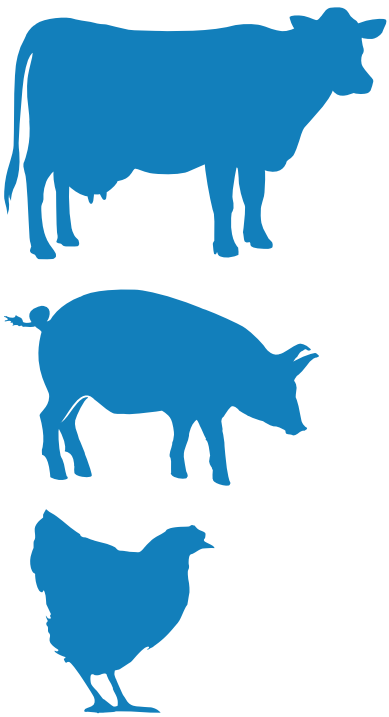
Veterinary Medicines Directorate

Highlights

UK-VARSS 2023

Published November 2024

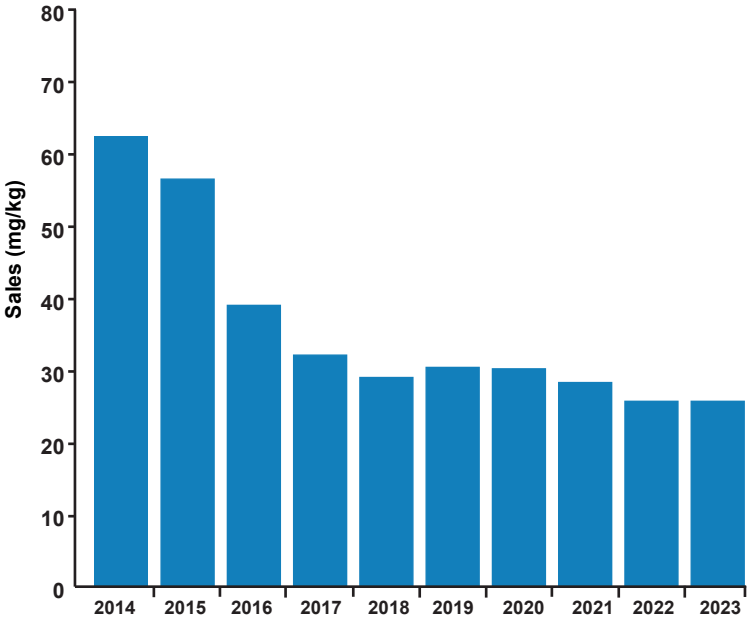


Antibiotic use and resistance 2014-2023

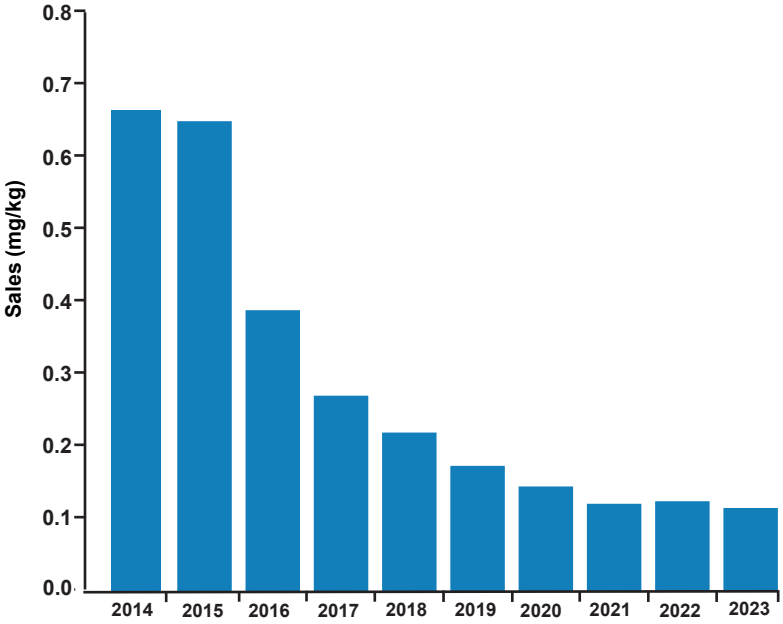
A decade of bringing together antibiotic use and resistance data

This year's UK-VARSS report marks 10 years of bringing together data on antibiotic sales, usage and resistance. This allows us to show long-term trends and demonstrates how reducing antibiotic use has been followed by a reduction in antimicrobial resistance (AMR) at a national level.

