

# Pure

## Scotland's Rural College

### Measurement of antimicrobial usage & resistance

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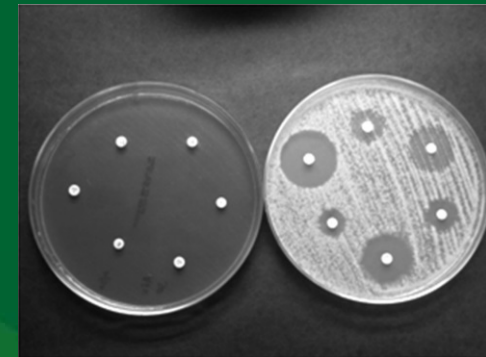
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# Measurement of Antimicrobial Usage & Resistance

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*Leading the way in Agriculture and Rural Research, Education and Consulting*

# Epidemiology of AMR in faecal *E. coli*

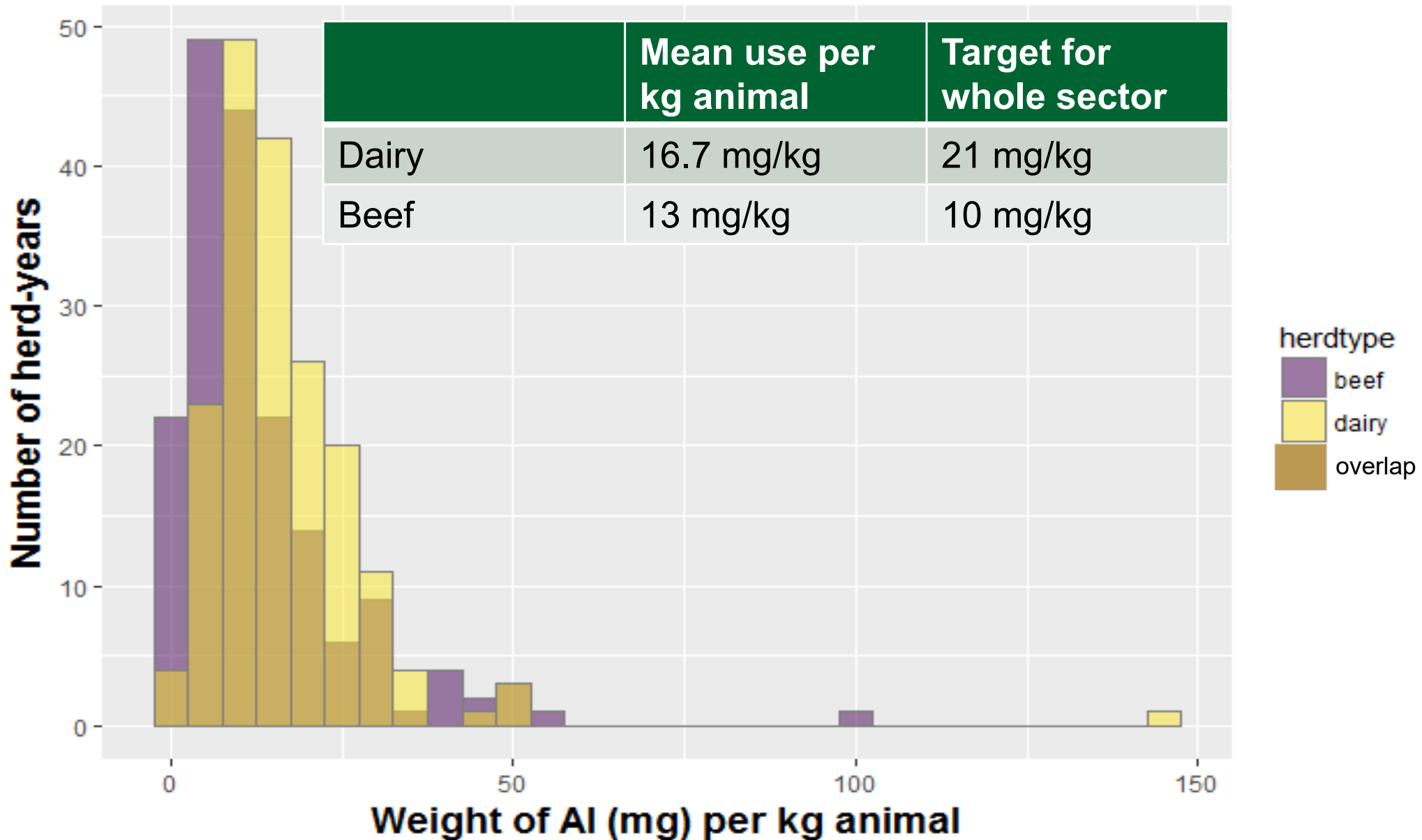


- Higher (sample level) prevalence in diarrhoeic calves than non-diarrhoeic calves
- Higher (sample level) prevalence in calves, compared to adult cows. Lowest in sheep

Table: prevalence of samples from healthy calves, adult cows and sheep testing resistant to three antimicrobials

