the supplementary material only. For the first time this year, the complete dataset is available in downloadable Excel format in Supplementary Material 6.

Classification of resistance as low, moderate, high etc. throughout the report is consistent with the European Food Safety Authority (EFSA) definitions for these terms (**Table 4.2**).

Table 4.2: Definitions used for classification of resistance

Description of resistance level	Equivalent percentage resistance range
Rare	<0.1%
Very low	0.1% to 1%
Low	>1% to 10%
Moderate	>10% to 20%
High	>20% to 50%
Very high	>50% to 70%
Extremely high	>70%

Certain active compounds included in the antibiotic testing panels are not authorised for use in food-producing animals (see Introduction, **Table 1**). These are included in the panels to allow monitoring of possible emergence of resistance to these antibiotics, or because they are representative of an antibiotic class. Panels of antibiotics can vary between years and individual isolates. Where a figure shows no data against specific antibiotics or years as a result of this panel variation, this has been marked on the graph.

For some bacterial pathogens, very few numbers of isolates are recovered in any one year and therefore the prevalence of resistance and any changes seen between years need to be interpreted with caution.

For *E. coli* isolated from ruminants and pigs, results are also analysed by age, as summarised in

Table 4.3.

Table 4.3: Age categories of food-producing animals.

Animal	Neonatal	Pre-weaned	Post-weaned	Adult
Cattle	< 1 week	Unweaned and not known to be less than 1 week	From weaning to adult	≥ 24 months
Sheep	< 1 week	Unweaned and not known to be less than 1 week	From weaning to adult	≥ 12 months
Pigs	< 1 week	Unweaned and not known to be less than 1 week	From weaning to adult	≥ 5 months

4.4.1 Zoonotic organisms

Summary results for important zoonotic and multi-host organisms are presented in this section. The complete dataset can be found in Supplementary Material 6.

4.4.1.1 *Escherichia coli*

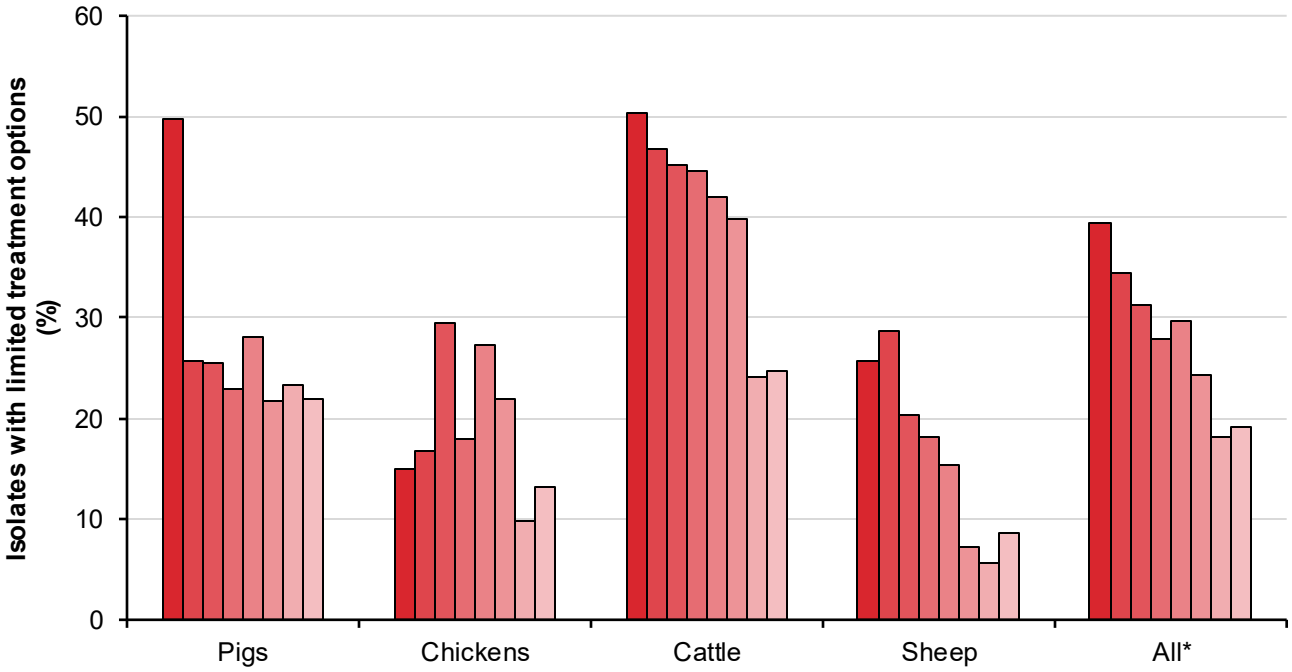
E. coli is an important commensal organism of the gastrointestinal tract of animals and humans, and can cause disease in both. The *E. coli* strains affecting animals are usually different to those affecting humans, but there is some overlap. *E. coli* can cause a range of clinical problems in food-producing animals, including diarrhoea and septicaemia. Some diseases caused by *E. coli* are related to pathogenicity, with particular strains possessing recognised virulence factors, whilst opportunistic *E. coli* infections from the gut flora can also occur. *E. coli* also acts as a reservoir of transferable resistance genes which can pass on to other bacterial species.

This section includes a summary of *E. coli* isolated from animals through clinical surveillance in England and Wales. Additional results are presented in the individual animal species sections.

Limited treatment options (that is, resistance to four or more individual antibiotics) were detected for 19% [95% CI: 17-21%] of *E. coli* tested in 2024 (**Figure 4.1**). This percentage has reduced significantly from 40% [95% CI: 36-43%] in 2017, the first year these results were generated.

The percentage of isolates with limited treatment options declined significantly in pigs, cattle, and sheep between 2017 and 2025. In 2024, *E. coli* with limited treatment options were most frequently detected in cattle isolates (25% [95% CI: 21-29%]), followed by pigs (22% [95% CI: 19-26%]), chickens (13% [95% CI: 9-19%]) and sheep (8.7% [95% CI: 6.0-13%]). Very small numbers of isolates (eight) from turkeys were submitted in 2024, of which 25% [95% CI: 7-60%] had limited treatment options.

Figure 4.1: Percentage of *E. coli* with limited treatment options, isolated from different animal species from 2017 to 2024 (n=1,468 in 2024).



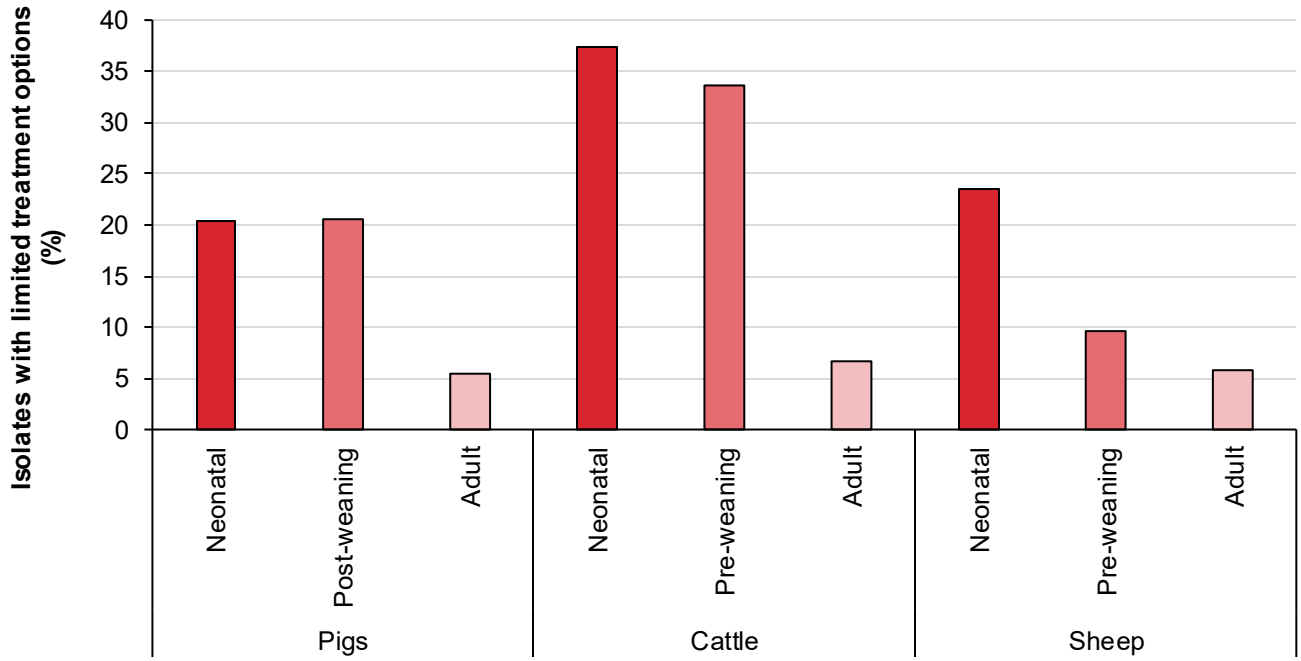
*Includes cattle, sheep, pigs, chickens and turkeys

As in previous years, there was a general trend towards higher resistance in *E. coli* isolates from young cattle, pigs, and sheep than from adults. For example, limited treatment options are lower in adults across all species: 5.5% [95% CI: 7.9-15%] in pigs, 6.7% [95% CI: 2.9-15%] in cattle and 5.8% [95% CI: 2.3-14%] in sheep (**Figure 4.2**). This is likely due to differences in disease presentation and antibiotic treatment in different age groups.

Interestingly, there is a marked difference in the frequency of limited treatment options in *E. coli* isolates from neonatal compared to pre-weaning lambs, whereas in pigs and cattle, there is much less difference between these age groups (**Figure 4.2**). Limited treatment options in *E. coli* isolated from neonatal lambs appears much more frequent (24% [95% CI: 15-35%]) than in pre-weaning lambs (10% [95% CI: 4.0-21%]). In pigs, limited treatment options are similarly frequent for neonatal piglets (21% [95% CI: 13-30%]) and post-weaning pigs (21% [95% CI: 13-31%]). Limited treatment options are only slightly more frequent in *E. coli* from

neonatal calves (37% [95% CI: 30-46%]) than they are from pre-weaning calves (34% [95% CI: 26-43%]). Full results are available in Supplementary Material 6.

Figure 4.2: Percentage of *E. coli* with limited treatment options in 2024, isolated from different age categories of pigs, cattle and sheep.



4.4.1.2 *Salmonella* spp.

Salmonella is an important cause of foodborne disease in people. It can be part of the normal gut flora in animals but can cause disease in animals too. *Salmonella* isolated from animals are reported on a statutory basis, and a culture of the organism must be provided to government when detected by private veterinary laboratories in Great Britain. Detailed data on *Salmonella* is published annually by APHA in the Salmonella in Animals and Feed in Great Britain report.

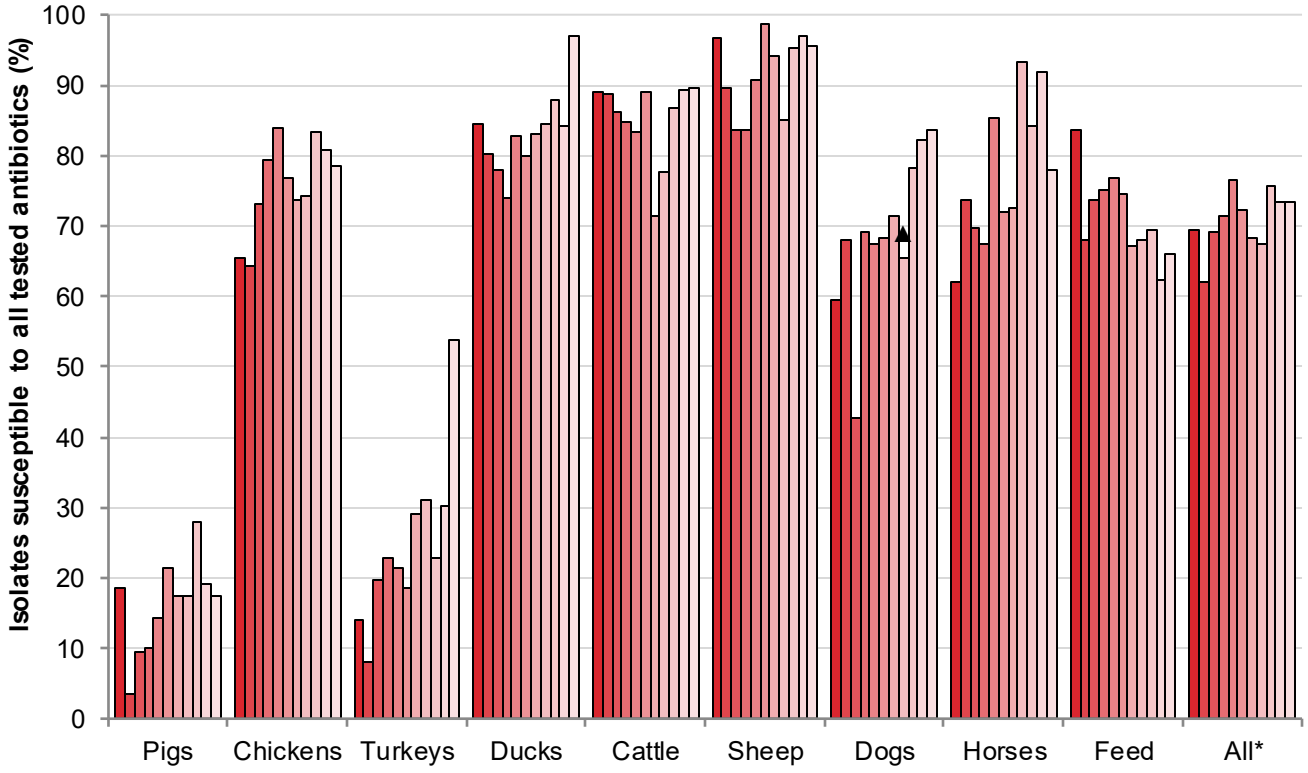
Of the 4,705 *Salmonella* isolates tested in Great Britain in 2024, the majority were from food-producing animals (52%). Other sources include animal feed (21%), companion animals (11%), and the environment (7.0%). The main serovars identified were *S*. Typhimurium (12%), *S*. Idikan (9.8%), and *S*. Montevideo (9.4%). The number of isolates tested per animal species was highly variable. Overall patterns of resistance in *Salmonella* can be affected by which serovars are circulating in different animal hosts.

In 2024, the proportion of *Salmonella* isolated from all species that were fully susceptible to the panel of antibiotics tested was 73% [95% CI: 72-75%], the same as in 2023 (**Figure 4.3**).

Full susceptibility in most animal species has increased since 2014, whereas it has remained fairly stable in cattle and sheep. Full susceptibility appears to be decreasing in *Salmonella* isolated from feed. These results could be affected by long-term changes in antibiotic usage and/or a change in the *Salmonella* population.

In 2024, full susceptibility was highest in ducks (97% [95% CI: 93-99%]), sheep (96% [95% CI: 89-98%]), and cattle (90% [95% CI: 86-92%]). Full susceptibility was lowest in pigs (17% [95% CI: 14-21%]) and turkeys (54% [95% CI: 44-64%]). Full susceptibility in *Salmonella* from turkeys increased significantly this year, from 30% [95% CI: 21-41%] in 2023 to 54% [95% CI: 44-64%] in 2024. A large decrease in full susceptibility was observed in isolates from horses, from 92% [95% CI: 83-97%] in 2023 to 78% [95% CI: 66-87%] in 2024.

Figure 4.3: *Salmonella* spp. isolates susceptible to all tested antibiotics (full susceptibility), from different sources and animal species, from 2014 to 2024 (n=4,014 in 2024).



▲ *Salmonella* in dogs became reportable in 2021

* Also includes other non-avian species, other avian species and farm environment

Key: 2014 2024

Overall, 9.6% [95% CI: 8.8-11%] of all *Salmonella* tested in 2024 had limited treatment options. These results show a marked difference between the pig sector and all other sectors, with 75% [95% CI: 70-79%] of *Salmonella* isolated from pigs showing limited treatment options. Limited treatment options were much less frequent in *Salmonella* from other origins, of which the highest were feed (5.7% [95% CI: 4.5-7.4]) and dogs (5.1% [95%

CI: 3.5-7.4]). No samples with limited treatment options were detected in ducks or sheep in 2024.

Resistance to HP-CIAs in *Salmonella* from animals, their feed, and environment, remains low. Resistance to the HP-CIAs cefotaxime and ceftazidime was detected in a limited number of isolates from dogs (0.6% [95% CI: 0.2-1.7%]), chickens (0.1% [95% CI: 0.0-0.4%]) and feed (0.1% [95% CI: 0.0-0.4%]). Resistance to the HP-CIA ciprofloxacin was detected at low frequencies in *Salmonella* from dogs (2.6% [95% CI: 1.5-4.3%]), feed (1.3% [95% CI: 0.8-2.2%]), and chickens (0.5% [95% CI: 0.2-0.9%]). Resistance to the HP-CIA nalidixic acid was highest in *Salmonella* from feed (9.1% [95% CI: 7.4-11%]), followed by horses (8.5% [95% CI: 3.7-18%]). It was not detected in sheep or ducks.

The National Control Programmes' (NCPs) regulated *Salmonella* serovars are subject to higher levels of control. These include: *S.* Typhimurium, monophasic *S.* Typhimurium, *S.* Enteritidis and *S.* Infantis. Over half of the *Salmonella* Typhimurium isolates detected in 2024 originated from pigs, feed, and dogs, and 54% [95% CI: 50-58%] were fully susceptible. However, there are clear differences in resistance profiles between different animal species. Among pig isolates, only 0.9% [95% CI: 0.3-3.3%] of *Salmonella* Typhimurium were fully susceptible, while 91% [95% CI: 87-94%] displayed limited treatment options. In contrast, 87% [95% CI: 78-92%] of isolates from feed and 83% [95% CI: 74-90%] from dogs were fully susceptible, with only one isolate per source classified as having limited treatment options (1.1% [95% CI: 0.2-6.1%] and 1.2% (95% CI: 0.2-6.5%] respectively).

The majority of monophasic *S.* Typhimurium were recovered from pigs, dogs, and feed, and only 4.3% [95% CI: 2.0-9.0%] were fully susceptible, whereas 79% [95% CI: 72-85%] had limited treatment options. *S.* Enteritidis are predominantly recovered from poultry. In 2024, 82% [95% CI: 74-88%] of these were fully susceptible and 11% [95% CI: 6.5-18%] had limited treatment options.

