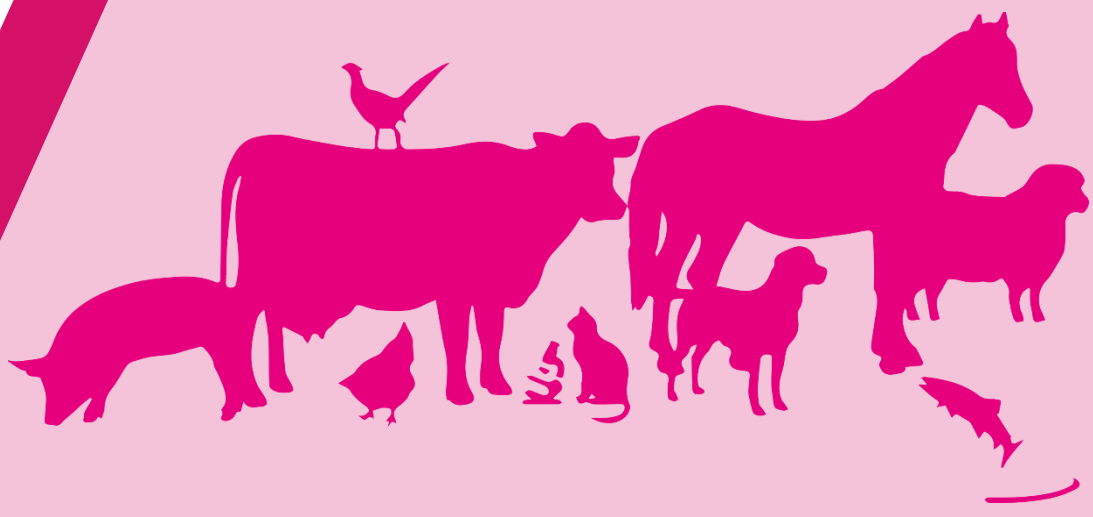
Veterinary
Medicines
Directorate

UK Veterinary Antibiotic Resistance and Sales Surveillance Report

UK-VARSS 2025

Published November 2026



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Authors

Veterinary Medicines Directorate (VMD):

- Dr Manal AbuOun
- Dr Judy Bettridge MRCVS
- Dr Fraser Broadfoot MRCVS
- Dr Tamsin Dewé MRCVS
- Dr Jennifer Dow
- Dr Kitty Healey MRCVS
- Dr Jibril Jibril
- Elizabeth Anderson
- Charlotte Bailey
- Getrude Kayeyia
- Edel Light
- Sannah Malik
- Aimee Morgan
- Shivi Rajendram

Animal and Plant Health Agency (APHA):

- Prof Muna Anjum
- Dr Sam Connelly
- Dr Nick Duggett
- Dr Catherine Fearnley
- Dr Alice Lampard MRCVS
- Prof Francesca Martelli MRCVS
- Dr John Rodgers
- Dr Chris Teale MRCVS

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Foreword

It gives me great pleasure to once again introduce our annual UK VARSS report, where we bring together trend data across the country on antimicrobial sales, use and resistance. The VARSS data gives us the opportunity to pick up changes in the way antibiotics are being used in animals, how this is reflected in resistance data from bacteria from these animals, and how the different data sets interact. We gain insights from these data for monitoring the effectiveness of our policy interventions. Often there are standout trends. This year, however, most of our key indicators have remained very similar to previous years.

For sales data in particular, this flat trend can be seen across total sales, and in the sales of highest priority critically important antibiotics (which remain extremely low). There are ups and downs in usage across the different sectors, but even here there are no great changes from last year, or emerging trends that are suggestive of a significant change in direction.

For antimicrobial resistance our primary indicator is full susceptibility in *E. coli* isolates from healthy pigs and poultry, sampled under the harmonised monitoring programme. The results for this parameter point towards a slight drop in full susceptibility compared with last year (when we saw a larger fall).

While there has been a slight increase in the percentage of multi drug resistant *E. coli* in the harmonised monitoring programme data, this parameter is still similar to the last few years of reporting and it is too early to say whether this is the start of a trend.

Usage data from pigs and meat poultry show that antibiotic use in these sectors has been staying broadly consistent or falling over recent years, so there are no clear usage trends over time that would give us cause for alarm regarding changing stewardship of antibiotics in these species.

While the top level indicators do not show dramatic changes this year, we have been continuing to work on filling surveillance gaps in sales, usage and resistance and there are some excellent examples of this work that we are delighted to share in this report.

We have expanded the level of reporting detail in areas of our clinical surveillance. One of these is for *Salmonella* surveillance, where we have separated out individual *Salmonella* serovars from different animal species, and presented resistance levels in a more granular way. This helps us to distinguish changes driven by particular serovars from broader trends. Another example is where we have broken down the levels of resistance in clinical *E. coli* isolates from cattle and sheep according to the age of the animal at the time of sampling. This has demonstrated marked differences in the susceptibility of *E. coli* from animals of different ages, which is clinically relevant information for prescribers.

We have continued our work on the Private Laboratories Initiative (PLI), in which we are working to broaden our coverage of clinical veterinary diagnostic sampling beyond the government scanning surveillance. We are collaborating with government and academic partners, and veterinary diagnostic laboratories to understand, assess and improve privately-held AMR data from livestock, fish, horses, dogs and cats. With 26 private veterinary laboratories now participating, this year's report includes, for the first time, verified resistance results for important clinical pathogens from dogs and cats – an important step towards improving our national understanding and capacity to detect emerging threats. Results this year covered four bacteria from cats and dogs: *E. coli, K. pneumoniae, S. aureus* and *S.*

pseudintermedius which are important in both animal health and in public health. This testing has highlighted potentially important resistance in clinical infections from dogs and cats, including multidrug resistance and resistance to critically important antibiotics.

The PLI is not the only area of focus on companion animals. The RUMA Companion animal and Equine group developed and published their own targets for antibiotic stewardship in cats and dogs for the first time in 2025, including ambitions to reduce national use of antibiotics in dogs and cats by 30%, and use of highest priority critically important antibiotics in cats by 50% from 2024 levels. We measure cat and dog antibiotic consumption trends via stratification of antibiotic sales data; these data already show reductions in use over time. The newly published targets will build on these reductions. Meanwhile, the British Equine Veterinary Association's leadership in the equine sector has concentrated on broadening and modernising its antimicrobial usage data collection, increasing its coverage and moving to a digital data platform under the MonitorME initiative.

Significant data gaps do, of course, remain. One of the most pressing of these is still ruminant antibiotic usage data. The cattle and sheep sectors have worked hard to develop the recently launched Ruminant Antibiotic Stewardship Roadmap. We very much welcome this drive to support improved engagement, action, and better antibiotic use data across dairy cattle, beef cattle, calf and sheep sectors.

Alongside all of this work we are moving ahead with a UK-wide survey of AMR in healthy prime beef cattle at slaughter in 2027, modelled on the harmonised monitoring protocols, and which will further our understanding of resistance in bacteria from cattle. The Healthy Cats and Dogs AMR surveillance project announced in summer 2025 is also progressing well in its work piloting AMR monitoring in healthy companion animals, contributing to our goal of building a more complete One Health picture of resistance across animal populations.

The data generated by all these government and stakeholder initiatives represents the tip of the iceberg of action on AMR in animals. When we review the sales, usage and AMR trends we are seeing the quality of veterinary prescribing practices, the standard of farming, the seriousness with which this issue is taken by food businesses, and the awareness of the issue by all animal owners – all these are reflected in the results in the VARSS report. This is why we continue to value so highly the work of the RUMA Targets Task Force as they deliver their third suite of voluntary targets for improving antimicrobial stewardship and reducing the AMR risk in farm animals, as well as the targets and voluntary initiatives mentioned above which have been developed by companion animal and equine sectors. It is only by placing actions in the hands of these groups that the culture around responsible stewardship of antibiotics is embedded and sustained.

Indeed, in the words of the British Equine Veterinary Association, their work on collecting antibiotic use data is "*more than a surveillance exercise. The long-term aim is to create a sustainable, profession-led stewardship resource that enables equine practices to use their own data to support continuous improvement*". It is by incorporating this kind of action on AMR into a wider programme and philosophy of good practice, and evolving standards, that we will meet the high ambitions that we have set ourselves.

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

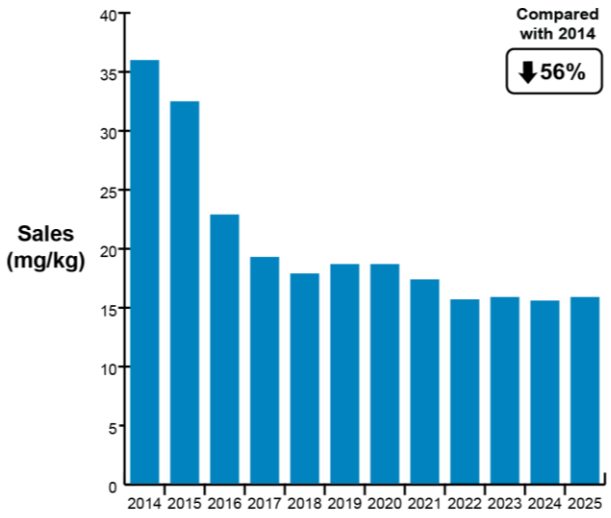
Antibiotic use and resistance 2014-2025

Key trends in antibiotic use and resistance since 2015

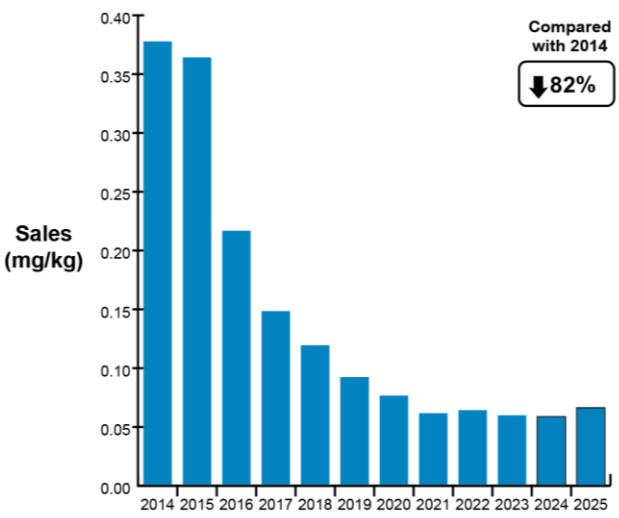
The UK-VARSS report brings together data on antibiotic sales, use and resistance. This allows us to show long term trends and acts as an early warning sign for emerging issues in antibiotic use and resistance.

Sales for food-producing animals (mg/kg)

Sales of antibiotics in food-producing animals 2014-2025

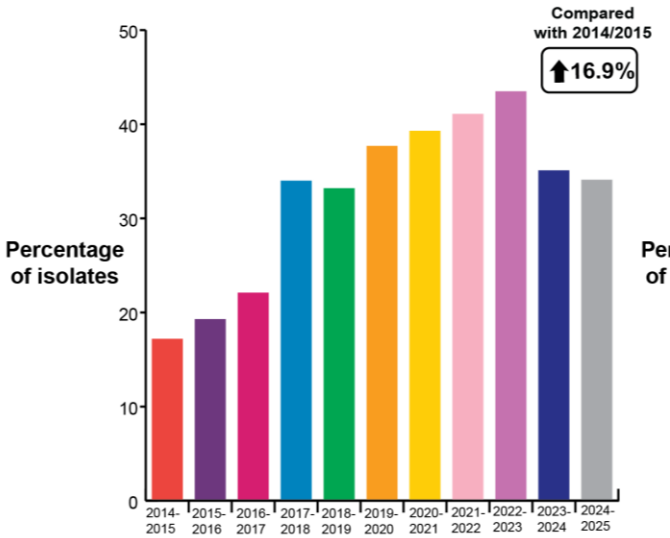


Sales of highest priority critically important antibiotics (HP-CIAs) in food-producing animals 2014-2025

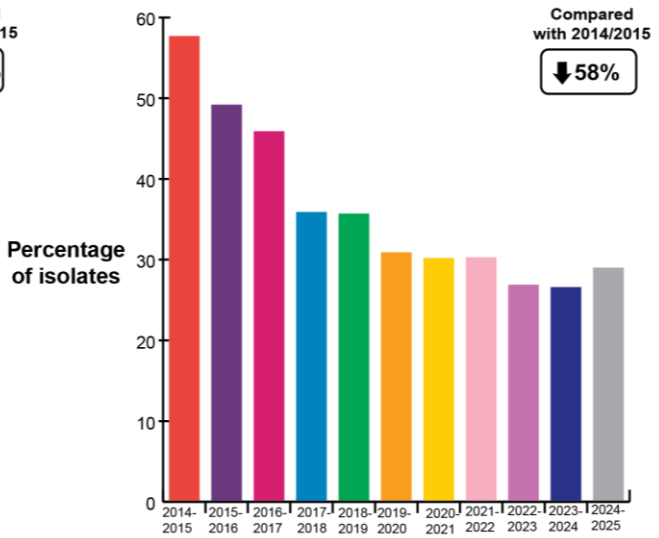


Resistance indicators for pigs and poultry

Percentage of fully susceptible *E. coli* isolates 2014-2025



Percentage of multi-drug resistant *E. coli* isolates 2014-2025

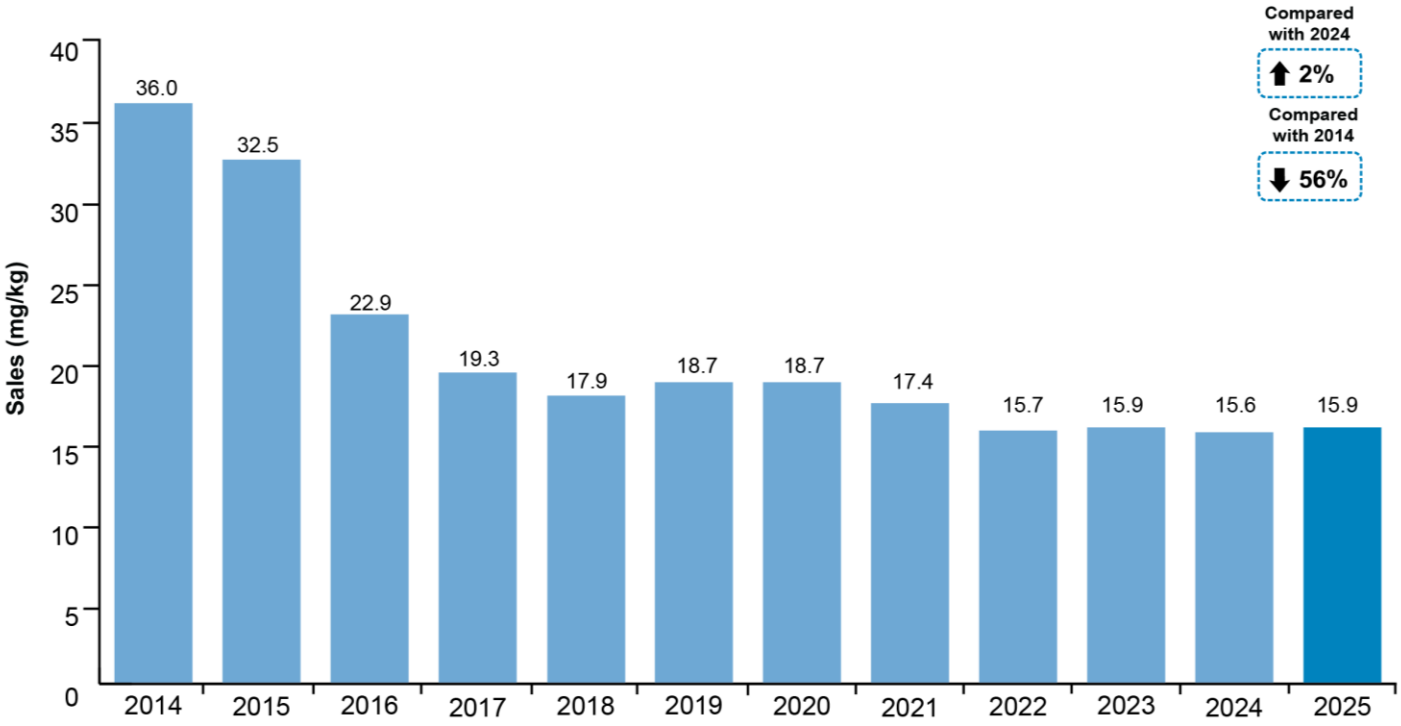


Indicators are an important tool for interpreting and comparing results of antibiotic use (AMU) and antimicrobial resistance (AMR) monitoring programmes.The indicators for sales and resistance are adjusted for population size. *E. coli* is the indicator organism for resistance. The outcome indicators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

Antibiotic sales

Sales for food-producing animals (mg/kg)

Sales of veterinary antibiotics for use in food-producing animals, adjusted for animal population, were 15.9 mg/kg in 2025. This represents a 2% (0.3 mg/kg) increase since 2024 and a 56% (20.2 mg/kg) decrease since 2014.



Over half of all antibiotics sold were either tetracyclines (33%) or penicillins (21%). Sales of highest priority critically important antibiotics (HP-CIAs) in food-producing animals remain at very low levels (0.07 mg/kg) and account for 0.4% of total sales in 2025.

	2014 (mg/kg)	2024 (mg/kg)	2025 (mg/kg)	Compared with 2014
Total HP-CIAs	0.38	0.06	0.07	⬇ 82%
Fluoroquinolones	0.20	0.05	0.06	⬇ 71%
3rd/4th generation cephalosporins	0.11	0.01	0.01	⬇ 93%
Colistin	0.07	0.00	0.00	⬇100%

Sales of antibiotics for all animals (tonnes)

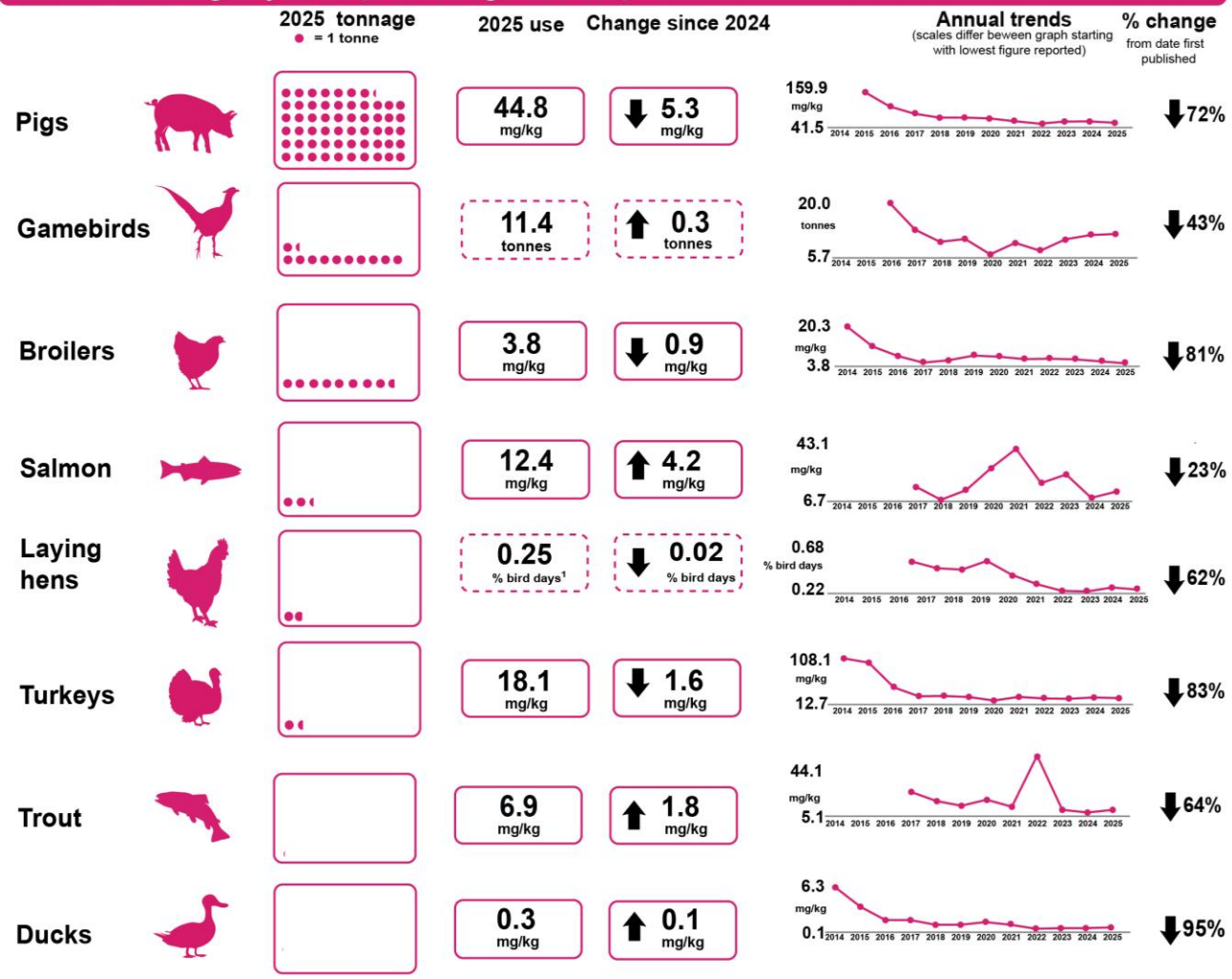
2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Compared with 2014
452	411	299	256	238	243	242	228	205	200	194	195	⬇ 56%

Total amount of HP-CIAs sold in 2025 was 0.83 tonnes representing an increase of 4% (0.03 tonnes) since 2024 and a decrease of 83% (3.9 tonnes) since 2014. Sales of HP-CIAs continue to represent a very small proportion (0.4%) of total veterinary antibiotic sales in tonnes.

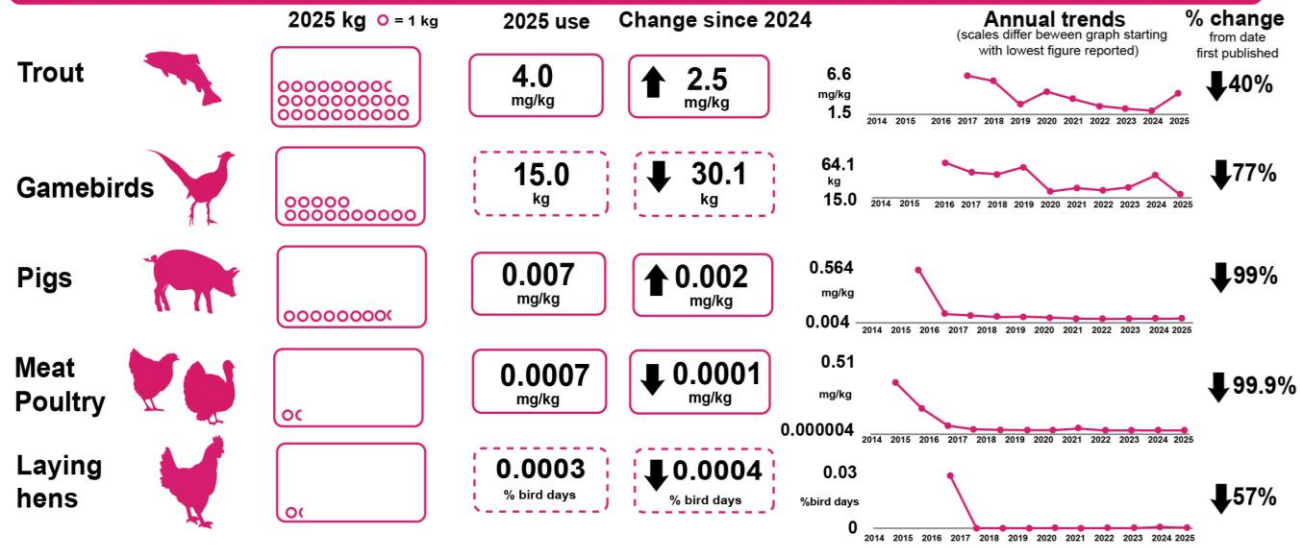
Antibiotic usage

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 83% for all sectors shown and calculated to represent the entire population.

Antibiotic usage by food-producing animal species



Highest priority critically important antibiotics by food-producing animal species



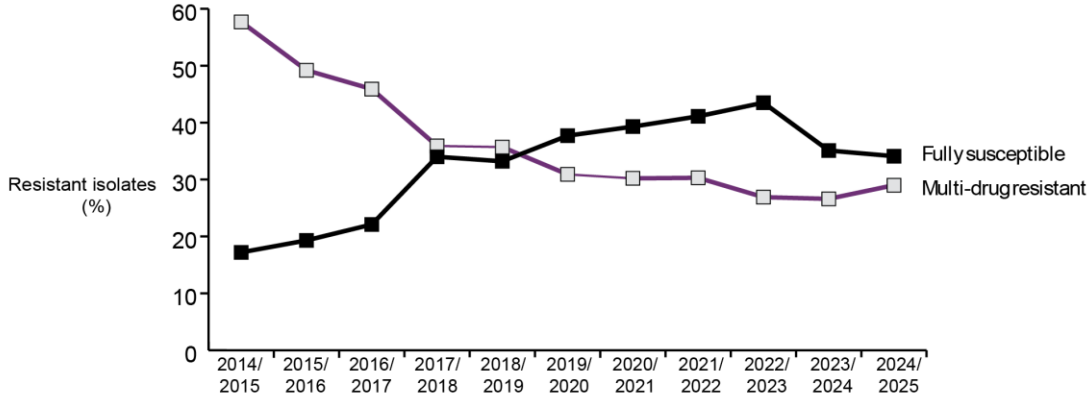
▬ ▬ ▬ indicates different metric for usage

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

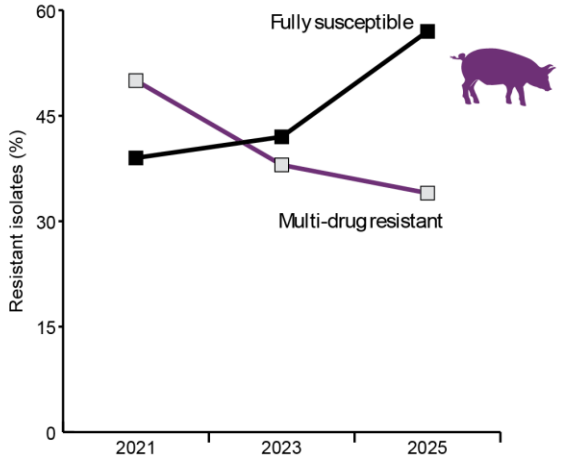
Key resistance outcome indicators: *E. coli*

The harmonised monitoring outcome indicators combine results from healthy pigs and poultry at slaughter to give an overall picture of AMR, and are internationally comparable. The percentage of *E. coli* with full susceptibility has remained at similar levels since its substantial decrease between 2023 and 2024. This is predominantly due to increased resistance in broilers in 2024 with a slight decrease in full susceptibility in pigs in 2025. Multi-drug resistance (MDR) has increased slightly by 2% in 2025, but remains significantly lower than in 2014/2015.



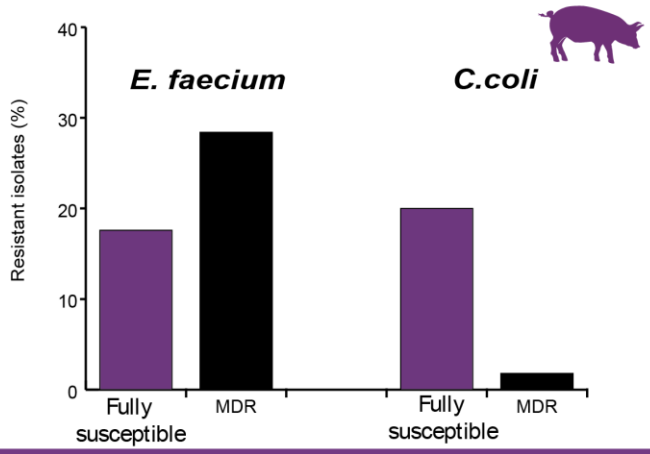
Resistance in *Salmonella*

Resistance in *Salmonella* in pigs showed the most notable improvement, with full susceptibility increasing to 57% in 2025. MDR continued to decrease and no resistance to HP-CIAs or human-only antibiotics were detected.



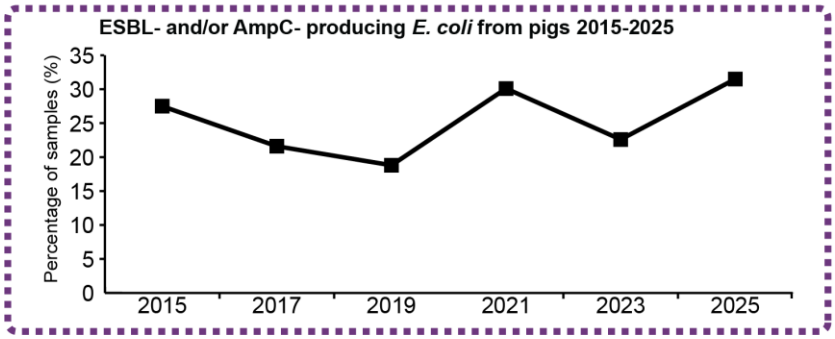
New surveillance

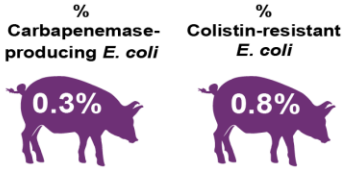
This is the second year enterococci and *C. coli* were tested in pigs. Resistance levels in both *E. faecium* and *C. coli* were similar to 2023, with 28% of *E. faecium* and 1.8% of *C. coli* being MDR. Vancomycin resistance was detected in *E. faecium* for the first time.



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. Carriage of ESBL-/AmpC-producing *E. coli* increased from 23% in pigs in 2023 to 32% in 2025. More than a third of these isolates were resistant to both third- and fourth- generation cephalosporins and fluoroquinolone antibiotics.





Antibiotic resistance - clinical surveillance

Clinical surveillance is a programme of passive surveillance that evaluates AMR in bacteria isolated from diagnostic samples, including those with 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

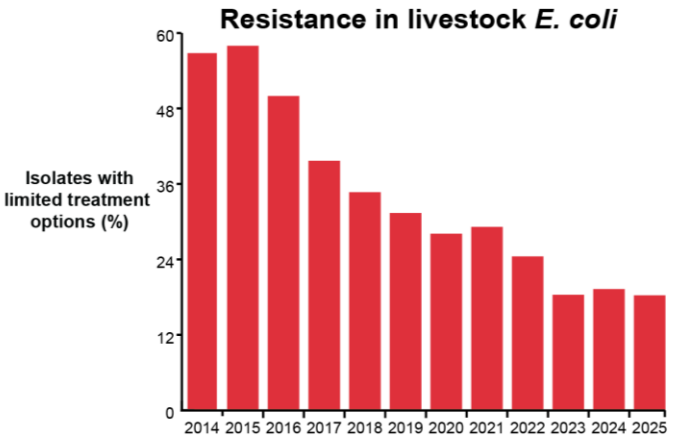
7,866 isolates were tested for AMR in England and Wales in 2025. Of these, 4,929 were *Salmonella* and 1,837 were *Escherichia coli*. Major sources of isolates included: poultry (26%), cattle (16%), pigs (15%), dogs (10%), sheep (8.9%) and feed (15%).

Percentage of *E. coli* in livestock with limited treatment options

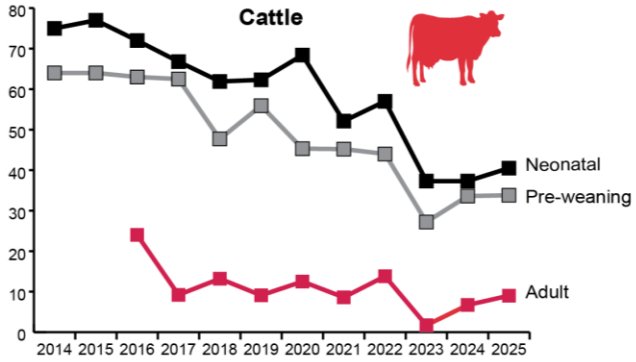
In 2025, 18% of all livestock *E. coli* isolates had limited treatment options (resistance to four or more antibiotics). This is a 68% reduction compared with 2014.

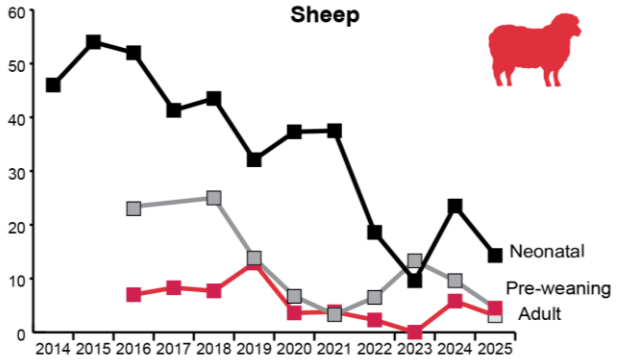
Higher resistance was observed in *E. coli* isolates from young animals than from adults.For lambs and calves, neonatal animals have the highest percentage of isolates with limited treatment options, whilst post-weaning pigs have higher resistance than neonates.

The percentage of *E. coli* with limited treatment options has declined substantially in young pigs, cattle and sheep since 2014.



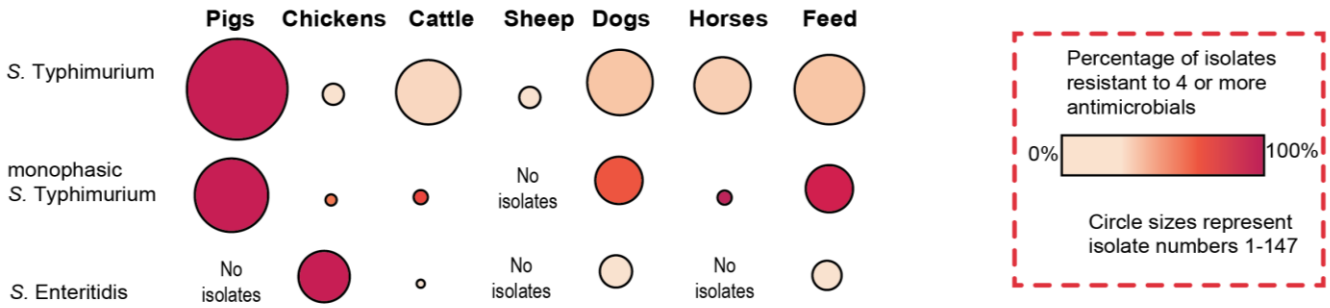
Limited treatment options (%) by age group





Resistance in *Salmonella*

Certain *Salmonella* serovars are regulated, due to public health concerns, and there are differences in resistance profiles between serovars as well as animal species. Monophasic *S.* Typhimurium isolates from pigs and feed, including raw pet food, had significantly higher levels of limited treatment options compared to all other sources.



Private Laboratories Initiative (PLI)

The PLI was established to help improve the sharing of AMR data held by private veterinary laboratories with government. This year, for the first time, the VARSS report includes verified data from cats and dogs provided by the University of Liverpool. Testing in dogs and cats covered four bacteria: *E. coli*, *K. pneumoniae*, *S. aureus* and *S. pseudintermedius*.

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 2025 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 2025, 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.

Some of the VARSS data is presented in an interactive data dashboard, allowing users to interrogate data on antibiotic sales and key AMR indicators from 2014-2025. Sales, usage, and resistance data presented in the report are also available in a downloadable spreadsheet format, 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, dihydrostreptomycin, 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: 4th generation cephalosporins	Cefquinome	
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, polymyxin B	
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

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).

Sales data provide the best available approximation of the quantity of antibiotics administered to all animal species in the UK. However, they do not include special imports, and medicines sold in one year may be used in a later year, or may not be used at all. Further information on special imports is provided in Section 1.2.1. Commentary is included throughout this chapter where sales do not align with anticipated use.

The EU has introduced a revised animal-biomass denominator for normalising antibiotic sales and use in food-producing animals. To support harmonisation with European reporting, this report applies the revised indicator retrospectively across the time series and refers to it as mg/kg. Results calculated using the former Population Correction Unit (PCU) denominator are identified as mg/PCU. Although the absolute values differ between the two indicators, the overall trends over time are similar. For further information on these metrics, please refer to the Veterinary Antimicrobial Resistance and Sales Surveillance 2024 Report.

For ease of reading, the data have generally been rounded to one decimal place, although additional decimal places are shown for very small values. The raw data and further detail about the methodology used can be found in S1.1 of Supplementary Material 1.

1.2 Summary

UK sales of veterinary antibiotics for food-producing animals in 2025 were 15.9 mg/kg (27.7 mg/PCU). This represents an increase of 2% since 2024 and a 56% decrease since 2014. Sales of Highest Priority Critically Important Antibiotics (HP-CIAs) for food-producing animals remain very low at 0.07 mg/kg, a reduction of 82% since 2014 and accounting for less than 0.5% of total antibiotic sales. This represents a small increase of 0.008 mg/kg since 2024.

The overall quantity of antibiotics sold for all animals (which includes both livestock and companion animals) was 195 tonnes, an increase of 0.6% since 2024 and a 57% decrease since 2014. In 2025, sales of HP-CIAs for all animals were 0.83 tonnes, representing a slight increase of 0.03 tonnes since 2024 and a decrease of 83% since 2014. For the fifth year in a row, no colistin was sold for use in animals.

1.2.1 Special Import Scheme

Veterinary medicines are authorised for specific conditions and target species, based on assessed data, and are authorised either for Great Britain (GB), Northern Ireland (NI) or UK wide use. When there is no veterinary medicine authorised in the territory where the animal is being treated for the specific indication or condition, veterinary surgeons may prescribe under the cascade on a case-by-case basis to avoid unacceptable suffering. This may include the use of an alternative authorised veterinary medicine for a different indication or species, or, where no suitable authorised product is available, the importation of a veterinary medicine authorised outside the UK. In order to do this, a Special Import Certificate from the VMD is required (see S1.5 Supplementary Material 1 for further details).

Antibiotic use datasets for pigs, meat poultry, laying hens, gamebirds, salmon and trout cover at least 83% of each sector and include products imported under the Special Import Scheme (see Chapter 2). **Table 1.1** shows the amount of active ingredient imported through the Special Import Scheme reported by these sectors, alongside the mg/kg that this would represent if it was added to the sales data. Where use data is not available for an animal species or sector (e.g. dogs and cats) or where there is low coverage (e.g. horses and ruminants), it is not currently possible to reliably estimate the levels of antibiotics used in those sectors through the Special Import Scheme. This is a key data gap and highlights the importance of collecting antibiotic use data.

Table 1.1 Active ingredient reported as used under the Special Import Scheme by sectors with high-coverage use data, and the corresponding contribution to the UK food-producing animal sales indicator, 2020 to 2025.

	2020	2021	2022	2023	2024	2025
Active ingredient (tonnes)	2.2	1.6	1.1	5.3	9.6	10.6
Mg/kg	0.2	0.1	0.1	0.4	0.8	0.9

A trimethoprim-sulfonamide premix for pigs accounted for 62% of the special import use reported by these sectors in 2025 and was the main driver of the increase between 2022 and 2025, following discontinuation of the equivalent UK-authorised product.

1.3 Results

1.3.1 Harmonised outcome indicators for antibiotic use

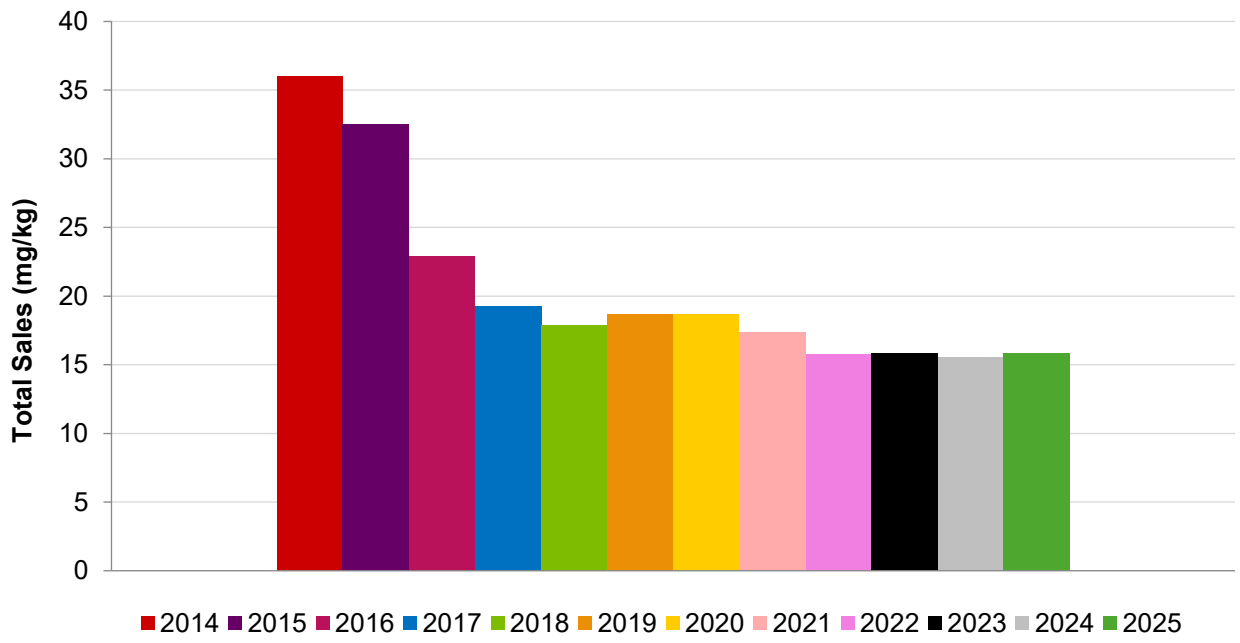
Harmonised indicators support consistent monitoring of trends and comparisons between regions and countries. A number of different indicators for monitoring antibiotic sales in animals have been developed globally and regionally (see S1.1 of Supplementary Material 1 for more detail). For consistency 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 and the mg/kg metric for food-producing animals was implemented in 2023.

The primary indicator is the “overall sales of veterinary antibiotics in milligram of active substance per kilogram of animal biomass (mg/kg)” for food-producing animals (for the purposes of this definition, food-producing animals include livestock and horses). Secondary indicators are the sales in mg/kg of third- and fourth- generation cephalosporins, quinolones (and percentage of fluoroquinolones) and polymyxins, which measure 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

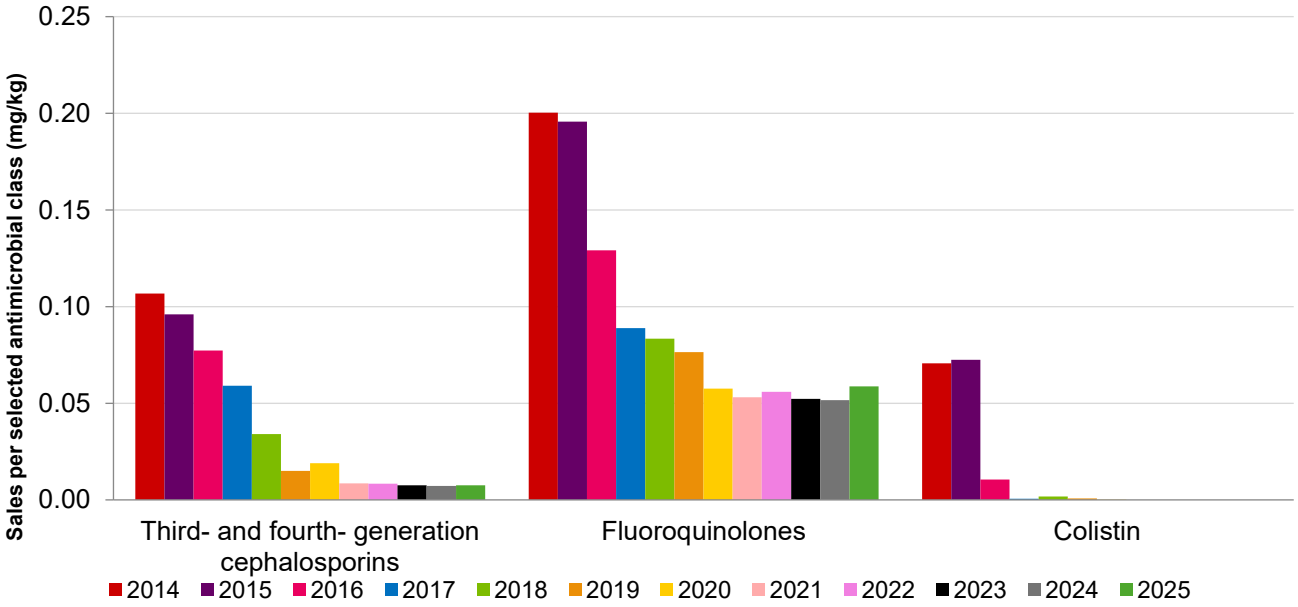
food-producing animals, but has not been used in the last five years. Both primary and secondary indicators have shown a decreasing trend since 2014 (**Figure 1.1**).

Figure 1.1: Harmonised outcome indicators for antibiotic consumption in food-producing animal species in the UK: primary indicator (A) and secondary indicators (B), 2014 to 2025.

(A)



(B)

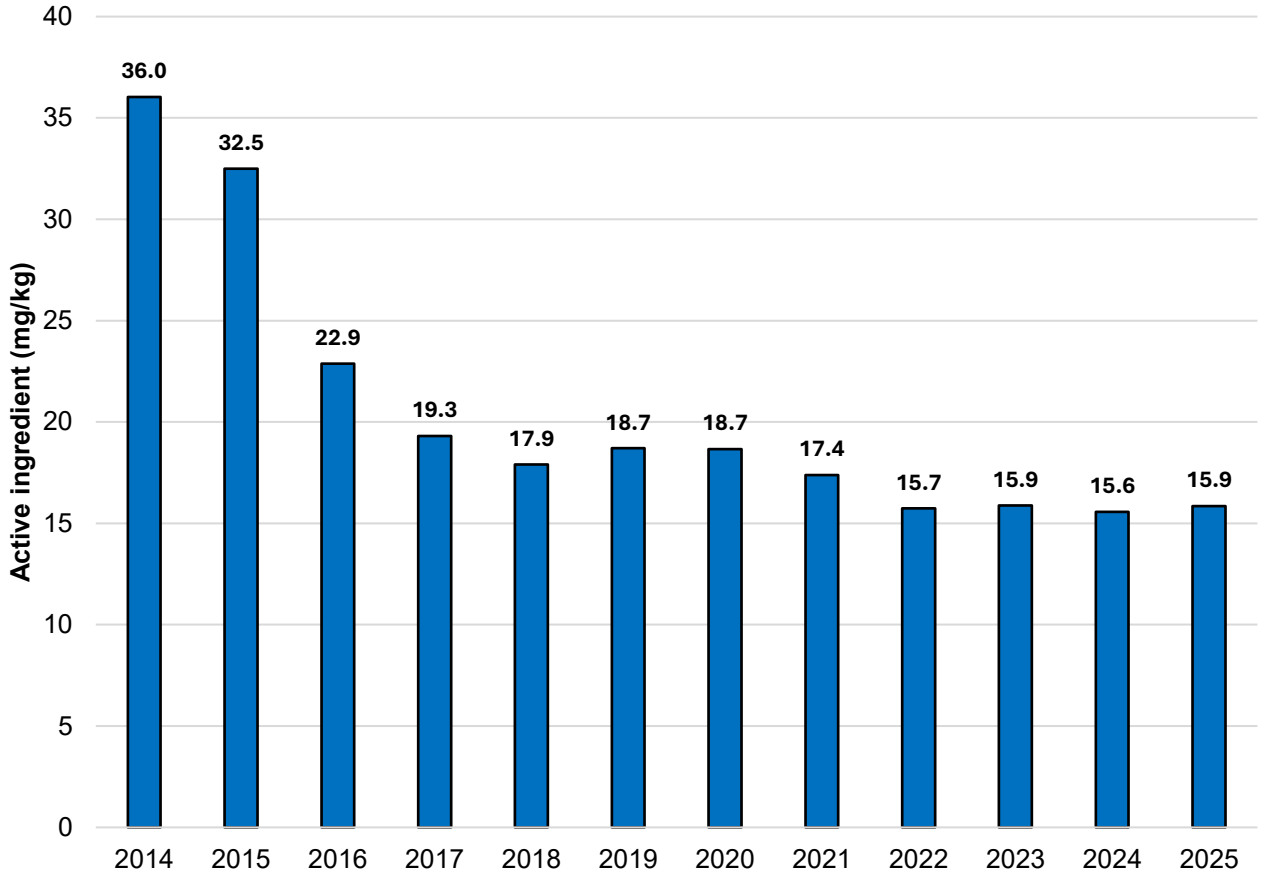


1.3.2 Sales of antibiotics for food-producing animal species (mg/kg)

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

Antibiotic sales for food-producing animal species in 2025 were 15.9 mg/kg (27.7 mg/PCU), which is a small increase of 2% since 2024. This represents a reduction of 56% (20.2 mg/kg) since 2014 (**Figure 1.2**).

Figure 1.2: Antibiotic active ingredient sold for use in food-producing animals adjusted for population in mg/kg, 2014 to 2025.



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

The top five antibiotic classes sold in 2025 for food-producing animals as a percentage of total sales were tetracyclines (33%), penicillins (21%), aminoglycosides (13%), macrolides (10%), and trimethoprim-sulfonamides (9%) (**Figure 1.3**).

Tetracycline sales increased by 10% (0.46 mg/kg) between 2024 and 2025, despite being 65% (9.7 mg/kg) lower than in 2014. The increase mainly related to a premix product authorised for pigs and poultry. This was not reflected in sector use data and, following investigation, was attributed mainly to stock entering wholesalers in 2025 for use in subsequent years.

Conversely, sales of penicillins decreased between 2024 and 2025, by 18% (0.75 mg/kg). This primarily relates to products formulated as oral powders and authorised for use in pigs

and poultry. Since 2014, the sales of penicillins (over 80% of which are either for oral/water or injectable use) have reduced by 49% (3.2 mg/kg).

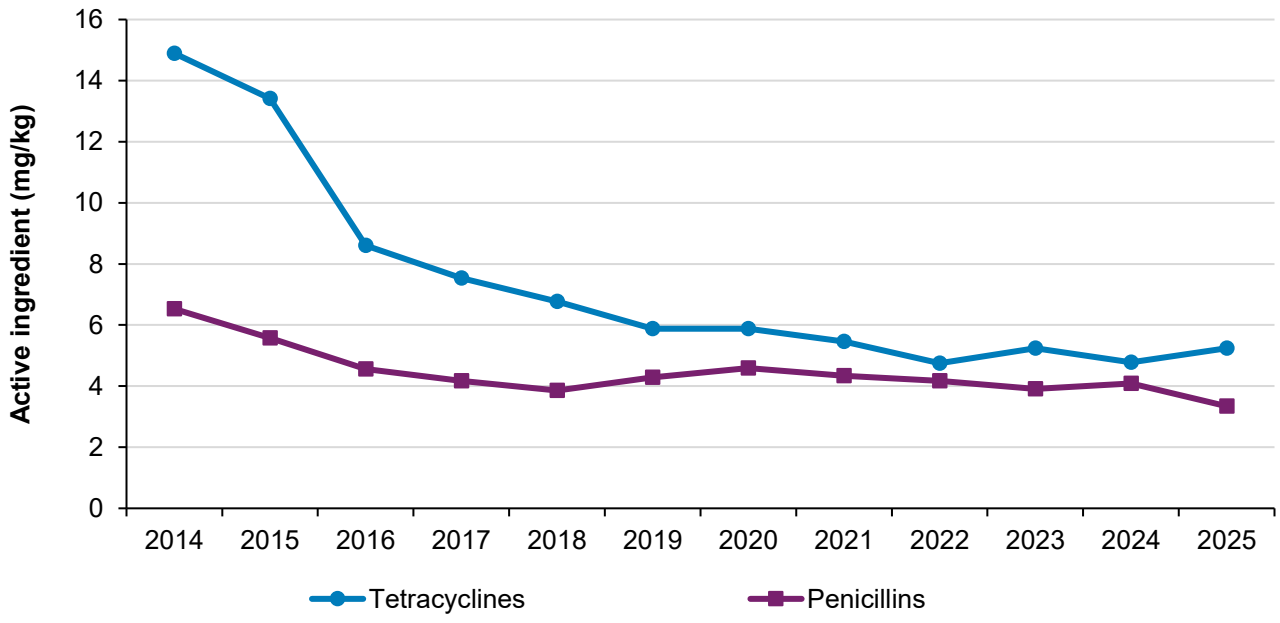
Between 2024 and 2025, aminoglycoside sales increased by 28% (0.46 mg/kg), returning to approximately the level recorded in 2014 (**Figure 1.3 B**). This has been driven by an increase in the sales of an oral powder product authorised for use in cattle, poultry and pigs between 2024 and 2025.

Macrolide sales increased slightly, by 3% (0.04 mg/kg), between 2024 and 2025, but remained 61% (2.5 mg/kg) lower than in 2014. The increase between 2024 and 2025 relates to an increase in sales of 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.

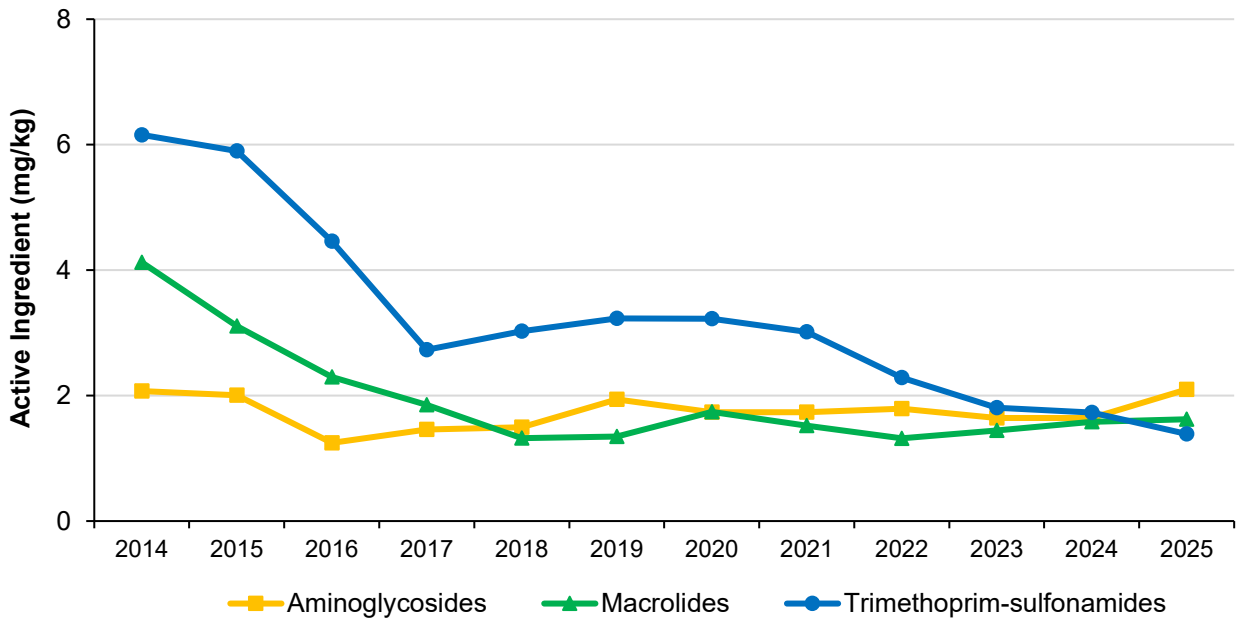
As described in chapter 2, the increases in aminoglycoside oral powder and macrolide oral solutions were not reflected in the available use data for pigs, poultry, gamebirds or dairy cattle. This may reflect products entering the supply chain in 2025 for use in subsequent years, or use occurring in animal populations not fully captured by current antibiotic use datasets. As described in section 2.3.6, no beef data were available in 2025 and dairy coverage was 49%. In addition, although coverage is high for pigs (98%), meat poultry (83%), laying hens (estimated 90%) and gamebirds (estimated 80% for soluble products), it is not complete and use patterns may differ in the populations not represented within the data.

Figure 1.3: Sales of (A) the top highest-selling antibiotic classes and (B) the other three of the five highest-selling classes for food-producing animals (mg/kg), 2014 to 2025. Note: different scales are used in panels A and B.

A)



B)

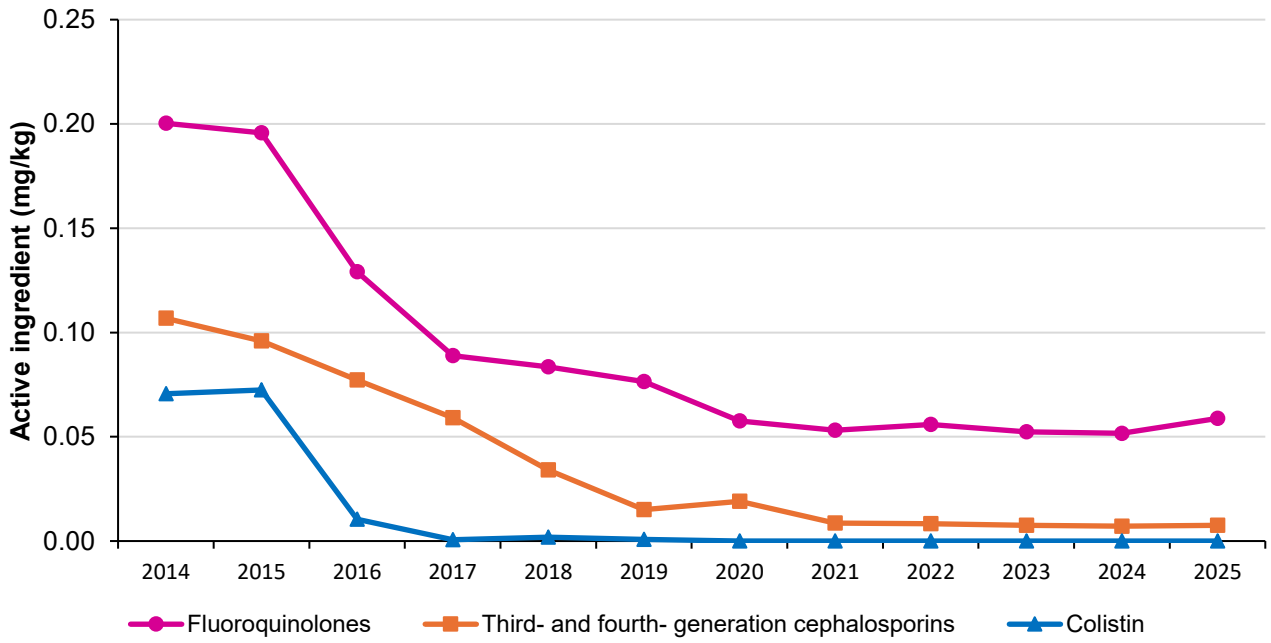


Sales of HP-CIAs for food-producing animals are shown in **Figure 1.4**. Sales remained very low, at 0.07 mg/kg. This was an increase of 0.008 mg/kg since 2024 but an 82% (0.3 mg/kg) decrease since 2014. This increase relates to an increase in fluoroquinolone sales, in particular for a fluoroquinolone oral solution product authorised for use in chickens. In 2025, HP-CIAs accounted for 0.4% of the total antibiotic sales for food-producing animals.

