

## Prudent use of antimicrobials in farm animal production

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## Outline

- Set the scene
  - The problem of antimicrobial resistance
- Control
  - Drivers of resistance and usage
  - Education *versus* Legislation
  - Implementation of controls – what do you think?




### Introduction

What is antimicrobial resistance?

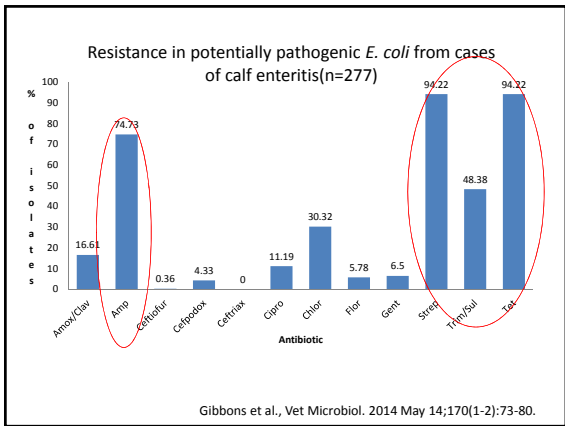
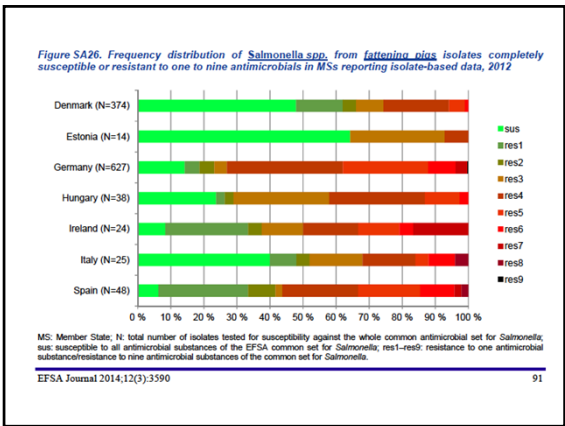
Why do we care?

Treatment failure – MRSA, MRSP,  
MDR *E. coli*, Swine dysentery

Public health concerns  
•e.g. ESBL-producing  
*E. coli* and *Salmonella*  
in poultry

### SOME FIGURES



Summary

EU monitoring

- Documents high levels of resistance to 'older' antimicrobials
- Resistance to newer antimicrobials, including critically important antimicrobials is low but emerging in intensively-reared species

- Therapeutic failure in animals

Drivers of resistance

All antimicrobial use, including prudent use, selects for resistance

Other aspects

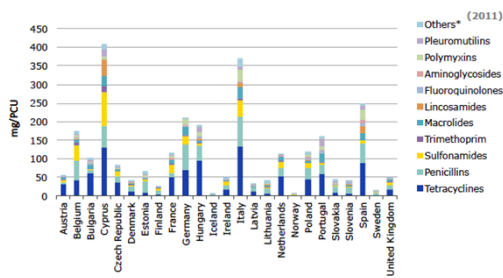
- Selection of resistance at low antimicrobial concentrations
- Oral antimicrobial use in animals
- Environmental pollution with AM residues and AMR organisms



Antibiotic use

Antibiotic sales

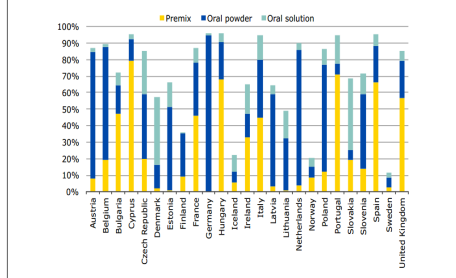
Figure 9. Sales for food-producing species, including horses, in mg/PCU, of the various veterinary antimicrobial classes, by country<sup>1</sup>, for 25 countries in 2011 and for 20 countries in 2010



Sales of veterinary antimicrobial agents in 25 EU/EEA countries in 2011 - Third ESVAC report