Sales of antibiotics in food-producing animals 2014-2023

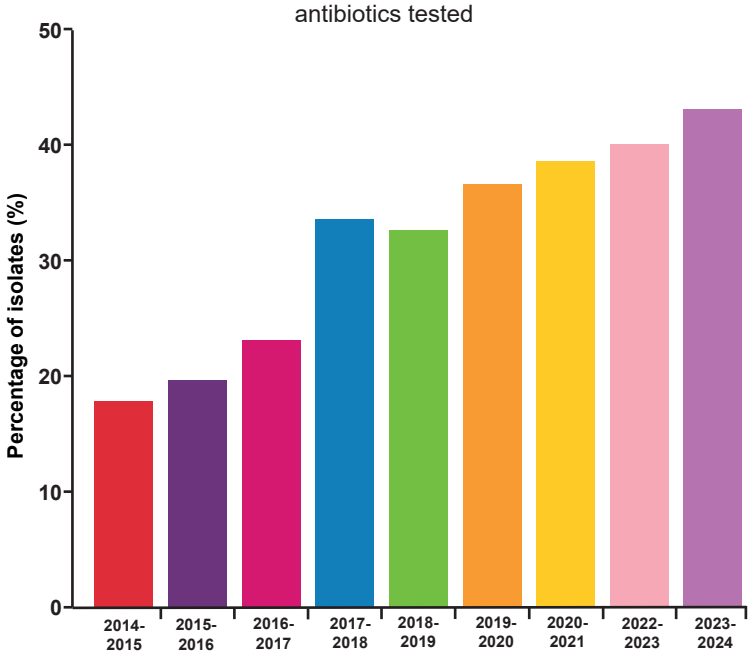


Sales of HP-CIAs in food-producing animals 2014-2023



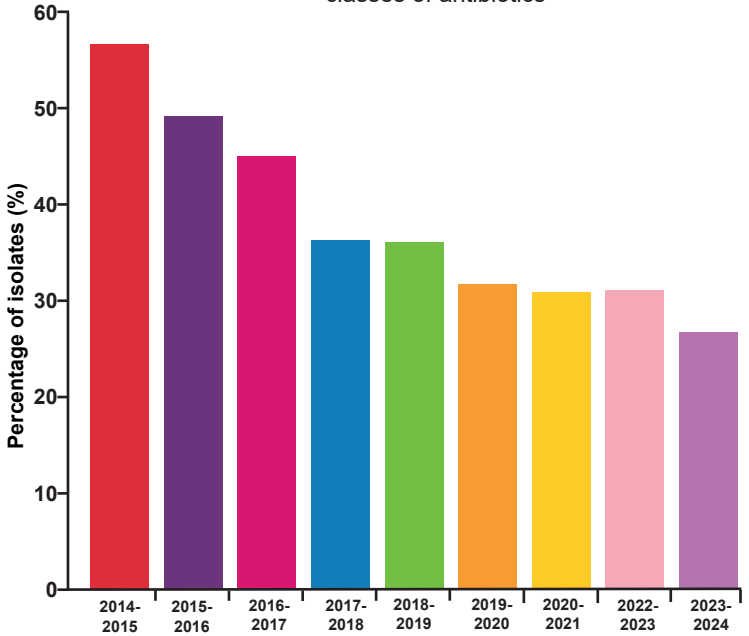
Percentage of fully susceptible *E. coli* isolates 2014-2023