In 2025, fluoroquinolones accounted for the majority (89%) of the HP-CIAs sold for use in food-producing animals, with the remaining being third- or fourth- generation cephalosporins. For the fifth year in a row, no colistin was sold in the UK for use in animals.

The increase in sales of a fluoroquinolone oral solution authorised for chickens was not reflected in the available use data for broilers, laying hens or gamebirds. This may reflect products entering the supply chain in 2025 for use in subsequent years, or use occurring in animal populations not fully captured by current antibiotic use datasets. As described in section 2.1.2, although coverage is high for meat poultry (83%), laying hens (estimated 90%) and gamebirds (estimated 80% for soluble products), it is not complete and use patterns may differ in the populations not represented within the data.

Figure 1.4: Active ingredient adjusted for population (mg/kg) of HP-CIAs sold for use in food-producing animals, 2014 to 2025.



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

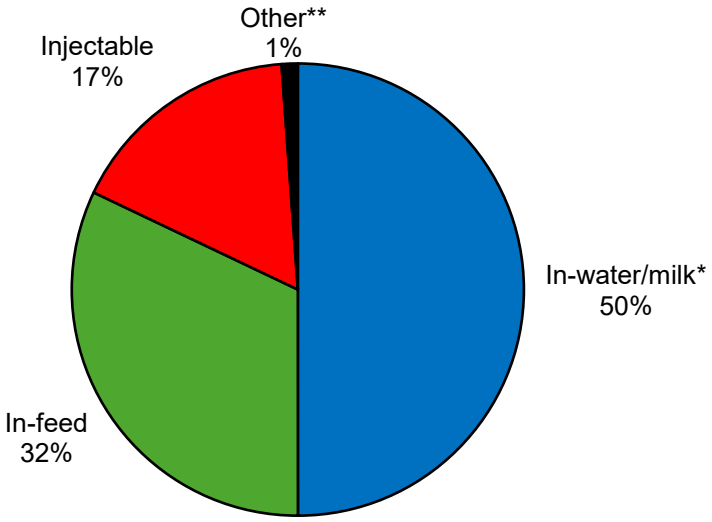
In 2025, 50% of antibiotics sold for food-producing animals were products formulated to mix into drinking water for livestock, or into milk for youngstock cattle (in-water/milk administration). Almost one-third (32%) was for in-feed use, and 17% for injectable use (**Figure 1.5**). In-water/milk product sales decreased by 4% since 2024 and have exceeded in-feed sales for the seventh year running. In-feed sales have increased notably (20%) since 2024 but have still decreased by 77% (17 mg/kg) since 2014 (**Figure 1.6**). The long-term trend away from in-feed antibiotics towards in-water/milk antibiotics is consistent with stewardship measures implemented by 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 feed mill 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.

The increase in in-feed sales between 2024 and 2025 relates to products containing tetracyclines, authorised for the pig and poultry sectors. However, although these products were ‘sold’ into the UK market, use data from the pig sector show reduced use between 2024 and 2025. As mentioned previously, further investigation has found that this relates to commercial factors with product sold into wholesalers in 2025 that will not be used until subsequent years.

Sales data do not include antibiotics imported under the Special Import Scheme, as described in Section 1.2.1. However, sector- and species-specific use datasets capture

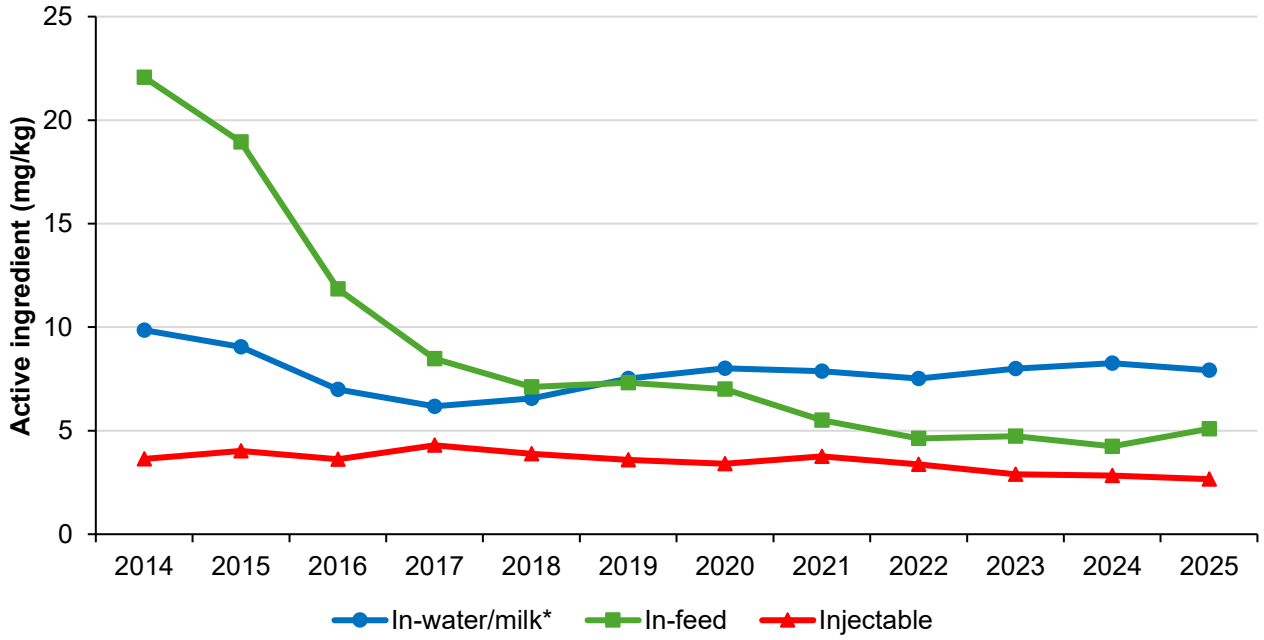
some imported products, which are discussed in Chapter 2. In 2025, substantial quantities of a trimethoprim-sulfonamide premix were imported for use in pigs following discontinuation of the equivalent UK-authorised product. Intermittent availability problems affecting an injectable penicillin-streptomycin product authorised for cattle, pigs, sheep and horses also resulted in imports of an equivalent product, which may partly explain the reduction in injectable sales.

Figure 1.5: Antibiotic active ingredient sold for use in food-producing animals by route of administration (% weight), 2025



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

Figure 1.6: Active ingredient (mg/kg) of antibiotics by main routes of administration sold for use in food-producing animals, 2014 to 2025.



*Includes oral powders and oral solutions

1.3.5 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 1.7**. DCDvet represents the estimated number of treatment courses per dairy cow per year, using standard course doses of four tubes for dry-cow treatment and three tubes for lactating-cow treatment.

In 2025, dry cow intramammary sales were 0.45 DCDvet, a reduction of 10% (0.05 DCDvet) since 2024 and 28% (0.17 DCDvet) since 2014. Sales of lactating cow intramammary antibiotic products were lower at 0.28 DCDvet, a reduction of 22% (0.08 DCDvet) since 2024 and 69% (0.61 DCDvet) since 2014.

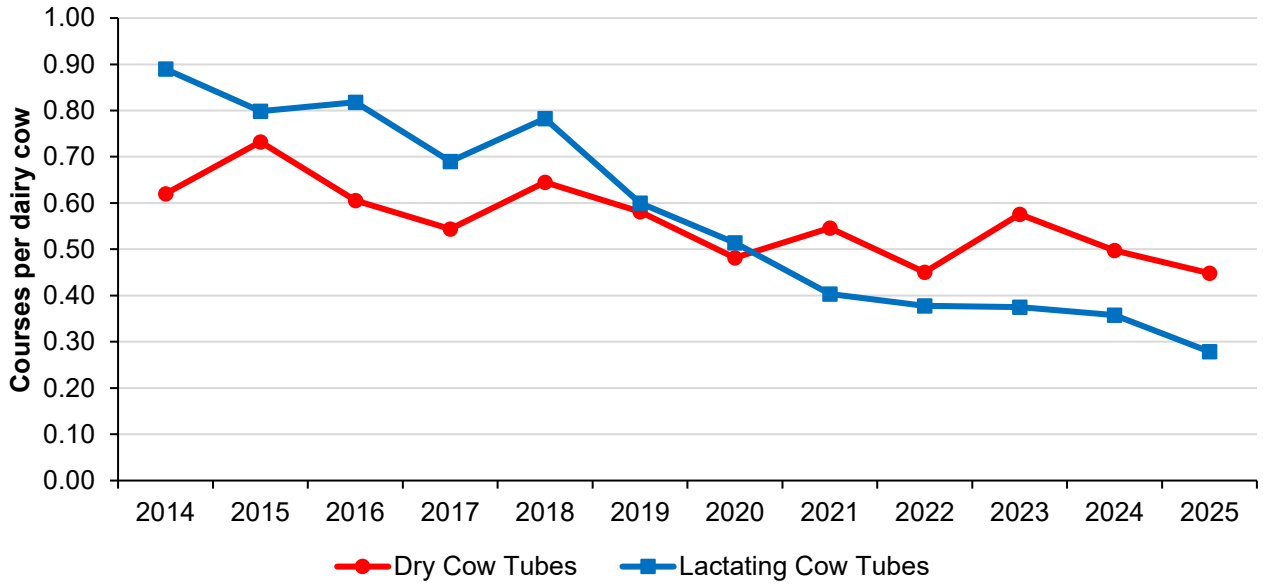
The reduction in the sales of dry cow tubes is encouraging, although the rate of reduction is slower than for lactating cow tubes. This is despite the industry focus away from blanket dry cow therapy, i.e. where all dairy cattle in a group are administered prophylactic antibiotics at drying off without an individual risk assessment, towards selective dry cow therapy, where antibiotic use is based on an individual risk assessment. As noted in last year's report, 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 remain very low (0.013 DCDvet) in 2025, an increase of 0.005 DCDvet since 2024 and a reduction of 96% (0.35 DCDvet) since 2014 (**Figure 1.7 B**). No sales of HP-CIA intramammary dry cow products occurred in 2025 for the second year running.

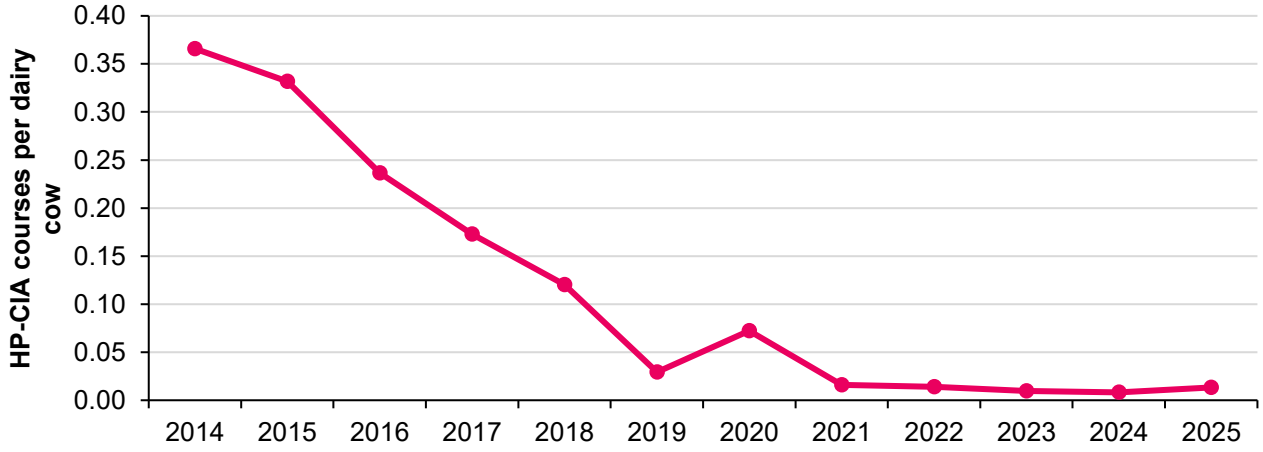
As described in section 1.2.1, if the available products are considered clinically unsuitable by the veterinary surgeon, alternative products authorised outside the UK can be imported on a case-by-case basis under the Special Import Scheme. These products are not captured in the sales data, although their use is captured and discussed further in Chapter 2, highlighting the importance of reliable use data. In the antibiotic use data, imported products have accounted for around 10% of the total intramammary lactating cow tubes used since 2022, due to an equivalent lactating cow product being discontinued in the UK.

Figure 1.7: Sales of (A) dry-cow and lactating-cow intramammary products and (B) HP-CIA intramammary products, expressed as courses per dairy cow, 2014 to 2025. Note: different scales are used in each panel.

(A)



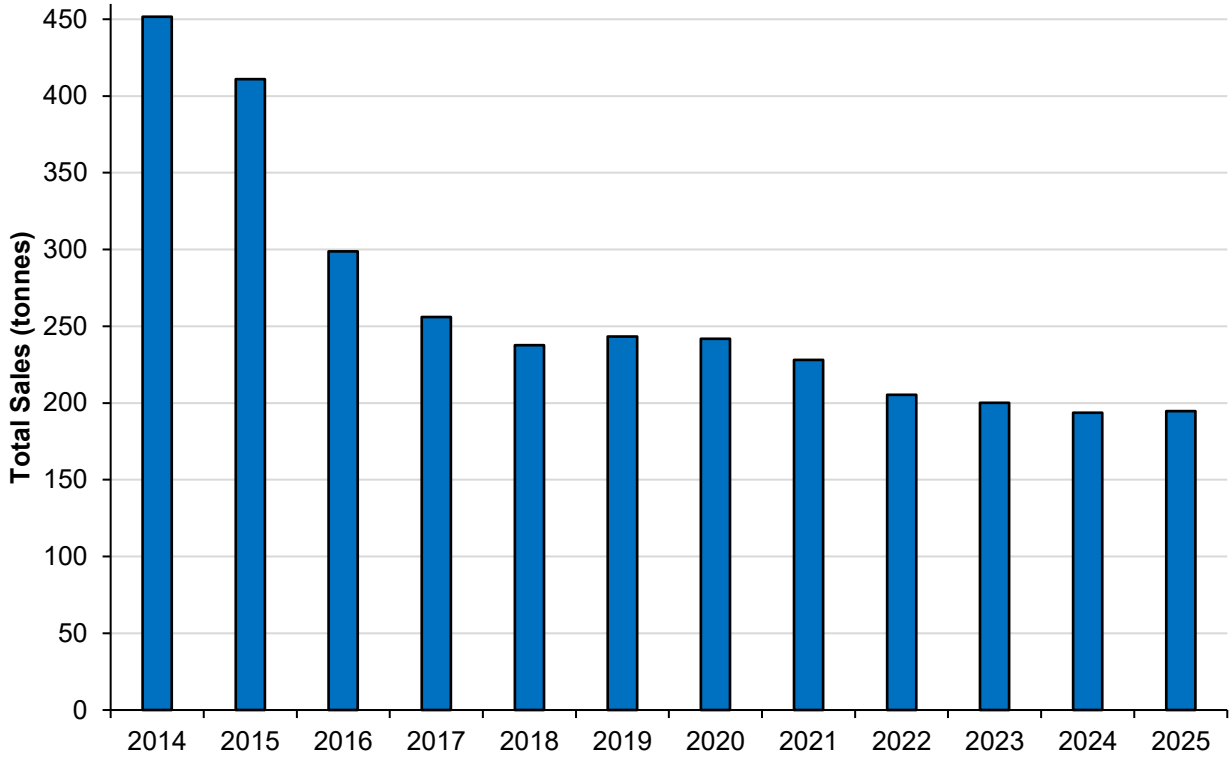
(B)



1.3.6 Total sales of antibiotics for all animals (tonnes)

Total sales of antibiotics for all animals (livestock and companion animals) are measured in total weight of active ingredient (tonnes). Results are shown in **Figure 1.8**. The total quantity of antibiotic active ingredient sold in 2025 was 195 tonnes, which is a 0.6% (1.2 tonnes) increase since 2024 and 57% (257 tonnes) decrease since 2014.

Figure 1.8: Active ingredient (tonnes) of antibiotics sold for use in all animals, 2014 to 2025.



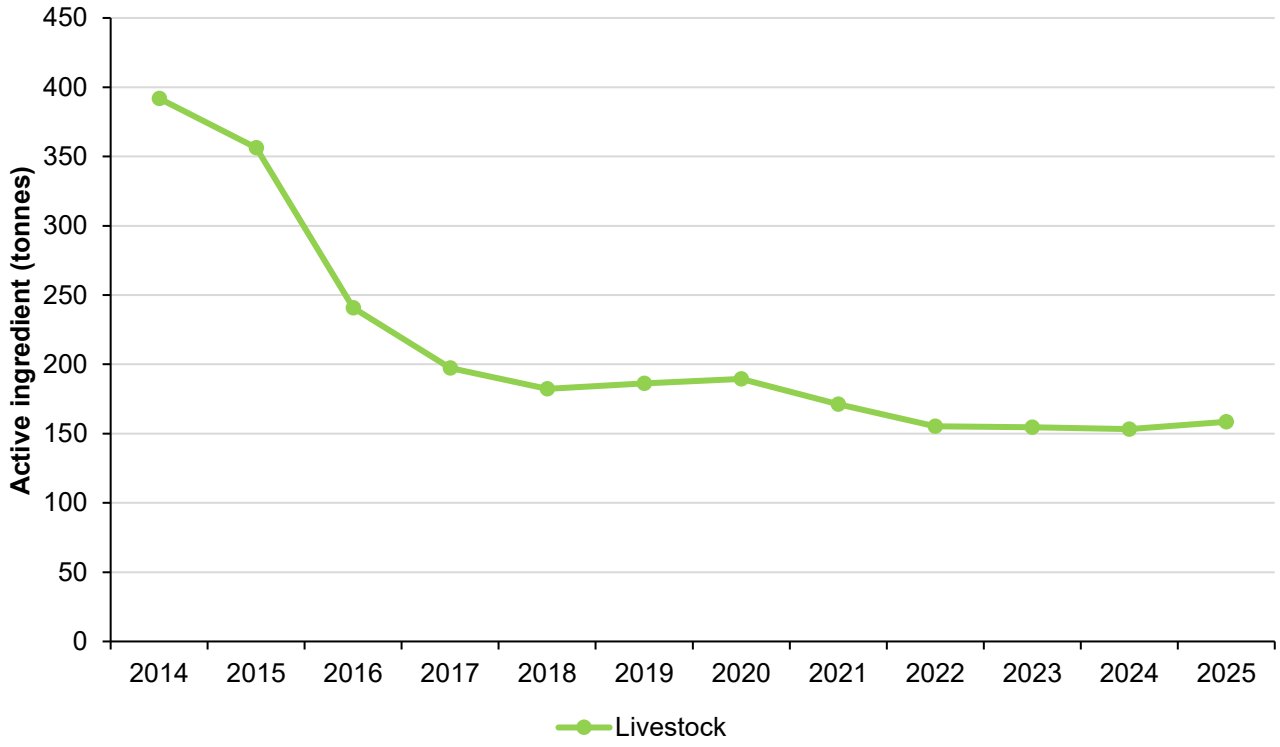
1.3.6.1 Total sales of antibiotics by species (tonnes)

Veterinary antibiotics can be authorised for use in one or multiple species. Some products are authorised for livestock only, some for companion animals only (dogs, cats and horses), and others for a combination of both livestock and companion animals.

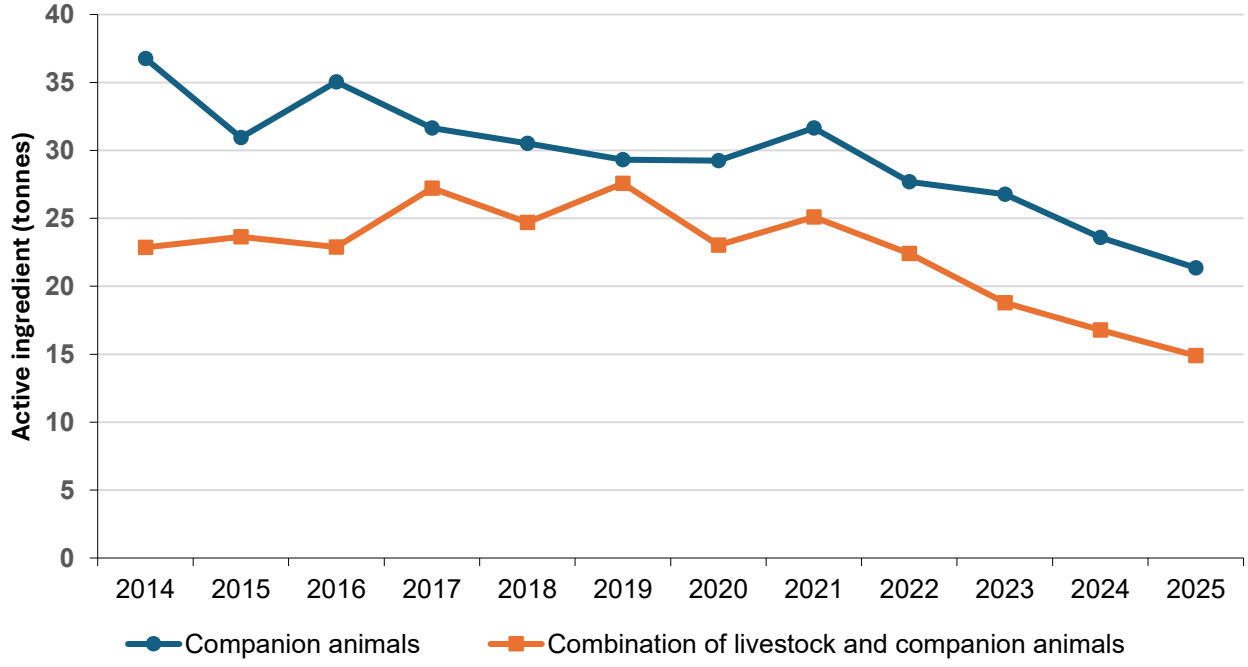
In 2025, 81% of total antibiotics sold were attributed to products authorised for livestock only, 11% for companion animals only and 8% for both livestock and companion animals. Livestock only products increased by 3% (5 tonnes) since 2024 whereas those authorised for companion animals only and companion animals and livestock reduced by 9% (2.2 tonnes) and 11% (1.9 tonnes) respectively. The companion animals and livestock category comprised 99% injectable products (**Figure 1.9**).

Figure 1.9: Active ingredient (tonnes) in antibiotics sold for (A) livestock only and (B) companion animals only or both livestock and companion animals, 2014 to 2025. Note: different scales are used in each panel.

(A)



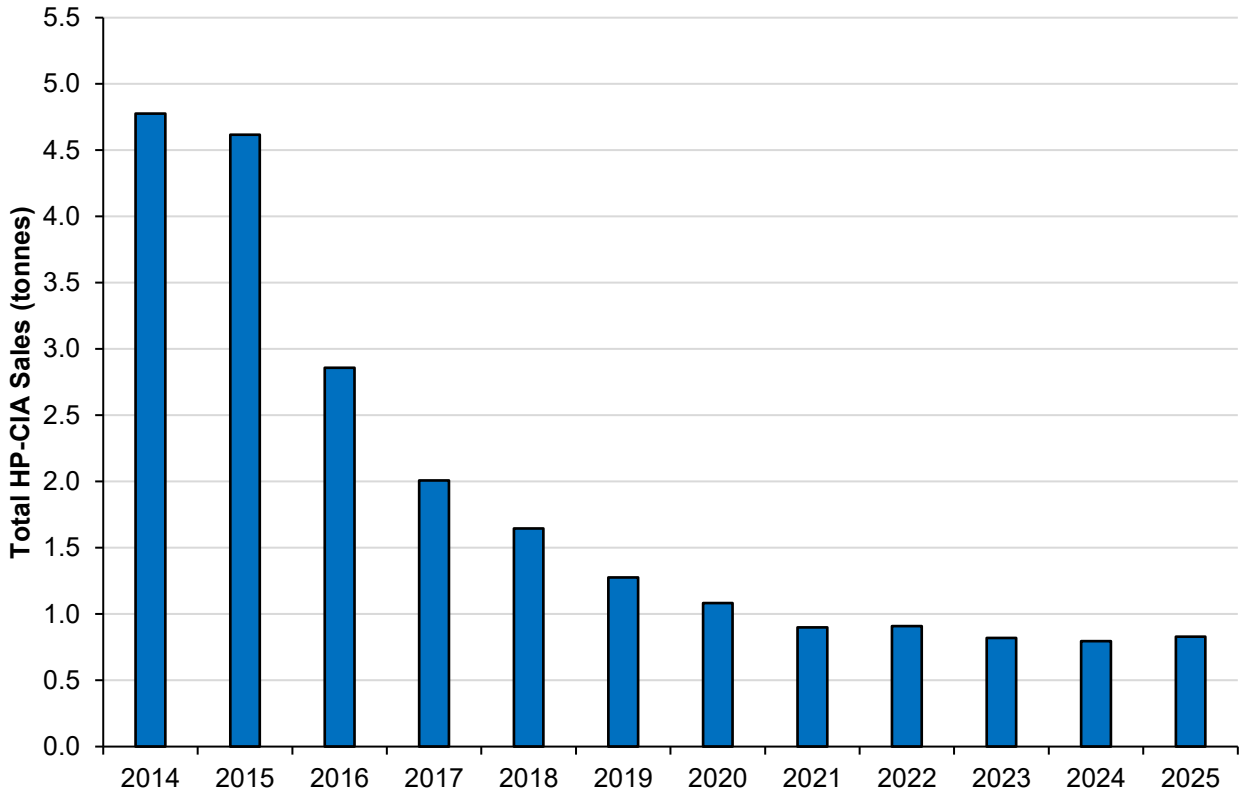
(B)



1.3.7 Total sales of HP-CIAs (tonnes)

Total sales of HP-CIAs in 2025 were 0.83 tonnes (**Figure 1.10**), representing a slight increase of 0.03 tonnes since 2024 and a reduction of 83% (3.9 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 2025. For the fifth year in a row, no colistin was sold for use in animals.

Figure 1.10: Active ingredient (tonnes) of HP-CIAs sold for use in all animals, 2014 to 2025.



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 or delivered to the animal owner or veterinary practice) for a defined animal species or production sector. This is different from sales data, which are 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 2.1.1 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. Data collection systems also enable 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 are presented graphically throughout, but full datasets and methodology can be found in Supplementary Material 1 and 3.

For sectors with high-coverage use data, product-level use can be extrapolated and compared with sales as an additional validation check. In 2025, sales and use generally showed comparable trends. The main exceptions were higher sales (relative to use) of an in-feed tetracycline product (authorised for pigs, chickens, turkeys and ducks), an oral macrolide product (authorised for cattle, pigs chickens and turkeys), an oral aminoglycoside product (authorised for cattle, pigs, chickens, turkeys, ducks and some gamebirds.) and an oral fluoroquinolone product (authorised for chickens). For the in-feed tetracycline product, the MA holders have informed us that this relates to commercial factors, with product sold into wholesalers in 2025 that will not be used until subsequent years. For the other products, the higher sales may reflect products entering the supply chain in 2025 for use in subsequent years, or use occurring in animal populations not fully captured by current antibiotic use datasets. As described in section 2.1.2, no beef data were available in 2025 and dairy coverage was 49%. In addition, although coverage is high for pigs (98%), meat poultry (83%), laying hens (estimated 90%) and gamebirds (estimated 80% for soluble products), it is not complete and use patterns may differ in the populations not represented within the data.

In this report, one-year percentage changes are not presented for Highest Priority Critically Important Antibiotics (HP-CIAs). Use of these antibiotics is generally very low, meaning that relatively small changes in use can result in large percentage increases or decreases that may overstate the significance of year-on-year variation. In some cases, lower antibiotic use classes have also been grouped as “Other” to improve the readability of the figure.

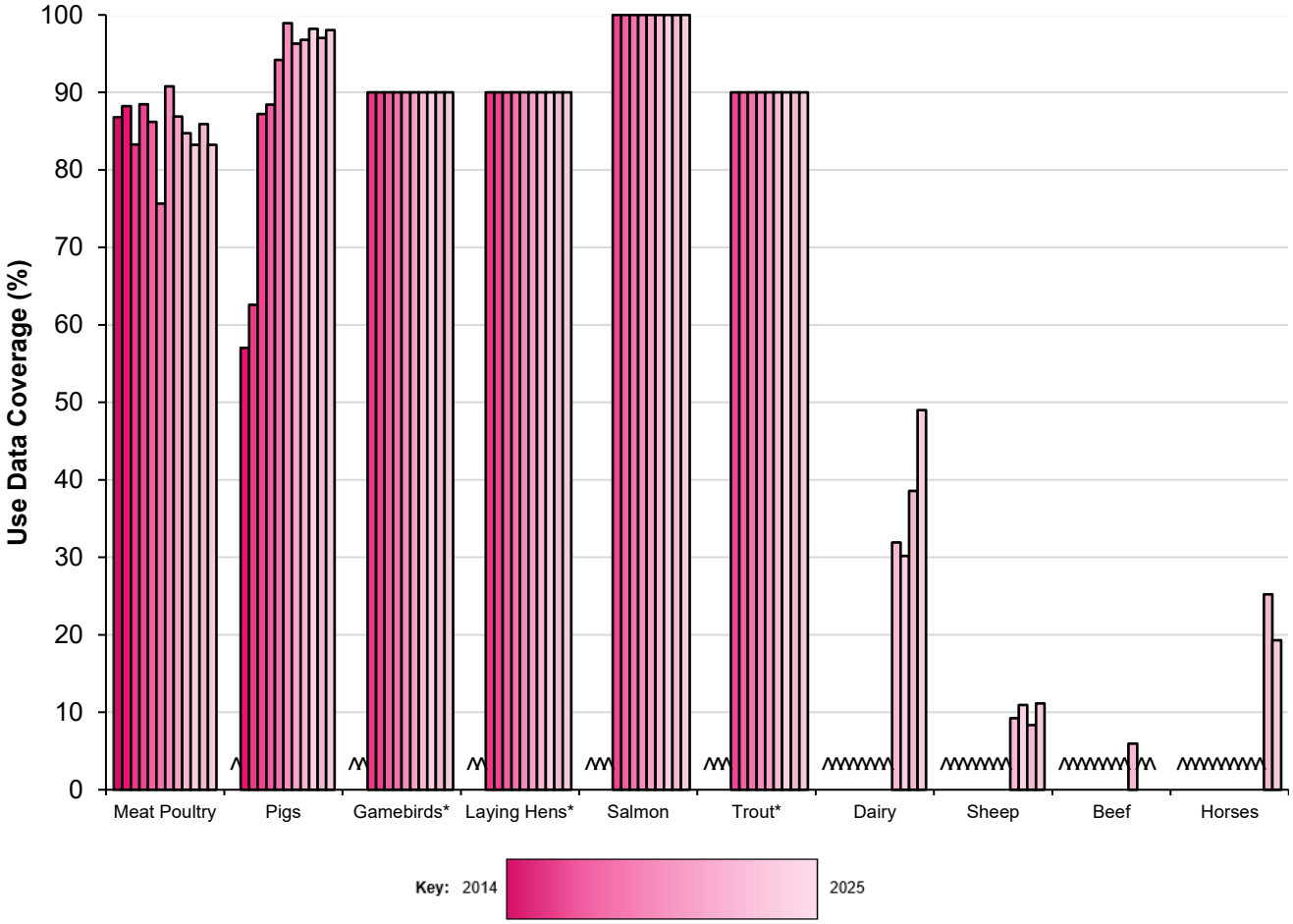
2.1.1 Special Import Products

Veterinary medicines are authorised for specific conditions and target species based on scientific assessment of data submitted to the VMD. Where no suitable authorised medicine is available in the relevant UK territory, veterinary surgeons may, on a case-by-case basis and to avoid unacceptable suffering, prescribe medicines under the Cascade and apply for a Special Import Certificate (SIC) to import products authorised outside that territory. SIC applications must be submitted by the prescribing veterinary surgeon and approved by the VMD before importation. Application details are reviewed by the VMD and may be subject to further assessment depending on the product requested and the associated risks to animal, human and environmental health. Certificates issued under the SIC scheme are routinely monitored, including for unusually large quantities requested, with follow-up undertaken where necessary. Information on approved SICs is held by the VMD. However, SIC certificate data are not a reliable indicator of actual antimicrobial use because approval to import a product does not confirm that it was imported, supplied or administered. For this reason, SIC certificate data are not published in this report. However, the antibiotic use data includes antibiotics imported under the Special Import Scheme, and these data are presented in this chapter.

2.1.2 Antibiotic Use Coverage

The VMD's work with different livestock sectors means that antibiotic use data representing 83% of the meat poultry sector, 98% of the pig sector, and 90% or more of the laying hen, trout, salmon and gamebird sectors can be published. In the ruminant sectors, coverage of antibiotic use data continues to increase through Medicine Hub, with data now representing 49% of the dairy sector and 11% of the sheep sector. The UK Ruminant Antibiotic Stewardship Roadmap is helping to drive this progress by bringing stakeholders together to strengthen antibiotic stewardship and increase participation in antibiotic use data collection. Antibiotic use data collection also continues within the equine sector, where data covering approximately 19% of horses were available in 2025 with progress towards developing a digital platform. All of these data continue to be collected on a voluntary basis (see **Figure 2.1**).

Figure 2.1: Availability and estimated coverage of antibiotic use data in the different sectors, 2014 to 2025.



^Data not available

*Estimated figures

2.2 Summary

The key trends are as follows:

- **Pigs:** Antibiotic use was 44.8 mg/kg in 2025, an 11% reduction (5.3 mg/kg) from 50.0 mg/kg in 2024. This represents a 72% reduction since data were first published in 2015. HP-CIA use increased from 0.005 mg/kg in 2024 to 0.007 mg/kg in 2025 but remained 99% lower than in 2015 and accounted for 0.01% of total antibiotic use.

- **Broilers:** Antibiotic use was 3.8 mg/kg in 2025, a 20% reduction (0.9 mg/kg) from 4.7 mg/kg in 2024. This represents an 81% reduction since data were first published in 2014. No HP-CIAs were used in meat broilers in 2025, for the second consecutive year.

- **Turkeys:** Antibiotic use was 18.1 mg/kg in 2025, an 8% reduction (1.6 mg/kg) from 19.7 mg/kg in 2024. This represents an 83% reduction since data were first published

in 2014. Fluoroquinolones were the only HP-CIAs used, decreasing from 0.022 mg/kg in 2024 to 0.020 mg/kg in 2025 and accounting for 0.1% of total antibiotic use.

- **Ducks:** Antibiotic use was 0.34 mg/kg in 2025, a 42% increase (0.10 mg/kg) from 0.22 mg/kg in 2024, although use remained very low. This represents a 95% reduction since data were first published in 2014. No HP-CIAs have been used in ducks during the 11-year reporting period.

- **Laying hens:** Antibiotic use was 0.254% bird days in 2025, a 9% reduction from 0.278% bird days in 2024. This represents a 62% reduction since data were first published in 2016. Fluoroquinolone use was 0.0003% bird days in 2025, a reduction of 0.0004% bird days from 2024, and accounted for 0.1% of total antibiotic use.

- **Gamebirds:** In the gamebird sector, antibiotic use is not adjusted for population size, and the gamebird sector indicated that the number of birds reared in 2025 increased by 1.8% compared with 2024. Furthermore, in October 2026, the gamebird sector notified VMD of an error in the 2024 dataset previously supplied for reporting; corrected figures revise total antibiotic use from 10.3 to 11.1 tonnes active ingredient. Antibiotic use was 11.4 tonnes in 2025, a 3% increase (0.3 tonnes) from 2024. This represents a 43% reduction since data were first published in 2016. HP-CIA use decreased by 67%, from 45.1 kg in 2024 to 15.0 kg in 2025, and was 77% lower than in 2016, accounting for 0.1% of total antibiotic use.

- **Salmon:** Antibiotic use was 12.4 mg/kg in 2025, a 52% increase (4.2 mg/kg) from 8.1 mg/kg in 2024. Use nevertheless remained 23% lower than when data were first published in 2017. No HP-CIAs have been used in the salmon sector since 2021.

- **Trout:** Antibiotic use was 6.9 mg/kg in 2025, a 36% increase (1.8 mg/kg) from 5.1 mg/kg in 2024. Use nevertheless remained 64% lower than when data were first published in 2017. The only HP-CIA used was the quinolone oxolinic acid, which increased from 1.5 mg/kg in 2024 to 4.0 mg/kg in 2025 and accounted for 57% of total antibiotic use. Oxolinic acid use remained 40% lower than in 2017. The increase was attributed to enteric redmouth outbreaks on a small number of farms.

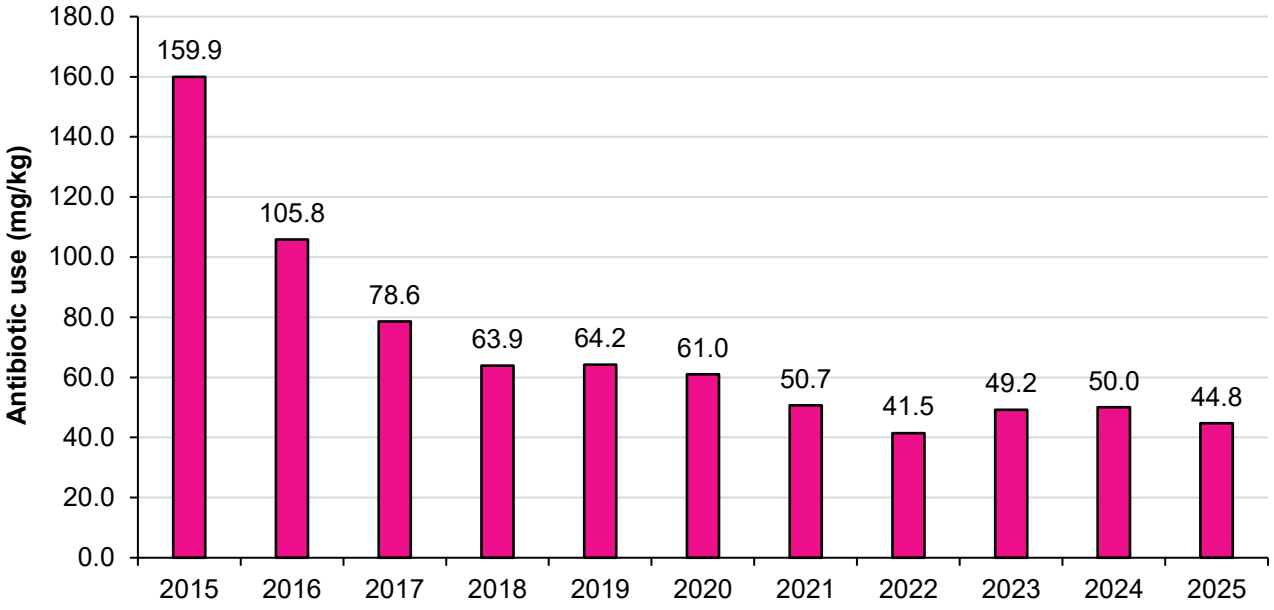
2.3 Results

2.3.1 Pigs

2.3.1.1 Antibiotic use data

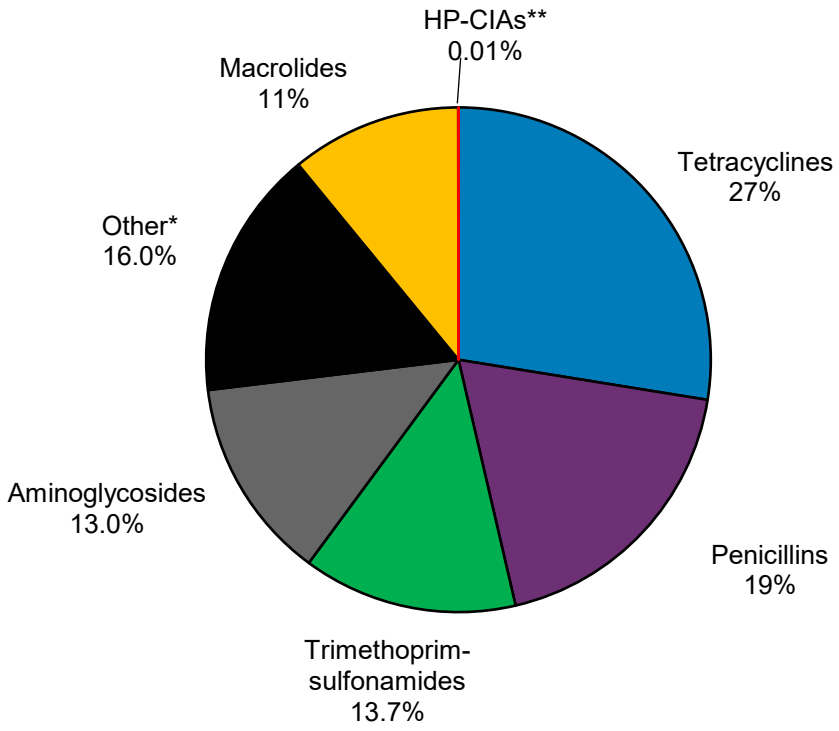
Data from the electronic Medicines Book for Pigs (eMB Pigs) represent 98% of UK pig production. This is equivalent to 9.8 million pigs produced for the food chain in 2025. Data show that in 2025, the total antibiotic use in pigs was 57.3 tonnes, or 44.8 mg/kg (77.2 mg/PCU) when adjusted for population. This is a decrease of 11% (5.3 mg/kg) since 2024 and a total reduction of 72% since data were first reported in 2015 (**Figure 2.2**).

Figure 2.2: Antibiotic active ingredient adjusted for population (mg/kg) reported in eMB Pigs, 2015 to 2025.



Almost half (46%) of antibiotics used in pigs were either tetracyclines (27%) or penicillins (19%). The use of tetracyclines decreased by 17% between 2024 and 2025 and the use of penicillins decreased by 8% in the same period. The next most used classes were trimethoprim-sulfonamides and aminoglycosides. The use of trimethoprim-sulfonamides reduced by 14% between 2024 and 2025 and the use of aminoglycosides reduced by 15% in the same period. When looking at the longer-term trends, aminoglycosides are the only one of the top four antibiotic classes that have increased in use since 2015 (186%) (**Figure 2.3 and 2.4**).

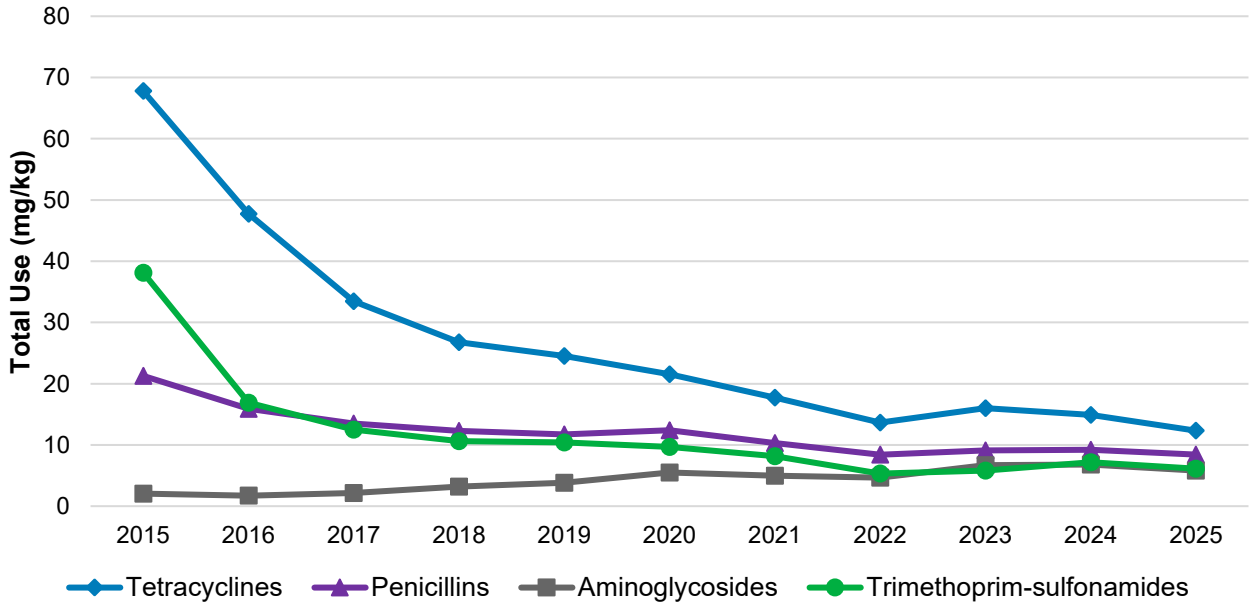
Figure 2.3: Active ingredient (% weight) of antibiotics by antibiotic class reported in eMB pigs, 2025.



*The category 'Other' contains the following antibiotics classes (% of total): lincosamides (8%), pleuromutilins (6%) and amphenicols (2%).

**HP-CIAs used were fluoroquinolones or third- and fourth-generation cephalosporins, which together represented < 0.01% of the weight (kg) of active ingredients used.

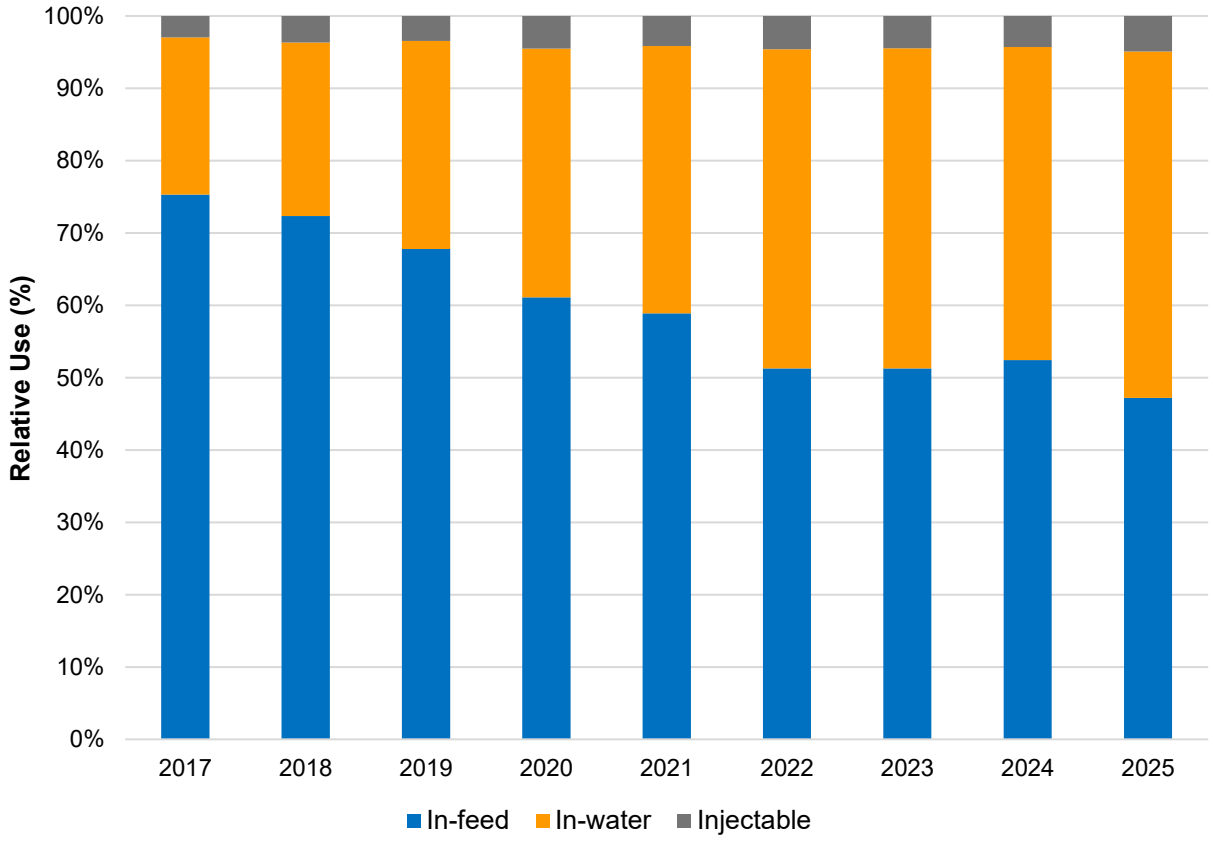
Figure 2.4: Active ingredient (mg/kg) of the top four antibiotic classes reported in eMB Pigs, 2015 to 2025.



Products imported under the Special Import Scheme accounted for 16% of active ingredient used in 2025 (9.2 tonnes), compared to 15% (9.6 tonnes) in 2024 and 7% (4.4 tonnes) in 2023. The majority of this (71% in 2025 and 78% in 2024) relates to the import of premixes containing trimethoprim-sulfonamide, due to the equivalent UK-authorised 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 use data.

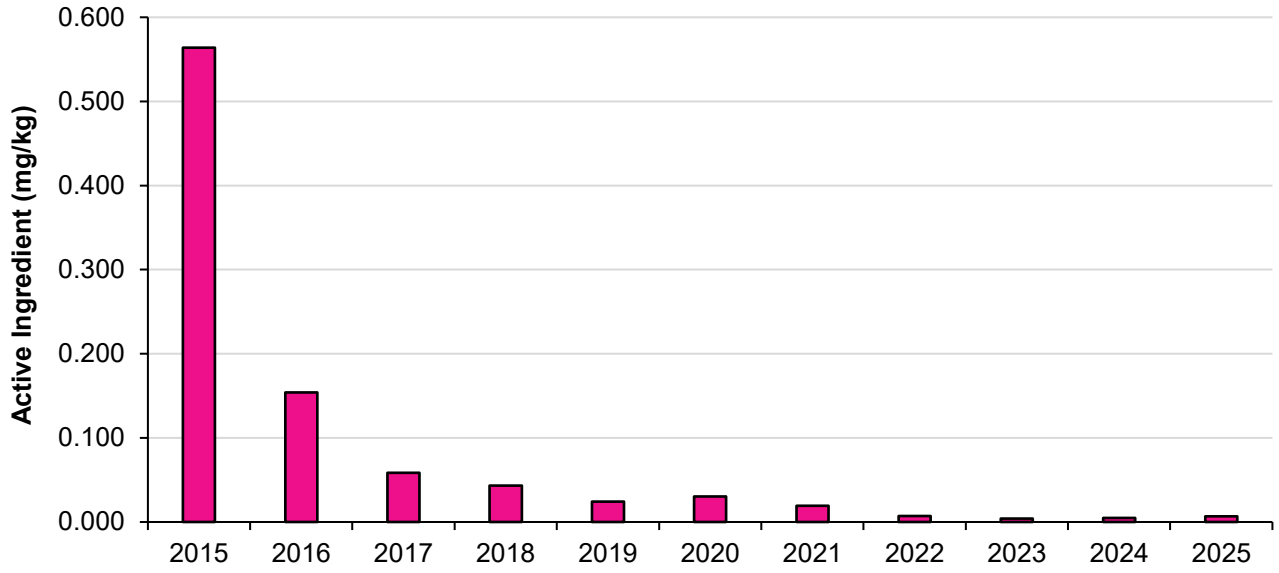
In-water administration allows for more targeted administration of antibiotics than in-feed, and the pig sector has been actively encouraging in-water use. In 2025, in-water use exceeded in-feed use for the first time, becoming the most common route of antibiotic administration in pigs (48%) (**Figure 2.5)**. The proportion administered in-feed (47%) has notably decreased since 2017, when it accounted for 75% of overall use.

Figure 2.5: Active ingredient (% weight) of antibiotics by route of administration reported in eMB Pigs, 2017 to 2025.



The use of HP-CIAs in pigs is shown in **Figure 2.6**. In 2025, 8.4 kg of HP-CIAs were used, which represents 0.007 mg/kg, or 0.01% of antibiotics by weight of active ingredient. This represents a slight increase of 0.002 mg/kg between 2024 and 2025. Fluoroquinolones accounted for 96% of 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 six years.

Figure 2.6: Active ingredient (mg/kg) of HP-CIAs reported in eMB Pigs, 2015 to 2025.



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

"This year marks the 10th anniversary of the electronic Medicines Book for Pigs (eMB Pigs), which now indicates an overall reduction in antibiotic use of 72% since its inception. This highlights the value of a sustained, coordinated industry-wide approach. The 11% reduction in antibiotic use between 2024 and 2025 is particularly encouraging, demonstrating continued progress towards the industry's target of reducing antibiotic use by 20% between 2024 and 2028. The use of Highest-Priority Critically Important Antibiotics (HP-CIAs) also remains low. The sector continues to be committed to the principle of using antibiotics 'as little as possible and as much as necessary', ensuring they are available when needed to protect animal health and welfare.

Alongside this, there remains a strong focus on disease prevention through improving herd health, strengthening biosecurity, refining management practices and, where appropriate, vaccine use, so that antibiotics are needed less in the first place. eMB Pigs has enabled producers and vets to benchmark performance, identify opportunities for improvement and track progress over time, turning data into practical action on farm.

Another key focus has been encouraging in-water administration in place of in-feed medication where appropriate, allowing more targeted use of antibiotics. This approach continues to gain traction, and in 2025 in-water administration exceeded in-feed administration for the first time, becoming the most common route of antibiotic administration in pigs.

The pig industry remains committed to delivering its new RUMA Targets Task Force commitments, which includes expanding the existing Persistently High User scheme to identify and support holdings within the top 10% for antibiotic use in each production category, based on rolling 12-month eMB Pigs data. Other priorities include supporting producers and veterinarians to measure and improve biosecurity and providing communication skills training, including motivational interviewing techniques, to help veterinary professionals encourage the uptake of preventative health measures on farm.

Disease pressures, financial adversity, and new and emerging challenges will continue to test the industry, but the foundations built over the past decade, including shared data, consistent measurement and industry-wide collaboration, leave it well placed to sustain further progress whilst safeguarding pig health and welfare."

2.3.2 Meat Poultry

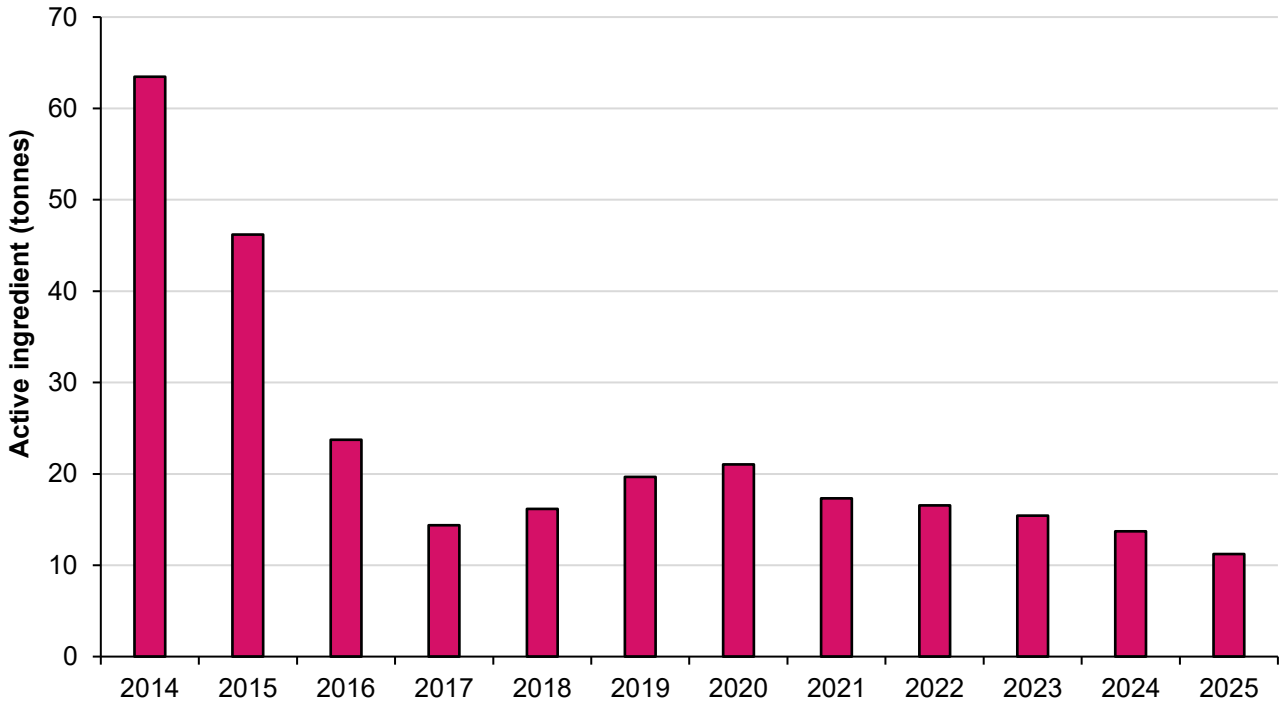
2.3.2.1 Antibiotic use data

Data from the British Poultry Council (BPC) Antibiotic Stewardship was captured from 83% of the meat poultry industry in 2025. This is equivalent to 956 million broilers, 6.7 million turkeys and 9.8 million ducks, including breeding birds. Overall, the industry reported 11.2 tonnes of active ingredient used in 2025. This is the lowest use since data were first published in 2014, representing an 18% (2.5 tonnes) decrease since 2024, and an 82% decrease since 2014 (**Figure 2.7**).

Third- and fourth-generation cephalosporins have never been used by the meat poultry sectors, and colistin has not been used since 2016. In 2025, the meat poultry sector used 1.8 kg of fluoroquinolones, which was all used in the turkey sector. This is a reduction of 19% (0.4 kg) since 2024 and represents 0.02% of overall antibiotic use. HP-CIA use has now reduced by 99.9% since 2014.

