



Supplementary Material

SALES DATA CORRECTIONS - SEE ERRATUM



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Supplementary Material for Chapter 1

S1.1: Changes in Methodology

The European Commission (EC) has requested the European Medicines Agency (EMA) to take the lead in collating data collected on the use of antibiotic agents in animals in the European Union. The EMA has therefore developed a harmonised approach for the collection and reporting of data based on national sales figures. This is designed to be comparable with usage data of human antibiotics.

Published ESVAC reports are available from:

http://www.ema.europa.eu/ema/index.jsp?curl=pages/regulation/document_listing/document_listing_000302.jsp

The ESVAC publications use a different method to calculate mg/PCU compared to the approach previously used in the UK. Table S1.1.1 summarises these differences, which are also highlighted in Figure S1.1.1 and Table S1.1.2.

Table S1.1.1. Differences between the ESVAC and VARSS methodology used in previous publications for the calculation of quantity of antibiotic sold

	UK-VARSS	ESVAC
Products included	↑ All authorised veterinary antibiotic products.	↓ Topical presentations are not included.
Calculation of active ingredient quantity	↓ Ingredients are converted to active moiety (the active molecule not including salts)	↑ Active ingredient weights relate directly to information held within the SPC
Calculation of PCU	↑ Horses <u>not</u> included as food producing animals	↓ Horses <u>included</u> as food producing animals
Calculation of mg/PCU	↓ Only takes into account products which are authorised for use in food producing animals <i>only</i> . Horses are excluded. Takes into account all administration routes.	↑ All formulations (<i>for all species</i>) other than tablets included; it is considered that tablets are primarily used in the treatment of non-food producing animals.
Conclusion	Likely underestimates mg/PCU	Likely overestimates mg/PCU

Key:

↑ = Increases overall mg/PCU ↓ = Decreases overall mg/PCU

In order to harmonise the national and European reporting, the ESVAC methodology has been adopted. The historical data based on the traditional UK methodology, as well as 2015 data calculated in the same way, can be seen in Figure S1.1.1.

For further details on how mg/PCU is calculated please see:

<https://www.gov.uk/government/publications/understanding-the-mgpcu-calculation-used-for-antibiotic-monitoring-in-food-producing-animals>

Data have been collected from Market Authorisation Holders since 1993, although this was only a statutory requirement from 2005. Data shown in Figure S1.1.1 represent sales of antibiotics for therapeutic use only, and do not contain sales of products marketed as growth promoters, which were banned in 2006.

Figure S1.1.1: Tonnes of active ingredient of antibiotic sold for all species 1993-2016 using the original UK-VARSS methodology

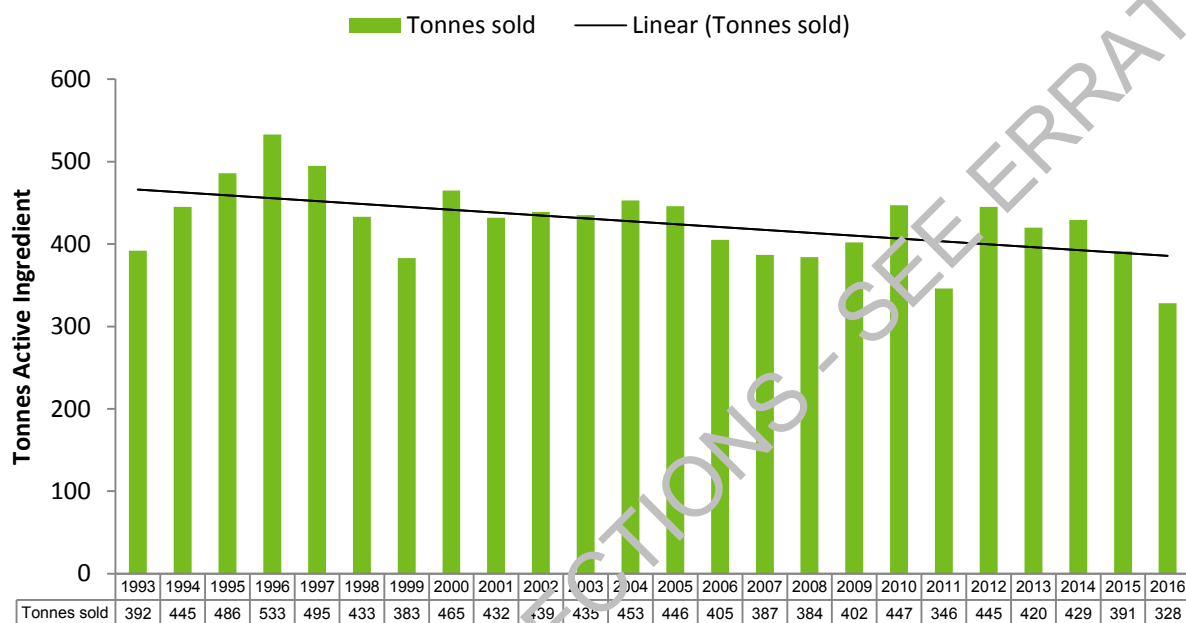


Figure S1.1.2: Milligrams (mg) of active ingredient of antibiotic sold for food producing species per Population Correction Unit (PCU) 2012-2016 calculated using the ESVAC and original UK-VARSS methodology

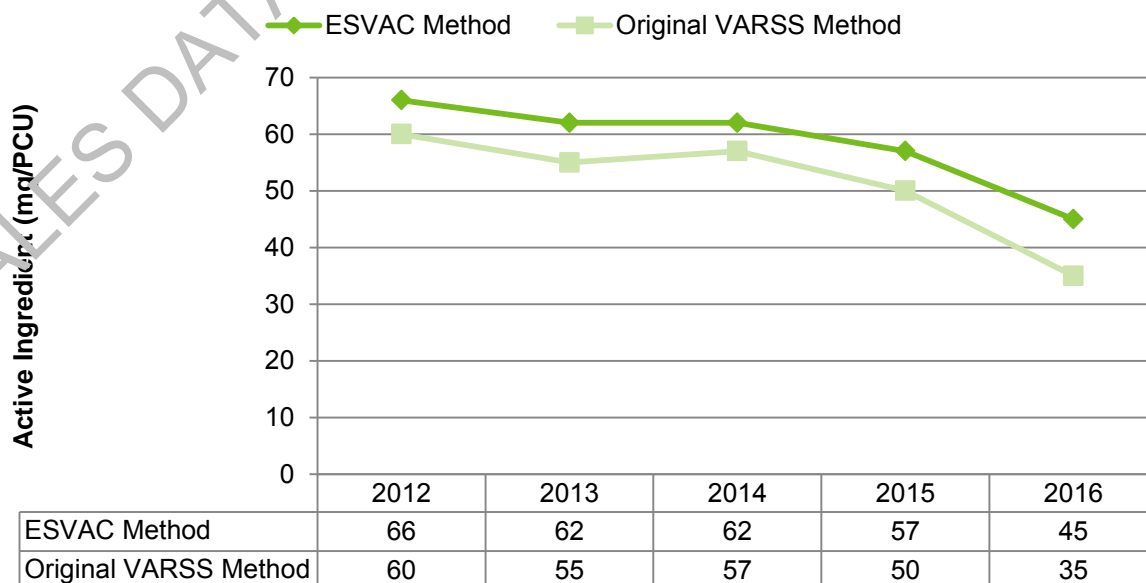


Table S1.1.2: Comparison of UK-VARSS and ESVAC methodology for the calculation on tonnes of active ingredient sold, Population Correction Unit (PCU), and milligrams (mg) of active ingredient sold per PCU for food producing species, 2012-2016.

	2012		2013		2014		2015		2016	
	VARSS	ESVAC	VARSS	ESVAC	VARSS	ESVAC	VARSS	ESVAC	VARSS	ESVAC
Tonnes of active ingredient	381	447	355	422	369	430	332	395	238	320
PCU (thousand tonnes)	6354	6749	6404	6799	6518	6915	6584	6961	6765	7142
mg/PCU	60	66	55	62	57	62	50	57	35	45

Figure S1.1.3 shows historical data for mg/PCU for 2005-2016, calculated using ESVAC methodology. The data represented accounts for sales of antibiotics for food producing animals only, inclusive of horses.

Figure S1.1.3: Milligrams (mg) of active ingredient of antibiotic sold for food-producing species per Population Correction Unit (PCU) 2005-2016 using the ESVAC methodology



Table S1.1.3 shows the sales for other antibiotic products, which include topical preparations and those for sensory organs e.g. aerosols, creams, gels, shampoos and ear and eye medications (not included in ESVAC calculation).

Table S1.1.3: Tonnes of active ingredient of antibiotic sold for all species by “other” routes of administration 2012-2016

	2012	2013	2014	2015	2016
Others	2	2	3	2	3

S1.2: Population Correction Unit (PCU)

When assessing antibiotic sales it is important that the demographics of the animal population potentially exposed to treatment are also taken into account, (see Annex A of the main report - data limitations). This is achieved through use of the PCU, a technical unit of measurement (where 1 PCU = 1kg of animal treated), which is calculated by multiplying a standardised average weight at time of treatment (see Table S1.2.2) with the associated annual animal/ slaughter numbers. The calculation also takes into account animals exported from the UK for slaughter, or imported to the UK for fattening. Full details on the methodology of calculation of the PCU can be found in the 2009 ESVAC report:

http://www.ema.europa.eu/ema/pages/includes/document/open_document.jsp?webContentId=WC500112309

Table S1.2.1 shows the combined UK PCU value for food producing species and horses. The standard formula used for calculation of the PCU for poultry does not include population figures for egg producers (laying hens) so the poultry PCU is an underestimate (EMA, 2011).

Table S1.2.1: Population correction unit (PCU) (in thousand tonnes) by food producing species and total 2012-2016

	2012	2013	2014	2015	2016
Total food producing species + horses*	6749	6799	6915	6961	7142
Sheep and goat	2697	2730	2809	2795	2845
Cattle	1706	1692	1731	1743	1792
Poultry	1040	1059	1042	1082	1151
Pig	733	716	745	770	789
Horses**	395	395	395	378	378
Fish	176	177	193	187	***

* Total food producing species PCU includes cattle, pigs, sheep, goats, poultry (broilers), fish and horses.

** Horse population data are obtained from the British Equestrian Trade Association survey which is run every 5 years.

*** UK aquaculture population statistics for 2015 are not yet available as they are collated through 2017. Therefore, for fish PCU calculation purposes, 2015 data have been used.

Companion animals are not included in the PCU as reliable population data cannot be collected and no agreed weights at time of treatment have been allocated for these species.

Table S1.2.2: Average weights at time of treatment (kg) used to calculate the Population Correction Unit (PCU)

Animal Category	Average weight at treatment (kg)	Source
Cattle		
Slaughter cows	425	Montforts (1999) ¹
Slaughter heifers	200	EMA ²
Slaughter bullocks and bulls	425	Montforts (1999) ¹
Slaughter calves and young cattle	140	Montforts (1999) ¹ ; EMA ²
Imported/ exported cattle for slaughter	425	Montforts (1999) ¹
Imported/ exported cattle for fattening	140	Montforts (1999) ¹
Livestock dairy cows	425	Montforts (1999) ¹ ; EMA ²
Pigs		
Slaughter pigs	65	Montforts (1999) ¹
Imported/ exported pigs for slaughter	65	Montforts (1999) ¹
Imported/ exported pigs for fattening	25	M. Goll (Eurostat, personal comm.)
Livestock sows	240	Montforts (1999) ¹
Poultry		
Slaughter broilers	1	Montforts (1999) ¹ ; EMA ²
Slaughter turkeys	6.5	Montforts (1999) ¹ ; EMA ²
Imported/ exported poultry for slaughter	1	Montforts (1999) ¹ ; EMA ²
Sheep and goats		
Slaughter sheep and goats	20	Montforts (1999) ¹
Imported/ exported sheep and goats for slaughter	20	Montforts (1999) ¹
Livestock sheep	75	Montforts (1999) ¹
Horses		
Living horses	400	Montforts (1999) ¹ ; EMA ²
Fish⁵		

¹ M.H.M.M. Montforts (1999). Environmental risk assessment for veterinary medicinal products. Part 1. Other than GMO-containing and immunological products. First update.

² European Medicines Agency (EMA). Revised guideline on environmental impact assessment for veterinary medicinal products in support of the VICH guidelines GL6 and GL 38 ([EMA/CVMP/ERA/418282/2005-Rev.1](https://www.ema.europa.eu/en/documents/regulatory-information/veterinary/ema-guideline-on-environmental-impact-assessment-for-veterinary-medicinal-products-in-support-of-the-vich-guidelines-gl6-and-gl-38_en.pdf)).

³ Assume broilers.

⁴ Assume lambs.

⁵ Data from Eurostat is given as 1,000 tonnes slaughtered fish (as live weight).