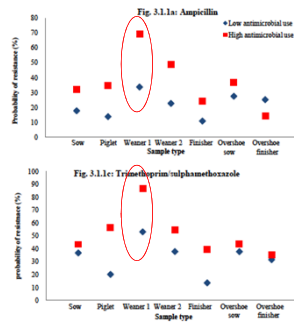
Sales of oral formulations

Figure 7. Oral solutions, oral powders and premixes as percentages of total sales, in mg per population correction unit (mg/PCU), of veterinary antimicrobial agents for food-producing animals (including horses), by country, for 2011



Sales of veterinary antimicrobial agents in 25 EU/EEA countries in 2011 - Third ESVAC report

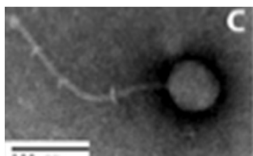
Probability of resistance in *E. coli* isolates from high and low antimicrobial-use farms



In-feed antimicrobials

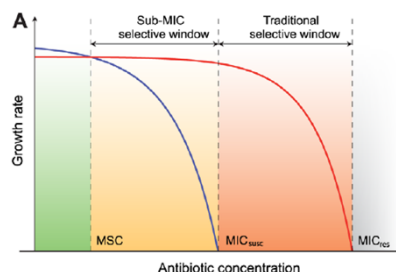
Gibbons, PhD thesis, 2011

Allen et al., 2011 – mBio - November/December Volume 2 Issue 6 e00260-11



- Some antimicrobials can induce changes in bacterial and phage communities
- Integrase-encoding genes increased in faecal phages from medicated pigs

Gullberg et al., 2011  
PLoS Pathogens - November/December 2011 Volume 2 Issue 6 e00260-11



Extremely low concentrations of antimicrobials (in environment or body) can enrich and maintain existing mutants and select for new mutants

Other Influences on antimicrobial prescribing - veterinarians:

- Susceptibility test results
- Own experience
- Risk of AMR
- Ease of administration
- Mechanism of activity of drug
- Drug distribution in body

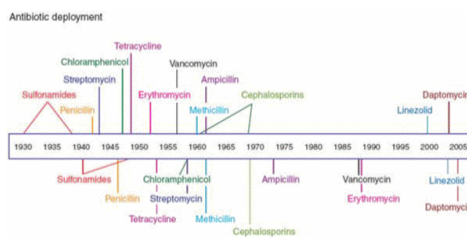
De Briyne et al., Vet Rec. 2013 Nov 16;173(19):475  
Gibbons et al., Vet Rec. 2013 Jan 5;172(1):14.

Summary – drivers of resistance

- Clinical usage – appropriate and inappropriate
- Pressures on vets
- Collateral effects of clinical usage on commensals
- Low doses of antimicrobials
- Environmental ‘pollution’ with AMs and AMR genetic elements?

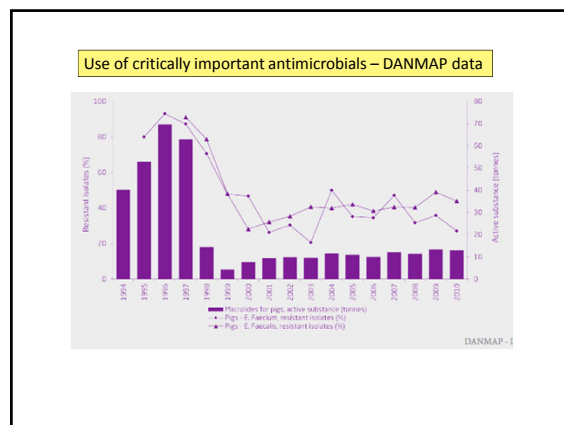
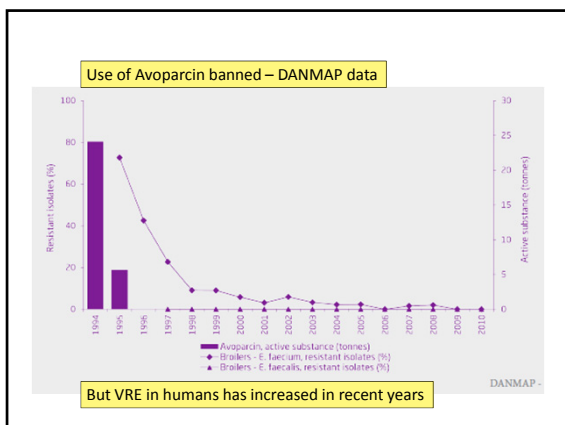
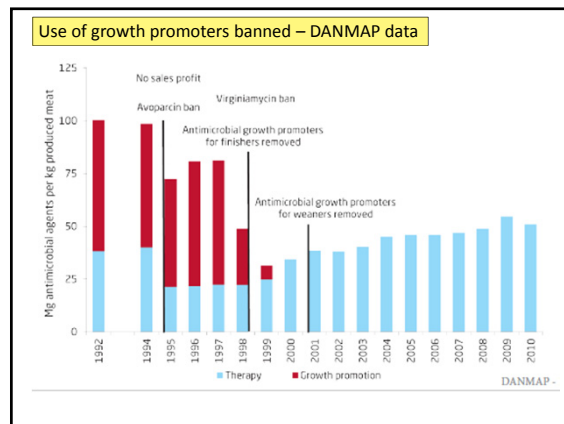
What can we do?