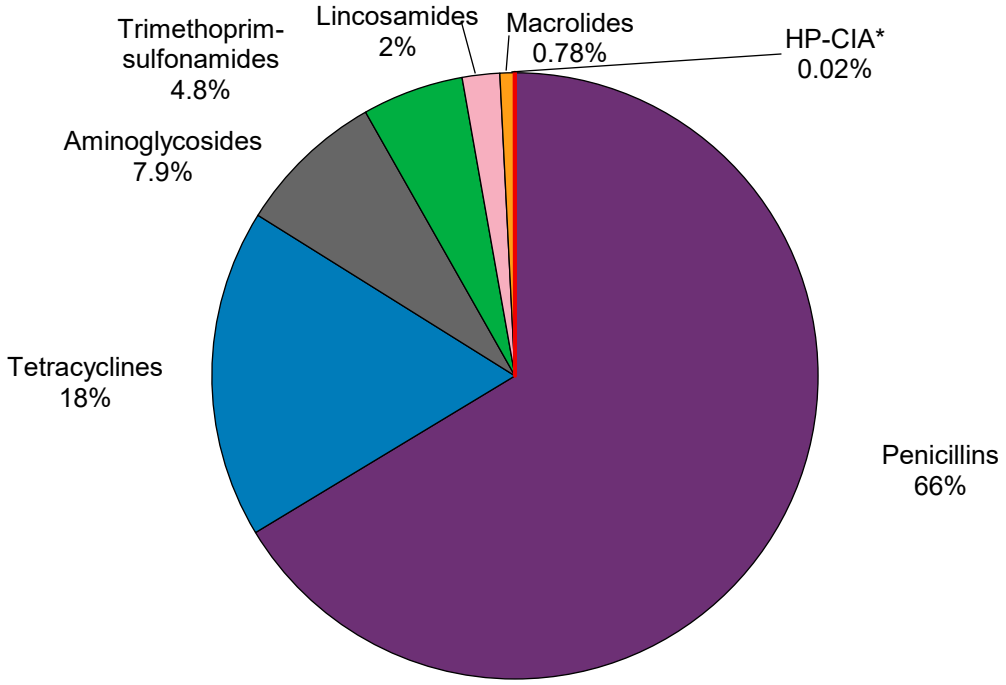
Products imported under the Special Import Scheme accounted for 61 kg of active ingredient (0.5% of total use) in 2025. This was imported due to a lack of a UK authorised product containing paromomycin for turkeys.

Figure 2.7: Active ingredient (tonnes) of antibiotics used by all meat poultry (broilers, turkeys and ducks) members of BPC Antibiotic Stewardship, 2014 to 2025.



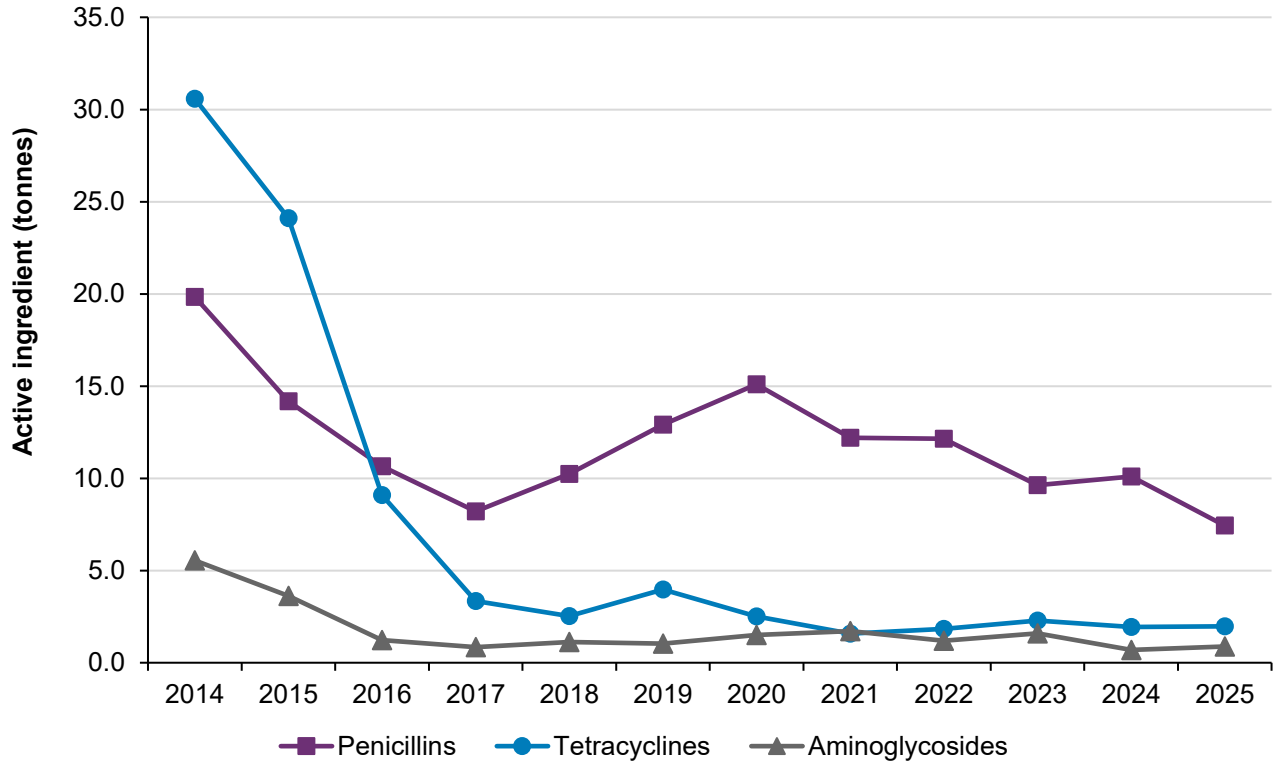
In 2025, 66% of active ingredients used in meat poultry were penicillins (99.5% of which was amoxicillin) (**Figure 2.8**), compared with 74% in 2024. This is because the use of penicillins decreased by 26% (2.7 tonnes) between 2024 and 2025. Since 2014, the top three antibiotic classes (penicillins, tetracyclines, aminoglycosides) used in meat poultry have reduced by 63%, 94% and 84% respectively (**Figure 2.9**).

Figure 2.8: Active ingredient (% weight) of antibiotics by antibiotic class used by all meat poultry (broilers, turkeys and ducks) members of BPC Antibiotic Stewardship, 2025.



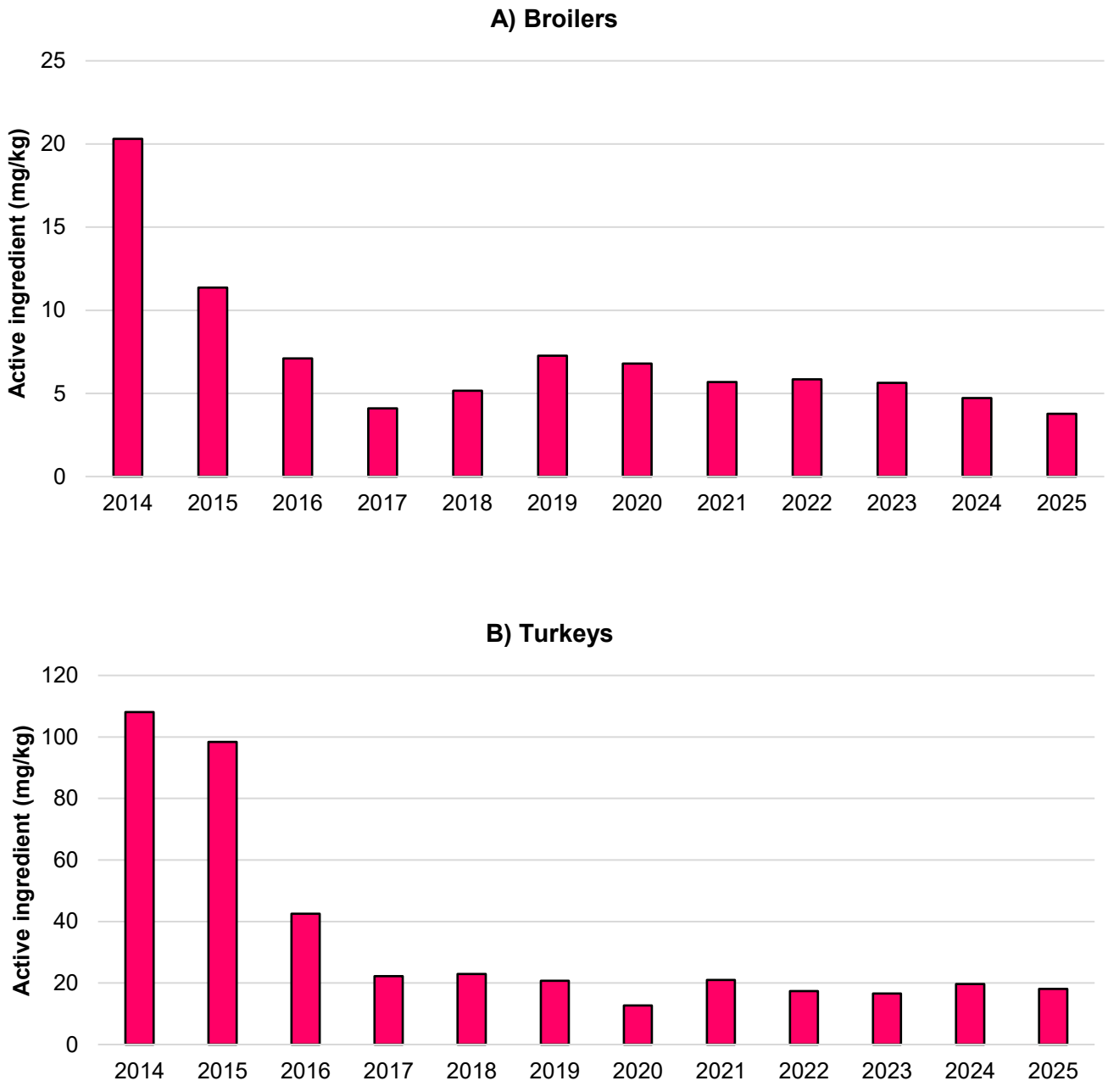
*HP-CIA used was fluoroquinolones which represented < 0.02% of the weight (kg) of active ingredients used

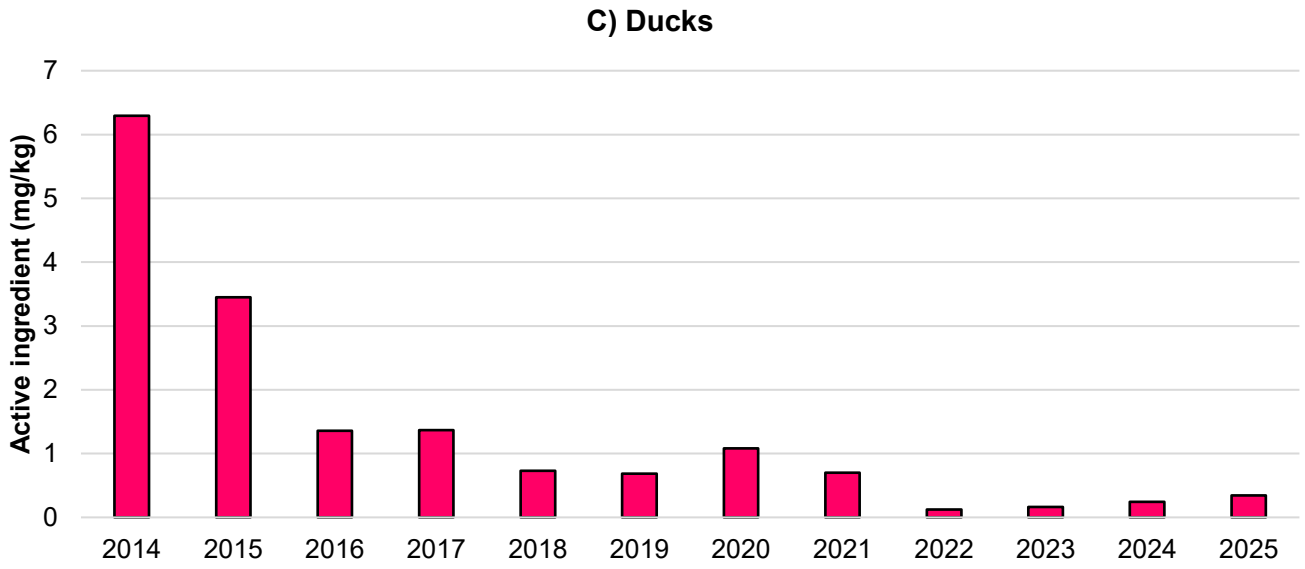
Figure 2.9: Active ingredient (tonnes) of the top three antibiotics by antibiotic class used by all meat poultry (broilers, turkeys and ducks) members of BPC Antibiotic Stewardship, 2014 to 2025.



When adjusting for the size of the animal population (and excluding breeding birds), antibiotic use in the broiler sector decreased by 20% (0.9 mg/kg) in 2025 to 3.8 mg/kg (9.1 mg/PCU) (**Figure 2.10**). This represents an 81% decrease since data were 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 decreased by 8% (1.6 mg/kg) to 18.1 mg/kg (36.7 mg/PCU) in 2025. It has reduced by 83% since 2014 and remains below the sector target of 24.6 mg/kg (50 mg/PCU) (**Figure 2.10**). The duck sector demonstrated an increase of 0.1 mg/kg to 0.3 mg/kg (0.83 mg/PCU), which remains a very low level, and antibiotic use has decreased by 95% since 2014. Note that, as breeder birds are not part of the slaughter population used to calculate the denominator, they are not included within the meat poultry mg/kg metric.

Figure 2.10: Active ingredient (mg/kg) of antibiotics used by members of BPC Antibiotic Stewardship in (A) broilers, (B) turkeys, and (C) ducks, 2014 to 2025. Note: different scales are used in each panel.





When looking at HP-CIAs, there was no fluoroquinolone use in broiler production in 2025 for the second year in a row, and fluoroquinolone use has never been reported in ducks. Fluoroquinolone use in slaughter turkeys decreased very slightly from 0.022 mg/kg in 2024 to 0.020 mg/kg in 2025.

2.3.2.2 Statement from British Poultry Council

“The UK meat poultry sector recorded its lowest ever antibiotic use in 2025, with use in broilers and turkeys remaining below their RUMA Targets and use in ducks remaining at very low levels. This achievement reflects more than a decade of collaboration and leadership across the BPC Antibiotic Stewardship membership. The continued success of the programme demonstrates the value of voluntary industry leadership, robust data collection and transparent reporting in driving and evidencing progress. By working together, sharing data and experiences, and supporting research into antimicrobial resistance and responsible medicine use, the sector has continued to make sustained progress whilst maintaining high standards of animal health and welfare. Antibiotic use in broilers fell by 20% between 2024 and 2025, while turkey use decreased by 8%.

Use of Highest Priority Critically Important Antibiotics (HP-CIAs) remains exceptionally low following sustained reductions over the past decade, and there was again no fluoroquinolone use reported in broiler production in 2025. These results reflect the sector's long-standing commitment to preserving these antibiotics for situations where they are genuinely needed.

Disease challenges continue to require careful management. Blackhead Disease (*Histomonas meleagridis*) and *Pasteurella multocida* have posed significant challenges for turkey producers, and these disease pressures have contributed to antibiotic use in the turkey sector during 2025. Following the withdrawal of dimetridazole due to concerns regarding residues and consumer safety, there are currently no authorised veterinary medicines available in the UK for the prevention or treatment of Blackhead Disease. Control therefore relies primarily on biosecurity and management measures. Where disease occurs, veterinary surgeons may prescribe medicines under the Cascade and use targeted antibiotic treatments to manage secondary bacterial infections and support bird health and welfare.

Despite these challenges, BPC Antibiotic Stewardship continues to demonstrate that responsible antibiotic use is a deliberate and health-led choice. Members remain committed to reducing the need for antibiotics through strong biosecurity, good husbandry, effective disease prevention and continual improvement, whilst ensuring that antibiotics remain available when needed to protect animal health and welfare."

2.3.3 Laying hens

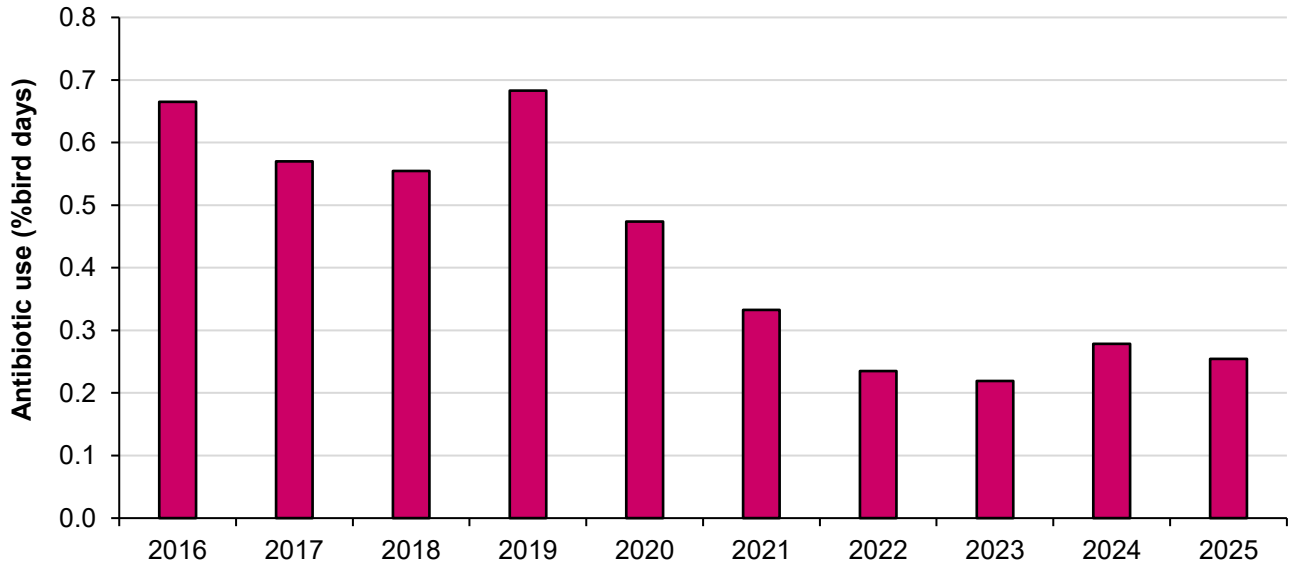
2.3.3.1 Antibiotic use data

In 2025, data collected by the British Egg Industry Council (BEIC) represented around 90% of the laying-hen sector, equivalent to around 38.4 million hens and pullets laying eggs for eating in 2025, alongside layer breeders. Overall, the sector reported that a total of 1.9 tonnes of antibiotic active ingredient was used. Unlike other sectors, the laying hen sector collects detailed information on the actual number of days each bird received an antibiotic and presents this as % bird days, which represents the average number of days of treatment administered per chicken over a 100-day period (see Supplementary Material 1) for the full methodology). The sector considers this metric more suitable for adjusting for the underlying population and monitoring trends because it does not rely on standardised assumptions for bodyweight and dose rates.

In 2025, the population adjusted figure was 0.254% bird days. This is a decrease of 9% since 2024 and 62% since data were first published in 2016 (**Figure 2.11**).

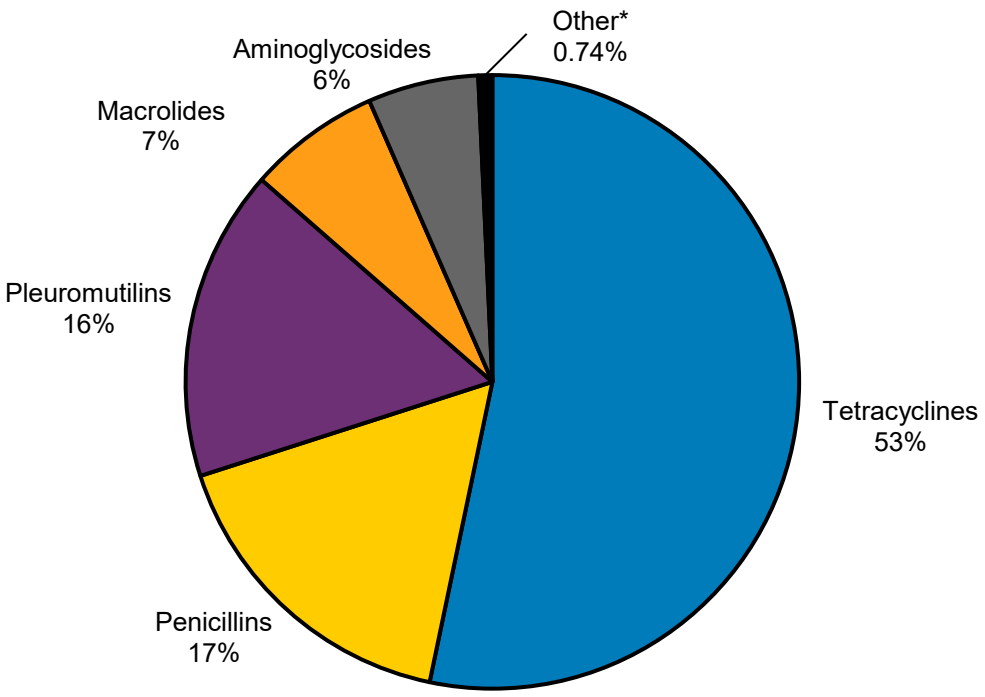
Products containing oxytetracycline imported under the Special Import Scheme accounted for 1 tonne of active ingredient (56% of total use). This is necessary due to the lack of a UK authorised in-water oxytetracycline product for laying hens.

Figure 2.11: Antibiotic use (% bird days) by members of the BEIC Lion Code, 2016 to 2025.



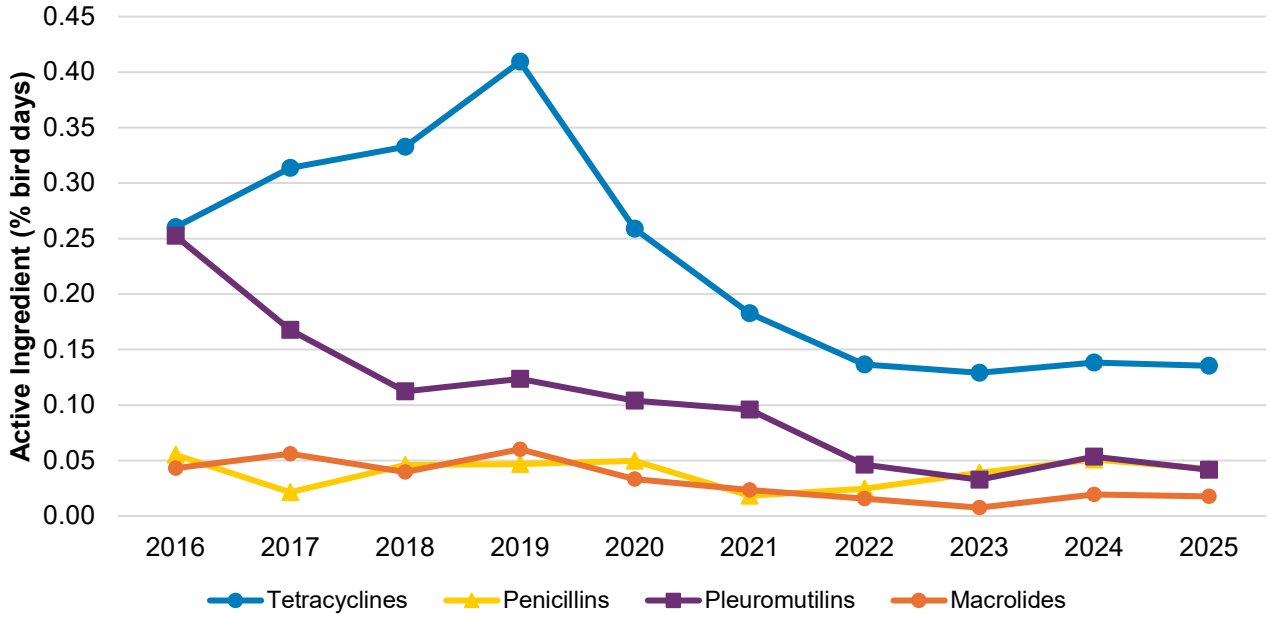
Tetracyclines, pleuromutilins and penicillins accounted for 86% of total use in 2025 (**Figure 2.12**) and these decreased by 2%, 22% and 16% respectively between 2024 and 2025 (**Figure 2.13)**. When considering HP-CIAs, 1.3kg of fluoroquinolones were used in 2025, which equates to 0.0003% bird days (0.1% of total use). This is only the second time HP-CIAs have been used in the laying hen sector since 2016. Fluoroquinolones are not authorised for use in laying hens producing eggs for human consumption because of concerns regarding residues in eggs and the protection of consumers. However, BEIC has indicated that this relates to a specific incidence of significant disease in a single layer breeding flock where first-line treatments did not control the progression of disease and the decision was taken to permit the use of enrofloxacin in this flock under very close veterinary supervision following culture and sensitivity testing. Fertile eggs from these treated birds are hatched to provide laying hens and the eggs are not marketed as shell eggs for human consumption.

Figure 2.12: Antibiotic use (% of total bird days) by antibiotic class by members of the BEIC Lion Code, 2025.



*Other includes fluoroquinolones, polymyxins, sulfonamides, lincosamides and combination products

Figure 2.13: Antibiotic use (% bird days) for the leading antibiotic classes reported by members of the British Egg Industry Council Lion Code, 2016 to 2025.



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 2025 show that the laying hen sector continues to be a low user of antibiotics. Use remained well below the Lion Scheme target of 1% bird days and decreased compared with 2024. HP-CIA use also remained substantially below the sector target of 0.05% bird days. Overall antibiotic use is now around 62% lower than when reporting began in 2016, demonstrating the sector's continued commitment to responsible antibiotic stewardship.

The Lion Code continues to focus on disease prevention through high standards of biosecurity, hygiene, feed and water quality, supported by veterinary oversight and flock health planning. Widespread vaccination programmes and preventative health measures also play an important role in maintaining bird health and reducing the need for antibiotic treatment.

HP-CIA use remains very low and the Lion Scheme maintains stringent restrictions on the use of these products, with fluoroquinolones only permitted in exceptional circumstances following veterinary assessment and approval through the Lion Scheme derogation process. BEIC remains committed to supporting the responsible use of antibiotics while maintaining high standards of animal health, welfare and food safety."

2.3.4 Gamebirds

2024 Data Correction

In October 2026, the gamebird sector notified VMD of an error that had been identified during a review of the 2024 gamebird antibiotic use dataset previously supplied. The error affected the reported quantity of one in-feed antibiotic product and resulted in an underestimation of total antibiotic use in 2024. The figures revised as shown below:

Metric	Originally Reported	Corrected
Total antibiotic use (tonnes active ingredient)	10.3	11.1
Change from 2023 to 2024 (tonnes active ingredient)	+0.47	+1.2
Change from 2023 to 2024 (%)	+5%	+12%
In-feed change from 2023 to 2024 (tonnes active ingredient)	-1.1	-0.5
In-feed change from 2023 to 2024 (%)	-25%	-8%
In-feed as proportion of total use in 2024	33%	38%

Therefore, to summarise, antibiotic use in gamebirds increased from 9.9 tonnes in 2023 to 11.1 tonnes in 2024, representing an increase of 1.2 tonnes (12%). In-feed antibiotic use decreased by 0.4 tonnes (8%) between 2023 and 2024. In-feed administration accounted for 38% of total antibiotic use in 2024, compared with 47% in 2023.

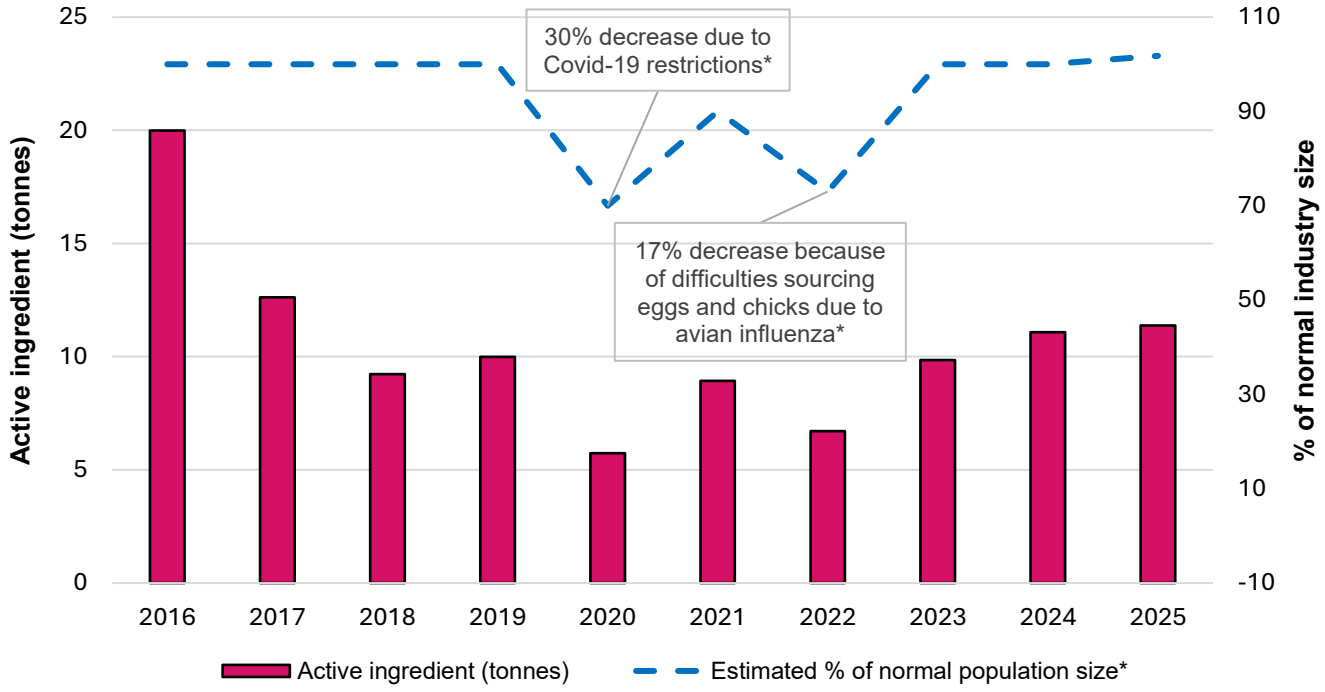
2.3.4.1 Antibiotic use data

The antibiotic use metric is not equivalent to that used in other sectors as it is not adjusted for population size and the gamebird sector indicated that the number of birds reared in 2025 increased by 1.8% compared with 2024.. The gamebird sector has recognised the limitations of reporting antibiotic use solely as tonnes of active ingredient and, as part of its TTF3 commitments, is trialling and refining a population-adjusted mg/kg metric. However, work is still ongoing to develop a consistent methodology and no agreed population-adjusted metric is currently available for national reporting.

In 2025, 11.4 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. However, when comparing 2024 and 2025, it is estimated that approximately the same number of gamebirds were reared while antibiotic use increased by 3% (0.3 tonnes). This still represents a reduction of 43% since data were first published in 2016. This overall reduction is mainly due to the reductions that took place between 2016 and 2018 (**Figure 2.14**).

Products imported under the Special Import Scheme accounted for 0.1 tonnes of active ingredient (1% total use) in 2025. While there is a UK-authorised in-water oxytetracycline product, it is not currently marketed, and veterinary surgeons have therefore continued to rely on products imported under the Special Import Scheme.

Figure 2.14: Antibiotic active ingredient used in gamebirds (tonnes) and estimated population size (% of normal population size), as reported through the GFA and BVPA data collection programme, 2016 to 2025.

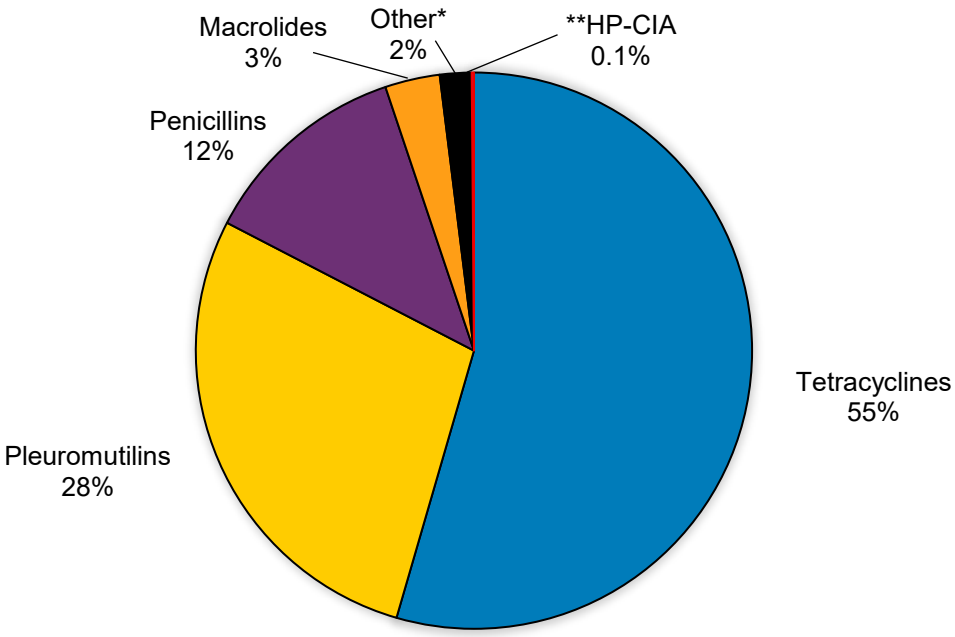


*% change in population size as estimated by the Game Farmers Association

The use of antibiotics broken down by active ingredient is shown in **Figure 2.15** and **2.16**.

Tetracyclines remain the most used active ingredient, representing 55% of total antibiotic use in 2025 (6.2 tonnes). The increase in antibiotic use between 2024 and 2025 is primarily attributed to a 12% (0.7 tonnes) increase in the use of tetracyclines although, since 2016, the use of this class has dropped by 57%. By contrast, pleuromutilins have reduced to a lesser degree by 9% over the same period.

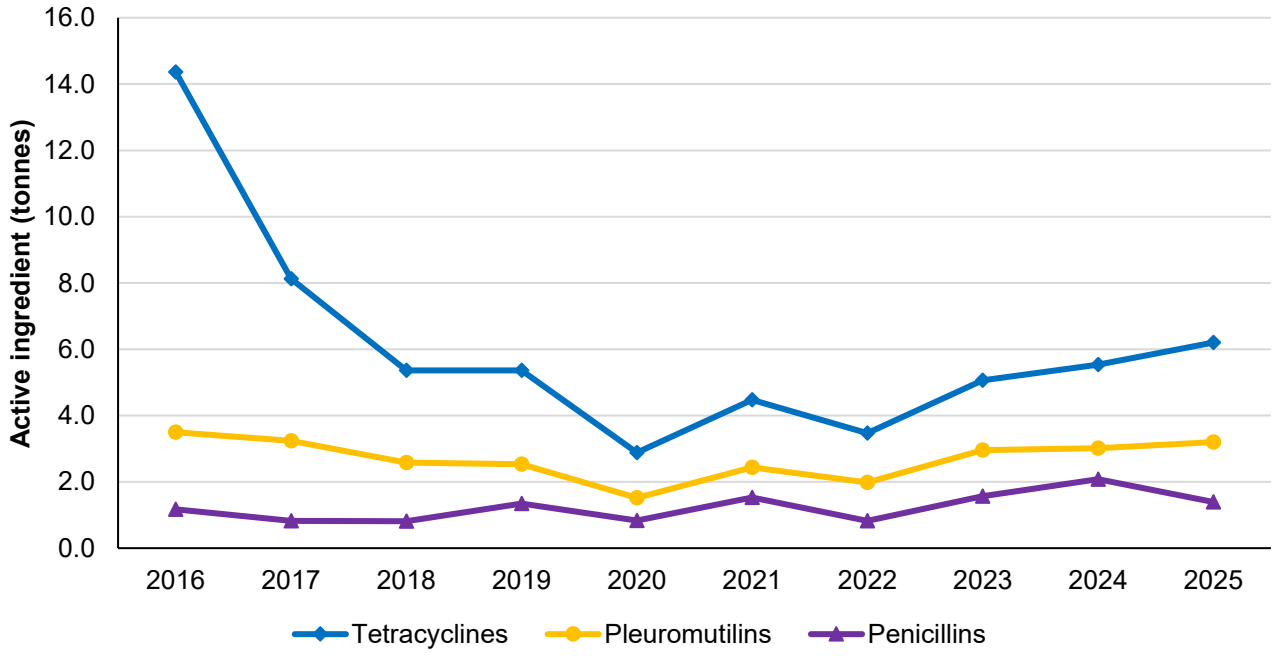
Figure 2.15: Active ingredient (% weight) of antibiotics by antibiotic class used in gamebirds, collected by the GFA and BVPA data collection programme, 2025.



*'Other' includes amphenicols (1.1%) aminoglycosides (0.4%), lincosamides (0.2%), and trimethoprim-sulfonamides (0.05%).

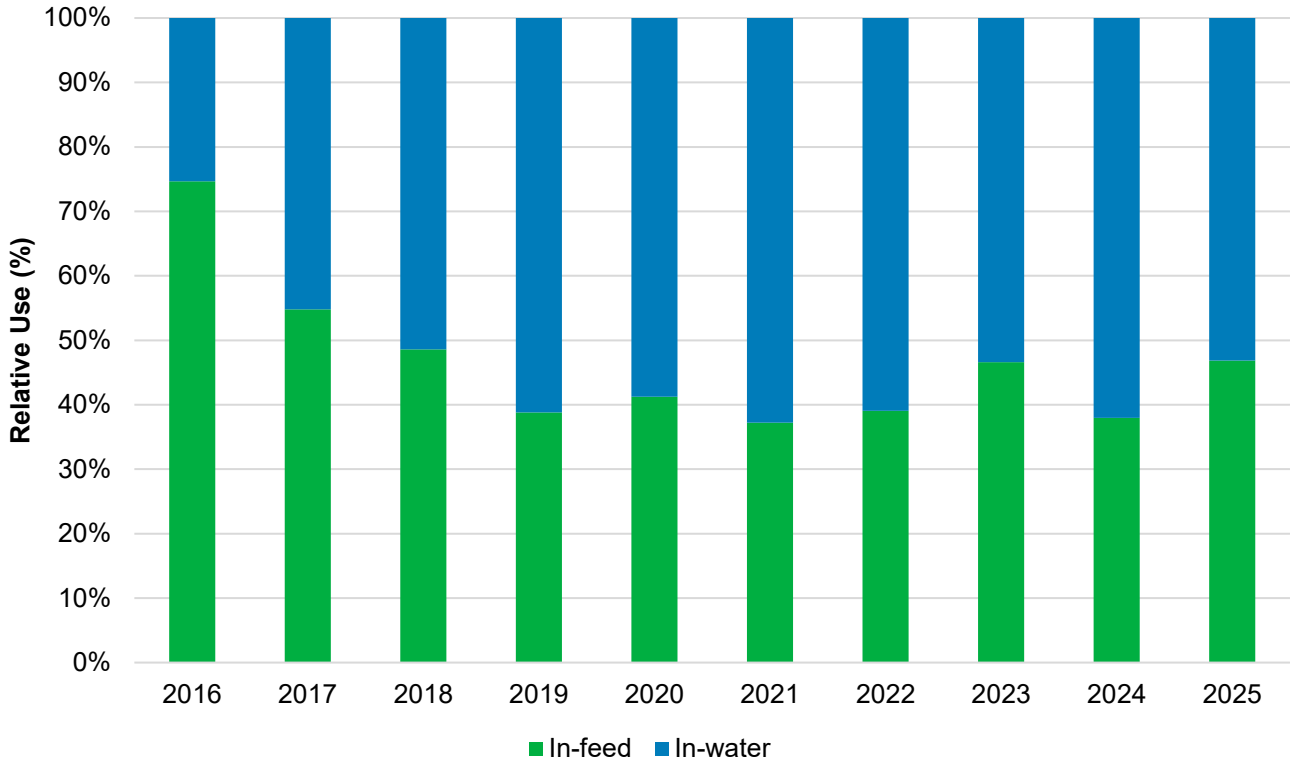
**HP-CIA used was fluoroquinolones which represented 0.1% of the weight (kg) of active ingredients used.

Figure 2.16: Active ingredient (tonnes) of top three antibiotics by antibiotic class used in gamebirds, collected by the GFA and BVPA data collection programme, 2016 to 2025.



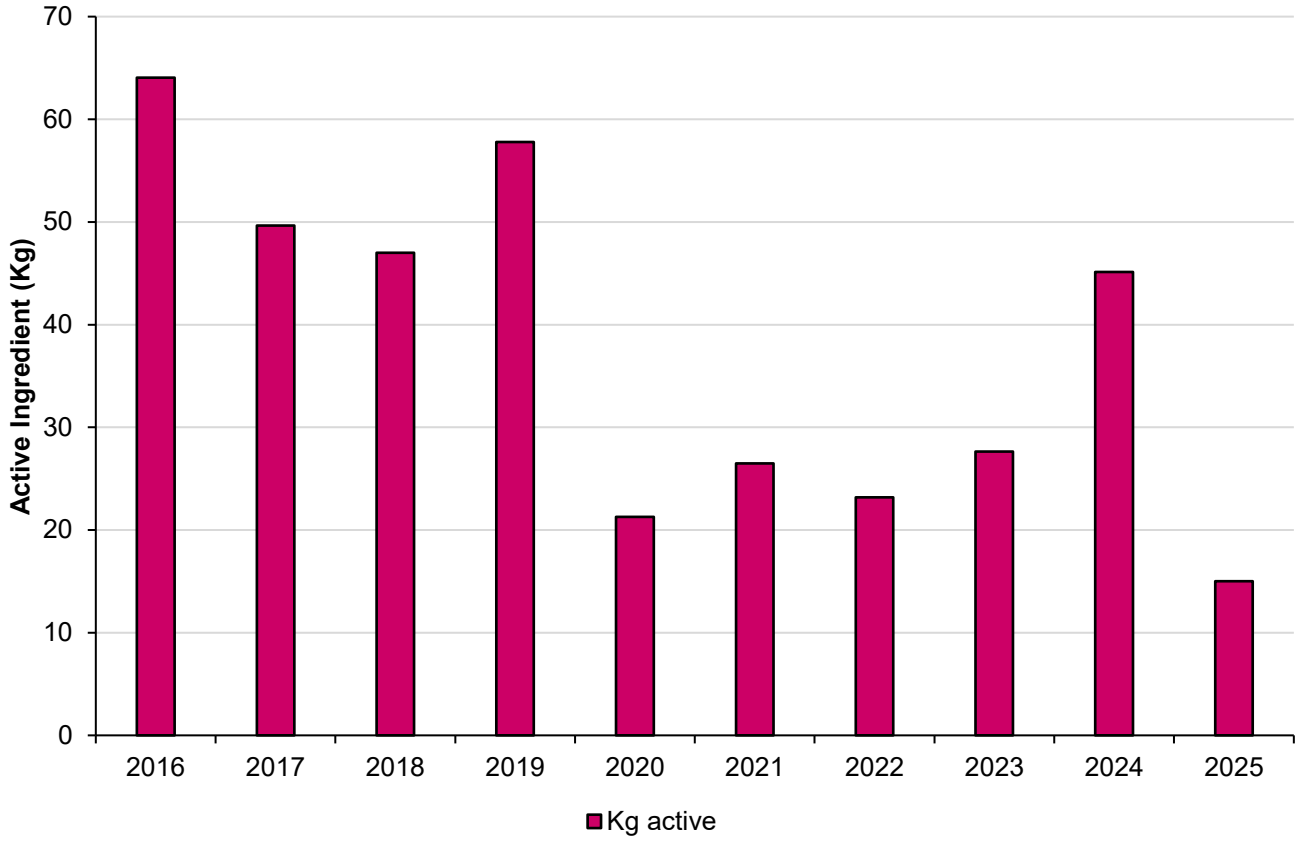
Analysis by route of administration shows that in-feed use increased by 27% (1.1 tonnes) between 2024 and 2025 whereas in-water use decreased by 12% (0.8 tonnes). Therefore, the proportion administered in-feed increased from 38% in 2024 to 47% in 2025 despite the industry focus on moving from in-feed to in-water medication where possible, as it allows for more targeted treatment. However, the proportion administered in-feed has still dropped considerably since 2016, when it accounted for 75% of antibiotic use (**Figure 2.17**).

Figure 2.17: Active ingredient (% relative use) by route of administration used in gamebirds, collected by the GFA and BVPA data collection programme, 2016 to 2025.



The fluoroquinolone enrofloxacin is the only HP-CIA used by the gamebird sector. Its use has decreased by 67% from 45.1 kg in 2024 to 15.0 kg in 2025, accounting for 0.1% of overall use. HP-CIA use is 77% lower than when data were first published in 2016 (**Figure 2.18**).

Figure 2.18: Active ingredient of HP-CIAs (kg) used in gamebirds, collected by the GFA and BVPA data collection programme, 2016 to 2025.



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

"The gamebird sector remains committed to responsible antibiotic stewardship whilst maintaining high standards of bird health and welfare. While overall antibiotic use increased slightly by 3% between 2024 and 2025, total use remains 43% lower than when data collection began in 2016. As in previous years, these figures should be interpreted with caution as gamebird antibiotic use is currently reported as total active ingredient rather than being adjusted for the population of birds reared. Nevertheless, the sector recognises that further progress is needed and has renewed its commitment through the latest RUMA Targets Task Force process to reduce total tonnes of antibiotic use by 40% from the 2019 baseline by 2028.

The increase in antibiotic use during 2025 was primarily associated with increased use of tetracyclines, which are commonly used to manage enteric disease challenges. Weather conditions, environmental factors and the complex interaction between gut health, protozoal disease and secondary bacterial infections continue to present significant challenges for the sector. Despite this, it is encouraging that use of the fluoroquinolone enrofloxacin fell by 67% in 2025 and now accounts for only 0.1% of total antibiotic use. The sector remains committed to ensuring these antibiotics are used only as a last resort and with appropriate clinical justification.

During the last year, the sector's Antibiotic Communications Group has continued to promote practical measures to support responsible antibiotic use. This has included publication of new guidance and educational materials on the responsible use of medicated feed, promotion of good prescribing practice, continued support for the Trusted Game health and welfare scheme and encouraging management, husbandry and biosecurity improvements that reduce disease risk.

The sector has also continued to work collaboratively with vets, researchers and industry partners through initiatives such as the AMAST Antibiotic Use in Gamebirds Workshop. This work has highlighted the need for improved diagnostics, a better understanding of enteric disease challenges such as hexamitiasis and coccidiosis, and further research into practical alternatives that can reduce the need for antibiotics whilst protecting bird health and welfare.

By working together, the gamebird sector remains committed to delivering further reductions in antibiotic use through improved disease prevention, enhanced benchmarking, ongoing education, practical research and the sharing of good practice, whilst supporting healthy birds, sustainable production systems and the wider environmental and conservation benefits associated with gamebird management."

2.3.5 Aquaculture

2.3.5.1 Salmon

2.3.5.1.1 Antibiotic use data

In data collected by Salmon Scotland representing 100% of the industry (198 thousand tonnes liveweight of fish produced), 2.4 tonnes of antibiotic active ingredient were used in 2025, representing 12.4 mg/kg (**Figure 2.19**). This is an increase of 52% (4.2 mg/kg) since 2024 and a decrease of 23% compared with 2017, when data were first published. The 2025 use figures are based on production figures, as published in the Marine Production Survey 2025.

In 2025, 25% of use was oxytetracycline and 75% florfenicol. This reflects the limited range of antibiotic treatment options currently available within the sector. Between 2024 and 2025, oxytetracycline use increased by 188% (2.0 mg/kg) and florfenicol use increased by 31% (2.2 mg/kg). Since 2017, oxytetracycline use has reduced by 78% and the use of florfenicol has increased by 326% (**Figure 2.20**).

Figure 2.19: Antibiotic active ingredient (mg/kg) used in salmon, 2017 to 2025.

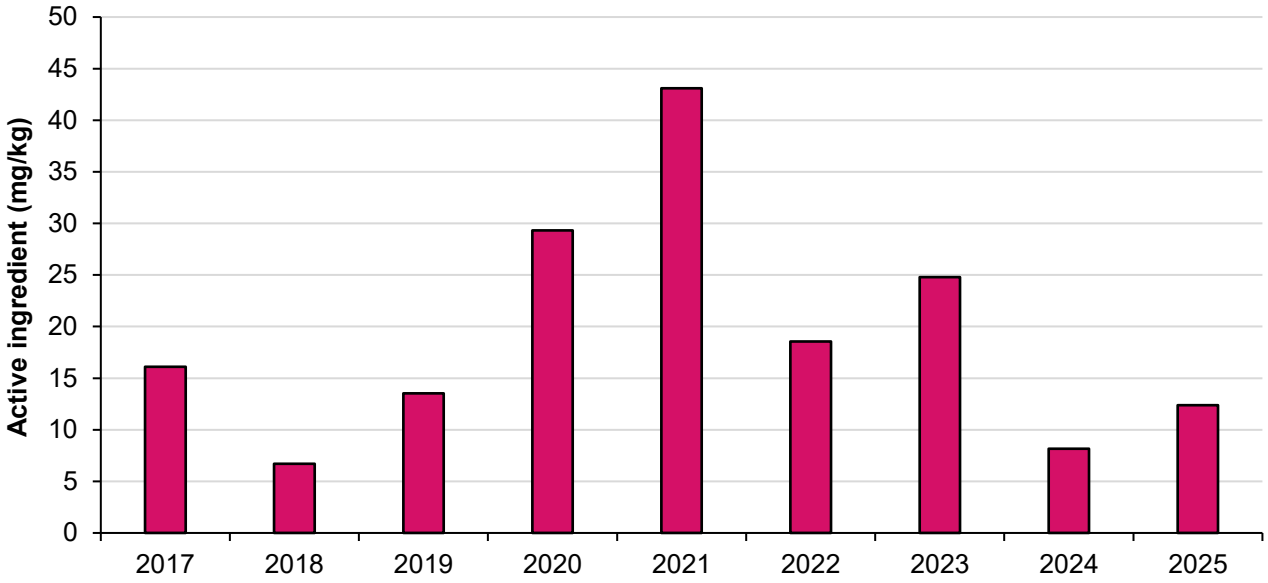
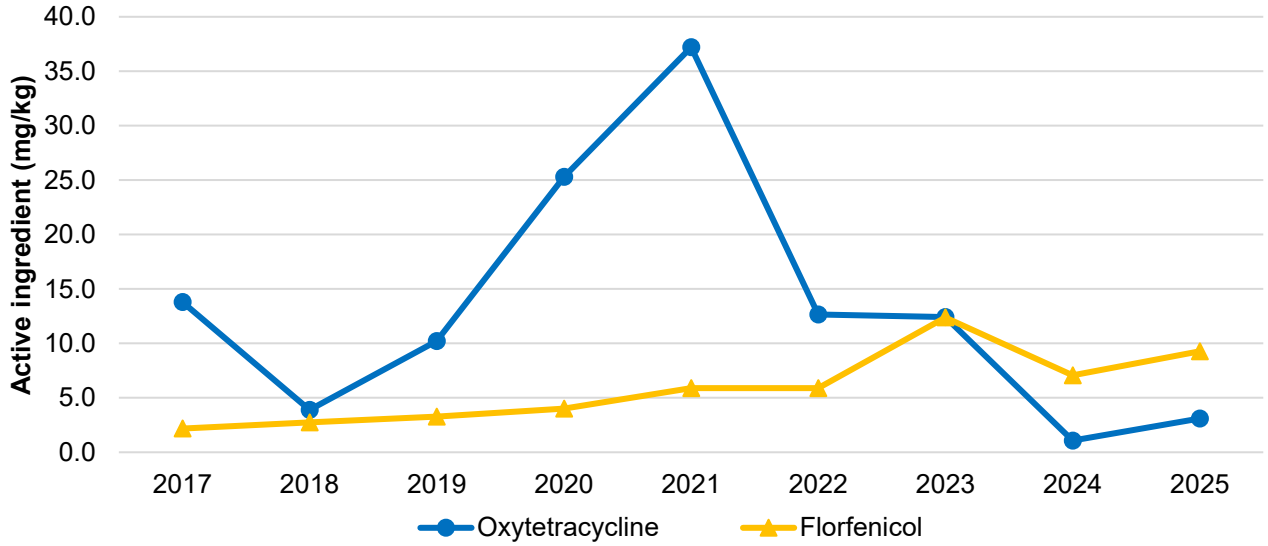


Figure 2.20: Antibiotic active ingredient (mg/kg) by antibiotic class used in salmon, 2017 to 2025.



2.3.5.1.2 Statement from Salmon Scotland

"The data records an increase in antibiotic use in food producing fish compared to 2024. Antibiotic treatments continue to be relatively infrequent in the salmon farming sector, with salmon requiring antibiotic treatment on only 13.2% of freshwater farms and 10.0% of marine farms treated during 2025. 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. The sector uses antibiotics targeted at fish-specific bacteria and, similar to previous years, there was no use of the HP-CIA oxolinic acid

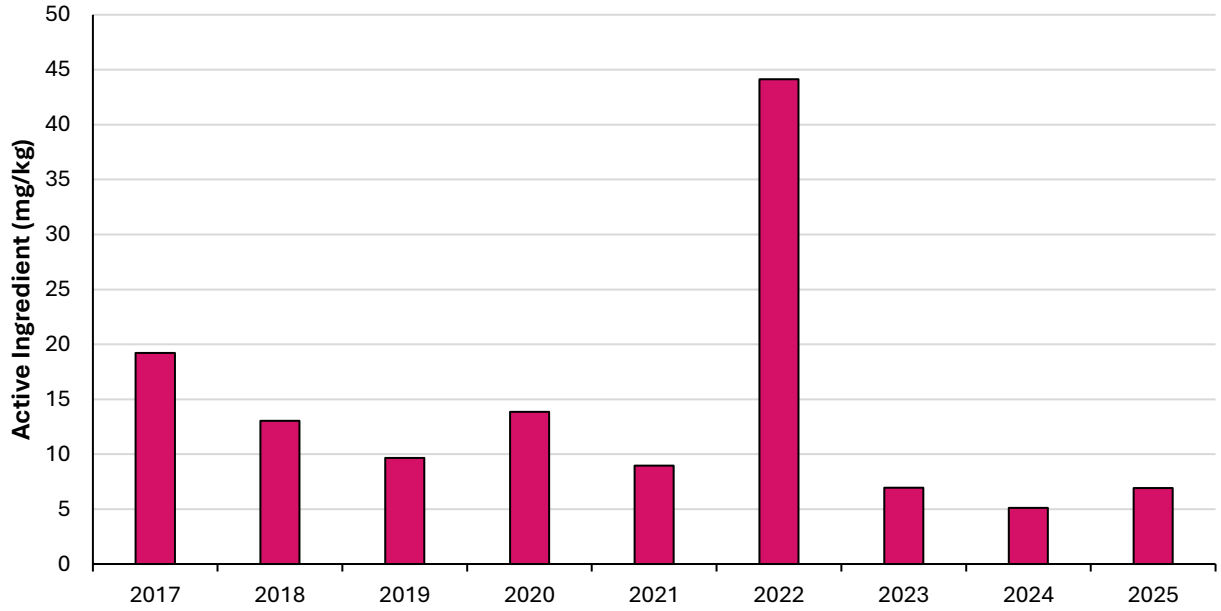
in 2025. The salmon sector continues to focus on a holistic and preventative approach to health management, including vaccination, antibiotic stewardship, biosecurity and health and welfare planning. The sector also continues to support the development of innovative approaches to fish health management, 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 were obtained from veterinary practices that treat approximately 90% of UK trout production (7 thousand tonnes liveweight of fish produced) and demonstrates that a total of 0.05 tonnes of antibiotic active ingredient was used in 2025. This represents 6.9 mg/kg, which is an increase of 36% (1.8 mg/kg) since 2024, but use remained 64% lower than when recording began in 2017 (see **Figure 2.21**).

Figure 2.21: Active ingredient (mg/kg) of antibiotics by antibiotic class used in trout, 2017 to 2025.



The trout sector has a limited range of antibiotic treatment options available. Oxytetracycline is currently the only antibiotic active ingredient authorised specifically for use in trout. Florfenicol products authorised for use in salmon may be prescribed for trout under the Cascade, while oxolinic acid products are imported through the Special Import Certificate (SIC) scheme. When considering use by class, oxytetracycline and florfenicol account for 43% of antibiotic use and, between 2024 and 2025, their use decreased by 0.6 mg/kg and 0.1 mg/kg, respectively.

The HP-CIA oxolinic acid is a quinolone which is commonly used to treat enteric redmouth disease caused by *Yersinia ruckeri*. In 2025, use of oxolinic acid accounted for 57% of overall use and, between 2024 and 2025, this increased from 1.5 mg/kg to 4.0 mg/kg. This is still 40% lower than when recording began in 2017. The increase in oxolinic acid use is reported to have been driven by disease outbreaks on a small number of sites. The causes of these included management factors and water quality issues, alongside cases where Enteric Redmouth vaccine supply issues in previous years resulted in fish not being vaccinated as planned, increasing susceptibility to disease.

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

"While antibiotic use in the trout sector increased in 2025, overall use remains well below the industry target of 20 mg/kg and is still 64% lower than when reporting began in 2017. The increase was largely driven by higher use of oxolinic acid, which reflected disease challenges on a small number of sites and outbreaks of bacterial diseases requiring treatment to protect fish health and welfare. In particular, the sector experienced the effects of Enteric Redmouth vaccine supply issues the previous year, resulting in some fish not being vaccinated as planned, with a consequent increase in susceptibility to disease.

Antibiotics are only used when clinically necessary and under veterinary oversight. The trout sector remains committed to reducing antibiotic use through disease prevention, including vaccination, good husbandry, biosecurity and the promotion of best practice through the Quality Trout UK standard. The sector continues to invest in fish health initiatives and supports the development and availability of new and improved vaccines, recognising their importance in preventing disease outbreaks and reducing reliance on antibiotics in the future."

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 which first published data covering 2022 in 2023.

Currently, the Medicine Hub captures around 11% of the national sheep flock data and 49% of the dairy herd. As these data represent a smaller percentage of the national ruminant population (in comparison to other sectors) they cannot be interpreted as ‘national’ antibiotic use figures for these sectors. However, they do provide some valuable insights.