4.4.1.3 Livestock-associated methicillin-resistant *Staphylococcus aureus* (LA-MRSA)

Methicillin is a beta-lactam antibiotic, related to penicillin. Methicillin-resistant *Staphylococcus aureus* (MRSA) is usually also resistant to other antibiotics that could be used to treat infections. LA-MRSA are, as the name indicates, commonly associated with livestock. They differ from other types of MRSA, such as hospital- or community-associated strains, which are more frequently found in humans and are spread from person to person.

When present, LA-MRSA usually lives in the nose or on skin and is an opportunistic pathogen of animals and people. Anyone who has contact with farmed livestock can become colonised with LA-MRSA, although the risk is higher for those in frequent contact with livestock. When it causes disease in animals or people, LA-MRSA most commonly causes a localised skin infection, but occasionally it can cause diseases such as pneumonia or bacteraemia.

LA-MRSA is present in livestock around the world. It was detected in food-producing animals in the UK for the first time in 2014, and sporadic clinical cases are detected annually. Clonal

complex (CC) 398 is a common LA-MRSA CC group isolated from food-producing animals. When detected, isolates undergo whole genome sequencing and are shared with the UK Health Security Agency (UKHSA) to investigate any possible associations with infections in humans. More information on the One Health relevance of LA-MRSA can be found in the Third UK One Health Report.

In 2024, two isolates of LA-MRSA ST398 spa-type t011 were detected in England and Wales. One isolate was from a neonatal piglet with infectious arthritis, hypogammaglobulinaemia (reduced immunity) and concomitant viral infections, and the other was from a pheasant with infectious arthritis. The porcine LA-MRSA isolate had a chromosomal mutation in the *gyrA* gene (S80Y), conferring resistance to the HP-CIA ciprofloxacin, and multiple other resistance genes. The LA-MRSA isolate from the pheasant also had multiple resistance genes.

4.4.1.4 *Streptococcus suis*

Streptococcus suis causes meningitis, arthritis and pneumonia in pigs. It is also zoonotic, although human infections are rare. Resistance in *S. suis* isolates is presented in the pig species section below (Section 4.4.2.3).

4.4.2 Pigs

Results for pathogenic bacteria isolated from pigs are presented in this section and are organised by body system. The complete pig dataset can be found in Supplementary Material 6.

4.4.2.1 Gastrointestinal system

Escherichia coli

E. coli is one of the major causes of diseases in pigs, presenting primarily as diarrhoea with rapid dehydration and can cause sudden death. 573 isolates of *E. coli* were tested from pigs in 2024, of which 22% [95% CI: 20-26%] had limited treatment options. The age of the animal was unknown for 62% of the isolates. When age was known, *E. coli* was recovered from neonatal (15% of the total) and post-weaning (13%) piglets more frequently than from adult pigs (9.6%).

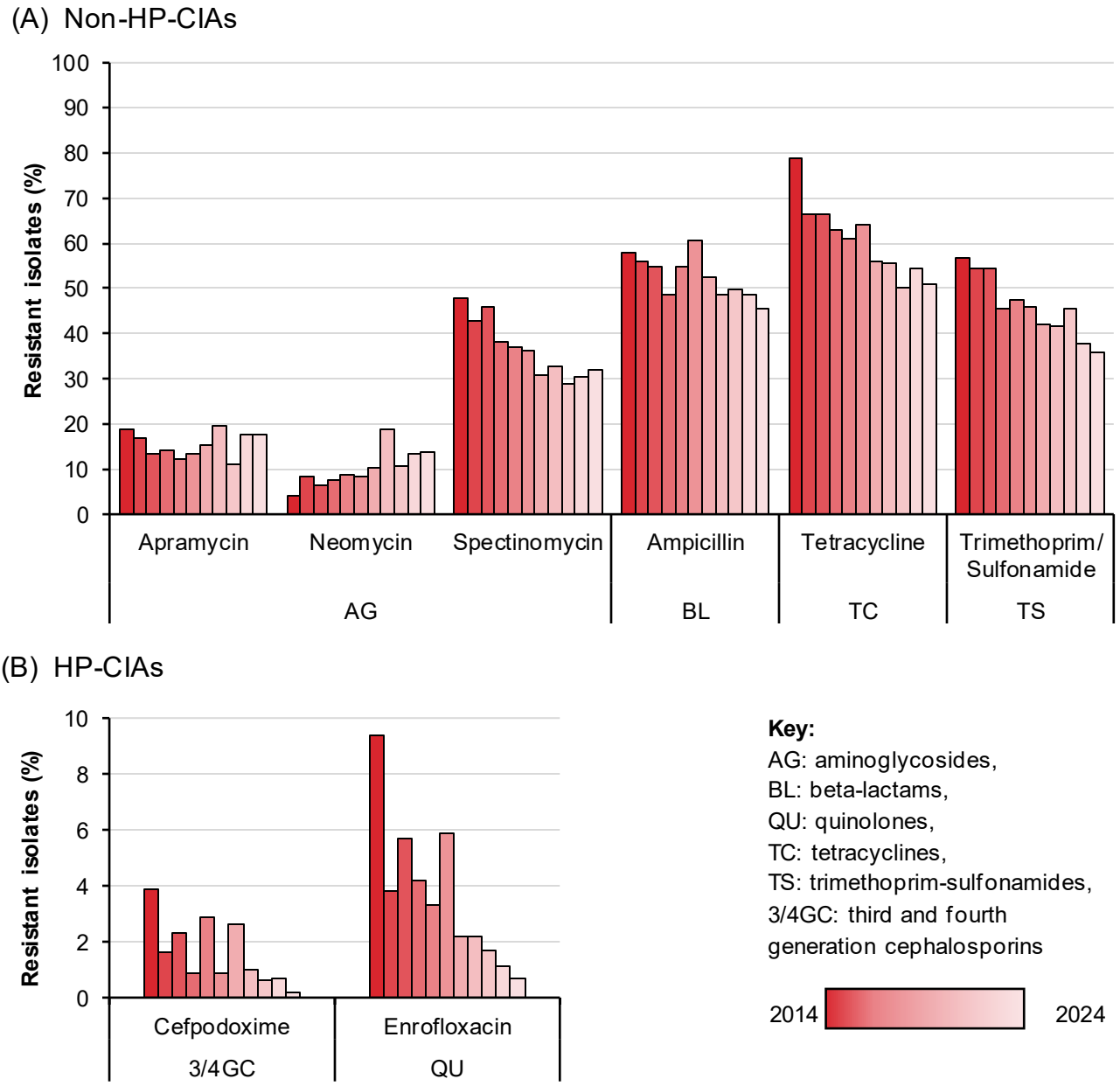
For all *E. coli* isolated from pigs (**Figure 4.4**), the highest levels of resistance were detected to the antibiotic classes that have been most commonly used in the pig sector (tetracycline, penicillins, trimethoprim/sulfonamides, and aminoglycosides; Section 1.3.1. Notably, resistance of clinical *E. coli* isolates to almost all antibiotics has reduced substantially since 2014, mirroring reductions in AMU (Chapter 2, Section 2.4.1.1), and resistance in *E. coli* from healthy pigs (Section 3.3.2.1 in VARSS 2023).

The exception is resistance to neomycin, which has increased significantly from 3.9% [95% CI: 1.9-7.8%] of clinical *E. coli* isolates in 2014 to 14% [95% CI: 11-17%] in 2024. This appears to be predominantly driven by resistance in the post-weaning age group, which has

increased from 2.4% [95% CI: 0.7-8.3%] in 2014 to 12% [95% CI: 7-22%] in 2024 (Supplementary Material 6). This aligns with antibiotic use data for aminoglycosides in pigs, which has increased from 2 mg/kg in 2015 to 6.8 mg/kg in 2024.

Resistance to HP-CIAs cefpodoxime (0.2% [95% CI:0.03-0.1%]) and enrofloxacin (0.7% [95%CI: 0.3-1.8%]) was very low in *E. coli* isolated from pigs in 2024 and has declined significantly since 2014. This is consistent with the antibiotic use data for HP-CIAs in pigs, which has reduced from 0.56 mg/kg in 2015 to 0.005 mg/kg in 2024.

Figure 4.4: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Escherichia coli* isolates from pigs, from 2014 to 2024 (n=573 in 2024). Note scale differs between graphs.



Salmonella spp.

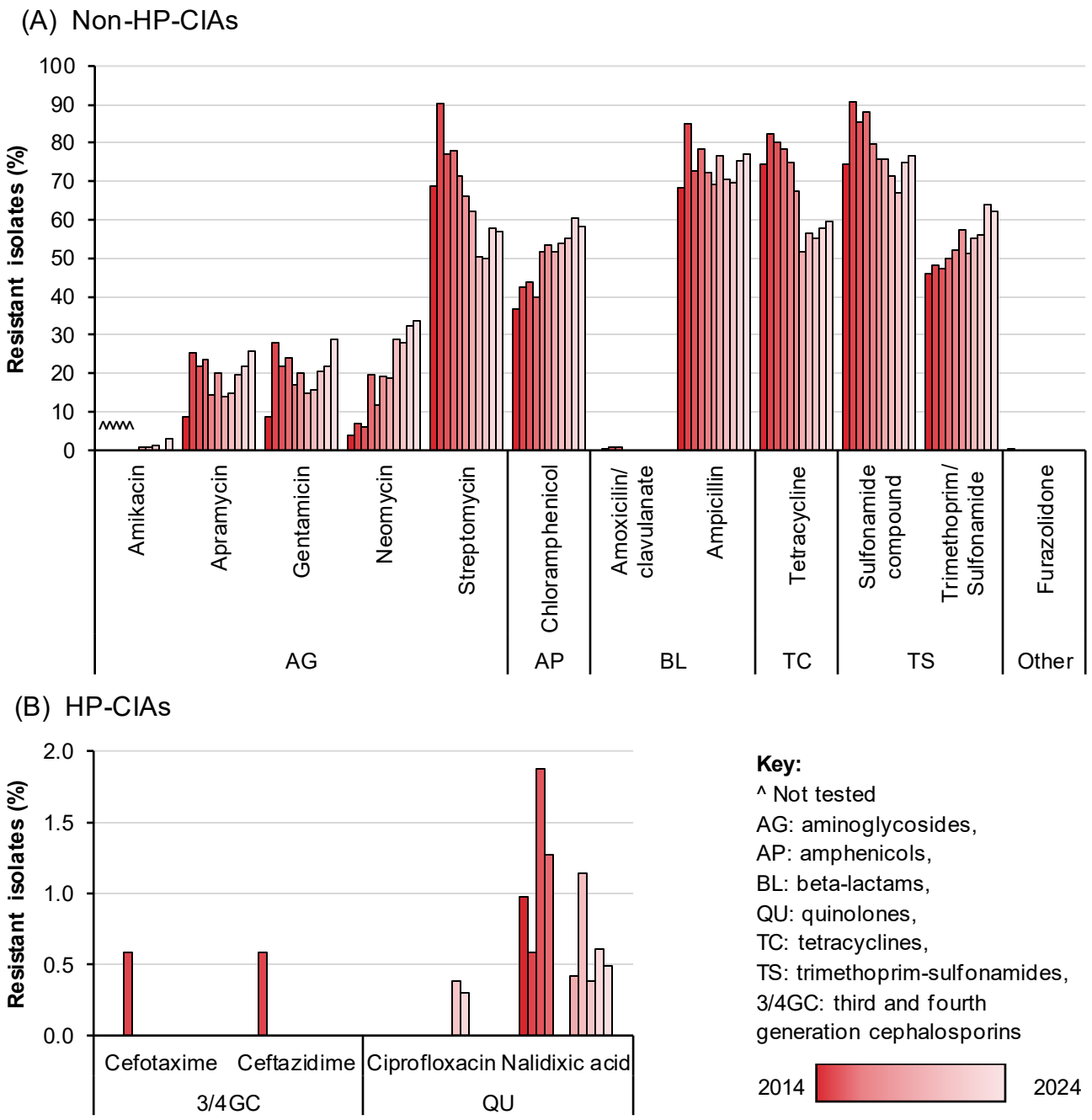
Salmonellosis primarily presents as diarrhoea in pigs but can cause a range of clinical signs including fever, loss of appetite and laboured breathing. *Salmonella* data for pigs is presented for all age groups (**Figure 4.5 A**).

A total of 404 *Salmonella* isolates were tested from pigs in 2024. The most prevalent serovars identified were *S.* Typhimurium (53%), monophasic *S.* Typhimurium (23%), and *S.* Derby (10%). A total of 17% [95% CI: 14-21%] were fully susceptible and 75% [95% CI: 70-79%] had limited treatment options. Resistance was most common to the antibiotic classes used most widely in the pig sector (ampicillin 77% [95% CI: 73-81%], sulfonamide 77% [95% CI: 72-81%], trimethoprim/sulfonamide 62% [95% CI: 58-67%]).

Resistance to the aminoglycosides has been increasing since 2014, and in 2024 18% [95% CI: 15-23%] of the resistant isolates were resistant to aminoglycosides (typically apramycin, gentamicin, neomycin, and streptomycin). Resistance to amikacin, which is not used in UK pigs, increased from 0.0% [95% CI: 0.0-1.2%] in 2023 to 3.0% [95% CI: 1.7-5.1%] in 2024, the majority (58% [95% CI: 32-81%]) of which were confirmed to have the *rmtB* gene, which confers high-level resistance to all clinically relevant aminoglycosides. This may be affected by increased use of aminoglycoside antibiotics by the pig sector but could also be attributable to varying resistance patterns in circulating serovars. For example, in recent years, *S.* Typhimurium has replaced monophasic Typhimurium as the most frequently isolated serovar in pigs (Livestock Book).

Resistance to the HP-CIAs cefotaxime and ceftazidime has not been detected in *Salmonella* isolated from pigs since 2015, and resistance to the quinolones remains very low (**Figure 4.5 B**).

Figure 4.5: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Salmonella* isolates from pigs, from 2014 to 2024 (n=404 in 2024). Note scale differs between graphs.



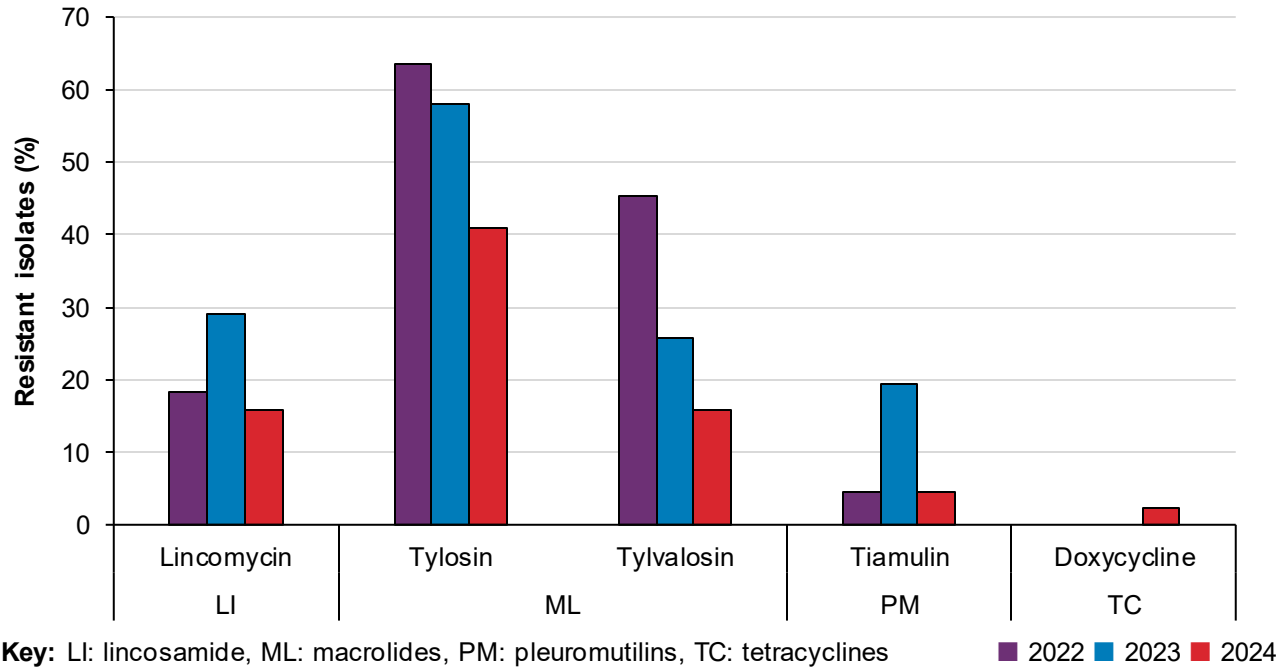
Brachyspira hyodysenteriae

Brachyspira hyodysenteriae causes swine dysentery, an enteric disease of pigs which results in serious ill-thrift in its chronic form. A limited range of antibiotics are available for the treatment of swine dysentery so other aspects of disease control, such as hygiene and herd husbandry, are important.

Tiamulin is an important veterinary antibiotic used in the treatment of swine dysentery. All available isolates of *B. hyodysenteriae* are tested for tiamulin susceptibility each year, using broth microdilution and measured by MIC. Since 2022, MIC testing has been expanded to include a wider panel of antibiotics.

AST results for the 44 *B. hyodysenteriae* isolates (**Figure 4.6**) show that 4.5% [95% CI: 1.3-15%] of isolates were resistant to tiamulin in 2024, compared to 19% [95% CI: 9.0-36%] in 2023. These tiamulin resistant isolates were also resistant to tylosin; in addition, one was also resistant to doxycycline, and another resistant to lincomycin.

Figure 4.6: Resistance in *Brachyspira hyodysenteriae* isolates from pigs, from 2022 to 2024 (n=44 in 2024).