Full susceptibility means there was no resistance to the antibiotics tested



Percentage of multi-drug resistant *E. coli* isolates 2014-2023

Multi-drug resistance means resistance to three or more classes of antibiotics

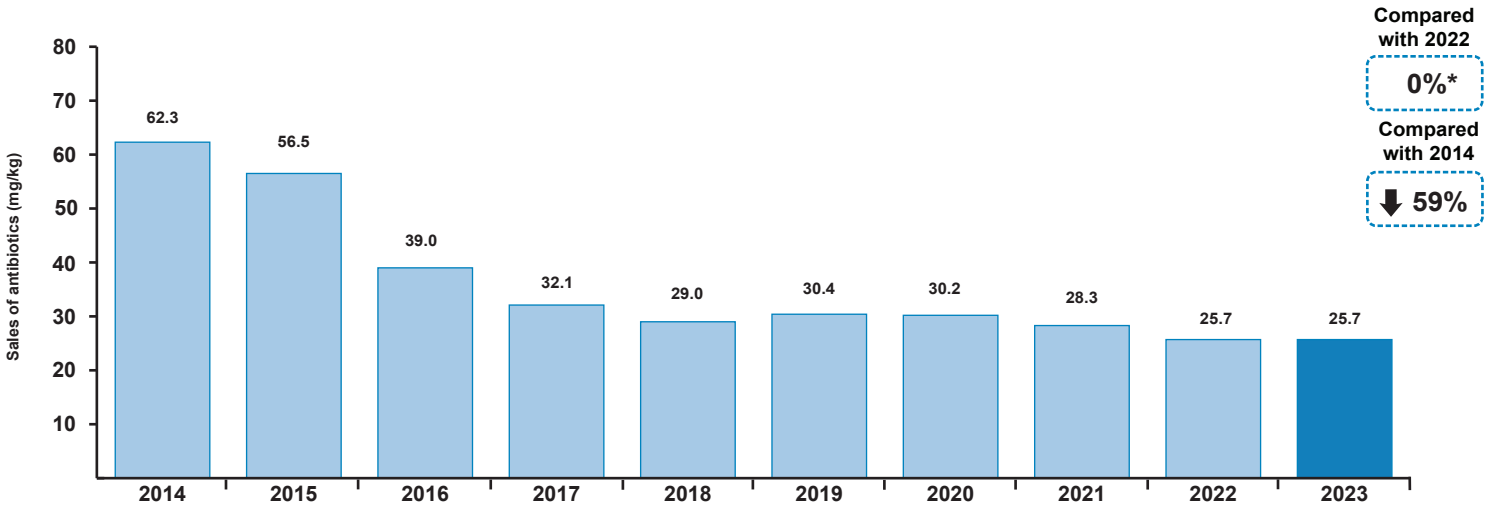


Indicators are an important tool for interpreting and comparing the results of AMU and AMR monitoring programmes. The indicators for sales are weighted by population size. *Escherichia coli* is the indicator organism for resistance. The outcome indicators for resistance are averaged over two years, due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

Antibiotic sales

Sales for food-producing animals (mg/kg)

Sales of veterinary antibiotics for use in food-producing animals, adjusted for animal population, were 25.7 mg/kg in 2023; this represents no change since 2022 and an overall 59% (36.6 mg/kg) decrease since 2014.



Sales of highest priority critically important antibiotics (HP-CIAs) in food-producing animals remain at very low levels at 0.11mg/kg in 2023 and account for less than 0.5% of total sales.

	2014 (mg/kg)	2022 (mg/kg)	2023 (mg/kg)	Compared with 2014
Total HP-CIAs	0.67	0.12	0.11	⬇ 84%
Fluoroquinolones	0.35	0.10	0.09	⬇ 74%
3rd/4th generation cephalasporins	0.19	0.02	0.02	⬇ 91%
Colistin	0.12	0.00	0.00	⬇100%

New harmonised mg/kg metric for all animals

A new harmonised mg/kg metric for all animals has been developed for analysing sales data. This uses different animal categories and weights (meaning it is not comparable with the current food producing animal mg/kg metric). This metric is expected to be used when the EU publishes their 2023 sales in 2025. We have introduced this new metric as we recognise the value of harmonised regional surveillance. The 2023 UK sales using this metric is 16.5 mg/kg.

Sales of antibiotics for all animals (tonnes)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Compared with 2014
Tonnes	447	406	293	246	223	229	227	212	193	189	⬇ 58%

Over 60% of all antibiotics were sold were either tetracyclines (33%) or penicillins (28%).

Sales of HP-CIAs (not adjusted for animal population size) for 2023 was 0.82 tonnes representing a decrease of 9% (0.09 tonnes) since 2022 and an 83% decrease (3.96 tonnes) since 2014. Sales of HP-CIAs continue to respresent a small proportion (< 0.5%) of total veterinary antibiotic sales in tonnes.

* 0.03% to 2 d.p

Antibiotic usage

Antibiotic usage refers to the amount of antibiotics prescribed and/or administered per sector. The data have been collected and provided to the VMD by the animal industry on a voluntary basis. Coverage is at least 85% for all sectors shown. Ruminant coverage of use data is low and may not be representative of the national sectors and is not included in this section of the report.