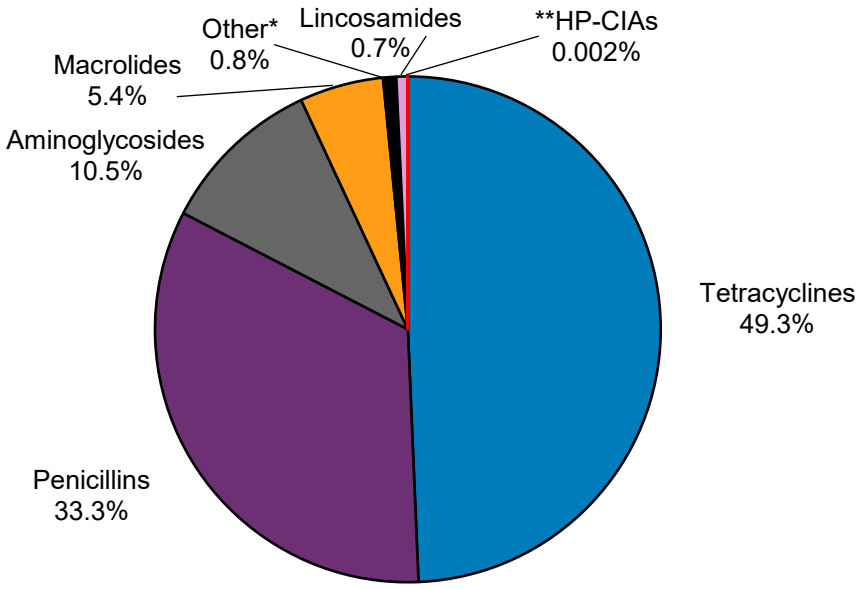
Antibiotic use data from the beef sector were not provided for inclusion in this report. This is because the large diversity of beef farm system in the UK (suckler, dairy beef, calf rearers and finishers) combined with the low coverage (around 10%) results in a higher chance of the mg/kg data not being an accurate reflection of the national picture (see the RUMA sector target reports for further details).

The mg/kg figures presented for ruminants, unless otherwise stated, are calculated using the revised mg/kg methodology for dairy and sheep (see Supplementary Material 1 for further details).

2.3.6.2 Sheep antibiotic use data

Antibiotic use data representing 11% of the UK finished lambs (over 1.4 million) and over 1 million adult sheep was collected in 2025. The overall use was 0.5 tonnes, which represented 4.3 mg/kg (4.8 mg/PCU). Overall, 83% of the antibiotic classes used were either tetracyclines or penicillins (**Figure 2.22**) and 97% were injectables. HP-CIA use was extremely low, accounting for 0.0001 mg/kg (0.002% of total use). Products imported under the Special Import Scheme accounted for 57 kg of active ingredient (11% of total use) and largely relate to injectable tetracyclines and injectable penicillin/ streptomycin products, due to product shortages of the authorised equivalent products in 2025. However, it should be noted that, due to the limited proportion of the industry covered, these data may not be representative of overall use in the sheep sector.

Figure 2.22: Antibiotic active ingredient used in sheep, by antibiotic class, 2025.



*Other includes trimethoprim-sulfonamides (0.26%), amphenicols (0.56%), first- and second-generation cephalosporins (0.02%) and aminocoumarins (0.0005%).

**HP-CIA used was fluoroquinolones which represented < 0.002% of the weight (kg) of active ingredients used.

2.3.6.2.1 Statement from the Sheep Antibiotic Guardian Group

“The sheep sector remains committed to using antibiotics as little as possible and as much as necessary. This promotes responsible use as well as protecting animal health and welfare. Close collaboration between farmers, vets and industry organisations continues to underpin the sector's approach to antimicrobial stewardship.

Data submitted to Medicine Hub from flocks representing approximately 11% of UK finished lamb production continues to provide a useful indication of antibiotic use within the sheep sector. Whilst the dataset does not represent the whole national flock, the figures from participating farms continue to demonstrate low use. Tetracyclines and penicillins accounted for most use, with very low use of highest priority critically important antibiotics (HP-CIAs), and the vast majority of treatments administered were as injectables to individual animals. These findings are consistent with the sector's ongoing efforts to preserve antibiotics that are most important to human medicine while ensuring appropriate treatment is available when needed

The sheep sector continues to encourage uptake of national medicine recording systems and voluntary data sharing through Medicine Hub to strengthen the evidence base and improve understanding of antibiotic use patterns. Increasing participation remains important to support national reporting and identify opportunities for continued improvement.

This year the sheep sector has worked collaboratively with cattle sector colleagues and across the nations to develop and launch the UK Ruminant Antibiotic Stewardship Roadmap. This initiative has brought together farming, veterinary, research and industry stakeholders to identify practical approaches for strengthening stewardship and improving the collection of antibiotic use data across the UK ruminant sectors. The recommendations emerging from the project will help inform future stewardship activities and support the continued responsible use of antibiotics in sheep farming. This is in addition to ongoing initiatives promoting flock health planning, vaccination, biosecurity and strong veterinary-farmer relationships.

Through its continued focus on the principles of Plan, Prevent, Protect, the sheep sector remains committed to reducing disease risk, improving flock resilience and ensuring antibiotics remain effective for the future."

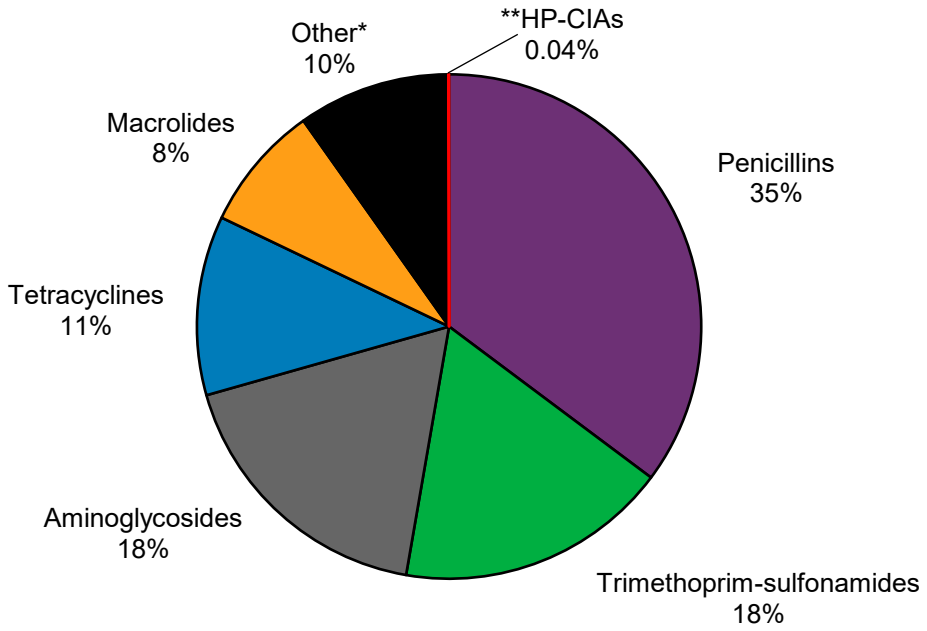
2.3.6.3 Dairy antibiotic use data

Data collected in 2025 represented 49% of the dairy sector. Overall, the use in this sample of the dairy sector was 5.4 tonnes, which represented 6.8 mg/kg (14.1 mg/PCU). This is almost identical to the dairy use figure published in 2024. The most commonly used antibiotic class was penicillins, representing 35% of total antibiotics used (**Figure 2.23**). Trimethoprim-sulfonamides, aminoglycosides and tetracyclines represented 18%, 18% and 12% of use respectively. HP-CIAs accounted for 0.003 mg/kg (0.04%), 57% of which were fluoroquinolones, with the remainder third- and fourth-generation cephalosporins.

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 0.5 tonnes of active ingredient (10% of the total), 66% of which were injectable products containing penicillin and streptomycin. This is due to product shortages for the authorised equivalent product, which occurred in 2025. Imported products also accounted for 5% of intramammary lactating cow active ingredient used and 1% 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 2.23: Antibiotic active ingredient used in dairy cattle, by antibiotic class, 2025.



*Includes first- and second-generation cephalosporins (5.1%), amphenicols (4.4%), lincosamides (0.2%), and aminocoumarins (0.14%).

**HP-CIAs include fluoroquinolones and third- and fourth- generation cephalosporins, which together accounted for 0.04% of the weight (kg) of active ingredients used.

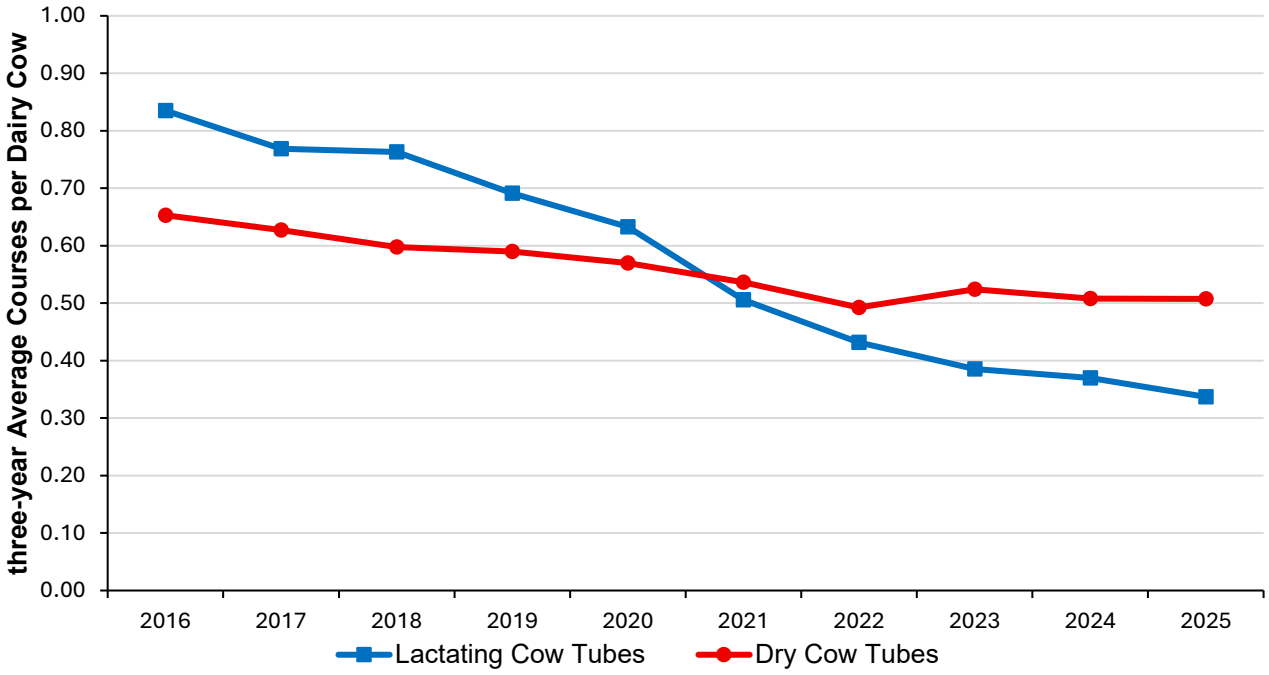
2.3.6.4 Using sales to estimate use in cattle

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 these data are included here.

2.3.6.4.1 Rolling three-year average of intramammary sales

The cattle sector monitors use of intramammary sales using a three-year rolling average of sales of intramammary products for both lactating and dry cow products. In 2025, the three-year rolling average was 0.51 DCDVet for dry cow tubes. This represents essentially no change since the previous three-year average. For lactating cow intramammary tubes the three-year rolling average was 0.34 DCDVet, which is a reduction of 9% (0.03 DCDVet) on the previous three-year average. Since 2016, the three-year average for dry cow tubes has reduced by 22% and lactating cow tubes by 60% (**Figure 2.24**). Yearly sales of intramammary products are presented in Chapter 1 (Section 1.3.5).

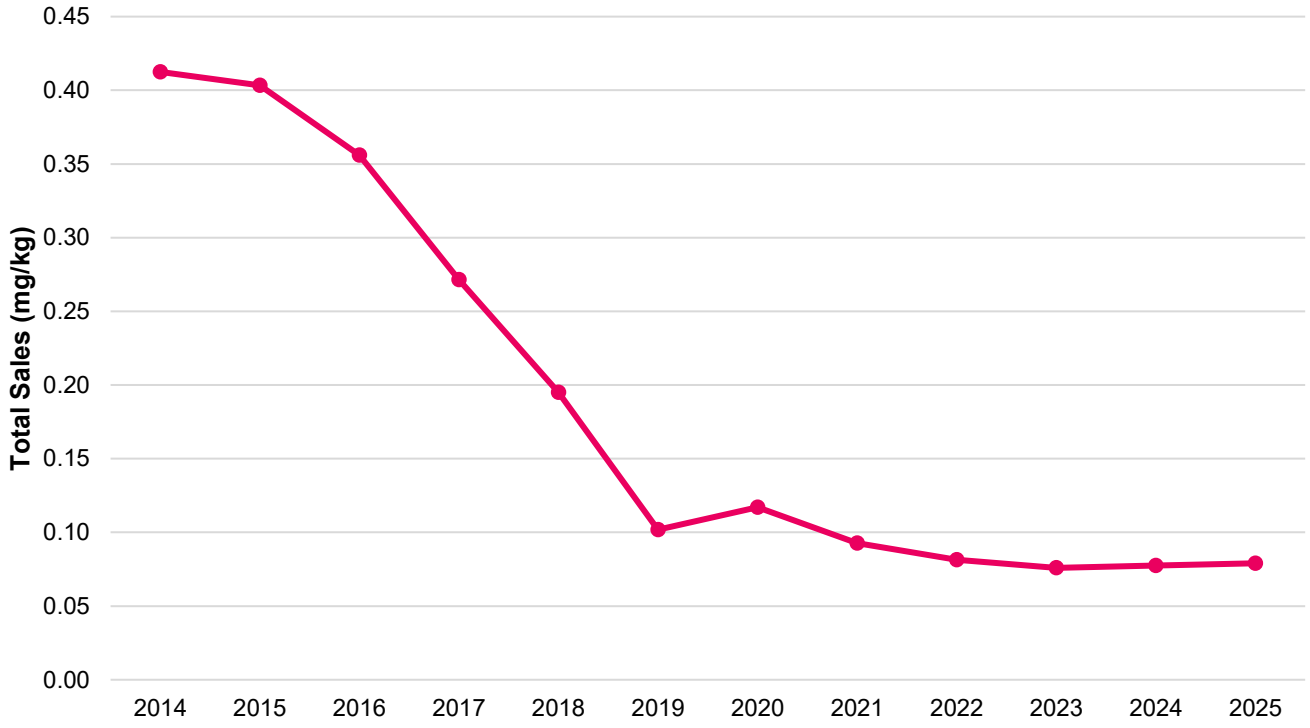
Figure 2.24: Three-year rolling average of sales of lactating-cow and dry-cow intramammary products (DCDVet), 2016 to 2025.



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 of antibiotic use data for the pig sector show that the use of these products is very low. It is therefore reasonable to assume that the majority of these products are used in cattle. As shown in **Figure 2.25**, sales in 2025 were the same as 2024 at 0.08 mg/kg (0.19 mg/PCU) and have fallen by 81% since 2014.

Figure 2.25: Sales of injectable HP-CIA products authorised for cattle (mg/kg), 2014 to 2025.



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

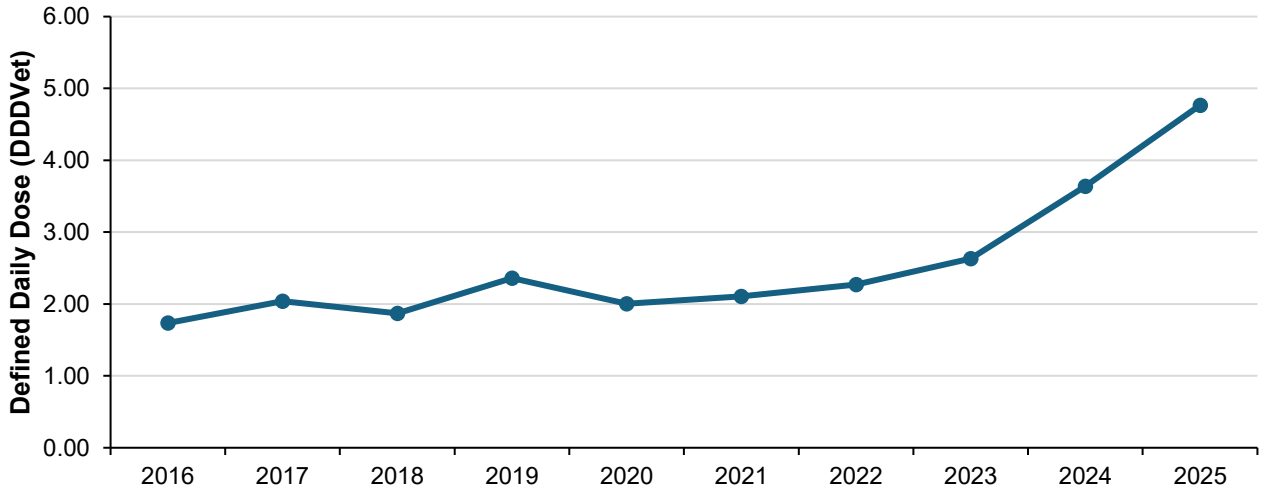
Oral antibiotic products authorised for pre-ruminant calves are generally administered in milk or milk replacer, primarily for respiratory and enteric disease, with some products also used for the management of cryptosporidiosis. As several are also authorised for pigs and poultry, sales cannot be attributed reliably to calves alone. Dairy antibiotic use data, covering 49% of the sector, capture use in calves remaining on their farm of birth, but not use after animals move to specialist calf-rearing or other beef enterprises, and no beef use data were available for 2025. The available use data therefore provide only partial coverage of this important area of stewardship. Monitoring calf in-milk antibiotic use is an important focus for the sector, and as part of the RUMA Targets Taskforce the industry set a target to reduce calf oral antibiotic use by 10% compared with the previous year during 2025–2029.

Last year, VMD estimated oral calf antibiotic use using a residual-sales methodology. This approach used sales data for products authorised in cattle and other livestock species and subtracted antibiotic use reported by other sectors where these products are also used (pigs, poultry and gamebirds) and extrapolated up to cover the whole population, as outlined below:

Total sales of oral products (authorised for use in calves, pigs, meat poultry and laying hens)	–	**Usage data for oral products in pigs, meat poultry, laying hens and gamebirds** *extrapolated to represent 100% sector coverage*

The Defined Daily Dose (DDDVet) methodology was used to provide an estimate of the average number of days that each calf receives an antibiotic. The full methodology can be found in Supplementary Material 1. This year, application of the residual-sales methodology produced an estimated value of 4.77 DDDVet for 2025, 31% higher than in 2024 and a 175% increase since 2016 (see **Figure 2.26**).

Figure 2.26: Sales of oral antibiotic products authorised for use in cattle and livestock species minus use data for pigs, poultry and gamebirds, analysed by Defined Daily Dose (DDDVet), 2016 to 2025.



The lack, or low coverage, of usage data in some sectors generates a strong incentive to see if extrapolation of sales data can give any insights on use. This works well for products like intramammary tubes which are only authorised for one species and sector. The assumptions are more complex for orally administered antibiotics in calves, to the extent this year that we do not consider this extrapolation to be a reliable indicator of use of these products in calves. This is because the rise in sales of this product type was driven primarily by increased sales of oral aminoglycoside and macrolide products authorised for calves alongside other livestock species (pigs, meat poultry and gamebirds). The available antibiotic use data for dairy (covering 49% of the sector), which includes calves reared on the dairy farm, do not demonstrate any use of this oral aminoglycoside product and show relatively low use of the oral macrolide product. This observation is broadly consistent with historical antibiotic use data previously collected by the VMD from the dairy and beef sectors, which also showed limited use of these products in the cattle population. However, it should be noted that the dairy data only captures calves that remain on the dairy holding and no beef antibiotic use data were available for 2025.

As explained earlier in the sales and use chapter, alternative explanations for sales and use data not correlating are that it may reflect products entering the supply chain in 2025 for use in subsequent years, or use occurring in animal populations not fully captured by current antibiotic use datasets. As described in section 2.1.2, although coverage is high for pigs (98%), meat poultry (83%), laying hens (estimated 90%) and gamebirds (estimated 80% for soluble products), it is not complete and use patterns may differ in the populations not represented within the data.

Taking all of these factors into account, we do not consider the residual-sales methodology to provide a reliable estimate of calf antibiotic use in 2025. The patterns observed in the sales data are not consistent with the available dairy use data or with historical antibiotic use data from the cattle sector. As the reasons for this discrepancy cannot currently be determined with sufficient confidence, we will not be using this figure to estimate calf antibiotic use in 2025.

2.3.6.5 Statement from the Cattle Antibiotic Guardian Group (CAGG)

"The cattle sectors continue to support the voluntary collection of antibiotic use data through Medicine Hub, the industry-owned data collection system for ruminants. The coverage of dairy antibiotic use data increased from 39% to 49% in 2025, representing a significant step forward in the industry's ability to monitor antibiotic use and support stewardship. This progress has been supported by increased participation across the supply chain, including dairy processors and milk purchasers. CAGG welcomes this increase in participation and recognises that further improving the coverage and representativeness of antibiotic use data, alongside strengthening stewardship and responsible use, is a key ambition of the UK Ruminant Antibiotic Stewardship Roadmap. 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).

Encouragingly, antibiotic use within the dairy dataset remains low, with very low use of highest priority critically important antibiotics (HP-CIAs). The continued reduction in sales of lactating cow intramammary products is also encouraging and reflects ongoing improvements in mastitis prevention and management. However, while dry cow tube sales remain significantly below historic levels, recent progress has been limited, and further efforts are needed to support the appropriate implementation of selective dry cow therapy.

While we don’t think this year that the residual-sales methodology is a reliable indicator of use of these products in calves, for the reasons outlined in the report, the cattle sectors continue to recognise calf antibiotic use as a priority area for action and remain committed to working with farmers, veterinarians and industry partners to better understand the drivers of use, improve calf management and reduce the need for antibiotic treatment while maintaining high standards of animal health and welfare."

2.3.7 Companion Animals

2.3.7.1 Antibiotic use in dogs and cats

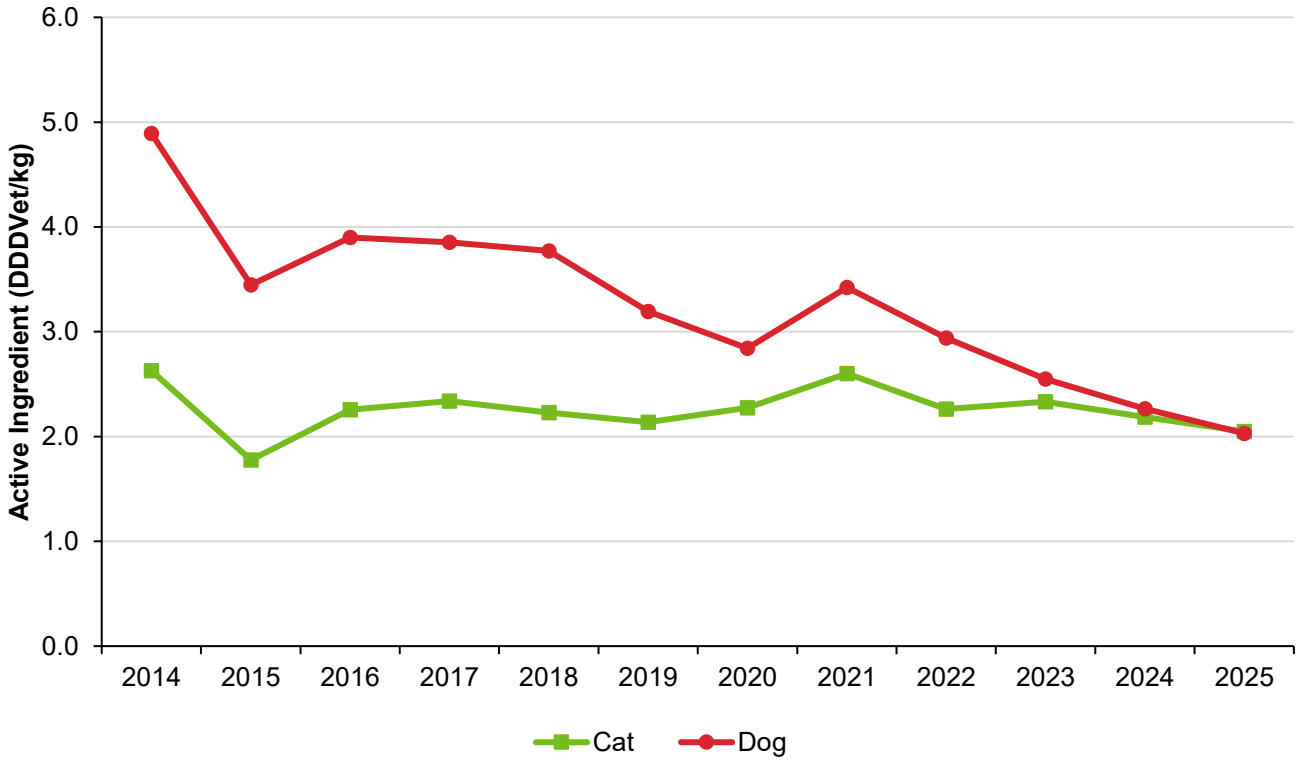
Antibiotic use data are not available for the UK’s estimated 11.1 million dogs and 10.5 million cats. Therefore, antibiotic use in dogs and cats is estimated by stratifying the sales data reported by veterinary pharmaceutical companies; the full methodology was developed in conjunction with the Responsible Use of Medicines Alliance – Companion Animal and Equine (RUMA CA&E) and further details can be found in Supplementary Material 1.

In 2025, antibiotic use in dogs and cats was estimated to be 42 mg/kg for dogs (7.6 tonnes active) and 30 mg/kg for cats (1.3 tonnes active), and use of HP-CIAs was 0.32 mg/kg for

dogs and 0.47 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 2025, the DDDVet was 2.03 for dogs and 2.05 for cats. Sales of antibiotic products for dogs in 2025 have decreased by 10% (0.23 DDDVet) since 2024 and 58% since 2014. In cats, sales have decreased to a lesser degree by 6% (0.14 DDDVet) since 2024 and 22% since 2014 (**Figure 2.27**).

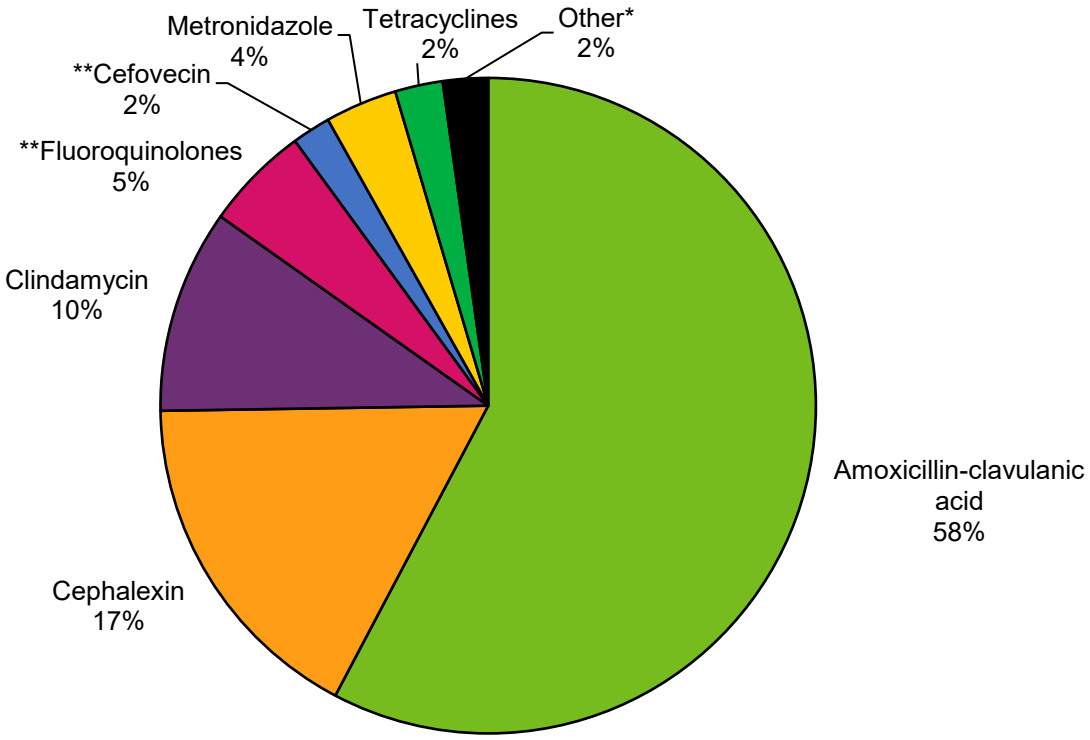
Figure 2.27: Active ingredient (DDDVet/animal) of antibiotics sold for use in dogs and cats, 2014 to 2025.



In dogs, products containing amoxicillin combined with beta-lactamase inhibitor (clavulanic acid) were the most sold active ingredient in 2025 (**Figure 2.28**), representing 58% of total sales. This was followed by cephalexin (a first-generation cephalosporin), which represented 17% of total sales. In cats, amoxicillin-clavulanic acid was also the most sold active ingredient in 2025, representing 56% of total sales, followed by the third-generation cephalosporin cefovecin (an HP-CIA) which represented 30% of total sales (**Figure 2.28**).

Figure 2.28: Active ingredient (DDDVet/animal) of antibiotics by active ingredient or antibiotic class sold for use in (A) dogs and (B) cats, 2025.

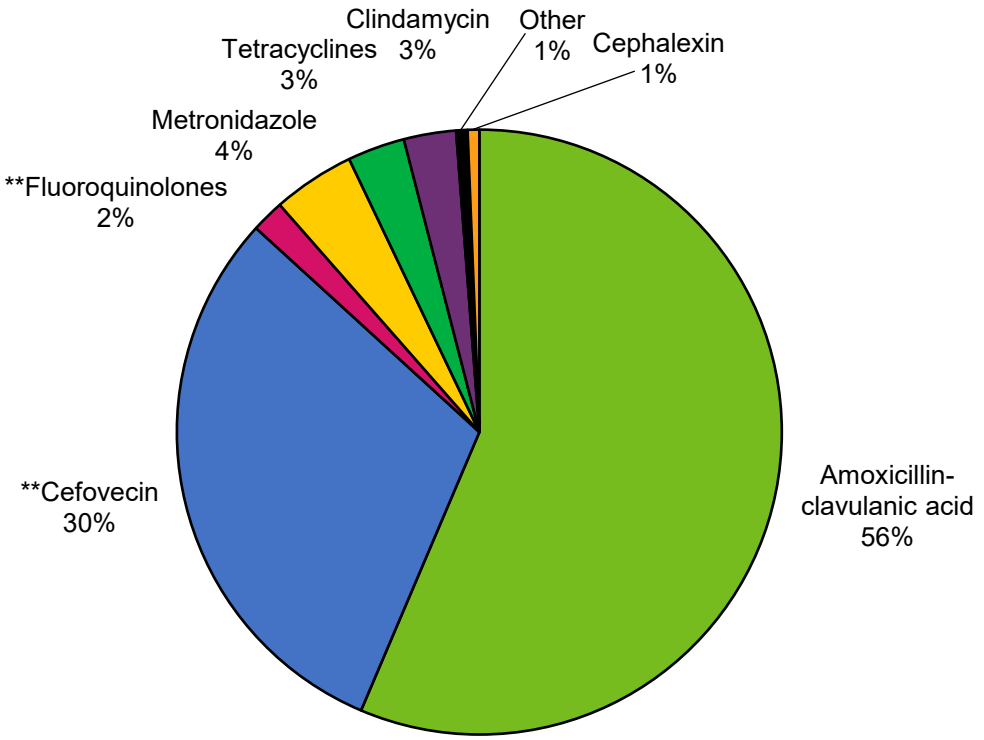
(A)



*Other includes aminopenicillins (amoxicillin and ampicillin) (2%), metronidazole-spiramycin (0.12%)

**Fluoroquinolones and the third-generation cephalosporin (cefovecin) fall under the category of an HP-CIA

(B)

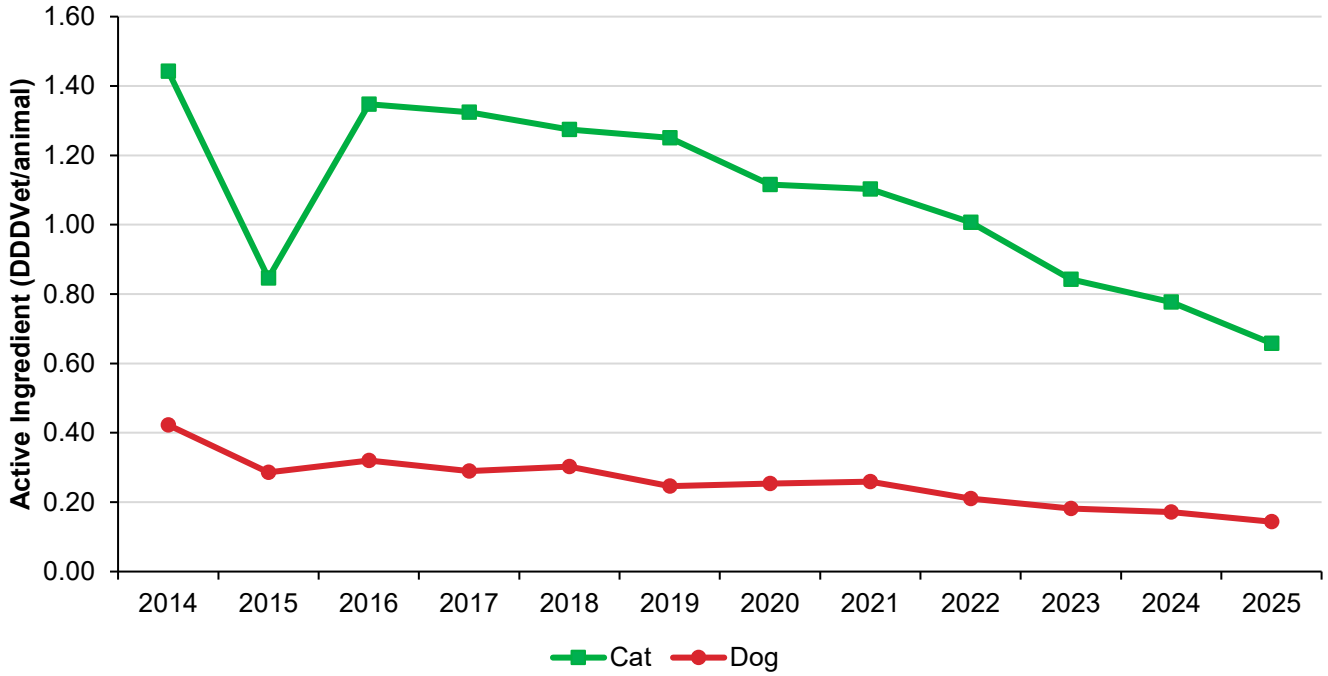


*Other includes aminopenicillins (amoxicillin and ampicillin) (0.5%), and metronidazole-spiramycin (0.12%)

** Fluoroquinolones and the third-generation cephalosporin cefovecin fall under the category of an HP-CIA

In dogs and cats, sales of HP-CIAs (Figure 2.29) accounted for 7% and 32% of total sales respectively. This represents a 0.03 DDDVet decrease for dogs since 2024 and a 66% decrease since 2014. In cats, a 0.12 DDDVet decrease is observed since 2024 and a 54% decrease since 2014 (**Figure 2.29**). Fluoroquinolones represented 73% of HP-CIA use in dogs, whereas in cats, 95% of HP-CIA sales were of the third-generation cephalosporin, cefovecin. Note that the large reductions in HP-CIA use recorded in cats in 2015 may have been influenced by product availability during that period and should be interpreted with caution.

Figure 2.29: Active ingredient (DDDVet/animal) of HP-CIAs sold for use in dogs and cats, 2014 to 2025.



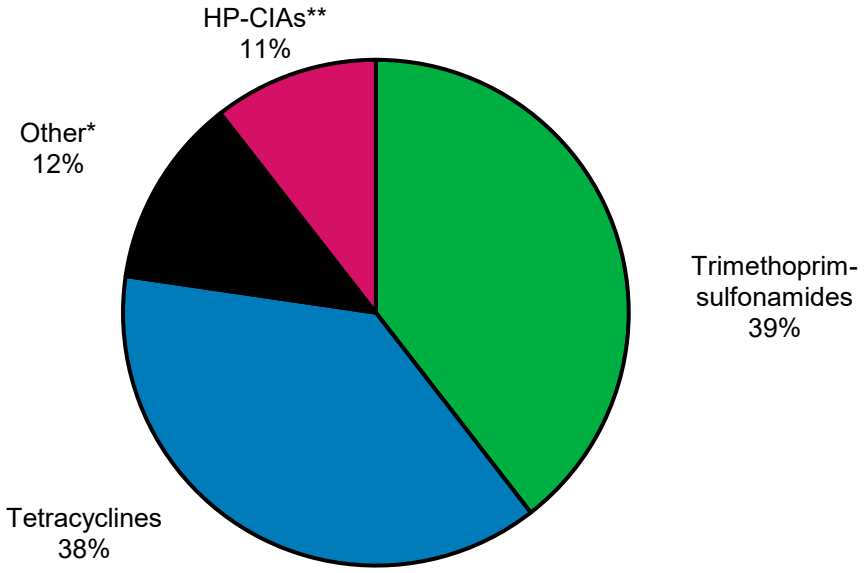
2.3.7.2 Antibiotic use in horses

Antibiotic use data were collected by the British Equine Veterinary Association (BEVA) as part of the MonitorMe scheme, with the aim of providing a UK figure and allowing practices to benchmark their antibiotic use relative to the national use figure. The data presented here comes from 34 veterinary practices and represents over 140,000 horses (around 19% of the total UK population).

Each submitting veterinary 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, these data were analysed using the mg/kg calculation (using a standard weight of 500 kg where average weights weren't provided) as well as the number of Defined Daily Doses, which uses standard equine dose rates to estimate the average number of treatment days per horse per year. This methodology is described further in Supplementary Material 1. 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 widely used oral trimethoprim-sulfonamide products is 30 mg/kg).

This sample shows that antibiotic use was 2.9 tonnes of active ingredient, which represents 41.7 mg/kg and 1.18 DDDVet/animal. HP-CIA use was 0.12 DDDVet/animal (11%), which is evenly spread between later generation cephalosporins and fluoroquinolones (see **Figure 2.30**).

Figure 2.30: Active ingredient (DDDVet/animal), by active ingredient or antibiotic class, in horses 2025.



*Nitroimidazoles, chloramphenicol, polymyxin B, rifampicin, lincosamides, first- and second-generation cephalosporins, and macrolides.

**Fluoroquinolones, third- and fourth- generation cephalosporins

2.3.7.3 Companion Animal and Equine Sector Updates

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

“The companion animal sector has made substantial progress in antimicrobial stewardship over recent years, supported by increasing awareness of antimicrobial resistance, improved stewardship resources and growing engagement from veterinary teams across the UK.

In 2025, RUMA CA&E launched the first national antimicrobial use reduction targets for companion animals. Using 2024 as the baseline, the sector has committed to reducing overall antimicrobial use in dogs and cats by 30% over five years and reducing HP-CIA use in cats by 50% over the same period. While it is too early to formally assess progress against these targets, the latest VARSS results continue to show encouraging long-term reductions in antibiotic use and Highest Priority Critically Important Antibiotic (HP-CIA) use in dogs and cats, providing a strong foundation for future stewardship activities.

To support delivery of these targets, RUMA CA&E launched its first condition-specific stewardship toolkits in 2026, focusing on canine acute diarrhoea and cat bite abscesses/cat fight wounds. These resources bring together evidence, decision-support tools and client communication materials to support prescribing decisions and help veterinary teams embed antimicrobial stewardship in clinical practice.

This targeted, evidence-based approach helps ensure reductions are achieved through improved prescribing decisions while maintaining high standards of animal health and welfare. Further condition-specific initiatives, including canine pyoderma and feline lower

urinary tract disease, are already in development as part of RUMA CA&E's ongoing stewardship programme."

RCVS Knowledge

"The 2026 RCVS Knowledge Antimicrobial Stewardship Awards highlighted the important contribution that quality improvement can make to responsible antibiotic use in veterinary practice. This year's award-winning and highly commended projects demonstrated how evidence-based interventions and clinical audit can support meaningful changes in prescribing behaviour whilst maintaining high standards of patient care and animal welfare.

Several of the recognised projects focused on common clinical presentations where antimicrobial stewardship opportunities exist in everyday practice. These included reducing unnecessary antibiotic use in dogs with acute diarrhoea and improving the responsible use of cefovecin, with all of the projects sharing a common focus on implementing clearer prescribing guidance to support responsible antimicrobial use. Together, these projects demonstrate how practical, practice-led interventions can translate antimicrobial stewardship principles into measurable improvements.

RCVS Knowledge continues to support veterinary teams through initiatives such as VetTeamAMR, a free online learning platform providing practical training on antimicrobial stewardship and responsible prescribing. By combining education, quality improvement and the sharing of successful stewardship projects, RCVS Knowledge is helping to embed antimicrobial stewardship into everyday clinical practice and support the responsible use of antibiotics across the veterinary profession."

British Equine Veterinary Association

"The equine data presented in this year's VARSS report, collected through BEVA's MonitorME programme, continue to improve our understanding of antimicrobial use within the equine sector and provide an important evidence base for antimicrobial stewardship. The results demonstrate the value of collecting antibiotic use information directly from equine practice and provide important insights into prescribing patterns, antibiotic classes used and national stewardship trends.

MonitorME provides the valuable evidence base for antimicrobial stewardship within the equine sector. By collating antimicrobial use information from across equine practice, the programme helps improve understanding of prescribing patterns, supports analysis of national trends and enables participating practices to better understand their own antimicrobial use.

During 2026, BEVA has focused on developing MonitorME from a largely spreadsheet-based reporting process into a modern digital platform. The new system has been designed to simplify data submission, improve data processing and provide more accessible feedback to participating practices through online reporting and data visualisation tools.

BEVA sees MonitorME as more than a surveillance exercise. The long-term aim is to create a sustainable, profession-led stewardship resource that enables equine practices to use their own data to support continuous improvement. Increasing participation remains a key priority, helping to strengthen the national evidence base and allowing the profession to demonstrate responsible antibiotic use through robust data."

CHAPTER 3

Harmonised monitoring of antibiotic resistance

3.1 Introduction

The harmonised monitoring programme provides a long-running and representative assessment of antimicrobial resistance (AMR) in bacteria isolated from healthy food-producing animals in the UK. It involves testing for resistance in zoonotic and commensal bacteria from healthy food-producing animals at slaughter and on-farm *Salmonella* isolates from the poultry National Control Programmes (NCP). This surveillance is designed to be representative of UK food-producing animal populations, providing up-to-date data on AMR in broilers and fattening pigs throughout the UK, and turkeys in Great Britain. Continuity of surveillance enables trends to be assessed, emerging resistance issues to be identified, and progress in tackling AMR to be monitored. Maintaining harmonisation with other European countries in this area facilitates comparability of AMR data, which means the UK situation can be better contextualised and risks more accurately understood.

In the harmonised monitoring programme, key livestock species are monitored for AMR 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 2025 data presented here originates from healthy fattening pigs at slaughter in the UK. Key outcome indicators for AMR in food-producing animals in the UK are generated by combining results from pigs, broilers and turkeys over two successive years. These indicators are weighted by the estimated weight of the animal populations, thereby providing an overall measure of AMR for these species.

Standard testing involves isolating specific bacteria on non-selective media 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 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. The bacteria, selected resistance, sample origins, animal species and monitoring years included in the programme are summarised in Table S4.1 in Supplementary material 4.

The majority of results in this chapter are reported 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 to assess resistance to the antibiotics tested because they are more sensitive than clinical breakpoints (CBPs) for detecting emerging resistance. ECOFFs 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).

Results are presented in two graphs: antibiotics within non-HP-CIA classes (A), and antibiotics within HP-CIA and human-only classes (B), according to World Health Organisation (WHO) categorisation.

The harmonised monitoring programme provides surveillance of AMR in healthy food-producing animals. This is complemented by the Food Standards Agency (FSA) monitoring and reporting of AMR in retail meat.

Box 3.1: Updates and corrections since UK-VARSS Report 2024

Please note that some results for previous years, as shown in this chapter and the Supplementary Material 5, differ from previous reports due to amendments in historical data.

Data updates: The pig and poultry population weights used to calculate the primary key outcome indicator (fully susceptible *E. coli*) and secondary outcome indicators (multi-drug resistant, ciprofloxacin resistant and presumptive ESBL/AmpC *E. coli*) have been updated in UK-VARSS 2025. Following the introduction of revised animal weight metrics, these indicators have been recalculated for all years. Previous UK-VARSS reports used population correction unit (PCU) weight metrics. A comparison of the weight metrics is outlined in Section 1.1.1 of UK-VARSS 2024.

Data corrections: The secondary key outcome indicator data for presumptive ESBL-/AmpC-producing *E. coli* has been updated in UK-VARSS 2025 following the identification and correction of a calculation error affecting data reported for 2022-2024. A comparison of the originally published and corrected values is provided in Supplementary Material 4, Section S3.2, Figure S1.1. Individual animal species results were unaffected. Corrected values indicate an increasing trend since 2020, rather than the stable or declining trend suggested by previously published figures. Despite this, levels remain lower than in 2015.

3.2 Summary

- ***Escherichia coli*** is widely used as an indicator bacterium owing to its commensal nature and high prevalence within intestinal tracts of animals and people. Key outcome indicators were generated from *Escherichia coli* and weighted by estimated animal population weight to provide an overall measure of AMR in UK meat poultry and pigs.
    - The primary key outcome indicator, percentage of *E. coli* with full susceptibility, has remained at similar levels, after its substantial decrease between 2022/23 and 2023/2024. This predominantly reflects increased resistance in broilers in 2024 but is also affected by slightly increased resistance in pigs in 2025.
    - Two of the secondary harmonised outcome indicators - multi-drug resistant (MDR) *E. coli* and ESBL-/AmpC-producing *E. coli* marginally worsened in 2025, while ciprofloxacin resistance remained stable.
    - Resistance to antibiotics within HP-CIA and human-only classes in indicator *E. coli* remained low (<10%), with no resistance detected to meropenem, colistin or tigecycline.
- **Enterococci** are indicator species for the detection of AMR in Gram positive bacteria. Resistance patterns remained broadly stable, and resistance to ampicillin reduced significantly. In *E. faecium*, vancomycin-resistant isolates were detected for the first time, while resistance to linezolid remained very low. Neither vancomycin nor linezolid resistance was detected in *E. faecalis*.
- ***Salmonella*** is an important foodborne pathogen that has been monitored for AMR in pig caecal samples since 2021. Resistance in *Salmonella* showed the most notable improvement, with full susceptibility increasing to 57% in 2025. MDR continued to decrease. For the first time, no resistance to HP-CIAs or human-only antibiotics was detected.
- ***Campylobacter*** is a zoonotic pathogen and a leading cause of food poisoning in people in the UK. Resistance in *Campylobacter coli* in 2025 was broadly similar to 2023. While tetracycline resistance remained extremely high (75%), resistance to the HP-CIA ciprofloxacin decreased slightly, and MDR remained uncommon.
- Selective media was used to detect carriage of specific resistances, even in very small amounts within individual animals. Carriage of ESBL-/AmpC-producing *E. coli* increased from 23% of pigs in 2023 to 32% in 2025; more than a third of these isolates were resistant to both third- and fourth-generation cephalosporins and fluoroquinolone antibiotics. Carriage of *E. coli* resistant to carbapenems, colistin, or amikacin remained negligible, at <1%.

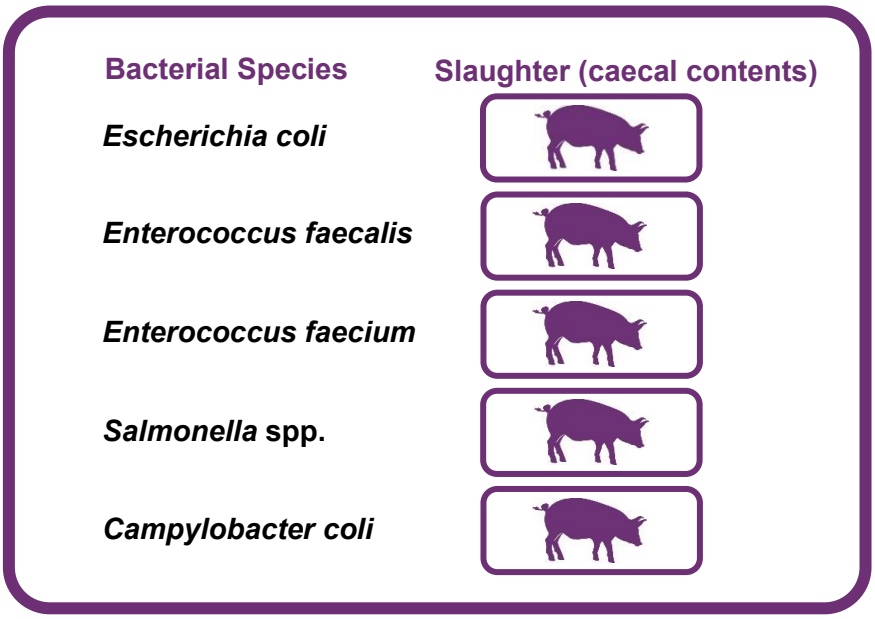
3.3 Methods

3.3.1 Sample collection and culture

The sampling plans were randomised, stratified, and weighted by slaughter throughput. All countries within the UK were included in the sampling frame for pigs. Between January and December 2025, samples were collected from slaughterhouses processing 90% of domestically produced fattening pigs. Caecal samples were taken from individual pigs for the isolation of *Escherichia coli*, *Enterococcus faecalis, Enterococcus faecium, Salmonella* spp. *and Campylobacter coli* as described in Decision (EU) 2020/1729, (**Figure 3.1**). Samples

were cultured on non-selective media using standardised methods. Single typical colonies were selected for speciation and susceptibility testing (AST, Section 3.3.2).

Figure 3.1: Summary of bacterial species isolated using non-selective media in 2025 according to sample origin.



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. Standardised broth microdilution was used to determine the minimum inhibitory concentration (MIC) against a panel of antibiotics. The antibiotics used are listed in Table 4.2 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 (**Table 1**).

3.3.3 Interpretation of results

Epidemiological cut-off values (ECOFFs) were used to interpret the results in this chapter. ECOFFs distinguish wild-type (natural) bacterial populations from those that have acquired resistance mechanisms. ECOFFs are used for AMR surveillance to identify emerging resistance, whereas clinical breakpoints (CBPs) are used to predict whether an infection is likely to be treatable. Consequently, isolates classified as 'resistant' using ECOFF do not necessarily correspond to clinical treatment failure (i.e. a drug-resistant infection).

Where possible, European Committee on Antimicrobial Susceptibility Testing (EUCAST) ECOFF values were used. 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 are regularly reviewed and updated as new data emerges. The cut-off values in this chapter were sourced in February 2026 and are listed in Table 4.2 of Supplementary Material 4.

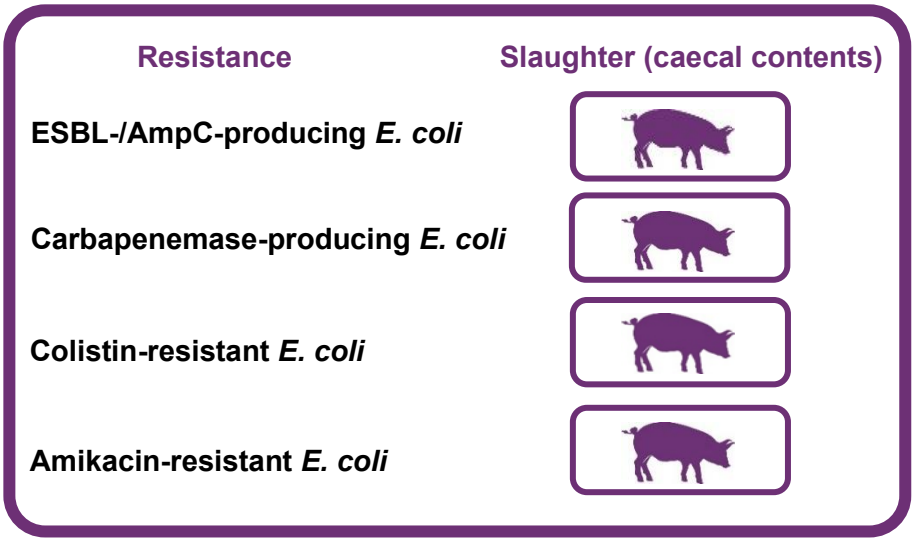
Readers interested in looking at comparative human clinical breakpoints can find the breakpoints used in Table 4.2 of Supplementary Material 4 and the full set of results in Supplementary Material 5.

In this report, multi-drug resistance (MDR) is defined as resistance to three or more antibiotic classes.

3.3.4 Using selective media to detect resistance

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, even when present in very small amounts within individual samples. This type of testing focuses on identifying the presence of resistance to specific highest priority critically important antibiotic classes (HP-CIAs) or other antibiotics with human health relevance. Caecal samples were cultured on selective media to identify ESBL-, AmpC- and/or carbapenemase-producing, colistin-resistant *E. coli* and amikacin-resistant *E. coli* (Figure 3.2**,** S3.6 in Supplementary Material 4).

Figure 3.2: Specific resistances in *E. coli* identified by selective media.



3.3.5 Polymerase chain reaction

Polymerase chain reaction (PCR) was used to detect specific antibiotic resistance mechanisms in *E. coli* isolated from pigs using selective media: the *rmtB* gene present in amikacin-resistant isolates and selected *mcr* genes in colistin-resistant isolates. (S3.7 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 detected from pigs (S3.8 in Supplementary Material 4).

3.3.7 Statistical analysis

Confidence intervals (CIs) are used to describe 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 Key AMR outcome indicators

Key outcome indicators are standardised measures for interpreting and comparing AMR monitoring data across different countries and sectors. By ensuring consistent collection reporting over time, they enable assessment of trends and facilitate international comparisons in a transparent way.

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. This report includes one primary and three secondary outcome indicators from the ongoing harmonised monitoring for AMR in pigs and poultry. The primary outcome indicator of full 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. The outcome indicators are combined over two years due to the alternating schedule for AMR pig and poultry sampling and are weighted by estimated population weight (kg) (Section 3.4.1).

Statistical significance for long-term differences in the key outcome indicators was determined by simple linear regression. Changes in trends were determined by change-point linear regression.

3.4 Results

Classification of resistance as low, moderate, high etc. throughout the report is consistent with the EFSA definitions for these terms (**Table 3.1**).

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 ^).

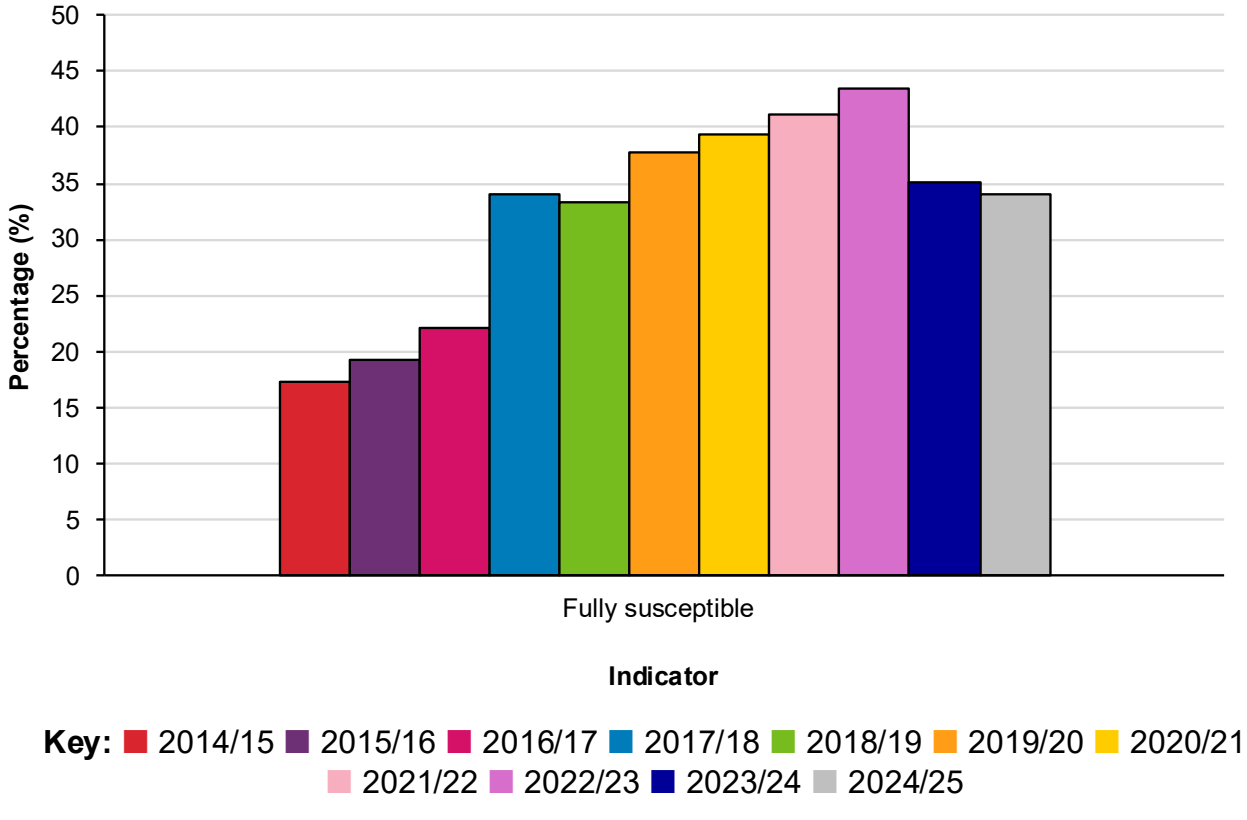
The complete dataset is available in downloadable Excel format in Supplementary Material 5.

3.4.1 Key AMR outcome indicators

This report includes one primary and three secondary key outcome indicators from the ongoing harmonised monitoring for AMR, providing an indication of the UK's progress in combating AMR in pigs and meat poultry.

The primary key outcome indicator (**Figure 3.3**) shows that full susceptibility in *E. coli* isolated from broilers, turkeys and pigs broadly remained unchanged at 34% in 2024/2025, compared with 35% in 2023/2024. The previous reporting period marked the first notable decline in full susceptibility since monitoring began in 2014, mainly driven by increased resistance in broilers. As the data are combined over two years this reduction in susceptibility in broilers in 2024 continues to influence the overall result for 2024/2025. A slight reduction in full susceptibility for pigs in 2025 has also contributed. This indicator remains significantly higher than in 2014/2015 (17.2%).