S1.3: Antibiotic Active Ingredients Authorised for Use in Animals

Class/Active Ingredient	Authorised Species	Administration Route
Tetracyclines		
Chlortetracycline	Cattle, Pigs, Sheep, Chickens, Turkey, Ducks	cutaneous spray, oral/water, premix
Doxycycline	Pigs, Chickens, Turkey, <i>Cats, Dogs, Pigeons</i>	tablet, oral/water, premix
Oxytetracycline	Cattle, Pigs, Sheep, Chickens, Salmon, Trout, <i>Dogs, Cats, Horses</i>	tablet, injectable, premix, oral/water, cutaneous spray
Tetracycline	Cattle, Pigs, Chickens	tablet, oral
Sul- Trim		
Sulfadiazine	Cattle, Pigs, Chickens, Turkey, <i>Cats, Dogs, Horses</i>	tablet, oral/water, injectable, premix, intramammary suspension,
Sulfadimethoxine	<i>Pigeons</i>	oral/water
Sulfadimidine	Cattle, Pigs, Sheep	injectable
Sulfadoxine	Cattle, <i>Horses</i>	injectable
Sulfamethoxazole	Pigs, Chickens	oral/water
Trimethoprim	Cattle, Pigs, Chickens, Turkey, <i>Cats, Dogs, Horses</i>	tablet, oral/water, premix, intramammary suspension
Beta-lactams		
<i>1st Generation Cephalosporins</i>		
Cefalexin	Cattle, <i>Cats, Dogs</i>	tablet, injectable, intramammary suspension
Cefalonium	Cattle	intramammary suspension
Cefapirin	Cattle	intramammary suspension, intrauterine suspension
<i>3rd Generation Cephalosporins*</i>		
Cefoperazone	Cattle	intramammary suspension
Cefovecin	<i>Cats, Dogs</i>	injectable
Ceftiofur	Cattle, Pigs, <i>Horses</i>	injectable
<i>4th Generation Cephalosporins*</i>		
Cefquinome	Cattle, Pigs, <i>Horses</i>	injectable, intramammary suspension/ointment
Penicillins		
Amoxicillin	Cattle, Pigs, Sheep, Chickens, Turkey, Ducks, Salmon, <i>Cats, Dogs, Pigeons</i>	injectable, tablet, oral/water, premix, intramammary suspension, top dressing
Ampicillin	Cattle, Pigs, Sheep, <i>Cats, Dogs</i>	injectable, tablet, intramammary suspension
Benzyloxy penicillin	Cattle, Pigs, Sheep, Chickens, <i>Cats, Dogs, Horses</i>	injectable, oral/water, intramammary suspension
Cloxacillin	Cattle, Sheep, <i>Cats, Dogs, Horses</i>	intramammary suspension, eye ointment
Nafcillin	Cattle	intramammary suspension
Phenoxymethylpenicillin	Pigs	premix
Aminoglycosides		
Apramycin	Cattle, Pigs, Chickens	premix, oral/water
Dihydrostreptomycin	Cattle, Pigs, Sheep, <i>Cats, Dogs, Horses</i>	injectable, intramammary suspension
Framycetin	Cattle, <i>Cats, Dogs</i>	injectable, intramammary suspension, ear drops
Gentamicin	<i>Cats, Dogs, Horses, Rabbits</i>	injectable, eye drops, ear drops, gel

Aminoglycosides continued		
Kanamycin	Cattle	intramammary suspension
Neomycin	Cattle, Sheep, <i>Cats, Dogs, Horses</i>	injectable, oral/water, intramammary suspension, ear drops
Spectinomycin	Cattle, Pigs, Sheep, Chickens	injectable, premix, oral/water
Streptomycin	Cattle, Sheep, <i>Cats, Dogs, Horses</i>	injectable, oral/water, intramammary suspension
Fluoroquinolones*		
Danofloxacin	Cattle, Pigs	injectable
Difloxacin	Cattle, Chickens, Turkeys, <i>Dogs</i>	injectable, tablet, oral/water
Enrofloxacin	Cattle, Pigs, Sheep, Chickens, Turkeys, Goats, <i>Cats, Dogs, Rabbits, Reptiles, Ornamental Birds, Rodents</i>	injectable, tablet, oral/water
Ibafloxacin	No currently authorised products	-
Marbofloxacin	Cattle, Pigs, <i>Cats, Dogs</i>	tablet, injectable, ear drops
Orbifloxacin	<i>Dogs</i>	<i>ear drops, oral/water</i>
Pradofloxacin	<i>Cats, Dogs</i>	<i>tablet</i>
Macrolides		
Erythromycin	Chickens	oral/water
Gamithromycin	Cattle	injectable
Spiramycin	Cattle, <i>Dogs, Cats</i>	injectable, tablet
Tildipirosin	Cattle, Pigs	injectable
Tilmicosin	Cattle, Pigs, Sheep, Chickens, Turkey, <i>Rabbits</i>	injectable, premix, oral/water
Tulathromycin	Cattle, Pigs	injectable
Tylosin	Cattle, Pigs, Chickens, Turkey	oral/water, premix, injectable
Tylvalosin	Pigs, Chickens, Turkey, Game Birds	oral/water, premix
Other		
<i>Amphenicols</i>		
Florfenicol	Cattle, Pigs, Sheep, Salmon	injectable, oral/water, premix, ear gel
<i>Lincomycins</i>		
Lincomycin	Cattle, Pigs, Chicken, <i>Cats, Dogs</i>	oral/water, premix, injectable, intramammary solution
Clindamycin	<i>Cats, Dogs</i>	tablet, oral/water
Pirlimycin	Cattle	intramammary solution
<i>Pleuromutilins</i>		
Tiamulin	Pigs, Chickens, Turkey, <i>Rabbits</i>	oral/water, premix, injectable
Valnemulin	Pigs, <i>Rabbits</i>	oral/water, premix
<i>Polymyxins</i>		
Colistin	Cattle, Pigs, Sheep, Chickens	oral/water
Polymyxin B	<i>Cats, Dogs</i>	<i>ear drops, cutaneous suspension</i>
<i>Steroidal antibiotics</i>		
Fusidic acid	<i>Cats, Dogs, Rabbits</i>	<i>ear drops, gel</i>

*denotes the classes of antibiotics which are considered 'highest priority critically important antibiotics for people' (HP-CIAs) based on classification by European Medicines ad hoc expert group on AMR.

Non- food producing species are indicated in italics

S1.4: Cascade Prescribing

The Cascade is a legislative provision in the Veterinary Medicines Regulations that allows a veterinary surgeon to prescribe unauthorised medicines that would not otherwise be permitted e.g. imported medicines or a medicine licensed for another species or human use. The principle of the Cascade is that, if there is no suitable veterinary medicine authorised in the UK to treat a condition, the veterinary surgeon responsible for the animal may in particular circumstances (for example to avoid causing unacceptable suffering) treat with an unauthorised medicine. Food producing animals may only be treated under the Cascade with medicines whose pharmacologically active substances are listed in the Table of Allowed Substances in Commission Regulation EU No 37/2010.

The data used in this report do not include data on sales of imported or human antibiotics used in animals in accordance with the prescribing cascade, as currently there is no mechanism by which such information can be obtained. The understanding is that use of human products in food producing species is not extensive, due to issues with longer withdrawal periods when using such products.

The VMD continues to explore methods that can accurately incorporate information on the amounts of antibiotics imported into/exported from the UK and methods that can accurately incorporate sales of antibiotics licensed for humans that are sold for animal use under the Cascade prescribing system.

SALES DATA CORRECTIONS - SUPPLEMENTUM

Supplementary Material for Chapter 3

S3.1: EU Harmonised Monitoring Requirements of 2013/652/EU

Table S3.1.1 Summary of requirements of 2013/652/EU

	Sampling Year						
	2014	2015	2016	2017	2018	2019	2020
<i>Salmonella</i> spp. - broilers	x		x		x		x
<i>Salmonella</i> spp. - layers	x		x		x		x
<i>Salmonella</i> spp. - fattening turkeys	x		x		x		x
<i>Salmonella</i> spp. - broiler carcasses	x		x		x		x
<i>Salmonella</i> spp. - fattening turkey carcasses	x		x		x		x
<i>Salmonella</i> spp. - pig carcasses		x		x		x	
<i>Campylobacter jejuni</i> - broilers	x		x		x		x
<i>Campylobacter jejuni</i> - fattening turkeys	x		x		x		x
<i>E. coli</i> - broiler caeca	x		x		x		x
<i>E. coli</i> - turkey caeca	x		x		x		x
<i>E. coli</i> - pig caeca		x		x		x	
ESBL, AmpC or carbapenemase producing <i>E. coli</i> - broiler caeca	x		x		x		x
ESBL, AmpC or carbapenemase producing <i>E. coli</i> - turkey caeca	x		x		x		x
ESBL, AmpC or carbapenemase producing <i>E. coli</i> - pig caeca		x		x		x	
ESBL, AmpC or carbapenemase producing <i>E. coli</i> - fresh broiler meat, pig meat and bovine meat gathered at retail	x	x	x	x	x	x	x
<i>Campylobacter coli</i> - broilers	x		x		x		x
<i>Campylobacter coli</i> - pig		x		x		x	
<i>E. faecium</i> and <i>E. faecalis</i> - broilers, fattening turkeys, fattening pigs, bovines <1yr age	x	x	x	x	x	x	x

Key:

x = Mandatory

x = Voluntary

Pig and Bovine

Poultry

Note: The UK is exempt from the monitoring of resistance in isolates of bovine origin as we do not meet the cattle (<1 year of age) slaughter throughput as specified in the legislation.

S3.2: EU Harmonised Monitoring results of Susceptibility testing in *E. coli*

Table S3.2.1: Resistance in *E. coli* (interpreted using both CBPs and ECVs) from broiler and turkey caecal samples

Antibiotic	No. of isolates resistant (Percentage resistant)							
	2014				2016			
	Broiler (n=159)		Turkey (n=168)		Broiler (n=190)		Turkey (n=224)	
	CBPs	ECVs	CBPs	ECVs	CBPs	ECVs	CBPs	ECVs
Ampicillin	116 (73)	116 (73)	116 (69)	116 (69)	128 (67.4)	128 (67.4)	136 (60.7)	136 (60.7)
Azithromycin	-	-	-	-	-	-	-	-
Cefotaxime	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.4)	1 (0.4)
Ceftazidime	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.4)	1 (0.4)
Chloramphenicol	20 (12.6)	14 (8.8)	20 (11.9)	17 (10.1)	13 (6.8)	7 (3.7)	20 (8.9)	17 (7.6)
Ciprofloxacin	6 (3.8)	39 (24.5)	12 (7.1)	29 (17.3)	5 (2.6)	41 (21.6)	11 (4.9)	35 (15.6)
Colistin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gentamicin	31 (19.5)	32 (20.1)	7 (4.2)	7 (4.2)	13 (6.8)	14 (7.4)	5 (2.2)	5 (2.2)
Meropenem	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Nalidixic acid	39 (24.5)	39 (24.5)	31 (18.5)	31 (18.5)	40 (21.1)	40 (21.1)	32 (14.3)	32 (14.3)
Sulphonamide	*	104 (65.4)	*	54 (32.1)	*	100 (52.6)	*	57 (25.4)
Tetracyclines	97 (61)	97 (61)	132(78.5)	132(78.6)	84 (44.2)	84 (44.2)	150 (67)	150 (67)
Tigecycline	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Trimethoprim	75 (47.2)	75 (47.2)	40 (23.8)	40 (23.8)	81 (42.6)	81 (42.6)	51 (22.8)	51 (22.8)

*No clinical breakpoint value available.

- Not applicable

S3.3: EU Harmonised Monitoring results of Susceptibility testing in *Campylobacter jejuni*

Table S3.3.1: Resistance in *Campylobacter jejuni* (interpreted using both CBPs and ECVs) from broiler and turkey caecal samples

Antibiotic	No. of isolates resistant (Percentage resistant)							
	2014				2016			
	Broiler (n=165)		Turkey (n=157)		Broiler (n=180)		Turkey (n=190)	
	CBPs	ECVs	CBPs	ECVs	CBPs	ECVs	CBPs	ECVs
Ciprofloxacin	72 (43.6)	72 (43.6)	55 (35)	55 (35)	73 (40.6)	73 (40.6)	66 (34.7)	66 (34.7)
Erythromycin	0 (0)	0 (0)	1 (0.6)	1 (0.6)	1 (0.6)	1 (0.6)	2 (1.1)	2 (1.1)
Gentamicin	*	0 (0)	*	2 (1.3)	*	0 (0)	*	0 (0)
Nalidixic acid	*	73 (44.2)	*	55 (35)	*	74 (41.1)	*	62 (32.6)
Streptomycin	*	0 (0)	*	2 (1.3)	*	2 (1.1)	*	3 (1.6)
Tetracyclines	95 (57.6)	97 (58.8)	102 (65)	102 (65)	101 (56.1)	101 (56.1)	79 (41.6)	82 (43.2)

*No clinical breakpoint value available.

S3.4: EU Harmonised Monitoring results of Susceptibility testing in *Salmonella*

Table S3.4.1: Resistance in *Salmonella* (interpreted using both CBPs and ECVs) from broiler, layer hen and turkey caecal samples

Antibiotic	No. of isolates resistant (Percentage resistant)											
	2014		2016		2014		2016		2014		2016	
	Broiler (n=168)		Broiler (n=170)		Layer (n=58)		Layer (n=34)		Turkey (n=162)		Turkey (n=169)	
	CBPs	ECVs	CBPs	ECVs	CBPs	ECVs	CBPs	ECVs	CBPs	ECVs	CBPs	ECVs
Ampicillin	6 (3.6)	6 (3.6)	6 (3.5)	6 (3.5)	0 (0)	0 (0)	2 (5.7)	2 (5.9)	37 (22.8)	37 (22.8)	9 (5.3)	9 (5.3)
Azithromycin	-	-	-	-	-	-	-	-	-	-	-	-
Cefotaxime	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Ceftazidime	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Chloramphenicol	12 (7.1)	2 (1.2)	10 (5.9)	1 (0.6)	1 (1.7)	0 (0)	1 (2.9)	0 (0)	25 (15.4)	1 (0.6)	5 (3)	1 (0.6)
Ciprofloxacin	0 (0)	6 (3.6)	1 (0.6)	15 (8.8)	0 (0)	1 (1.7)	0 (0)	3 (8.8)	0 (0)	33 (20.4)	0 (0)	3 (1.8)
Colistin	0 (0)	0 (0)	0 (0)	0 (0)	3 (5.2)	3 (5.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gentamicin	12 (7.2)	14 (8.3)	2 (1.2)	2 (1.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.6)	1 (0.6)
Meropenem	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Nalidixic acid	6 (3.6)	6 (3.6)	6 (3.5)	6 (3.5)	1 (1.7)	1 (1.7)	1 (2.9)	1 (2.9)	33 (20.4)	33 (20.4)	3 (1.8)	3 (1.8)
Sulphonamide	*	52 (31)	*	31 (18.2)	*	0 (0)	*	4 (11.8)	*	74 (45.7)	*	126 (74.6)
Tetracyclines	34 (20.2)	34 (20.2)	33 (19.4)	33 (19.4)	0 (0)	0 (0)	2 (5.7)	2 (5.7)	79 (48.8)	79 (48.8)	128 (75.7)	128 (75.7)
Tigecycline	0 (0)	10 (6)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (1.9)	13 (8)	0 (0)	0 (0)
Trimethoprim	32 (19)	32 (19)	0 (0)	0 (0)	0 (0)	0 (0)	1 (2.9)	1 (2.9)	12 (7.4)	12 (7.4)	4 (2.4)	4 (2.4)

*No clinical breakpoint value available

- Not applicable

S3.5: Food Business Operator *Salmonella* testing

Table S3.5.1 Resistance in FBO *Salmonella* in England and Wales

Antibiotic	No. resistant / No. tested (Percentage resistant)
	England & Wales 2016
Ampicillin	0/17 (0)
Azithromycin	0/17 (0)
Cefotaxime	0/17 (0)
Ceftazidime	0/17 (0)
Chloramphenicol	0/17 (0)
Ciprofloxacin	0/17 (0)
Colistin	0/17 (0)
Gentamicin	0/17 (0)
Meropenem	0/17 (0)
Nalidixic acid	0/7 (0)
Sulphonamide	2/17 (11.8)
Tetracyclines	1/17 (5.9)
Tigecycline	0/17 (0)
Trimethoprim	2/17 (11.8)

Supplementary Material for Chapter 4

S4.1: Disc diffusion breakpoints, corresponding MIC breakpoints and breakpoints under review for the main bacteria covered in this report.

