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

Figure 1A
e Frequency distribution of Salmonella spp. from Salmonella spp. isolates completely susceptible or resistant to one or more antimicrobials in EU reporting laboratories (1st data, 2012)

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 sales

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

Sales of oral formulations

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

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

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

**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?

Use of growth promoters banned – DANMAP data

Use of Avoparcin banned – DANMAP data

But VRE in humans has increased in recent years

Use of critically important antimicrobials – DANMAP data

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](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 Strauss, 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
- 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?