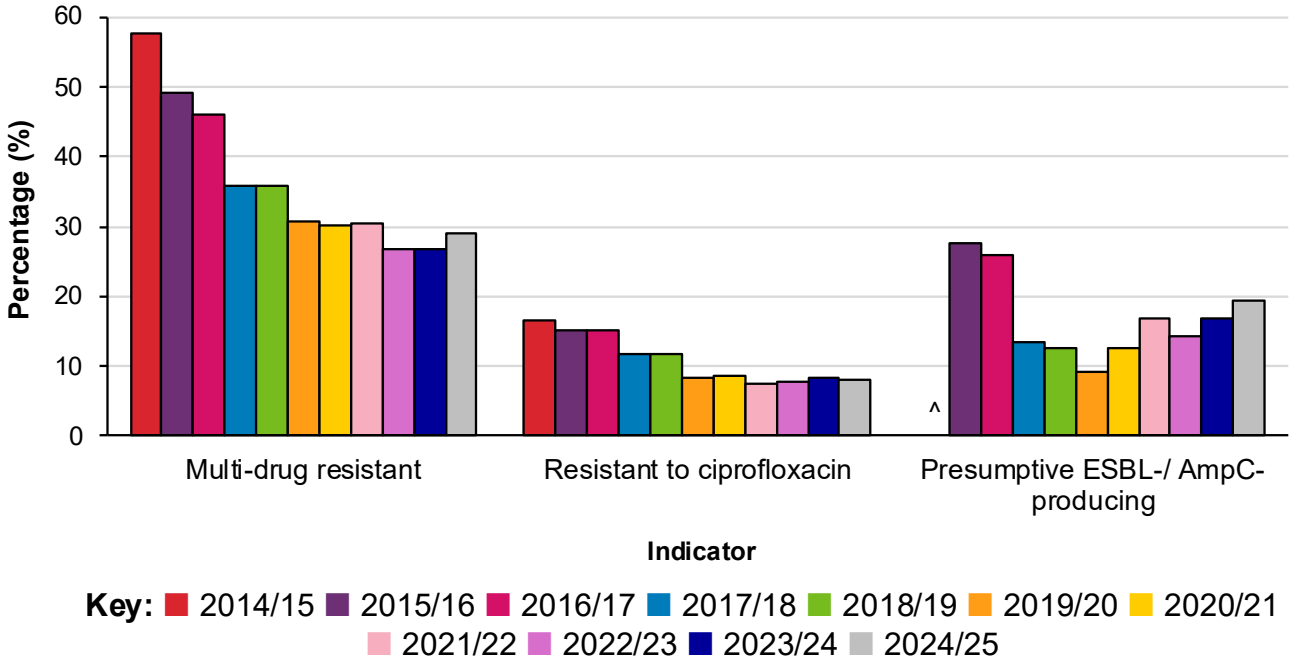
Figure 3.3: Primary key outcome indicator: percentage of fully susceptible *Escherichia coli* isolates from broilers, turkeys and pigs, weighted by estimated animal population (kg), combined over two years.



^ Data not available

The secondary key outcome indicators in 2024/2025 (**Figure 3.4**) have also worsened slightly. The percentage of MDR isolates (29%) has increased from 26.6% in 2023/2024, but remains significantly lower than in 2014/2015 (57.7%). The percentage of samples containing presumptive ESBL-/AmpC-producing *E. coli* also increased, from 17% in 2023/2024 to 19.5% in 2024/2025. Corrected values for previous years (Box 3.1) show a significant increase in trend since 2019/2020 (9.1%). The percentage of isolates resistant to the HP-CIA quinolone ciprofloxacin (8.0% in 2024/2025) has remained stable since 2019/2020 (8.4%), and remains significantly lower than in 2014/2015 (16.5%).

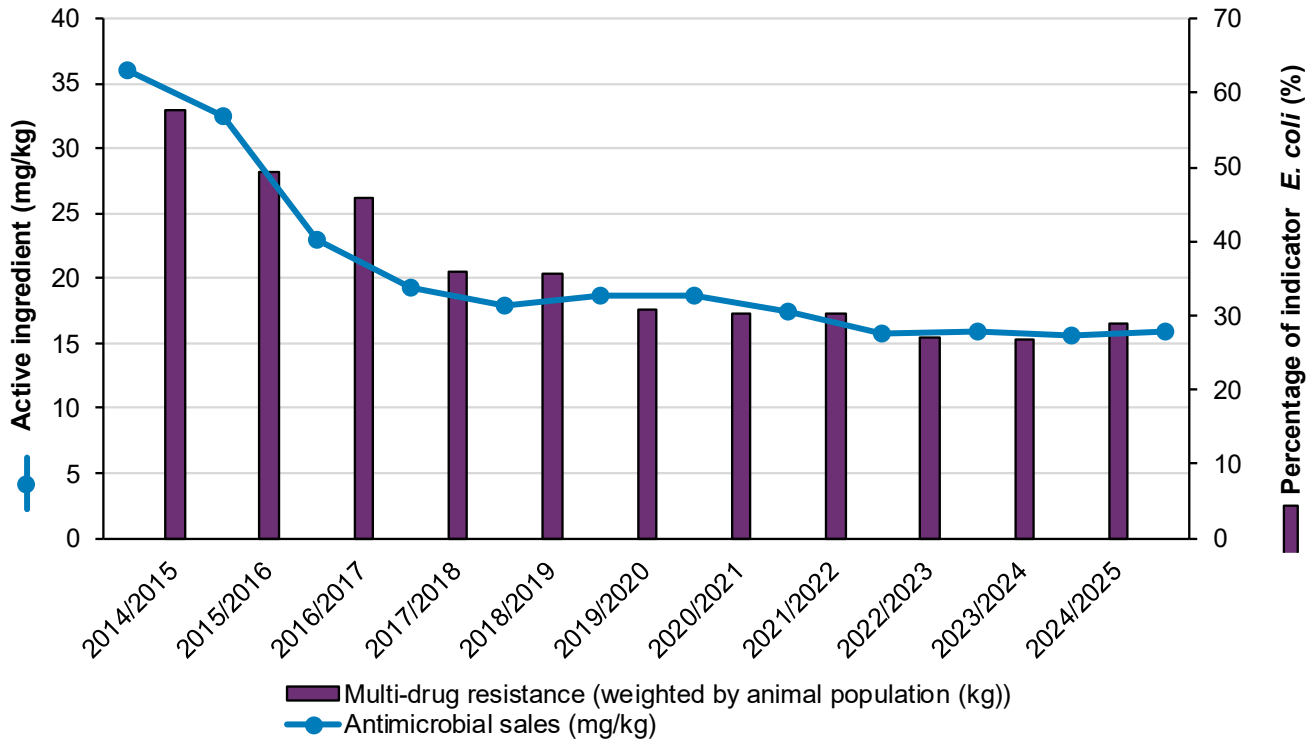
Figure 3.4: Secondary key outcome indicators: percentage of *Escherichia coli* from broilers, turkeys and pigs weighted by the estimated animal population weight (kg), combined over two years. ESBL/AmpC results refer to caecal samples, all other indicators refer to isolates



^ Data not available

Harmonised outcome indicators are also measured for antibiotic sales (Section 1.3.1). Overlaying indicators for sales (antibiotic consumption) with those for resistance (multi-drug resistant *E. coli*) illustrates how reductions in antibiotic sales since 2014 have been reflected in reductions in resistance over the same time period (**Figure 3.5).**

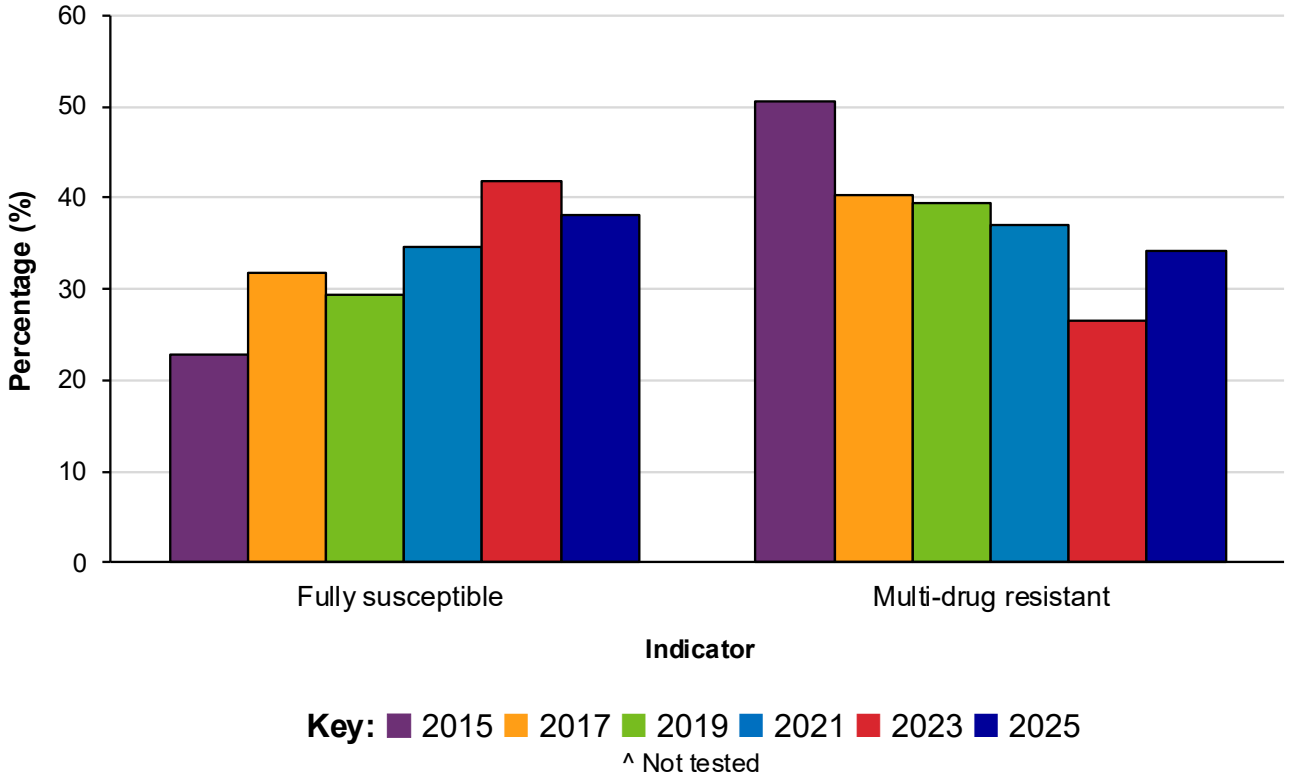
Figure 3.5: Antibiotic active ingredient sold for use in food-producing animals adjusted for population (mg/kg; primary indicator) and percentage of multi-drug resistant *Escherichia coli* isolates from pigs, broilers and turkeys weighted by estimated animal population weight (kg; secondary indicator), combined over two years.



3.4.2 *Escherichia coli*

In 2025 antibiotic susceptibility testing was carried out on 170 indicator *E. coli* isolates obtained from pig caecal samples. Full susceptibility was 38% [95% CI: 31–46%] in 2025, decreased slightly from 42% [95% CI: 35–49%] in 2023. Full susceptibility remains significantly higher than in 2015 (23% [95% CI: 17-30%]). MDR was 34% [95% CI: 27-42%] in 2025, increased to from 26% [95% CI: 20–34%] in 2023 (**Figure 3.6**). This is the first increase in MDR in pigs since monitoring began in 2015.

Figure 3.6: Percentage of fully susceptible and multi-drug resistant *Escherichia coli* isolated from healthy pigs at slaughter between 2015 and 2025 (n=170 in 2025).

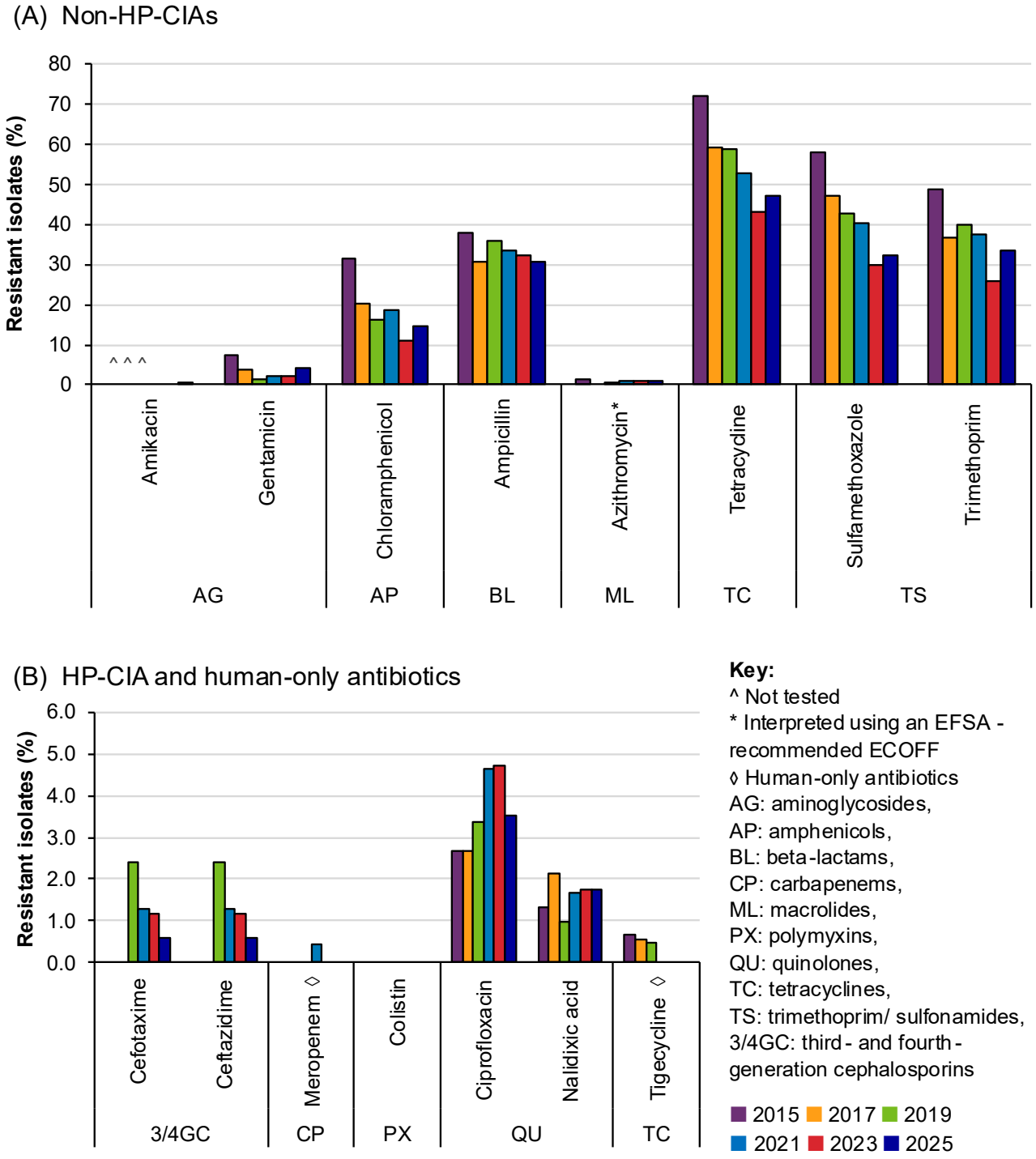


Resistance to several of the non-HP-CIA antibiotic classes have shown modest increases since 2023 (**Figure 3.7 A**), however the overall picture shows downward trends since 2015. The largest increase in resistance was to trimethoprim, from 26% [95% CI: 20-33%] in 2023 to 34% in 2025 [95% CI: 27-41%]. This may be linked to a 6% (0.3mg/kg) increase in use reported by the sector between 2023 and 2025.

For the first time, amikacin resistance was detected in a single indicator *E. coli* isolate (0.6% [95% CI:0.1-3.3%]), using MIC testing. Although the indictor isolate was not confirmed by PCR or WGS, it did originate from a sample that also yielded amikacin-resistant *E. coli* on selective amikacin-containing agar, in which the *rmtB* gene was detected (section 3.4.6.4).

For antibiotics within the HP-CIA and human only antibiotic classes (**Figure 3.7 B**), resistance was either low, very low, or not detected. The highest resistance was to ciprofloxacin, detected in 3.5% [95% CI: 1.6-7.4%] of isolates. No resistance was detected to meropenem, colistin or tigecycline.

Figure 3.7: Resistance to (A) antibiotics in non-HP-CIA classes and (B) HP-CIA and human-only antibiotic classes in *Escherichia coli* isolated from healthy pigs at slaughter between 2015 and 2025 (n=170 2025). Interpreted using EUCAST ECOFFs unless otherwise indicated. Note scale differs between graphs.



3.4.3 *Enterococcus* spp.

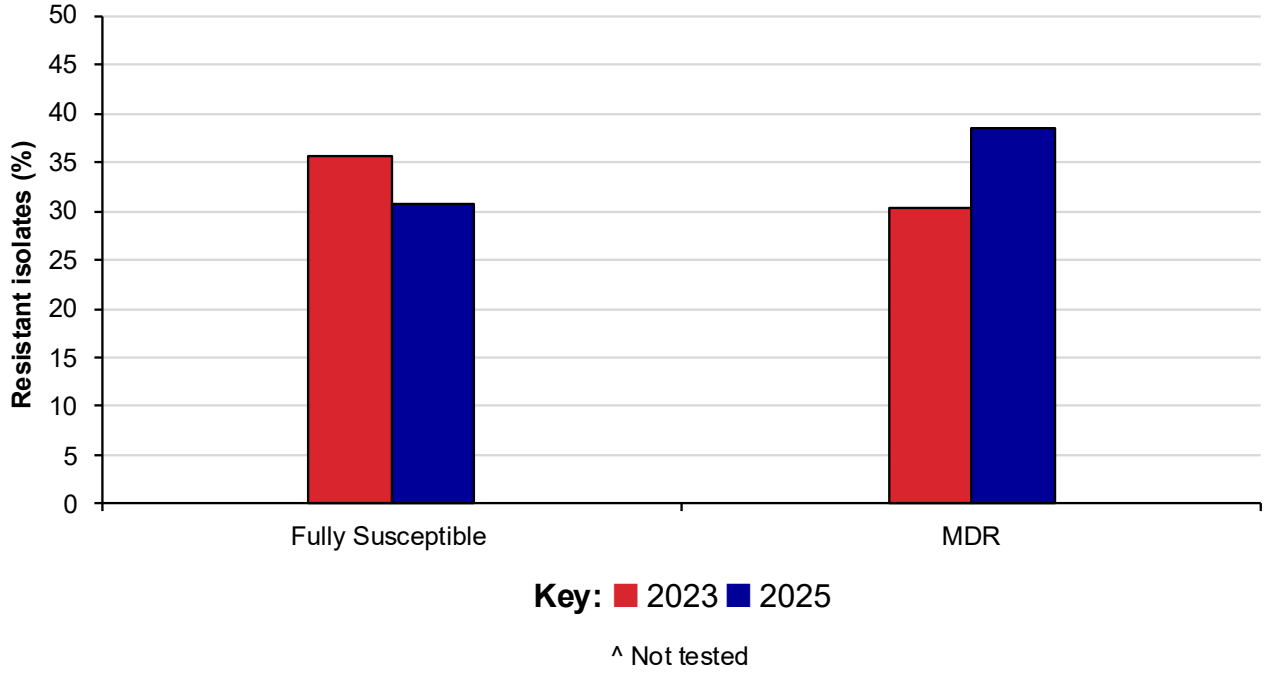
E. faecalis and *E. faecium* were introduced to the AMR surveillance programme in Great Britain in 2022 as an indicator species for resistance in Gram-positive bacteria, and were first tested in GB pigs in 2023. *E. faecalis and E. faecium* from pigs in Northern Ireland were tested for the first time in 2025.

E. faecalis is the leading cause of human enterococcal infections. *E. faecium* is also commonly found in the gut of pigs and like other bacteria has the ability to acquire and transfer resistance. Their inclusion enabled testing against an expanded antibiotic panel including vancomycin and linezolid, which are important antibiotics in human medicine. 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 VRE and MRSA infections in human patients. Neither of these antibiotics are licensed for veterinary use in the UK.

3.4.3.1 *Enterococcus faecalis*

A total of 26 isolates were recovered from pig caecal samples in 2025 (**Figure 3.8**). Full susceptibility to all antibiotics tested was 31% [95% CI: 17-50%], compared with 36% [95% CI: 24-49%] in 2023. MDR was 39% [95% CI: 22-57%] in 2025, increased from 30% [95% CI: 20-43%] in 2023. The relatively small number of *E. faecalis* isolates (n=26) recovered in 2025 means that caution is needed when interpreting year on year differences.

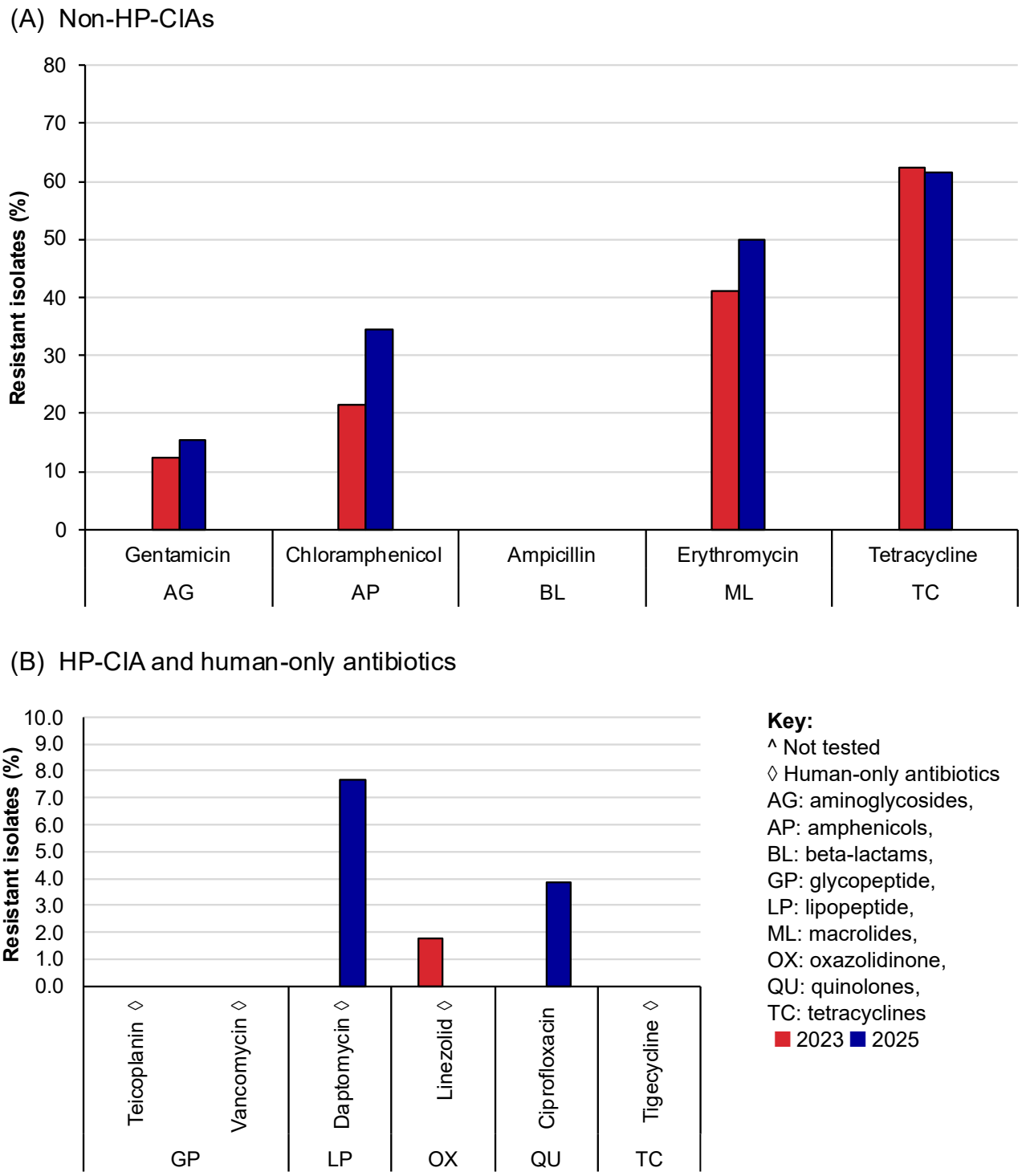
Figure 3.8: Percentage of fully susceptible and multi-drug resistant *Enterococcus faecalis* isolated from healthy pigs at slaughter (n=26 in 2025).



For antibiotics in non-HP-CIA classes (**Figure 3.9 A**), resistance was highest to tetracyclines (61% [95% CI: 43-78%]), which is the most-used antibiotic class in pigs (section 2.3.1). Resistance to erythromycin was 50% [95% CI: 32-68%] in 2025, increased from 41% [95% CI: 29-54%] in 2023. Chloramphenicol resistance was 35% [95% CI: 19-54%] 2025, increased from 21% [95% CI: 13-24%] in 2023. No resistance was detected to ampicillin in either year.

For antibiotics in HP-CIA and human-only classes (**Figure 3.9 B**), resistance was either not detected or remained low. No resistance was detected to vancomycin or linezolid in 2025. Resistance to the HP-CIA ciprofloxacin was detected in 3.8% [95% CI: 0.7-18%] of isolates, and daptomycin resistance was detected in 7.7% [95% CI: 2.1-24%]; neither resistance was detected in 2023. To our knowledge, this is the first detection of daptomycin resistance in enterococci recovered from pigs in the UK. Daptomycin is an antibiotic used for MRSA infections in people; as it is not licensed for use in animals in the UK, the origin of these findings requires further investigation.

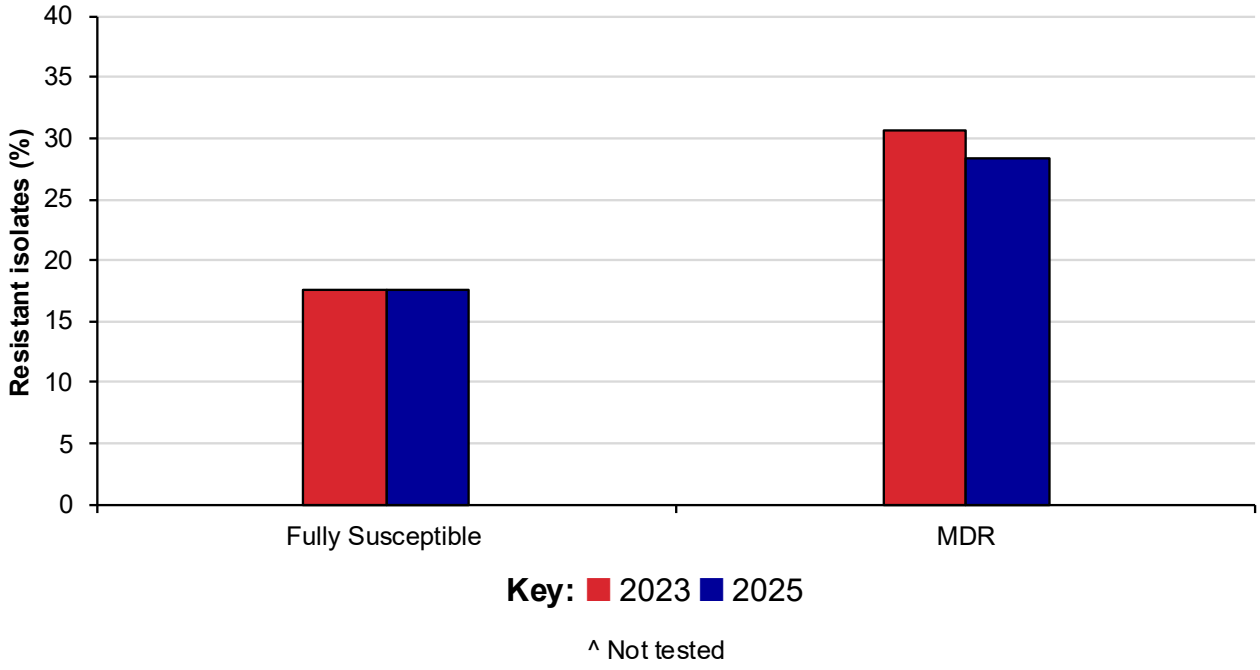
Figure 3.9: Resistance to (A) antibiotics in non-HP-CIA classes and (B) antibiotics in HP-CIA and human-only antibiotic classes in *Enterococcus faecalis* isolated from pigs at slaughter in 2023 and 2025 in Great Britain (n=26 in 2025). Interpreted using EUCAST ECOFFs unless otherwise indicated. Note scale differs between graphs.



3.4.3.2 *Enterococcus faecium*

A total of 176 *E. faecium* isolates were tested from pig caecal samples (**Figure 3.10**). Of these, 18% [95% CI: 13-24%] were sensitive to all of the antibiotics in the panel, and 28% were MDR [95% CI: 22-35%]). These figures are similar to those from 2023.

Figure 3.10: Percentage of fully susceptible and multi-drug resistant *Enterococcus faecium* isolated from healthy pigs at slaughter (n=176 in 2025).

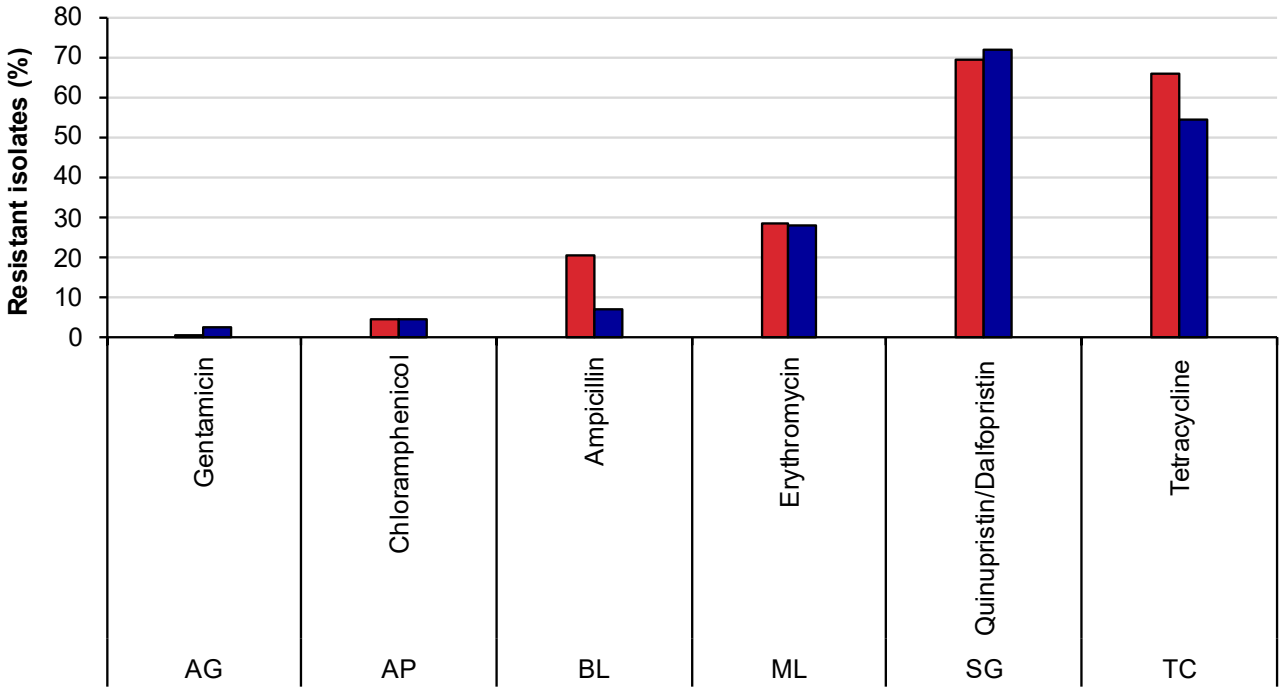


For antibiotics in non-HP-CIA classes (**Figure 3.11 A**), the overall picture has improved for 2025. Ampicillin resistance was low at 6.8% [95% CI: 3.9-11.5%] in 2025, decreased significantly from a moderate level of 21% [95% CI: 15-27%] in 2023. Tetracycline resistance remained very high at 55% [95% CI: 47-62%] in 2025, decreasing from 66% [95% CI: 59-73%] in 2023. Resistance to the streptogramin combination quinupristin/dalfopristin was highest at 72% [95% CI: 65-78%]. Although streptogramins are not authorised for use in UK, they are available for veterinary use in some countries.

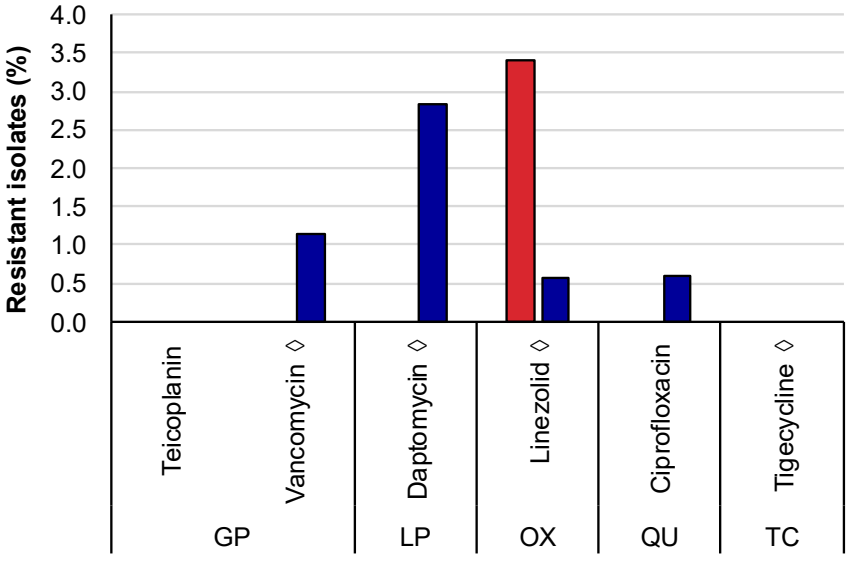
For antibiotics in HP-CIA and human-only antibiotic classes (**Figure 3.11 B**), resistance was either low, very low, or not detected. Resistance to linezolid was 0.6% [95% CI: 0.1-3.1%]) in 2025, decreased from 3.4% [95% CI: 1.6-7.2%]) in 2023. Low resistance level to daptomycin (2.8% [95%CI: 1.2-6.5%]) and vancomycin (1.1% [95%CI: 0.3-4.0%]) was detected in *E. faecium* from pigs for the first time in 2025.

Figure 3.11: Resistance to (A) non-HP-CIAs and (B) HP-CIAs and human-only antibiotics in *Enterococcus faecium* isolated from pigs at slaughter in 2023 and 2025 (n=176 in 2025). 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
◊ Human-only antibiotics
AG: aminoglycosides,
AP: amphenicols,
BL: beta-lactams,
GP: glycopeptide,
LP: lipopeptide,
ML: macrolides,
SG: streptogramin.
OX: oxazolidinone,
QU: quinolones,
TC: tetracyclines
2023 2025

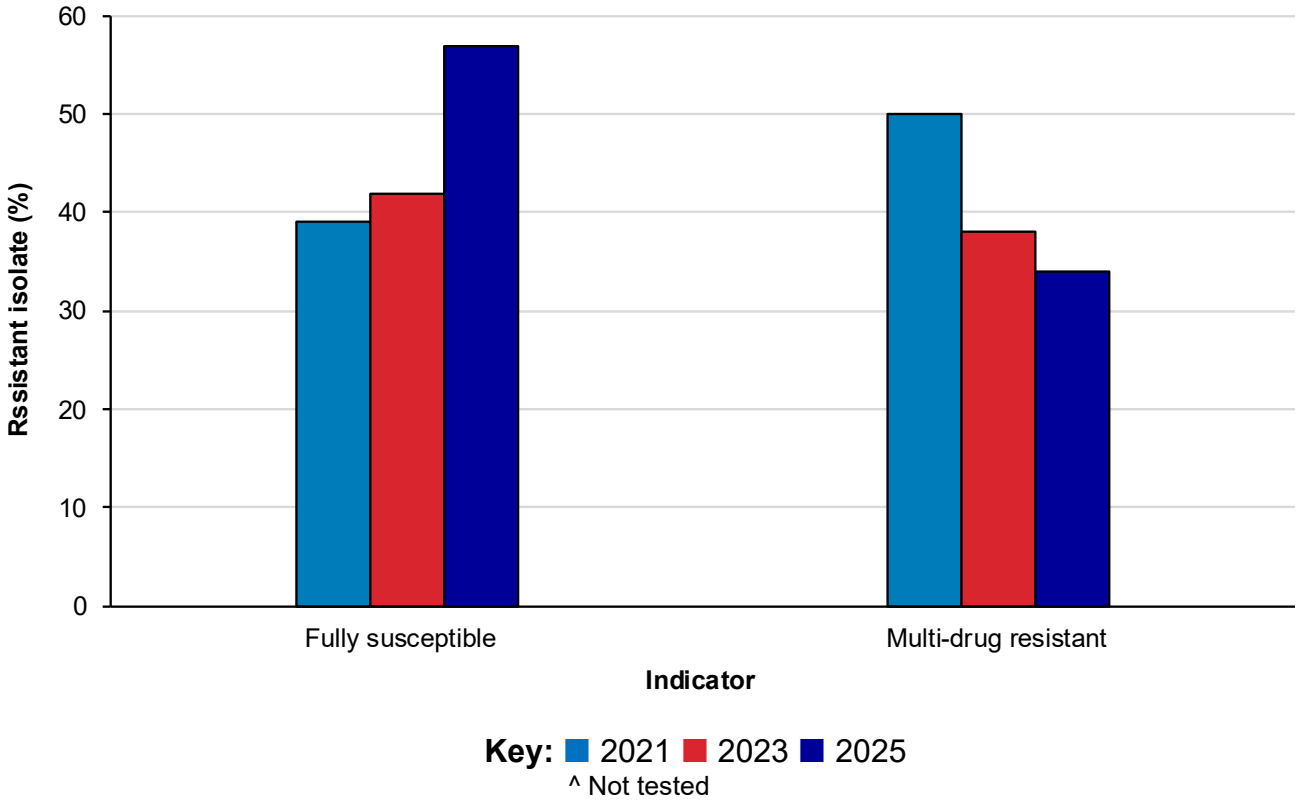
3.4.4 *Salmonella* spp.

Salmonella is an important cause of foodborne disease in people and can also cause disease in animals. The UK has been monitoring AMR in *Salmonella* isolated from pig caecal samples since 2021. Prior to this (2015-2019), isolates were obtained from carcass swabs. As the prevalence of *Salmonella* is higher in gut contents than on carcasses, results from caecal samples provide a more representative assessment of AMR in *Salmonella* from healthy pigs.

In 2025, a total of 100 *Salmonella* isolates were tested. Ten serovars were identified, with the three most common being *S.* Derby (29 isolates), monophasic *S.* Typhimurium (26 isolates), and *S.* Panama (16 isolates). These were also the top three serovars detected in 2023.

Overall, 57% [95% CI: 47-66%] of isolates were fully susceptible in 2025, compared with 42% [95% CI: 33-52%%] in 2023 (**Figure 3.12**)**.** This represents the highest level of full susceptibility observed since monitoring began. MDR was 34% [95% CI: 25-44%] in 2025, decreased from 38% [95% CI: 29-48%] in 2023 (**Figure 3.12**)**.** Of the three most common serovars, MDR was highest in monophasic Typhimurium (81%), but much less frequent in *S.* Derby (6.9%), and *S.* Panama (0.0%). The most common MDR resistance profiles were ampicillin-sulfamethoxazole-tetracycline (29%) and ampicillin-sulfamethoxazole-tetracycline-trimethoprim (13%). This may reflect the fact that tetracyclines, penicillins and trimethoprim-sulfonamides are the most common antibiotic classes administered to pigs (accounting for 60% total use), although serovar composition is also a major factor.

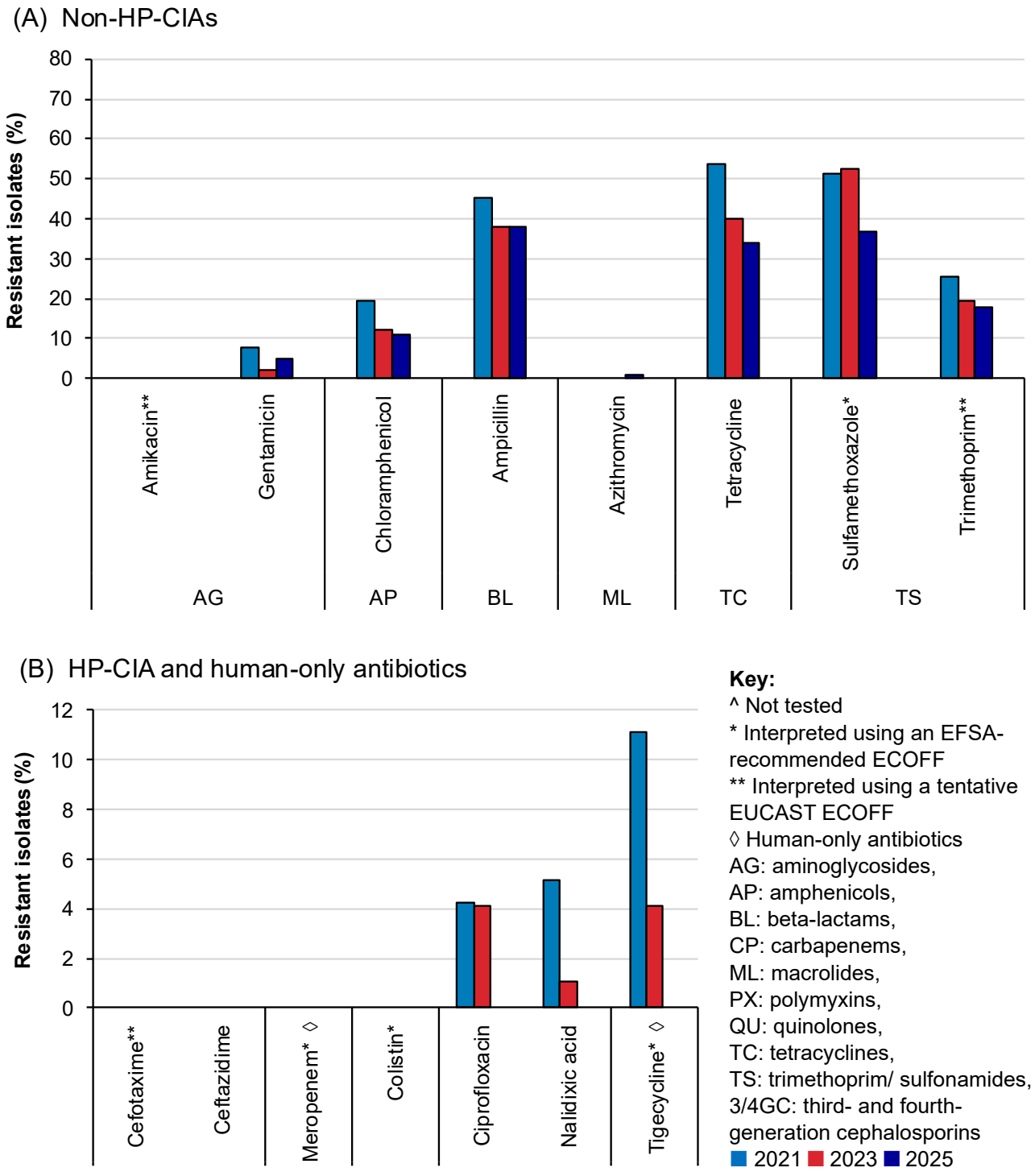
Figure 3.12: Percentage of fully susceptible and multi-drug resistant *Salmonella* isolated from healthy pigs at slaughter (n=100 in 2025).



For antibiotics in non-HP-CIA classes (**Figure 3.13 A**), resistance to most antibiotics continued to decrease between 2021 and 2025. The highest resistance in 2025 was observed for ampicillin (38% [95% CI: 29-48%]), sulfamethoxazole (37% [95% CI: 28-47%]), and tetracycline (34% [95% CI: 25-44%]). In contrast, gentamicin resistance remained low (5.0% [95% CI: 2.2-11.2%]). For the first time, one *S*. 4,12:I:- isolate (1%) showed resistance to the macrolide azithromycin.

Resistance to antibiotics in HP-CIA or human-only classes (**Figure 3.13 B**) was not detected in 2025. There is very low use of HP-CIAs in pigs (0.01% of overall use).

Figure 3.13: Resistance to (A) antibiotics in non-HP-CIA classes and (B) HP-CIA and human-only classes in *Salmonella* isolated from pig samples between 2021 and 2025 (n=100 in 2025). Interpreted using EUCAST ECOFFs unless otherwise indicated. Note scale differs between graphs.



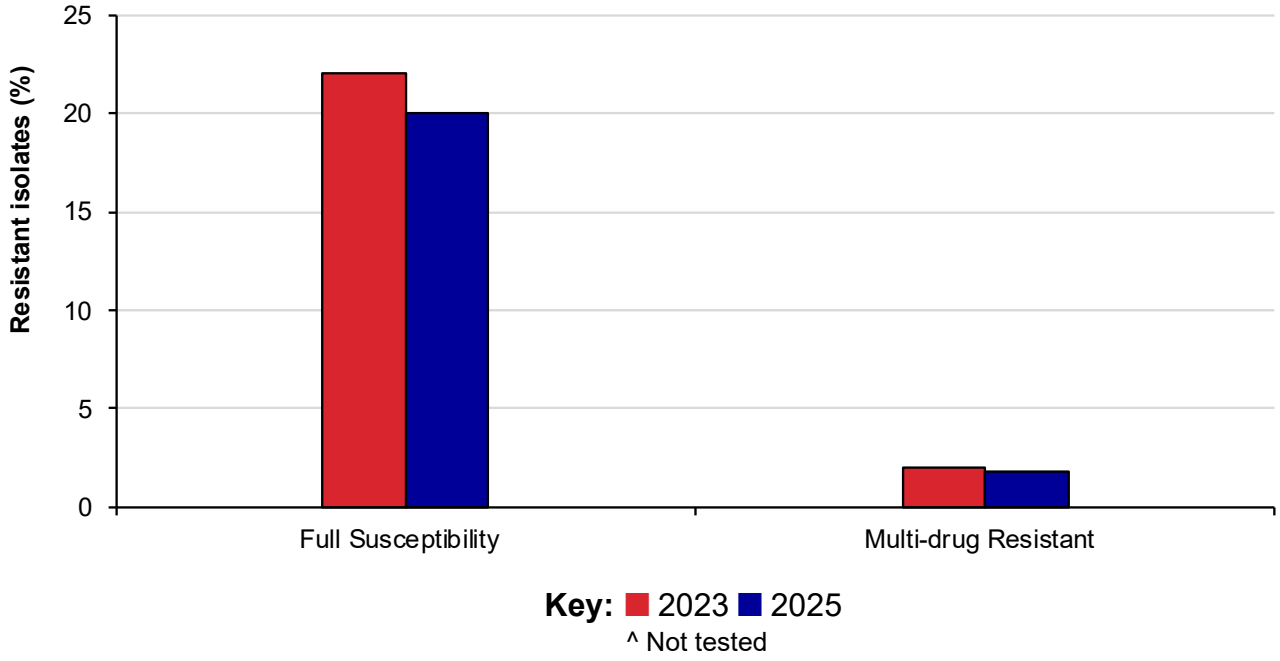
3.4.5 *Campylobacter* spp.

Campylobacter is the most common cause of food poisoning in people in the UK. The majority of human *Campylobacter* infections are acquired from food, direct contact with animals, or environmental cross contamination. AMR in *C. jejuni* has been monitored in UK poultry since 2014. *Campylobacter* was added to the pig surveillance programme in 2023 by testing AMR in *C. coli*, a more prevalent *Campylobacter* species in pigs. *C. coli* is usually more resistant to antibiotics than *C. jejuni* and can transfer resistance genes to *C. jejuni.*

3.4.5.1 *Campylobacter coli*

Resistance in *C. coli* isolated from pig caecal samples is shown in **Figure 3.14**. A total of 170 isolates from pigs were tested, of which 20% were susceptible to all the antibiotics tested, and 1.8% were MDR. These figures are similar to those from 2023.

Figure 3.14: Percentage of fully susceptible and multi-drug resistant *Campylobacter coli* isolated from healthy pigs at slaughter in 2023 and 2025 (n=170 in 2025). Note ertapenem was excluded (see Box 3.2).

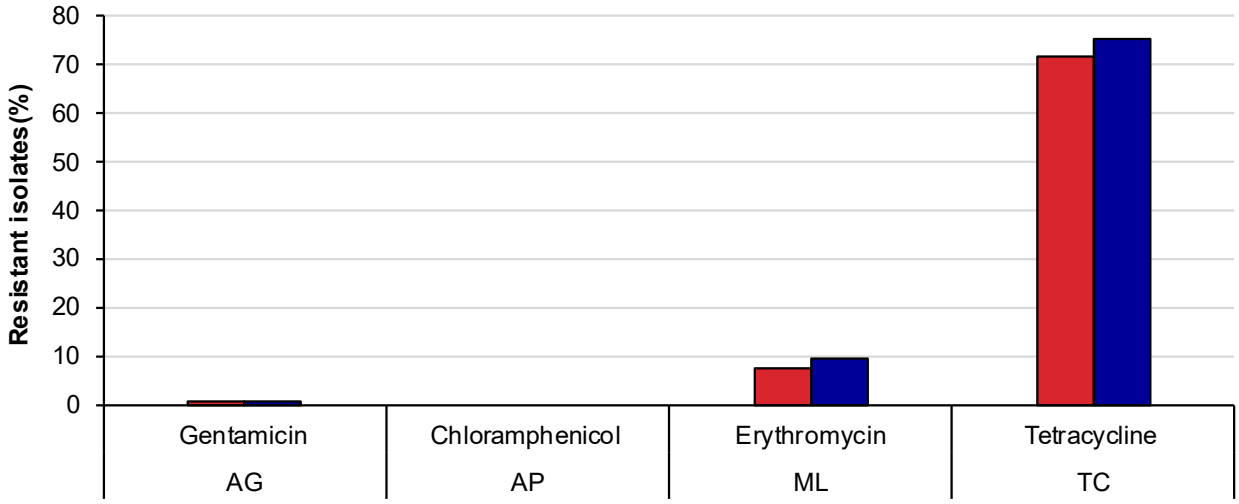


Resistance to tetracycline remained extremely high in 2025 (75% [95% CI: 68-81%]) (**Figure 3.15 A**). Resistance to erythromycin, a first-line antibiotic for treating campylobacteriosis in people, remained low at 9.4% [95% CI: 5.9-15%] in 2025.

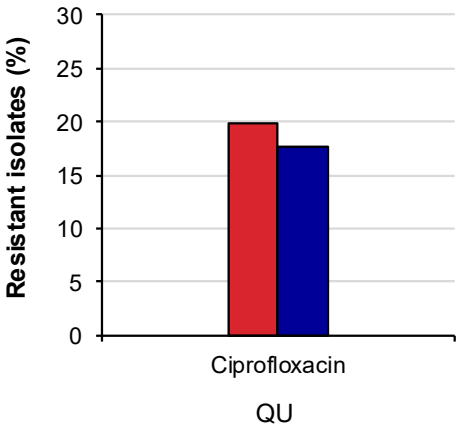
Resistance to the HP-CIA fluroquinolone ciprofloxacin remained moderate (18% [95% CI: 13-24%]) in 2025 (**Figure 3.15 B).** MDR co-resistance to ciprofloxacin, erythromycin, and tetracycline remained low (1.8% [95% CI: 0.4-3.2%]) in 2025.

Figure 3.15: Resistance to (A) antibiotics in non-HP-CIA classes and (B) HP-CIA classes in *Campylobacter coli* isolated from pigs at slaughter between 2023 and 2025 (n=170 in 2025). Interpreted using EUCAST ECOFFs unless otherwise indicated. Note scale differs between graphs.

(A) Non-HP-CIAs



(B) HP-CIA



Key:
^ Not tested
AG: aminoglycosides,
AP: amphenicols,
ML: macrolides,
QU: quinolones,
TC: tetracyclines
2023 2025

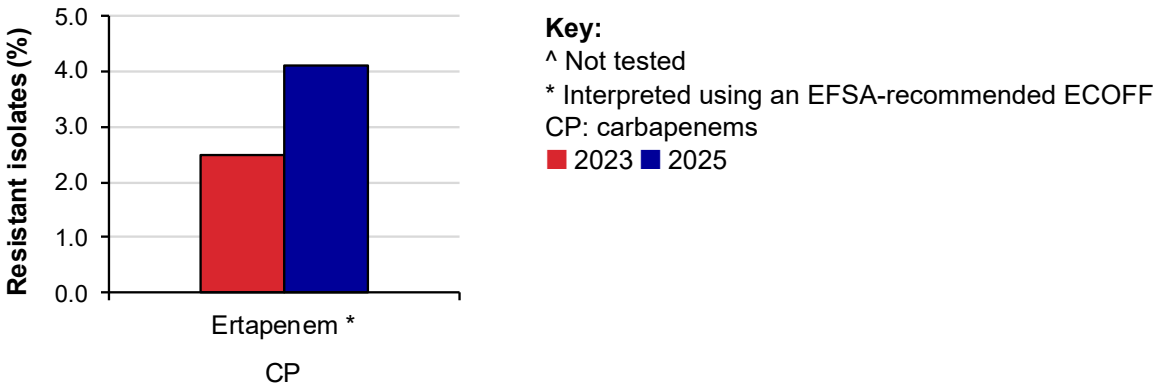
Box 3.2: Ertapenem resistance in *Campylobacter*

Ertapenem is a member of the carbapenem group of antibiotics, classified by WHO as human-only antibiotics. Carbapenems are not authorised for use in food-producing animals in the UK. Ertapenem was first included in the antibiotic panel used to test for resistance in *Campylobacter* species in 2022, using the EFSA recommended ECOFF of 0.5 mg/L. There is currently no validated EUCAST ECOFF for ertapenem resistance in *C. coli*.

Ertapenem is used in some countries to treat serious invasive *Campylobacter* infections in humans and was added to the panel to maintain international harmonisation of surveillance for this antibiotic class. However, there is still debate as to the suitability of ertapenem to represent the carbapenem class of antibiotics.

Resistance to ertapenem in *C. coli* from UK pigs was 4.1% [95% CI: 2-8%] in 2025, increased from 2.5% [95% CI: 1-6%] in 2023 (**Figure 3.16**). While resistance in 2025 remained low, additional data points are needed to determine whether this is a trend.

Figure 3.16: *Campylobacter coli* isolated from pigs at slaughter in 2023 and 2025 (n=170 in 2025). Interpreted using an EFSA-recommended ECOFF.



3.4.6 Using selective media to detect resistance

Additional, more sensitive, testing was conducted using selective media (S3.6 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 pigs, these results can be interpreted as the percentage of animals carrying these resistances.

Across the UK, the carriage of resistance to two different HP-CIAs is tested in this way: third- and fourth-generation cephalosporins (ESBL-/AmpC-producers) and carbapenems. In GB, selective media has also been used to test for resistance to the HP-CIA colistin, and, in pigs only, the non-HP-CIA amikacin. Resistant bacteria subsequently undergo phenotypic susceptibility testing against other antibiotics and molecular testing to identify the underlying

genetic mechanisms. Methods are described in Supplementary Material 4 (section S3.7 and S3.8, respectively).

To further improve the sensitivity of AMR surveillance in UK animals, techniques for selective media monitoring for vancomycin- and linezolid-resistant enterococci (VRE and LRE) are currently being developed by APHA.

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

The results in section **3.4.2** (**Figure 3.7 B**) show that the frequency of resistance to third generation cephalosporins in individual isolates of *E. coli* from caecal samples of UK pigs is 0.6% [95% CI: 0.1-3.3%], using non-selective media. By contrast, selective media shows that 32% [95% CI: 27-37%] of 298 pig caecal samples contained some *E. coli* expressing ESBL and/or AmpC phenotypes in 2025 (**Figure 3.17**). This is the highest prevalence since 2015 (28% [95% CI: 23-33%]), when testing began.

Both ESBL and AmpC confer resistance to third generation cephalosporins and the penicillins. ESBL genes are more often found on plasmids, which enables them to be transmitted readily to other bacteria. AmpC genes, whilst less transmissible, additionally confer resistance to beta-lactamase inhibitors such as clavulanate. Carriage of both ESBL-producing (16% [95% CI: 13-21%]) and AmpC-producing (15% [95% CI: 11-20%]) *E. coli* increased in 2025. This is despite the use of third and fourth generation cephaloporins and beta-lactamase inhibitors being extremely low in pigs and, in both cases, reducing between 2023 and 2025. No isolates were detected with both ESBL and AmpC phenotypes.

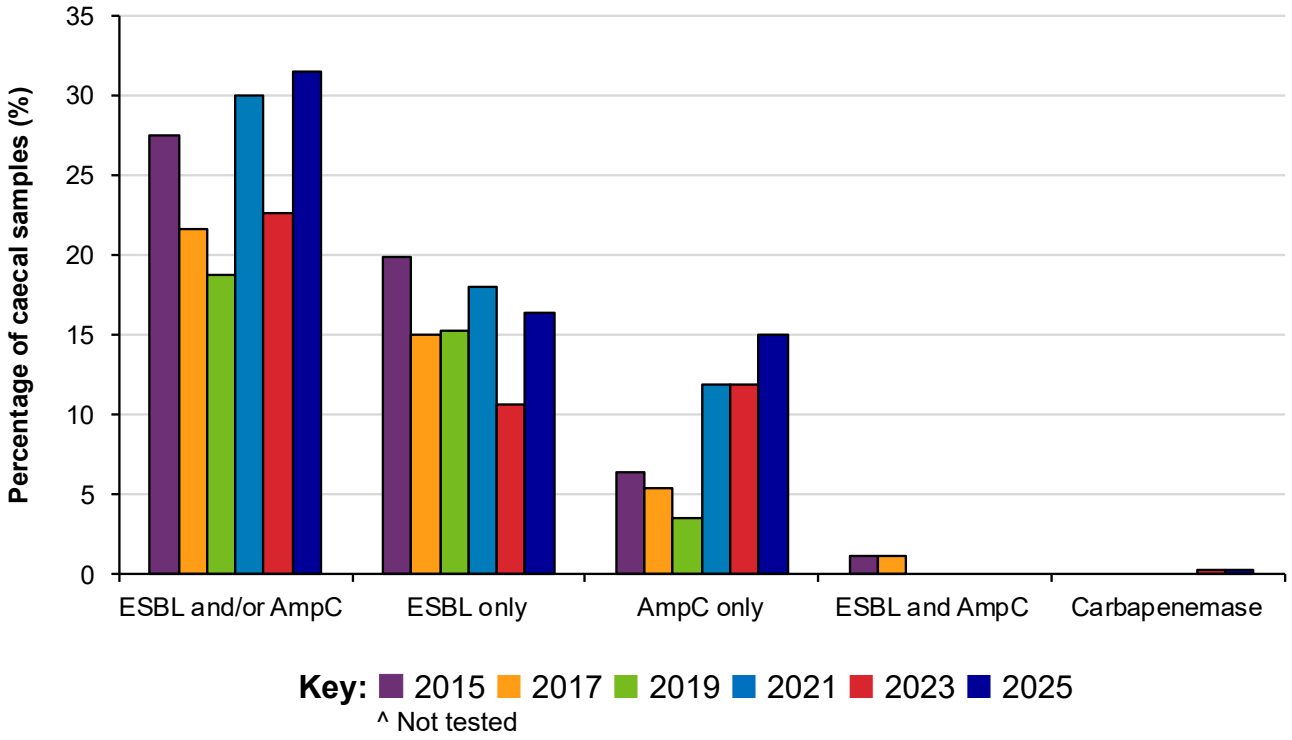
Of the 49 isolates with an ESBL phenotype, the most common antibiotic resistance gene was *bla*$_{\text{CTX-M-15}}$ (49%), which is associated with human populations. For the first time since WGS was introduced, *bla*$_{\text{CTX-M-15}}$ was the most frequently detected ESBL gene in pigs. The other genes detected included *bla*$_{\text{CTX-M-1}}$ (29%), *bla*$_{\text{CTX-M-14}}$ (12%), *bla*$_{\text{CTX-M-55}}$ (10%), and *bla*$_{\text{TEM-52b}}$ (2.0%). These genes are commonly found on plasmids and are associated with resistance to other antibiotics. ESBL resistance was present in multiple *E. coli* lineages, with the ESBL phenotype detected in 20 different sequence types (STs). ST58 was the most common sequence type, accounting for 37% of isolates.

