Veterinary
Medicines
Directorate

Supplementary Material 3 – resistance data

UK-VARSS 2021

Published November 2022

This publication is available at www.gov.uk/government/collections/veterinary-antimicrobial-resistance-and-sales-surveillance.

Suggested citation: UK-VARSS (2022). *Supplementary Material 3 (UK-VARSS 2021)*. New Haw, Addlestone: Veterinary Medicines Directorate.

Any enquiries or correspondence regarding this publication should be sent to us at: postmaster@vmd.gov.uk.

www.gov.uk/government/organisations/veterinary-medicines-directorate

Published on 8th November 2022

Contents

S1.1: Harmonised monitoring results of susceptibility testing in *Escherichia coli*

The epidemiological cut-off (ECOFF) values applied for this section were the same as those set out in the EU Commission Implementing Decision 2020/1729. Please note, cefotaxime, ceftazidime, cefepime, cefoxitin, ciprofloxacin and colistin are HP-CIAs. For individuals using screen readers, please note that cells read out as blank denotes that no isolates were tested, or that no data is available.

Table S1.1.1: Susceptibility in *E. coli* interpreted using EUCAST a) ECOFFs and b) CBPs from caecal samples from pigs at slaughter in the UK. This table shows the number and percentage of isolates with higher resistance levels than expected background levels for that species for 2015, 2017, 2019 and 2021.

a) ECOFFs

Antibiotic	2015 (n=150)	2017 (n=186)	2019 (n=208)	2021 (n=237)
Amikacin	-	-	-	0
Ampicillin	57 (38.0)	57 (30.6)	75 (36.1)	79 (33.3)
Cefotaxime	0	0	5 (2.4)	3 (1.3)
Ceftazidime	0	0	5 (2.4)	3 (1.3)
Chloramphenicol	47 (31.3)	38 (20.4)	34 (16.3)	44 (18.6)
Ciprofloxacin	4 (2.7)	5 (2.7)	7 (3.4)	11 (4.6)
Colistin	0	0	0	0
Gentamicin	11 (7.3)	7 (3.8)	3 (1.4)	5 (2.1)
Meropenem	0	0	0	0
Nalidixic acid	2 (1.3)	4 (2.2)	2 (1.0)	4 (1.7)
Sulfamethoxazole	87 (58.0)	88 (47.3)	89 (42.8)	96 (40.5)
Tetracycline	108 (72.0)	110 (59.1)	122 (58.7)	125 (52.7)
Tigecycline	1 (0.7)	1 (0.5)	1 (0.5)	0
Trimethoprim	73 (48.7)	68 (36.6)	83 (39.9)	89 (37.6)

b) CBPs

Antibiotic	2015 (n=150)	2017 (n=186)	2019 (n=208)	2021 (n=237)
Amikacin	-	-	-	0
Ampicillin	57 (38.0)	57 (30.6)	75 (36.1)	79 (33.3)
Cefotaxime	0	0	3 (1.4)	3 (1.3)
Ceftazidime	0	0	2 (1.0)	2 (0.8)
Chloramphenicol	48 (32.0)	43 (23.1)	38 (18.3)	60 (25.3)
Ciprofloxacin	1 (0.7)	3 (1.6)	1 (0.5)	3 (1.3)
Colistin	0	0	0	0
Gentamicin	10 (6.7)	7 (3.8)	3 (1.4)	5 (2.1)
Meropenem	0	0	0	0
Nalidixic acid	-	-	-	-
Sulfamethoxazole	-	-	-	-
Tetracycline	-	-	-	-
Tigecycline	1 (0.7)	1 (0.5)	1 (0.5)	0
Trimethoprim	73 (48.7)	67 (36.0)	83 (39.9)	89 (37.6)

Table S1.1.2: Distribution of ESBL/AmpC and CPE enzymes detected in *E. coli* from healthy pigs at slaughter in the UK in 2021**.** Note - if more than one isolate was of an unknown sequence type (ST), it has been assumed that they belonged to different STs.

Enzyme	Number of isolates	Proportion of isolates (n=109) (%)	Proportion of caecal samples (n=372) (%)	Number of unique STs	Sequence type (ST)
CMY-2	3	2.8	0.8	3	29, 939, 1485
CTX-M-1	31	28.4	8.3	18	23, 56, 88 (n=4), 101 (n=2), 117 (n=7), 224 (n=3), 369, 410 (n=2), 648, 711, 767, 1324, 1586, 1727, 8324, three unassigned
CTX-M-3	2	1.8	0.5	1	4038
CTX-M-14	7	6.4	1.9	5	58, 88 (n=2), 223, 1788 (n=2), one unassigned
CTX-M-15	11	10.1	3.0	9	10, 48 (n=2), 58, 69, 75 (n=2), 88, 394, 3268, one unassigned
CTX-M-32	2	1.8	0.5	2	10, 101
CTX-M-55	6	5.5	1.6	4	410, 1771 (n=3), two unassigned
CTX-M-65	1	0.9	0.3	1	23
SHV-12	2	1.8	0.5	2	58, 6256
TEM-52b	2	1.8	0.5	2	10, 3288
AmpC promoter mutation	41	37.6	11.0	9	23 (n=29), 88 (n=2), 156 (n=4), 2473, unassigned (n=5)
Unknown	1	0.9	0.3	1	2705

Table S1.1.3: Decreased susceptibility in ESBL-/AmpC-producing *E. coli* from caecal samples from healthy pigs at slaughter in the UK for 2021.