Antibiotic usage by food-producing animal species

2023 tonnage: ● = 1 tonne

Annual trends* (Note scales differ beween graphs)

% change* (*from date first published)

Species	2023 Usage [1]	Change since last year	Annual trends* (axis range, years)	% change*
Pigs	84.8 mg/kg	↑ 13.0 mg/kg	119.5 – 56.4 mg/kg; 2015–2023	↓ 69%
Broilers	13.5 mg/kg	↓ 0.5 mg/kg	48.8 – 9.9 mg/kg; 2014–2023	↓ 72%
Gamebirds	9.9 tonnes	↑ 3.1 tonnes	20.0 – 5.7 tonnes; 2016–2023	↓ 51%
Salmon	19.9 mg/kg	↑ 1.4 mg/kg	43.1 – 6.7 mg/kg; 2017–2023	↑ 24%
Turkeys	33.6 mg/kg	↓ 1.7 mg/kg	219.5 – 25.7 mg/kg; 2014–2023	↓ 85%
Laying hens	0.22 % bird days	↓ 0.02 % bird days	0.67 – 0.22 %bird days; 2016–2023	↓ 67%
Trout	6.9 mg/kg	↓ 37.2 mg/kg	44.1 – 6.9 mg/kg; 2017–2023	↓ 64%
Ducks	0.4 mg/kg	↑ 0.1 mg/kg	15.1 – 0.3 mg/kg; 2014–2023	↓ 97%

Highest priority critically important antibiotics by food-producing animal species

2023 kg: ○ = 1 kg

Annual trends* (Note scales differ beween graphs)

% change* (*from date first published)

Species	2023 Usage	Change since last year	Annual trends* (axis range, years)	% change*
Gamebirds	27.7 kg	↑ 4.5 kg	64.1 – 21.6 tonnes; 2016–2023	↓ 57%
Trout	1.8 mg/kg	↓ 0.4 mg/kg	6.6 – 1.8 mg/kg; 2017–2023	↓ 73%
Pigs	0.007 mg/kg	↓ 0.005 mg/kg	0.98 – 0.00721 mg/kg; 2015–2023	↓ 99%
Meat Poultry	0.00441 mg/kg	↑ 0.0044 mg/kg	1.22 – 0.00001 mg/kg; 2014–2023	↓ 99%

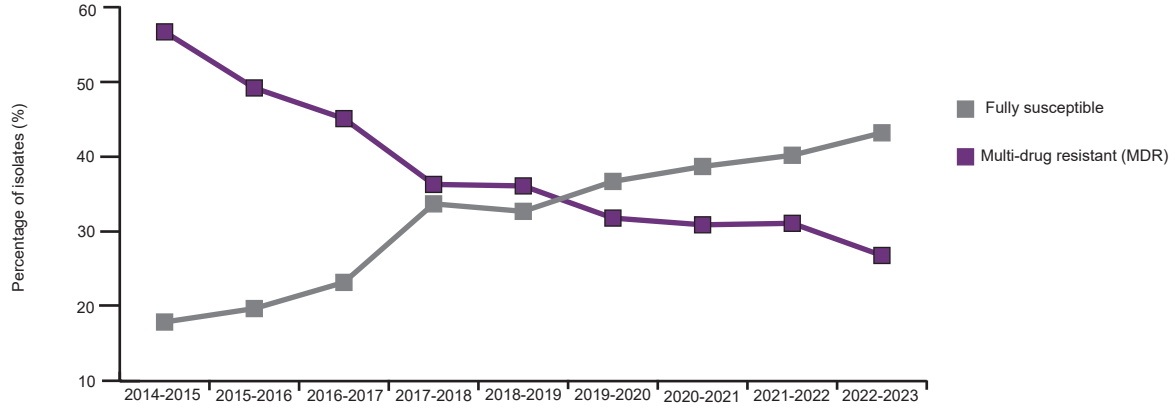
[1] mg/kg relates to the amount of active ingredient standardised by kg biomass and calculated using ESVAC methodology, % bird days refers to 'actual daily bird-doses/100 bird-days at risk'

- - - indicates a different metric for usage

Antibiotic resistance in zoonotic and commensal bacteria from healthy animals at slaughter

Key resistance outcome indicators: *E. coli*

The harmonised monitoring outcome indicators combine results from healthy pigs and poultry at slaughter to give an overall picture of antimicrobial resistance (AMR), and are internationally comparable. Results from 2023 are very positive, with considerable improvements since 2015. The percentage of *E. coli* isolates showing full susceptibility to the panel of antibiotics tested is at a new high of 43%, more than doubling since 2014/2015. The percentage of multi-drug resistant isolates (resistant to three or more antibiotic classes) is at a new low of 27%.