4.4.2.2 Respiratory system

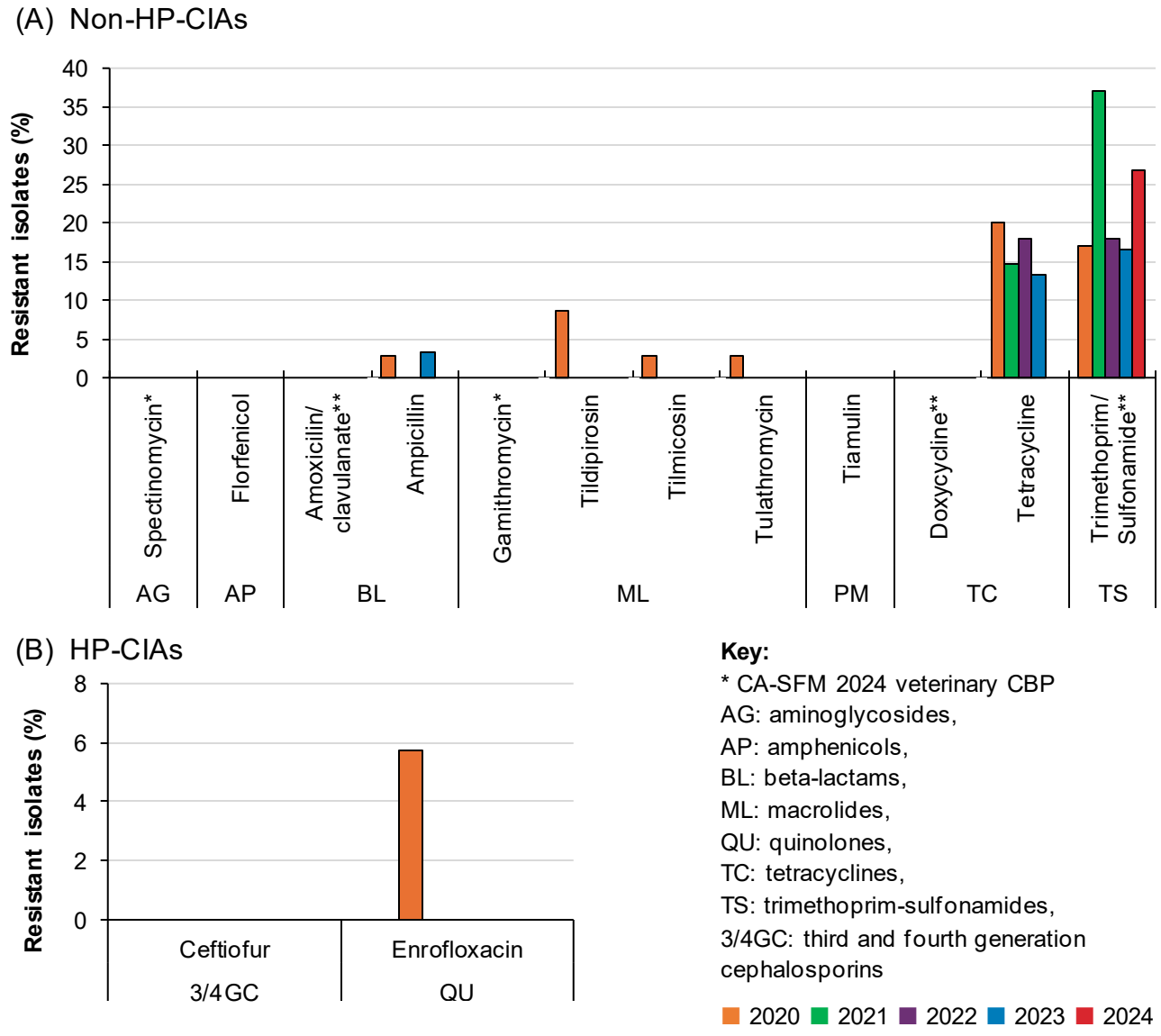
Actinobacillus pleuropneumoniae

Actinobacillus pleuropneumoniae causes pneumonia in pigs. Of the nine isolates tested in 2024, 33% [95% CI: 12-65%] were fully susceptible, and none were MDR (Supplementary Material 6). 67% [95% CI: 35-88%] were resistant to ampicillin, and 44% [95% CI: 19-73%] to tetracycline. No resistance was detected to HP-CIAs.

Pasteurella multocida

P. multocida causes a range of respiratory conditions in pigs, including pneumonia. *P. multocida* toxigenic strains are responsible for the development of atrophic rhinitis. Twenty-six isolates from pigs were tested in 2024, of which 73% [95% CI: 54-86%] were fully susceptible, and none were MDR. Only trimethoprim/sulfonamide resistance (27% [95% CI: 14-46%]) was detected in 2024 (**Figure 4.7**).

Figure 4.7: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Pasteurella multocida* isolated from pigs interpreted using CLSI veterinary breakpoints unless indicated otherwise, from 2020 to 2024 (n=26 in 2024). Note scale differs between graphs.



4.4.2.3 Multi-system pathogens

Streptococcus suis

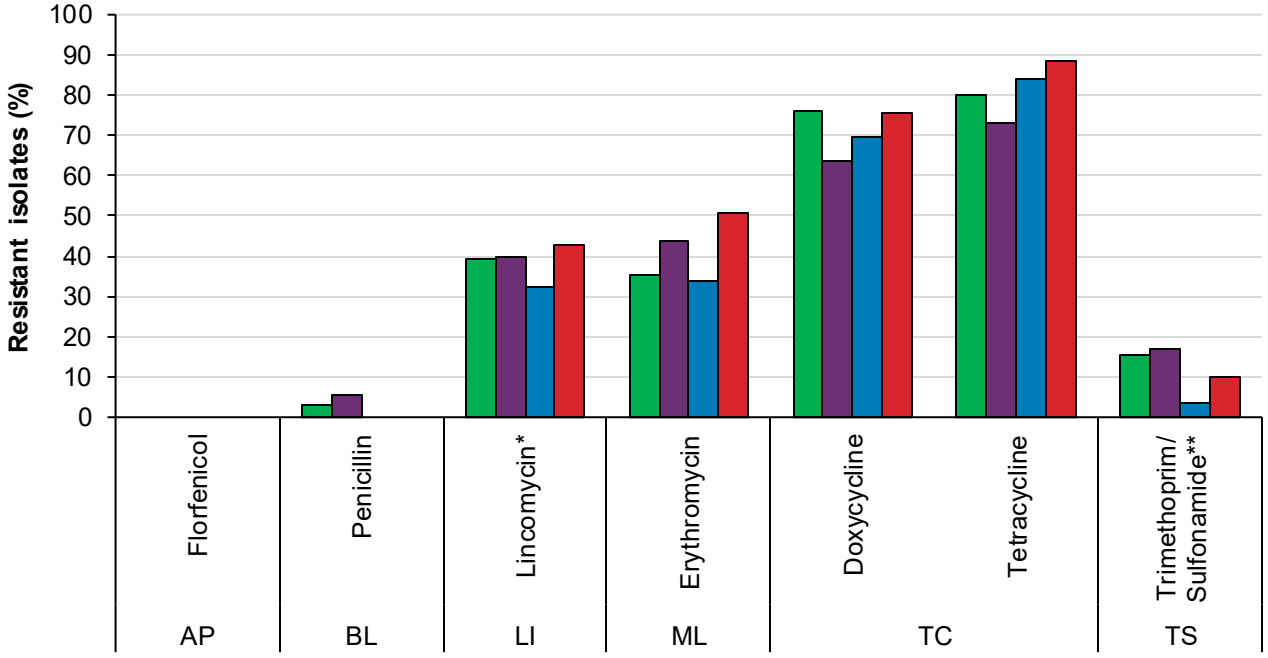
Streptococcus suis causes meningitis, arthritis and pneumonia in pigs. It is also zoonotic, although human infections are rare and usually occur following contact with affected pigs. A range of MIC breakpoints are used for this organism, because all drug/bacteria species combinations are not available from the same source.

Of the 61 isolates tested in 2024, 8.2% [95% CI: 3.6-18%] were fully susceptible (decreased from 20% [95% CI: 12-30%] in 2021, the baseline year), and 39% [95% CI: 28-52%] were MDR (increased from 35% [95% CI: 25-47%] in 2021). Increased resistance to several non-HP-CIAs was observed in 2024 (**Figure 4.8**). Fifty-one percent (51% [95% CI: 39-63%]) of isolates were resistant to erythromycin, the majority of which were resistant to lincomycin and/or tetracyclines. Penicillin resistance was not detected according to veterinary CBPs, indicating that penicillins remain a viable first-line choice in the treatment of the majority of *S. suis* infections in pigs.

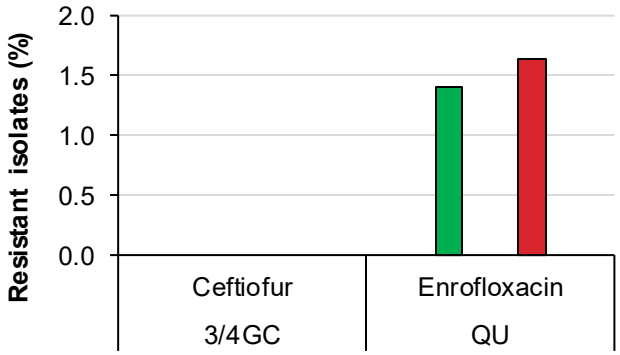
Three percent (3.0% [95% CI: 0.9-11%]) of isolates had MIC values above the human CBP for penicillin in *S. suis* meningitis, indicating clinical resistance in this scenario. Fluoroquinolones with enhanced activity against streptococci are available in human medicine, but susceptibility to these compounds was not tested.

Figure 4.8: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Streptococcus suis* isolated from pigs, from 2021 to 2024 (n=61 in 2024). Interpreted using CLSI veterinary breakpoints unless indicated otherwise.

(A) Non-HP-CIAs



(B) HP-CIAs



Key:
* CA-SFM 2024 veterinary CBP
** EUCAST human CBP for Streptococci
AG: aminoglycosides,
AP: amphenicols,
BL: beta-lactams,
ML: macrolides,
QU: quinolones,
TC: tetracyclines,
TS: trimethoprim-sulfonamides,
3/4GC: third and fourth generation cephalosporins

2021 2022 2023 2024

4.4.3 Poultry

Results for pathogenic bacteria isolated from poultry are presented in this section and are organised by body system. The complete poultry dataset can be found in Supplementary Material 6.

4.4.3.1 Multi-system pathogens

Escherichia coli

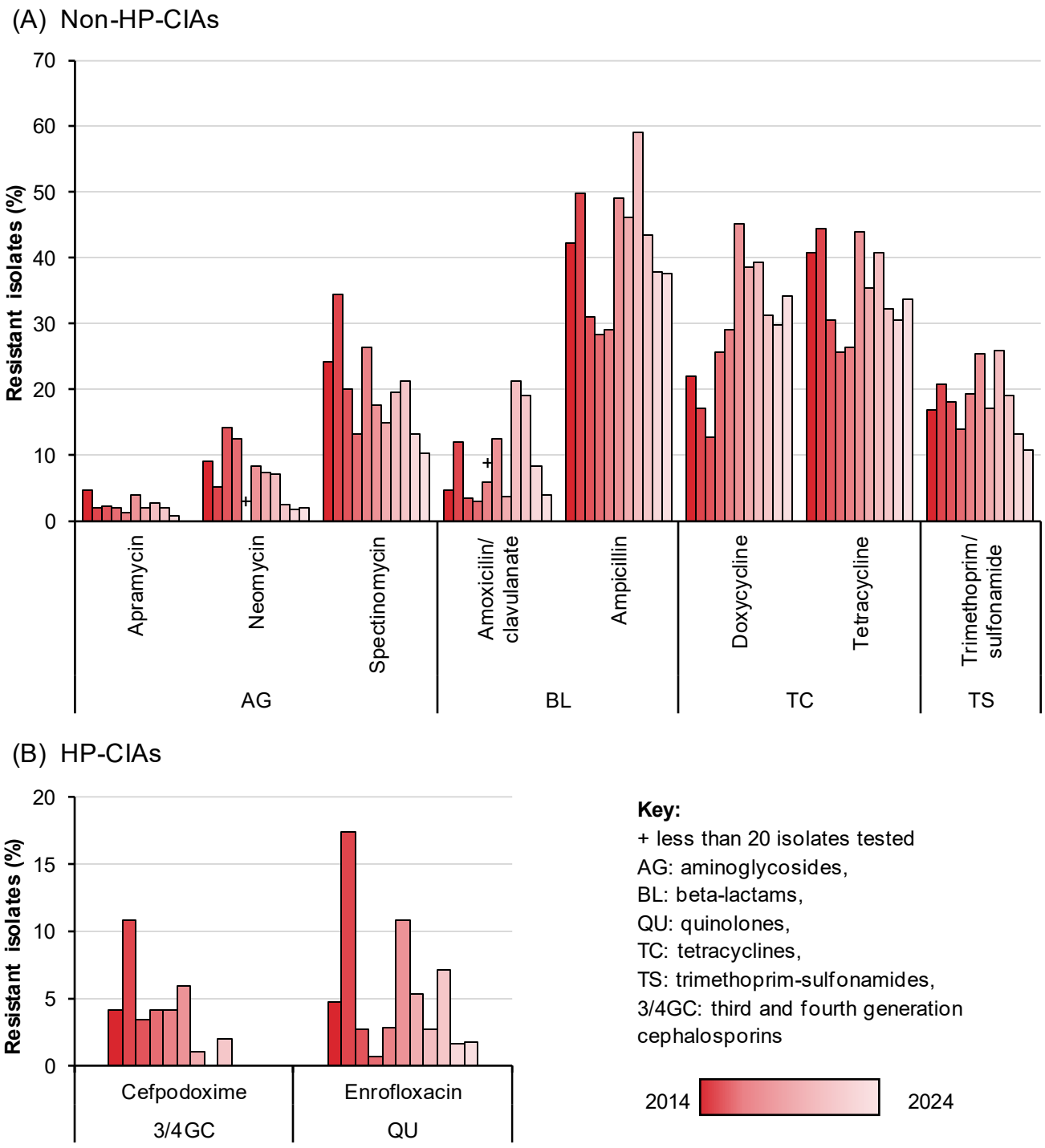
E. coli can cause a range of clinical problems in poultry, including respiratory illness, reduced appetite and poor growth.

The clinical samples submitted for testing from chickens and turkeys arise from flocks of various types and sizes, including commercial farms, pet birds and small-scale poultry keepers. Underlying reasons for annual changes in the prevalence of resistance may therefore reflect differences in the numbers of submissions received by APHA from different production types in different years. Much larger numbers of chicken isolates (n=175) were obtained in 2024 compared to turkey isolates (n=8).

In chickens, 13% [95% CI: 9.0-19%] of isolates had limited treatment options. High levels of resistance were detected to ampicillin (38% [95% CI: 31-45%]), doxycycline (34% [95% CI: 28-42%]) and tetracycline (34% [95% CI: 27-41%]) (**Figure 4.9**). Resistance to the other antibiotics tested has mostly declined over time.

Of the HP-CIAs, resistance to the third-generation cephalosporin cefpodoxime was not detected in 2024, and resistance to the fluoroquinolone enrofloxacin (1.7% [95% CI: 0.6-4.9%]) remains low.

Figure 4.9: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Escherichia coli* isolates from chickens, from 2014 to 2024 (n=175 in 2024). Note scale differs between graphs.



Salmonella spp.

Salmonellosis can cause a wide range of clinical signs in poultry including lethargy, loss of appetite, and poor growth. *Salmonella* isolates reported in this section arise predominantly from systematic on-farm sampling as part of the *Salmonella* National Control Programmes (NCPs) for poultry, and are not associated with disease. Some farms, particularly in the duck sector, also make voluntary submissions of this kind. A very low percentage of *Salmonella* isolates from poultry arise from clinical submissions. Further details can be obtained from the Salmonella in animals and feed in Great Britain report.

Chickens

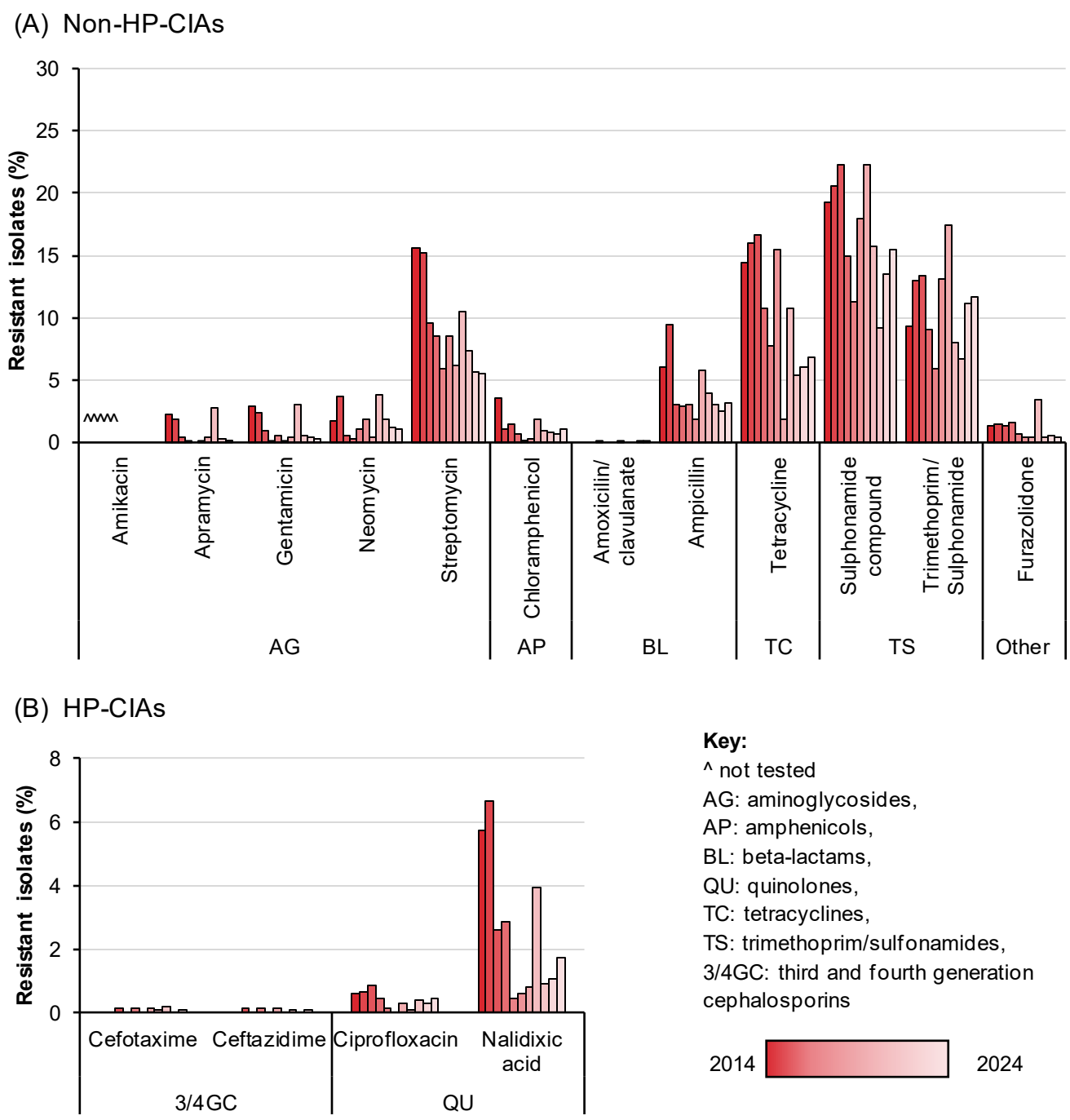
In 2024, 1523 Salmonella isolates were tested from chickens, 99% of which arose from statutory and voluntary surveillance, i.e. not associated with disease. The most frequently identified serovars in 2024 were *S. Idikan* (22%), *S. Montevideo* (20%), and *S. Kedougou* (14%). Full susceptibility was detected in 79% [95% CI: 77-81%] of isolates and 2.8% [95% CI: 2.0-3.7%] had limited treatment options.