Antibiotic	Disc Charge (micrograms)	<i>Escherichia coli</i> , Enterobacteriaceae	<i>Salmonella</i>	<i>Staphylococci</i>	<i>Streptococci</i>	<i>Pasteurella</i> , <i>Mannheimia</i> , <i>Histophilus</i> , <i>Actinobacillus</i>
Amikacin (AK)	30	R ≤ 18mm R ≥ 16mg/l	R ≤ 18mm R ≥ 16mg/l	NA	NA	NA
Amoxicillin/ clavulanic acid (AMC)	20/10	R ≤ 14mm R > 8mg/l	R ≤ 14mm R > 8mg/l	NA	NA	R ≤ 13mm
Amoxicillin/ clavulanic acid	2/1	NA	NA	R ≤ 17mm R > 1mg/l	R ≤ 13mm	NA
Ampicillin (AM)	10	R ≤ 14mm R > 8mg/l	R ≤ 14mm R > 8mg/l	R ≤ 13mm	R ≤ 13mm	R ≤ 29mm R > 1mg/l
Apramycin (APR)	15	R ≤ 13mm R ≥ 32 mg/l	R ≤ 13mm R ≥ 32 mg/l	NA	NA	R ≤ 13mm [†]
Cefotaxime (CTX)	30	R ≤ 29mm R ≥ 2mg/l	R ≤ 29mm R ≥ 2mg/l	NA	NA	NA
Cefpodoxime	10	R ≤ 17mm R > 1mg/l	NA	NA	NA	R ≤ 13mm
Ceftazidime (CAZ)	30	R ≤ 26mm R ≥ 2mg/l	R ≤ 26mm R ≥ 2mg/l	NA	NA	NA
Cefalexin	30	R ≤ 15mm R > 16mg/l	NA	R ≤ 13mm	R ≤ 24mm R > 2mg/l	R ≤ 13mm
Chloramphenicol (C)	30	R ≤ 20mm R > 8mg/l	R ≤ 20mm R > 8mg/l	NA	NA	NA

Antibiotic	Disc Charge (micrograms)	<i>Escherichia coli</i> , Enterobacteriaceae	<i>Salmonella</i>	<i>Staphylococci</i>	<i>Streptococci</i>	<i>Pasteurella</i> , <i>Mannheimia</i> , <i>Histophilus</i> , <i>Actinobacillus</i>
Ciprofloxacin (CIP)	1	NA	R ≤ 16mm R ≥ 1mg/l	NA	NA	NA
Doxycycline	30	R ≤ 13mm	NA	R ≤ 30mm R ≥ 2mg/l	NA	R ≤ 13mm
Erythromycin	5	NA	NA	R ≤ 19mm R ≥ 2mg/l	R ≤ 21mm* R ≥ 0.5mg/l	R ≤ 13mm
Enrofloxacin	5	R ≤ 13mm R ≥ 4mg/l	NA	R ≤ 13mm	R ≤ 13mm	R ≤ 13mm
Florfenicol	30	R ≤ 13mm R > 32mg/l	NA	NA	R ≤ 13mm	R ≤ 13mm
Furazolidone (FR)	15	NA	≤ 13mm	NA	NA	NA
Gentamicin (CN)	10	NA	R ≤ 19mm R ≥ 4mg/l	NA	NA	NA
Lincomycin	10	NA	NA	R ≤ 13mm	R ≤ 13mm	R ≤ 13mm
Nalidixic acid (NA)	NA	NA	≤ 13mm	NA	NA	NA
Neomycin (N)	10	R ≤ 13mm R > 8mg/l	R ≤ 13mm R > 8mg/l	NA	NA	NA
Neomycin	30	NA	NA	R ≤ 13mm	R ≤ 13mm	NA
Novobiocin	30	NA	NA	R ≤ 13mm	R ≤ 13mm	NA
Penicillin	1IU	NA	NA	R ≤ 24mm R > 0.12mg/l	R ≤ 19mm** R > 0.25mg/l	R ≤ 21mm R > 0.12 mg/l
Spectinomycin	25	R ≤ 13mm	NA	NA	NA	R ≤ 13mm [†]

Antibiotic	Disc Charge (micrograms)	<i>Escherichia coli</i> , Enterobacteriaceae	<i>Salmonella</i>	<i>Staphylococci</i>	<i>Streptococci</i>	<i>Pasteurella</i> , <i>Mannheimia</i> , <i>Histophilus</i> , <i>Actinobacillus</i>
Streptomycin (S)	10	R ≤ 12mm R > 8mg/l	R ≤ 13mm R > ~8mg/l	NA	NA	R ≤ 13mm [†]
Sulphonamide compounds (SU)	300	NA	≤ 13mm	NA	NA	NA
Tetracycline (T)	10	R ≤ 13mm R > 8mg/l	R ≤ 13mm R > 8mg/l	R ≤ 19mm R ≥ 2mg/l	R ≤ 19mm*** R ≥ 2mg/l	R ≤ 25mm
Trimethoprim/ sulphonamide (TM)	25	R ≤ 15mm R ≥ 4mg/l	R ≤ 15mm R ≥ 4mg/l	R ≤ 16mm R ≥ 4mg/l	R ≤ 19mm R ≥ 2mg/l	R ≤ 13mm
Tylosin	30	NA	NA	R ≤ 13mm	R ≤ 13mm	R ≤ 13mm

Key:

- BSAC human clinical breakpoint
- Animal and Plant Health Agency (APHA) historical veterinary disc diffusion zone size breakpoint and MIC corresponding to that zone size breakpoint
- Animal Health and Veterinary Laboratories Agency (AHVLA) historical veterinary breakpoint (under ongoing review)

Notes:

Where zone size disc diffusion data collected using the BSAC method and MIC data are both available then it is possible to draw regression lines and investigate the MIC which approximately corresponds to the historical veterinary breakpoint of 13mm. This has been done for several compounds (highlighted in blue in the table above).

BSAC state that all *Salmonella* isolates should be reported as resistant to gentamicin and amikacin; resistance traits are used for epidemiological purposes (correlation with particular resistance mechanisms) in this report.

The 16 antibiotics with antibiotic code e.g. amikacin (AK) are the set used for *Salmonella* susceptibility testing.

Some *Haemophilus-Pasteurella-Actinobacillus* i.e. "HPA" organisms, for example *Actinobacillus pleuropneumoniae*, show a degree of intrinsic resistance to aminoglycosides.

* Erythromycin R ≤ 21mm for beta-haemolytic streptococci; R ≤ 19mm for other streptococci.

** Penicillin R ≤ 19mm for beta-haemolytic streptococci; R ≤ 16mm for other streptococci.

*** Tetracycline R ≤ 19mm for beta-haemolytic streptococci; R ≤ 23mm for other streptococci

Table S4.1.1: Antibiotic disc concentrations used in Northern Ireland

Antibiotic	Expected Zone diameter (mm)			
	Disc	Resistant	Intermediate	Susceptible
Ampicillin	AMP10	<=13	14-16	>=17
Chloramphenicol	C30	<=12	13-17	>=18
Gentamicin	CN10	<=12	13-14	>=15
Kanamycin	K30	<=13	14-17	>=18
Streptomycin	S10	<=11	12-14	>=15
Sulphonamides	S3.300	<=12	13-16	>=17
Tetracycline	TE30	<=11	12-14	>=15
Trimethoprim	W5	<=10	11-15	>=16
Furazolidone	FR100		Not available	>=17
Nalidixic acid	NA30	<=13	14-18	>=19
Ciprofloxacin	CIP5	<=15	16-20	>=21
Cefotaxime	CTX30	<=22	23-25	>=26
Ceftazidime	CAZ30	<=17	18-20	>=21
Amoxicillin	AMC30	<=13	14-17	>=18
Framycetin	FY100		Not available	
Apramycin	APR15		Not available	
Spectinomycin	SH100		Not available	

S4.2: Clinical surveillance data for isolates from bovine mastitis cases

Table S4.2.1 Resistance (interpreted using BSAC CBPs) in *Escherichia coli* mastitis isolates

Antibiotic	No. (%) of isolates resistant		
	2014	2015	2016
Amoxi/Clav	11/149 (7.4)	13/88 (14.8)	6/106 (5.7)
Ampicillin	36/149 (24.2)	23/88 (26.1)	29/106 (27.4)
Cefotaxime	-	-	-
Cefpodoxime	3/149 (2)	2/88 (2.3)	0/106 (0)
Ceftazidime	-	-	-
Cefalexin	-	-	-
Enrofloxacin	4/149 (2.7)	0/88 (0)	2/106 (1.9)
Neomycin	6/149 (4)	4/88 (4.5)	8/106 (7.5)
Streptomycin	14/149 (9.4)	11/88 (12.5)	15/106 (14.2)
Tetracycline	17/149 (11.4)	16/88 (18.2)	18/106 (17)
Trimetho/Sulpho	13/149 (8.7)	9/88 (10.2)	14/106 (13.2)

- No isolates tested

Table S4.2.2: Resistance (interpreted using BSAC CBPs) of *staphylococci* and *streptococci* from mastitis cases

Antibiotic	No. resistant / No. tested (Percentage resistant)								
	<i>Staphylococcus aureus</i>			<i>Streptococcus uberis</i>			<i>Streptococcus dysgalactiae</i>		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
Amoxi/Clav	12/82 (14.6)	9/77 (11.7)	4/62 (6.5)	0/122 (0)	0/123 (0)	0/94 (0)	0/41 (0)	0/36 (0)	0/41 (0)
Ampicillin	29/82 (35.4)	25/77 (32.5)	7/62 (11.3)	0/122 (0)	0/123 (0)	0/94 (0)	0/41 (0)	0/36 (0)	0/41 (0)
Penicillin	29/82 (35.4)	25/77 (32.5)	8/62 (12.9)	0/122 (0)	0/123 (0)	0/94 (0)	0/41 (0)	0/36 (0)	0/41 (0)
Neomycin	0/82 (0)	2/77 (2.6)	0/62 (0)	72/121 (59.5)	79/119 (66.4)	47/93 (50.5)	10/41 (24.4)	3/36 (8.3)	10/40 (25)
Novobiocin	1/82 (1.2)	0/77 (0)	0/62 (0)	11/121 (9.1)	10/119 (8.4)	6/93 (6.5)	2/41 (4.9)	1/36 (2.8)	4/40 (10)
Tetracycline	3/82 (3.7)	4/77 (5.2)	1/62 (1.6)	66/122 (54.1)	62/123 (50.4)	37/94 (39.4)	35/41 (85.4)	34/36 (94.4)	40/41 (97.6)
Tylosin	1/82 (1.2)	2/77 (2.6)	0/62 (0)	20/122 (16.4)	14/123 (11.4)	8/94 (8.5)	4/41 (9.8)	2/36 (5.6)	4/41 (10)

S4.3: Clinical surveillance data for isolates from respiratory infections of cattle

Table S4.3.1: Resistance (interpreted using BSAC CBPs) of *Pasteurella multocida*, *Mannheimia haemolytica* and *Trueperella pyogenes* from respiratory infections of cattle*

Antibiotic	No. (%) of isolates resistant								
	<i>P. multocida</i>			<i>M. haemolytica</i>			<i>T. pyogenes</i>		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
Amoxicillin/Clavulanic acid	0/29 (0)	0/42 (0)	0/76 (0)	0/12 (0)	0/28 (0)	0/35 (0)	0/13 (0)	0/8 (0)	0/4 (0)
Ampicillin	1/29 (3.4)	0/42 (0)	2/76 (2.6)	0/12 (0)	1/28 (3.6)	0/35 (0)	0/13 (0)	0/8 (0)	0/4 (0)
Cefalexin	-	-	-	-	-	-	0/13 (0)	0/8 (0)	0/4 (0)
Cefpodoxime	0/29 (0)	0/42 (0)	0/76 (0)	0/12 (0)	0/28 (0)	0/35 (0)	-	-	-
Enrofloxacin	0/29 (0)	0/42 (0)	0/76 (0)	0/12 (0)	0/28 (0)	0/35 (0)	-	-	-
Florfenicol	0/29 (0)	1/42 (2.5)	2/70 (2.8)	2/12 (16.7)	0/28 (0)	1/35 (2.8)	0/13 (0)	0/8 (0)	0/4 (0)
Tetracycline	9/29 (31)	16/42 (38.1)	44/76 (57.8)	3/12 (25)	0/28 (0)	3/35 (8.6)	8/13 (61.5)	5/8 (62.5)	2/4 (50)
Trimethoprim/Sulphonamide	0/29 (0)	1/42 (2.4)	0/76 (0)	0/12 (0)	0/28 (0)	0/35 (0)	3/13 (23.1)	3/8 (37.5)	0/4 (0)
Tylosin	-	-	-	-	-	-	0/13 (0)	1/8 (12.5)	1/4 (25)

*No resistant *H. somni* isolates were detected between the years 2014 and 2016 and are, therefore, not included in this table.

