

Scotland's Rural College

Measurement of antimicrobial usage & resistance

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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*

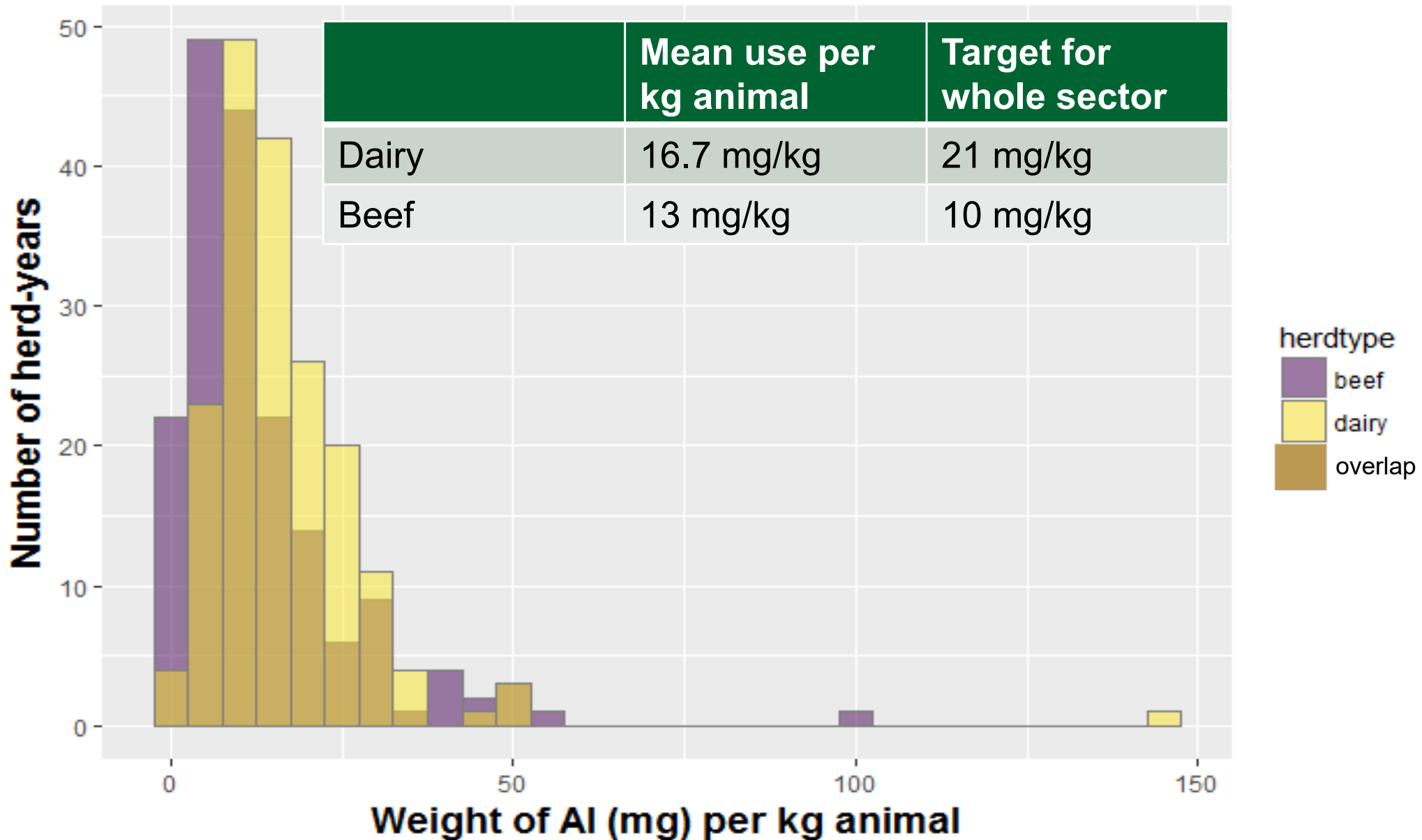


- Higher (sample level) prevalence in diarrhoeic calves than non-diarrhoeic calves
- Higher (sample level) prevalence in calves, compared to adult cows. Lowest in sheep

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

| | Ampicillin | Apramycin | Nalidixic Acid |
|-------------------|-------------------|------------------|-----------------------|
| Calves | 87.8% | 15.2% | 7.38% |
| Adult cows | 47.0% | 3.36% | 1.94% |
| Sheep | 20.6% | 4.55% | 0.785% |