New AMR surveillance

This year's harmonised monitoring includes testing for three new species of bacteria in pigs: *Campylobacter coli*, *Enterococcus faecalis* and *Enterococcus faecium*. The addition of enterococci allows for detection of vancomycin-resistant enterococci (VRE), which are of clinical importance in people. No VRE were detected in pigs in 2023.

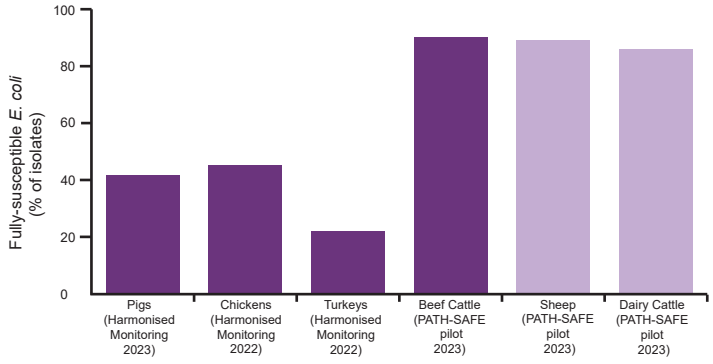
Pathogen Surveillance in Agriculture, Food and Environment (PATH-SAFE)

This year's report includes results from AMR surveillance pilots in milk from dairy cattle, beef cattle and sheep carried out under the PATH-SAFE programme. These surveys mirror the methodology used in our routine surveillance in pigs and poultry. However, the PATH-SAFE surveys were not conducted over an entire calendar year, and coverage of animal populations (27-28%) was less than that achieved in our routine harmonised monitoring (81% in 2023). Nonetheless these results provide an initial baseline for AMR in cattle and sheep. Results show that full susceptibilty of *E. coli* from ruminants was extremely high (>86%), although there were some notable sector-specific findings, for example, carriage of ESBL/AmpC-producing *E. coli* in beef cattle (see below graph).

E. coli in different animal species

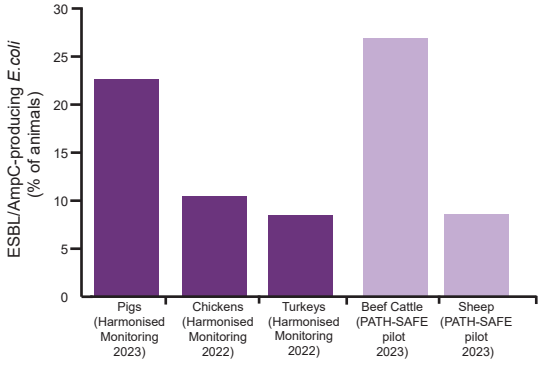
Full susceptibility in *E.coli*

- This graph shows the percentage of *E. coli* isolated from different animal species that are fully susceptible to the panel of antibiotics tested (i.e no resistance was found).
- These *E. coli* were isolated from our routine surveillance (harmonised monitoring, dark purple) and PATH-SAFE pilot surveys (light purple).



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 ESBL-/AmpC-producing *E. coli* to multiply, making them easier to detect.
- This tells us the percentage of individual animals carrying resistance to 3rd and 4th generation cephalosporins even at very low levels.



Antibiotic resistance in clinical surveillance

Clinical surveillance aims to provide veterinarians with relevant treatment information using results from bacteria isolated from diagnostic samples. 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.