	<b>Ampicillin</b>	<b>Apramycin</b>	<b>Nalidixic Acid</b>
<b>Calves</b>	<b>87.8%</b>	<b>15.2%</b>	<b>7.38%</b>
<b>Adult cows</b>	<b>47.0%</b>	<b>3.36%</b>	<b>1.94%</b>
<b>Sheep</b>	<b>20.6%</b>	<b>4.55%</b>	<b>0.785%</b>

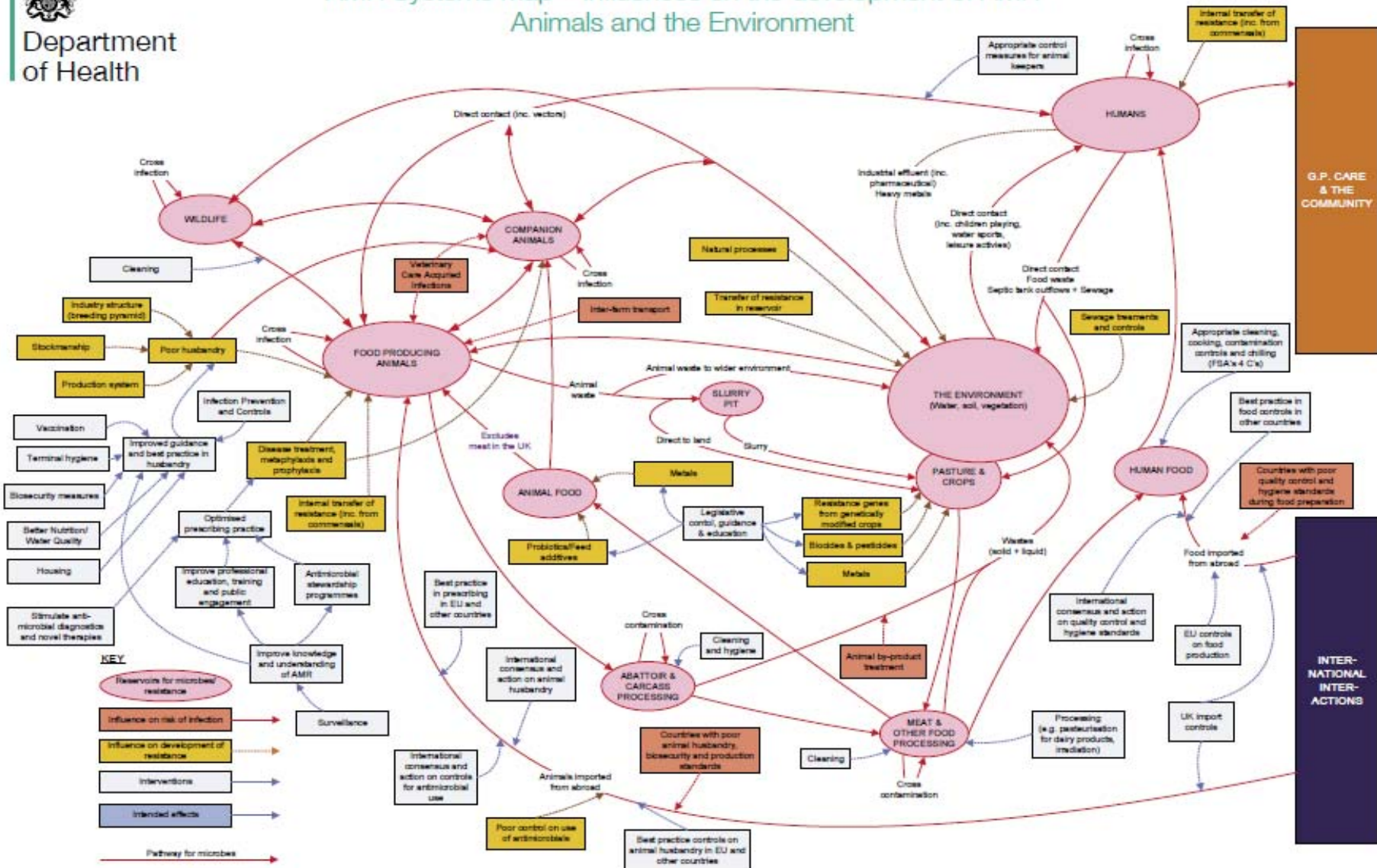
# AMU: difficult to measure



# Importance of measurement



AMR Systems Map – Influences on the development of AMR  
Animals and the Environment




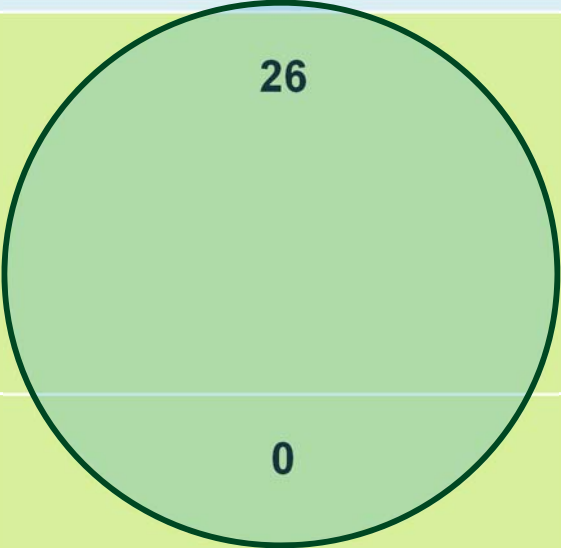


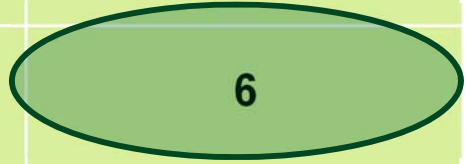
# What measures of AMR are available?