Antibiotic	Number of AmpC isolates with decreased susceptibility (n=45)	Proportion of AmpC isolates with decreased susceptibility (%)	Number of ESBL isolates with decreased susceptibility (n=68)	Proportion of ESBL isolates with decreased susceptibility (%)
Ampicillin	45	100	68	100
Azithromycin	1	2.2	2	2.9
Cefepime	6	13.3	68	100
Cefotaxime	45	100	68	100
Cefoxitin	45	100	0	0
Ceftazidime	45	100	65	95.6
Chloramphenicol	1	2.2	12	17.6
Ciprofloxacin	0	0	25	36.8
Colistin	0	0	0	0
Ertapenem	1	2.2	0	0
Gentamicin	0	0	11	16.2
Imipenem	0	0	0	0
Meropenem	0	0	0	0
Nalidixic acid	0	0	13	19.1
Sulphonamide	32	71.1	47	69.1
Tetracycline	9	20.0	50	73.5
Tigecycline	0	0	0	0
Trimethoprim	30	66.7	42	61.8

S1.2: Harmonised monitoring results of susceptibility testing in *Salmonella* spp.

Table S1.2.1: Susceptibility in *Salmonella* spp. interpreted using EUCAST ECOFFs and CBPs from caecal samples from pigs at slaughter in the UK for 2021. This table shows the number and percentage of isolates with resistance levels higher than expected background levels.

Antibiotic	(2021, n=117)	
	ECOFFs	CBPs
Amikacin	0	0
Ampicillin	53 (45.3)	53 (45.3)
Azithromycin	-	-
Cefotaxime	0	0
Ceftazidime	0	0
Chloramphenicol	23 (19.7)	27 (23.1)
Ciprofloxacin	7 (6.0)	7 (6.0)
Colistin	-	-
Gentamicin	9 (7.7)	9 (7.7)
Meropenem	0	0
Nalidixic acid	6 (5.1)	6 (5.1)
Sulfamethoxazole	-	-
Tetracycline	63 (53.8)	63 (53.8)
Tigecycline	-	-
Trimethoprim	30 (25.6)	30 (25.6)

S2.1: Clinical surveillance data for isolates from bovine mastitis cases

Table S2.1.1: Resistance (interpreted using breakpoints) in *E. coli* mastitis isolates from England and Wales for 2021. The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

Antibiotic	2021
Amoxicillin/clavulanate	1/42 (2.4)
Ampicillin	17/42 (7.1)
Cefpodoxime	0/42 (0)
Enrofloxacin	1/42 (2.4)
Neomycin	1/42 (2.4)
Streptomycin	3/42 (7.1)
Tetracycline	6/42 (14.3)
Trimethoprim/sulphonamide	3/42 (7.1)

Table S2.1.2: Resistance (interpreted using breakpoints) of *Staphylococci* and *Streptococci* from mastitis cases from England and Wales from in 2021. The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

Antibiotic	*Streptococcus dysgalactiae*	*Streptococcus uberis*	*Staphylococcus aureus*
Amoxicillin/clavulanate	0/13 (0)	0/49 (0)	3/25 (12.0)
Ampicillin	0/13 (0)	0/49 (0)	3/25 (12.0)
Cefalexin	0/13 (0)	2/49 (4.1)	0/25 (0)
Neomycin	0/12 (0)	24/49 (49.0)	0/25 (0)
Novobiocin	0/12 (0)	0/49 (0)	0/25 (0)
Penicillin	0/13 (0)	0/49 (0)	3/25 (12.0)
Tetracycline	13/13 (100)	25/49 (51.0)	1/25 (4.0)
Tylosin	0/13 (0)	0/49 (0)	0/25 (0)

Table S2.1.3: Resistance (interpreted using breakpoints) of *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* from mastitis cases from England and Wales for 2021. The table shows the number of resistant isolates out of the total number tested.

Antibiotic	*Klebsiella pneumoniae*	*Pseudomonas aeruginosa*
Amoxicillin/clavulanate	2/5 (40.0)	6/6 (100)
Ampicillin	5/5 (100)	6/6 (100)
Cefotaxime	-	6/6 (100)
Cefpodoxime	0/3 (0)	-
Ceftazidime	-	0/6 (0)
Enrofloxacin	0/5 (0)	0/6 (0)
Neomycin	0/3 (0)	1/3 (33.3)
Streptomycin	0/1 (0)	0/3 (0)
Tetracycline	0/5 (0)	6/6 (100)
Trimethoprim/sulphonamide	0/5 (0)	5/6 (83.3)

S2.2: Clinical surveillance data for isolates from respiratory infections of cattle