Resistance was most frequent to the sulfonamides (16% [95% CI: 14-17%]), including trimethoprim/sulfonamide (12% [95% CI: 10-13%]), and to tetracycline (6.8% [95% CI: 5.7-8.2%]) (**Figure 4.10 A**). Resistance to these antibiotics has been increasing since 2022, despite use of these antibiotic classes in broilers reducing over this period.

Resistance to the quinolone HP-CIAs ciprofloxacin and nalidixic acid were detected in 0.5% [95% CI: 0.2-0.9%] and 1.7% [95% CI: 1.2-2.5%] of isolates, respectively (**Figure 4.10 B**). All the ciprofloxacin-resistant isolates also showed resistance to nalidixic acid.

One isolate (0.07% [95% CI: 0.0-0.4%]) of *Salmonella* Agona was co-resistant to ciprofloxacin, cefotaxime, ceftazidime, and streptomycin. Whole genome sequencing analysis identified the *bla*$_{IMP-1}$ beta lactamase gene, which confers resistance to carbapenems. Phenotypic resistance to carbapenems, which are not used in animals, was confirmed by MIC testing. This was the first detection of a carbapenem-resistant *Salmonella* from UK livestock. Extensive follow-up investigations and control measures were implemented according to the government's contingency plan for potentially high-risk AMR threats. Further details are available on page 292 of Salmonella in Animals and Feed in Great Britain.

Figure 4.10: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Salmonella* isolates from chickens, from 2014 to 2024 (n=1,523 in 2024). Note scale differs between graphs.

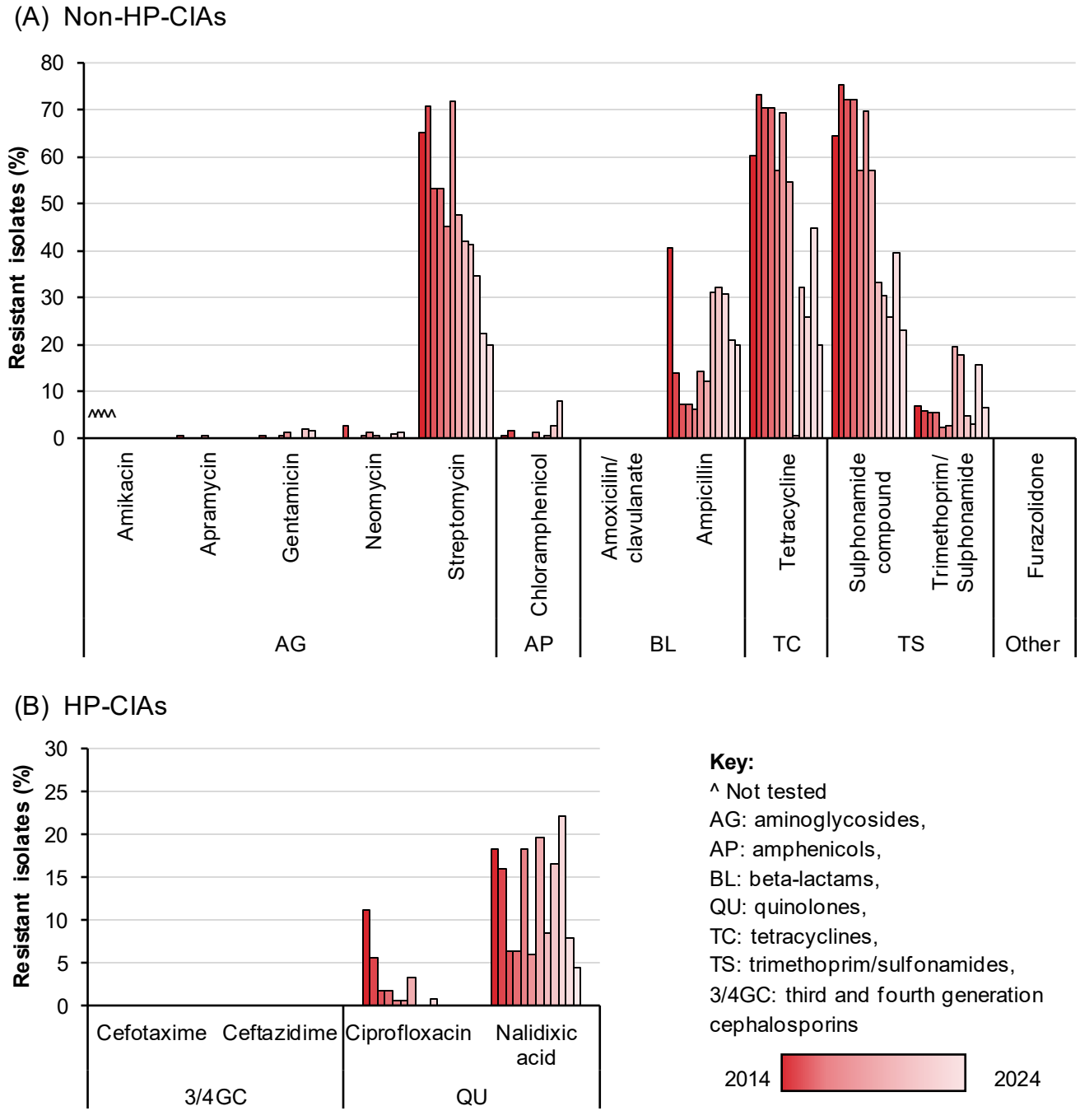


Turkeys

A total of 91 *Salmonella* isolates were obtained from turkeys in 2024, 99% from statutory and voluntary surveillance. The most commonly identified serovars included *S.* Kedougou (21%), *S.* Agona (18%), and *S.* Anatum (15%). Full susceptibility was detected in 54% [95% CI: 44-64%] of isolates, a statistically significant increase from 30% [95% CI: 21-41%] in 2023. A total of 1.1% [95% CI: 0.2-6.0%] of *Salmonella* isolates had limited treatment options.

There were reductions in resistance to several antibiotics in 2024 (**Figure 4.11**), notably to tetracycline, which reduced significantly from 45% [95% CI: 34-56%] in 2023 to 20% [95% CI: 13-29%] in 2024. This was mainly attributed to a reduction in tetracycline resistant *S.* Kedougou.

Figure 4.11: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Salmonella* isolates from turkeys, from 2014 to 2024 (n=91 in 2024). Note scale differs between graphs.



Ducks

A total of 194 *Salmonella* isolates were obtained from ducks, over 99% of which arose from voluntary surveillance (i.e., were not associated with disease). The most commonly identified serovars included *S. Indiana (73%), S. Newport* (12%), and *S. Kottbus* (7.7%). Full susceptibility was detected in 97% [95% CI: 93-99%] of isolates, a significant increase from 84% [95% CI: 75-90%] detected in 2023. No isolates had limited treatment options.

4.4.4 Cattle

Results for pathogenic bacteria isolated from cattle are presented in this section and are organised by body system. The complete cattle dataset can be found in Supplementary Material 6.

4.4.4.1 Gastrointestinal system

Escherichia coli

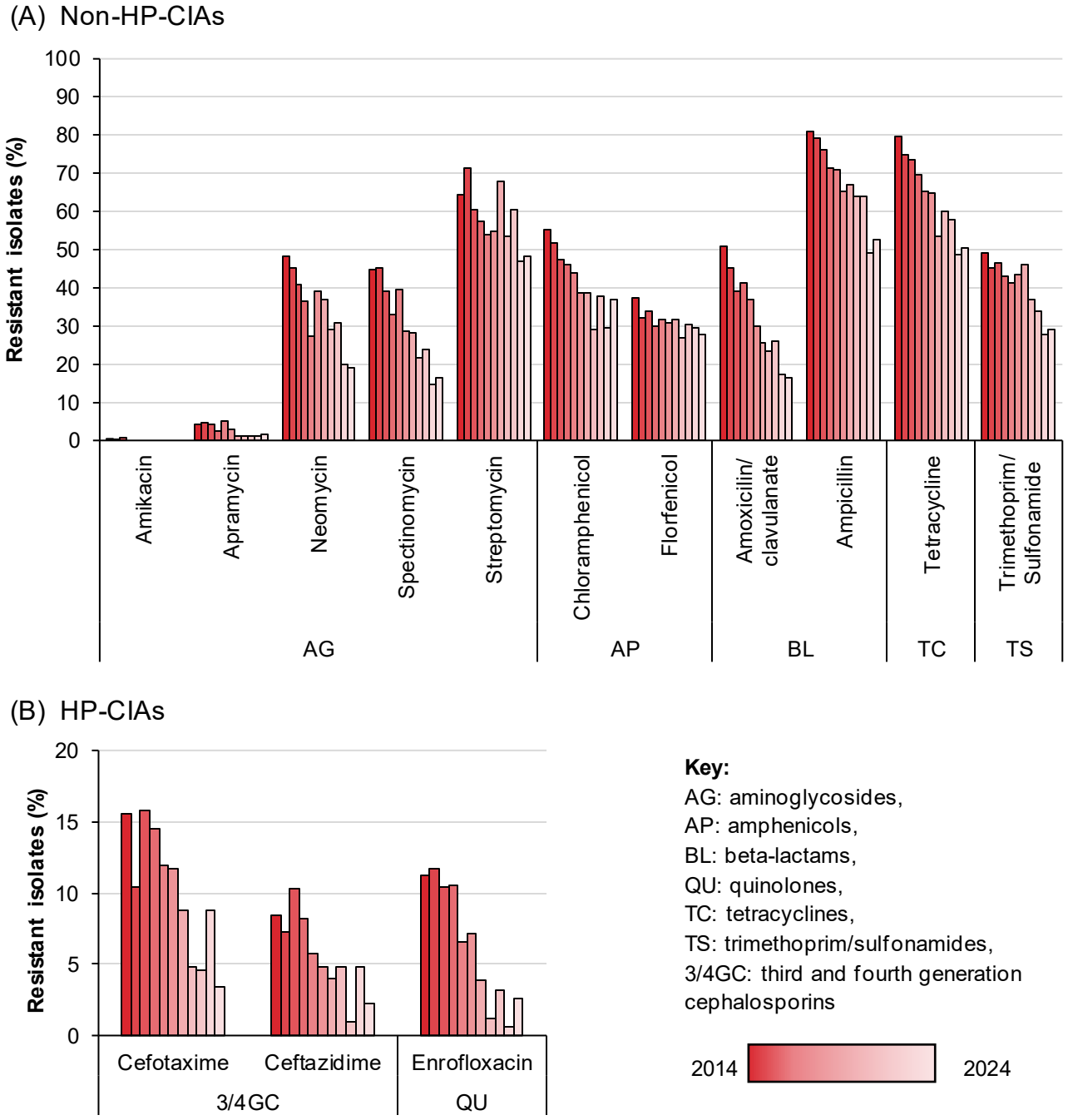
E. coli is a common cause of diarrhoea and dehydration in cattle, and can cause mortalities. 425 *E. coli* isolates from cattle were tested in 2024, of which 25% [95% CI: 21-29%] had limited treatment options. The age of the animal is not always recorded; however, where it is known, *E. coli* were predominantly collected from the neonatal category (32% of all isolates), compared to 27% from pre-weaning calves and 18% from adult cattle.

Resistance in all clinical *E. coli* isolates from cattle was highest to ampicillin (53% [95% CI: 48%-58%]), tetracycline (51% [95% CI: 46%-55%]), and streptomycin (48% [95% CI: 38%-59%]) in 2024 (**Figure 4.12)**. Resistance has declined substantially to all antibiotics tested since 2014. It is not possible to relate this back to antibiotic usage data due to low coverage in the beef sector.

The occurrence of resistance in neonatal calves was generally similar to that seen in pre-weaning calves, but mostly lower than in adults (Supplementary Material 6). This is consistent with other animal species, where resistance and usage tend to be higher in younger animals. Resistance to apramycin, for example, was not detected in adult animals but was detected at very low levels in neonatal (0.8% [95% CI: 0.1-4.4%]) and low levels in pre-weaned calves (3.8% [95% CI: 1.5-9.4%]).

The occurrence of *E. coli* isolates with limited treatment options was higher in *E. coli* recovered from enteric and other conditions of adult cattle (6.7% [95% CI: 2.9%-15%]) compared to *E. coli* isolates from mastitis in adult cattle (4.0% [95% CI: 0.7%-20%]).

Figure 4.12: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in all clinical *Escherichia coli* isolates recovered from cattle of all ages, from 2014 to 2024 (n=425 in 2024). Note scale differs between graphs.



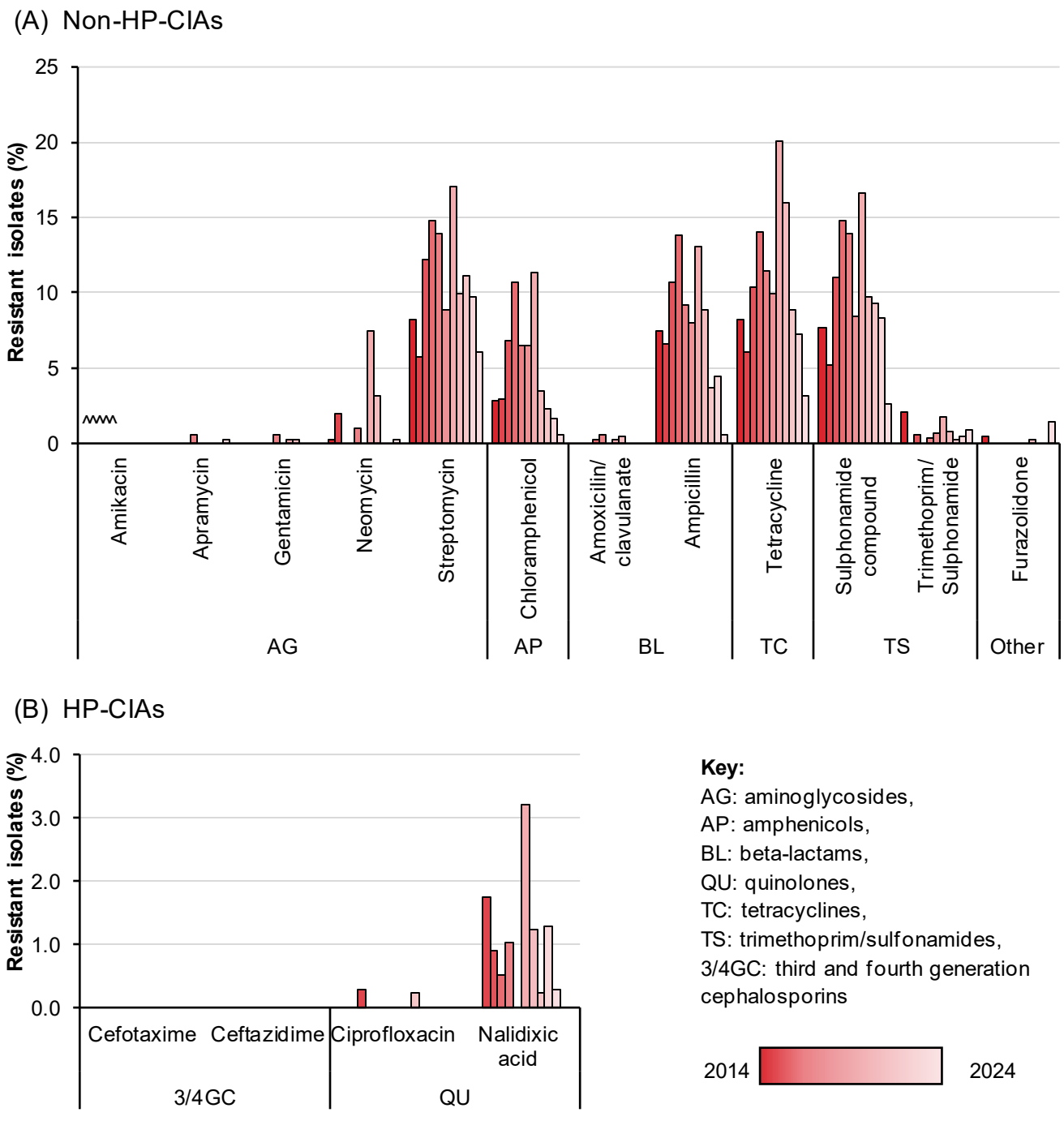
Salmonella spp.

Salmonellosis can cause a wide range of clinical signs in cattle including diarrhoea, joint infections, chronic pneumoniae, abortion and sudden death from septicaemia. *Salmonella* data for cattle is presented below for all age groups (**Figure 4.13**).

Of the 346 *Salmonella* isolates tested from cattle in 2024, the most common serovar was *S.* Dublin (59%), followed by *S.* Typhimurium (17%) and *S.* Mbandaka (12%). In 2024, 90% [95% CI: 86-92%] were susceptible to the full panel of antibiotics tested, which is similar to 2023. Limited treatment options were detected for 0.6% [95% CI: 0.2-2.1%] of *Salmonella* isolated from cattle in 2024, which is a reduction from the 3.2% [95% CI: 1.9-5.2%] in 2023. Low levels of resistance were detected to streptomycin (6.1% [95% CI: 4.0-9.1%]), tetracycline (3.2% [95% CI: 1.8-5.6%]), sulfonamides (2.6% [95% CI: 1.4-4.9%]) and furazolidone (1.4% [95% CI: 0.6-3.3%]). Levels of resistance to the other antibiotics tested were either very low (<1%) or not detected.

Resistance to the HP-CIAs, third-generation cephalosporins and the fluoroquinolone ciprofloxacin, was not detected. Resistance to the HP-CIA quinolone nalidixic acid was very low (0.3% [95% CI: 0.1-1.6%]) and has decreased from 1.3% [95% CI: 0.6-2.8%] in 2023.

Figure 4.13: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Salmonella* isolates from cattle, from 2014 to 2024 (n=346 in 2024). Note scale differs between graphs.



4.4.4.2 Respiratory system

Bovine respiratory disease complex is a multi-factorial disease, associated with a range of viral and bacterial pathogens, including *Mannheimia haemolytica* and *Pasteurella multocida*. Results are presented for these key respiratory pathogens in this chapter, all generated using MICs, as outlined in S4.2 in Supplementary Material 4.