- No isolates tested

S4.4: Clinical surveillance data for isolates from respiratory infections of pigs

Table S4.4.1 Resistance (interpreted using BSAC CBPs) of *Pasteurella multocida* and *Actinobacillus pleuropneumoniae* from respiratory infections of pigs

Antibiotic	No. resistant / No. tested (Percentage resistant)					
	Pigs, <i>P. multocida</i>			Pigs, <i>A. pleuropneumoniae</i>		
	2014	2015	2016	2014	2015	2016
Amoxicillin/Clavulanic acid	0/27 (0)	0/11 (0)	0/19 (0)	0/14 (0)	0/22 (0)	0/14 (0)
Ampicillin	1/33 (3)	0/12 (0)	6/31 (19.3)	0/14 (0)	2/22 (9.1)	1/15 (6.7)
Apramycin	1/32 (3.1)	0/12 (0)	1/31 (3.2)	4/14 (28.6)	2/22 (9.1)	3/15 (20)
Cefpodoxime	0/32 (0)	0/12 (0)	0/31 (0)	0/14 (0)	0/22 (0)	0/15 (0)
Doxycycline	0/27 (0)	0/11 (0)	0/19 (0)	0/14 (0)	0/22 (0)	0/14 (0)
Enrofloxacin	0/33 (0)	0/12 (0)	0/31 (0)	0/14 (0)	0/22 (0)	0/15 (0)
Florfenicol	0/27 (0)	0/11 (0)	0/19 (0)	0/14 (0)	0/22 (0)	0/14 (0)
Lincomycin	-	-	-	-	-	-
Neomycin	0/32 (0)	1/12 (8.3)	3/31 (9.7)	5/14 (35.7)	2/22 (9.1)	3/15 (20)
Spectinomycin	0/32 (0)	0/12 (0)	0/31 (0)	4/14 (28.6)	2/22 (9.1)	2/15 (13.3)
Streptomycin	3/27 (11.1)	2/11 (18.2)	6/19 (31.5)	5/14 (35.7)	2/22 (9.1)	2/14 (14.3)
Tetracycline	27/33 (81.8)	8/12 (66.7)	25/31 (80.6)	4/14 (28.6)	8/22 (36.4)	7/15 (46.7)
Trimethoprim/Sulphonamide	11/33 (33.3)	1/12 (8.3)	7/31 (22.6)	0/14 (0)	9/22 (40.9)	7/15 (46.7)
Tylosin	1/28 (3.6)	3/11 (27.3)	7/19 (36.8)	13/14 (92.9)	20/22 (90.9)	14/14 (100)

- No isolates tested

S4.5: Clinical surveillance data for isolates from respiratory infections of sheep

Table S4.5.1: Resistance (interpreted using BSAC CBPs) of *Pasteurella multocida*, *Mannheimia haemolytica*, *Bibersteinia trehalosi* and *Trueperella pyogenes* from sheep

Antibiotic	No. resistant / No. tested (Percentage resistant)											
	Sheep, <i>P. multocida</i>			Sheep, <i>M. haemolytica</i>			Sheep, <i>B. trehalosi</i>			Sheep, <i>T. pyogenes</i>		
	2014	2015	2016	2014	2015	2016	2014	2015	2016	2014	2015	2016
Amoxicillin/Clavulanic acid	0/2 (0)	0/3 (0)	0/4 (0)	0/24 (0)	0/35 (0)	0/49 (0)	0/21 (0)	0/40 (0)	0/95 (0)	0/10 (0)	0/1 (0)	0/2 (0)
Ampicillin	0/2 (0)	1/3 (33.3)	0/4 (0)	0/24 (0)	0/35 (0)	0/49 (0)	0/21 (0)	0/40 (0)	0/95 (0)	0/10 (0)	0/1 (0)	0/2 (0)
Cefalexin	-	-	-	-	-	-	-	-	-	0/10 (0)	0/1 (0)	0/2 (0)
Cefpodoxime	0/2 (0)	0/3 (0)	0/4 (0)	0/24 (0)	0/35 (0)	0/49 (0)	0/21 (0)	0/40 (0)	0/95 (0)	-	-	-
Enrofloxacin	0/2 (0)	0/3 (0)	0/4 (0)	0/24 (0)	0/35 (0)	0/49 (0)	0/21 (0)	0/40 (0)	1/95 (1.1)	-	-	-
Florfenicol	0/2 (0)	0/3 (0)	0/4 (0)	0/23 (0)	0/35 (0)	0/47 (0)	0/21 (0)	0/40 (0)	0/95 (0)	0/9 (0)	0/1 (0)	0/2 (0)
Tetracycline	0/2 (0)	0/3 (0)	2/4 (50)	2/24 (8.3)	1/35 (2.9)	2/49 (4.1)	0/21 (0)	1/40 (2.5)	2/95 (2.1)	2/10 (20)	0/1 (0)	1/2 (50)
Trimethoprim/Sulphonamide	0/2 (0)	0/3 (0)	0/4 (0)	1/24 (4.2)	1/35 (2.9)	0/49 (0)	0/21 (0)	1/40 (2.5)	0/95 (0)	4/9 (44.4)	0/1 (0)	0/2 (0)
Tylosin	-	-	-	-	-	-	-	-	-	0/10 (0)	0/1 (0)	1/2 (50)

- No isolates tested

S4.6: Other Veterinary Pathogens

Table S4.6.1: MIC values of *Brachyspira hyodysenteriae* isolates from infections of pigs to tiamulin

Year	MIC								
	<0.06	0.12	0.25	0.5	1	2	4	8	>8
2010	10	1	-	1	1	-	-	-	-
2011	10	-	-	-	-	2	-	-	-
2012	2	-	2	-	-	2	1	-	2
2013	-	-	1	2	1	-	1	-	3
2014	-	-	-	-	-	2	-	1	1
2015	-	-	3	-	-	1	-	1	-
2016	1	-	-	-	1	-	1	-	-

Table S4.6.2: Resistance (interpreted using BSAC CBPs) of *Streptococcus suis* from infections of pigs

Antibiotic	No. (%) of isolates resistant		
	Pigs, <i>S. suis</i>		
	2014	2015	2016
Ampicillin	0/64 (0)	0/63 (0)	0/86 (0)
Penicillin	0/64 (0)	0/63 (0)	0/86 (0)
Cefalexin	-	-	-
Enrofloxacin	0/64 (0)	0/63 (0)	0/86 (0)
Lincomycin	21/64 (32.8)	26/63 (41.3)	30/86 (34.9)
Tetracycline	61/64 (95.3)	59/63 (93.7)	78/86 (90.7)
Trimethoprim/Sulphonamide	15/64 (23.4)	14/63 (22.2)	11/56 (12.8)
Tylosin	24/64 (37.5)	37/63 (58.7)	37/56 (43)

- No isolates tested

Table S4.6.3: Resistance (interpreted using BSAC CBPs) of *Erysipelothrix rhusiopathiae* from infections of pigs

Antibiotic	No. (%) of isolates resistant		
	Pigs, <i>E. rhusiopathiae</i>		
	2014	2015	2016
Amoxicillin/Clavulanic acid	-	-	-
Ampicillin	0/11 (0)	0/6 (0)	0/18 (0)
Enrofloxacin	1/11 (9.1)	0/6 (0)	0/18 (0)
Lincomycin	0/11 (0)	0/6 (0)	0/18 (0)
Tetracycline	3/11 (27.3)	2/6 (33.3)	6/18 (33.3)
Trimethoprim/Sulphonamide	2/11 (18.2)	2/6 (33.3)	8/18 (44.4)
Tylosin	0/11 (0)	0/6 (0)	0/18 (0)

- No isolates tested

Table S4.6.4: Resistance (interpreted using BSAC CBPs) of *Staphylococcus aureus* from infections of chickens

Antibiotic	No. (%) of isolates resistant		
	Chickens, <i>S. aureus</i>		
	2014	2015	2016
Amoxicillin/Clavulanic acid	0/26 (0)	0/8 (0)	1/12 (8.3)
Ampicillin	0/26 (0)	0/8 (0)	1/15 (6.7)
Doxycycline	2/26 (7.7)	0/8 (0)	1/15 (6.7)
Enrofloxacin	0/26 (0)	0/8 (0)	1/15 (6.7)
Erythromycin	2/26 (8)	1/8 (12.5)	1/12 (8.3)
Lincomycin	2/26 (7.7)	1/8 (12.5)	0/15 (0)
Tetracycline	3/26 (11.5)	1/8 (12.5)	3/15 (20)
Trimethoprim/Sulphonamide	0/26 (0)	0/8 (0)	0/15 (0)
Tylosin	0/26 (0)	0/8 (0)	1/15 (6.7)

Table S4.6.5 Resistance (interpreted using BSAC CBPs) of *Listeria monocytogenes* and *Streptococcus dysgalactiae* from infections of sheep

Antibiotic	No. (%) of isolates resistant					
	Sheep, <i>Listeria monocytogenes</i>			Sheep, <i>Streptococcus dysgalactiae</i>		
	2014	2015	2016	2014	2015	2016
Amoxicillin/Clavulanic acid	0/2 (0)	0/4 (0)	0/49 (0)	0/14 (0)	0/18 (0)	0/35 (0)
Ampicillin	0/2 (0)	0/4 (0)	0/49 (0)	0/14 (0)	0/18 (0)	0/35 (0)
Cefalexin	0/2 (0)	3/4 (75)	7/49 (14.3)	0/14 (0)	0/18 (0)	0/35 (0)
Florfenicol	0/2 (0)	0/4 (0)	0/49 (0)	0/14 (0)	0/18 (0)	0/35 (0)
Tetracycline	1/2 (50)	0/4 (0)	2/49 (4.1)	14/14 (100)	18/18 (100)	34/35 (97.1)
Trimethoprim/Sulphonamide	0/2 (0)	0/4 (0)	0/49 (0)	0/14 (0)	0/18 (0)	0/35 (0)
Tylosin	0/2 (0)	0/4 (0)	0/49 (0)	3/14 (21.4)	0/18 (0)	4/35 (11.4)

S4.7 Clinical surveillance data for *E. coli*

Table S4.7.1: Resistance in all *E. coli* from cattle, sheep, pigs, chickens and turkeys (combined) in England & Wales, Northern Ireland and Scotland

Antibiotic	No. resistant / No. tested (Percentage resistant)								
	England & Wales			Northern Ireland			Scotland		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
Amikacin	2/590 (0.3)	3/524 (0.6)	4/467 (0.9)	-	-	-	-	-	-
Amoxi/Clav	314/1045 (30)	282/1034 (27.3)	221/1123 (19.7)	496/986 (50.3)	471/931 (50.6)	504/906 (55.6)	72/293 (24.6)	69/346 (19.9)	69/485 (14.2)
Ampicillin	733/1144 (64.1)	713/1101 (64.8)	683/1200 (56.7)	798/986 (80.9)	745/931 (80.3)	733/906 (80.9)	136/293 (46.4)	130/346 (37.6)	183/484 (37.8)
Apramycin	73/1118 (6.5)	60/1073 (5.6)	68/1135 (6)	116/980 (11.8)	138/917 (15)	97/865 (11.2)	3/236 (1.3)	3/271 (1.1)	7/426 (1.6)
Cefotaxime	80/593 (13.5)	49/526 (9.3)	62/469 (13.2)	-	-	-	-	-	-
Cefpodoxime	19/481 (4)	34/474 (7.2)	7/314 (2.2)	396/980 (40.4)	403/912 (44.2)	387/891 (43.4)	12/236 (5.1)	8/271 (3)	12/427 (2.8)
Ceftazidime	44/593 (7.4)	34/526 (6.5)	41/469 (8.7)	-	-	-	-	-	-
Chloramphenicol	298/590 (50.5)	244/524 (46.6)	200/467 (42.8)	-	-	-	0/2 (0)	0/1 (0)	0/4 (0)
Doxycycline	157/452 (34.7)	132/451 (29.3)	165/538 (30.7)	-	-	-	-	-	-
Enrofloxacin	93/1144 (8.1)	118/1101 (10.7)	78/1200 (6.5)	418/986 (42.4)	414/931 (44.5)	380/908 (41.9)	13/293 (4.4)	12/346 (3.5)	17/485 (3.5)
Florfenicol	209/764 (27.4)	174/709 (24.5)	164/792 (20.7)	448/919 (48.7)	413/878 (47)	404/808 (50)	33/223 (14.8)	28/257 (10.9)	31/202 (15.4)
Neomycin	287/1049 (27.4)	266/1030 (25.8)	249/1100 (22.6)	986/986 (100)	932/932 (100)	583/586 (99.5)	26/293 (8.9)	26/346 (7.5)	28/485 (5.8)
Spectinomycin	441/1118 (39.4)	462/1073 (43.1)	423/1135 (37.3)	-	-	3/35 (8.6)	56/236 (23.7)	60/271 (22.1)	78/426 (18.3)
Streptomycin	442/742 (59.6)	443/685 (64.7)	394/743 (53)	-	-	33/33 (100)	7/55 (12.7)	2/73 (2.7)	4/54 (7.4)
Tetracycline	779/1144 (68.1)	708/1101 (64.3)	727/1200 (60.6)	770/986 (78.1)	745/927 (80.4)	687/907 (75.7)	169/293 (57.7)	160/346 (46.2)	175/485 (36.1)
Trimetho/Sulpho	442/1144 (38.6)	420/1101 (38.1)	461/1200 (38.4)	629/986 (63.8)	615/926 (66.4)	551/907 (60.7)	76/293 (25.9)	64/346 (18.5)	99/485 (20.4)

- No isolates tested

Table S4.7.2: Resistance in all *E. coli* from cattle (all ages) in England & Wales, Northern Ireland and Scotland

Antibiotic	No. resistant / No. tested (Percentage resistant)								
	England & Wales			Northern Ireland			Scotland		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
Amikacin	2/492 (0.4)	2/441 (0.5)	3/365 (0.8)	-	-	-	-	-	-
Amoxi/Clav	271/533 (50.8)	223/494 (45.1)	175/450 (38.9)	424/733 (58)	443/714 (62)	410/695 (59.9)	61/146 (41.8)	44/150 (29.3)	48/161 (29.8)
Ampicillin	431/533 (80.9)	392/494 (79.4)	343/450 (76.2)	630/732 (86)	602/714 (84)	571/634 (83.5)	76/146 (52.1)	58/150 (38.7)	76/161 (47.2)
Apramycin	22/517 (4.3)	22/480 (4.6)	17/425 (4)	83/729 (11)	105/709 (15)	71/655 (10.8)	2/90 (2.2)	2/77 (2.6)	3/102 (2.9)
Cefotaxime	77/495 (15.6)	46/443 (10.4)	58/367 (15.8)	-	-	-	-	-	-
Cefpodoxime	-	-	-	308/731 (42)	328/704 (47)	304/680 (44.7)	12/90 (13.3)	0/78 (0)	10/103 (9.7)
Ceftazidime	42/495 (8.5)	32/443 (7.2)	38/367 (10.3)	-	-	-	-	-	-
Chloramphenicol	271/492 (55.1)	228/441 (51.7)	173/365 (47.4)	-	-	-	0/1 (0)	-	0/4 (0)
Doxycycline	-	-	-	-	-	-	-	-	-
Enrofloxacin	60/533 (11.3)	58/494 (11.7)	47/450 (10.4)	358/732 (50)	361/714 (51)	337/686 (49.1)	11/146 (7.5)	6/150 (4)	13/161 (8.1)
Florfenicol	190/507 (37.5)	147/455 (32.3)	132/392 (33.7)	416/728 (57)	402/712 (56)	373/653 (57.1)	32/90 (35.6)	22/77 (28.6)	28/104 (26.9)
Neomycin	250/517 (48.4)	217/480 (45.2)	174/425 (40.9)	732/732 (100)	714/714 (100)	420/422 (99.5)	21/146 (14.4)	20/150 (13.3)	22/161 (13.7)
Spectinomycin	231/517 (44.7)	218/480 (45.4)	166/425 (39.1)	-	-	2/33 (6.1)	34/90 (37.8)	29/77 (37.7)	31/102 (30.4)
Streptomycin	316/492 (64.2)	315/441 (71.4)	221/365 (60.5)	-	-	31/31 (100)	7/55 (12.7)	1/72 (2.4)	4/54 (7.4)
Tetracycline	424/533 (79.5)	369/494 (74.7)	331/450 (73.6)	597/732 (82)	593/711 (83)	542/685 (79.1)	81/146 (55.5)	65/150 (43.3)	74/161 (46)
Trimetho/Sulph	261/533 (49)	224/494 (45.3)	210/450 (46.7)	503/732 (69)	505/711 (71)	452/685 (66)	43/146 (29.5)	26/150 (17.3)	39/161 (24.2)