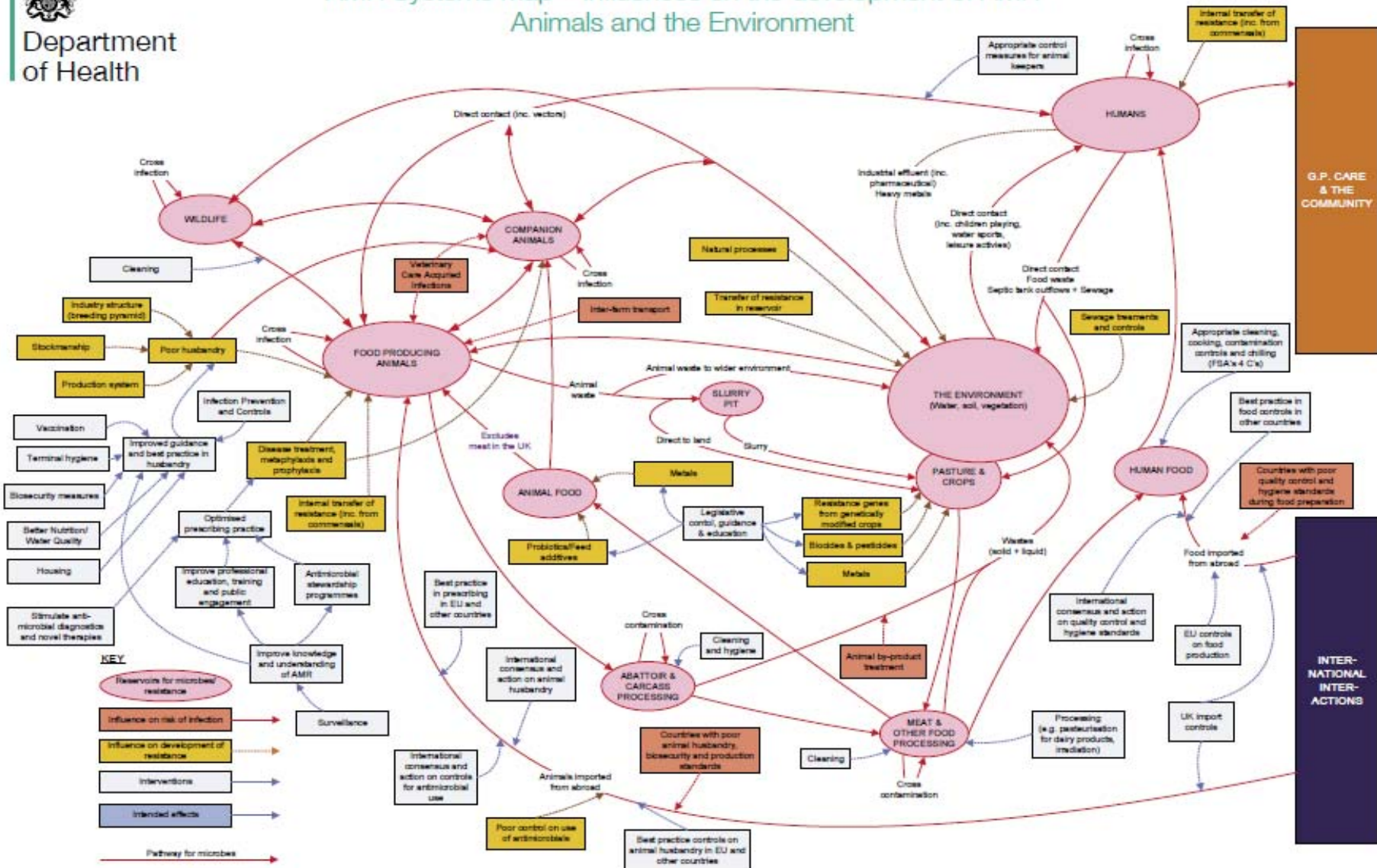
AMU: difficult to measure



Importance of measurement



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




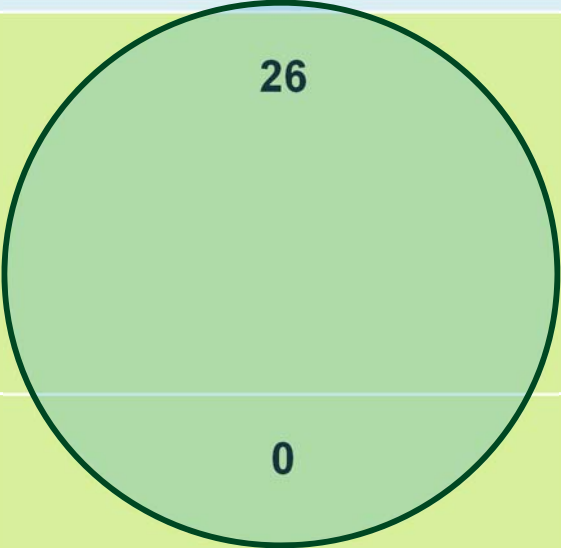


What measures of AMR are available?



| | 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 | Sensitive |  |  |
| Minimum Inhibitory Concentration (MIC) of 8 isolates | Resistant | |  |

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



- 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



- 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?



- 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



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- 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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Blas Bla black sheep, have you any AMR?

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), its 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 and No ampicillin demonstrated resistance to the 14 Co. (coliforms) tested. (trimethoprim-sulfamethoxazole). The only genetic resistance markers detected were for erythromycin and tetracycline.

Conclusions
AMR in enteric abattoir samples in healthy Scottish sheep entering the food chain is negligible.

References and Acknowledgements
This work was supported by the Scottish Government through the Food for People 2017-2020 which is an open access resource. Further information can be found at: www.sefari.ac.uk

SEFARI **epic** **SRUC**

Estimating Antimicrobial Usage from Pharmaceutical Sales Data

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). Data on antimicrobial usage in agriculture are generally hard to gather because the devices-making for the administration of antimicrobials is largely the farmer and his/her veterinary practitioner.

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

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

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

References and Acknowledgements
Further information on this work is available from: R. W. Humphrey, M. K. Henry, A. Barwell, C. Corneil, G. J. Gunn, R. Smith, G. T. Innocent, S. C. Tongue

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