Of the 41 *E. coli* isolates expressing the AmpC phenotype, all contained an AmpC mechanism. The most common mechanism was mutations in the *ampC* promoter (76%), followed by *bla*$_{\text{CMY-2}}$ (13%) and *bla*$_{\text{DHA-1}}$ (11%). Four isolates were borderline AmpC phenotypes, although all harboured the AmpC promoter mutation. These 45 isolates represented 20 different STs, indicating that like the ESBL phenotype, AmpC resistance was present in a genetically diverse population of *E. coli*. ST23 was the most common sequence type accounting for 33% of isolates.

Amongst ESBL- and/or AmpC-producing isolates from pigs, there is an emerging trend of increasing co-resistance to other antibiotics, including HP-CIAs. Co-resistance to the fluoroquinolones (ciprofloxacin and nalidixic acid) was 38% [95% CI: 29-48%] in 2025, increased from 25% [95% CI: 17-36%] in 2023. This suggests that 12% [95% CI: 8.9-16%] of UK pigs are carrying *E. coli* resistance to two HP-CIA classes (third-/fourth-generation cephalosporins and fluoroquinolones) within their gut content, a significant increase from 5.7% [95% CI: 3.6-8.7%] in 2023. Co-resistance to the aminoglycoside gentamicin occurred in 17% [95% CI: 11-26%] of the ESBL/AmpC producing isolates in 2025, up from 6.6% [95% CI: 2.8-14%] in 2023. Co-resistance to fluoroquinolones and aminoglycosides was detected

in 6.4% [95% CI: 3.0-13%] of ESBL/AmpC-producers, increased since 2023 (1.3% [95% CI: 0.2-7.1%]). It is important to note these results were determined using ECOFFs and therefore do not necessarily indicate clinical resistance. However, these data are important to understand AMR in Gram-negative bacteria of public health importance and therefore warrant continued monitoring to determine whether these increases indicate an emerging trend.

Figure 3.17: ESBL/AmpC- and carbapenemase-producing *Escherichia coli* cultured on selective media, from caecal samples from healthy pigs at slaughter in the UK between 2015 and 2025.



3.4.6.2 Carbapenemase-producing *E. coli*

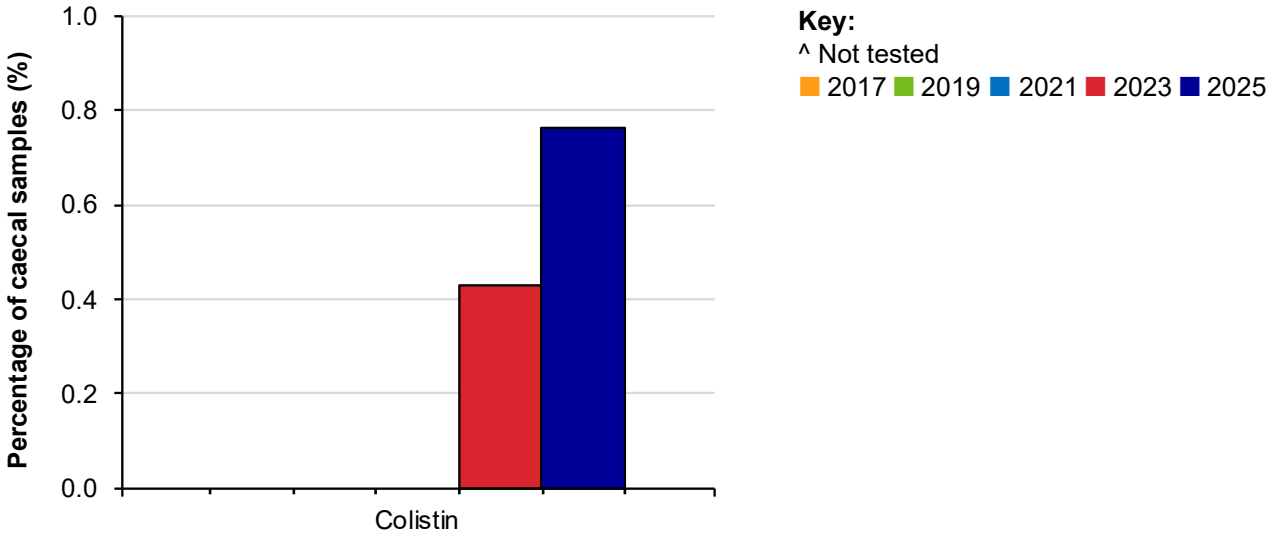
In 2025, selective media testing showed the that 0.3% [95% CI: 0.1-1.9%] of pigs in the UK carried carbapenemase-producing *E. coli* (**Figure 3.17**), which is similar to 2023 (0.3% [95% CI: 0.1-1.7%]. This is the second consecutive sampling year in which carbapenemase-producing *E. coli* have been detected through the harmonised monitoring programme. Two isolates recovered from the same pig sample underwent WGS. Both isolates harboured carbapenemase and ESBL mechanisms; one carried the *bla*$_{\text{NDM-5}}$ gene and the other carried the *bla*$_{\text{OXA-181}}$ gene, both of which confer resistance to carbapenems and cephalosporins. Carbapenems are not used in food-producing animals and therefore this finding likely represents transmission from human populations, whether directly or via the environment.

3.4.6.3 Colistin-resistant *E. coli*

No colistin resistance was detected in indicator *E. coli* isolates from UK pigs using standard non-selective testing (Section 3.4.2 (**Figure 3.7**)). However, growth of samples from Great Britain on selective media identified colistin-resistant *E. coli* in 0.8% [95% CI: 0.2-2.7%] of

pigs in 2025 (**Figure 3.18**). This compares with 0.4% [95% CI: 0.1-2.4%] in 2023 and is the second consecutive sampling year in which colistin resistant *E. coli* have been detected, despite no colistin being used in pigs since 2020. Resistance was attributable to the mobile colistin resistance gene *mcr*-1.

Figure 3.18 Colistin-resistant *Escherichia coli* cultured on selective media, from caecal samples from healthy pigs at slaughter in Great Britain between 2017 and 2025.

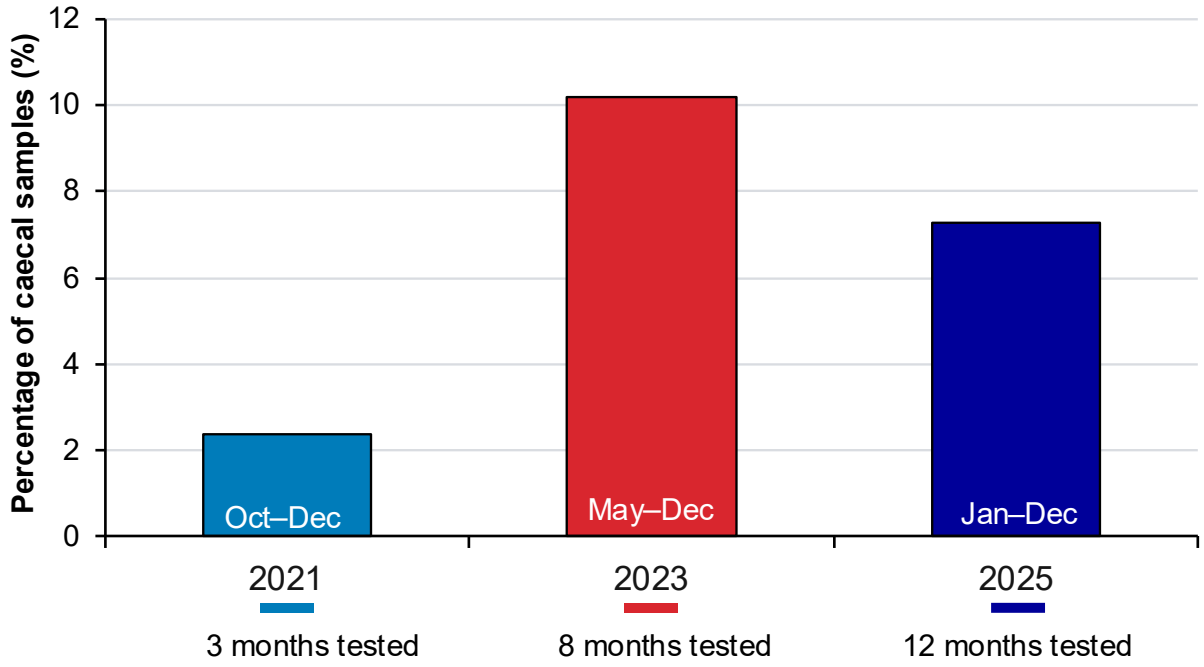


3.4.6.4 Amikacin-resistant *E. coli*

Pig caecal samples were tested for amikacin resistance using selective media in 2025; this was the first time this testing was conducted over the entire year. Resistance to amikacin was detected in 0.6% of indicator *E. coli* isolates from UK pigs using non-selective testing (section 3.4.2 and **Figure 3.7**)**.** Using selective media on samples from Great Britain, 7.3% [95% CI: 4.7-11%] of pigs were shown to carry amikacin-resistant *E. coli* in 2025 (**Figure 3.19**). This was lower than the prevalence observed in 2023 (10% [95% CI: 6.6-15%]), although that was limited to samples collected between May and December.

The *rmtB* gene, which confers resistance to aminoglycosides, was detected in 89% of the amikacin-resistant isolates in 2025. The absence of *rmtB* in a small number of isolates suggests that other resistance mechanisms may be contributing to amikacin resistance and should be monitored. Amikacin is not used in pigs, but other aminoglycosides represented 13.0% of total use in pigs in 2025, which may contribute to the persistence of aminoglycoside resistance genes such as *rmtB*.

Figure 3.19: Amikacin-resistant *Escherichia coli* cultured on selective media, from caecal samples from healthy pigs at slaughter in Great Britain between 2017 and 2025. Reporting periods differ by year, so the percentages are not directly comparable.



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. However, some diagnostic samples from sick animals, 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 (see below for Scotland and Northern Ireland). When a bacterial pathogen is isolated from these samples, antimicrobial susceptibility testing (AST) 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 sick and healthy animals, their feed, and samples collected from animal and feed production environments in Great Britain. Further details of testing and reporting requirements are available in the annual report on *Salmonella* in animals and feed in Great Britain.

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 reported in this chapter are used to identify new and emerging patterns of resistance, 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 (see Supplementary Material 4 Section S4.1.1 for more detail).

Clinical surveillance in England and Wales 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 six years. This enhancement should generate more robust susceptibility testing outputs for specific veterinary pathogens. MIC results for *Pasteurella multocida* (pigs, cattle and sheep), *Mannheimia haemolytica* (cattle and sheep), *Bibersteinia trehalosi* (sheep) and *Actinobacillus pleuropneumoniae* (pigs) have been generated since 2020; and in pigs, testing of *Streptococcus suis* and *Brachyspira hyodysenteriae* by broth microdilution date from 2021 and 2023, respectively. To aid interpretation, MIC results are shown in multi-coloured graphs in this chapter; disc diffusion results are shown on a red colour scale. This chapter also includes MIC results from clinical AMR surveillance in farmed trout in England and Wales, which is being piloted by the Centre for Environment, Fisheries and Aquaculture Science (Cefas).

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

Findings from any of these programmes where an isolate is considered to pose a particular risk to human or animal health are reported to the Defra Antibiotic 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.

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 are not routinely captured within existing government surveillance programmes. 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 are generated; what types of data are collected; and the methodologies used; to assess and improve their suitability for inclusion in national AMR surveillance. 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). PLI is led by the VMD and covers four major animal streams: livestock, fish, dogs and cats, and equine. Delivery of the streams is shared between government and academic partners. Work in the livestock and fish sectors is led by the government agencies APHA and Cefas, while engagement with the small animal and equine sectors is led by the University of Liverpool and the University of Cambridge's Equine Infectious Disease Surveillance (EIDS) Unit, respectively.

The project has so far successfully onboarded 26 private veterinary laboratories and developed proficiency testing schemes for cat and dog samples, and equine samples. The project team is deeply grateful to the participating PVLs for their engagement and willingness to contribute, and commitment to understanding how government and the private sector can work together to strengthen AMR surveillance. This work will improve our national understanding of AMR in animals and the UK's capacity to detect and respond to emerging threats. This year, for the first time, verified AMR results for bacteria (other than *Salmonella*) from dogs and cats are presented in this report (Section 4.4.7.2).

Box 4.1: Updates and corrections

Data updates and corrections since UK-VARSS Report 2024

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

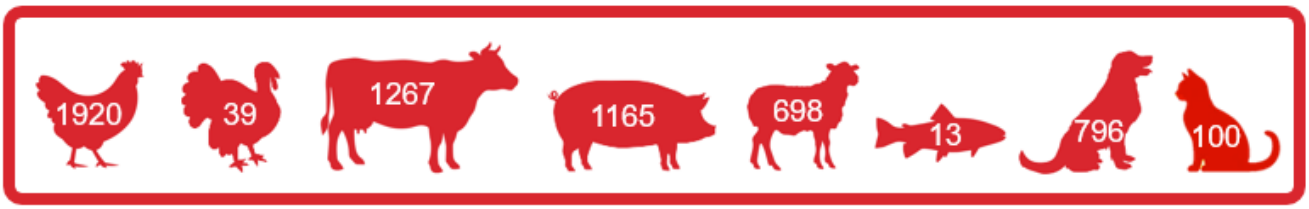
The mastitis data reported from the Private Laboratories Initiative has been updated following a revised data extraction and validation process, which removed duplicate records and corrected sample-date attribution. These changes have resulted in changes to some historical data points.

Recent evidence has raised uncertainties about the breakpoints previously used to interpret meropenem resistance in *Aeromonas salmonicida* in trout. The MIC values for this antibiotic are therefore presented, but not interpreted.

4.2 Summary

Clinical antimicrobial susceptibility testing occurs to provide veterinary surgeons with relevant treatment information using AMR results from bacteria isolated from diagnostic samples. Results collated from this testing form the clinical surveillance programme. 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 isolates of which are derived from systematic on-farm sampling as part of the *Salmonella* National Control Programmes (NCPs).

Figure 4.1: Number of isolates tested for AMR, for selected animal species, in England and Wales in 2025.



- 7,866 isolates were tested for AMR in England and Wales in 2025. **Figure 4.1** shows the distribution of isolates across selected species: other sources included horses (92 isolates), other animal species (331 isolates), feed (1177 isolates) and environmental samples (268 isolates). Of these, 4,929 (63%) were *Salmonella,* and 1,837 (23%) were *Escherichia coli.*
- Resistance in *E. coli* isolated from animals continued to decline in 2025. This report measures the percentage of isolates that are clinically resistant to four or more antibiotics; defined as having limited treatment options. This year, 18% of all clinical *E. coli* isolates tested had limited treatment options. This was most pronounced in isolates from cattle (27%) and pigs (19%). Resistance was higher in isolates from younger animals compared to adults.
- Full susceptibility of *Salmonella* isolates to the panel of antibiotics tested was 76%, improved from 73% in 2024. Between animal species, however, full susceptibility was variable: it was most frequent in *Salmonella* isolates from cattle (94%), sheep (92%), and ducks (91%), and less frequent in those from pigs (22%) and turkeys (35%).

The main findings from this chapter are as follows:

- **Pigs:** the most frequently tested bacteria were *E. coli* (56%) and *Salmonella* (28%). In 2025, *E. coli* with limited treatment options comprised 19% of all isolates from pigs, continuing the decrease observed since 2014. In post-weaning piglets, the proportion of isolates with limited treatment options was 24%, increased slightly from 2024 (21%). Resistance to the aminoglycosides was higher in post-weaning pigs than in adults or neonates. Levels of *Salmonella* isolations with limited treatment options remained high (70%). However, resistance to HP-CIAs remains low or very low across all bacterial species tested.

- **Poultry:** the most frequently tested bacteria were *Salmonella* (93%), which are mostly collected through the NCPs, and *E. coli* (6.2%). The percentage of isolates with limited treatment options was higher for *E. coli* (13%) than *Salmonella* (4.9%). Rates of full susceptibility remained high in *Salmonella* isolates from chickens (79%) and ducks (91%); however, isolations of *Salmonella* with limited treatment options were more frequent in turkeys (27%, compared to 1.1% in 2024). This was largely attributable to a single outbreak. Resistance to HP-CIAs in chickens was <2.5% for both organisms.

- **Cattle:** *E. coli* with limited treatment options from cattle was 27% of all isolates in 2025, a significant decrease since 2014. Resistance was higher in neonatal calves compared to pre-weaning calves and adult cattle. Resistance to HP-CIAs was low (<5%). Full susceptibility in *Salmonella* from cattle was 94% in 2025, while low numbers of isolates had limited treatment options (1.1%). Data from The Vale Veterinary Laboratory, collected under the Private Laboratories Initiative, showed recent increases in resistance in *E. coli* causing mastitis, particularly to beta-lactam antibiotics.

- **Sheep:** bacterial submissions screened for antimicrobial susceptibility included *E. coli* (48%), *Mannheimia haemolytica* (23%), *Bibersteinia trehalosi* (11%) and *Salmonella* (8.6%). Many isolates were fully susceptible to all antimicrobials, and only one *E. coli* exhibited resistance to an HP-CIA. Aminoglycoside resistance levels were broadly encouraging, with spectinomycin resistance in *E. coli* from lambs showing some of the largest decreases (12%, down from 22% in 2024).

- **Trout:** a total of 13 isolates were tested in 2025. All *Aeromonas salmonicida* isolates were resistant to oxolinic acid. Most *Yersinia ruckeri* were fully susceptible, with two isolates (29%) resistant to meropenem, which is not authorised for use in animals.

- **Dogs and cats:** This year, reporting includes results from selected *E. coli, Klebsiella pneumoniae, S. aureus* and *S. pseudintermedius* isolations from UK private veterinary laboratories tested at University of Liverpool, as part of the Private Laboratories Initiative (PLI). Although the isolate selection is not representative of all submissions from small animals, they still provided some useful insights. Resistance to amoxicillin/clavulanate was high across most organisms and sample types, although many isolates remained susceptible to other first-line choices, such as trimethoprim-sulfonamides. Resistance was higher in isolates arising from infections of skin and soft tissue, compared to the urinary tract. The variability between organisms highlights the importance of bacterial identification and susceptibility testing.

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. Bacteria from rainbow trout and brown trout produced in England and Wales were recovered from post-mortem or other diagnostic samples submitted to Cefas. Bacteria were also isolated by private veterinary laboratories across Great Britain from cattle (Section 4.4.4.4) and cats and dogs (Section 4.4.7.2) as part of the PLI.

Submission of diagnostic material is at the veterinarian's discretion. It may be more likely in serious cases of disease or those not responsive to treatment and may, therefore, be subject to bias. Further bias is introduced for the cat and dog samples (except *Salmonella*), because isolates included in this report are not a representative sample of all clinical submissions. Private laboratories across England, Wales and Scotland, participating in the PLI project for cats and dogs, were invited to submit bacterial isolates to the University of Liverpool for standardised testing by broth microdilution, interpreted using up-to-date clinical breakpoints. Isolate selection was proportional to laboratory size and aimed for a balanced split between resistant and susceptible isolates for each bacterial species.

Any laboratory, including private veterinary laboratories, isolating *Salmonella* spp. from animals, animal production environments, animal by-products, feed or feed mills, 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. Numbers of isolates tested against each antibiotic can be found in Supplementary Material 6.

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 2025, 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.

Two types of data were generated under the PLI used different methods. Data presented in Section 4.4.4.4 (The Vale Veterinary Laboratory) used another disc diffusion protocol, described separately in S4.4 in Supplementary Material 4. Data presented in Section 4.4.7.2 were generated by broth microdilution conducted by the University of Liverpool on bacteria isolated by small animal diagnostic laboratories (S4.5 in Supplementary Material 4).

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.

Table 4.1: Summary of bacterial species and AST methods employed

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

4.3.3 Interpretation

In Chapter 4, terrestrial animal results are interpreted using clinical breakpoints (CBPs). As the peak and duration of antimicrobial concentration varies between preparations, animal species, and body system, veterinary-specific clinical breakpoints are most likely to suggest treatment success or failure. Further details are provided in Sections 4.1 and 4.5 of Supplementary Material 4.

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.

Disc diffusion data has been interpreted using BSAC human CBPs. If unavailable, historical veterinary breakpoints from APHA or its predecessor, the Animal Health and Veterinary Laboratory Agency (AHVLA), have been used (Table S4.3 in Supplementary Material 4). These results should be interpreted with caution as breakpoints that indicate an antibiotic is effective in humans does not necessarily predict success in an animal.

Two types of data generated under the PLI used different methods. Data presented in Section 4.4.4.4 (The Vale Veterinary Laboratory) used CLSI veterinary CBPs described in S4.4 in Supplementary Material 4. MIC data generated by the University of Liverpool on isolates submitted by small animal diagnostic laboratories (S4.5 in Supplementary Material 4) were interpreted using clinical breakpoints taken from CLSI Vet01 Ed7, 2024. If veterinary breakpoints were not available, human CBPs from CLSI or EUCAST were used.

There is a shortage of suitable cut-off values for aquatic pathogens. For trout, CLSI epidemiological cut-off values were used where possible. However, where published cut-off values were not available for all combinations of bacteria and antibiotics the normalised resistance interpretation (NRI) method was chosen to determine the wild type cut-off value (COwt). These results do not necessarily imply clinical resistance. Cut-off values for meropenem resistance in *Aeromonas salmonicida* are still under development, and these results have not been interpreted.

In this chapter, isolates that were resistant to four or more antibiotics have been classified as having limited treatment options. Multi-drug resistance (MDR) is defined 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* from livestock, *Salmonella* spp., and livestock-associated methicillin-resistant *Staphylococcus aureus* (LA-MRSA) are presented first, in Section 4.4.1. AMR results for veterinary pathogenic bacteria are then presented by animal species and body system. For *E. coli* isolated from ruminants and pigs, results are also analysed by age, as summarised in **Table 4.2**.

E. coli and *S. aureus* tested by PLI partners are not included in Section 4.4.1, as different methods mean the data are not comparable. These results are described in the relevant species sections: Section 4.4.4.4, for mastitis pathogens, and Section 4.4.7.2 for cats and dogs.

Table 4.2: 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

For some bacterial pathogens, small 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 bacteria where there are fewer than 20 isolates from an animal species, these are, in the main, not described in the text, but can be found in the complete dataset, which 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 4.3**).

Table 4.3: 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 designated by the World Health Organisation as authorised for use only in humans, while others such as chloramphenicol are only authorised for use in non-food-producing animals (see Introduction, Table 1). These antibiotics are included in the testing panels to allow monitoring of possible emergence of resistance to these antibiotics, or because they are representative of an antibiotic class. Further details are available in Supplementary Material 4. 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.

4.4.1 Zoonotic organisms

Summary results for important zoonotic and multi-host organisms are presented in this section. Additional results are presented in the individual animal species sections.

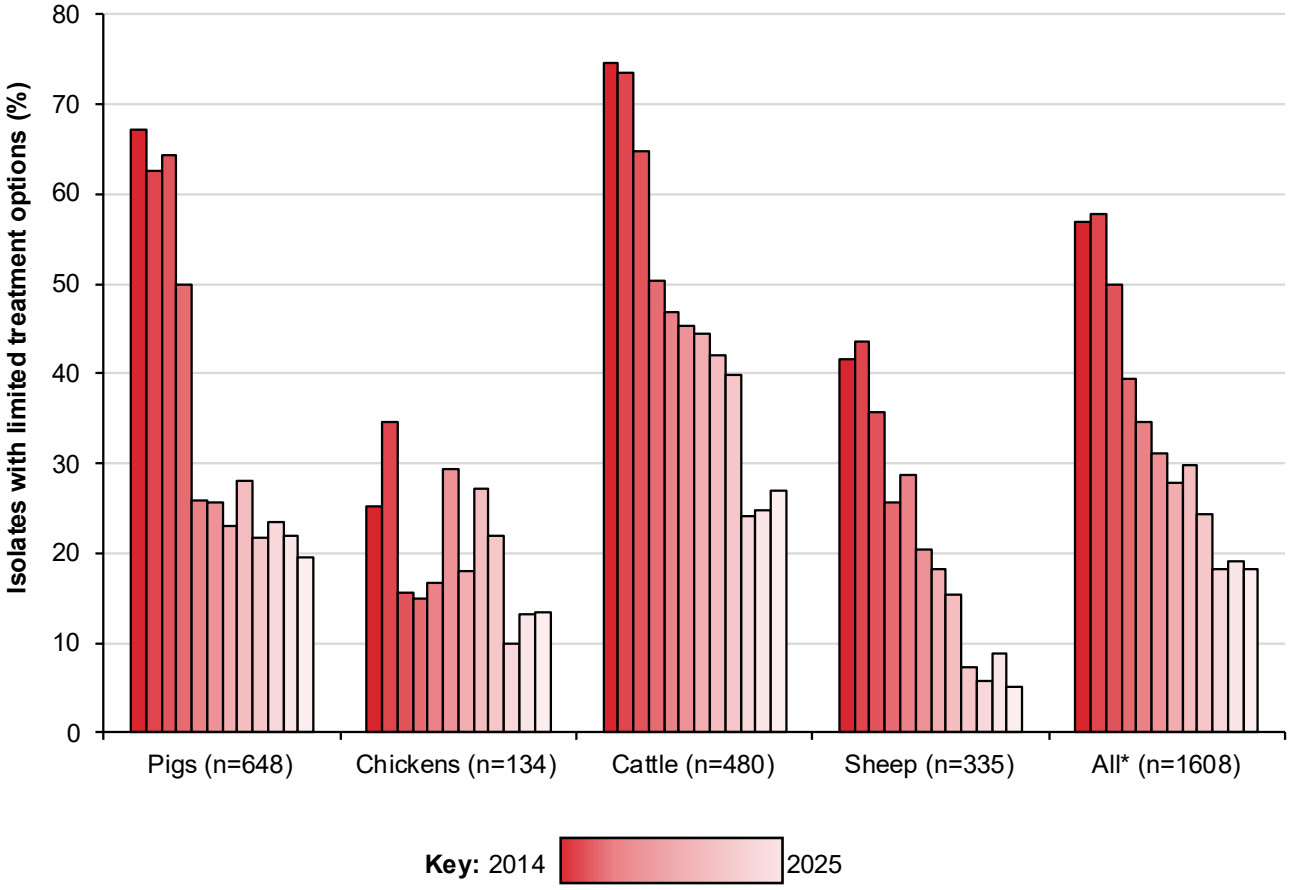
4.4.1.1 *Escherichia coli*

E. coli is an important commensal organism of the gastrointestinal tract of animals and humans, capable of causing 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 and companion 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.

Limited treatment options (that is, clinical resistance to four or more individual antibiotics) were detected in 18% [95% CI: 16-20%] of *E. coli* tested in 2025 (**Figure 4.2**). Historical *E. coli* data from 2014-16 have been incorporated into the analysis, extending the time series used to assess long term trends. These show a significant decline since 2014 in the percentage of isolates with limited treatment options (57% [95% CI: 54-60%]).

In 2025, *E. coli* with limited treatment options were most frequently detected in cattle (27% of isolates [95% CI: 23-31%]), followed by pigs (19% [95% CI: 17-23%]), chickens (13% [95% CI: 9-20%]) and sheep (5% [95% CI: 3-8%]). The historic data from 2014-16 show that, in pigs, the fall in the percentage of *E. coli* with limited treatment options was greatest between 2016 and 2018, coinciding with a substantial drop in antimicrobial usage from 2015 to 2017 (Section 2.3.1.1). In subsequent years, levels have continued to decline at a more gradual rate. In sheep, the percentage of *E. coli* with limited treatment options has also shown a relatively steady decrease over the whole period. In cattle, significant decreases in the percentage of *E. coli* with limited treatment options were seen between 2015- 2017 and 2022-2023. In both cattle and chickens, levels have increased slightly year-on-year since 2023.

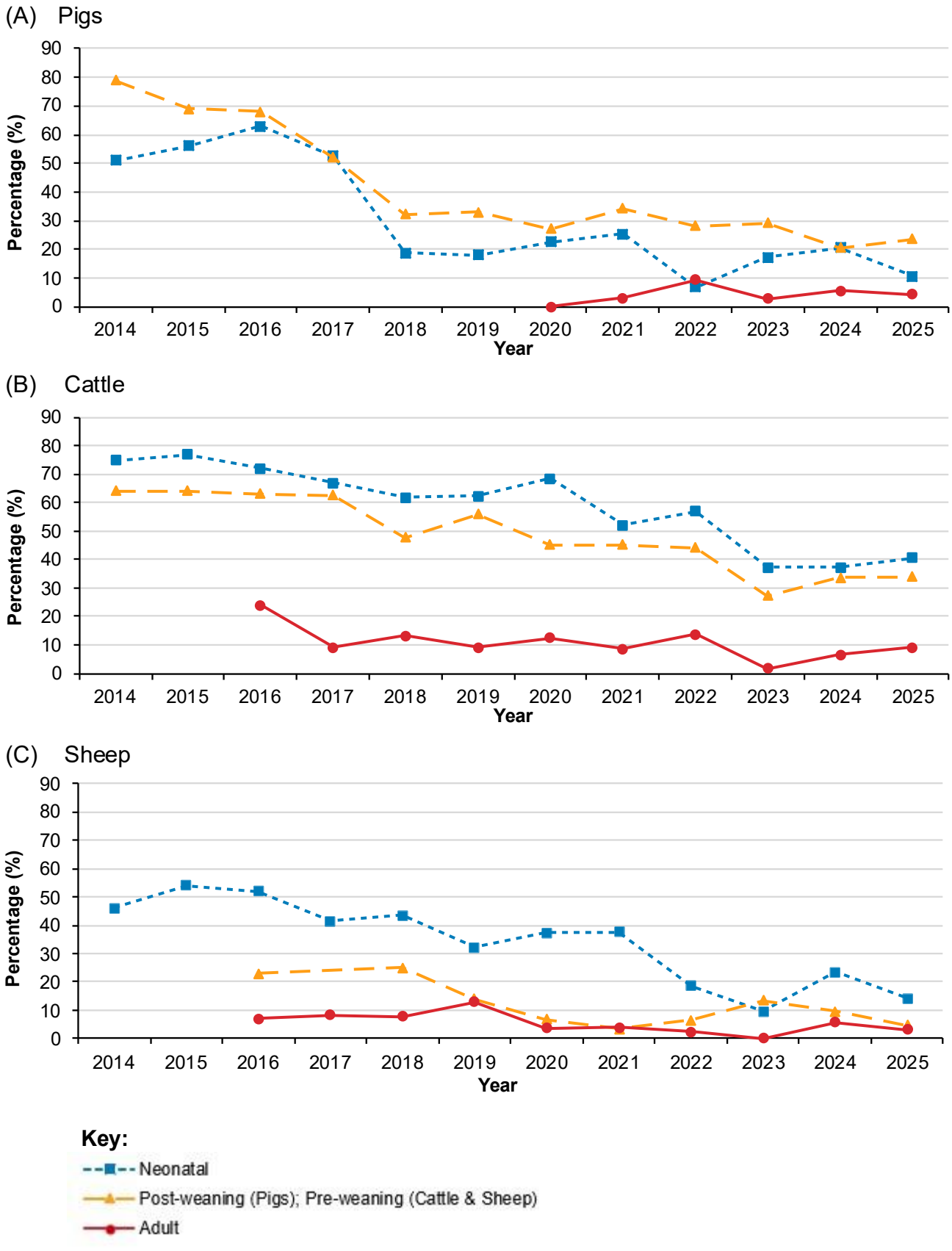
Figure 4.2: Percentage of *E. coli* with limited treatment options, isolated from different animal species from 2014 to 2025. Note that isolates are tested against different panels of antibiotics, depending on species and age of animal. Brackets indicate the number of isolates tested in 2025.



*Includes cattle, sheep, pigs, chickens and turkeys

As in previous years, higher resistance was observed in *E. coli* isolates from young animals than from adults (**Figure 4.3**). This may reflect differences in disease presentations and antibiotic treatments between age groups (see individual animal sections below). However, the patterns are not the same for all species. For lambs and calves, neonatal animals have the highest percentage of isolates with limited treatment options, which falls in the pre-weaned age group, with a significantly larger drop in sheep than in cattle. A contrasting picture is seen in pigs, where older pre-weaned piglets tend to have the greatest percentages of isolates with limited treatment options. It is encouraging that the percentage of *E. coli* with limited treatment options has declined substantially in young pigs, cattle, and sheep since 2014.

Figure 4.3: Percentage of *E. coli* with limited treatment options from 2014 to 2025, isolated from different age categories of pigs, cattle and sheep (defined in **Table 4.2**). Brackets indicate the number of isolates tested in 2025.



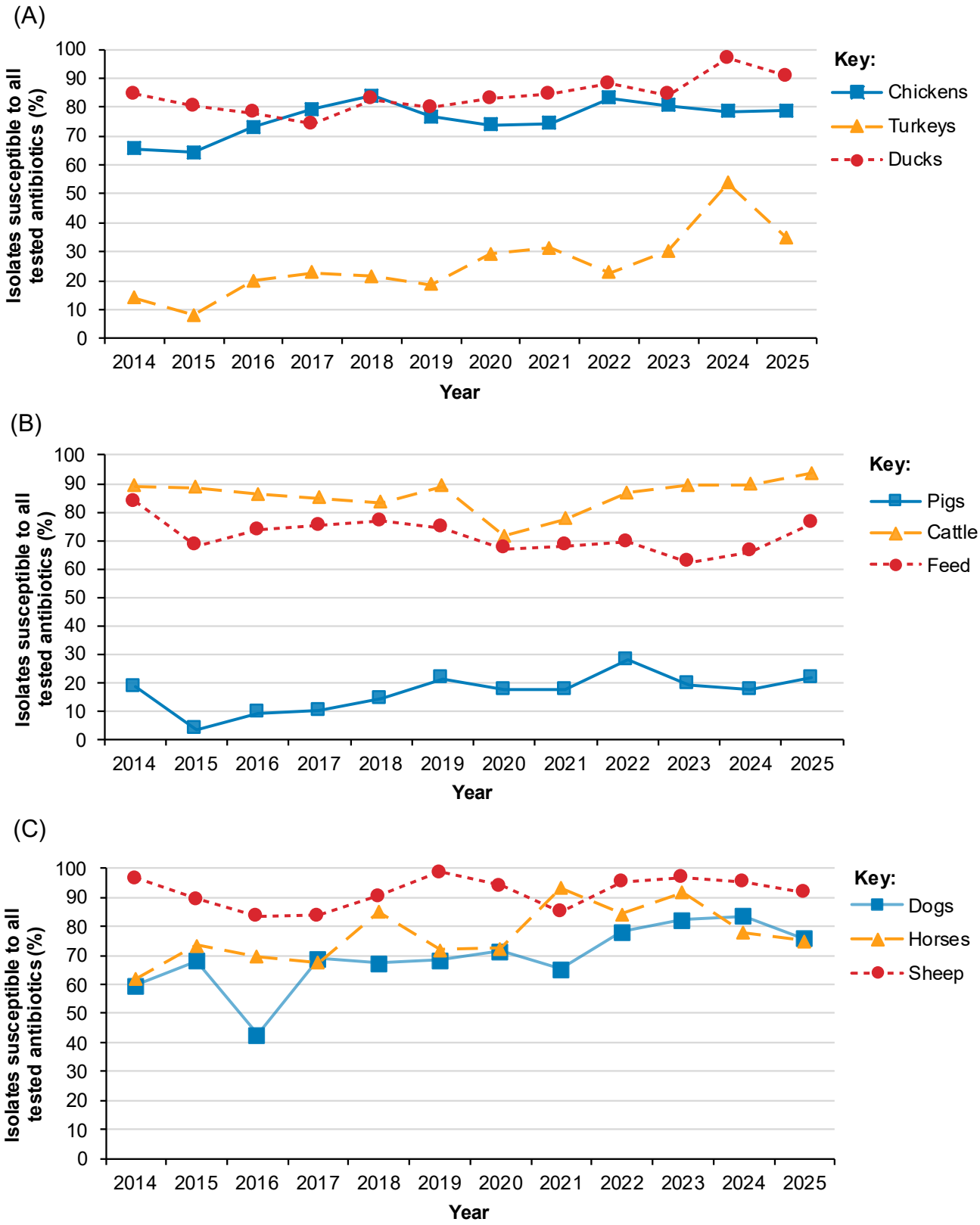
4.4.1.2 *Salmonella* spp.

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* are published annually by APHA in the Salmonella in Animals and Feed in Great Britain report.

Of the 4,929 *Salmonella* isolates tested in Great Britain in 2025, the majority were from food-producing animals (56%). This comprised submissions from chickens (36% of all isolates), cattle (9.3%), pigs (6.7%), ducks (2.4%), sheep (1.2%) and turkeys (0.5%). Other major sources include animal feed (24%), a category which includes raw meat pet food and other animal by-products, as well as livestock feed and feedmill environments. Dogs (8.5%), other animal and bird species (6.0%), and environmental samples (5.4%) make up the remainder. In *Salmonella,* patterns of resistance or susceptibility can be affected by shifts in the predominant serovars circulating in different animal hosts, as well as changes in antibiotic usage. More detailed serovar changes by host can be found in species-specific sections below.

In 2025, the proportion of *Salmonella* isolated from all species that were fully susceptible to the panel of antibiotics tested was 76% [95% CI: 75-77%]. This has increased from 73% [95% CI: 72-75%] in 2024 and 69% [95% CI: 67-71%] in 2014. Full susceptibility in *Salmonella* spp. varied between animal species (**Figure 4.4**). In 2025, full susceptibility was highest in cattle (94% [95% CI: 91-96%]), sheep (92% [95% CI: 82-96%]), and ducks (91% [95% CI: 84-95%]), whilst the lowest was in pigs (22% [95% CI: 18-26%]) and turkeys (35% [95% CI: 19-54%]). The largest increase in full susceptibility observed this year was in isolates from feed (from 66% in 2024 [95% CI: 63-69%] to 76% in 2024 [95% CI: 73-79%]). The largest decrease in full susceptibility was observed in isolates from turkeys, although the number of turkey submissions in 2025 was considerably lower than in previous years.

Figure 4.4: *Salmonella* spp. isolates susceptible to all tested antibiotics (full susceptibility), from different sources and animal species, from 2014 to 2025. *Salmonella* in dogs became reportable in 2021. Brackets indicate the number of isolates tested in 2025.



The proportion of *Salmonella* having limited treatment options from all sources in 2025 was 9.2% [95% CI: 8.4-10%], comparable to 2024 (9.6% [95% CI: 8.8-11%]). Data for this metric are available from 2023 onwards (Supplementary Material 6). Levels of isolates with limited treatment options in pigs across all three years are substantially higher than other sources. However, in 2025 these fell to 70% [95% CI: 65-75%] from 75% in 2024 [95% CI: 70-79%]. A statistically significant increase was observed in turkeys, from 1.1% in 2024 [95% CI: 0.2 – 6.0%] to 27% [95% CI: 14-46%] in 2025, but this was attributable to a single outbreak of a MDR *S.* Goldcoast in a limited number of flocks. There was also a significant increase in the percentage of *Salmonella* with limited treatment options in dogs (from 5.1% [95% CI: 3.5–7.4%] to 11% [95% CI: 8.0-14%])). As in 2024, no isolates with limited treatment options were detected in ducks or sheep.

Overall, resistance to HP-CIAs remained uncommon in *Salmonella.* This is important, as the third-generation cephalosporin and fluoroquinolone classes are used to treat severe or invasive *Salmonella* infections in humans. Resistance to the third-generation cephalosporins was very low (<1%) overall, and the MDR isolates from the turkey outbreak accounted for 33% and 40% of cefotaxime and ceftazidime resistance, respectively. However, 4.3% [95% CI: 1.7-11%] of *Salmonella* isolates from horses carried third-generation cephalosporin resistance. For the quinolone class, ciprofloxacin resistance was also very low across the sectors (<2%). Resistance to nalidixic acid was low, and found across majority of animal species, feed, and environment. (S6.1.5 in Supplementary Material 6).

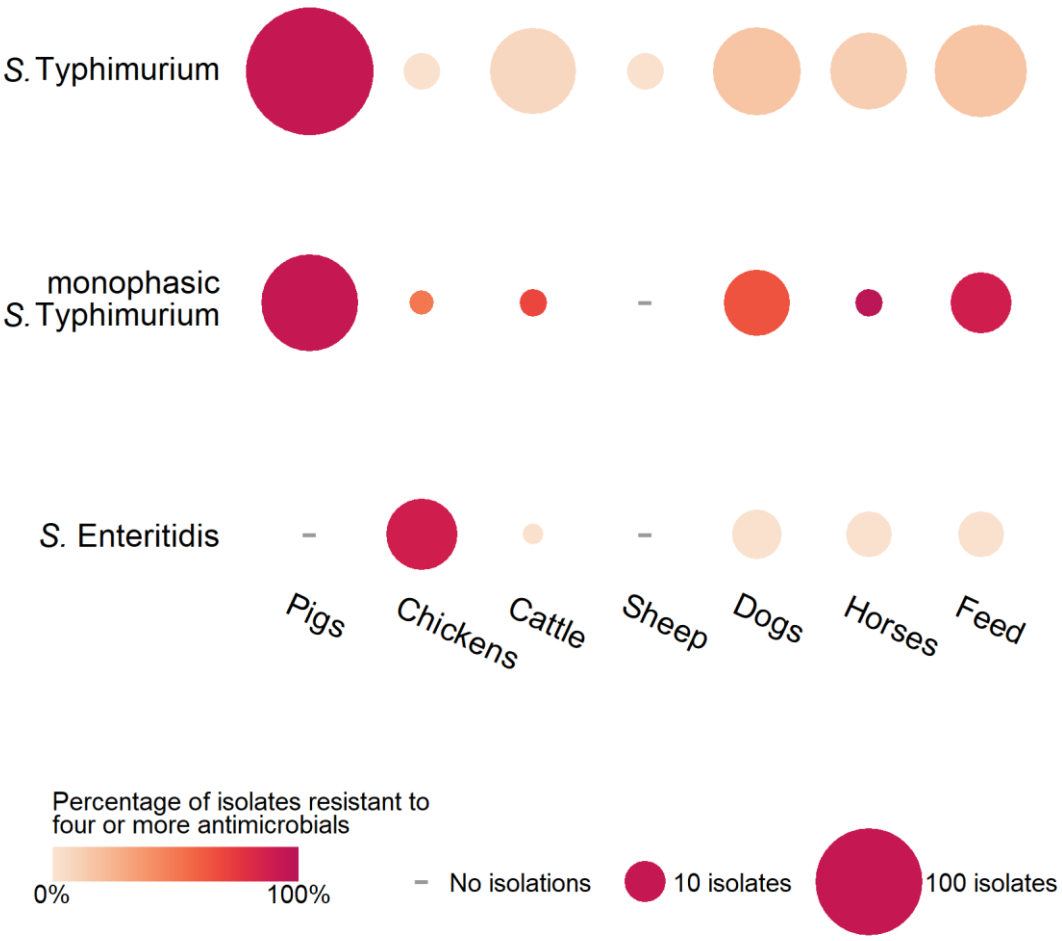
The National Control Programmes' (NCP) regulated *Salmonella* serovars are subject to higher levels of control, due to public health concerns: *S.* Typhimurium, monophasic *S.* Typhimurium, *S.* Enteritidis, and *S.* Infantis. One third (33%) of the 442 *S.* Typhimurium isolates detected in 2025 originated from pigs; other major sources included feed (16%), dogs (14%), and cattle (14%). Full susceptibility in *S.* Typhimurium was 51% [95% CI: 46-56%] in 2025. There were clear differences in resistance profiles in these serovars between different animal species (**Figure 4.5**).

Among pig isolates, only 2.7% [95% CI: 1.1-6.8%] of *Salmonella* Typhimurium were fully susceptible, while 95% [95% CI: 90-97%] displayed limited treatment options. In contrast, 82% [95% CI: 71-90%] of Typhimurium isolates from cattle were fully susceptible, while only 1.6% [95% CI: 0.3-8.7%] had limited treatment options.

The majority of monophasic *S.* Typhimurium were recovered from pigs (50%), dogs (21%), and feed (17%). Only 1.9% [95% CI: 0.6-5.3%] of all monophasic *S.* Typhimurium were fully susceptible, whereas 81% [95% CI: 74-86%] had limited treatment options. However, the levels of isolates with limited treatment options were significantly higher in pigs (93% [95% CI: 85-97%]) and feed (89% [95% CI: 72-96%]), compared to all other sources (59% [95% CI: 46-71%]).

In 2025, 100 *S.* Enteritidis were recovered, predominantly from chickens (39%) and dogs (16%), and 57% [95% CI: 47-66%] of all isolates were fully susceptible. Of the 100 isolates 34% [95% CI: 25-44%] had limited treatment options. These were found only in chickens.

Figure 4.5: Percentage of *Salmonella* isolates with limited treatment options for selected serovars from different sources in 2025. The area of the circle represents the number of isolates. The colour intensity represents the percentage with 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 much more frequently found in humans and are spread from person to person.

When present, LA-MRSA usually lives in the nose or on skin. This is termed ‘colonisation’, and people and animals can carry it without it causing disease. LA-MRSA is also an opportunistic pathogen of animals and people. Anyone who has contact with farmed livestock can become colonised with LA-MRSA, although the likelihood 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 in animals 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 2025, three *spa*-type t011 LA-MRSA isolates belonging to the clonal complex CC398 were detected in pigs on different premises. One was recovered from a piglet alongside an isolate of *Trueperella pyogenes.* The piglet displayed signs of lameness, nervousness and wasting. The second LA-MRSA was isolated from joint swab of a pig with infectious arthritis, while the third was an incidental finding from a pig with other disease conditions. All three LA-MRSA isolates harboured resistance genes to tetracyclines, while the second and third additionally carried streptomycin resistance.

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. More information on diagnostic submissions in pigs can be found on the GB Pig Disease Surveillance Dashboard.

4.4.2.1 Gastrointestinal system

Escherichia coli

E. coli is an important cause of diarrhoea (scours), especially in neonatal and post-weaning pigs. Enterotoxin-producing *E. coli* can cause profuse watery diarrhoea and rapid dehydration, high mortalities, and retarded growth rates in surviving piglets. Control relies on a combination of management, nutrition, vaccination and, where necessary, antibiotic treatments. Historically, medicinal products containing zinc oxide were also used to prevent disease, but these were withdrawn in 2024.

In 2025, a total of 648 *E. coli* isolates from pigs were tested for antimicrobial susceptibility, reflecting a year-on-year increase in the number of isolations (453 in 2023 and 573 in 2024). Of the 525 isolates (81%) where age group was known, 73% came from post-weaning animals.

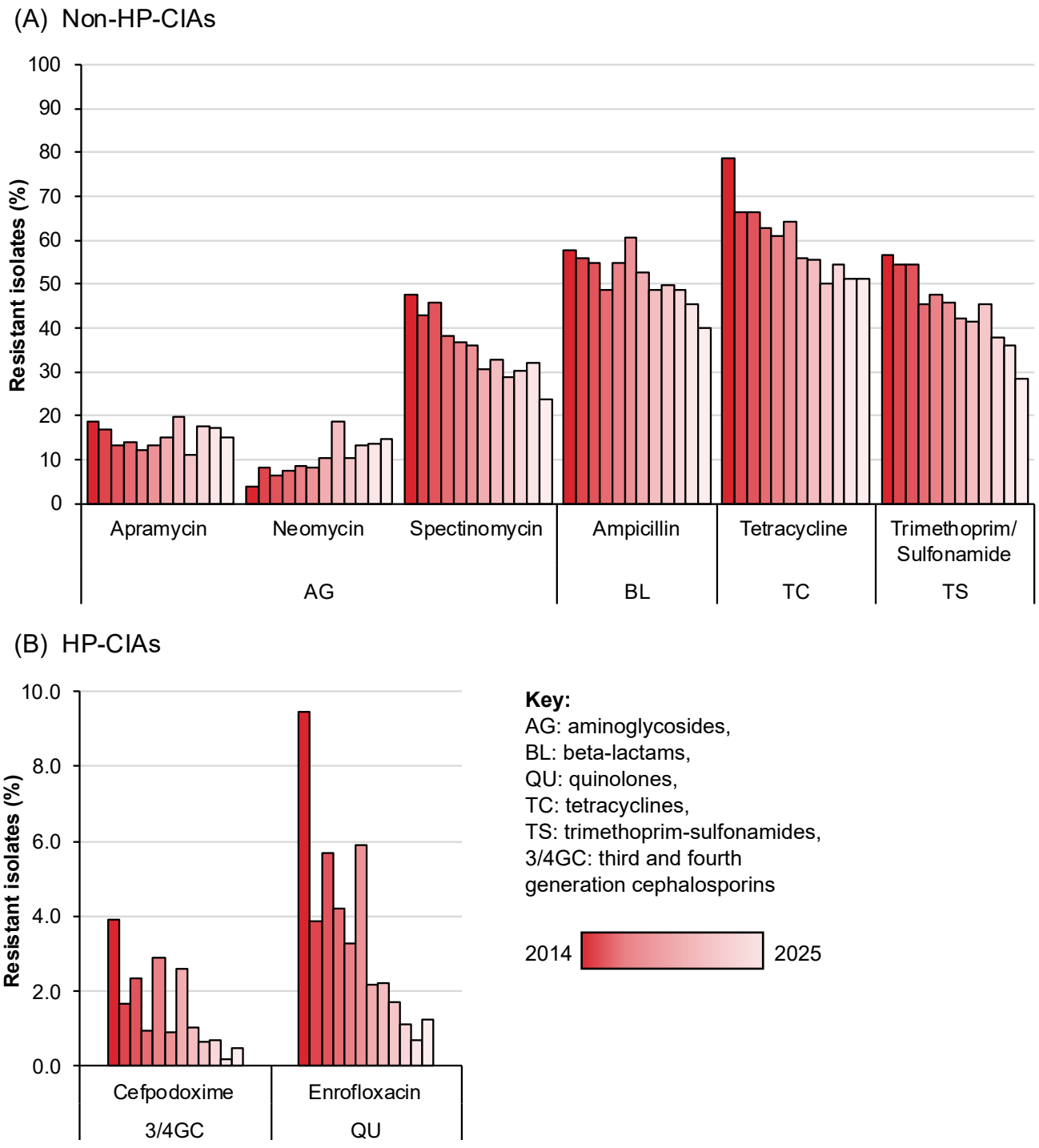
Resistance to four or more antibiotics (limited treatment options) in all pig *E. coli* was 19% [95% CI: 17-23%] in 2025 (**Figure 4.2**). This metric has now been generated for isolates dating back to 2014, when 67% [95% CI: 60-74%] of pig *E. coli* had limited treatment options. The significant decrease coincides with the fall in antimicrobial usage across the sector (Section 2.3.1) and longer-term trends show that levels of *E. coli* with limited treatment options in pigs has fallen in all age groups since 2014 **(Figure 4.3).**

Overall, resistance to most antimicrobials continues to decline in clinical *E. coli* isolates from pigs (**Figure 4.6**). Levels of resistance to ampicillin (40% [95% CI: 36-44%]), trimethoprim-sulfonamide (29% [95% CI: 25-32%]) and spectinomycin (24% [95% CI: 21-27%]) are all at the lowest seen since 2014. Resistance to apramycin (15% [95% CI: 13-18%]) and tetracycline (51% [95% CI: 47-55%]) remained comparable to levels in over the last three years. Resistance to neomycin, however, continued its upward trend to 14.7% [95% CI: 12.1-17.6%] of all *E. coli* tested in 2025. For comparison, neomycin use in pigs has shown a sustained rise from 0.75 to 3.4 mg/kg between 2016 and 2024, although reported use in 2025 has fallen (Chapter 2, Section 2.3.1.1).

For HP-CIAs in *E. coli* from pigs, resistance to enrofloxacin was low (1.2% [95% CI: 0.6-2.4%]) in 2025, increased from very low (0.7% [95% CI: 0.3-1.8%]) in 2024. Enrofloxacin-resistant *E. coli* was isolated from all pig age groups. Cefpodoxime resistance was detected in three isolates, all from post-weaning pigs, representing 0.5% [95% CI: 0.2-1.4%] of all isolates tested.

For most antimicrobials, resistance levels were higher in the post-weaning age group than in neonates or adults, which is reflected in the relative levels of limited treatment options in different age groups **(Figure 4.6 A, S6.1.4)**. Age-related differences were particularly conspicuous for apramycin, where 23% [95% CI: 19-28%] of isolates from the post-weaning age group were resistant, compared to only 1.4% [95% CI: 0.2-5.5%] of all adult and neonate isolates; and spectinomycin, where 29% [95% CI: 25-34%] of the post-weaning isolates were resistant, compared to 9.9% [95% CI: 5.7-16.4%] of adult and neonate isolates.

Figure 4.6: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Escherichia coli* isolates from pigs, from 2014 to 2025 (n=648 in 2025). Note scale differs between graphs.



Salmonella spp.

Salmonella infections in pigs vary considerably in their clinical presentation. Although some serovars cause diarrhoea, fever and pneumonia, other infections may be subclinical. The isolates tested for resistance include diagnostic submissions where *Salmonella* was considered the causal pathogen, as well as those where it was identified as a secondary or incidental finding.

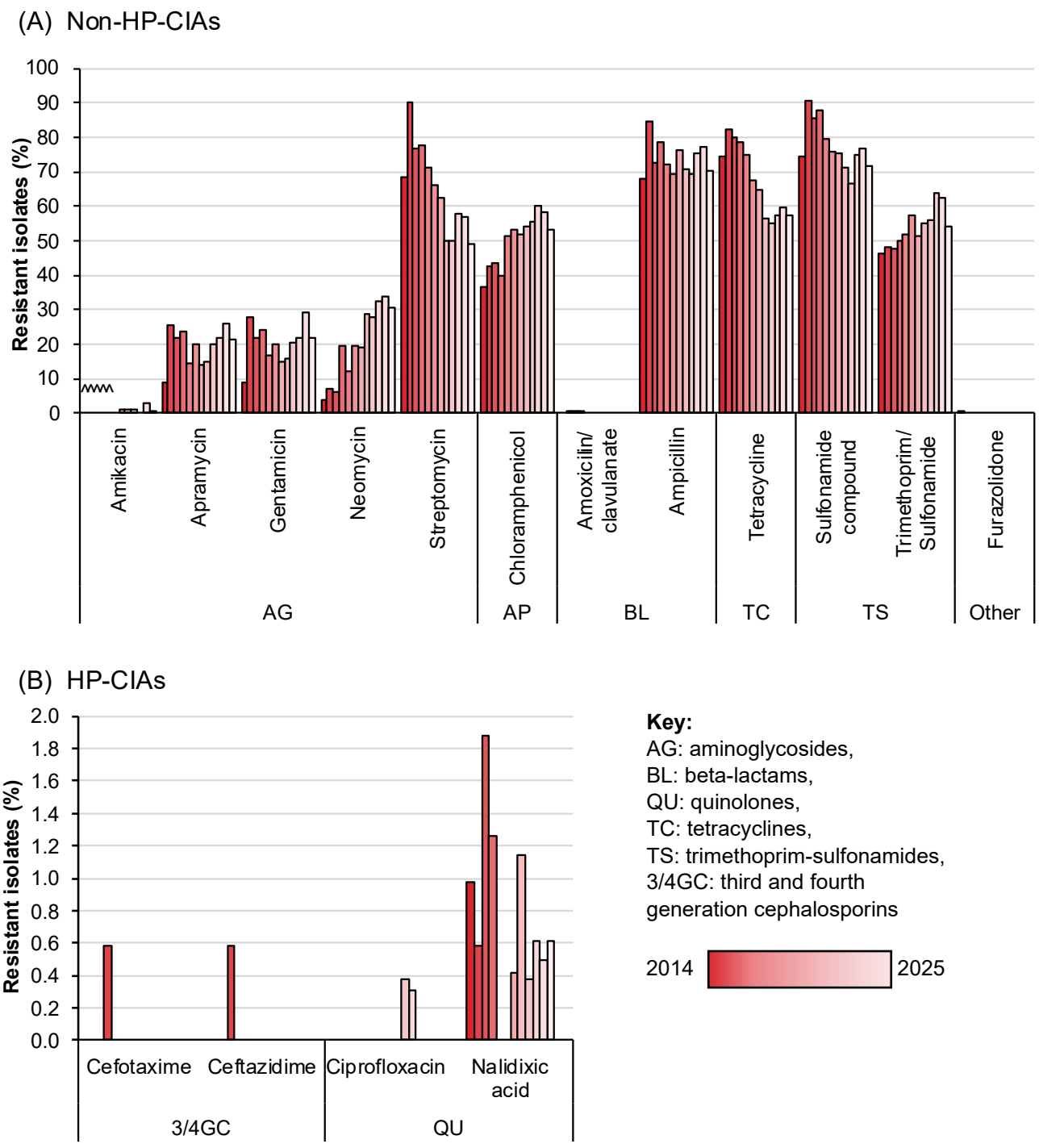
A total of 328 *Salmonella* isolates were investigated for antimicrobial susceptibility. The three main serovars isolated from pig submissions were the same as in 2024: *S.* Typhimurium (45%), monophasic *S.* Typhimurium (24%), and *S.* Derby (13%). *S.* Typhimurium and especially the monophasic variants tend to display more resistances compared to other serovars (*Salmonella* in animals and feed in Great Britain). Overall, 70% [95% CI: 65-75%] of pig *Salmonella* had limited treatment options. However, this was significantly more frequent in the top two serovars, at 95% [95% CI: 89-97%] of *S.* Typhimurium and 93% [95% CI: 84-97%] of monophasic *S.* Typhimurium.