- No isolates tested

Table S4.7.3: Resistance in all *E. coli* from pigs (all ages) in England & Wales, Northern Ireland and Scotland

Antibiotic	No. resistant / No. tested (Percentage resistant)								
	England & Wales			Northern Ireland			Scotland		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
Amikacin	-	-	-	-	-	-	-	-	-
Amoxi/Clav	6/151 (4)	8/159 (5)	11/267 (4.1)	33/101 (33)	21/93 (23)	39/77 (50.6)	3/11 (27.3)	5/22 (22.7)	4/28 (14.3)
Ampicillin	104/180 (57.8)	102/182 (56)	165/300 (55)	71/101 (70)	67/93 (72)	61/78 (78.2)	6/11 (54.5)	6/22 (27.3)	9/28 (32.1)
Apramycin	34/180 (18.9)	31/182 (17)	40/300 (13.3)	20/100 (20)	20/93 (22)	13/77 (16.9)	0/11 (0)	0/22 (0)	0/28 (0)
Cefotaxime	-	-	-	-	-	-	-	-	-
Cefpodoxime	7/180 (3.9)	3/182 (1.6)	7/300 (2.3)	28/100 (28)	26/93 (28)	19/77 (24.7)	0/11 (0)	0/21 (0)	0/28 (0)
Ceftazidime	-	-	-	-	-	-	-	-	-
Chloramphenicol	-	-	-	-	-	-	-	-	-
Doxycycline	90/151 (59.6)	79/159 (49.7)	128/267 (47.9)	-	-	-	-	-	-
Enrofloxacin	17/180 (9.4)	7/182 (3.8)	17/300 (5.7)	23/101 (23)	28/93 (30)	16/78 (20.5)	0/11 (0)	2/22 (9.1)	3/28 (10.7)
Florfenicol	8/151 (5.3)	16/159 (10.1)	21/267 (7.9)	12/100 (12)	12/93 (13)	8/77 (10.4)	0/11 (0)	1/22 (4.5)	0/28 (0)
Neomycin	7/180 (3.9)	15/182 (8.2)	19/300 (6.3)	101/101 (100)	93/93 (100)	74/74 (100)	0/11 (0)	0/22 (0)	0/28 (0)
Spectinomycin	86/180 (47.8)	78/182 (42.9)	138/300 (46)	-	-	-	5/11 (45.4)	3/22 (13.6)	6/28 (21.4)
Streptomycin	82/151 (54.3)	71/159 (44.7)	116/267 (43.4)	-	-	-	-	-	-
Tetracycline	142/180 (78.9)	121/182 (66.5)	90/300 (66.3)	81/101 (80)	76/93 (82)	60/78 (76.9)	8/11 (72.7)	9/22 (40.9)	12/28 (42.9)
Trimetho/Sulph	102/180 (56.7)	99/182 (54.4)	163/300 (54.3)	79/101 (78)	70/92 (76)	50/78 (64.1)	6/11 (54.5)	3/22 (13.6)	11/28 (39.3)

- No isolates tested

Table S4.7.4: Resistance in all *E. coli* from sheep (all ages) in England & Wales, Northern Ireland and Scotland

Antibiotic	No. resistant / No. tested (Percentage resistant)								
	England & Wales			Northern Ireland			Scotland		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
Amikacin	0/98 (0)	1/83 (1.2)	1/102 (1)	-	-	-	-	-	-
Amoxi/Clav	26/130 (20)	21/133 (15.8)	26/179 (14.5)	23/83 (28)	24/66 (36)	30/69 (44.1)	8/29 (27.6)	11/48 (22.9)	13/70 (18.6)
Ampicillin	71/130 (54.6)	74/133 (55.6)	86/179 (48)	60/83 (72)	44/66 (67)	51/65 (79.4)	11/29 (37.9)	19/48 (39.6)	27/70 (38.6)
Apramycin	3/120 (2.5)	1/119 (0.8)	5/139 (3.6)	8/83 (10)	7/66 (11)	6/67 (9)	0/28 (0)	1/46 (2.2)	0/70 (0)
Cefotaxime	3/98 (3.1)	3/83 (3.6)	4/102 (3.9)	-	-	-	-	-	-
Cefpodoxime	-	-	-	30/83 (36)	25/66 (38)	21/68 (30.9)	0/28 (0)	0/46 (0)	2/70 (2.9)
Ceftazidime	2/98 (2)	2/83 (2.4)	3/102 (2.9)	-	-	-	-	-	-
Chloramphenicol	27/98 (27.6)	16/83 (19.3)	27/102 (26.5)	-	-	-	0/1 (0)	0/1 (0)	-
Doxycycline	-	-	-	-	-	-	-	-	-
Enrofloxacin	1/130 (0.8)	2/133 (1.5)	7/179 (3.9)	13/83 (22)	11/66 (17)	9/68 (13.2)	0/29 (0)	2/48 (3.6)	1/70 (1.4)
Florfenicol	11/106 (10.4)	11/95 (11.6)	11/133 (8.3)	19/83 (23)	19/66 (29)	16/67 (23.9)	1/28 (3.6)	5/44 (11.4)	3/70 (4.3)
Neomycin	9/121 (7.4)	21/121 (17.4)	23/148 (15.5)	83/83 (100)	66/66 (100)	38/38 (100)	4/29 (13.8)	4/48 (8.3)	5/70 (7.1)
Spectinomycin	52/120 (43.3)	67/119 (56.3)	63/139 (45.3)	-	-	-	7/28 (25)	13/46 (28.3)	18/70 (25.7)
Streptomycin	44/99 (44.4)	57/85 (67.1)	57/111 (51.4)	-	-	-	-	1/1 (100)	-
Tetracycline	89/130 (68.5)	86/133 (64.7)	111/179 (62)	60/83 (72)	48/66 (72)	47/68 (69.1)	18/29 (62.1)	26/48 (54.2)	34/70 (48.6)
Trimetho/Sulph	28/130 (21.5)	36/133 (27.1)	39/179 (21.8)	32/83 (39)	22/66 (33)	26/68 (38.2)	7/29 (24.1)	7/48 (14.6)	12/70 (17.1)

- No isolates tested

Table S4.7.5: Resistance in all *E. coli* from chickens (all ages) in England & Wales, Northern Ireland and Scotland

Antibiotic	No. resistant / No. tested (Percentage resistant)								
	England & Wales			Northern Ireland			Scotland		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
Amikacin	-	-	-	-	-	-	-	-	-
Amoxi/Clav	11/230 (4.8)	30/248 (12.1)	8/223 (3.6)	3/33 (9)	5/25 (20)	5/30 (16.7)	0/94 (0)	9/114 (7.9)	4/212 (1.9)
Ampicillin	124/294 (42.2)	143/287 (49.8)	82/264 (31.1)	16/33 (48)	18/26 (72)	16/30 (53.3)	32/94 (34)	38/114 (33.3)	63/212 (29.7)
Apramycin	14/294 (4.8)	6/287 (2.1)	6/264 (2.3)	1/33 (3)	2/26 (8)	1/30 (3.3)	1/94 (1.1)	0/114 (0)	3/212 (1.4)
Cefotaxime	-	-	-	-	-	-	-	-	-
Cefpodoxime	12/294 (4.1)	31/287 (10.8)	9/264 (3.4)	14/33 (42)	14/26 (54)	21/31 (67.7)	0/94 (0)	8/114 (7)	0/212 (0)
Ceftazidime	-	-	-	-	-	-	-	-	-
Chloramphenicol	-	-	-	-	-	-	-	-	-
Doxycycline	65/294 (22.1)	49/287 (17.1)	34/264 (12.9)	-	-	-	-	-	-
Enrofloxacin	14/294 (4.8)	50/287 (17.4)	7/264 (2.7)	3/33 (9)	6/26 (23)	6/30 (20)	1/94 (1.1)	1/114 (0.9)	0/212 (0)
Florfenicol	-	-	-	-	-	3/3 (100)	0/94 (0)	0/114 (0)	-
Neomycin	21/230 (9.1)	13/247 (5.3)	32/223 (14.3)	33/33 (100)	26/26 (100)	15/15 (100)	1/94 (1.1)	2/114 (1.8)	1/212 (0.5)
Spectinomycin	71/294 (24.1)	99/287 (34.5)	53/264 (20.1)	-	-	-	9/94 (9.6)	14/114 (12.3)	20/212 (9.4)
Streptomycin	-	-	-	-	-	-	-	-	-
Tetracycline	120/294 (40.8)	128/287 (44.6)	81/264 (30.7)	12/33 (36)	13/26 (50)	11/30 (36.7)	52/94 (55.3)	52/114 (45.6)	47/212 (22.2)
Trimetho/Sulph	50/294 (17)	60/287 (20.9)	48/264 (18.1)	5/33 (15)	7/26 (27)	5/30 (16.7)	18/94 (19.1)	20/114 (17.5)	31/212 (14.6)

- No isolates tested

Table S4.7.6: Resistance in all *E. coli* from turkeys (all ages) in England & Wales, Northern Ireland and Scotland

Antibiotic	No. resistant / No. tested (Percentage resistant)								
	England & Wales			Northern Ireland			Scotland		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
Amikacin	-	-	-	-	-	-	-	-	-
Amoxi/Clav	0/1 (0)	-	1/4 (25)	2/7 (29)	1/3 (33)	3/8 (37.5)	0/13 (0)	0/12 (0)	0/14 (0)
Ampicillin	3/7 (42.9)	2/5 (40)	7/7 (100)	5/7 (71)	2/3 (66)	7/8 (87.5)	11/13 (84.6)	9/12 (75)	8/13 (61.5)
Apramycin	0/7 (0)	0/5 (0)	0/7 (0)	0/7 (0)	1/3 (33)	3/3 (37.5)	0/13 (0)	0/12 (0)	1/14 (7.1)
Cefotaxime	-	-	-	-	-	-	-	-	-
Cefpodoxime	0/7 (0)	0/5 (0)	0/7 (0)	2/7 (29)	2/3 (66)	6/8 (75)	0/13 (0)	0/12 (0)	0/14 (0)
Ceftazidime	-	-	-	-	-	-	-	-	-
Chloramphenicol	-	-	-	-	-	-	-	-	-
Doxycycline	2/7 (28.6)	4/5 (80)	3/7 (42.9)	-	-	-	-	-	-
Enrofloxacin	1/7 (14.3)	1/5 (20)	0/7 (0)	1/7 (0.1)	-	2/8 (25)	1/13 (7.7)	1/12 (8.3)	0/14 (0)
Florfenicol	-	-	-	-	-	-	-	-	-
Neomycin	0/1 (0)	-	1/4 (25)	7/7 (100)	3/3 (100)	6/6 (100)	0/13 (0)	0/12 (0)	0/14 (0)
Spectinomycin	1/7 (14.3)	0/5 (0)	3/7 (42.9)	-	-	-	1/13 (7.7)	1/12 (8.3)	3/14 (21.4)
Streptomycin	-	-	-	-	-	-	-	-	-
Tetracycline	4/7 (57.1)	4/5 (80)	5/7 (71.4)	6/7 (86)	2/3 (66)	6/8 (75)	10/13 (76.9)	8/12 (66.7)	8/14 (57.1)
Trimetho/Sulph	1/7 (14.3)	1/5 (20)	1/7 (14.3)	2/7 (29)	2/3 (66)	3/8 (37.5)	2/13 (7.7)	8/12 (66.7)	6/14 (42.9)

- No isolates tested

Table S4.7.7: Resistance in *E. coli* from cattle in England & Wales, Northern Ireland and Scotland in 2014

Antibiotic	No. resistant / No. tested (Percentage resistant)						
	England & Wales			Northern Ireland ¹	Scotland		
	Neonatal	Pre-weaning	Adult	Neonatal	Neonatal	Pre-weaning	Adult
Amikacin	2/432 (0.5)	0/28 (0)	0/3 (0)	-	-	-	-
Amoxi/Clav	231/449 (51.4)	20/44 (45.5)	2/8 (25)	207/321 (64)	35/103 (34)	25/37 (67.6)	1/5 (20)
Ampicillin	365/449 (81.3)	32/44 (72.7)	6/8 (75)	287/321 (89)	46/103 (44.7)	28/37 (75.7)	2/5 (40)
Apramycin	20/442 (4.5)	2/37 (5.4)	0/7 (0)	43/320 (13)	1/52 (1.9)	1/37 (2.7)	-
Cefotaxime	64/432 (14.8)	7/28 (25)	4/6 (66.7)	-	-	-	-
Ceftazidime	32/432 (7.4)	5/28 (17.9)	3/6 (50)	-	-	-	-
Chloramphenicol	237/432 (54.9)	12/28 (42.9)	3/3 (100)	-	1/1 (100)	-	-
Enrofloxacin	52/449 (11.6)	4/44 (9.1)	2/8 (25)	163/321 (51)	5/103 (4.9)	6/37 (16.2)	0/5 (0)
Florfenicol	163/439 (37.1)	10/35 (28.6)	2/3 (66.7)	187/320 (58)	14/52 (26.9)	18/37 (48.6)	-
Neomycin	218/442 (49.3)	18/37 (48.6)	1/7 (14.3)	321/321 (100)	11/103 (10.7)	10/37 (27)	0/5 (0)
Spectinomycin	204/442 (46.2)	11/37 (29.7)	1/7 (14.3)	-	18/52 (34.6)	16/37 (43.2)	-
Streptomycin	278/432 (64.4)	14/28 (50)	2/3 (66.7)	-	7/50 (14)	-	0/5 (0)
Tetracycline	357/449 (79.5)	37/44 (84.1)	5/8 (62.5)	260/321 (81)	45/103 (43.7)	33/37 (89.2)	2/5 (40)
Trim/Sulpho	217/449 (48.3)	22/44 (50)	3/8 (37.5)	223/321 (69)	23/103 (22.3)	19/37 (51.4)	1/5 (20)

¹ No pre-weaning or adult data available for Northern Ireland.
 - No isolates tested

Table S4.7.8: Resistance in *E. coli* from cattle in England & Wales, Northern Ireland and Scotland in 2015