Mannheimia haemolytica

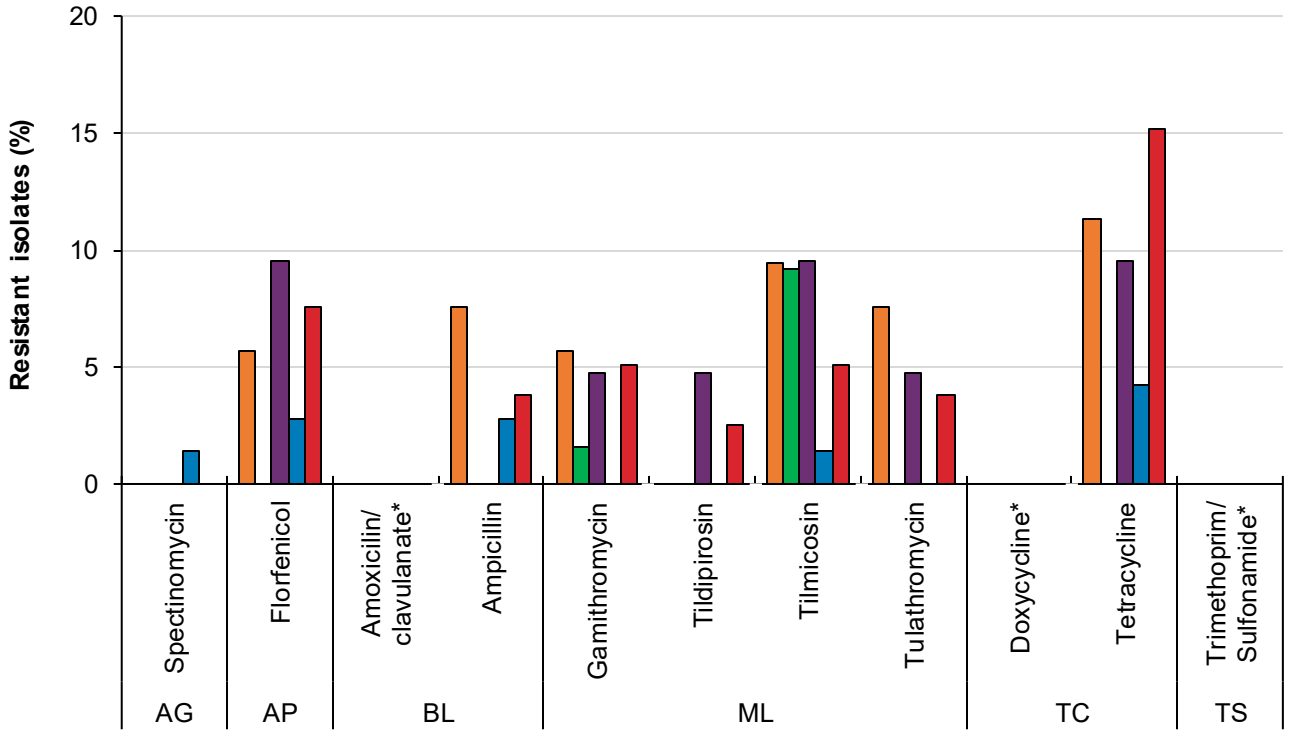
The predominant serotypes of *M. haemolytica* causing respiratory disease in cattle in the UK differ from those in sheep. The overall picture shows resistance in *M. haemolytica* from cattle varying year-on-year (**Figure 4.14**).

Seventy-nine isolates of *M. haemolytica* from cattle underwent AST in 2024. Of these, 76% [95% CI: 66-84%] were susceptible to the entire antibiotic panel, and none [95% CI: 0.0-4.6%] were MDR. The highest levels of resistance were detected to tetracycline (15% [95% CI: 9.0-25%]) and florfenicol (7.6% [95% CI: 3.5-16%]) (**Figure 4.14**). All the isolates resistant to florfenicol were also resistant to tetracycline. Macrolide resistance was low (<10%) but when present in individual isolates, these tended to be resistant to more than one individual antibiotic. For example, 5.1% of isolates [95% CI: 2.0-12%] were resistant to gamithromycin, but half of these were also resistant to tilmicosin and tildipirosin.

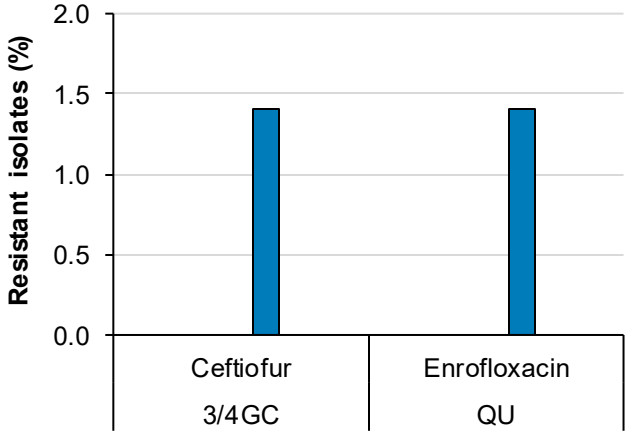
No resistance was detected to the HP-CIAs ceftiofur (a third-generation cephalosporin) and enrofloxacin (a fluoroquinolone) using CBPs. While the 2024 isolates were not clinically resistant to enrofloxacin, 22% [95% CI: 14-32%] of *M. haemolytica* tested in 2024 had MIC values exceeding the EUCAST ECOFF, indicating a divergence from wild type. This is similar to the percentage of isolates exceeding the ECOFF in 2023 (26% [95% CI: 17-37%) and 2022 (19% [95% CI: 7.7- 40%]).

Figure 4.14: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Mannheimia haemolytica* isolated from cattle, from 2020 to 2024 (n=71 in 2023). Interpreted using cattle CLSI veterinary breakpoints unless indicated otherwise. Note scale differs between graphs.

(A) Non-HP-CIAs



(B) HP-CIAs



Key:
* CA-SFM 2024 veterinary CBP
AG: aminoglycosides,
AP: amphenicols,
BL: beta-lactams,
ML: macrolides,
QU: quinolones,
TC: tetracyclines,
TS: trimethoprim-sulfonamides,
3/4GC: third and fourth generation cephalosporins

2020 2021 2022 2023 2024

Pasteurella multocida

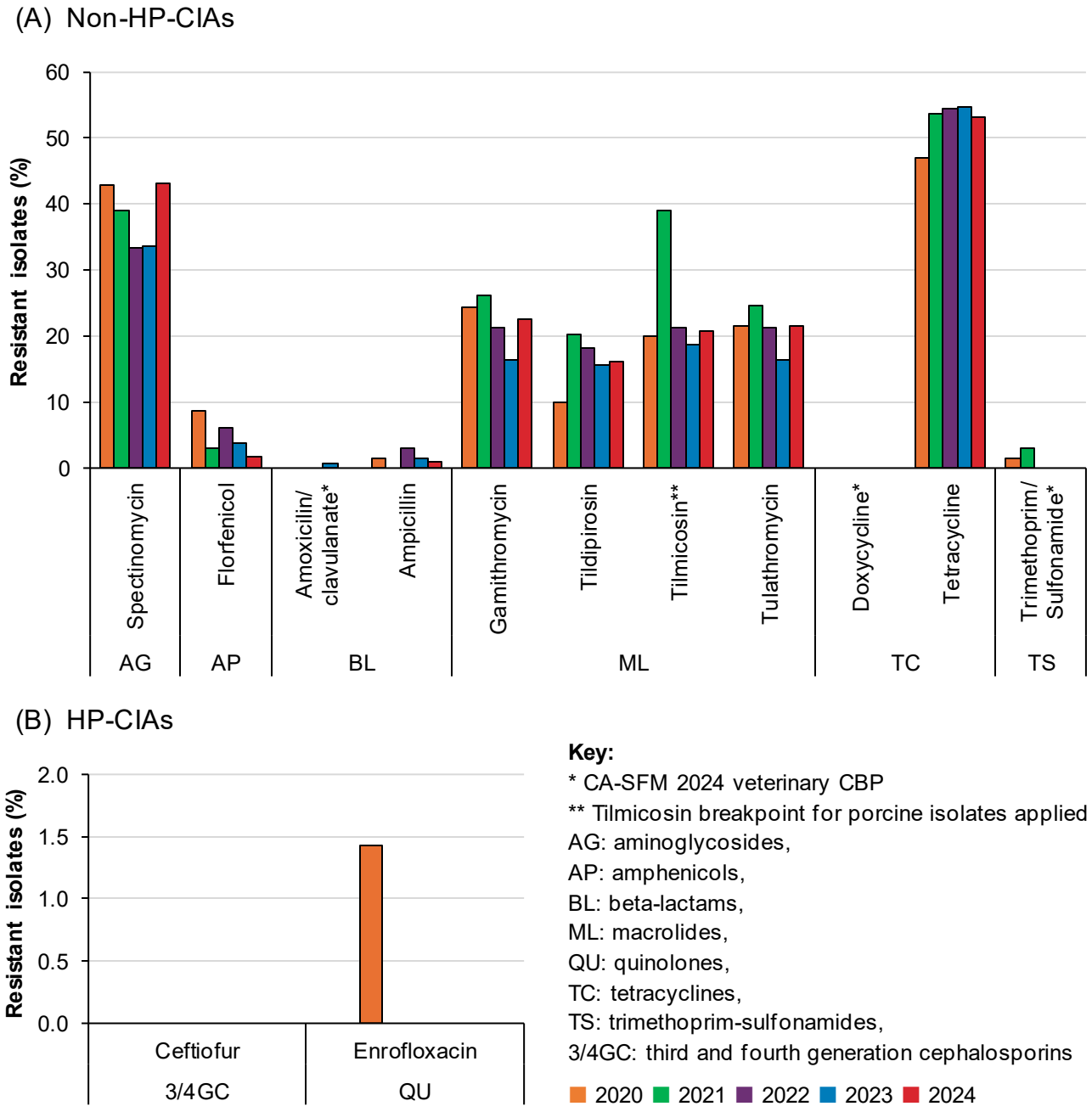
Larger numbers of *P. multocida* from cattle undergo AST each year compared to *M. haemolytica*, and resistance appears fairly consistent over time (**Figure 4.15**).

In 2024, 41% [95% CI: 33-51%] of *P. multocida* isolates were fully susceptible to the panel of antibiotics tested, and 18% [95% CI: 12-26%] were MDR. While full susceptibility is unchanged since last year, MDR has increased from 7.8% [95% CI: 4.3-14%].

The highest levels of resistance in 2024 were to tetracycline (53%, [95% CI: 44-62%]) and spectinomycin (43%, [95% CI: 34-53%]). The majority (90%, [95% CI: 78-96%]) of spectinomycin-resistant isolates were also resistant to tetracycline. However, all tetracycline-resistant isolates were susceptible to doxycycline, indicating that this may be a viable treatment choice, even when tetracycline resistance is detected. Sixteen percent of all isolates [95% CI: 11-24%] were resistant to macrolides.

Resistance to HP-CIAs was not detected in *P. multocida* in 2024.

Figure 4.15: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Pasteurella multocida* isolated from cattle, from 2020 to 2024 (n=128 in 2023). Interpreted using cattle CLSI veterinary breakpoints unless indicated otherwise. Note scale differs between graphs.



4.4.4.3 Reproductive system

Bovine mastitis is complex and can involve a range of pathogens. These include *E. coli,* staphylococci, and streptococci.

In recent years, there has been a decline in diagnostic submissions for mastitis to the government laboratory network, with private veterinary surgeons increasingly submitting clinical samples to private veterinary laboratories (PVLs). The decline in submissions to government laboratories can be seen in the Cattle Disease Surveillance Dashboard for Great Britain. Using *Streptococcus uberis*, a pathogen causing bovine mastitis, as an example: in 2014, there were 236 diagnoses, and just 49 diagnoses in 2024. This cannot be explained by a reduction in the dairy cow numbers, nor disease prevalence. Therefore, the decrease is due either to an overall reduction in diagnostic testing, increased use of on-farm diagnostic test kits, and/or increased submissions to PVLs.

To get a better picture of AMR in UK animals, the VMD is leading a collaboration with APHA, Cefas, the Universities of Liverpool and Cambridge, and the private sector. This project, the Private Laboratories Initiative (PLI, Section 4.3.8), aims to collect and analyse data from PVLs, to supplement the clinical AMR surveillance results generated by APHA.

This section therefore presents two sets of results. First, results from APHA's clinical surveillance programme; these are limited to *E. coli* and *S. uberis*, due to low numbers of isolates of other bacterial species (full results for the remaining organisms are available in Supplementary Material 6). Secondly, data is presented from The Vale Veterinary Laboratory, a key contributor to the PLI. Direct comparison between results arising from governmental and private veterinary laboratories should be made with caution, as there are differences in the laboratory methods, antibiotic panels and interpretation criteria used.

The data presented are aggregated at a national level and therefore have limited ability to inform treatment protocols on individual farms. However, resistance should be considered when veterinary surgeons and farmers develop mastitis control programs for individual farms.

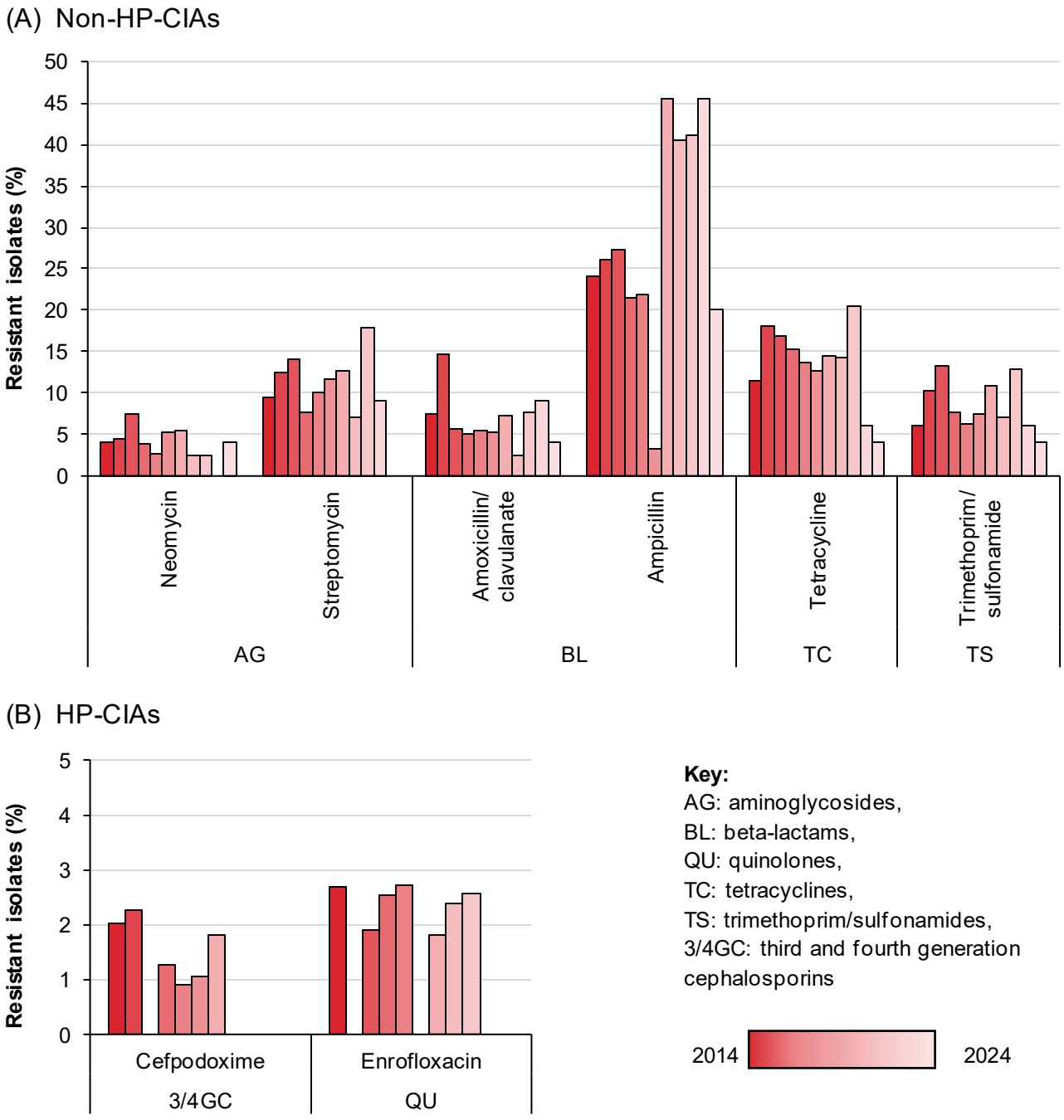
Escherichia coli

E. coli and other coliforms are major causes of bovine mastitis. Most *E. coli* strains originate from the cow's immediate environment, and no particular virulence factors are required to infect the mammary gland. These *E. coli* isolates are therefore mainly of faecal origin.

Of the 25 *E. coli* isolates recovered from mastitis diagnostic samples submitted to governmental laboratories in 2024 and tested, a single isolate (4.0% (95% CI: 0.7-20%]) had limited treatment options. This is a reduction from 9.1% [95% CI: 3.1-24%] in 2023. There were moderate levels of resistance to ampicillin in 2024 (20% [95% CI: 9.0-39%], (**Figure 4.16**), which has reduced since 2023 (46% [95% CI: 30-62%]). Only single isolates (4.0% [95% CI: 0.7-20%]) displayed any resistance to amoxicillin/clavulanate, neomycin, tetracycline and trimethoprim/sulfonamides. A single *E. coli* (4.0% [95% CI: 0.7-20%] from

bovine mastitis was resistant to ampicillin and amoxicillin/clavulanate but susceptible to cefpodoxime. Resistance to the other antibiotics tested, including HP-CIAs, were not detected.

Figure 4.16: Resistance to non-HP-CIAs (A) and HP-CIAs (B) in *Escherichia coli* isolated from mastitis samples submitted to governmental laboratories from cattle in England and Wales, from 2014 to 2024 (n=25 in 2024). Note scale differs between graphs.