- Develop new antimicrobials



- Develop novel therapies

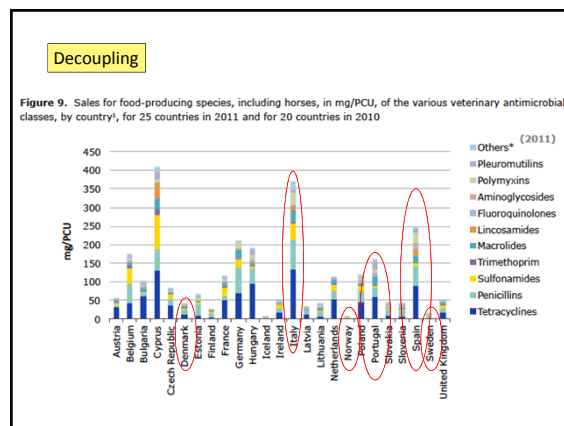
What can we do?  
Educate or Legislate?



### Ban the use of certain antimicrobials

Denmark:

- 2002 – regulations to restrict the use of fluoroquinolones - use in animals down by 85% by 2005
- 2010 - voluntary programme discontinuing the use of cephalosporin for a two-year period in pigs - cephalosporin consumption 50% reduced from 2009 to 2010.



**Legislate**

- Ban vets from selling antimicrobials for profit - decoupling
- Ban medicated feed
- Ban prophylactic and metaphylactic use
- Set targets
- Ban the use of critically important antimicrobials in animals
- Prohibit derogations from product authorisations
- Surveillance

**Educate**

- Veterinarians
- Farmers
- Health professionals
- Industry
- Community

- Improve infection control and management
- Better use of data, diagnostics
- Optimize prescribing practice

**Education of farmers**


US study

- 86% not concerned that overuse in animals could lead to resistance in farm workers
- Barriers to correct use of antibiotics were lack of time and limited finances

Friedman et al., 2007. Zoonoses and Public Health, 54, 366-375

**Education of farmers**

- Communication issues, especially research findings
- Economic feasibility
- Practical considerations



•Alarcon, P., et al., PREVET (2013),  
 •<http://dx.doi.org/10.1016/j.prevetmed.2013.08.004>

**Does education work?**

Review of studies on prescribing practice in human medicine:

- Printed materials
- Audit and feedback
- Interactive meetings
- Delayed prescriptions
- Multi-faceted interventions


•1 in 4 studies showed sustained reductions in use

Arnold and Straus, 2005. Cochrane database of systematic reviews, Issue 4

**Does education work?**

Use of technology

- Clinical decision support systems
  - 5 of 7 studies – marginal to moderate effects in improving prescribing behaviour
  - Holstiege et al., 2014.(Review) [J Am Med Inform Assoc.](http://www.jamda.com) 2014 Aug 14
- Smartphone apps – good uptake by junior doctors
- 71% - improved knowledge of antibiotic use
- Charani et al., 2013



Tackling the problem of antimicrobial resistance –

Which is more effective, education or legislation?  
How do we prioritize?