Antibiotic	No. resistant / No. tested (Percentage resistant)						
	England & Wales			Northern Ireland ¹	Scotland		
	Neonatal	Pre-weaning	Adult	Neonatal	Neonatal	Pre-weaning	Adult
Amikacin	2/352 (0.6)	0/59 (0)	0/7 (0)	-	-	-	-
Amoxi/Clav	181/376 (48.1)	23/75 (30.7)	5/15 (33.3)	201/331 (61)	23/114 (24.6)	15/30 (50)	1/6 (16.7)
Ampicillin	310/376 (82.4)	52/75 (69.3)	10/15 (66.7)	296/331 (89)	40/114 (35.1)	16/30 (1.9)	2/6 (33.3)
Apramycin	12/369 (3.3)	8/73 (11)	1/13 (7.7)	34/329 (10)	2/45 (4.4)	0/30 (0)	0/2 (0)
Cefotaxime	37/352 (10.5)	3/59 (5.1)	2/9 (22.2)	-	-	-	-
Ceftazidime	28/352 (8)	2/59 (3.4)	1/9 (11.1)	-	-	-	-
Chloramphenicol	174/352 (49.4)	35/59 (59.3)	3/7 (42.9)	-	-	-	-
Enrofloxacin	38/376 (10.1)	11/75 (14.7)	4/15 (26.7)	167/331 (50)	2/114 (1.8)	4/30 (7.5)	0/6 (0)
Florfenicol	105/359 (29.2)	25/61 (41)	3/9 (33.3)	187/331 (56)	10/45 (22.2)	12/30 (2.5)	0/2 (0)
Neomycin	161/369 (43.6)	39/73 (53.4)	6/13 (46.2)	331/331 (100)	11/114 (9.6)	8/30 (3.75)	1/6 (16.7)
Spectinomycin	173/369 (46.9)	29/73 (39.7)	4/13 (30.8)	-	20/45 (44.4)	8/30 (3.75)	1/2 (50)
Streptomycin	250/352 (71)	46/59 (78)	4/7 (57.1)	-	1/68 (1.5)	-	0/4 (0)
Tetracycline	284/376 (75.5)	55/75 (73.3)	11/15 (73.3)	284/331 (86)	46/114 (40.4)	18/30 (1.7)	1/6 (16.7)
Trim/Sulpho	168/376 (44.7)	34/75 (45.3)	7/15 (46.7)	245/331 (74)	17/114 (14.9)	9/30 (3.3)	0/6 (0)

¹ No pre-weaning or adult data available for Northern Ireland.
 - No isolates tested

Table S4.7.9 Resistance in *E. coli* from cattle in England & Wales, Northern Ireland and Scotland in 2016

Antibiotic	No. resistant / No. tested (Percentage resistant)						
	England & Wales			Northern Ireland ¹	Scotland		
	Neonatal	Pre-weaning	Adult	Neonatal	Neonatal	Pre-weaning	Adult
Amikacin	3/305 (1)	0/33 (0)	0/1 (0)	-	-	-	-
Amoxi/Clav	136/336 (40.5)	30/62 (48.4)	0/16 (0)	338/524 (64.5)	33/103 (32)	11/38 (29)	4/20 (20)
Ampicillin	266/336 (79.2)	53/62 (85.5)	5/16 (31.3)	457/523 (87.4)	48/103 (46.6)	20/38 (52.6)	8/20 (40)
Apramycin	15/328 (4.6)	1/54 (1.9)	0/12 (0)	60/525 (11.4)	3/52 (5.8)	0/35 (0)	0/15 (0)
Cefotaxime	49/306 (16)	5/34 (14.7)	0/1 (0)	-	-	-	-
Ceftazidime	31/306 (10.1)	5/34 (14.7)	0/1 (0)	-	-	-	0/3 (0)
Chloramphenicol	147/305 (48.2)	12/33 (36.4)	0/1 (0)	-	0/1 (0)	0/3 (0)	-
Enrofloxacin	35/336 (10.4)	8/62 (12.9)	2/16 (12.5)	227/525 (43.2)	6/103 (5.8)	4/38 (10.5)	3/20 (15)
Florfenicol	107/314 (34.1)	12/42 (28.6)	0/5 (0)	308/525 (58.7)	11/53 (20.8)	14/35 (40)	3/16 (18.8)
Neomycin	145/328 (44.2)	18/54 (33.3)	1/12 (8.3)	337/338 (99.7)	10/103 (9.7)	10/38 (26.3)	2/20 (10)
Spectinomycin	131/328 (39.9)	21/54 (38.9)	3/12 (25)	-	18/52 (34.6)	11/35 (31.4)	2/15 (13.3)
Streptomycin	186/305 (61)	20/33 (60.6)	1/1 (100)	-	3/50 (6)	-	1/4 (25)
Tetracycline	257/336 (76.5)	47/62 (75.8)	7/16 (43.8)	437/524 (83.4)	44/103 (42.7)	24/38 (63.2)	6/20 (30)
Trim/Sulpho	161/336 (47.9)	29/62 (46.8)	6/16 (37.5)	365/524 (69.7)	19/103 (18.5)	17/38 (44.7)	3/20 (15)

¹ No pre-weaning or adult data available for Northern Ireland.
 - No isolates tested

Table S4.7.10: Resistance in *E. coli* from pigs in England & Wales, Northern Ireland and Scotland in 2014

Antibiotic	No. resistant / No. tested (Percentage resistant)						
	England & Wales			Northern Ireland ¹	Scotland		
	Neonatal	Post-weaning	Adult	Neonatal	Neonatal	Post--weaning	Adult
Amoxi/Clav	0/25 (0)	3/78 (3.8)	0/6 (0)	11/43 (26)	2/7 (28.6)	0/1 (0)	0/1 (0)
Ampicillin	19/39 (48.7)	51/84 (60.7)	3/7 (42.9)	28/43 (65)	3/7 (42.9)	0/1 (0)	1/1 (100)
Apramycin	1/39 (2.6)	31/84 (36.9)	0/7 (0)	8/43 (19)	0/7 (0)	0/1 (0)	0/1 (0)
Cefpodoxime	0/39 (0)	1/84 (1.2)	0/7 (0)	9/43 (21)	0/7 (0)	0/1 (0)	-
Doxycycline	12/25 (48)	51/78 (65.4)	3/6 (50)	-	-	-	-
Enrofloxacin	7/39 (17.9)	5/84 (6)	1/7 (14.3)	10/43 (23)	0/7 (0)	0/1 (0)	0/1 (0)
Florfenicol	1/25 (4)	4/78 (5.1)	0/6 (0)	9/43 (21)	0/7 (0)	0/1 (0)	0/1 (0)
Neomycin	2/39 (5.1)	2/84 (2.4)	1/7 (14.3)	43/43 (100)	0/7 (0)	0/1 (0)	0/1 (0)
Spectinomycin	20/39 (51.3)	44/84 (52.4)	3/7 (42.9)	-	3/7 (42.9)	1/1 (100)	0/1 (0)
Streptomycin	10/25 (40)	49/78 (62.8)	3/6 (50)	-	-	-	-
Tetracycline	30/39 (76.9)	69/84 (82.1)	5/7 (71.4)	33/43 (77)	5/7 (71.4)	1/1 (100)	0/1 (0)
Trimetho/Sulph	19/39 (48.7)	54/84 (64.3)	2/7 (28.6)	40/43 (93)	3/7 (42.9)	1/1 (100)	0/1 (0)

¹ No post-weaning or adult data available for Northern Ireland.

- No isolates tested

Table S4.7.11: Resistance in *E. coli* from pigs in England & Wales, Northern Ireland and Scotland in 2015

Antibiotic	No. resistant / No. tested (Percentage resistant)						
	England & Wales			Northern Ireland ¹	Scotland		
	Neonatal	Post-weaning	Adult	Neonatal	Neonatal	Post--weaning	Adult
Amoxi/Clav	2/30 (6.7)	4/93 (4.3)	1/7 (14.3)	10/47 (21)	1/5 (20)	3/15 (20)	1/1 (100)
Ampicillin	18/39 (46.2)	63/97 (64.9)	3/7 (42.9)	36/47 (77)	1/5 (20)	4/15 (26.7)	1/1 (100)
Apramycin	0/39 (0)	25/97 (25.8)	0/7 (0)	10/47 (21)	0/5 (0)	0/15 (0)	1/1 (0)
Cefpodoxime	0/39 (0)	2/97 (2.1)	0/7 (0)	9/47 (19)	0/5 (0)	0/15 (0)	-
Doxycycline	13/30 (43.3)	51/93 (54.8)	2/7 (28.6)	-	-	-	-
Enrofloxacin	1/39 (2.6)	5/97 (5.2)	0/7 (0)	16/47 (34)	0/5 (0)	2/15 (13.3)	0/1 (0)
Florfenicol	1/30 (3.3)	13/93 (14)	1/7 (14.3)	4/47 (9)	0/5 (0)	0/15 (0)	1/1 (100)
Neomycin	1/39 (2.6)	12/97 (12.4)	0/7 (0)	47/47 (100)	0/5 (0)	0/15 (0)	0/1 (0)
Spectinomycin	15/39 (38.5)	48/97 (49.5)	2/7 (28.6)	-	0/5 (0)	0/15 (0)	0/1 (0)
Streptomycin	10/30 (33.3)	45/93 (48.4)	4/7 (57.1)	-	-	-	-
Tetracycline	28/39 (71.8)	67/97 (69.1)	3/7 (42.9)	40/47 (85)	3/5 (60)	5/15 (33.3)	1/1 (100)
Trimetho/Sulph	17/39 (43.6)	63/97 (64.9)	3/7 (42.9)	37/47 (78)	0/5 (0)	3/15 (20)	0/1 (0)

¹ No post-weaning or adult data available for Northern Ireland.

- No isolates tested

Table S4.7.12: Resistance in *E. coli* from pigs in England & Wales, Northern Ireland and Scotland in 2016

Antibiotic	No. resistant / No. tested (Percentage resistant)						
	England & Wales			Northern Ireland ¹	Scotland		
	Neonatal	Post-weaning	Adult	Neonatal	Neonatal	Post-weaning	Adult
Amoxi/Clav	2/62 (3.2)	8/155 (5.2)	-	12/21 (57.1)	0/3 (0)	3/19 (15.8)	1/6 (16.7)
Ampicillin	40/71 (56.3)	94/168 (56)	1/1 (100)	14/21 (66.7)	1/3 (33.3)	7/19 (36.8)	1/6 (16.7)
Apramycin	1/71 (1.4)	33/168 (19.6)	0/1 (0)	6/21 (28.6)	0/3 (0)	0/19 (0)	0/6 (0)
Cefpodoxime	2/71 (2.8)	4/168 (2.4)	0/1 (0)	6/21 (28.6)	0/3 (0)	0/19 (0)	0/6 (0)
Doxycycline	33/62 (53.2)	78/155 (50.3)	-	-	-	-	-
Enrofloxacin	9/71 (12.7)	4/168 (2.4)	0/1 (0)	6/21 (28.6)	1/3 (33.3)	2/19 (10.5)	0/6 (0)
Florfenicol	3/62 (4.8)	15/155 (9.7)	-	2/21 (9.5)	0/3 (0)	0/19 (0)	0/6 (0)
Neomycin	3/71 (4.2)	12/168 (7.1)	0/1 (0)	21/21 (100)	0/3 (0)	0/19 (0)	0/6 (0)
Spectinomycin	29/71 (40.8)	88/168 (52.4)	0/1 (0)	-	1/3 (33.3)	4/19 (21.1)	1/6 (16.7)
Streptomycin	22/62 (35.5)	71/155 (45.8)	-	-	-	-	-
Tetracycline	51/71 (71.8)	116/168 (69)	0/1 (0)	17/21 (81)	2/3 (66.7)	9/19 (47.4)	1/6 (16.7)
Trimetho/Sulph	36/71 (50.7)	101/168 (60.1)	0/1 (0)	14/21 (66.7)	3/3 (100)	7/19 (36.8)	1/6 (16.7)

¹ No post-weaning or adult data available for Northern Ireland
 - No isolates tested

Table S4.7.13: Resistance in *E. coli* from sheep in England & Wales, Northern Ireland and Scotland in 2014

Antibiotic	No. resistant / No. tested (Percentage resistant)						
	England & Wales			Northern Ireland ¹	Scotland		
	Neonatal	Pre-weaning	Adult	Neonatal	Neonatal	Pre-weaning	Adult
Amoxi/Clav	23/105 (21.9)	0/12 (0)	1/5 (20)	3/25 (12)	3/21 (14.3)	3/4 (75)	2/4 (50)
Ampicillin	58/105 (55.2)	4/12 (33.3)	2/5 (40)	17/25 (68)	6/21 (28.6)	3/4 (75)	2/4 (50)
Apramycin	3/100 (3)	0/11 (0)	0/2 (0)	2/25 (8)	0/20 (0)	0/4 (0)	0/4 (0)
Cefotaxime	3/89 (3.4)	0/3 (0)	-	-	-	-	-
Ceftazidime	2/89 (2.2)	0/3 (0)	-	-	-	-	-
Chloramphenicol	26/89 (29.2)	0/3 (0)	-	-	0/1 (0)	0/4 (0)	0/4 (0)
Enrofloxacin	1/105 (1)	0/12 (0)	0/5 (0)	4/25 (16)	0/21 (0)	0/4 (0)	0/4 (0)
Florfenicol	11/93 (11.8)	0/4 (0)	0/2 (0)	4/25 (16)	0/21 (0)	1/4 (25)	0/4 (0)
Neomycin	7/100 (7)	1/11 (9.1)	0/3 (0)	25/25 (100)	2/21 (9.5)	1/4 (25)	1/4 (25)
Spectinomycin	45/100 (45)	3/11 (27.3)	1/2 (50)	-	5/20 (25)	2/4 (50)	0/4 (0)
Streptomycin	38/89 (42.7)	1/3 (33.3)	1/1 (100)	-	-	-	-
Tetracycline	71/105 (67.6)	8/12 (66.7)	3/5 (60)	19/25 (76)	12/21 (57.1)	4/4 (100)	2/4 (50)
Trimetho/Sulph	24/105 (22.9)	1/12 (8.3)	1/5 (20)	10/25 (40)	5/21 (23.8)	1/4 (25)	1/4 (25)

¹ No pre-weaning or adult data available for Northern Ireland
 - No isolates tested

Table S4.7.14: Resistance in *E. coli* from sheep in England & Wales, Northern Ireland and Scotland in 2015