Table S2.2.1: Resistance (interpreted using breakpoints) of *Pasteurella multocida* and *Mannheimia haemolytica* from respiratory infections of cattle in England and Wales in 2021. The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

Antibiotic	*Pasteurella multocida*	*Mannheimia haemolytica*
Amoxicillin/clavulanate	0/88 (0)	0/82 (0)
Ampicillin	0/88 (0)	0/82 (0)
Cefpodoxime	0/88 (0)	0/81 (0)
Enrofloxacin	0/88 (0)	0/82 (0)
Florfenicol	0/86 (0)	0/80 (0)
Tetracycline	79/88 (89.8)	71/82 (86.6)
Trimethoprim/sulphonamide	1/88 (1.1)	0/82 (0)
Multi-resistant	0/88 (0)	-

S2.3: Clinical surveillance data for isolates from respiratory infections of pigs

Table S2.3.1: Resistance (interpreted using breakpoints) of *Pasteurella multocida* and *Actinobacillus pleuropneumoniae* from respiratory infections of pigs in England and Wales in 2021. The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

Antibiotic	*Pasteurella multocida*	*Actinobacillus pleuropneumoniae*
Ampicillin	1/36 (2.8)	3/19 (15.8)
Apramycin	0/36 (0)	17/19 (89.5)
Cefpodoxime	0/36 (0)	0/19 (0)
Enrofloxacin	0/36 (0)	0/19 (0)
Neomycin	0/36 (0)	18/19 (94.7)
Spectinomycin	0/36 (0)	17/19 (89.5)
Tetracycline	31/36 (86.1)	0/19 (0)
Trimethoprim/sulphonamide	11/36 (30.6	0/19 (0)

S2.4: Clinical surveillance data for isolates from respiratory infections of sheep

Table S2.4.1: Resistance (interpreted using breakpoints) of *Pasteurella multocida*, *Mannheimia haemolytica* and *Bibersteinia trehalosi* from sheep in England and Wales in 2021. The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

Antibiotic	*Pasteurella multocida*	*Mannheimia haemolytica*	*Bibersteinia trehalosi*
Amoxicillin/ clavulanate	0/20 (0)	0/133 (0)	0/43 (0)
Ampicillin	0/20 (0)	0/133 (0)	0/43 (0)
Cefpodoxime	0/20 (0)	0/133 (0)	0/42 (0)
Enrofloxacin	0/20 (0)	0/133 (0)	0/43 (0)
Florfenicol	0/20 (0)	0/133 (0)	0/42 (0)
Tetracycline	11/20 (55.0)	120/133 (90.2)	1/43 (2.3)
Trimethoprim/sulphonamide	0/20 (0)	2/133 (1.5)	0/43 (0)

S2.5: Clinical surveillance data for other veterinary pathogens

Table S2.5.1: MIC values in mg/ml of *Brachyspira hyodysenteriae* isolates from infections of pigs to tiamulin in England and Wales in 2021**.**

Year	<0.06	0.125	0.25	0.5	1	2	4	8	>8
2021	6	2	2	-	-	-	-	2	-

Table S2.5.2: Resistance (interpreted using breakpoints) of *Streptococcus suis* and of *Erysipelothrix rhusiopathiae* from infections of pigs in England and Wales in 2021. The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

Antibiotic	*Streptococcus suis*	*Erysipelothrix rhusiopathiae*
Ampicillin	0/87 (0)	0/9 (0)
Enrofloxacin	0/87 (0)	0/9 (0)
Lincomycin	26/87 (29.9)	0/9 (0)
Penicillin	0/87 (0)	0/9 (0)
Tetracycline	74/87 (85.1)	1/9 (11.1)
Trimethoprim/sulphonamide	16/87 (18.4)	9/9 (100)

Table S2.5.3: Resistance (interpreted using breakpoints) of *Staphylococcus aureus* from infections of chickens in England and Wales in 2021. The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

Antibiotic	2021
Ampicillin	0/1 (0)
Doxycycline	0/1 (0)
Enrofloxacin	0/1 (0)
Lincomycin	0/1 (0)
Penicillin	0/1 (0)
Tetracycline	0/1 (0)
Trimethoprim/sulphonamide	0/1 (0)
Tylosin	0/1 (0)

Table S2.5.4 Resistance (interpreted using breakpoints) of a) *Listeria monocytogenes* and b) *Streptococcus dysgalactiae* from infections of sheep in England and Wales in 2021. The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

a) *Listeria monocytogenes*

Antibiotic	2021
Amoxicillin/ clavulanate	0/5 (0)
Ampicillin	0/5 (0)
Cefalexin	0/5 (0)
Penicillin	0/5 (0)
Tetracycline	0/5 (0)
Trimethoprim/sulphonamide	0/4 (0)
Tylosin	0/5 (0)

b) *Streptococcus dysgalactiae*

Antibiotic	2021
Amoxicillin/clavulanate	0/17 (0)
Ampicillin	0/17 (0)
Cefalexin	0/17 (0)
Neomycin	1/13 (7.7)
Novobiocin	0/13 (0)
Penicillin	0/17 (0)
Tetracycline	15/17 (88.2)
Trimethoprim/sulphonamide	0/4 (0)
Tylosin	0/17 (0)

Table S2.5.5: Findings of LA-MRSA in the UK by government laboratories for England and Wales in 2021. Please note, there were no cases of LA-MRSA in Scotland for 2021. A presumptive MRSA was detected in a pig in Northern Ireland in 2021.