In 2025, 22% [95% CI: 18-26%] of *Salmonella* isolates were susceptible to all 16 antimicrobials tested, which is an increase from 17% [95% CI: 14-21%] in 2024, but remains below the 28% [95% CI: 23-34%] seen in 2022. The most common resistances observed were to sulfonamides (72% [95% CI: 67-77%]), ampicillin (70% [95% CI: 65-75%]), and tetracycline (58% [95% CI: 52-63%]) (**Figure 4.7 A**). These represent the three classes of antimicrobials most used in pigs (Section 2.3.1).

The aminoglycosides apramycin and neomycin are important for control of enteric infections in the pig industry, while gentamicin and amikacin are considered of public health importance. Aminoglycoside use in pigs has steadily risen since 2016, although reductions were reported in 2025 (Chapter 2, Section 2.3.1.1). For neomycin, apramycin and gentamicin, resistance levels are significantly higher in recent years compared to 2014, although there is no statistically significant difference between 2021 and 2025 levels. Resistance to amikacin has been tested for in *Salmonella* since 2019, and is associated with the emergence of the *rmtB* gene, which also confers high-level resistance to several other aminoglycosides (Section 4.4.2.1 in VARSS 2024). Amikacin resistance was detected in two *S.* Typhimurium isolates in 2025 (0.6% [95% CI: 0.2-2.2%] of all pig *Salmonella* tested).

Resistance to HP-CIAs in *Salmonella* in pigs remains very low, with no resistance detected to third-generation cephalosporins or ciprofloxacin (**Figure 4.7 B**). Resistance to the quinolone nalidixic acid was only detected in two *S.* Derby isolates (0.6% [95% CI: 0.2-2.2%] of all pig *Salmonella* tested).

Figure 4.7: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Salmonella* isolates from pigs, from 2014 to 2025 (n=328 in 2025). Note scale differs between graphs.



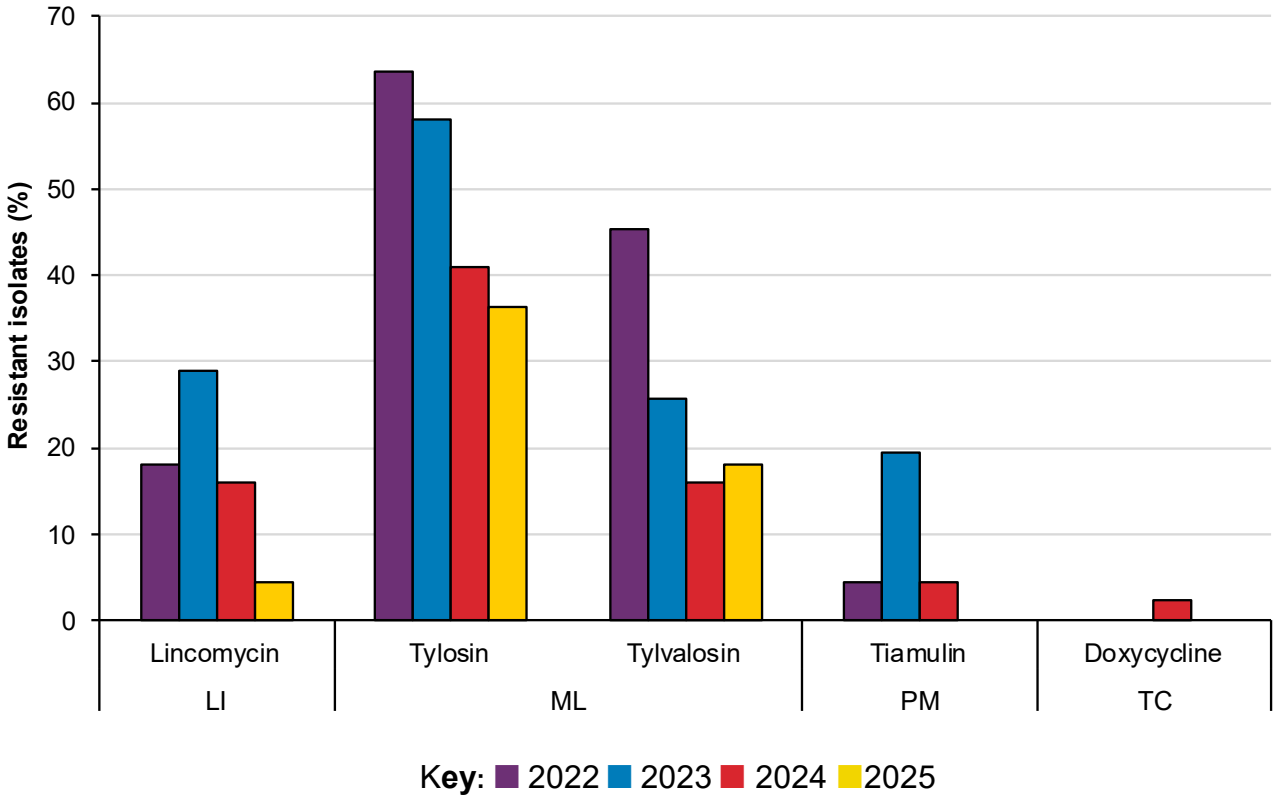
Brachyspira hyodysenteriae

Brachyspira hyodysenteriae causes swine dysentery, typically associated with bloody diarrhoea in growing pigs. However, in a newly infected herd, all age groups may be affected, and milder strains of the bacteria have emerged that cause low-grade scouring, rather than frank dysentery. Recovered pigs may be chronically stunted.

Strict biosecurity is the most important tool in the control of swine dysentery, though autogenous vaccines are available. The range of antimicrobials effective against *Brachyspira* species is limited. Tiamulin is a particularly important treatment and isolates' susceptibility is determined through broth microdilution and MIC. Since 2022, a wider panel of antimicrobials has been used in testing.

In 2025, there were 21 isolates of *Brachyspira hyodysenteriae* from England and Wales, and one isolate from Scotland screened for antimicrobial susceptibility. Fourteen isolates (64% [95% CI: 43-82%]) were susceptible to all five antimicrobials, using established veterinary clinical breakpoints, and none were resistant to three or more antimicrobial classes (MDR). No isolates were resistant to tiamulin or doxycycline in 2025. Resistance to macrolides remains the most common (**Figure 4.8**), but the proportion of resistant isolates has continued to decrease since 2022.

Figure 4.8: Resistance in *Brachyspira hyodysenteriae* isolates from pigs, from 2022 to 2025 (n=22 in 2025).



LI: lincosamide, ML: macrolides, PM: pleuromutilins, TC: tetracyclines

4.4.2.2 Respiratory system

A number of organisms contribute to respiratory diseases in pigs, and chronic co-infections with viruses and/or *Mycoplasma hyopneumoniae* are common. Acute outbreaks of respiratory disease affecting large numbers of pigs can also occur. As well as addressing underlying infectious agents, longer-term control may involve alterations to the physical environment to improve ventilation and reduce ammonia concentrations; or changes to pig management systems, such as avoiding mixing batches of pigs from different sources and age groups.

Actinobacillus pleuropneumoniae

Actinobacillus pleuropneumoniae contributes to Porcine Respiratory Disease Complex, and may be a primary cause of pneumonia, or cause secondary infections. There are many different circulating strains, causing either acute disease or chronic, low-grade infections.

Ten isolates were tested for antimicrobial susceptibility in 2025. Five of these (50% [95% CI: 24-76%]) were resistant to both ampicillin and tetracycline. Of the remaining isolates, three (30% [95% CI: 11-60%]) were fully susceptible to all 11 antimicrobials tested by MIC.

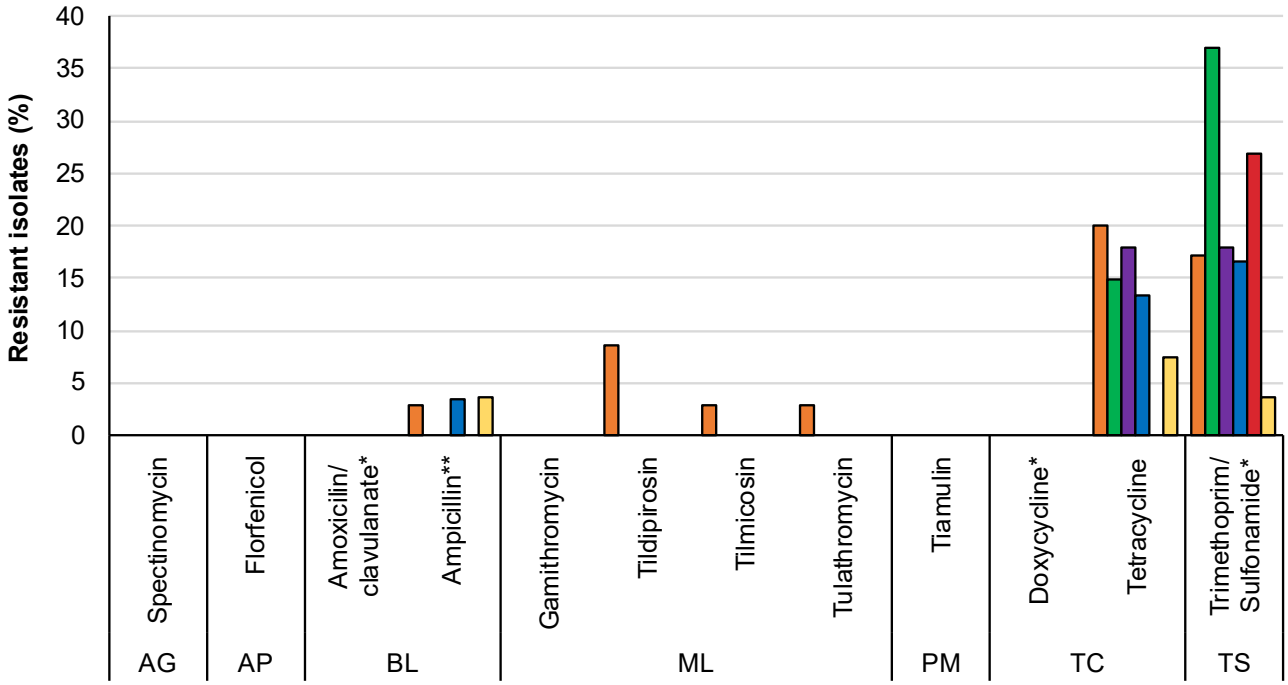
Pasteurella multocida

Pasteurella multocida is generally a secondary, opportunistic pathogen contributing to respiratory disease in pigs. Toxigenic strains of the bacteria can cause atrophic rhinitis, which can be managed with vaccination and eradication programmes.

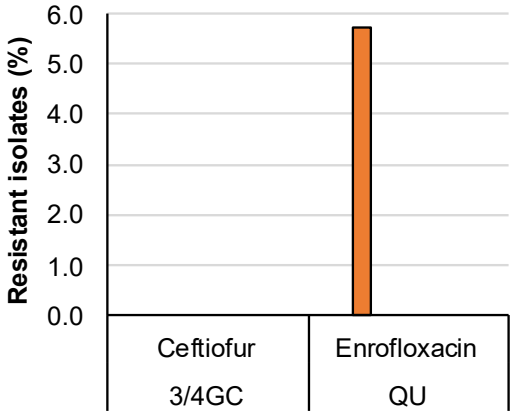
There were 27 isolates tested for antimicrobial susceptibility in 2025. Of these, 85% [95% CI: 68-94%] were susceptible to all 13 antimicrobials tested. Four individual isolates were each resistant to a single non-HP-CIA antibiotic (**Figure 4.9**).

Figure 4.9: 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 2025 (n=27 in 2025). Note scale differs between graphs.

(A) Non-HP-CIAs



(B) HP-CIAs



Key:
* CA-SFM 2023 veterinary CBP
** EUCAST human CBP for *P. multocida*
AG: aminoglycosides,
AP: amphenicols,
BL: beta-lactams,
ML: macrolides,
PM: pleuromutilin,
QU: quinolones,
TC: tetracyclines,
TS: trimethoprim-sulfonamides,
3/4GC: third and fourth generation cephalosporins
2020 2021 2022
2023 2024 2025

4.4.2.3 Multi-system pathogens

Streptococcus suis

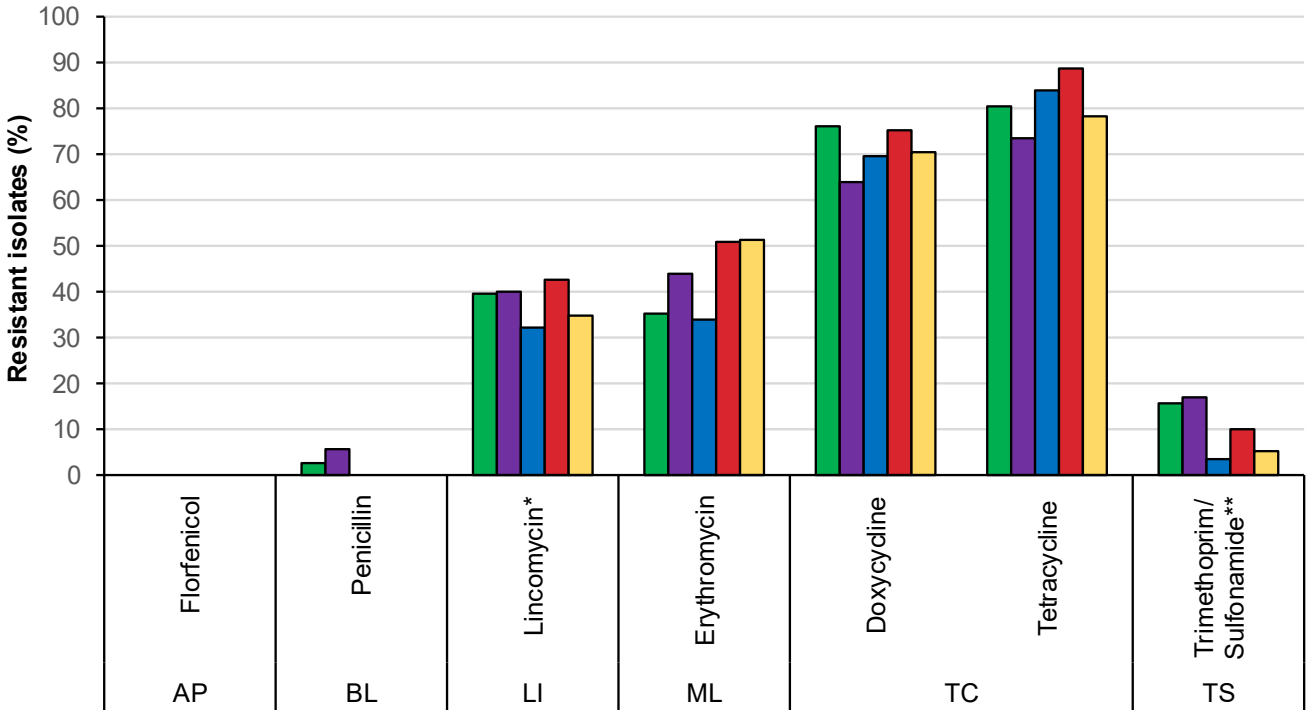
Streptococcus suis is frequently carried in the tonsils of healthy pigs, but under conditions of stress, including coinfection with viruses such as porcine reproductive and respiratory virus (PRRSV), virulent strains may cause outbreaks in weaned piglets. Clinical signs of septicaemia, such as depression and inappetence, progress quickly to meningitis. Polyarthritis, respiratory infections and endocarditis are also features of some outbreaks. Zoonotic transmission to people, usually in close contact with affected pigs, is possible.

Since 2021, *S. suis* isolates have been tested against a panel of nine antimicrobials using MIC testing (**Figure 4.10**). In 2025, 78 isolates were tested and 19% [95% CI: 12-29%] were fully susceptible, while 31% [95% CI: 22-42%] were MDR. These figures are similar to the baseline year, 2021, when 20% [95% CI: 12-30%] of isolates were fully susceptible and 35% [95% CI: 25-47%] MDR.

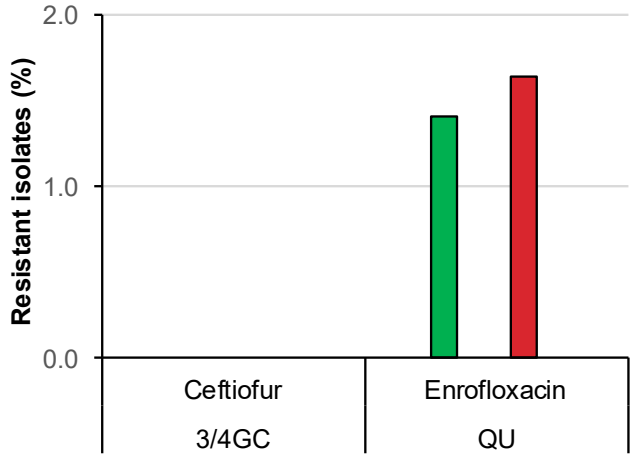
Resistance to non-HP-CIA antimicrobials remains at similar levels to previous years. Resistance was extremely high (>70%) against antimicrobials in the tetracycline class. Erythromycin resistance was seen in 51% of isolates [95% CI: 40-62%] and commonly co-occurred with doxycycline and/or lincomycin resistance. Resistance to florfenicol was not detected, and furthermore, no resistance to penicillin was identified, indicating that penicillin remains a viable first-line treatment. In 2025, no isolates were resistant to the HP-CIAs tested, ceftiofur and enrofloxacin.

Figure 4.10: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Streptococcus suis* isolated from pigs, from 2021 to 2025 (n=78 in 2025). Interpreted using CLSI veterinary breakpoints unless indicated otherwise.

(A) Non-HP-CIAs



(B) HP-CIAs



Key:
* CA-SFM 2023 veterinary CBP
** EUCAST human CBP for *S. suis*
AP: amphenicols,
BL: beta-lactams,
LI: lincosamides,
ML: macrolides,
QU: quinolones,
TC: tetracyclines,
TS: trimethoprim-sulfonamides,
3/4GC: third and fourth generation cephalosporins
2021 2022 2023 2024 2025

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 is a pathogen of concern that causes a range of clinical problems in poultry. Although it is found normally in the gut of healthy birds, it may cause opportunistic infections at times of stress, especially in young chicks. Distinct strains, known as Avian Pathogenic *E. coli* (APEC), can also invade outside the gut, causing a range of diseases including respiratory illness, and infections of the heart, liver and reproductive tract. APEC strains typically carry higher levels of resistance than commensal *E. coli.* Vaccines are used for control, but do not protect against all strains. Good hygiene, especially in the hatchery, is vital, and probiotics are often used to try and reduce colonisation in early life.

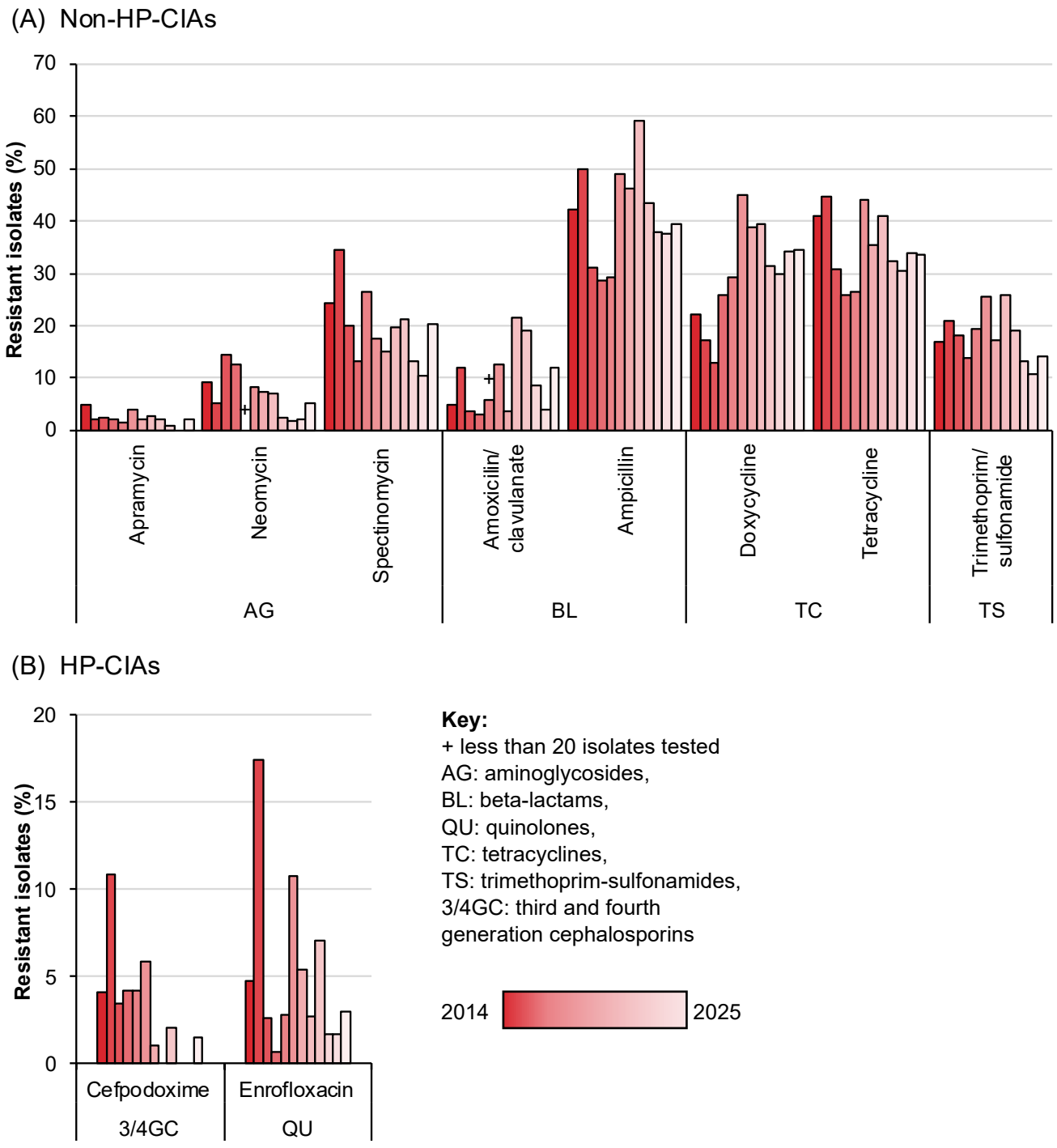
The clinical samples submitted from poultry arise from a variety of flocks, including commercial farms and small-scale poultry keepers. Consequently, annual fluctuations in resistance may reflect differences in the profile of submissions from year to year. Since 2017, APHA has tested, on average, around 120 chicken and 10 turkey *E. coli* isolates per year. In 2025, 134 chicken isolates and 11 turkey isolates were investigated for antimicrobial susceptibility.

In 2025, 13% [95% CI: 9.0-20%] of chicken isolates and 9.1% [95% CI: 1.6-37%] of turkey isolates had limited treatment options. For chickens, this represents a decrease from the baseline year of 2014 (25% [95% CI: 21-30%]), although a slight year-on-year increase since 2023 (**Figure 4.2**).

In chicken isolates, the most frequently identified resistances were to ampicillin (40% [95% CI: 38-48%]), doxycycline (34% [95% CI: 27-42%]) and tetracycline (34% [95% CI: 26-42%]) (**Figure 4.11 A**). Spectinomycin resistance increased to 20% [95% CI: 14-28%] in 2025 from 10% [95% CI: 6.6-16%] in 2024. Resistance to amoxicillin/clavulanate also rose slightly to 12% [95% CI: 6.4-21%] in 2025, from 4% [95% CI: 1.6-9.7%] in 2024.

Resistance to the HP-CIAs remained low (<3%) in chickens in 2025 (**Figure 4.11 B**).

Figure 4.11: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Escherichia coli* isolates from chickens, from 2014 to 2025 (n=134 in 2025). Note scale differs between graphs.



Salmonella spp.

Signs of clinical *Salmonella* infections in poultry may include lethargy, watery diarrhoea and high mortality in chicks under three weeks of age, although the bacterium is often carried and shed without clinical disease. The majority of *Salmonella* isolates in poultry are from statutory submissions made through the National Control Programmes (NCPs), which systematically samples healthy chicken breeder, layer and broiler flocks, and turkey flocks. Voluntary NCP submissions from the duck sector have increased in recent years. Thus, submissions associated with disease make up a very small proportion of all poultry isolates tested for antimicrobial resistance. Further details can be found in the annual *Salmonella* in animals and feed in Great Britain report. Using antimicrobials to prevent disease in any animal (prophylaxis) is not permitted under the Veterinary Medicines Regulations, unless the consequences of not prescribing are likely to be severe. As many detections of *Salmonella* in poultry represent sub-clinical carriage, antibiotic treatment is generally not indicated. Further treatment restrictions apply to poultry under the Control of Salmonella in Poultry Order (2007).

Chickens

The number of chicken *Salmonella* isolates tested in 2025 was 1,778. *S.* Idikan (30% of chicken isolates) and *S.* Montevideo (19%) remained the top two serovars in 2025, and *S.* Mbandaka (13.3%) was the third-most common, replacing *S.* Kedougou. There were 39 isolations of the regulated serovar, *S.* Enteritidis. Full susceptibility to all sixteen antimicrobials tested remains steady at 79% [95% CI: 77-81%].

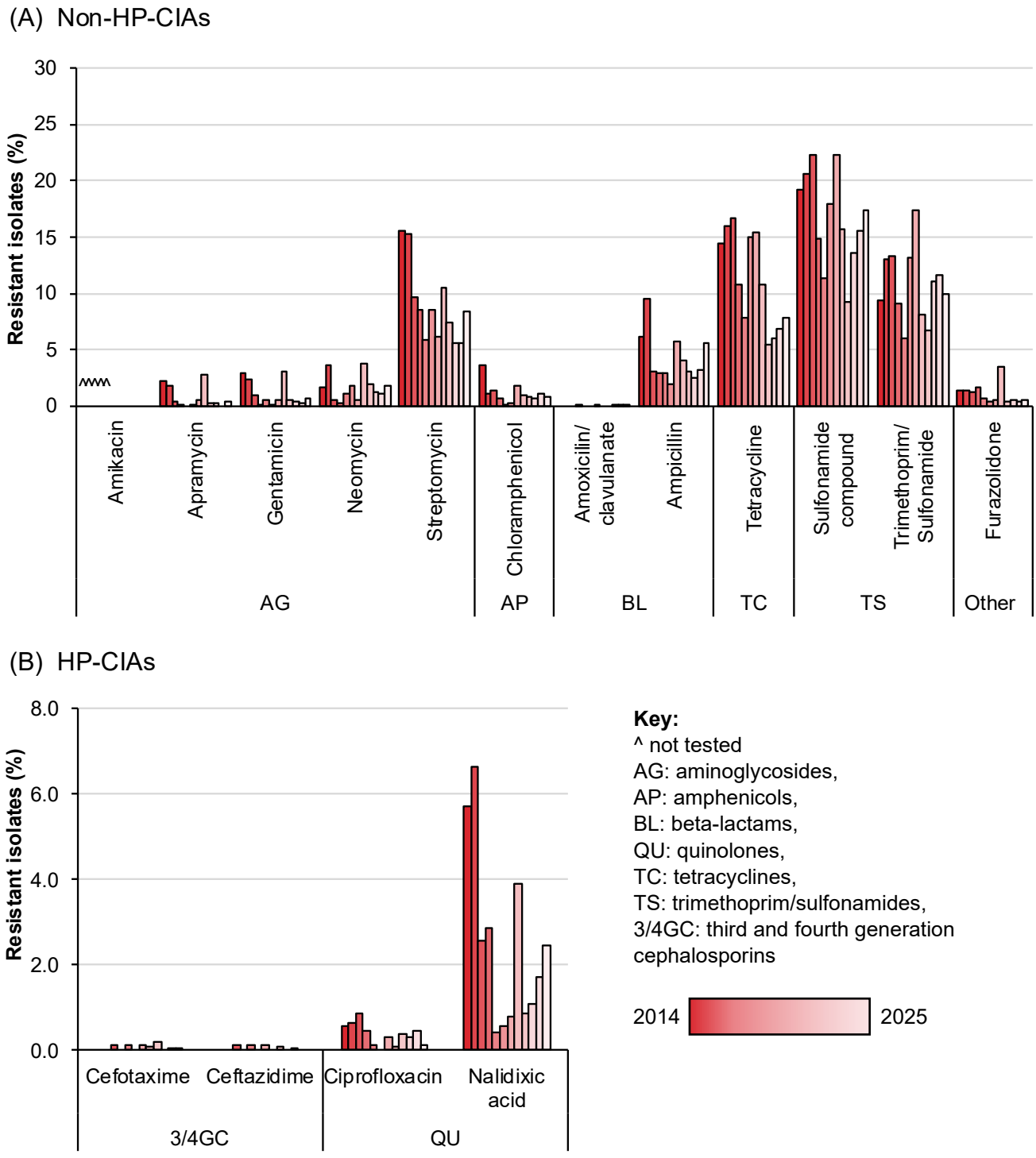
The overall proportion of isolates classed as having limited treatment options was 4.9% [95% CI: 4.0-6.0%] in 2025, a significant increase since 2024 (2.8% [95% CI: 2.0-3.7%]). However, this figure is biased by an increased number of *S.* Enteritidis isolates (34) with limited treatment options included in the 2025 data, all but one of which originated from a single outbreak.

Resistance was most frequent to the sulfonamides, with 17% [95% CI: 15.6-19.2%] of isolates resistant to sulfonamides and 10% [95% CI: 8.6-11.4%] resistant to trimethoprim-sulfonamide combinations (**Figure 4.12 A**). Despite sustained reductions in antimicrobial use in the broiler and layer sectors, resistance to the most commonly used antimicrobials, ampicillin (5.6% [95% CI:4.6-6.7%]) and tetracycline (7.8% [95% CI:6.7-9.2%]), rose again this year, as did aminoglycoside resistance. This included seven isolates (0.4% [95% CI: 0.2-0.8%]) with apramycin resistance, whereas none were detected in 2024. Five of these were *S.* Infantis isolates from broiler flocks, one was a monophasic *S.* Typhimurium, isolated from a broiler breeder flock and one *S.* Kedougou from broiler flock. The reason for this is unclear, as there has been no apramycin use in broilers since 2021 (Section 2.3.2.1).

Resistance to HP-CIAs was low (<2.5%) in 2025. Only two isolates (0.1% [95% CI: 0.0-0.4%]) were detected with resistance to the HP-CIA ciprofloxacin; however, both isolates were susceptible to at least one aminoglycoside (**Figure 4.12 B**). *Salmonella* that carry both aminoglycoside and ciprofloxacin resistance are of greater concern in human infections, as

treatment options are reduced. Both isolates came from broiler flocks and were of different serovars. One *S.* Enteritidis isolate with resistance to the third-generation cephalosporin, cefotaxime, was detected in 2025 from a broiler flock.

Figure 4.12: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Salmonella* isolates from chickens, from 2014 to 2025 (n=1778 in 2025). Note scale differs between graphs.



Turkeys

Twenty-six *Salmonella* isolates from turkeys were investigated in 2025. The overall number of turkey submissions has decreased, as the sector has been affected by avian influenza and farmers switching to broiler production. However, 2025 also saw the lowest rates of *Salmonella* isolations in turkeys since the NCP began in 2010, with no breeding flocks testing positive for any serovar. The most common serovars tested were *S.* Kedougou (27%), *S.* Goldcoast (19%) and *S.* Senftenberg (15%). A single *S.* Goldcoast isolate was initially investigated under the UK government's ResAlert contingency plan, due to the identification of concurrent resistance to four HP-CIAs. Additional voluntary submissions made by the farm after restocking, and further NCP sampling, identified three further *S.* Goldcoast isolates on the same farm, one of which was fully susceptible. A second farm with a multi-drug-resistant *S.* Goldcoast was later identified through NCP sampling. As part of the investigation and control measures, extensive follow-up sampling was conducted by APHA on both premises. The combined effects of additional outbreak-related sampling and overall low submission numbers create additional biases in the turkey *Salmonella* data for 2025, thus figures for this year may not represent wider trends in the turkey sector.

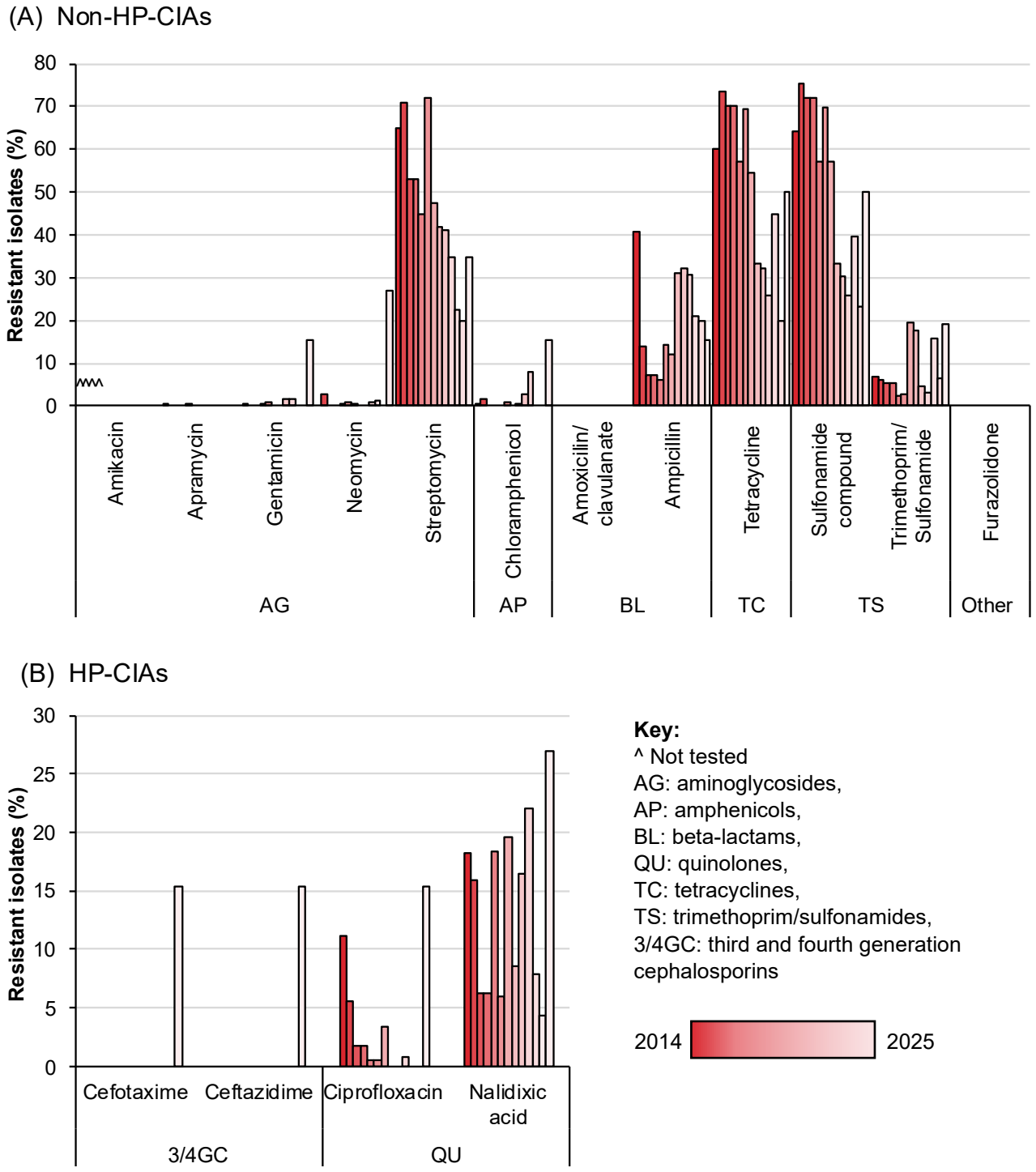
Resistance levels in *Salmonella* from turkeys increased in 2025. The proportion of isolates susceptible to all antimicrobials tested decreased to 35% [95% CI: 19-54%] in 2025 from 54% [95% CI: 44-64%] in 2024. Conversely, the proportion of isolates with limited treatment options increased to 27% [95% CI: 14-46%] in 2025 from 1.1% [95% CI: 0.2 - 6.0%] in 2024. However, these are partly attributable to the additional sampling conducted under the ResAlert contingency plan, which found an additional four *S.* Goldcoast strains, three of which were MDR. Four of the five *S.* Goldcoast isolates (15% of all *Salmonella* from turkeys) were resistant to the HP-CIAs, cefotaxime, ceftazidime, ciprofloxacin, and nalidixic acid **(Figure 4.13)**. They were additionally resistant to the non-HP-CIAs chloramphenicol, gentamicin and neomycin. Four *S.* Senftenberg isolates (15%) carried resistance to nalidixic acid only.

Ducks

There were 118 *Salmonella* isolates from ducks tested for antimicrobial susceptibility. As in previous years, *S. Indiana* was the most common serovar (65%), followed by *S.* Give (10%) and *S.* Newport (10%). There was a single isolation of *S.* Typhimurium, which was fully susceptible to all antimicrobials tested.

Overall, 91% [95% CI: 84-95%] of isolates were fully susceptible, and none had limited treatment options. Six *S.* Give and one *S.* Indiana isolate were concurrently resistant to ampicillin, sulfonamides and trimethoprim-sulfonamide compounds. No resistance to HP-CIA antibiotics was detected.

Figure 4.13: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Salmonella* isolates from turkeys, from 2014 to 2025 (n=26 in 2025). Note scale differs between graphs.



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

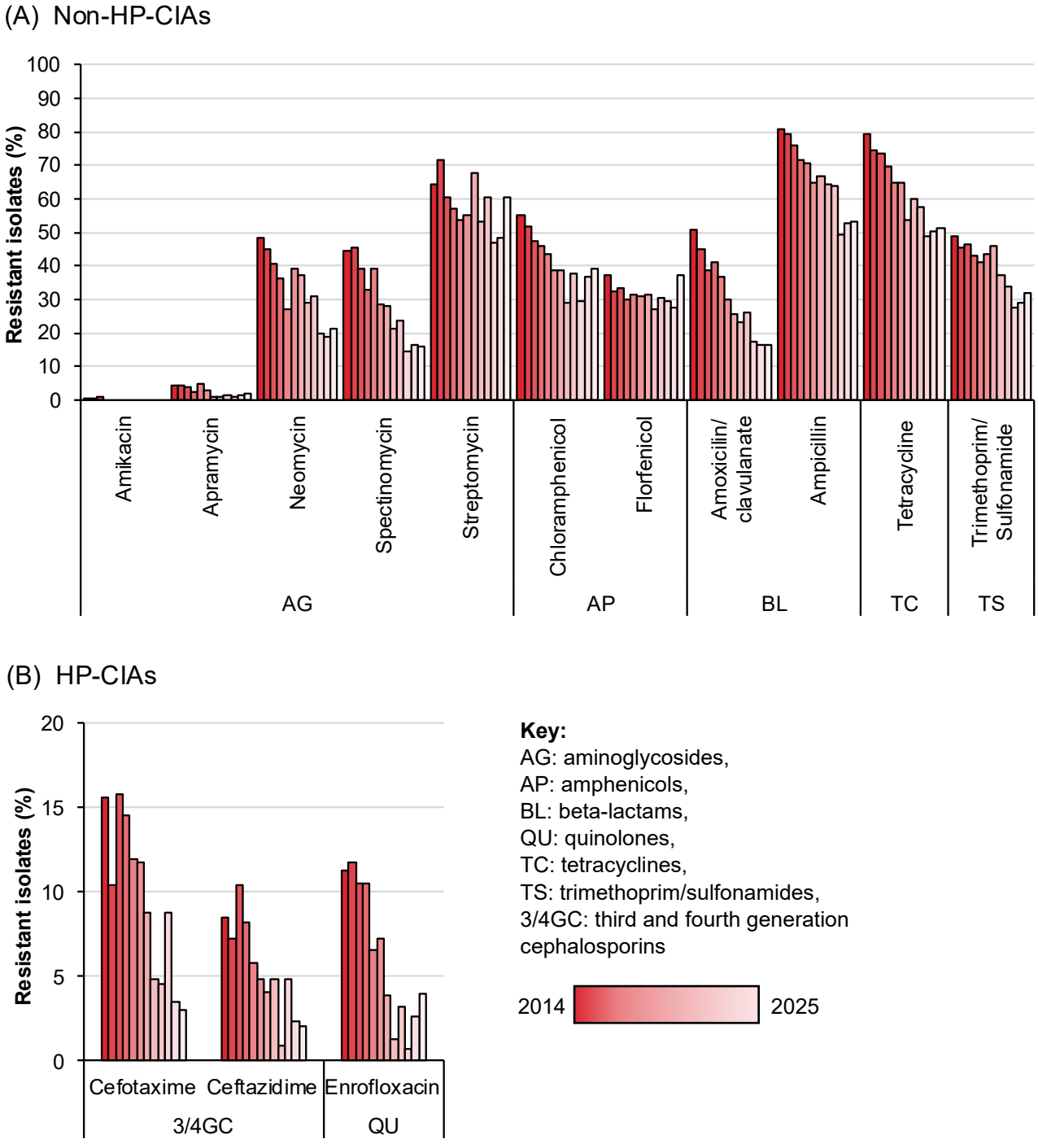
E. coli is a common cause of diarrhoea and dehydration in cattle and can cause mortalities. A total of 480 *E. coli* isolates from cattle (excluding mastitis samples) were tested in 2025, of which age information was available for 78%. In 2025, as in previous years, *E. coli* came predominantly from neonatal animals (31%), followed by pre-weaning calves (28%) and adult cattle (19%).

In 2025, 27% [95% CI: 23-31%] of *E. coli* isolated from cattle had limited treatment options. This was more common in neonatal (41% [95% CI: 33-49%]) and pre-weaning (34% [95% CI: 26-42%]) calves than in adults (9.0% [95% CI: 5.0-17%]) (**Figure 4.3**).

Resistance in *E. coli* from cattle has declined substantially to most antibiotics tested since 2014. Resistance was highest to streptomycin (61% [95% CI: 51-70%]), ampicillin (53% [95% CI: 49%-58%]), and tetracycline (51% [95% CI: 47%-56%]) in 2025 (**Figure 4.14 A**). Resistance to all HP-CIA antimicrobials in *E. coli* remained low (<4%) and has significantly decreased from 2014 levels (**Figure 4.14 B**). Unfortunately, it is not possible to relate these findings back to changes in antibiotic usage, due to a paucity of data.

The levels of resistance in neonatal calves were similar to that seen in pre weaning calves, and higher than in adults (S6.1.4 in Supplementary Material 6).

Figure 4.14: 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 2025 (n=480 in 2025). Note scale differs between graphs.



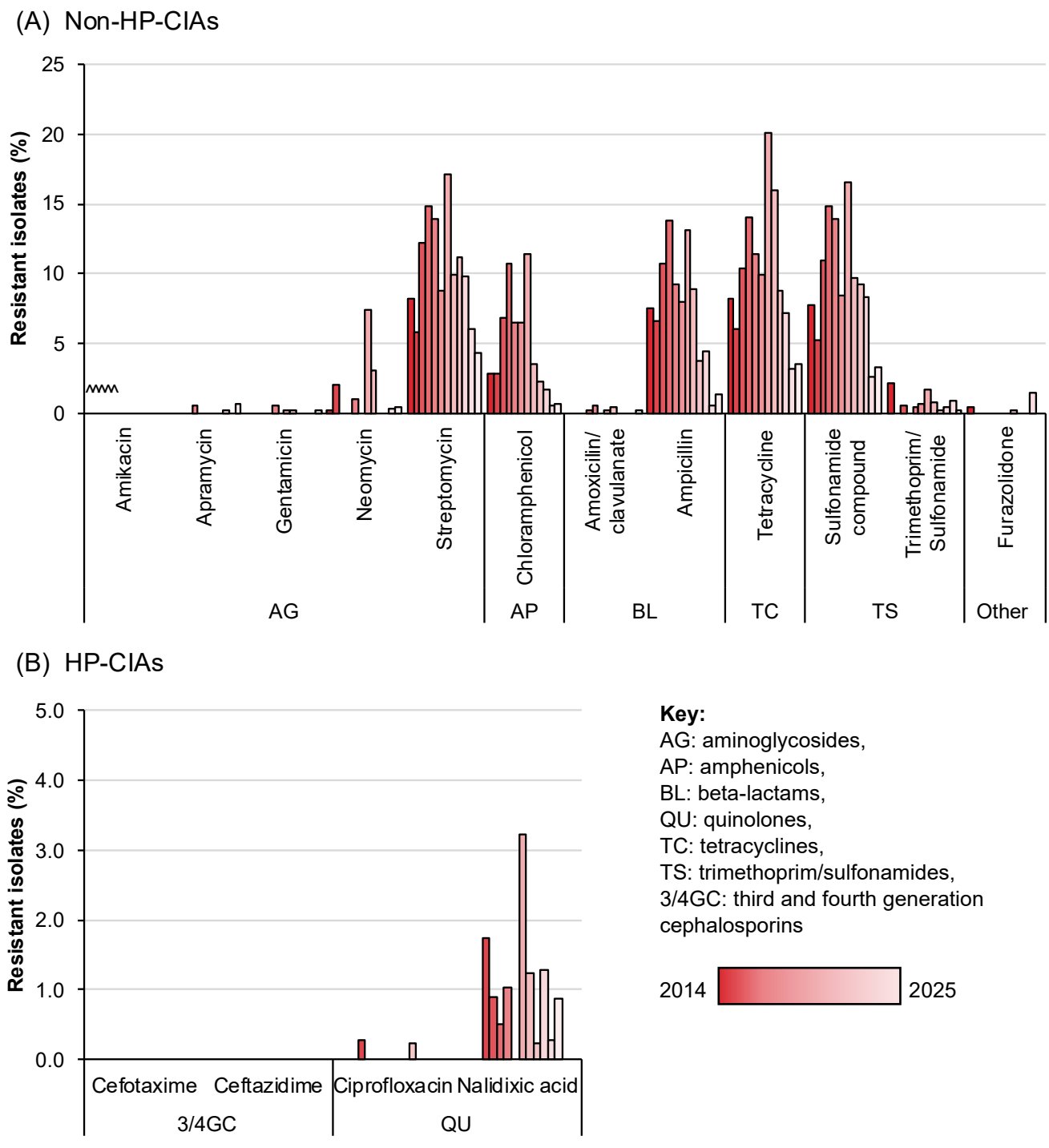
Salmonella spp.

Salmonellosis can cause a wide range of clinical signs in cattle including diarrhoea, joint infections, chronic pneumonia, abortion and sudden death from septicaemia. *Salmonella* data for cattle are presented below for all age groups (**Figure 4.15**).

In 2025, 456 *Salmonella* isolates from cattle were tested for antimicrobial susceptibility. As in 2024, *S.* Dublin (66%), *S.* Typhimurium (13%) and *S.* Mbandaka (11%) were the most common serovars. Full susceptibility to the panel of antibiotics tested in 2025 was 94% [95% CI: 91-96%], increased from 90% [95% CI: 86-92%] in 2024. Limited treatment options were detected in 1.1% [95% CI: 0.5-2.5%] of *Salmonella* isolated from cattle in 2025, comparable to 0.6% [95% CI: 0.2-2.1%] in 2024. In 2025, low resistance was detected to streptomycin (4.4% [95% CI: 2.9-6.7%]), tetracycline (3.5% [95% CI: 2.2-5.6%]), sulfonamides (3.3% [95% CI: 2.0-5.4%]) and ampicillin (1.3% [95% CI: 0.6-2.8%]). Resistance to the other antibiotics tested were either very low (<1%) or not detected.

Resistance to the HP-CIA quinolone nalidixic acid was also very low (0.9% [95% CI: 0.3-2.2%]), and resistance to the other HP-CIAs, third-generation cephalosporins and the fluoroquinolone ciprofloxacin, was not detected in 2025.

Figure 4.15: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Salmonella* isolates from cattle, from 2014 to 2025 (n=456 in 2025). 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 4.16**).

Ninety-six isolates of *M. haemolytica* from cattle underwent AST in 2025 and 84% [95% CI: 76-90%] of these had full susceptibility to the panel of antibiotics tested. Multi-drug resistance was detected in 3.1% [95% CI: 1.1-8.8%] of *M. haemolytica* isolates.

In 2025, resistance was highest to tetracycline (10% [95% CI: 5.8-18%]), florfenicol (7.3% [95% CI: 3.6-14%]), and tilmicosin (7.3% [95% CI: 3.6-14%]) (**Figure 4.16**).

No resistance was detected to either HP-CIA, the third-generation cephalosporin ceftiofur or the fluoroquinolone enrofloxacin.

Pasteurella multocida

There were 120 *P. multocida* from cattle tested in 2025, which is comparable to previous years. The relative number of isolations of *P. multocida* compared to *M. haemolytica* is also in line with previous submissions, and resistance appears fairly consistent over time (**Figure 4.17**).

In 2025, full susceptibility of *P. multocida* isolates to the panel of antibiotics tested was 35% [95% CI: 27-44%], decreased from 41% [95% CI: 33-51%] in 2024. However, MDR levels remained at 17% [95% CI: 11-24%] in 2025, similar to 18% [95% CI: 12-26%] in 2024.

Resistance to tetracycline was 63% [95% CI: 54-71%] in 2025, increased from 53% [95% CI: 44-62%] in 2024 and 47% [95% CI: 36-59%] in 2020. Resistance to doxycycline remained at 0% [95% CI: 0-3.1%]. Spectinomycin resistance was 50% [95% CI: 41-59%] in 2025, increased from 43% [95% CI: 34-53%] in 2024, and 98% of these isolates were also resistant to tetracycline. Co-resistance was also common between macrolides, with 13% [95% CI: 8.4-21%] of *P. multocida* isolates resistant to all four macrolide antibiotics, emphasising the continued need for bacterial identification and susceptibility testing in cattle respiratory cases.

Resistance to HP-CIAs was not detected in *P. multocida* from cattle in 2025.

Figure 4.16: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Mannheimia haemolytica* isolated from cattle, from 2020 to 2025 (n=96 in 2025). Interpreted using cattle CLSI veterinary breakpoints unless indicated otherwise. Note scale differs between graphs.

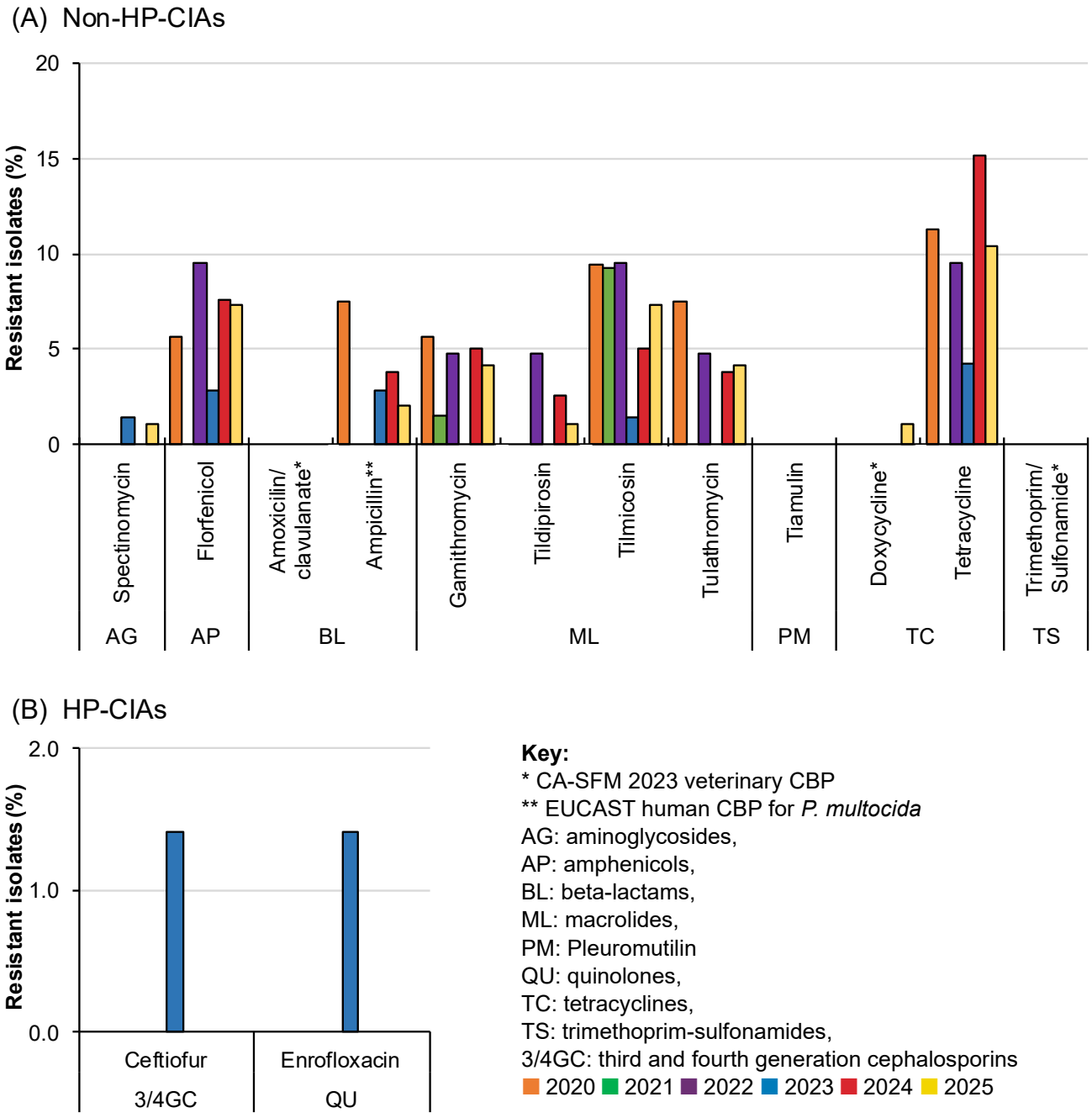
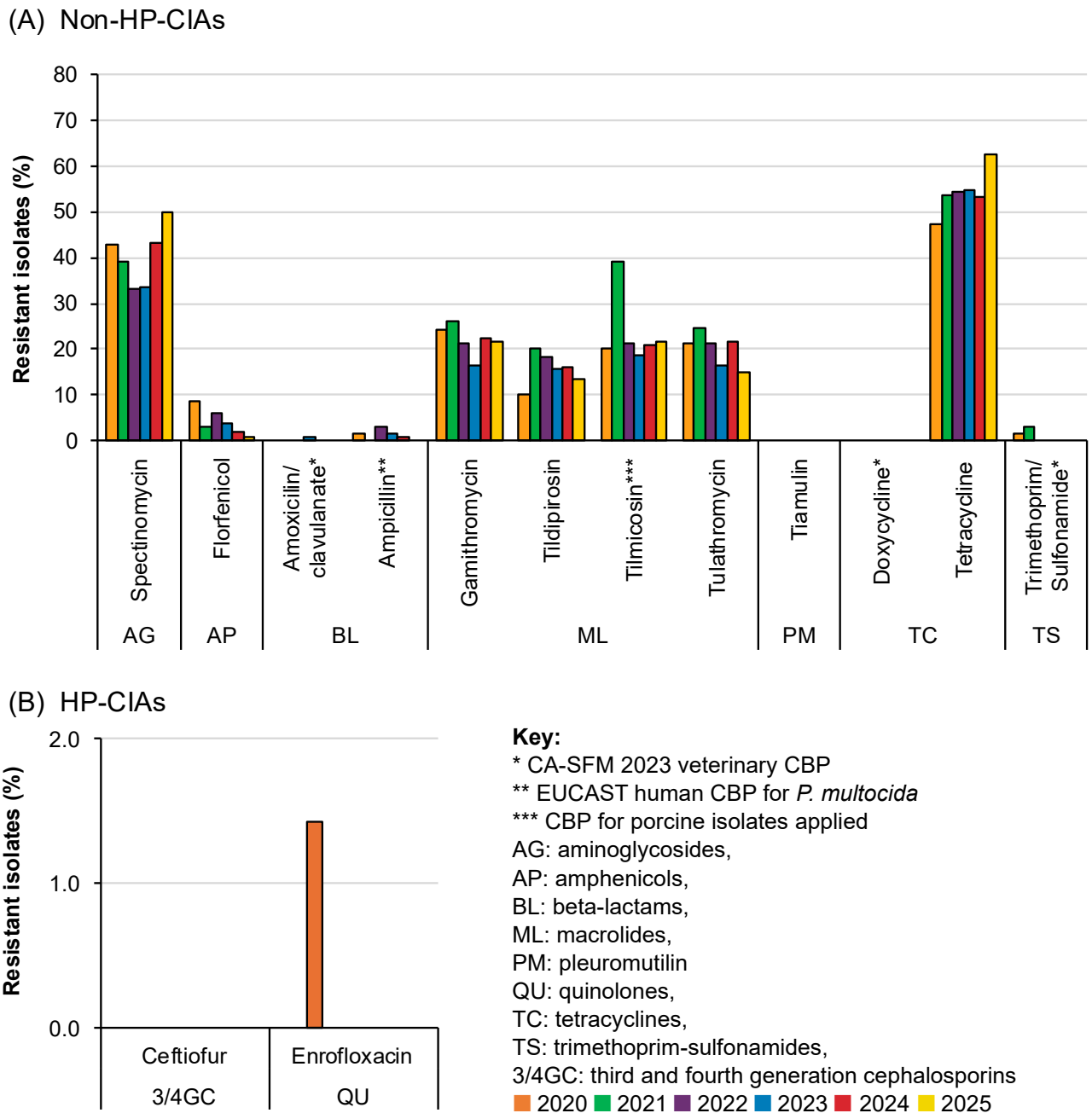


Figure 4.17: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Pasteurella multocida* isolated from cattle, from 2020 to 2025 (n=120 in 2025). Interpreted using cattle CLSI veterinary breakpoints unless indicated otherwise. Note scale differs between graphs.



4.4.4.3 Reproductive system

Bovine mastitis can involve a range of pathogens. These are commonly classed according to the major source, and include environmental pathogens, such as *E. coli* and *Streptococcus uberis*; and contagious pathogens, such as *Staphylococcus aureus*, and *Streptococcus dysgalactiae*. Correct identification aids management, as contagious pathogens are often spread during milking, while environmental pathogens may require more attention to housing and bedding.