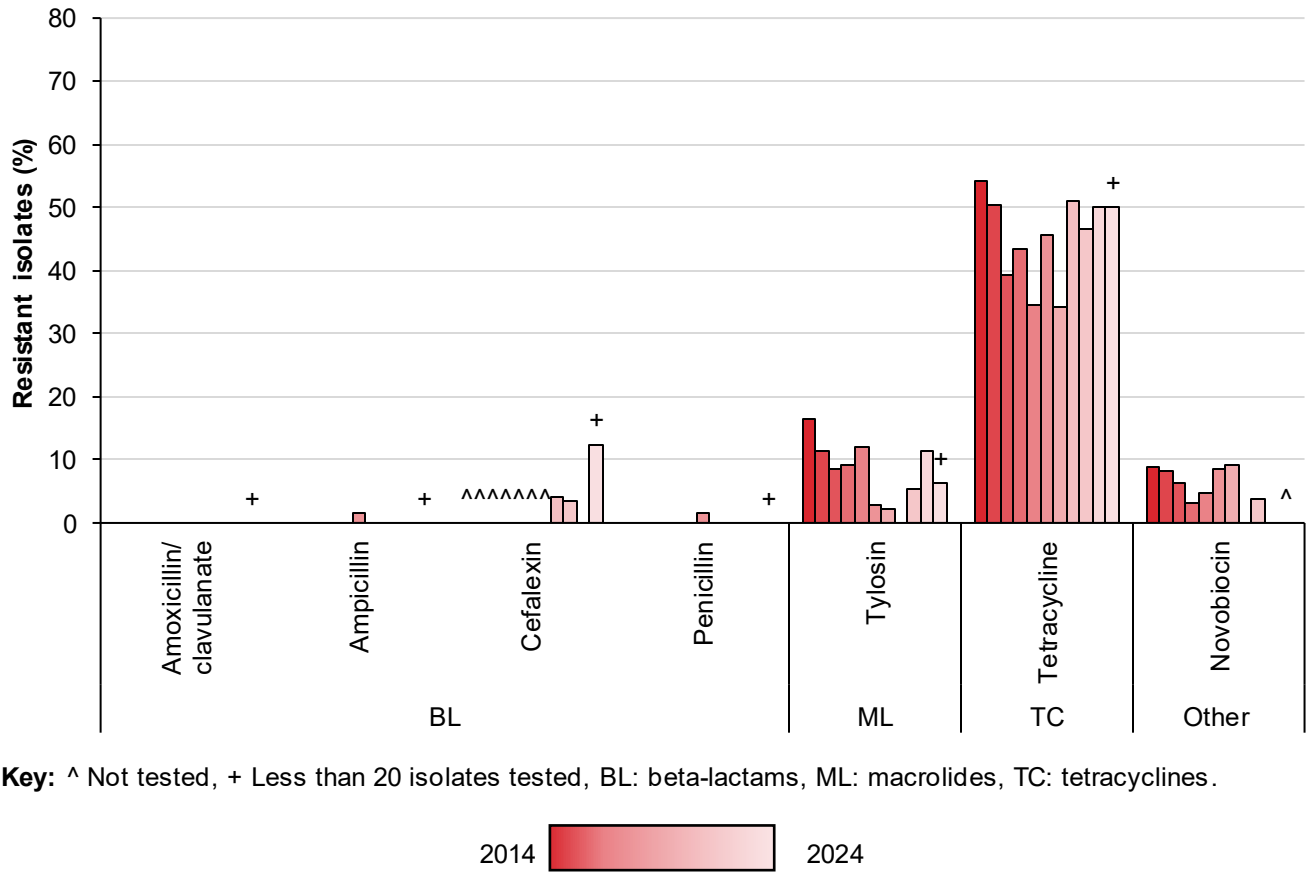


Streptococcus uberis

Streptococcus uberis is a well-recognised cause of bovine mastitis and is widely distributed in the environment of dairy cows, as well as being a commensal of the bovine vagina, tonsil, and skin. It is not regarded as zoonotic. In 2024, a total of 16 isolates were tested to the panel of antibiotics, none of which had limited treatment options.

Moderate resistance was detected to the first-generation cephalosporin cefalexin in 2024 (13%, [95% CI: 4.0-36%], **Figure 4.17**), although this result is difficult to interpret, given the low number of isolates tested. Looking at the long-term data, highest resistance has consistently been recorded to tetracycline. In 2024, 50% [95% CI: 28-72%] of isolates were resistant to tetracycline against the baseline of 54% [95% CI: 45-63%] which was detected in 2014.

Figure 4.17: Resistance in *Streptococcus uberis* isolated from mastitis samples from cattle in England and Wales, from 2014 to 2024 (n=16 in 2024).



Key: ^ Not tested, + Less than 20 isolates tested, BL: beta-lactams, ML: macrolides, TC: tetracyclines.

4.4.4.4 The Vale Veterinary Laboratory: key mastitis pathogens

Presented in **Figure 4.18** are the results from antibiotic susceptibility testing of key mastitis pathogens isolated from cattle by The Vale Veterinary Laboratory during 2020-2024, as part of the Private Laboratories Initiative (PLI, Section 4.3.8). Some results from previous years have been corrected (Box 4.1).

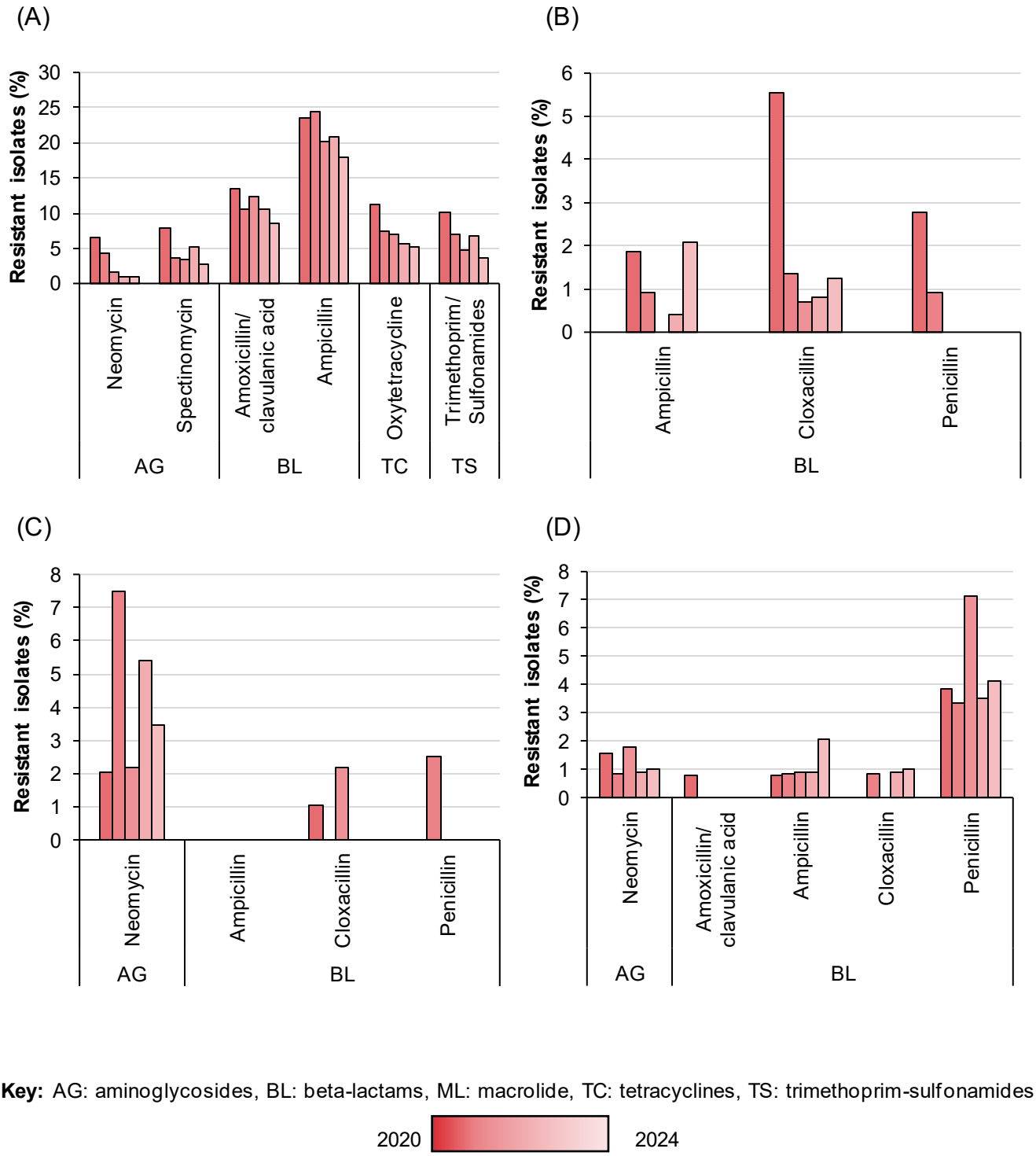
These isolates were tested by disc diffusion following different methodology from that used by governmental laboratories (S4.5 Supplementary Material 4), and therefore comparison of results generated by the two laboratories should be undertaken with caution. Ongoing activities under the PLI include working towards harmonisation of AST methods, so that results from different laboratories can be pooled reliably.

In *E. coli*, moderate resistance was detected to ampicillin (18% [95% CI: 13-24%]), and low resistance to amoxicillin/clavulanate (8.5% [95% CI: 5.3-13%]) and oxytetracycline (5.3% 95% CI: 3.2-10%]). Resistance to all antibiotics shown has reduced since 2020.

Neomycin was the most common resistance detected in *Streptococcus dysgalactiae*. Resistance in S. *dysgalactiae* was 3.4% [95% CI: 0.6-17%] in 2024, a reduction from 5.4% [95% CI: 15-17%] in 2023. In *S. uberis*, low levels of resistance to ampicillin (2.1% [95% CI: 0.9-4.7%]) and cloxacillin (1.2% [95% CI: 0.5-3.9%]) were also observed.

For *S. aureus*, very low to low levels of resistance were detected to neomycin (1.0% [95% CI: 0.2-5.6%]), cloxacillin (1.0% [95% CI: 0.2-5.6%]), ampicillin (2.1% [95% CI: 0.6-7.2%]), and penicillin (4.1% [95% CI:1.6-10%]). These have all increased since 2023. However, overall, resistance in streptococci and *S. aureus* appears broadly stable over time.

Figure 4.18: Resistance of (A) *Escherichia coli*, (B) *Streptococcus uberis*, (C) *Streptococcus dysgalactiae* and (D) *Staphylococcus aureus* isolated from bovine mastitis samples submitted to The Vale Veterinary Laboratory, from 2020 to 2024. Note scale differs between graphs.



Key: AG: aminoglycosides, BL: beta-lactams, ML: macrolide, TC: tetracyclines, TS: trimethoprim-sulfonamides

2020 2024

4.4.5 Sheep

Results for pathogenic bacteria isolated from sheep are presented in this section and are organised by body system. The complete sheep dataset can be found in Supplementary Material 6.

4.4.5.1 Gastrointestinal system

Escherichia coli

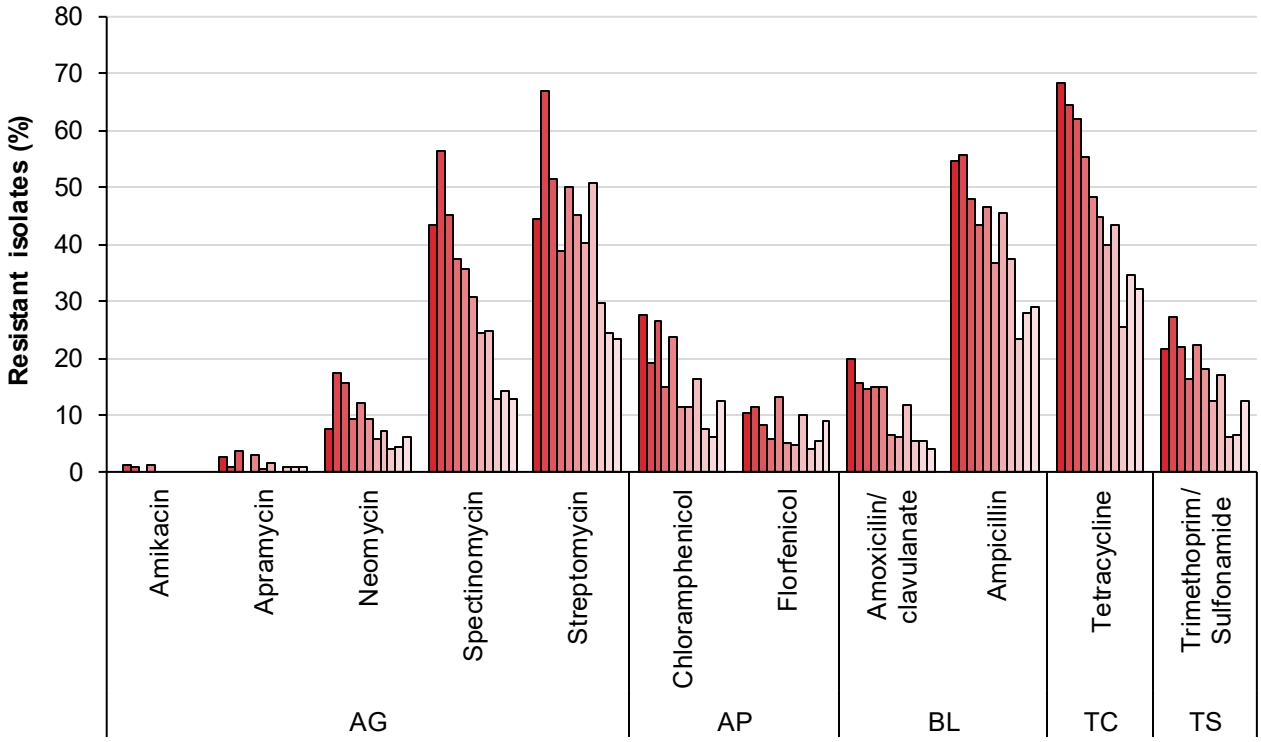
E. coli causes diarrhoea in sheep and watery mouth disease in newborn lambs. Of the 287 isolates tested in 2024, 34% were from sheep of unknown age, 24% were from neonates, 18% from pre-weaning lambs, and 24% from adult sheep. Results for individual age groups are presented in Supplementary Material 6. Across all age categories, a total of 8.7% [95% CI: 6.0-13%] of isolates had limited treatment options.

In 2024, resistance was highest to tetracycline (32% [95% CI: 27-38%]), ampicillin (29% [95% CI: 24-34%]), and streptomycin (23% [95% CI: 15-35%]) in *E. coli* isolated from sheep (**Figure 4.19**). Resistance to trimethoprim-sulfonamide, chloramphenicol, and florfenicol increased by 1.4 to 2.0 times between 2023 and 2024. However, the overall picture of resistance in *E. coli* from sheep is encouraging, with resistance declining over time. Resistance to individual HP-CIAs is low or very low, with <2% of isolates resistant to third-generation cephalosporins, and 0.3% [95% CI: 0.1-1.9%] resistant to the fluoroquinolone enrofloxacin in 2024.

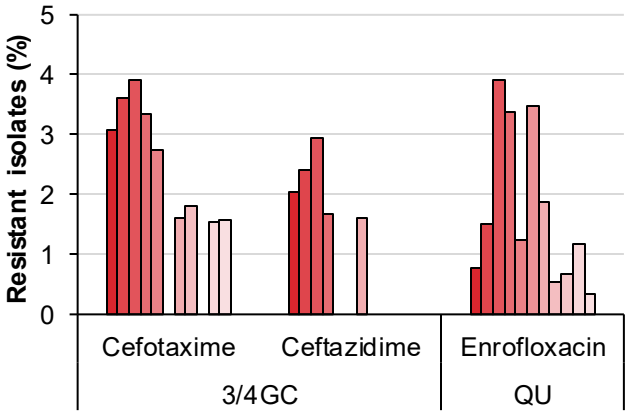
Limited treatment options occurred most frequently in neonatal lambs (24% [95% CI: 15-35%]) compared to pre-weaned lambs (9.6% [95% CI: 4.2-21%]) and adults (5.8% [95% CI: 2.3-14%]) in 2024.There were increases in resistance to several antibiotics in *E. coli* isolated from neonates in 2024: ampicillin, chloramphenicol, florfenicol, neomycin, streptomycin, and trimethoprim-sulfonamide (Supplementary Material 6). The increase in resistance to neomycin was significant (from 3.4% [95% CI: 1.2-9.7%] in 2023 to 18% [95% CI: 11-29%] in 2024). Other notable findings include an increase in resistance to spectinomycin in *E. coli* originating from pre-weaning lambs over the last few years: from 9.5% [95% CI: 2.7-29%] in 2021 to 22% [95% CI: 13-36%] in 2024.

Figure 4.19: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in all clinical *Escherichia coli* isolates recovered from sheep of all ages, from 2014 to 2024 (n=287 in 2024). Note scale differs between graphs.

(A) Non-HP-CIAs



(B) HP-CIAs



Key:
AG: aminoglycosides,
AP: amphenicols,
BL: beta-lactams,
QU: quinolones,
TC: tetracyclines,
TS: trimethoprim-sulfonamides,
3/4GC: third and fourth generation cephalosporins

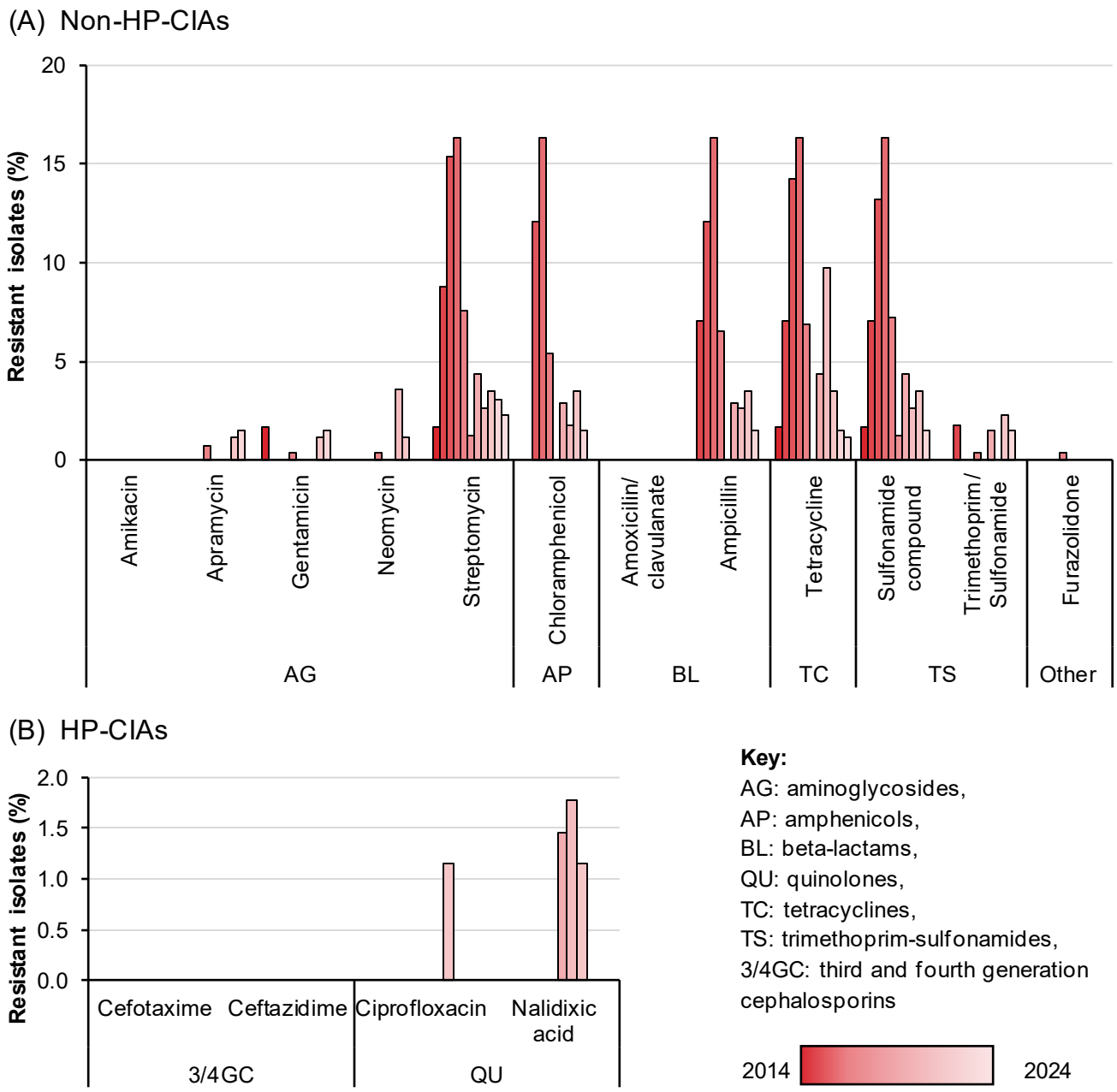
2014 — 2024

Salmonella spp.