Clonal complex	Year	Species	Source of the sample
CC398	2021	Pig	Clinical investigation

S2.6 Clinical surveillance data for *E. coli*

Table S2.6.1: 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

Table S2.6.2: Resistance (interpreted using breakpoints) in all *E. coli* from cattle, sheep, pigs, chickens and turkeys (combined) in England and Wales, Northern Ireland and Scotland in 2021. The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

Antibiotic	England and Wales	Northern Ireland	Scotland
Amikacin	0/199 (0)	-	-
Amoxicillin/clavulanate	109/566 (19.3)	252/724 (34.8)	27/146 (18.5)
Ampicillin	660/1262 (52.3)	479/724 (66.2)	34/146 (23.3)
Apramycin	123/1190 (10.3)	72/535 (13.5)	2/58 (3.4)
Cefotaxime	8/201 (4.0)	-	-
Cefpodoxime	6/752 (0.8)	415/718 (57.8)	3/146 (2.1)
Ceftazidime	7/201 (3.5)	-	-
Chloramphenicol	51/199 (25.6)	-	-
Doxycycline	65/164 (39.6)	-	-
Enrofloxacin	23/1262 (1.8)	195/724 (26.9)	3/146 (2.1)
Florfenicol	58/271 (21.4)	233/472 (49.4)	10/56 (17.9)
Neomycin	208/1082 (19.2)	717/724 (99.0)	12/115 (10.4)
Spectinomycin	324/1190 (27.2)	11/186 (5.9)	21/56 (37.5)
Streptomycin	105/199 (52.8)	185/186 (99.5)	5/87 (5.7)
Tetracycline	669/1262 (53.0)	421/723 (58.2)	46/144 (31.9)
Trimethoprim/sulphonamide	438/1262 (34.7)	307/723 (42.5)	14/146 (9.6)

Table S2.6.3: Resistance (interpreted using breakpoints) in all *E. coli* from cattle (all ages) in England and Wales, Northern Ireland and Scotland in 2021. The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

Antibiotic	England and Wales	Northern Ireland	Scotland
Amikacin	0/144 (0)	-	-
Amoxicillin/clavulanate	75/321 (23.4)	212/545 (38.9)	19/115 (16.5)
Ampicillin	206/321 (64.2)	373/545 (68.4)	20/115 (17.4)
Apramycin	3/284 (1.1)	31/518 (6.0)	1/30 (3.3)
Cefotaxime	7/146 (4.8)	-	-
Cefpodoxime	-	334/545 (61.3)	3/115 (2.6)
Ceftazidime	7/146 (4.8)	-	-
Chloramphenicol	42/144 (29.2)	-	-
Enrofloxacin	4/321 (1.2)	171/545 (31.4)	3/115 (2.6)
Florfenicol	49/181 (27.1)	211/365 (57.8)	6/30 (20.0)
Neomycin	83/284 (29.2)	541/545 (99.3)	7/115 (6.1)
Spectinomycin	61/284 (21.5)	9/179 (5.0)	14/30 (46.7)
Streptomycin	77/144 (53.5)	178/179 (99.4)	4/84 (4.8)
Tetracycline	193/321 (60.1)	329/545 (60.4)	29/115 (25.2)
Trimethoprim/sulphonamide	119/321 (37.1)	256/545 (47.0)	12/115 (10.4)

Table S2.6.4: Resistance (interpreted using breakpoints) in all *E. coli* from pigs (all ages) in England and Wales, Northern Ireland and Scotland from in 2021. The table shows the number of resistant isolates out of the total number tested and the percentage of resistance.

Antibiotic	England and Wales	Northern Ireland	Scotland
Amoxicillin/clavulanate	-	5/29 (17.2)	5/17 (29.4)
Ampicillin	286/588 (48.6)	19/29 (65.5)	6/17 (35.3)
Apramycin	116/588 (19.7)	3/29 (10.3)	1/17 (5.9)
Cefpodoxime	6/588 (1.0)	9/28 (32.1)	0/17 (0)
Enrofloxacin	13/588 (2.2)	5/28 (17.9)	0/17 (0)
Florfenicol	-	5/28 (17.9)	3/17 (17.6)
Neomycin	110/588 (18.7)	28/28 (100)	5/17 (29.4)
Spectinomycin	192/588 (32.7)	-	5/17 (29.4)
Tetracycline	327/588 (55.6)	16/28 (57.1)	10/17 (58.8)
Trimethoprim/sulphonamide	245/588 (41.7)	13/28 (46.4)	1/17 (5.9)

Table S2.6.5: Resistance (interpreted using breakpoints) in all *E. coli* from sheep (all ages) in England and Wales, Northern Ireland and Scotland in 2021. The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