Antibiotic	No. resistant / No. tested (Percentage resistant)						
	England & Wales			Northern Ireland ¹	Scotland		
	Neonatal	Pre-weaning	Adult	Neonatal	Neonatal	Pre-weaning	Adult
Amoxi/Clav	19/93 (20.4)	0/13 (0)	1/15 (6.7)	3/9 (33)	6/37 (24.3)	1/4 (25)	1/7 (14.3)
Ampicillin	60/93 (64.5)	8/13 (61.5)	4/15 (26.7)	7/9 (78)	17/37 (45.9)	1/4 (25)	1/7 (14.3)
Apramycin	0/93 (0)	1/12 (8.3)	0/6 (0)	0/9 (0)	1/35 (2.9)	0/4 (0)	0/7 (0)
Cefotaxime	2/74 (2.7)	0/6 (0)	0/1 (0)	-	-	-	-
Ceftazidime	1/74 (1.4)	0/6 (0)	0/1 (0)	-	-	-	-
Chloramphenicol	14/74 (18.9)	1/6 (16.7)	1/1 (100)	-	0/1 (0)	-	-
Enrofloxacin	2/93 (2.2)	0/13 (0)	0/15 (0)	0/9 (0)	2/37 (5.4)	0/4 (0)	0/7 (0)
Florfenicol	10/74 (13.5)	0/7 (0)	1/8 (12.5)	2/9 (22)	4/33 (12.1)	1/4 (25)	0/7 (0)
Neomycin	20/93 (21.5)	1/12 (8.3)	0/8 (0)	9/9 (100)	2/37 (5.4)	1/4 (25)	1/7 (14.3)
Spectinomycin	58/93 (62.4)	5/12 (41.7)	2/5 (33.3)	-	12/35 (34.3)	0/4 (0)	1/7 (14.3)
Streptomycin	51/74 (68.9)	3/6 (50)	1/5 (33.3)	-	1/1 (100)	-	-
Tetracycline	69/93 (74.2)	8/13 (61.5)	3/15 (33.3)	5/9 (56)	21/37 (56.8)	1/4 (25)	4/7 (57.1)
Trimetho/Sulph	32/93 (34.4)	2/13 (15.4)	1/15 (6.7)	4/9 (44)	6/37 (16.2)	1/4 (25)	0/7 (0)

¹ No pre-weaning or adult data available for Northern Ireland

- No isolates tested

Table S4.7.15: Resistance in *E. coli* from sheep in England & Wales, Northern Ireland and Scotland in 2016

Antibiotic	No. resistant / No. tested (Percentage resistant)						
	England & Wales			Northern Ireland ¹	Scotland		
	Neonatal	Pre-weaning	Adult	Neonatal	Neonatal	Pre-weaning	Adult
Amoxi/Clav	18/101 (17.8)	2/26 (7.7)	3/30 (10)	24/44 (54.5)	9/42 (21.4)	4/13 (30.8)	0/15 (0)
Ampicillin	60/101 (59.4)	10/26 (38.5)	9/30 (30)	36/44 (81.8)	19/42 (45.2)	7/13 (53.9)	1/15 (6.7)
Apramycin	3/98 (3.1)	1/17 (5.9)	1/13 (7.7)	3/44 (6.8)	0/42 (0)	0/13 (0)	0/15 (0)
Cefotaxime	3/86 (3.5)	0/11 (0)	-	-	-	-	-
Ceftazidime	2/86 (2.3)	0/11 (0)	-	-	-	-	-
Chloramphenicol	21/86 (24.4)	5/11 (45.5)	-	-	-	-	-
Enrofloxacin	5/101 (5)	0/26 (0)	1/30 (3.3)	8/44 (18.2)	1/42 (2.4)	0/13 (0)	0/15 (0)
Florfenicol	7/88 (8)	2/18 (11.1)	1/13 (7.7)	10/44 (22.7)	1/42 (2.4)	2/13 (15.4)	0/15 (0)
Neomycin	20/99 (20.2)	0/19 (0)	1/17 (5.9)	27/27 (100)	4/42 (9.5)	1/13 (7.7)	0/15 (0)
Spectinomycin	51/98 (52)	6/17 (35.3)	2/13 (15.4)	-	13/42 (31)	3/13 (23.1)	2/15 (13.3)
Streptomycin	48/87 (55.2)	6/13 (46.2)	1/4 (25)	-	-	-	-
Tetracycline	79/101 (78.2)	13/26 (50)	11/30 (36.7)	31/44 (70.5)	20/42 (47.6)	9/13 (69.2)	5/15 (33.3)
Trimetho/Sulph	30/101 (29.7)	3/26 (11.5)	2/30 (6.7)	22/44 (50)	10/42 (23.8)	2/13 (15.4)	0/15 (0)

¹ No pre-weaning or adult data available for Northern Ireland.
 - No isolates tested

S4.8: Clinical surveillance data for *Salmonella*

Table S4.8.1: Resistance in all *Salmonella* from cattle, pigs, sheep, chickens and turkeys (combined) from clinical surveillance in England and Wales, Northern Ireland and Scotland

Antibiotic	No. resistant / No. tested (Percentage resistant)								
	England & Wales			Northern Ireland			Scotland		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
Ampicillin	261/1358 (19.2)	281/1594 (17.6)	192/1394 (13.8)	29/257 (11.3)	16/218 (7.3)	20/228 (8.8)	45/147 (30.6)	61/167 (36.5)	4/131 (3.1)
Amoxi/Clav	0/1358 (0)	1/1594 (0.1)	1/1394 (0.1)	6/257 (2.3)	3/218 (1.4)	5/228 (2.2)	15/147 (10.2)	17/167 (10.2)	2/131 (1.5)
Apramycin	30/1358 (2.2)	59/1594 (3.7)	38/1394 (2.7)	3/257 (1.2)	2/218 (0.9)	7/228 (3.1)	9/146 (6.2)	10/164 (6.1)	2/128 (1.6)
Cefotaxime	0/1358 (0)	1/1594 (0.1)	1/1394 (0.1)	0/257 (0)	0/218 (0)	1/228 (0.4)	-	-	-
Ceftazidime	0/1358 (0)	1/1594 (0.1)	1/1394 (0.1)	0/257 (0)	0/218 (0)	0/228 (0)	-	-	-
Ciprofloxacin	19/1358 (1.4)	20/1594 (1.3)	8/1394 (0.6)	0/257 (0)	0/218 (0)	0/228 (0)	-	-	-
Chloramphenicol	107/1358 (7.9)	95/1594 (6)	114/1394 (8.2)	13/257 (3.9)	6/218 (2.8)	15/228 (6.6)	-	-	-
Gentamicin	34/1358 (2.5)	67/1594 (4.2)	42/1394 (3)	3/257 (1.2)	2/218 (0.9)	7/228 (3.1)	-	-	-
Furazolidone	10/1358 (0.7)	11/1594 (0.7)	9/1394 (0.6)	0/257 (0)	0/218 (0)	1/228 (0.4)	-	-	-
Nalidixic Acid	58/1358 (4.3)	98/1594 (6.1)	31/1394 (2.2)	6/257 (2.3)	12/218 (5.5)	13/228 (5.7)	4/144 (2.8)	4/164 (2.4)	0/128 (0)
Neomycin	18/1358 (1.3)	54/1594 (3.4)	11/1394 (1)	-	-	-	1/147 (0.7)	1/167 (0.6)	1/131 (0.8)
Streptomycin	351/1358 (25.8)	475/1594 (29.8)	304/1394 (21.8)	57/257 (22.2)	37/218 (17)	44/228 (19.3)	-	-	-
Sulph Compounds	379/1358 (27.9)	525/1594 (32.9)	421/1394 (30.2)	28/257 (10.9)	25/218 (11.5)	36/228 (15.8)	-	-	-
Tetracycline	350/1358 (25.8)	474/1594 (29.7)	370/1394 (26.5)	26/257 (10.1)	17/218 (7.8)	18/228 (7.9)	65/147 (44.2)	77/167 (46.1)	7/131 (5.3)
Trim/Sulpho	162/1358 (11.9)	199/1594 (12.5)	177/1394 (12.7)	-	-	-	26/147 (17.7)	26/167 (15.6)	0/131 (0)

- No isolates tested

Table S4.8.2: Resistance in all *Salmonella* from cattle (all ages) from surveillance in England and Wales, Northern Ireland and Scotland

Antibiotic	No. resistant / No. tested (Percentage resistant)								
	England & Wales			Northern Ireland			Scotland		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
Ampicillin	32/427 (7.5)	23/346 (6.6)	36/336 (10.7)	3/115 (2.6)	2/81 (2.5)	2/75 (2.7)	3/59 (5.1)	12/73 (16.4)	0/88 (0)
Amoxi/Clav	0/427 (0)	0/346 (0)	0/336 (0)	1/115 (0.9)	1/81 (1.2)	0/75 (0)	3/59 (5.1)	11/73 (15.1)	0/88 (0)
Apramycin	0/427 (0)	0/346 (0)	0/336 (0)	0/115 (0)	0/81 (0)	1/75 (1.3)	0/59 (0)	0/73 (0)	1/87 (1.2)
Cefotaxime	0/427 (0)	0/346 (0)	0/336 (0)	0/115 (0)	0/81 (0)	0/75 (0)	-	-	-
Ceftazidime	0/427 (0)	0/346 (0)	0/336 (0)	0/115 (0)	0/81 (0)	0/75 (0)	-	-	-
Ciprofloxacin	0/427 (0)	1/346 (0.3)	0/336 (0)	0/115 (0)	0/81 (0)	0/75 (0)	-	-	-
Chloramphenicol	12/427 (2.8)	10/346 (2.9)	23/336 (6.8)	1/115 (0.9)	0/81 (0)	1/75 (1.3)	-	-	-
Gentamicin	0/427 (0)	0/346 (0)	0/336 (0)	0/115 (0)	0/81 (0)	0/75 (0)	-	-	-
Furazolidone	2/427 (0.5)	0/346 (0)	0/336 (0)	0/115 (0)	0/81 (0)	0/75 (0)	-	-	-
Nalidixic Acid	0/427 (0)	6/346 (1.7)	3/336 (0.9)	2/115 (1.7)	4/81 (4.9)	4/75 (5.3)	1/59 (1.7)	4/73 (5.5)	0/87 (0)
Neomycin	1/427 (0.2)	7/346 (2)	0/336 (0)	-	-	-	0/59 (0)	0/73 (0)	0/88 (0)
Streptomycin	35/427 (8.2)	20/346 (5.8)	41/336 (12.2)	15/115 (13)	8/81 (9.9)	8/75 (10.7)	-	-	1/87 (1.2)
Sulph Compounds	33/427 (7.7)	18/346 (5.2)	37/336 (11)	3/115 (2.6)	2/81 (2.5)	2/75 (2.7)	-	-	-
Tetracycline	35/427 (8.2)	21/346 (6.1)	35/336 (10.4)	3/115 (2.6)	2/81 (2.5)	2/75 (2.7)	9/59 (15.3)	13/73 (17.8)	3/88 (3.4)
Trim/Sulpho	9/427 (2.1)	0/346 (0)	2/336 (0.6)	-	-	-	0/59 (0)	12/73 (0)	0/88 (0)

- No isolates tested

Table S4.8.3: Resistance in all *Salmonella* from pigs (all ages) from clinical surveillance in England and Wales, Northern Ireland and Scotland

Antibiotic	No. resistant / No. tested (Percentage resistant)								
	England & Wales			Northern Ireland			Scotland		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
Ampicillin	139/204 (68.1)	146/172 (84.9)	116/160 (72.5)	11/11 (100)	9/14 (64.3)	11/16 (68.8)	3/3 (100)	6/10 (60)	3/5 (60)
Amoxi/Clav	0/204 (0)	1/172 (0.6)	1/160 (0.6)	1/11 (9.1)	2/14 (14.3)	3/16 (18.8)	0/3 (0)	0/10 (0)	1/5 (20)
Apramycin	18/204 (8.8)	44/172 (25.6)	35/160 (21.9)	1/11 (9.1)	2/14 (14.3)	5/16 (31.3)	0/3 (0)	2/10 (10)	0/5 (0)
Cefotaxime	0/204 (0)	1/172 (0.6)	0/160 (0)	0/11 (0)	0/14 (0)	0/16 (0)	-	-	-
Ceftazidime	0/204 (0)	1/172 (0.6)	0/160 (0)	0/11 (0)	0/14 (0)	0/16 (0)	-	-	-
Ciprofloxacin	0/204 (0)	0/172 (0)	0/160 (0)	0/11 (0)	0/14 (0)	0/16 (0)	-	-	-
Chloramphenicol	75/204 (36.8)	73/172 (42.4)	70/160 (43.8)	4/11 (36.4)	5/14 (35.7)	12/16 (75)	-	-	-
Gentamicin	18/204 (8.8)	48/172 (27.9)	35/160 (21.9)	1/11 (9.1)	2/14 (14.3)	5/16 (31.3)	-	-	-
Furazolidone	1/204 (0.5)	0/172 (0)	0/160 (0)	0/11 (0)	0/14 (0)	0/16 (0)	-	-	-
Nalidixic Acid	2/204 (1)	1/172 (0.6)	3/160 (1.9)	1/11 (9.1)	2/14 (14.3)	2/16 (12.5)	0/3 (0)	0/10 (0)	0/5 (0)
Neomycin	8/204 (3.9)	12/172 (7)	10/160 (6.3)	-	-	-	0/3 (0)	1/10 (10)	0/5 (0)
Streptomycin	140/204 (68.6)	155/172 (90.1)	123/160 (76.9)	11/11 (100)	11/14 (78.6)	14/16 (87.5)	-	-	0/5 (0)
Sulph Compounds	152/204 (74.5)	156/172 (90.7)	137/160 (85.6)	11/11 (100)	11/14 (78.6)	14/16 (87.5)	-	-	-
Tetracycline	152/204 (74.5)	142/172 (82.6)	128/160 (80)	11/11 (100)	10/14 (71.4)	14/16 (87.5)	3/3 (100)	10/10 (100)	3/5 (60)
Trim/Sulpho	94/204 (46.1)	83/172 (48.3)	76/160 (47.5)	-	-	-	1/3 (33.3)	1/10 (10)	0/5 (0)

- No isolates tested

Table S4.8.4: Resistance in all *Salmonella* from sheep (all ages) from clinical surveillance in England and Wales, Northern Ireland and Scotland

Antibiotic	No. resistant / No. tested (Percentage resistant)								
	England & Wales			Northern Ireland			Scotland		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
Ampicillin	0/59 (0)	4/57 (7)	11/91 (12.1)	0/12 (0)	0/17 (0)	2/15 (13.3)	3/26 (11.5)	1/24 (4.2)	1/38 (2.6)
Amoxi/Clav	0/59 (0)	0/57 (0)	0/91 (0)	0/12 (0)	0/17 (0)	1/15 (6.7)	3/26 (11.5)	0/24 (0)	1/38 (2.6)
Apramycin	0/59 (0)	0/57 (0)	0/91 (0)	0/12 (0)	0/17 (0)	0/15 (0)	1/25 (4)	0/22 (0)	1/36 (2.6)
Cefotaxime	0/59 (0)	0/57 (0)	0/91 (0)	0/12 (0)	0/17 (0)	0/15 (0)	-	-	-
Ceftazidime	0/59 (0)	0/57 (0)	0/91 (0)	0/12 (0)	0/17 (0)	0/15 (0)	-	-	-
Ciprofloxacin	0/59 (0)	0/57 (0)	0/91 (0)	0/12 (0)	0/17 (0)	0/15 (0)	-	-	-
Chloramphenicol	0/59 (0)	0/57 (0)	11/91 (12.1)	0/12 (0)	0/17 (0)	1/15 (6.7)	-	-	-
Gentamicin	1/59 (1.7)	0/57 (0)	0/91 (0)	0/12 (0)	0/17 (0)	0/15 (0)	-	-	-
Furazolidone	0/59 (0)	0/57 (0)	0/91 (0)	0/12 (0)	0/17 (0)	0/15 (0)	-	-	-
Nalidixic Acid	0/59 (0)	0/57 (0)	0/91 (0)	0/12 (0)	1/17 (5.9)	1/15 (6.7)	1/25 (4)	0/22 (0)	0/36 (0)
Neomycin	0/59 (0)	0/57 (0)	0/91 (0)	-	-	-	0/26 (0)	0/24 (0)	1/38 (2.6)
Streptomycin	1/59 (1.7)	5/57 (8.8)	14/91 (15.4)	0/12 (0)	2/17 (11.8)	2/15 (13.3)	-	-	0/36 (0)
Sulph Compounds	1/59 (1.7)	4/57 (7)	12/91 (13.2)	0/12 (0)	2/17 (11.8)	2/15 (13.3)	-	-	-
Tetracycline	1/59 (1.7)	4/57 (7)	13/91 (14.3)	0/12 (0)	1/17 (5.9)	2/15 (13.3)	4/26 (15.4)	3/24 (12.5)	1/38 (2.6)
Trim/Sulpho	0/59 (0)	1/57 (1.8)	0/91 (0)	-	-	-	0/26 (0)	0/24 (0)	0/38 (0)