Salmonellosis can cause a wide range of clinical signs in sheep, including diarrhoea, fever, abortion and sudden death from septicaemia. *Salmonella* data for sheep is presented below for all age groups (**Figure 4.20**). The most common serovars were *Salmonella* 61:K:1,5,7 (55%), followed by *S.* Montevideo (21%), and *S.* Dublin (11%).

Of the 88 isolates tested in sheep in 2024, 96% [95% CI: 89-98%] were susceptible to the full panel of antibiotics tested, similar to the 97% [95% CI: 90-99%] seen in 2023. No isolates were detected with limited treatment options (0.0% [95% CI: 0.0-4.2%]). In 2024, resistance was only detected to two antibiotics, both at low levels: streptomycin (2.3% [95% CI: 0.6-7.9%]) and tetracycline (1.1% [95% CI: 0.2-6.2%]). Resistance to other antibiotics including HP-CIAs were not detected in 2024.

Figure 4.20: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Salmonella* isolates from sheep, from 2014 to 2024 (n=88 in 2024). Note scale differs between graphs.



4.4.5.2 Respiratory system

Pasteurellosis complex is a respiratory disease that can cause severe morbidity and mortality in sheep. Many factors play a role in the development of the disease. The most significant infectious agents are bacteria including *Bibersteinia trehalosi, Mannheimia haemolytica* and *Pasteurella multocida*. Results for these respiratory pathogens are generated using MICs, as outlined in S4.2 of Supplementary Material 4. Due to very low resistance in sheep, results are not presented graphically in this chapter.

Bibersteinia trehalosi

Of the 73 *B. trehalosi* isolates from sheep tested in 2024, 95% [95% CI: 87-98%] were fully susceptible to the panel of antibiotics. A low number of isolates (4.1% [95% CI: 1.4-11%]) were resistant to gamithromycin, and one of these (1.4% [95% CI: 0.2-7.4%]) was also resistant to the HP-CIA enrofloxacin. No MDR was detected.

Mannheimia haemolytica

The predominant serotypes of *M. haemolytica* causing respiratory disease in sheep differ from those in cattle. Of the 142 isolates of *M. haemolytica* from sheep tested in 2024, 97% [95% CI: 93-99%] were fully susceptible to the panel of antibiotics tested (Supplementary Material 6). No isolates were resistant to HP-CIAs and none were MDR.

Pasteurella multocida

A total of 17 isolates of *P. multocida* were recovered from diagnostic samples in 2024 and underwent AST. Of these, 94% [95% CI: 73-99%] were susceptible to the full panel of antibiotics tested (Supplementary Material 6), and none were resistant to HP-CIAs. No isolates were MDR.

4.4.6 Dogs

Results for *Salmonella* isolated from dogs are presented in this section. The complete dog dataset can be found in Supplementary Material 6.

A change in legislation in 2021 meant that *Salmonella* isolates from dogs became reportable under the Zoonoses Order in Great Britain. This means that a culture of the organism must be provided to government laboratories when detected by private veterinary laboratories in Great Britain.

4.4.6.1 Gastrointestinal system

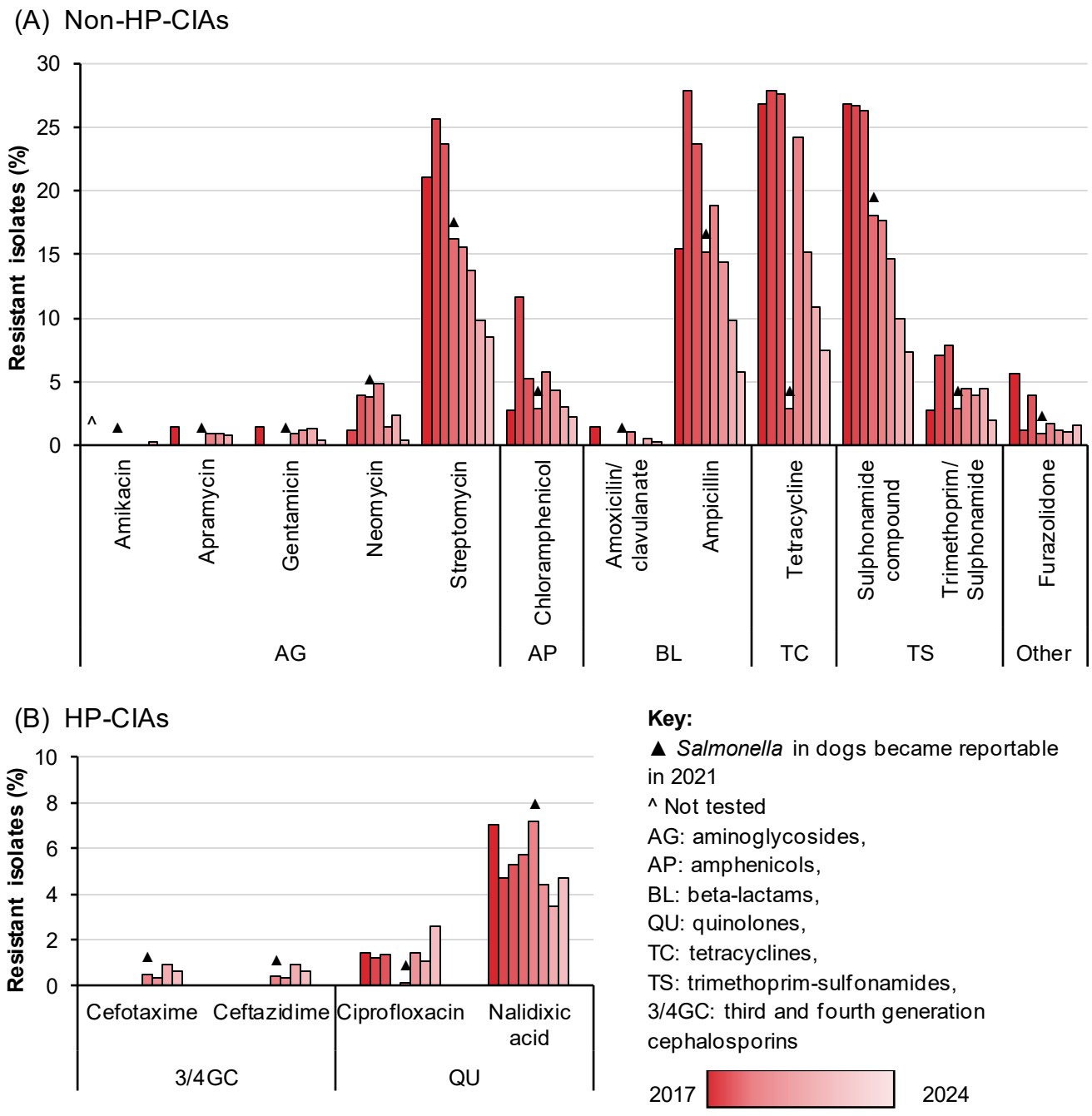
Salmonella spp.

Salmonellosis can cause a wide range of clinical signs in dogs including diarrhoea, fever, decreased appetite and lethargy. The most frequently detected serovar in dogs was *S. Typhimurium* (16%), followed by *S. Infantis* (7.9%) and *S. Newport* (5.7%).

Of the 509 *Salmonella* isolates tested from dogs in 2024, 84% [95% CI: 80-87%] were susceptible to the full panel of antibiotics tested. The proportion of isolates with limited treatment options was 5.1% [95% CI: 3.5-7.4%] in 2024, decreased from 8.3% [95% CI: 6.6-11%] in 2023. The most common resistance in 2024 was to streptomycin (8.4% [95% CI: 6.3%-11%]), followed by tetracycline (7.5% [95% CI: 5.5-10%]), and sulfonamide compounds (7.3% [95% CI: 5.3-9.9%]) (**Figure 4.21 A**). There appears to have been an overall reduction in resistance in *Salmonella* isolated from dogs over time.

For HP-CIA in 2024, low resistance to quinolones was detected, while very low resistance to third-generation cephalosporins were observed (**Figure 4.21 B**). Nalidixic acid was the most common quinolone resistance detected (4.7% [95% CI: 3.2-6.9%]). Only 0.6% [95% CI: 0.2-1.7%] of isolates displayed resistance to cefotaxime and ceftazidime. However, two of these isolates (0.4% [95% CI: 0.1-1.4%] of *Salmonella* isolated from dogs) were MDR, also being resistant to the HP-CIA ciprofloxacin, as well as to gentamicin, neomycin, and streptomycin.

Figure 4.21: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Salmonella* isolates from dogs, from 2017 to 2024 (n=509 in 2024). Note scale differs between graphs.



4.4.7 Trout

The VMD is working with the Centre for Environment, Fisheries and Aquaculture Science (Cefas) to explore clinical surveillance for AMR in the trout sector. This pilot is focused on three fish pathogens: *Aeromonas salmonicida*, which causes furunculosis; *Yersinia ruckeri*, which causes enteric redmouth disease (ERM); and *Flavobacterium psychrophilum*, which causes rainbow trout fry syndrome. These are three of the most important bacterial pathogens affecting farmed trout and salmon in Great Britain. These diseases are controlled by vaccination, but in instances of vaccine failure or supply shortages, outbreaks can occur.

In 2024, a total of 17 samples (10 *Y. ruckeri* and 7 *A. salmonicida*) were tested for resistance by broth microdilution against a panel of antibiotics relevant to fish and/or human health (Supplementary Material 6). In the trout sector, just three antibiotics are available for use: oxytetracycline (50% of total use in 2024), oxolinic acid (29%) and florfenicol (21%). Antibiotic use in the sector has decreased by 26% since 2023, and 73% since 2017, to the lowest figure seen. Other factors that may contribute to the development of resistance may also include watercourse contamination.

Understanding the significance and relevance of these results to trout health would be improved by testing larger numbers of isolates for AMR. Cefas are continuing to work with the British Trout Association (BTA) to explore barriers to sample submission.

Aeromonas salmonicida

None (0.0% [95% CI: 0-35%]) of the seven *A. salmonicida* isolates tested in 2024 were fully sensitive to the panel of antibiotics tested, whilst 57% [95% CI: 25-84%] were MDR. Very high resistance was found to florfenicol (57% [95% CI: 25-84%]). All isolates were sensitive to oxytetracycline, which is the most used antibiotic in the trout sector.

Extremely high resistance was detected to meropenem (86% [95% CI: 49-97%]), which is not authorised for use in animals. Very high resistance was also detected to the HP-CIA quinolones, enrofloxacin (57% [95% CI: 25-84%]) and oxolinic acid (57% [95% CI: 25-84%]). High resistance was also detected to the third-generation cephalosporin ceftazidime (29% [95% CI: 8.0-64%]). While the number of isolates tested are small, resistance to HP-CIAs and last-resort antibiotics used in human medicine are concerning. Further investigation, including whole genome sequencing, is under way.

Yersinia ruckeri

Of the 10 isolates tested by MIC in 2024, 70% [95% CI: 40-89%] were fully susceptible and none were MDR (resistant to 3 or more antibiotic classes). A single isolate (10% [95% CI: 2.0-40%]) was resistant to oxytetracycline.

All isolates were sensitive to the HP-CIA oxolinic acid. A single isolate (10% [95% CI: 2.0-40%]) was resistant to the HP-CIA ceftazidime. A separate isolate (10% [95% CI: 2.0-40%]) was resistant to meropenem, which is a carbapenem and therefore an antibiotic of last resort in human medicine, and is not used in animals.

4.4.8 Private Laboratories Initiative

Within the UK animal health sector, much of the diagnostic testing for AMR in pathogens affecting animals is conducted by private veterinary laboratories (PVLs) and the data is not routinely captured within existing government surveillance programmes. This gap limits national understanding of AMR in animals, the ability to assess associated risks to human health, and the capacity to detect and respond to emerging threats.

The Private Laboratories Initiative (PLI) was established to address this gap by improving the sharing of AMR data held by PVLs with government. The project aims to identify where AMR data is generated, what types of data are collected, the methodologies used, and to assess and improve their suitability for inclusion in national AMR surveillance. By enhancing data flows from the private sector, PLI supports the UK's One Health AMR objectives, as outlined in the UK National Action Plan, to contain and control AMR through optimised surveillance. PLI also helps address the recommendations made by the Public Accounts Committee, which highlight the need for better data collection, sharing and analysis.

PLI started with earlier Proof of Concept work undertaken with The Vale Veterinary Laboratory, which has featured in VARSS reports since 2021 (Section 4.4.4.4). The initiative started under the National Biosurveillance Network (NBN) and has since transitioned into the Biosecurity Portfolio of the Integrated Security Fund (ISF), which is governed by Cabinet Office and is taking the project into its next phase. This portfolio delivers innovative programming to support the UK Government's Biological Security Strategy (BSS) and broader national security objectives.

PLI is led by the VMD and covers four major animal streams in 2025: farm, fish, companion and equine. Delivery of the streams is shared between government and academic partners. Engagement with the farm animal and fish sectors is led by the government agencies APHA and Cefas, while the companion animal and equine sector engagement is led by the University of Liverpool and the University of Cambridge's Equine Infectious Disease Surveillance (EIDS) Unit, respectively.

Collaboration is central to the success of PLI. The project team is deeply grateful to the participating PVLs for their engagement and willingness to contribute. Their input is essential to understanding how government and the private sector can work together to strengthen AMR surveillance, and ultimately, mitigate AMR threats to animal and public health.

Annexes

Annex A: Glossary of terms

Active ingredient

The part of an antibiotic medicine that acts against the bacterial infection. Alternatively called 'active substance'.

AFBI

Agri-Food Biosciences Institute

AMEG

Antimicrobial Advice *ad hoc* Expert Group; AMEG is an *ad hoc* group established by the European Medicines Agency jointly under the Committee for Medicinal Products for Veterinary Use (CVMP) and the Committee for Medicinal Products for Human Use (CHMP). The AMEG was set up to provide guidance on the impact on public health and animal health of the use of antibiotics in animals, and on the measures to manage the possible risk to humans.

ATC vet

Anatomical Therapeutic Chemical classification system for veterinary medicinal products.

AHDB

Agriculture and Horticulture Development Board

Antibiotic

A large group of antibacterial substances capable of destroying or inhibiting the growth of bacteria, used for treatment or prevention of bacterial infections.

Antimicrobial

Naturally occurring, semi-synthetic or synthetic substances that exhibit antimicrobial activity (kill or inhibit the growth of micro-organisms). Used for treatment or prevention of infections. Antimicrobials include antibacterials (antibiotics), antivirals, antifungals and antiprotozoals.

Antibiotic/antimicrobial resistance

The ability of a bacterium/micro-organism to grow or survive in the presence of an antibiotic at a concentration that is usually sufficient to inhibit or kill bacteria/micro-organisms of the same species.

APHA

Animal and Plant Health Agency, an Executive Agency of the Department for Environment, Food and Rural Affairs (Defra)

AST

Antibiotic susceptibility testing: testing used to determine which antibiotics will inhibit the growth of, or kill, a bacterium/micro-organism.

BEIC

British Egg Industry Council

BPC

British Poultry Council

Broiler

A broiler is any chicken that is bred and raised specifically for meat production.

BSAC

British Society for Antimicrobial Chemotherapy

BTA

British Trout Association

Bulk Milk

Refrigerated milk from multiple cows within a herd stored for transportation from the farm to processing facilities i.e. to go on to be pasteurised.

BVPA

British Veterinary Poultry Association

CAGG

Cattle Antibiotic Guardian Group

CA-SFM

Committé Antibiogramme - Société Française de Microbiologie

CBP

Clinical Break Point: relates the laboratory results to the likelihood of clinical treatment success or failure.

Cefas

Centre for environment, fisheries and aquaculture science

CHAWG

Cattle Health and Welfare Group

CLSI

Clinical and Laboratory Standards Institute

Critically Important Antibiotics

These are antibiotic classes, which are the sole or one of limited available therapies, to treat serious bacterial infections in people and are used to treat infections caused by bacteria that may be transmitted to humans from non-human sources or, bacteria that may acquire resistance genes from non-human sources (WHO definition).

DARC

Defra Antimicrobial Resistance Coordination group

DCDVet

The Defined Course Doses represents the average number of courses per dairy cow using a standard course dose of four tubes per dry cow and three tubes for lactating cow treatments.

DDDVet

The Defined Daily Doses is the assumed average dose per kg animal per species per day. These standard daily doses are extracted from the Summary of Product Characteristics for each antibiotic product.

Defra

Department for Environment, Food and Rural Affairs

ECDC

European Centre for Disease Prevention and Control

HP-CIAs

Highest Priority Critically Important Antibiotics. In this report the classification according to the AMEG has been used; therefore the following classes of antibiotics are included under HP-CIAs: fluoroquinolones; third and fourth generation cephalosporins and polymyxins (including colistin).