Antibiotic	England and Wales	Northern Ireland	Scotland
Amikacin	0/55 (0)	-	-
Amoxicillin/clavulanate	22/189 (11.6)	24/82 (29.3)	3/12 (25.0)
Ampicillin	71/189 (37.6)	52/82 (63.4)	8/12 (66.7)
Apramycin	0/154 (0)	8/75 (10.7)	0/9 (0)
Cefotaxime	1/55 (1.8)	-	-
Cefpodoxime	-	45/82 (54.9)	0/12 (0)
Ceftazidime	0/55 (0)	-	-
Chloramphenicol	9/55 (16.4)	-	-
Enrofloxacin	1/189 (0.5)	10/82 (12.2)	0/12 (0)
Florfenicol	9/90 (10.0)	17/75 (22.7)	1/9 (11.1)
Neomycin	11/154 (7.1)	79/82 (96.3)	0/12 (0)
Spectinomycin	38/154 (24.7)	2/7 (28.6)	2/9 (22.2)
Streptomycin	28/55 (50.9)	7/7 (100)	1/3 (33.3)
Tetracycline	82/189 (43.4)	46/82 (56.1)	7/12 (58.3)
Trimethoprim/sulphonamide	32/189 (16.9)	26/82 (31.7)	1/12 (8.3)

Table S2.6.6: Resistance (interpreted using breakpoints) in all *E. coli* from chickens (all ages) in England and Wales, Northern Ireland and Scotland in 2021**.** The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

Antibiotic	England and Wales	Northern Ireland	Scotland
Amoxicillin/clavulanate	12/56 (21.4)	7/52 (13.5)	0/2 (0)
Ampicillin	87/147 (59.2)	26/52 (50.0)	0/2 (0)
Apramycin	4/147 (2.7)	6/52 (11.5)	0/2 (0)
Cefpodoxime	0/147 (0)	20/51 (39.2)	0/2 (0)
Enrofloxacin	4/147 (2.7)	6/52 (11.5)	0/2 (0)
Neomycin	4/56 (7.1)	52/52 (100)	0/2 (0)
Spectinomycin	29/147 (19.7)	-	0/2 (0)
Tetracycline	60/147 (40.8)	24/52 (46.2)	0/2 (0)
Trimethoprim/sulphonamide	38/147 (25.9)	7/52 (13.5)	0/2 (0)

Table S2.6.7: Resistance (interpreted using breakpoints) in all *E. coli* from turkeys (all ages) in England and Wales and Northern Ireland in 2021. No isolates from Scotland were tested in 2021. The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

Antibiotic	England and Wales	Northern Ireland
Amoxicillin/clavulanate	-	0/3 (0)
Ampicillin	10/17 (58.8)	0/3 (0)
Apramycin	0/17 (0)	2/3 (66.7)
Cefpodoxime	0/17 (0)	3/3 (100)
Doxycycline	7/17 (41.2)	-
Enrofloxacin	1/17 (5.9)	0/3 (0)
Neomycin	-	3/3 (100)
Spectinomycin	4/17 (23.5)	-
Tetracycline	7/17 (41.2)	0/3 (0)
Trimethoprim/sulphonamide	4/17 (23.5)	0/3 (0)

Table S2.6.8: Resistance (interpreted using breakpoints) in *E. coli* from cattle in a) England and Wales, b) Northern Ireland and c) Scotland for 2021, split by age category. The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

Please note that no pre-weaning or adult data is available for Northern Ireland.

a) England and Wales

Antibiotic	Neonatal	Pre-weaning	Adult
Amikacin	0/107 (0)	0/20 (0)	-
Amoxicillin/clavulanate	36/146 (24.7)	22/93 (23.7)	3/23 (13.0)
Ampicillin	110/146 (75.3)	58/93 (62.4)	10/23 (43.5)
Apramycin	1/136 (0.7)	1/77 (1.3)	1/22 (4.5)
Cefotaxime	5/107 (4.7)	1/21 (4.8)	-
Ceftazidime	5/107 (4.7)	1/21 (4.8)	-
Chloramphenicol	25/107 (23.4)	5/20 (25.0)	-
Enrofloxacin	1/146 (0.7)	2/93 (2.2)	0/23 (0)
Florfenicol	24/117 (20.5)	6/36 (16.7)	-
Neomycin	47/136 (34.6)	27/77 (35.1)	0/22 (0)
Spectinomycin	24/136 (18.4)	24/77 (31.2)	0/22 (0)
Streptomycin	53/107 (49.5)	12/20 (60.0)	-
Tetracycline	90/146 (61.6)	65/93 (69.9)	8/23 (34.8)
Trimethoprim/sulphonamide	58/146 (39.7)	38/93 (40.9)	5/23 (21.7)