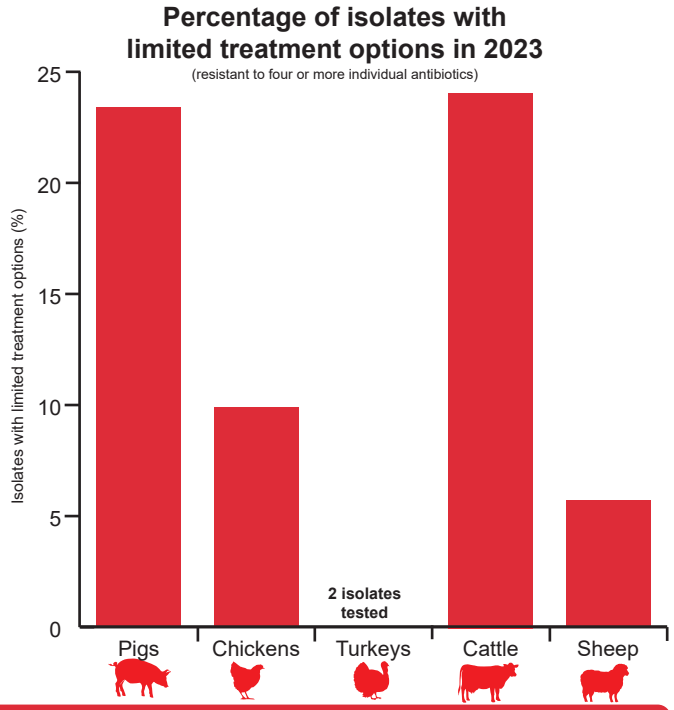
Key findings

- 7,415 isolates were tested for AMR in England and Wales, predominantly *Salmonella* and *E. coli*.
- Resistance in *E. coli* across all animal species mostly shows decreasing resistance since 2014.
- The percentage of isolates tested by animal species were: pigs (13%), poultry (30%), cattle (15%), sheep (7%), dogs (10%) and trout (<1%).

Resistance in *Escherichia coli*

- 1,168 *E. coli* isolates were tested from all species.
- 18% of isolates were resistant to four or more individual antibiotics, which could limit treatment options for veterinarians. This was most frequent in isolates from cattle (24%) and pigs (23%), as shown in adjacent graph.
- Across species, resistance tended to be higher in younger animals, which may reflect more frequent antibiotic use in this age group.

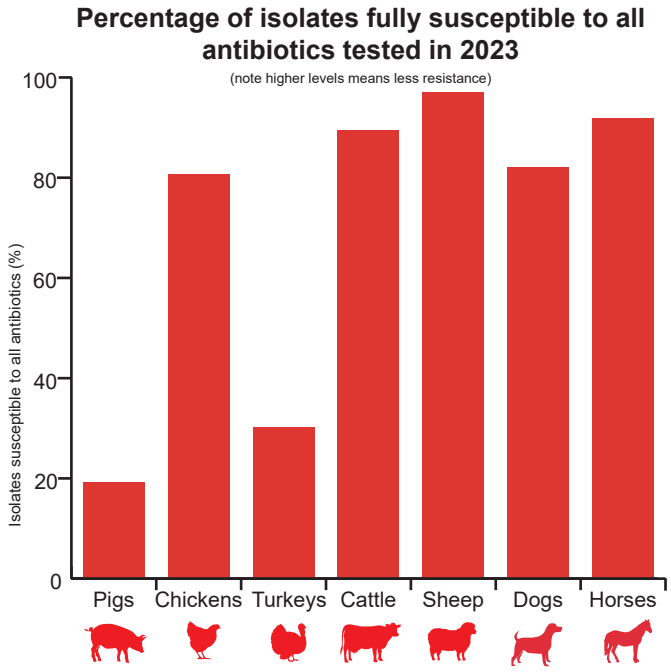
Highest priority critically important antibiotics (HP-CIAs): Resistance was low, very low or not detected in *E. coli*: cefotaxime (8.7%), cefpodoxime (0.7%), ceftazidime (4.9 %) and enrofloxacin (1.7%).



Resistance in *Salmonella* spp. from animals and their environment

- Of the 5,513 *Salmonella* isolates tested, 73% were fully susceptible. The lowest levels of susceptibility were in pigs (19%) and turkeys (30%), as shown in the adjacent graph.
- When looking at data since 2014, there are sector specific differences, with pigs, chickens and turkeys all showing trends of increasing full susceptibility. Full susceptibility in *Salmonella* from sheep and cattle remain high.
- 14% of *Salmonella* from all species indicated limited treatment options, that is, resistant to four or more individual antibiotics. This was most frequent in isolates from pigs (76%).