ECOFF

Epidemiological cut-off value: represents the point at which bacteria have developed a higher level of resistance to an antibiotic than the background level of resistance that exists naturally for that bacterial species. A ‘resistant’ (or ‘non-susceptible’) ECOFF does not necessarily imply a level of resistance which would correspond with clinical treatment failure.

EFSA

European Food Safety Authority

EMA

European Medicines Agency

eMB Pigs

Electronic Medicines Book for pigs

ESBL-producing

Extended spectrum beta lactamase producing: the bacteria is able to produce beta-lactamase enzymes that may make them resistant to some antibiotics.

ESVAC

European Surveillance of Veterinary Antimicrobial Consumption

EUCAST

European Committee on Antimicrobial Susceptibility Testing

Food-producing animal (species)

Animals used for food production including (but not limited to): cattle, sheep, pigs, poultry, salmon, trout and bees.

FSA

Food Standards Agency

FSS

Food Standards Scotland

GFA

Game Farmers Association

Injectable product

A product which is administered to animals via injection.

Intramammary product

A product which is administered into the udder.

IU

International Units, a conversion factor used for the calculation of the mass of the active substance.

Limited treatment options

Isolates resistant to four or more individual antibiotics

LA-MRSA

Livestock Associated-Methicillin Resistant *Staphylococcus aureus*

Medicated feeding stuff

Feeding stuffs that contain a veterinary medicine and that are intended for feeding to animals without further processing.

MDR

Multi-drug resistance, isolates resistant to three or more antibiotic classes.

MG/KG

The weight of antibiotic active ingredient sold for use or used in animals (in mg) compared with the weight of the animal population (in kg). For more detail, please see sections 1.1.1 and 2.1.1.

MIC

Minimum inhibitory concentration, the lowest concentration of an antibiotic that inhibits visible growth of a bacterium after overnight incubation.

MH

Medicine Hub for ruminants

MLST

Multi Locus Sequence typing, is a molecular typing method used to characterise bacterial isolates which generates a sequence type (ST)

NMR

National Milk Records

Non-food-producing animal (species)

Animals not reared for food. These are mainly companion animals including (but not limited to): dogs, cats, horses, small mammals, rabbits and birds.

NRL

National reference laboratories

PHWC

Pig Health and Welfare Council

Oral/water product

A product that is administered to animals orally. In this report this includes boluses, topdressings, powders, dissolvable powders, solutions.

PCR

Polymerase chain reaction: a laboratory technique used to amplify DNA sequences for further analysis.

Population Correction Unit (PCU)

This is a technical unit of measurement which is used to represent the estimated weight at treatment of livestock and slaughtered animals. It takes into account a country's animal population over a year, along with the estimated weight of each particular species at the time of treatment with antibiotics. 1 PCU = 1 kg of different categories of livestock and slaughtered animals.

Premix

Veterinary medicinal products intended for incorporation into medicated feeding stuffs.

Prodrug

Ingredient that after administration is metabolized (that is to say, converted within the body) into the pharmacologically active drug.

PSUR

Periodic Safety Update Report. Pharmacovigilance documents submitted by marketing authorisation holders (MAHs) at defined time points post-authorisation. These documents are intended to provide a safety update resulting in an evaluation of impact of the reports on the risk-benefit of a medicinal product.

RCVS

Royal College of Veterinary Surgeons

Red Tractor

Red Tractor Assured Food Standards is a UK company which licenses the Red Tractor quality mark, a product certification programme that comprises a number of farm assurance schemes for food products, animal feed and fertilizer.

RUMA

The Responsible Use of Medicines in Agriculture Alliance

SAGG

Sheep Antibiotic Guardian Group

SAVSNET

Small Animal Veterinary Surveillance Network

SPC

Summary of Product Characteristics

SRUC

Scotland’s Rural College Veterinary Services

ST

Sequence type, a designation assigned to a bacterial isolate based on a distinct combination of conserved housekeeping gene sequences.

TRACES

The 'TRAde Control and Expert System' (TRACES) is the European Commission’s online management tool for all sanitary requirements on intra-EU trade and importation of animals, semen and embryo, food, feed and plants.

VMD

Veterinary Medicines Directorate, an Executive Agency of the Department for Environment, Food and Rural Affairs (Defra)

VRE

Vancomycin-resistant enterococci

WGS

Whole genome sequencing, a laboratory method to DNA sequence the genome.

WHO

World Health Organization

WOAH

World Organisation for Animal Health, previously known as Office International des Epizooties (OIE)

Annex B: Data background and limitations

Antibiotic sales data

- Sales data do not permit accurate analysis of antibiotic consumption by animal species or production category. Some formulations of antibiotics are authorised with indications for use in more than one species, for example pigs and poultry. It is not possible to ascertain from sales data in which species the product was used.
- A given quantity of antibiotic may represent many doses in small animals or few doses in large animals. It is not possible to predict the number of doses represented by the quantity sold.
- Changes in quantities of veterinary antibiotics sold should be considered in parallel with changes in the UK animal population over the corresponding time period. The populations of animal species are an important denominator and may vary quite markedly from year to year depending on market conditions for animal derived food. Similarly, variations in the size of the animals being treated should be taken into consideration as larger animals will require a larger relative quantity of antibiotics over a treatment period.
- To try and address the variation in animal populations and demographics, over time and between countries, the ESVAC project has developed a Population Correction Unit (PCU), a calculation that estimates the weight of the animal (or group of animals) receiving an antibiotic at the most likely time of administration. This unit has been used across EU Member States and is currently the best approximation of consumption. This form of analysis is used in this report.
- Sales data in general over-estimate use, as not all antibiotics sold will be used. There is natural wastage resulting from pack sizes that do not meet dose need, and from drug expiry. In addition, a product could be sold one year and used, for example, the next year.
- Some products may be sold to UK feed mills for inclusion in feed which is then exported outside of the UK; currently there is no method for separating these sales from the total UK sales data, resulting in an over-estimate of use in UK feed.
- Some products may be imported into the UK on a Special Import Certificate; currently there is no method for including these data in the total UK sales data, resulting in an under-estimate of use in the UK.
- Medication sold for use in humans may be used in animals under certain circumstances, according to the prescribing Cascade; figures on such use are not included in the data presented. Further information on Cascade prescribing can be found in section S1.5 of Supplementary Material 1.

Antibiotic use data

- In most cases, antibiotic use data represents the antibiotics that the vet and/or the feedmill has supplied for use on a farm, or for a particular species or sector (all under prescription from the veterinary surgeon). However, just because a product is

supplied in a particular calendar year doesn't mean that it is necessarily used in that calendar year.

- Except in the Salmon sector, antibiotic use data doesn't have 100% coverage so the collected data may not be fully representative of the industry as a whole. For the majority of these sectors (pigs, meat poultry, laying hens, gamebirds and trout) coverage represents over 85%. However, for dairy and sheep coverage is much smaller (30% and 11% respectively) so the likelihood of this data not being representative of the whole sector is higher.

Resistance data, harmonised monitoring scheme

- The sampling size and strategy are designed to provide a sample which is representative of the wider population for each food-producing animal species (pigs, broiler chickens, and turkeys) in the UK. However, pigs and poultry are monitored on alternating years, therefore not providing annual data.
- The organisms monitored are of direct relevance to human health.
- Antibiotics are considered HP-CIAs if they are within "Category B" in the Antimicrobial Expert Group (AMEG) report; these have been included in the panel of antibiotics against which these organisms are tested.
- The sampling methodology used is standardised and harmonised to produce robust susceptibility data that is comparable across species, years, and internationally.
- This year, European Committee on Antimicrobial Susceptibility Testing (EUCAST) epidemiological cut-off values (ECOFFs) were used to assess susceptibility of the bacterial isolates. ECOFFs represent the point at which bacteria have developed a higher level of resistance to an antibiotic than the background level of resistance that exists naturally for that bacterial species. A 'decreased susceptibility' (or 'resistant') result based on ECOFFs does not necessarily imply a level of resistance that would correspond to clinical treatment failure. Minimum inhibitory concentrations (MICs) are also recorded and will enable any future changes in CBPs or ECOFFs to be taken into account.
- Defined EUCAST ECOFFs are not available for all drug/bug combinations. Where these were not available European Food Safety Authority (EFSA) cut-off values were applied. In the absence of both, then tentative EUCAST ECOFF were considered.
- Since 2022 ertapenem has been included in the antibiotic panel for the *Campylobacter*. It was chosen to represent the carbapenem antibiotic class. Ertapenem is an HP-CIA and used in some countries to treat invasive Campylobacteriosis. However, the characteristics of *Campylobacter* with respect to ertapenem resistance are still not very well understood and there is currently a concerted program of work being undertaken to better understand these interactions.
- It should be noted that when using selective culture methods, the detection of ESBL-, AmpC- or carbapenemase-producing *E. coli,* colistin- and amikacin-resistant *E. coli,* is more sensitive than when using non-selective culture methods. This is likely because resistant bacteria represent a minority within the bacterial populations in the gut of food-producing animals, making it unlikely to randomly isolate them from non-selective agar plate. Therefore, while these selective methods enhance detection,

they do not provide a reliable estimate of the actual risk these bacteria may potentially pose to human or animal health.

Resistance data, clinical surveillance (including MIC testing of veterinary pathogens)

There are a number of limitations associated with the AMR data and they should be borne in mind when interpreting results from the veterinary clinical surveillance programme.

Clinical surveillance limitations:

- Samples arise from diagnostic submissions, which involve mostly diseased animals, and cannot be considered to accurately reflect AMR within the general animal population in the UK.
- Veterinary surgeons have the option to submit samples to private laboratories rather than Government laboratories/Veterinary Investigation Centres. The proportion of samples that Government laboratories test compared to other laboratories is not known, and therefore the extent to which the samples processed by APHA, SRUC Veterinary Services and AFBI are representative of total diagnostic submissions is not known.
- The geographical proximity of a farm or veterinary practice to a government diagnostic laboratory may have an impact on the submission rate of samples; clinical surveillance may therefore, naturally, over-represent the animal populations within certain geographical areas.
- Other factors can also influence the submission rate of samples to veterinary diagnostic laboratories. These can include the severity of disease, impact on production or the value of the animals involved.
- The clinical surveillance performed on chickens includes a range of types of bird (layers, broilers, breeders and others) as well as both commercial and backyard flocks. The occurrence of resistance can be influenced by a number of factors, including the types of chickens examined, degree of epidemic spread of resistant bacterial clones, the emergence, dissemination and transfer of resistance determinants between and amongst bacteria as well as by the selective pressure exerted by the use of antibiotics.
- The veterinary clinical surveillance data details the number of bacterial isolates that underwent sensitivity testing, but not the numbers of animals for which samples were submitted for examination. Several bacteria may have been cultured from an individual animal or from a group of animals on the same farm. This type of clustering is not accounted for in the report, although since only low numbers of bacteria are usually subjected to susceptibility testing from the same outbreak of disease, its importance is probably limited.
- The diagnostic tests performed on any sample received through the clinical surveillance programme are dependent on the individual case; that is to say, isolates of the same bacterial species are not always tested against the same

panel of antibiotics. Therefore, if resistance is not detected in one isolate, it may not mean that resistance is not present, but that it was not tested for. This is especially true of commensal organisms.

- The levels of resistance demonstrated by the clinical surveillance isolates presented in this report may be higher than those seen in the wider bacterial populations present within animals in England and Wales. This is because samples from diseased animals can include submissions from animals that have been unresponsive to initial antibiotic therapy, and thus the isolates recovered may have already been exposed to antibiotic pressure(s).
- APHA does not provide a veterinary diagnostic service for companion animals, with the exception of Salmonella isolated from dogs, which is now encompassed under the Zoonoses Order. Therefore, bacteria from these animal groups are under-represented in this report.
- With regards to *E. coli*, each organisation in the UK sets their own criteria for testing AMR in *E. coli* from clinically sick animals and these criteria are not uniform. For example, AMR testing on *E. coli* isolates in Northern Ireland is mainly performed if samples are coming from less than 2-week-old calves and animals with bovine mastitis. This is pertinent to highlight as the selection of isolates for susceptibility testing based on age or other criteria can influence the result obtained. Bacterial isolates recovered from young animals can often be more resistant than those from older animals and this relates to the fact that antibiotics are in general more frequently administered to young animals than to older animals.

Laboratory methodology:

- Criteria for the susceptibility testing of some veterinary pathogens are not well-established; this document presents the data which has been collected and acknowledges its limitations and shortcomings. Resistances of particular importance or significance are wherever possible subject to confirmatory testing. The disc diffusion test can be regarded as a screening test, enabling the rapid testing of large numbers of isolates in a cost-effective way and providing a timely result for veterinary surgeons which can assist them in the selection of appropriate antimicrobial chemotherapy.
- The clinical breakpoints (CBP) used for determining resistance for isolates undergoing disc diffusion, recovered under the veterinary clinical surveillance programme in GB, are those recommended by BSAC. These breakpoints were originally determined for human medicine and their use in veterinary medicine is based on the assumption that the concentration of antibiotic at the site of infection is approximately the same in animals as it is in humans. Currently it is not known if this assumption is always correct, especially as different dosing regimens may be used in different animals and pharmacokinetics may vary between species. Currently, there is insufficient data available to apply animal species specific breakpoints to all organism/antibiotic combinations where these are required.

- For antibiotic susceptibility testing done by disc diffusion by APHA, in the case of some veterinary drug-bug combinations a BSAC CBP value may not exist. In this case, APHA may have derived a tentative or suggested breakpoint or the historical veterinary breakpoint (zone size cut-off of resistant: ≤13 mm) may have been used to define resistance. The breakpoints used are set out in S4.4 of Supplementary Material 4.
- Different antibiotic susceptibility testing methodologies are used in England and Wales (APHA), Scotland (SRUC Veterinary Services), and Northern Ireland (AFBI). APHA use BSAC methodology to determine resistance/susceptibility based on human clinical breakpoints, whilst AFBI use CLSI. SRUC Veterinary Services are in the process of changing from BSAC methodology to EUCAST. Isolates from pigs and poultry in 2024 have been tested by SRUC Veterinary Services using EUCAST methodology and breakpoints, cattle and sheep isolates were tested using BSAC methodology. **In light of the different methodologies and breakpoints used, the amalgamated results of UK wide monitoring should be interpreted with caution.**
- The disc diffusion methodology used to date, for assessing susceptibility of veterinary pathogens from clinical surveillance, are limited in the availability of breakpoints for all relevant antibiotic and organism combinations. Assessing the susceptibility of veterinary pathogens by determination of the MIC using a standardised broth microdilution method provides a higher quality, internationally recognised output, which is comparable with other monitoring programmes.
- The breakpoints used for determining resistance for isolates undergoing broth microdilution to generate MIC values, recovered under the veterinary clinical surveillance programme in GB, are those recommended by CLSI. These veterinary-specific breakpoints have been established to decrease reliance on human breakpoints and continue to be developed and reviewed. In the case of some veterinary drug-bug combinations a CLSI veterinary CBP value may not exist. In this case in the first instance CA-SFM veterinary CBPs have been used, and if veterinary CBPs were not available, EUCAST human CBPs were used.

Private Laboratories Initiative (PLI):

- The Private Laboratories Initiative (PLI) is a collaborative project between the VMD and APHA. The purpose is to collect and analyse data from the private veterinary laboratories to supplement the AMR surveillance co-ordinated by the VMD. There are differences in the laboratory methods, antibiotic panels and interpretation criteria used by government and private laboratories so the data should be interpreted with caution. The methods used to determine antimicrobial susceptibility in this data are based on those in CLSI Vet01 July 2013.

Annex C: Sources for reporting of sales data

To enable calculation of sold quantities of active ingredient of antibiotics, data were supplied by:

Marketing Authorisation Holders (MAHs)
It is mandatory for Marketing Authorisation Holders of manufactured antibiotics to provide the Veterinary Medicines Directorate with total annual sales data for each antibiotic product sold within the UK. Data were collected, verified and analysed to calculate the total weight, in tonnes, of each active ingredient sold for each antibiotic. Antibiotic sales data are collected as a proxy for antibiotic use.

Periodic Safety Update Reports (PSURs)
Sales figures submitted by MAHs in PSURs, for the purpose of Pharmacovigilance, were used to validate sales data published in this report. Where a PSUR had been returned to the VMD Pharmacovigilance team in the 2019 calendar year, reported sales were compared to those returned to the AMR team and any discrepancies were queried.

To enable calculation of the Population Correction Unit, data were supplied by:

Defra Statistics Division
The live weights of animals slaughtered for food are calculated by Defra. The population numbers of food-producing animals were supplied by Defra via the 'Agriculture in the UK' report.

CEFAS
The annual live weight of fish at slaughter for the UK was supplied by CEFAS (Centre for Environment, Fisheries and Aquaculture Science).

TRACES
Import and export figures obtained from TRACES were provided by the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) project and used in the calculation of the PCU.

Annex D: Contributors

Contributing Pharmaceutical Companies and Other Marketing Authorisation Holders (compiled by the VMD):

- Alfamed
- Animalcare Limited
- aniMedica GmbH
- Bela-Pharm GmbH & Co. KG
- Bimeda Animal Health Ltd
- Boehringer Ingelheim Animal Health Ltd
- Ceva Animal Health Ltd
- Chanelle Animal Health Ltd
- Dechra Ltd
- Divasa Farmavic S.A.
- Dopharma Research B.V.
- ECO Animal Health
- Ecuphar N.V
- Elanco Europe Ltd
- Emdoka bvba
- Eurovet Animal Health B.V.
- Fatro S.P.A.
- Franklin Pharmaceuticals Ltd
- Global Vet Health S.L.
- Huvepharma N.V.
- Industrial Veterinaria S.A.
- Intervet International B.V.
- Kela N.V.
- Kernfarm B.V.
- Krka Dd
- Laboratorios Hipra S.A.
- Laboratorios Karizoo S.A.
- Laboratorios SYVA S.A.U
- Lavet Pharmaceuticals Ltd
- Le Vet B.V.
- Livisto Int.'I.S.L
- MSD Animal Health UK Limited
- Nextmune Italy S.R.L.
- Nimrod Veterinary Products Ltd
- Norbrook Laboratories Ltd
- Orion Corporation
- SP Veterinaria S.A.
- TVM UK
- Univet Ltd

- Vetcare Oy
- Vétoquinol UK Ltd
- Vetpharma Animal Health S.L.
- VetViva Richter GmbH
- Virbac S.A.
- VMD N.V.
- Zoetis UK Ltd