b) Northern Ireland

Antibiotic	Neonatal
Amoxicillin/clavulanate	45/93 (48.4)
Ampicillin	83/93 (89.2)
Apramycin	19/92 (20.7)
Cefpodoxime	62/93 (66.7)
Enrofloxacin	41/93 (44.1)
Florfenicol	49/92 (53.3)
Neomycin	93/93 (100)
Tetracycline	81/93 (87.1)
Trimethoprim/sulphonamide	62/93 (66.7)

c) Scotland

Antibiotic	Neonatal	Pre-weaning	Adult
Amoxicillin/clavulanate	4/7 (57.1)	7/11 (63.6)	7/93 (7.5)
Ampicillin	6/7 (85.7)	7/11 (63.6)	8/93 (8.6)
Apramycin	1/7 (14.3)	0/11 (0)	0/9 (0)
Cefpodoxime	0/7 (0)	0/11 (0)	2/93 (2.2)
Enrofloxacin	0/7 (0)	0/11 (0)	2/93 (2.2)
Florfenicol	1/7 (14.3)	1/11 (9.1)	4/9 (44.4)
Neomycin	2/7 (28.6)	0/11 (0)	5/93 (5.4)
Spectinomycin	3/7 (42.9)	4/11 (36.4)	6/9 (66.7)
Tetracycline	7/7 (100)	8/11 (72.7)	13/93 (14.0)
Trimethoprim/sulphonamide	1/7 (14.3)	2/11 (18.2)	7/93 (7.5)

Table S2.6.9: Resistance (interpreted using breakpoints) in *E. coli* from pigs in England and Wales, Northern Ireland and Scotland for 2021. The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

Please note that no post-weaning or adult data is available for Northern Ireland.

a) England and Wales

Antibiotic	Neonatal	Post-weaning	Adult
Ampicillin	37/63 (58.7)	204/384 (53.1)	10/32 (31.3)
Apramycin	6/63 (9.5)	103/384 (26.8)	0/32 (0)
Cefpodoxime	1/63 (1.6)	2/384 (0.5)	0/32 (0)
Enrofloxacin	2/63 (3.2)	11/384 (2.9)	0/32 (0)
Neomycin	2/63 (3.2)	102/384 (26.6)	2/32 (6.3)
Spectinomycin	22/63 (34.9)	140/384 (36.5)	2/32 (6.3)
Tetracycline	42/63 (66.7)	219/384 (57.0)	15/32 (46.9)
Trimethoprim/sulphonamide	25/63 (39.7)	181/384 (47.1)	7/32 (21.9)

b) Northern Ireland

Antibiotic	Neonatal
Amoxicillin/clavulanate	1/7 (14.3)
Ampicillin	5/7 (71.4)
Apramycin	1/7 (14.3)
Cefpodoxime	2/7 (28.6)
Enrofloxacin	2/7 (28.6)
Florfenicol	1/7 (14.3)
Neomycin	7/7 (100)
Tetracycline	6/7 (85.7)
Trimethoprim/sulphonamide	5/7 (71.4)

c) Scotland

Antibiotic	Neonatal	Post-weaning	Adult
Amoxicillin/clavulanate	2/4 (50.0)	2/3 (66.7)	0/2 (0)
Ampicillin	2/4 (50.0)	3/3 (100)	0/2 (0)
Apramycin	1/4 (25.0)	0/3 (0)	0/2 (0)
Cefpodoxime	0/4 (0)	0/3 (0)	0/2 (0)
Enrofloxacin	0/4 (0)	0/3 (0)	0/2 (0)
Florfenicol	1/4 (25.0)	2/3 (66.7)	0/2 (0)
Neomycin	0/4 (0)	0/3 (0)	0/2 (0)
Spectinomycin	2/4 (50.0)	1/3 (33.3)	0/2 (0)
Tetracycline	2/4 (50.0)	3/3 (100)	1/2 (50.0)
Trimethoprim/sulphonamide	0/4 (0)	0/3 (0)	0/2 (0)

Table S2.6.10: Resistance (interpreted using breakpoints) in *E. coli* from sheep in a) England and Wales, b) Northern Ireland and c) Scotland from 2021. The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

Please note that no pre-weaning or adult data is available for Northern Ireland.

a) England and Wales

Antibiotic	Neonatal	Pre-weaning	Adult
Amikacin	0/49 (0)	-	-
Amoxicillin/clavulanate	13/64 (20.3)	1/30 (3.3)	6/52 (11.5)
Ampicillin	32/64 (50.0)	9/30 (30.0)	18/52 (34.6)
Apramycin	0/62 (0)	0/21 (0)	0/40 (0)
Cefotaxime	1/49 (2.0)	0/3 (0)	-
Ceftazidime	0/49 (0)	0/3 (0)	-
Chloramphenicol	8/49 (16.3)	1/3 (33.3)	-
Enrofloxacin	1/64 (1.6)	0/30 (0)	0/52 (0)
Florfenicol	7/51 (13.7)	0/12 (0)	1/14 (7.1)
Neomycin	4/62 (6.5)	0/21 (0)	3/40 (7.5)
Spectinomycin	28/62 (45.2)	2/21 (9.5)	4/40 (10.0)
Streptomycin	27/49 (55.1)	1/3 (33.3)	-
Tetracycline	34/64 (53.1)	17/30 (56.7)	16/52 (30.8)
Trimethoprim/sulphonamide	19/64 (29.7)	4/30 (13.3)	5/52 (9.6)