- No isolates tested

Table S4.8.5: Resistance in all *Salmonella* from chickens (all ages) from clinical surveillance in England and Wales, Northern Ireland and Scotland*

Antibiotic	No. resistant / No. tested (Percentage resistant)					
	England & Wales			Northern Ireland		
	2014	2015	2016	2014	2015	2016
Ampicillin	32/525 (6.1)	73/768 (9.5)	21/696 (3)	14/106 (13.2)	5/104 (4.8)	5/110 (4.5)
Amoxi/Clav	0/525 (0)	0/768 (0)	0/696 (0)	4/106 (3.8)	0/104 (0)	1/110 (0.9)
Apramycin	12/525 (2.3)	14/768 (1.8)	3/696 (0.4)	2/106 (1.9)	0/104 (0)	2/110 (1.8)
Cefotaxime	0/525 (0)	0/768 (0)	1/696 (0.1)	0/106 (0)	0/104 (0)	1/110 (0.9)
Ceftazidime	0/525 (0)	0/768 (0)	1/696 (0.1)	0/106 (0)	0/104 (0)	0/110 (0)
Ciprofloxacin	3/525 (0.6)	5/768 (0.7)	6/696 (0.9)	0/106 (0)	0/104 (0)	0/110 (0)
Chloramphenicol	19/525 (3.6)	8/768 (1)	10/696 (1.4)	5/106 (4.7)	1/104 (1)	1/110 (0.9)
Gentamicin	15/525 (2.9)	18/768 (2.3)	7/696 (1)	2/106 (1.9)	0/104 (0)	2/110 (1.8)
Furazolidone	7/525 (1.3)	11/768 (1.4)	9/696 (1.3)	0/106 (0)	0/104 (0)	1/110 (0.9)
Nalidixic Acid	30/525 (5.7)	51/768 (6.6)	18/696 (2.6)	3/106 (2.8)	5/104 (4.8)	5/110 (4.5)
Neomycin	9/525 (1.7)	28/768 (3.6)	4/696 (0.6)	-	-	-
Streptomycin	82/525 (15.6)	117/768 (15.2)	67/696 (9.6)	31/106 (29.2)	16/104 (15.4)	16/110 (14.5)
Sulph Compounds	101/525 (19.2)	158/768 (20.6)	155/696 (22.3)	14/106 (13.2)	10/104 (9.6)	14/110 (12.7)
Tetracycline	76/525 (14.5)	123/768 (16)	116/696 (16.7)	11/106 (10.4)	4/104 (3.8)	9/110 (8.2)
Trim/Sulpho	49/525 (9.3)	100/768 (13)	93/696 (13.4)	-	-	-

*Insufficient data from Scotland
 - No isolates tested

Table S4.8.6: Resistance in all *Salmonella* from turkeys (all ages) from clinical surveillance in England and Wales, Northern Ireland and Scotland*

Antibiotic	No. resistant / No. tested (Percentage resistant)		
	England & Wales		
	2014	2015	2016
Ampicillin	58/143 (40.6)	35/251 (13.9)	8/111 (7.2)
Amoxi/Clav	0/143 (0)	0/251 (0)	0/111 (0)
Apramycin	0/143 (0)	1/251 (0.4)	0/111 (0)
Cefotaxime	0/143 (0)	0/251 (0)	0/111 (0)
Ceftazidime	0/143 (0)	0/251 (0)	0/111 (0)
Ciprofloxacin	16/143 (11.2)	14/251 (5.6)	2/111 (1.8)
Chloramphenicol	1/143 (0.7)	4/251 (1.6)	0/111 (0)
Gentamicin	0/143 (0)	1/251 (0.4)	0/111 (0)
Furazolidone	0/143 (0)	0/251 (0)	0/111 (0)
Nalidixic Acid	26/143 (18.2)	40/251 (15.9)	7/111 (6.3)
Neomycin	0/143 (0)	7/251 (2.8)	0/111 (0)
Streptomycin	93/143 (65)	178/251 (70.9)	59/111 (53.2)
Sulph Compounds	92/143 (64.3)	189/251 (75.3)	80/111 (72.1)
Tetracycline	86/143 (60.1)	184/251 (73.3)	78/111 (70.3)
Trim/Sulpho	10/143 (7)	15/251 (6)	6/111 (5.4)

*Insufficient data from Scotland and Northern Ireland

Table S4.8.7: Resistance in all *Salmonella* Dublin from cattle, pigs, sheep, chickens and turkeys (combined) from clinical surveillance in England and Wales, Northern Ireland and Scotland*

Antibiotic	No. resistant / No. tested (Percentage resistant)								
	England & Wales			Northern Ireland			Scotland		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
Ampicillin	2/286 (0.7)	4/226 (1.8)	1/245 (0.4)	12/110 (10.9)	6/79 (7.6)	0/81 (0)	0/52 (0)	0/56 (0)	0/56 (0)
Chloramphenicol	0/286 (0)	1/226 (0.4)	1/245 (0.4)	0/110 (0)	0/79 (0)	0/81 (0)	-	-	-
Furazolidone	1/286 (0.3)	0/226 (0)	0/245 (0)	1/110 (0.9)	0/79 (0)	0/81 (0)	-	-	-
Nalidixic Acid	0/286 (0)	5/226 (2.2)	3/245 (1.2)	0/110 (0)	0/79 (0)	4/81 (4.9)	4/52 (7.7)	1/56 (1.8)	0/55 (0)
Neomycin	1/286 (0.3)	5/226 (2.2)	0/245 (0)	-	-	-	0/52 (0)	0/56 (0)	0/56 (0)
Streptomycin	7/286 (2.4)	9/226 (4)	4/245 (1.6)	0/110 (0)	0/79 (0)	7/81 (8.6)	0/52 (0)	0/56 (0)	-
Sulpha/Trim	2/286 (0.7)	0/226 (0)	0/245 (0)	0/110 (0)	0/79 (0)	0/81 (0)	0/52 (0)	0/56 (0)	0/56 (0)
Sulph Compounds	2/286 (0.7)	0/226 (0)	0/245 (0)	-	-	-	0/52 (0)	0/56 (0)	-
Tetracycline	1/286 (0.3)	1/226 (0.4)	1/245 (0.4)	2/110 (1.8)	5/79 (6.3)	0/81 (0)	0/52 (0)	0/56 (0)	3/56 (5.4)

- No isolates tested

*Minor amendments have been made to the historical data published in past VARSS reports for this data set.

Table S4.8.8: Resistance in all *Salmonella* Typhimurium from cattle, pigs, sheep, chickens and turkeys (combined) from clinical surveillance in England and Wales, Northern Ireland and Scotland**

Antibiotic	No. resistant / No. tested (Percentage resistant)								
	England & Wales			Northern Ireland			Scotland		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
Ampicillin	97/224 (43.3)	77/165 (46.7)	100/166 (60.2)	19/28 (67.9)	13/24 (54.2)	15/22 (68.2)	9/10 (90)	17/22 (77.3)	3/3 (100)
Apramycin	2/224 (0.9)	0/165 (0)	4/166 (2.4)	*	*	*	*	*	*
Chloramphenicol	82/224 (36.6)	75.9/165 (46)	96/166 (57.8)	10/28 (35.7)	6/24 (25)	14/22 (63.6)	-	-	-
Furazolidone	0/224 (0)	0/165 (0)	1/166 (0.6)	19/28 (67.9)	14/24 (58.3)	0/22 (0)	-	-	-
Nalidixic Acid	2/224 (0.9)	2/165 (1.2)	0/166 (0)	19/28 (67.9)	12/24 (50)	4/22 (18.2)	1/10 (10)	4/22 (18.2)	0/3 (0)
Neomycin	0/224 (0)	4/165 (2.4)	1/166 (0.6)	-	-	-	0/10 (0)	1/22 (4.5)	0/3 (0)
Streptomycin	89/224 (39.7)	85/165 (51.5)	106/166 (63.9)	10/28 (35.7)	13/24 (54.2)	19/22 (86.4)	-	-	-
Sulpha/Trim	80/224 (35.7)	53/165 (32.1)	48/166 (28.9)	0/28 (0)	0/24 (0)	-	1/10 (10)	1/22 (4.5)	0/3 (0)
Sulph Compounds	98/224 (43.8)	80/165 (48.5)	110/166 (66.3)	-	-	19/22 (86.4)	-	-	-
Tetracycline	110/224 (49.1)	77/165 (46.7)	102/166 (61.4)	1/28 (3.6)	2/24 (8.3)	18/22 (81.8)	1/10 (10)	21/22 (95.5)	3/3 (100)

- No isolates tested

* Data not available

** Minor amendments have been made to the historical data published in past VARSS reports for this data set.

Table S4.8.9: Resistance in all *Salmonella* other than Dublin and Typhimurium from cattle, pigs, sheep, chickens and turkeys (combined) from clinical surveillance in England and Wales, Northern Ireland and Scotland**

Antibiotic	No. resistant / No. tested (Percentage resistant)								
	England & Wales			Northern Ireland			Scotland		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
Ampicillin	233/1837 (12.7)	292/2198 (13.3)	220/1986 (11.1)	19/28 (67.9)	13/24 (54.2)	5/125 (4)	36/85 (42.4)	44/89 (49.4)	1/72 (1.4)
Apramycin	29/1837 (1.6)	64/2195 (2.9)	40/1986 (2)	*		*	*	*	*
Chloramphenicol	33/1837 (1.8)	53/2198 (2.4)	52/1986 (2.6)	10/28 (35.7)	6/24 (25)	1/125 (0.8)	-	-	-
Furazolidone	39/1837 (2.1)	42/2198 (1.9)	28/1986 (1.4)	19/28 (67.9)	14/24 (58.3)	1/125 (0.8)	-	-	-
Nalidixic Acid	73/1837 (4)	121/2198 (5.5)	52/1986 (2.6)	19/28 (67.9)	12/24 (50)	5/125 (4)	3/82 (3.7)	0/89 (0)	0/70 (0)
Neomycin	37/1837 (2)	70/2198 (3.2)	44/1986 (2.2)	-	-	-	1/85 (1.2)	0/89 (0)	1/72 (1.4)
Streptomycin	345/1837 (18.8)	497/2198 (22.6)	318/1986 (16)	10/28 (35.7)	13/24 (54.2)	18/125 (14.4)	-	-	-
Sulpha/Trim	384/1837 (20.9)	229/2198 (10.4)	207/1986 (10.4)	0/28 (0)	0/24 (0)	-	25/85 (29.4)	25/89 (28.1)	0/72 (0)
Sulph Compounds	384/1837 (20.9)	580/2198 (26.4)	471/1986 (23.7)	-	-	17/125 (13.6)	-	-	-
Tetracycline	367/1837 (20)	560/2198 (25.5)	455/1986 (22.9)	1/28 (3.6)	2/24 (8.3)	13/125 (10.4)	51/85 (60)	55/86 (61.8)	1/72 (1.4)

- No isolates tested

* Data not available.

** Minor amendments have been made to the historical data published in past VARSS reports for this data set.

Table S4.8.10: Top ten *Salmonella* serovars isolated in Northern Ireland

Rank	2014	2015	2016
1	Dublin / (321 isolations)	Derby / (437 isolations)	Dublin / (81 isolations)
2	Mbandaka / (196 isolations)	Mbandaka / (335 isolations)	Mbandaka / (46 isolations)
3	Kedougou / (128 isolations)	Dublin / (247 isolations)	Muenster / (37 isolations)
4	Senftenberg / (122 isolations)	Kedougou / (230 isolations)	Typhimurium / (22 isolations)
5	Montevideo / (115 isolations)	13,23:i:- / (189 isolations)	Senftenberg / (11 isolations)
6	13,23:i:- / (107 isolations)	Senftenberg / (90 isolations)	Derby / (5 isolations)
7	Typhimurium / (105 isolations)	Enteritidis / (87 isolations)	Tennessee / (4 isolations)
8	4,5,12:i:- / (71 isolations)	Typhimurium / (67 isolations)	Diarizonae 61:-:1,5,7 / (4 isolations)
9	Derby / (54 isolations)	4,12:i:- / (58 isolations)	Brandenburg / (2 isolations)
10	Newport / (44 isolations)	4,5,12:i:- / (54 isolations)	Choleraesuis / (2 isolations)

Table S4.8.11: Top ten *Salmonella* serovars isolated in Scotland

Rank	2014	2015	2016
1	Dublin / (58 isolations)	Dublin / (64 isolations)	Dublin / (68 isolations)
2	Typhimurium / (53 isolations)	Typhimurium / (49 isolations)	Typhimurium/ (25 isolations)
3	Arizonae / (16 isolations)	Arizonae / (17 isolations)	Montevideo/ (17 isolations)
4	Montevideo / (8 isolations)	Montevideo / (9 isolations)	Bovismorbificans/ (14 isolations)
5	Enteritidis / (4 isolations)	Salmonella sp. / (7 isolations)	Minnesota/ (17 isolations)
6	Spp. / (2 isolations)	Derby / (2 isolations)	Arizonae/ (13 isolations)
7	Mbandaka / (2 isolations)	Enteritidis / (2 isolations)	Mbandaka/ (9 isolations)
8	Bovismorbificans / (1 isolations)	Salmonella sp. / (6 isolations)	Panama/ (6isolations)
9	Group C2 / (1 isolations)	Mbandaka / (2 isolations)	4,5,12:i:-/ (3 isolations)
10	Aarhus / (1 isolations)	Senftenberg / (2 isolations)	Binza/ (2 isolations)