	Phenotypic	Genotypic
Isolate level test	Minimum Inhibitory Concentration (MIC) determination, Disk diffusion	PCR, Whole genome sequencing
Whole sample level test	Streak plating, Spiral plating, Spread plating, Disk diffusion,	PCR, Whole genome sequencing

# 40 ruminant faecal samples – isolate level V sample level



		Sample level (Streak plating method)	
Ampicillin			
Isolate level		Sensitive	Resistant
Based on	<b>Sensitive</b>		
Minimum			
Inhibitory			
Concentration			
(MIC)	<b>Resistant</b>		
of 8 isolates			





# RESAS (WP2.2.6) 2016-2021 comparison of methods



- Samples (n=189) from >1 study, in which *E. coli* was detected
- Sample level V isolate level (disk diffusion)
- Prevalence estimates (ampicillin): 60% V 2%

Sample level – Ampicillin streak plate score	Isolate level	
	Sensitive	Resistant
Sensitive	74	1
Resistant	111	3



# Prevalence

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- Comparisons of prevalence between studies only meaningful if the same measure was used.
- In the literature the most common measure of resistance is based on a single isolate per sample – this gives lower estimates of prevalence than whole sample techniques.

# Future studies

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- Exploring a method of serial dilution to enumerate the density of all *E. coli* and density of resistant *E. coli*
- If this method is successful then we aim to replicate measurement of AMR at more than one level (isolate, sample, animal) – where does variation lie?

# Measurement of AMR: Should we be worried?

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- We should be aware of the massive differences the different measures of AMR make.
- We should be concerned that we don't know what the best measures of AMR are for progressing the knowledge base.
- We should be aware that most published studies don't consider the choice of measurement.

# Acknowledgements



- RESAS
- Participating veterinarians and farmers
- Colleagues: J. Evans, S. Tongue, C. Webster, M. Henry, C. McCann, C. Mason, G. Gunn, G. Innocent

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**SEFARI** **Bla Bla black sheep, have you any AMR?** **SRUC**

**epic**

**Introduction**

Antimicrobial resistance (AMR) is a global challenge with national, regional and local implications. Collection of antimicrobial sensitivity (AMS) data from all levels of the food chain is required to help inform the issue of antimicrobial resistance (AMR), to development and transmission.

**Methods**

Convenience faecal samples: 51 coliform tested using PCR. 388 faecal samples from 11 Scottish sheep flocks were tested by qPCR and PCR. One E. coli isolate from each of 388 faecal samples from sheep presented to one Scottish abattoir in 2017/18 was tested for AMR by the diffusion against 12 antimicrobials. The same isolates were tested by PCR against a panel of AMR genes.

**Results**

Of the 51 convenience samples, only two gave isolates, but were phenotypically resistant to erythromycin and trimethoprim-sulfamethoxazole. No samples demonstrated resistance to the 14 Co. (coliforms) tested. (E. coli, Klebsiella, Enterobacter). The six genetic resistance markers detected were erythromycin and tetracycline.

total tested	sheep
total negative	382
Target Gene	0 (1.5%)
bla <sub>TEM</sub> pos	0
bla <sub>SHV</sub> pos	0
bla <sub>CTX</sub> pos	0
amp <sup>r</sup> pos	0
ermA pos	0
ermB pos	0
ermC pos	0
ermD pos	0
total positive	6 (1.5%)

**Conclusions:** no AMR, no AMR, three bags empty

**References and Acknowledgements**

SEFARI was an initiative of the Scottish Government through the Rural Innovation Programme (RIP) which is an effort to drive innovation in the rural sector.

**BioSS** **Estimating Antimicrobial Usage from Pharmaceutical Sales Data** **SRUC**

**Introduction**

The problems associated with AMR in humans have led to calls for reduced usage of antimicrobials in agriculture. Sector-specific targets in the UK have been set by the Responsible Use of Medicines in Agriculture (RUMA) Task Force (RTF).

**Methods**

Antimicrobial sales and demographic data for 78 farms were accessed using an extractable software tool and original farm identifier. Data were collected for the period 2011-2015.

**Results**

Dairy farms were sold more antibiotics per kg of animal live beef heads (P<0.01).

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**Conclusions**

The high level pattern in the output data fit our predictions for the sector, suggesting that the data processing has been executed successfully.

**References and Acknowledgements**

SEFARI was an initiative of the Scottish Government through the Rural Innovation Programme (RIP) which is an effort to drive innovation in the rural sector.