b) Northern Ireland

Antibiotic	Neonatal
Amoxicillin/clavulanate	15/36 (41.7)
Ampicillin	27/36 (75.0)
Apramycin	2/36 (5.6)
Cefpodoxime	13/36 (36.1)
Enrofloxacin	6/36 (16.7)
Florfenicol	13/36 (36.1)
Neomycin	34/36 (94.4)
Tetracycline	24/36 (66.7)
Trimethoprim/sulphonamide	16/36 (44.4)

c) Scotland

Antibiotic	Neonatal	Pre-weaning	Adult
Amoxicillin/clavulanate	0/3 (0)	2/2 (100)	1/7 (14.3)
Ampicillin	1/3 (33.3)	2/2 (100)	5/7 (71.4)
Apramycin	0/3 (0)	0/2 (0)	0/4 (0)
Cefpodoxime	0/3 (0)	0/2 (0)	0/7 (0)
Enrofloxacin	0/3 (0)	0/2 (0)	0/7 (0)
Florfenicol	0/3 (0)	0/2 (0)	1/4 (25.0)
Neomycin	0/3 (0)	0/2 (0)	0/7 (0)
Spectinomycin	0/3 (0)	1/2 (50.0)	1/4 (25.0)
Streptomycin	-	-	1/3 (33.3)
Tetracycline	1/3 (33.3)	2/2 (100)	4/7 (57.1)
Trimethoprim/sulphonamide	0/3 (0)	0/2 (0)	1/7 (14.3)

S2.7: Clinical surveillance data for *Salmonella*

Table S2.7.1: Resistance (interpreted using breakpoints) in all *Salmonella* from cattle, pigs, sheep, chickens and turkeys (combined) in England and Wales, Northern Ireland and Scotland in 2021. The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

Antibiotic	England and Wales	Northern Ireland	Scotland
Amikacin	2/2267 (0.09)		
Amoxicillin/clavulanate	2/2267 (0.1)	2/103 (1.9)	9/173 (5.2)
Ampicillin	319/2267 (14.1)	6/103 (5.8)	16/173 (9.2)
Apramycin	75/2267 (3.3)	2/103 (1.9)	0/173 (0)
Cefotaxime	0/2267 (0)	0/103 (0)	-
Cefpodoxime	-	-	0/173 (0)
Ceftazidime	0/2267 (0)	0/103 (0)	-
Chloramphenicol	176/2267 (7.8)	3/103 (2.9)	-
Ciprofloxacin	1/2267 (0.04)	0/103 (0)	-
Enrofloxacin	-	-	0/173 (0)
Florfenicol	-	-	10/173 (5.8)
Furazolidone	46/2267 (2.0)	0/103 (0)	-
Gentamicin	83/2267 (3.7)	2/103 (1.9)	-
Nalidixic acid	80/2267 (3.5)	0/103 (0)	9/173 (5.2)
Neomycin	144/2267 (6.4)	-	2/173 (1.2)
Spectinomycin	-	3/103 (2.9)	3/173 (1.7)
Streptomycin	365/2267 (16.1)	8/103 (7.8)	-
Sulphonamide compounds	475/2267 (21.0)	6/103 (5.8)	-
Tetracycline	411/2267 (18.1)	5/103 (4.9)	18/173 (10.4)
Trimethoprim/sulphonamide	259/2276 (11.4)	3/103 (2.9)	3/173 (1.7)

Table S2.7.2: Resistance (interpreted using breakpoints) in all *Salmonella* from cattle in England and Wales, Northern Ireland and Scotland in 2021. The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

Antibiotic	England and Wales	Northern Ireland	Scotland
Amikacin	0/482 (0)	-	-
Amoxicillin/clavulanate	2/482 (0.4)	1/79 (1.3)	8/121 (6.6)
Ampicillin	43/482 (8.9)	0/79 (0)	11/121 (9.1)
Apramycin	0/482 (0)	1/79 (1.3)	0/121 (0)
Cefotaxime	0/482 (0)	0/79 (0)	-
Cefpodoxime	-	-	0/121 (0)
Ceftazidime	0/482 (0)	0/79 (0)	-
Chloramphenicol	17/482 (3.5)	1/79 (1.3)	-
Ciprofloxacin	0/482 (0)	0/79 (0)	
Enrofloxacin	-	-	0/121 (0)
Florfenicol	-	-	8/121 (6.6)
Furazolidone	1/482 (0.2)	0/79 (0)	-
Gentamicin	1/482 (0.2)	0/79 (0)	-
Nalidixic acid	6/482 (1.2)	0/79 (0)	8/121 (6.6)
Neomycin	15/482 (3.1)	-	1/121 (0.8)
Spectinomycin	-	1/79 (1.3)	0/121 (0)
Streptomycin	48/482 (10.0)	2/79 (2.5)	-
Sulphonamide compounds	47/482 (9.8)	1/79 (1.3)	-
Tetracycline	77/482 (16.0)	0/79 (0)	12/121 (9.9)
Trimethoprim/sulphonamide	4/482 (0.8)	0/79 (0)	1/121 (0.8)