Highest priority critically important antibiotics (HP-CIAs) Resistance was low, very low or not detected in *Salmonella* spp.: cefotaxime and ceftazdime (>0.9%) and ciprofloxacin (<2.6%)



National Biosurveillance Network (NBN)

NBN is a major cross-government initiative to pilot and improve surveillance for biological threats across the One Health spectrum. It will assess how to better share and bring together surveillance outputs (including facilitating sharing of privately-held data) to generate better insights into threats. Most AMR data from animals in the UK is generated and held by private veterinary laboratories (PVLs) and does not ordinarily feed into AMR surveillance. Under the NBN pilot, the VMD is expanding on previous work with PVLs to facilitate data sharing with government across species sectors.

Background

How are sales data collected?
In the UK, from 2005 it has been a statutory requirement for pharmaceutical companies to report to the VMD the amount of antibiotic products sold for use in animals. The quantity of active ingredient is calculated from the amounts sold and the product characteristics. These sales data do not take into account wastage of veterinary antibiotics. However, this is the best currently available approximation of the quantity of antibiotics administered to animals in the UK.

How are usage data collected?
Data have been voluntarily provided by producers (pig, poultry and laying hen sectors), feed companies (gamebirds) and veterinary practices (gamebirds and fish). Usage data collection systems have been put in place to collect data from the British Poultry Council (meat poultry), the British Egg Industry Council (laying hen sector), the Game Farmers Association (gamebirds), the electronic Medicines Book (pigs), British Trout Association (trout) and Scottish Salmon Producers' Association (salmon).

Usage data, i.e. the amount of antibiotics purchased, prescribed and/or administered, have the potential to provide much more precise estimates of use. The VMD has been working with the animal production sectors to develop sector-led data collection systems to monitor their antibiotic usage.

What is the Population Correction Unit (PCU)?
Trends in sales of antibiotics between years and different countries cannot be determined without taking into consideration variations in the number and size of animals that may require treatment. Therefore, sales data are analysed using the population correction unit (PCU). This is a standard technical unit of measurement developed by the European Medicines Agency and adopted by EU countries. This allows data to be presented as mg of antibiotic per kg of livestock biomass. For more details click here.

What are Critically Important Antibiotics (CIAs)?
Certain antibiotic classes are categorised by the World Health Organization (WHO) as critically important antibiotics for human use, of which several are designated as 'highest priority critically important antibiotics' (HP-CIA). In January 2020, the European Medicines Agency published new scientific advice on the risk to humans from antibiotic resistance caused by the use of (HP-CIAs) in animals. The report was prepared by Antimicrobial Advice Ad Hoc Expert Group (AMEG). Quinolones, third and fourth generation cephalosporins and polymyxins were classified as category B, where the use of these antibiotics should be restricted, as a result of their critical importance in human medicine. For more details click here.

How is antibiotic resistance interpreted?
Antibiotic resistance in bacteria isolated from animals is monitored through two distinct surveillance programmes: harmonised monitoring and clinical surveillance. The harmonised monitoring scheme is a UK-wide programme in which we test bacteria from the gut of healthy pigs and poultry at slaughter, and the National Control Programme for *Salmonella,* giving us a representative picture of resistance in key livestock species entering the food chain. Clinical surveillance involves the testing of bacteria that have been isolated from clinical samples submitted by farmers and private veterinarians to government laboratories in England and Wales.

Susceptibility testing for harmonised monitoring is performed using broth microdilution to determine minimum inhibitory concentrations (MICs). Resistance is assessed using EUCAST (European Committee on Antimicrobial Susceptibility Testing) epidemiological cut-off values (ECOFFs) where possible. Where no EUCAST values were available, European Food Safety Authority (EFSA) recommended cut-off values were used. Where neither defined values are available, tentative EUCAST ECOFF values were applied. Results interpreted using ECOFFs are reported in full in Supplementary Material 2.

In the 2023 clinical surveillance programme, the majority of the results presented were assessed by disc diffusion techniques, and interpreted using BSAC (British Society for Antimicrobial Chemotherapy) human clinical breakpoints (CBPs) where available. Broth microdilution testing was introduced in UK-VARSS 2020 and continues to be developed and applied to an increasing number of organisms over the last four years. MIC results have been interpreted using veteirnary clinincal breakpoints from Clincal and Laboratory Standards Institute (CLSI) in the first instance, or Comité de l'Antibiogramme de la Société Française de Microbiologie (CA-SFM) when these are not available; if veterinary clinical breakpoints were not available, human clincal breakpoints were used. Full details of the methods used are available in Supplementary Material 2.