Fewer diagnostic submissions for mastitis are made to the government laboratory network than formerly, as can be seen in the Cattle Disease Surveillance Dashboard. Although the number of dairy producers has declined, this cannot fully explain the decrease in submissions, and it is believed that the decrease is due to a combination of factors, including an overall reduction in diagnostic testing, increased use of on-farm diagnostic test kits, and increased submissions to Private Veterinary Laboratories (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), aims to collect and analyse data from PVLs to supplement the clinical AMR surveillance results generated by APHA.

This section presents two sets of results. First, *E. coli* mastitis results from APHA's clinical submissions. Second, data are presented from The Vale Veterinary Laboratory, a key contributor to the PLI. For other bacterial species, where there are fewer than 20 isolates, results are available in Supplementary Material 6.

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.

Escherichia coli

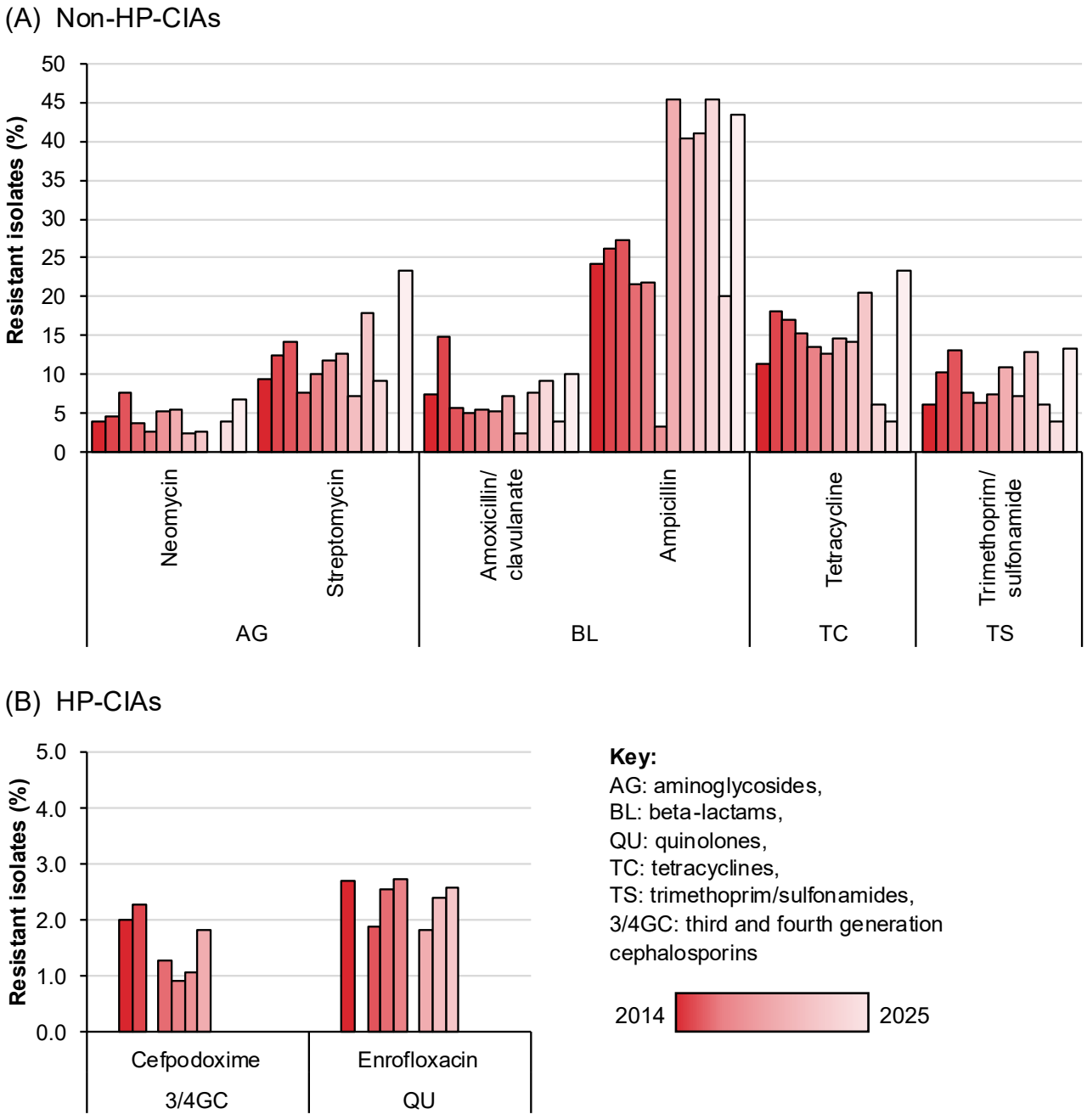
E. coli and other coliforms are major causes of environmental mastitis. *E. coli* is a common gut commensal shed in faeces and no particular virulence factors are required to infect the mammary gland. Keeping housing clean and dry, reducing humidity and slurry, and encouraging cows to stand and eat after milking to allow teat canals to close before lying down can all aid in control.

Of the 30 *E. coli* isolates from mastitis diagnostic samples submitted to governmental laboratories in 2025, 17% [95% CI: 7.3-34%] had limited treatment options. This is an increase from the single isolate (4.0% [95% CI: 0.7-20%]) detected in 2024.

In 2025, resistance to ampicillin (43% [95% CI: 27-61%]), streptomycin (23% [95% CI: 12-41%]), and tetracycline (23% [95% CI: 12-41%]) in *E. coli* from bovine mastitis were high and appear to have increased since 2014 (**Figure 4.18**), despite falling sales of intramammary lactating cow products. This contrasts with the overall picture of gastrointestinal *E. coli* from cattle, where resistance to these antimicrobials has decreased (Section 4.4.4.1). Ampicillin

resistance in mastitis samples was higher than that in other clinical *E. coli* from adult cattle (23% [95% CI: 16-33%]) but tetracycline levels were similar (20% [95% CI: 13-29%]). Streptomycin resistance was not tested in clinical *E. coli* from other sites in adult cattle. Resistance to HP-CIAs was not detected.

Figure 4.18: 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 2025 (n=30 in 2025). Note scale differs between graphs.



4.4.4.4 PLI: Key mastitis pathogens

Presented in **Figure 4.19** are the results from antibiotic susceptibility testing of key mastitis pathogens isolated from cattle by The Vale Veterinary Laboratory during 2020-2025, as part of the Private Laboratories Initiative (PLI). Some results from previous years have been corrected (**Box 4.1**). Data are derived from submissions from veterinary practices across the UK. Submissions from practices based in Northern Ireland may occasionally include samples collected from animals in Ireland; where identified, these have been excluded from the data presented.

These isolates were tested by disc diffusion following different methodology from that used by governmental laboratories (S4.4 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.

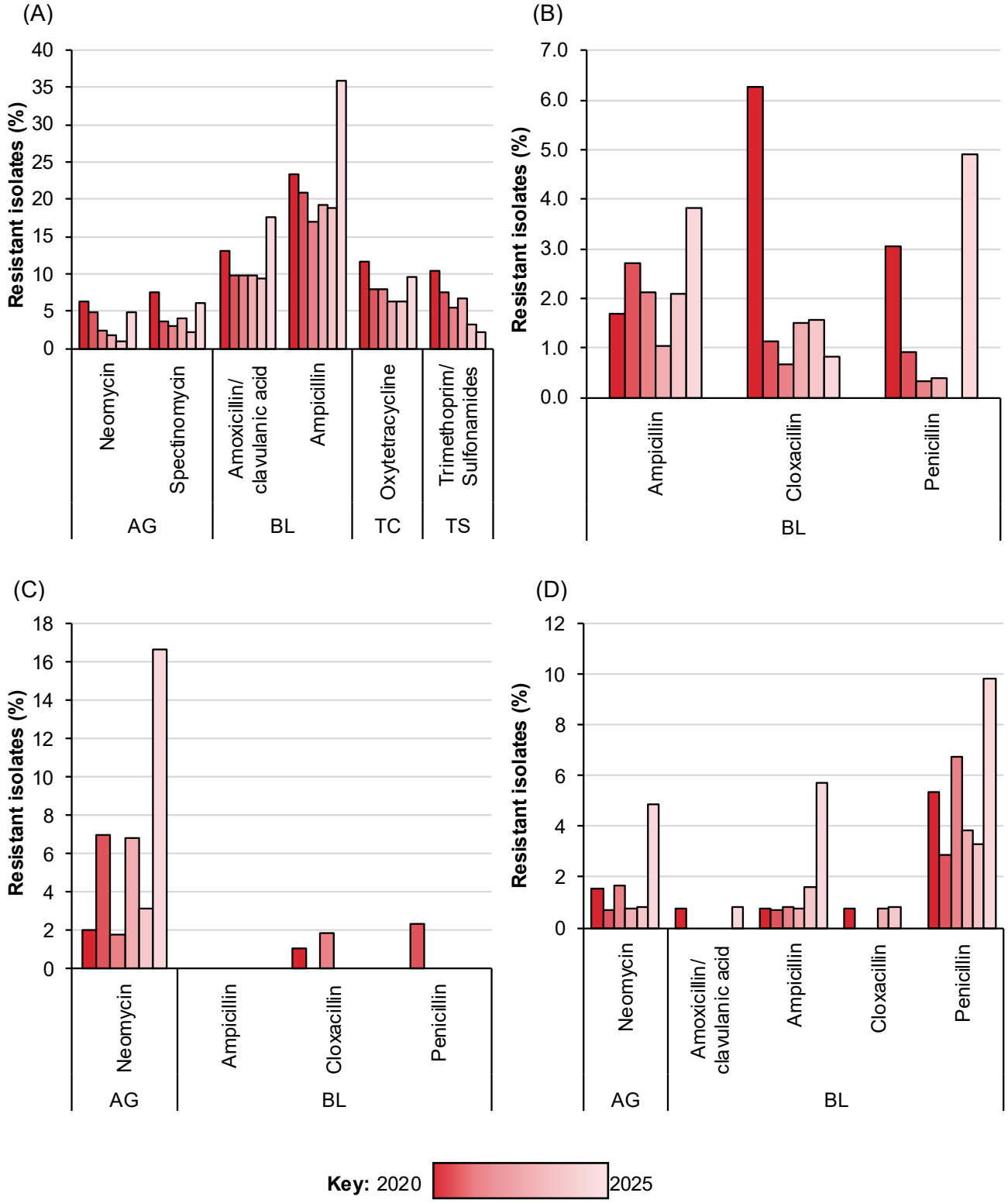
In 2025, *E. coli* isolates constituted 30% of mastitis samples tested, and resistance to most antibiotics increased (**Figure 4.19 A**). Similar to *E. coli* mastitis isolates tested in governmental laboratories **(Figure 4.18)**, higher resistance to ampicillin (36% [95% CI: 29-43%]) was observed, compared to other antimicrobials. Ampicillin resistance was significantly higher in 2025 than in 2024 (19% [95% CI: 14-25%]).

Streptococcus uberis was isolated in 41% of samples in 2025, and resistance to all antimicrobials was low (<5%) (**Figure 4.19 B**). There was a statistically significant increase in resistance to penicillin, with 4.9% of isolates [95% CI: 2.8-8.4%] in 2025 showing resistance, whereas no 2024 isolates [95% CI: 0-1.5%] were penicillin-resistant.

Streptococcus dysgalactiae was isolated in only 9% of mastitis cases in 2025 (**Figure 4.19 C).** No isolates demonstrated resistance to any of the beta-lactamase antimicrobials. Although neomycin resistance was moderate (17% [95% CI: 9.3-28%]) in 2025, many streptococcal bacteria are intrinsically resistant.

Staphylococcus aureus isolates in 2025 represented 19% of all mastitis pathogens tested, and resistance was low for all antimicrobials tested (**Figure 4.19 D**). A significant increase was seen in resistance to penicillin, at 9.8% [95% CI: 5.7-16%]) increased from 3.3% [95% CI: 1.3-8.1%] in 2024. A slight, non-significant rise in ampicillin resistance (5.7% [95% CI: 2.8-11%] in 2025, increased from 1.6% [95% CI: 0.4-5.7%] in 2024) was seen, but no isolates were resistant to cloxacillin.

Figure 4.19: 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 2025. Note scale differs between graphs. Note that not all isolates of a bacterial species are tested against all antimicrobials.



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

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 S6.6 in Supplementary Material 6.

4.4.5.1 Gastrointestinal system

Escherichia coli

Clinical *E. coli* infections in sheep may present as diarrhoea, watery mouth or septicaemia in newborn lambs. It may also cause mastitis in ewes. Further data on the numbers of clinical cases submitted to the veterinary diagnostic network can be found on APHA's GB Sheep Disease Surveillance Dashboard. Of the 335 *E. coli* isolates from sheep, 231 (69%) included age data. This included isolates from neonatal lambs (21%), lambs pre-weaning (20%), and adult sheep (29%). A total of 17 isolates (5.1% [95% CI: 3.2-8.0%]) with limited treatment options from sheep were described in 2025. This continues the steady decrease since 2014 (**Figure 4.2**), although isolates with limited treatment options are detected more frequently in neonatal lambs (14% of 2025 isolates [95% CI: 7.9-24%]) than in older pre-weaned lambs (4.5% [95% CI: 1.6-13%]) and adults (3.1% [95% CI: 1.1-8.8%]) (**Figure 4.3**).

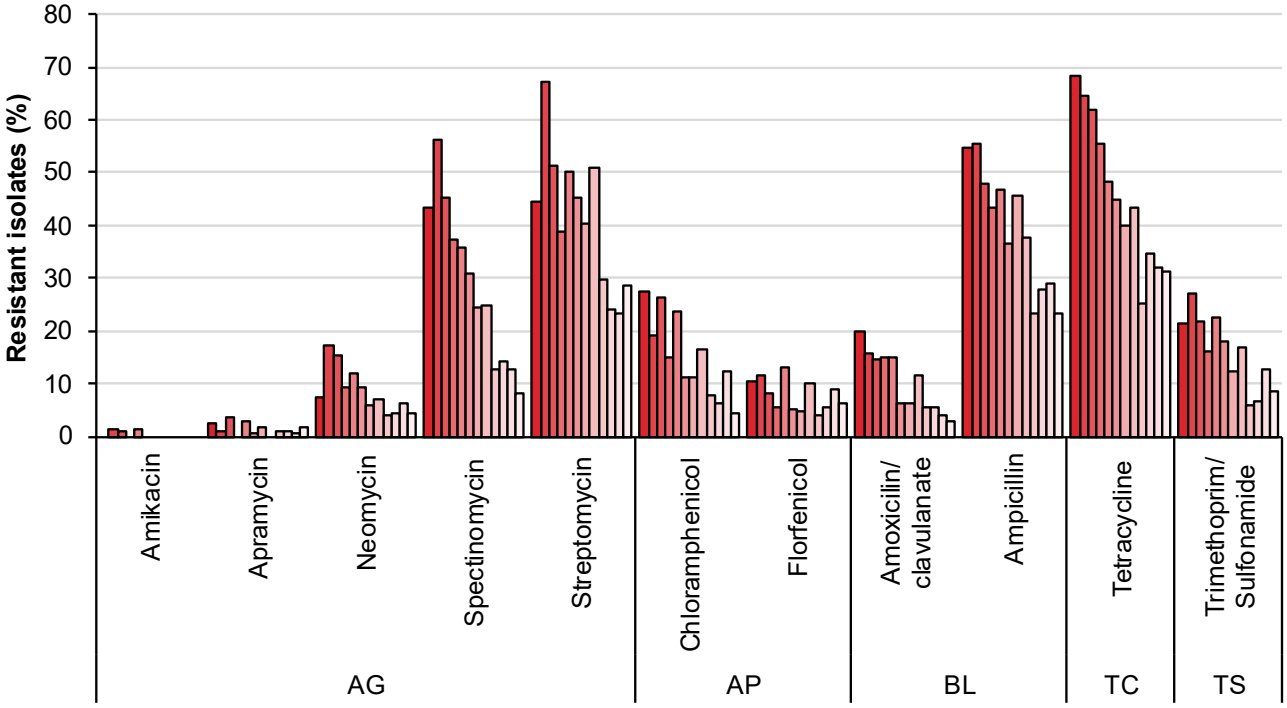
Resistance in *E coli* in sheep has declined over time to all routinely tested antimicrobials (**Figure 4.20**). In 2025, resistance was highest to tetracycline (31% [95% CI: 27-36%]), which is the class most used in sheep (Section 2.3.6.2). Most sheep *E. coli* isolates were tested against three aminoglycosides: neomycin, spectinomycin and apramycin. Spectinomycin resistance decreased to 8.0% [95% CI 5.5 -12%] in 2025 from 13% [95% CI 9 -17%] in 2024, and neomycin resistance also decreased slightly to 4.4% [95% CI 2.6-7.3%] from 6.1% [95% CI 3.8-9.7%] in 2024. Streptomycin resistance (29% [95% CI 18-42%]) was tested for in a limited number of isolates and was slightly but not significantly higher than in 2024 (23% [95% CI 15-35%]).

Of the HP-CIAs, no resistance to third- or fourth-generation cephalosporins was observed in sheep *E. coli* isolates in 2025. Resistance to enrofloxacin was 0.3% [95% CI: 0.1-1.7%], the lowest level recorded since the peak in 2016 (3.9% [95% CI: 1.9-7.9%]).

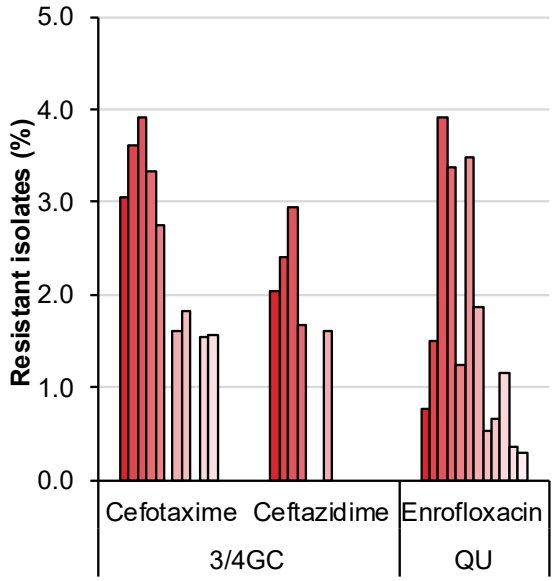
Decreases in spectinomycin resistance between 2024 and 2025 were particularly marked in neonatal and pre-weaned lambs. Spectinomycin resistance fell to 13% [95% CI:7-23%] in neonates from 22% [95% CI:14-34%] in 2024; and in older pre-weaned lambs fell to 11% [95% CI: 5.6-22%], from 22% [95% CI:13-36%] in 2024. The only spectinomycin product authorised for watery mouth in lambs was discontinued, with sales of this product last recorded in 2022.

Figure 4.20: 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 2025. Note that not all isolates are tested against all antimicrobials and that 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

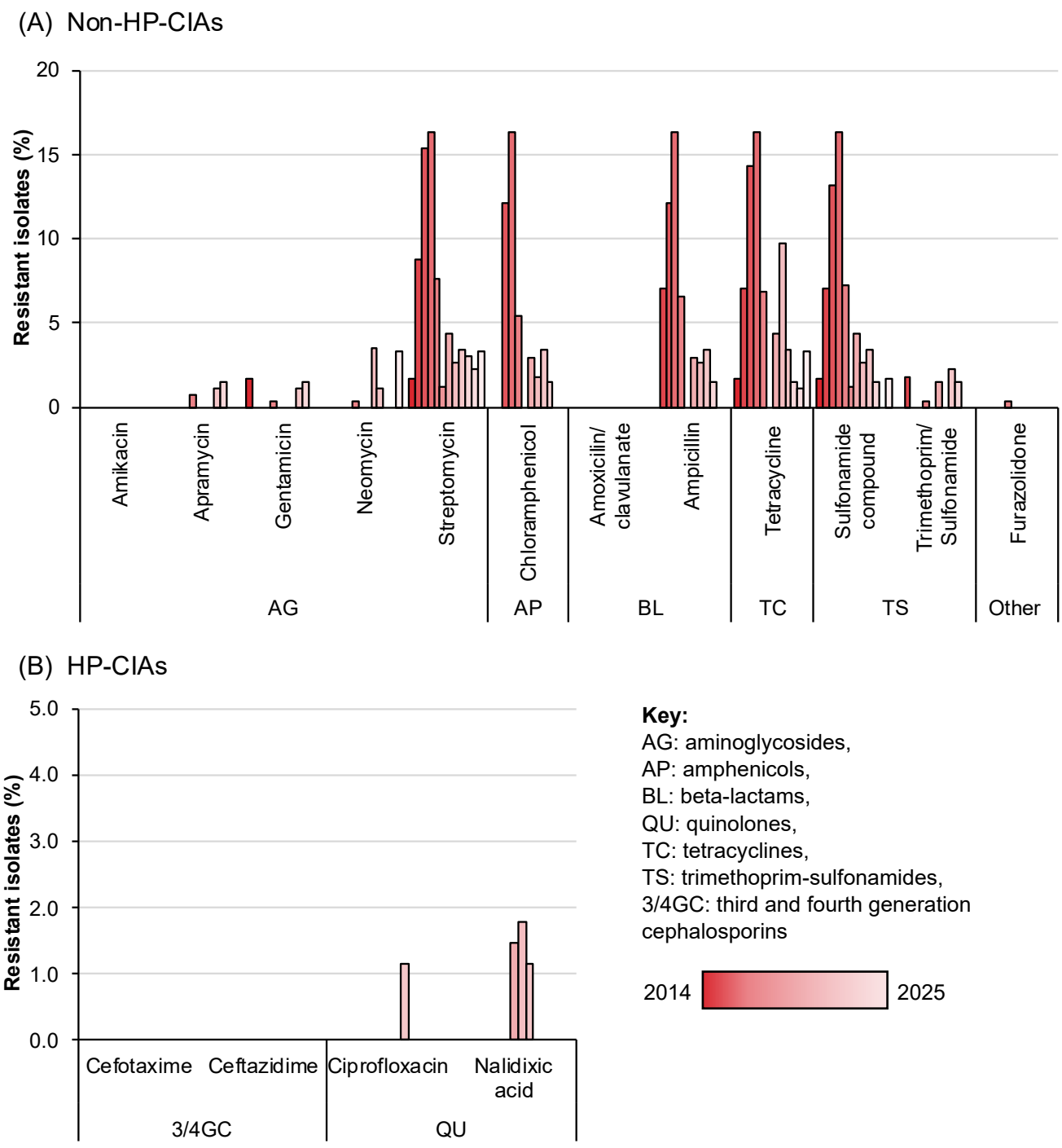
2014 — 2025

Salmonella spp.

Clinical presentations of salmonellosis in sheep may include diarrhoea, weight loss, fever, abortions, or sudden death from septicaemia. There were 60 *Salmonella* isolates from sheep in 2025 investigated for resistance. *Salmonella enterica* subspecies *diarizonae* 61:k:1,5,(7) was the most common serovar, comprising 83% of isolates, followed by *S.* Typhimurium (11.7%). A single isolate of each of the serovars *S.* Dublin, *S.* Montevideo and *S.* Chester were tested.

Resistance continues to be extremely low, with 92% [95% CI:82-96%] of isolates demonstrating susceptibility to all 16 antimicrobials tested. No isolates had limited treatment options and resistance to HP-CIAs was not detected (**Figure 4.21**). No isolates were resistant to beta-lactams, amphenicols or trimethoprim-sulfonamides. Among non-HP-CIAs tested, resistance was only detected to two of the five aminoglycosides in the panel: neomycin (3.3% [95% CI: 0.9-11%]) and streptomycin (3.3% [95% CI: 0.9-11%]).

Figure 4.21: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Salmonella* isolates from sheep, from 2014 to 2025 (n=60 in 2025). Note scale differs between graphs.



4.4.5.2 Respiratory system

Ovine respiratory disease due to pasteurellosis involves three bacteria of the family Pasteurellaceae; *Bibersteinia trehalosi, Mannheimia haemolytica* and *Pasteurella multocida.* All these are found in the throat and tonsils of healthy sheep, therefore isolation of these bacteria from swabs does not definitively confirm them as the cause of respiratory disease. Hence, diagnosis is usually made at post mortem examination. Underlying factors such as parasitic infections and micronutrient deficiencies commonly contribute, with clinical infections brought on by stressors such as weaning, handling or mixing. Lambs may develop septicaemia, sometimes with high mortalities, whereas older sheep can develop pneumonia.

All isolates from cases of pasteurellosis were tested against a panel of 13 antimicrobials using broth microdilution and MIC testing. Breakpoints used are from a mixture of CLSI and other standards and can be found in S4.2 in Supplementary Material 4.

Bibersteinia trehalosi

There were 74 isolates tested in 2025, of which two isolates (2.7% [95% CI: 0.7-9.3%]) were resistant to tetracycline. All other isolates were fully susceptible.

Mannheimia haemolytica

A total of 159 *Mannheimia haemolytica* isolates underwent susceptibility testing, of which 97% [95% CI: 93-99%] were fully susceptible and one MDR isolate (0.6% [95% CI: 0.1-3.5%]) was resistant to ampicillin, florfenicol, spectinomycin, and the macrolides tilmicosin and gamithromycin.

Including the MDR isolate, 2.5% [95% CI: 1.0-6.3%] of *M. haemolytica* carried resistance to at least one antimicrobial in the macrolide class, with one isolate (0.6% [95% CI: 0.1-3.5%]) resistant to all four tested (tildipirosin, tilmicosin, tulathromycin and gamithromycin). Tilmicosin and gamithromycin were the most common resistances overall (1.9% [95% CI: 0.6-5.4%]). One isolate (0.6% [95% CI: 0.1-3.5%]) was resistant to tetracycline only. All isolates were susceptible to trimethoprim-sulfonamide and doxycycline.

Pasteurella multocida

Twenty *Pasteurella multocida* isolates were tested in 2025. Eighteen of these (90% [95% CI: 70-97%]) were susceptible to all antimicrobials tested. One isolate (5.0% [95% CI: 0.9-24%]) was resistant to ampicillin and tilmicosin, and the second was resistant to tetracycline and spectinomycin.

4.4.6 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 2025, a total of 13 isolates (7 *Y. ruckeri* and 6 *A. salmonicida*) were tested for resistance by broth microdilution against a panel of antibiotics relevant to fish and/or human health (section S4.3 of Supplementary Material 4). However, interpretation of MIC values with epidemiological cut-offs/wild type cut-off values does not necessarily imply clinical resistance. In the trout sector, just three antibiotics are available for use: oxytetracycline, oxolinic acid (under special import) and florfenicol (which is licensed in salmon, but may be used in trout under the cascade). Development of resistance may also include other factors, such as watercourse contamination.

Although the number of isolates tested are small, resistance to HP-CIAs and last-resort antibiotics used in human medicine are concerning, and warrant further investigation, including whole genome sequencing. 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: 0-39%]) of the six *A. salmonicida* isolates from 2025 were fully susceptible to the panel of antibiotics tested, whilst one (17% [95% CI: 3.0-56%]) was MDR. All isolates were sensitive to sulfamethoxazole. Resistance to florfenicol, usually the first antibiotic of choice against *A. salmonicida,* was high (50% [95% CI: 19-81%]) in 2025. Moderate resistance was detected to oxytetracycline (17% [95% CI: 3.0-56%]), which is the most commonly used antibiotic in the trout sector (Section 2.3.5.2). Meropenem cut-off values are still under development, and results for this antibiotic will not be interpreted this year. MIC values for meropenem in *A. salmonicida* ranged from 0.03 mg/L to 1.0 mg/L in 2025 and were distributed more towards the higher end of this scale than in 2024. These isolates will be further studied to determine the presence or absence of genetic resistance determinants.

All isolates tested were resistant to the HP-CIA quinolones, enrofloxacin (100% [95% CI: 61-100%]) and oxolinic acid (100% [95% CI: 61-100%]), whilst resistance to the third-generation cephalosporin ceftazidime was moderate (17% [95% CI: 3.0-56%]).

Yersinia ruckeri

Of the seven isolates tested by MIC in 2025, five (71% [95% CI: 36-92%]) were fully susceptible and none were MDR. Two isolates (29% [95% CI: 8.2-64%]) were resistant to meropenem, which is not authorised for use in animals, but important in human health.

4.4.7 Cats and dogs

Results for pathogenic bacteria isolated from cat and dogs are presented in this section. Results for *Salmonella* from dogs are reported from statutory surveillance, while data for selected bacterial pathogens are presented from the Private Laboratories Initiative (PLI). The complete companion animal dataset can be found in Supplementary Material 6.

4.4.7.1 *Salmonella* spp.

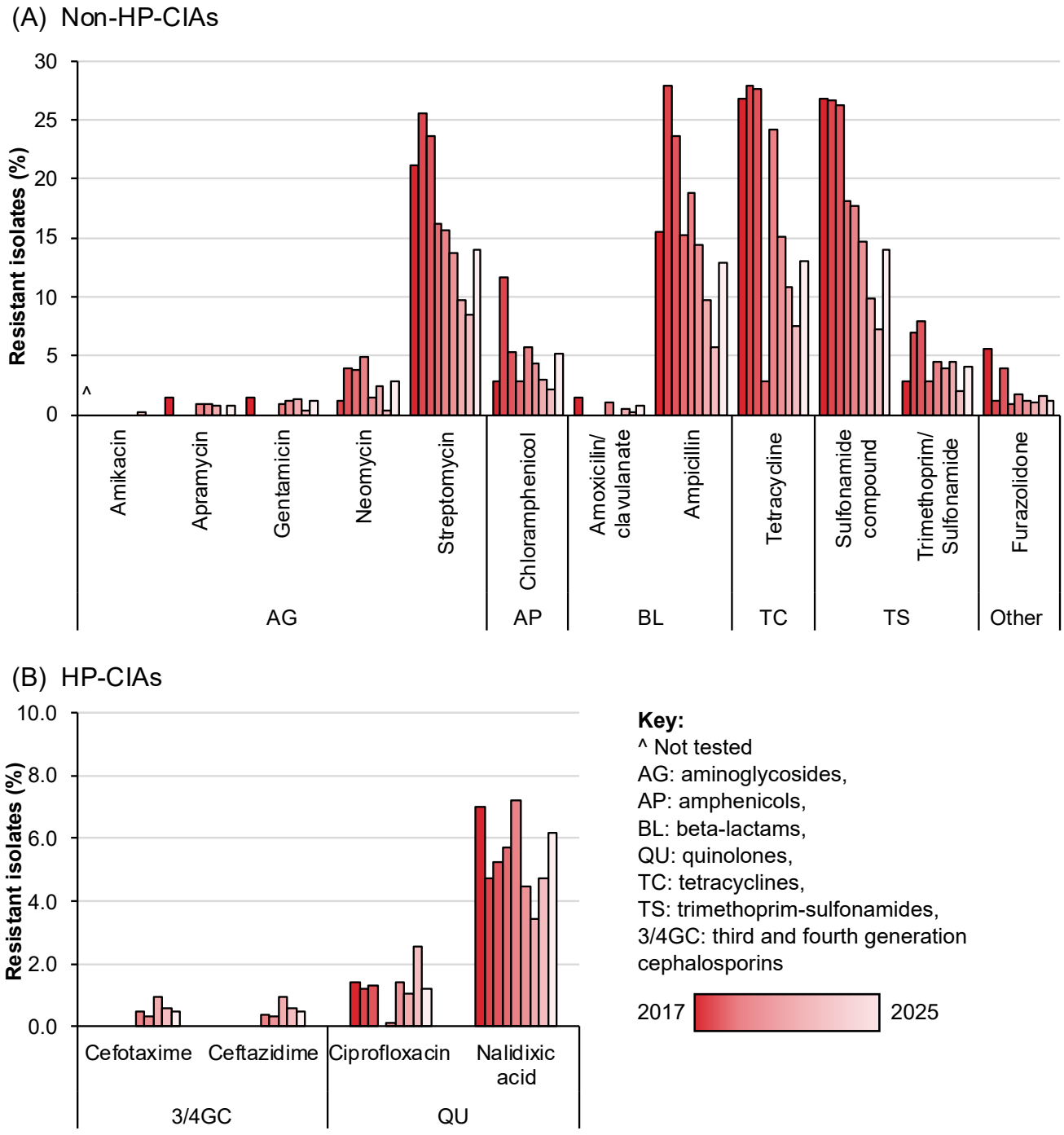
Dogs with *Salmonella* may present with gastrointestinal signs, including diarrhoea, poor appetite, fever and lethargy. Mild cases generally resolve with supportive treatment only, and do not require antimicrobials. As in other animals, *Salmonella* is also frequently carried and shed asymptomatically, emphasising the importance of hygiene after handling pet food or faeces. *Salmonella* isolates from dogs became reportable under an amendment to the Zoonoses Order in 2021. This means that a culture of the organism must be provided to government laboratories when detected by private veterinary laboratories in Great Britain. Prior to 2021, reporting was voluntary, and fewer isolates from dogs were received for testing. Whilst most isolations arise through clinical investigations, any *Salmonella* detected considered to be an incidental finding in dogs would also be reportable and may be included in the resistance testing.

Of the 420 isolates investigated for resistance in 2025, the most frequently detected serovars were *S.* Typhimurium (15%), followed by monophasic *S.* Typhimurium (7.9%), *S.* Infantis (6.9%), and *S.* Dublin (6.7%). Seventy-six percent of isolates [95% CI: 72-80%] were fully susceptible, a significant fall from 83% [95% CI: 80-86%] in 2024. Only 3% [95% CI: 0.5-15%] of the monophasic *S.* Typhimurium tested in 2025 were fully susceptible. Overall, 10% [95% CI: 7.9-14%] of isolates had limited treatment options, an increase from 5.1% [95% CI: 3.5-7.4%] in 2024. This may reflect changes in the serovar distribution, as in 2025, 45% of isolates with limited treatment options were monophasic *S.* Typhimurium. Of all monophasic *S.* Typhimurium tested in 2025, 50% came from pigs (Section 4.4.2.1), and 17% from animal feed samples, which includes raw pet food and feedmill environments (Section 4.4.1.2). Further details can be found in APHA's Salmonella in Animals and Feed in Great Britain report. However, it is not currently possible to definitively identify the source of dog infections.

Resistance was observed to several antimicrobials that are authorised in dogs, including ampicillin (13% [95% CI: 10-16%]) and trimethoprim-sulfonamide compounds (4.0% [95% CI: 2.5-6.4%]), both of which have increased since 2024 (**Figure 4.22 A**).

Two MDR *S.* Kentucky isolates were resistant to all HP-CIAs tested (ceftazidime, cefotaxime, ciprofloxacin and nalidixic acid), as well as four other antimicrobial classes. A further 5.7% of isolates were resistant to quinolones ciprofloxacin and/or nalidixic acid, but no other HP-CIAs (**Figure 4.22 B**).

Figure 4.22: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Salmonella* isolates from dogs, from 2017 to 2025 (n=420 in 2025). *Salmonella* in dogs became reportable in 2021. Note scale differs between graphs.



4.4.7.2 PLI: key cat and dog pathogens

In VARSS 2020, VMD reported on data collected from small animal PVLs as part of a Small Animal Veterinary Surveillance (SAVSNET) research project. However, differences in testing methodologies and interpretations of resistance between laboratories limited interpretations from those data. This year verified cat and dog results from the PLI are presented for the first time.

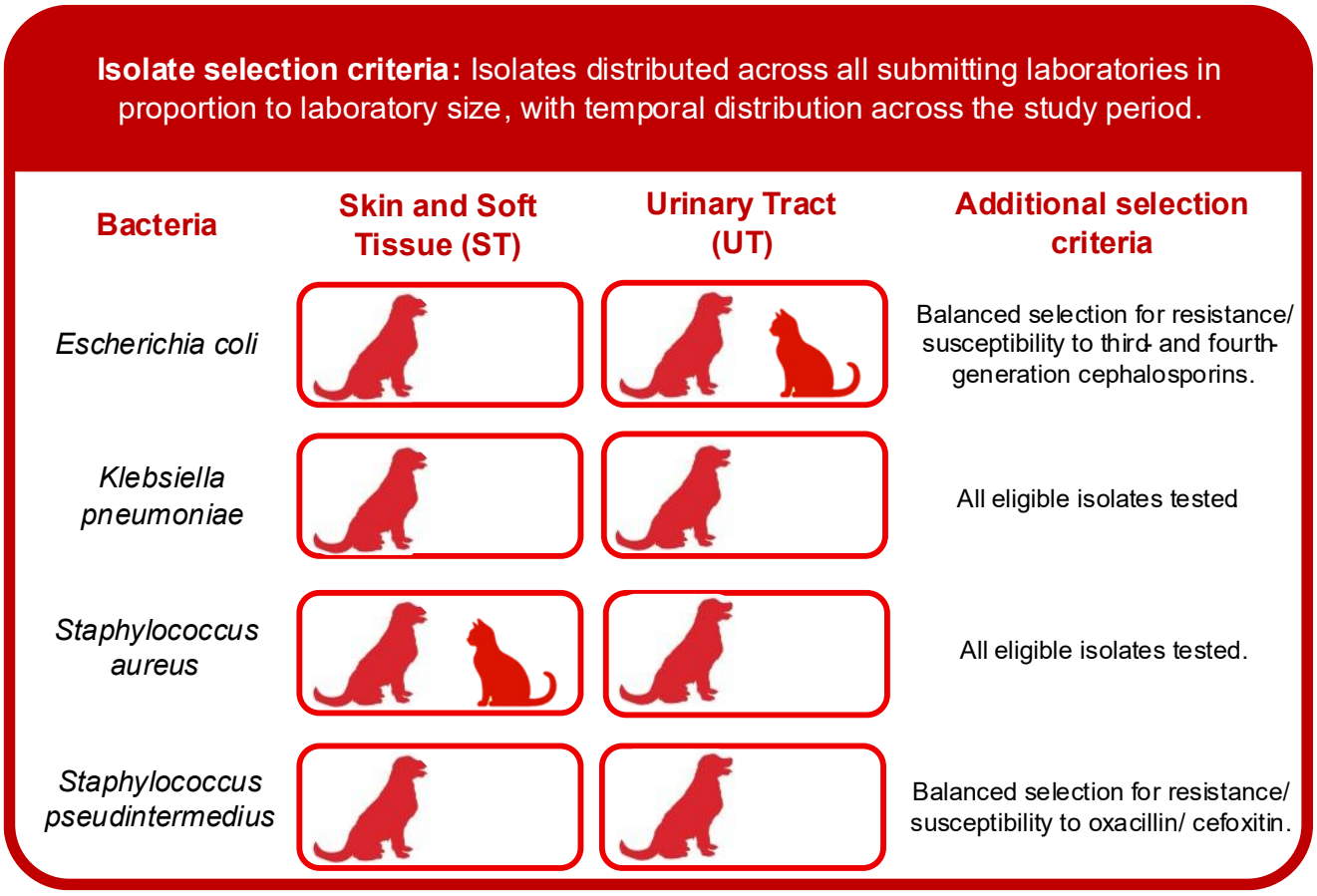
The cat and dog results are focused on selected bacterial isolates that have been submitted by PVLs to the University of Liverpool, where they are tested against a standard panel of antimicrobials using broth microdilution. As well as helping participating laboratories benchmark their own resistance testing methods, this has enabled the generation of a substantial, quality-assured dataset from clinical cat and dog isolates. These isolates were deliberately selected for the purpose of validating testing methods and aimed for a split between resistant and susceptible isolates against key antimicrobials, depending on the organism (for example, resistance to third- and fourth-generation cephalosporins for *E. coli*). The data, therefore, should not be considered representative of resistance in bacteria causing disease in the wider dog and cat populations. Additionally, as isolates originate from diagnostic specimens collected from clinically infected dogs and cats, animals may have already received a course of antibiotic treatment.

Testing in dogs and cats in 2025 covered four bacteria: *E. coli, K. pneumoniae, S. aureus* and *S. pseudintermedius.* As well as affecting animals, these species are important to public health. In humans, they can cause bloodstream infections in at-risk patients and contribute substantially to the maintenance and spread of AMR.

The bacterial isolates selected originated from skin and soft tissue (SST) infections and urinary tract (UT) samples (**Figure 4.23**). The British Small Animal Veterinary Association (BSAVA) recommends vet practices agree a protocol for first-line antimicrobial choices for common conditions. Topical treatment is preferred for SST infections; however, systemic antibiotics are used in serious cases. Suggested choices include clindamycin, trimethoprim-sulfonamides, amoxicillin/clavulanate, or cephalexin. First-line choices for sporadic UT infections include amoxicillin (with or without clavulanic acid) or trimethoprim-sulfonamides. Fluoroquinolones may be used in complicated cases, but bacterial culture and susceptibility testing is always recommended.

Interpretation of MIC tests uses CLSI veterinary clinical breakpoints, where available (Section 4.3.3). It should be noted that clinical breakpoints (CBPs) often differ between infection sites, reflecting differences in antibiotic penetration. For example, for some antimicrobials (e.g., amoxicillin-clavulanic acid), an *E. coli* from an SST infection is classed as resistant at a lower MIC value than the same organism in urine. This affects comparisons between bacteria and infection sites. Where there are fewer than 20 isolates from an animal species, infection site and bacteria combination, these are not individually described but can be found in Supplementary Material 6.

Figure 4.23: Summary of bacterial species and clinical sample types included in MIC testing, with the criteria used for isolate selection.



E. coli and *Klebsiella pneumoniae*

Selection of *E. coli* was based on resistance to third- and fourth- generation cephalosporins, whereas all submitted *K. pneumoniae* were included. *E. coli* isolates included SST infections in dogs (n=36), and UT samples in dogs (99) and cats (59). No isolate was fully susceptible to all antimicrobials tested. Similarly, testing of *K. pneumoniae* from dog SST (n=48) and UT (22) infections identified no fully susceptible isolates.

Of all *E. coli* (n=199) tested, 51% were classed as MDR and 44% of all *K. pneumoniae* (n=82) were MDR. MDR levels were consistently higher in SST than UT isolates (**Figure 4.23**). All *E. coli* from dog SST sites were MDR and were resistant to 1st/2nd generation cephalosporins, penicillins and doxycycline, emphasising the importance of culture and susceptibility testing to guide treatment.

All *E. coli* and *K. pneumoniae* isolates from SST sites were resistant to amoxicillin/ clavulanate, the most prescribed antimicrobial in cats and dogs (Section 2.3.7.1). Resistance in UT isolates was lower, at 28% of dog and 25% of cat *E. coli*, and 18% of dog *K. pneumoniae* (**Figure 4.25 A**). However, some of this difference is likely explained by different CBPs, as beta-lactamases achieve high concentrations in urine. Additionally, because *E. coli* were selected according to cephalosporin resistance, resistance to other beta-lactam classes is expected to be over-represented.

It is notable that in all gram-negative UT bacteria, resistance to cefalexin was the same or higher than amoxicillin/clavulanate resistance. This suggests that cefalexin is unlikely to be a viable alternative if an infection does not respond to first-line treatment with amoxicillin/clavulanate. Resistance to trimethoprim-sulfonamides was lower, seen in 8% of *E. coli* and 14% of *K. pneumoniae* dog UT isolates, and only one (2%) *E. coli* UT isolate from cats. A similar pattern was seen in dog SST isolates, where trimethoprim-sulfonamide resistance was 8.3% in *E. coli* and 19% in *K. pneumoniae.*

Due to the selection process, HP-CIA resistance levels were very high in this collection of isolates (**Figure 4.25 B**). Cefpodoxime resistance was seen in 41% of *E. coli* and 24% of *K. pneumoniae* from dogs. Fluoroquinolone resistance was seen in 15% of *E. coli* and 29% of *K. pneumoniae* in dogs. A lack of validated CBPs in cats means resistance cannot be calculated for fluoroquinolones for *E. coli*.

Resistance to the carbapenem, meropenem, was seen in three (8.3%) *E. coli* from SST samples, and one *K. pneumoniae* from a UT sample, all from dogs. Confirmatory testing was carried out to verify these results, as carbapenems are important last-line antimicrobials in human medicine. They are not authorised for use in animals, therefore, unless carbapenems were used under the cascade in these dogs, these detections are suggestive of a human or environmental source. Carbapenem use in food-producing animals (including horses, unless declared as non-food producing in their passport) is prohibited. Ertapenem resistance was observed at higher levels than meropenem across all bacteria and sites, but further testing suggested that this antimicrobial was not a good screen, as the isolates resistant to ertapenem but not meropenem were not confirmed as carbapenemase-producers using whole genome sequencing. One *E. coli* from a dog SST infection was resistant to colistin.

S. aureus and *S. pseudintermedius*

Most *Staphylococcus pseudintermedius* were isolated from SST (n=120), and UT sites (n =21) in dogs. *S. aureus* isolates came from SST sites in both dogs (n=20) and cats (n=20). As with the Gram-negative bacteria, none were fully susceptible.

Similar to Gram-negative organisms, MDR was higher in SST samples (**Figure 4.24**), although fewer UT isolates were available for comparison. For SST samples, MDR in *S. pseudintermedius* (dogs) was 68%; in *S. aureus*, MDR was 65% and 40% in dogs and cats, respectively. For UT samples from dogs, MDR in *S. pseudintermedius* was 33%.

Gram-positive organisms were deliberately selected according to oxacillin resistance (suggesting methicillin resistance), so 45% of all *S. aureus* and 52% of all *S. pseudintermedius* were resistant (**Figure 4.26 A**). For non-HP-CIA antimicrobials, resistance to amoxicillin/clavulanate was high: 32.5% of *S. pseudintermedius* and 50% of *S. aureus* from dog SST samples were resistant, and 55% of *S. aureus* from cat SST samples. In UT samples, 14% of *S. pseudointermedius* from dogs demonstrated resistance to amoxicillin/clavulanate. Clindamycin resistance in SST samples was only seen in one *S. aureus* from a dog (5%), and no cat isolates. However, 50% of the more common *S. pseudintermedius* from dog SST sites were resistant. Trimethoprim-sulfonamide resistance in *S. pseudintermedius* from dog UT sites was 14%.

Resistance to HP-CIAs was common, although this may be partly due to selection criteria applied (**Figure 4.26 B**). Resistance to the quinolone, marbofloxacin, was extremely high in dog isolates: 90% of *S. aureus* from SST sites, 89% of *S. pseudintermedius* from SST and

86% from UT sites were resistant. Resistance to enrofloxacin was consistently lower, with respective levels of 45%, 46% and 24%. However, a large proportion of organisms were classified as susceptible dose-dependent, meaning that bacteria are only clinically susceptible when specific higher (off-label) doses are used. This emphasises not only the importance of testing, but also of applying the latest clinical breakpoints for test interpretation. Only 15% of *S. aureus* from cat SST infections were resistant to the quinolone class. In dogs, resistance to the third-generation cephalosporin, cefovecin, in *S. pseudintermedius* was observed in 49% of SST and 14% of UT isolates.

No *Staphylococcus* isolates tested were resistant to linezolid or vancomycin, which are important antibiotics in human medicine. 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 VRE and MRSA infections in human patients. Neither of these antibiotics are licensed for veterinary use in the UK.

Figure 4.24: Percentage of different bacteria with multi-drug resistance from Soft Skin clinical samples from dogs in 2025. Note that isolates were selected for a split between susceptibility and resistance to key antimicrobial classes, depending on organism, and do not represent the wider population.

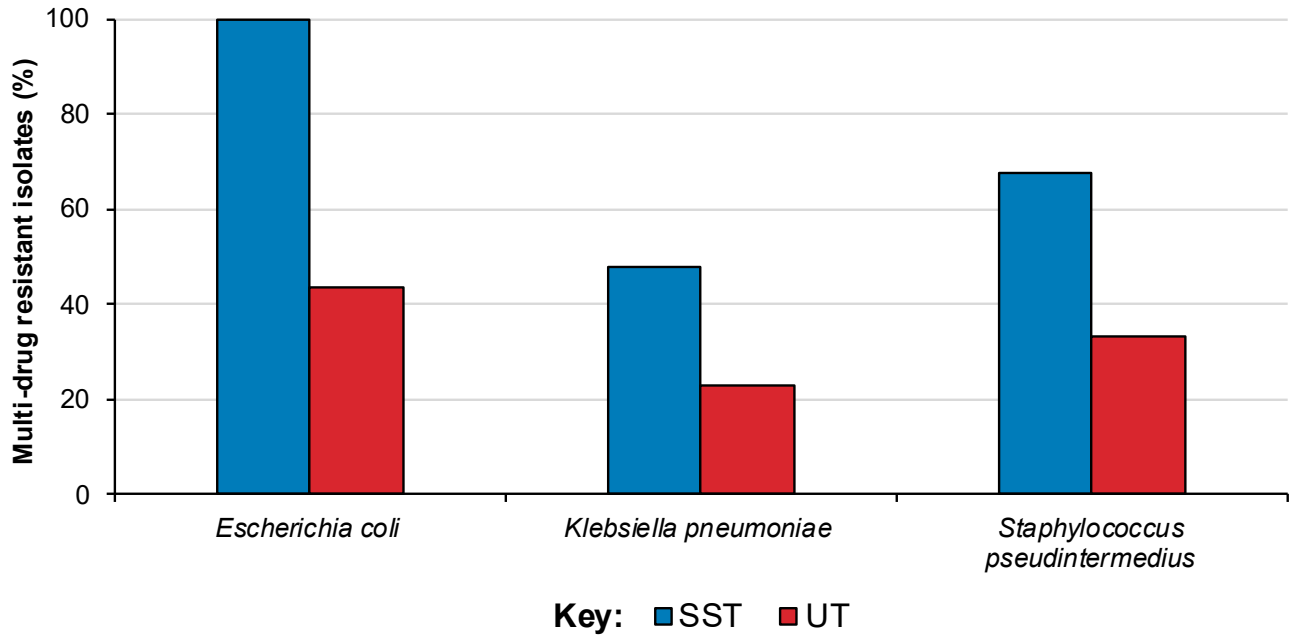


Figure 4.25: Resistance to (A) non-HP-CIAs and (B) HP-CIAs in *Escherichia coli* isolates recovered from urinary tract (UT) samples from dogs and cats in 2025.

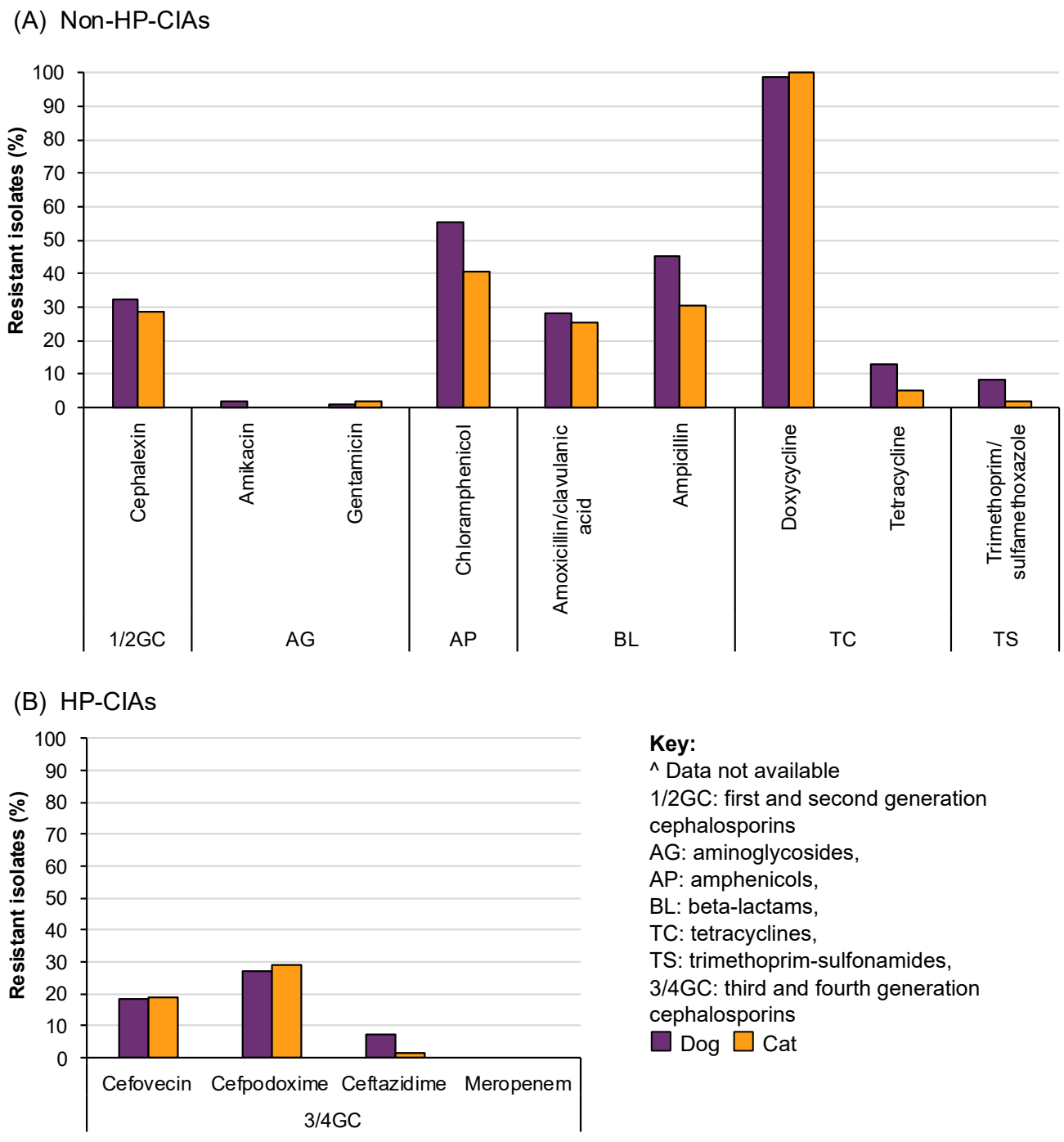
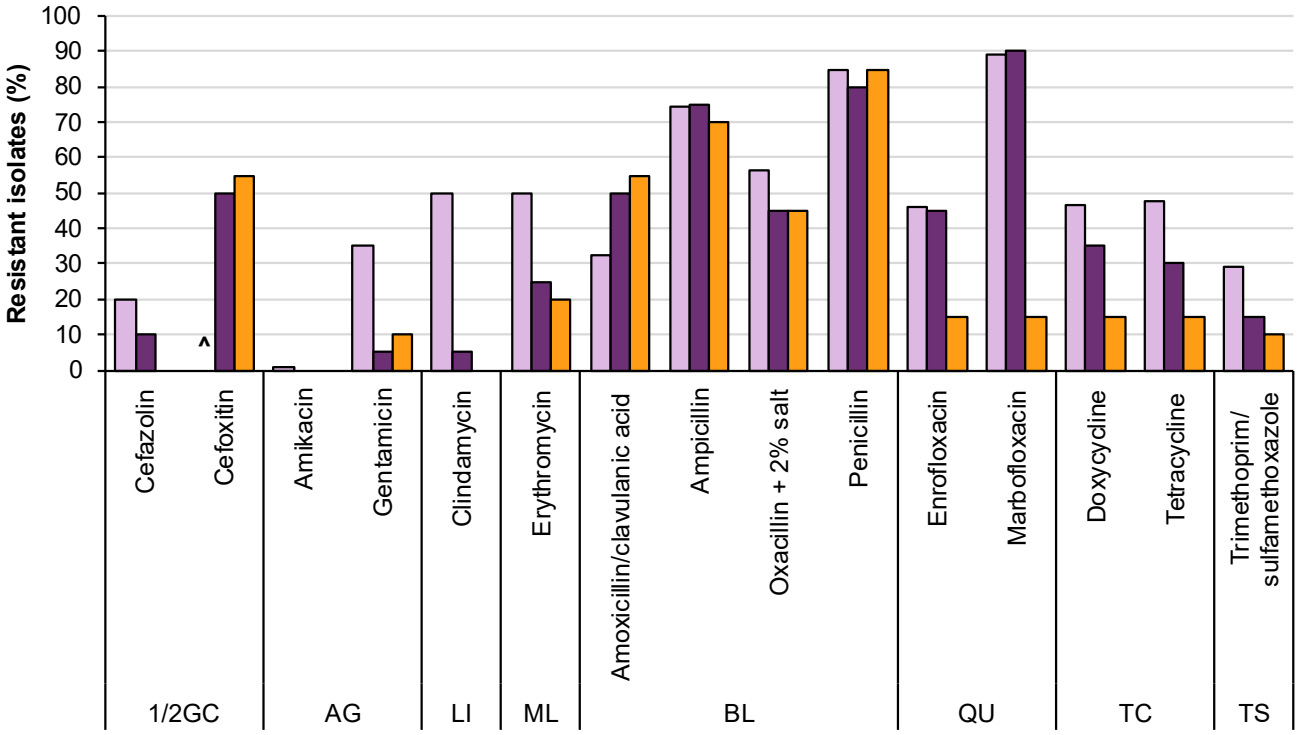
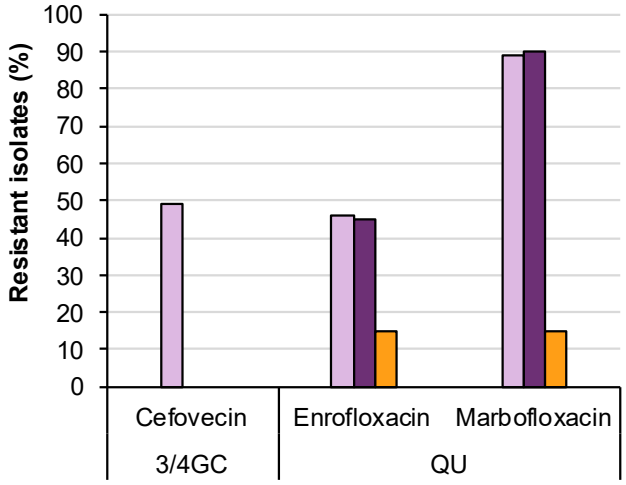


Figure 4.26: Resistant (A) non-HP-CIAs and (B) HP-CIAs in all *Staphylococcus aureus* and *Staphylococcus pseudintermedius* isolates from cat and dog skin and soft tissue (SST) samples in 2025.

(A) Non-HP-CIAs



(B) HP-CIAs



Key:
^ Data not available
1/2GC: first and second generation cephalosporins
AG: aminoglycosides,
LI: Lincosamides,
ML: Macrolides,
BL: beta-lactams,
QU: quinolones,
TC: tetracyclines,
TS: trimethoprim-sulfonamides,
3/4GC: third and fourth generation cephalosporins
Dog – *S. pseudintermedius*
Dog – *S. aureus*
Cat – *S. aureus*

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).

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 these 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