Table S2.7.3: Resistance (interpreted using breakpoints) in all *Salmonella* from sheep in England and Wales, Northern Ireland and Scotland in 2021. The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

Antibiotic	England and Wales	Northern Ireland	Scotland
Amikacin	0/113 (0)	-	-
Amoxicillin/clavulanate	0/113 (0)	1/17 (5.9)	0/38 (0)
Ampicillin	3/113 (2.7)	0/17 (0)	0/38 (0)
Apramycin	0/113 (0)	0/17 (0)	0/38 (0)
Cefotaxime	0/113 (0)	0/17 (0)	-
Cefpodoxime	-	-	0/38 (0)
Ceftazidime	0/113 (0)	0/17 (0)	-
Chloramphenicol	2/113 (1.8)	0/17 (0)	-
Ciprofloxacin	0/113 (0)	0/17 (0)	-
Enrofloxacin	-	-	0/38 (0)
Florfenicol	-	-	0/38 (0)
Furazolidone	0/113 (0)	0/17 (0)	-
Gentamicin	0/113 (0)	0/17 (0)	-
Nalidixic acid	2/113 (1.8)	0/17 (0)	0/38 (0)
Neomycin	4/113 (3.5)	-	0/38 (0)
Spectinomycin	-	0/17 (0)	1/38 (2.6)
Streptomycin	3/113 (2.7)	1/17 (5.9)	-
Sulphonamide compounds	3/113 (2.7)	0/17 (0)	-
Tetracycline	11/113 (9.7)	0/17 (0)	1/38 (2.6)
Trimethoprim/sulphonamide	0/113 (0)	0/17 (0)	1/38 (2.6)

Table S2.7.4: Resistance (interpreted using breakpoints) in all *Salmonella* from pigs in England and Wales, Northern Ireland and Scotland in 2021. The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

Antibiotic	England and Wales	Northern Ireland	Scotland
Amikacin	2/263 (0.8)	-	-
Amoxicillin/clavulanate	0/263 (0)	0/5 (0)	1/14 (7.1)
Ampicillin	186/263 (70.7)	5/5 (100)	5/14 (35.7)
Apramycin	39/263 (14.8)	2/5 (40.0)	0/14 (0)
Cefotaxime	0/263 (0)	0/5 (0)	-
Cefpodoxime	-	-	0/14 (0)
Ceftazidime	0/263 (0)	0/5 (0)	-
Chloramphenicol	142/263 (54.0)	2/5 (40.0)	-
Ciprofloxacin	0/263 (0)	0/5 (0)	-
Enrofloxacin	-	-	0/14 (0)
Florfenicol	-	-	2/14 (14.3)
Furazolidone	0/263 (0)	0/5 (0)	-
Gentamicin	41/263 (15.6)	2/5 (40.0)	-
Nalidixic acid	3/263 (1.1)	0/5 (0)	1/14 (7.1)
Neomycin	76/263 (28.9)	-	1/14 (7.1)
Spectinomycin	-	2/5 (40.0)	2/14 (14.3)
Streptomycin	132/263 (50.2)	5/5 (100)	-
Sulphonamide compounds	188/263 (71.5)	5/5 (100)	-
Tetracycline	148/263 (56.3)	5/5 (100)	5/14 (35.7)
Trimethoprim/sulphonamide	145/263 (55.1)	3/5 (60.0)	1/14 (7.1)

Table S2.7.5: Resistance (interpreted using breakpoints) in all *Salmonella* from chickens and turkeys in England and Wales in 2021. No isolates from Northern Ireland or Scotland were tested in 2021. The table shows the number of resistant isolates out of the total number tested and the percentage of resistant isolates.

Antibiotic	Chickens	Turkeys
Amikacin	0/1300 (0)	0/109 (0)
Amoxicillin/clavulanate	0/1300 (0)	0/109 (0)
Ampicillin	52/1300 (4.0)	35/109 (32.1)
Apramycin	36/1300 (2.8)	0/109 (0)
Cefotaxime	1/1300 (0.1)	0/109 (0)
Ceftazidime	0/1300 (0)	0/109 (0)
Chloramphenicol	12/1300 (0.9)	3/109 (2.8)
Ciprofloxacin	1/1300 (0.1)	0/109 (0)
Furazolidone	45/1300 (3.5)	0/109 (0)
Gentamicin	39/1300 (3.0)	2/109 (1.8)
Nalidixic acid	51/1300 (3.9)	18/109 (16.5)
Neomycin	49/1300 (3.8)	0/109 (0)
Streptomycin	137/1300 (10.5)	45/109 (41.3)
Sulphonamide compounds	204/1300 (15.7)	33/109 (30.3)
Tetracycline	140/1300 (10.8)	35/109 (32.1)
Trimethoprim/sulphonamide	105/1300 (8.1)	5/109 (4.6)