What is the issue of antimicrobial resistance in veterinary practice?

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NRL for Antimicrobial Resistance
Outline of the presentation

i. Major issues of antimicrobial resistance for vets

ii. Antimicrobial resistance (AMR) in commensal bacteria

iii. Consequences for the practitioner
Major issues of AMR for vets

1. Reduced efficacy of treatment

2. AMR in zoonotic bacteria
   - Consumer protection
   - Self protection from occupational disease

3. AMR in the microbiome / commensal bacteria
1. Reduced efficacy of treatment

Target Bacteria (pathogen)
Selection pressure if vets do a good job.....

Target Bacteria
(pathogen)

(Hit them early, hit them hard.....)
Major issues of AMR for vets

1. Reduced efficacy of treatment

2. Resistance in zoonotic bacteria
   - Consumer protection
   - Self protection from occupational disease

3. AMR in the microbiome / commensal bacteria
2. Resistance in zoonotic bacteria

Animal

Animal husbandry

Contact to animals

Environment

Contact to food

Ingestion

Human

Human

Carcass/Milk

Meat/Milk product

Meal
2. Occupational disease

Animal husbandry

Emissions

Contact to animals

Environment

Human

Human
2. Food safety

[Diagram showing the flow from Animal to Carcass/Milk to Meat/Milk product to Meal to Ingestion and Contact to food, with arrows indicating the direction of contact and interaction between humans and animals.]
Major issues of AMR for vets

1. Reduced efficacy of treatment

2. AMR in zoonotic bacteria
   • Consumer protection
   • Self protection from occupational disease

3. AMR in the microbiome / commensal bacteria
ii. AMR in the microbiome / commensal bacteria

Why should that be an issue?
Selection pressure if vets do a good job….

Target Bacteria
(pathogen)
Selection pressure if vets do a good job….

Target Bacteria (pathogen)

Skin flora (vital importance)

Gut flora (vital importance)

Environmental flora (at least inevitable)
Why should that be an issue?

- Commensal flora is omnipresent
- Selection pressure by every antimicrobial treatment
- Reservoir for resistance determinants
- Vehicle for resistance determinants
- Horizontal gene transfer to and from commensals
## AMR in commensal bacteria

### Food chain approach

<table>
<thead>
<tr>
<th>Poultry</th>
<th>Pigs</th>
<th>Cattle</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Laying hens</td>
<td>- Fattening pigs</td>
<td>- Dairy cows</td>
</tr>
<tr>
<td>- Table eggs</td>
<td>- Pork</td>
<td>- Milk</td>
</tr>
<tr>
<td>- Broiler</td>
<td></td>
<td>- Veal calf</td>
</tr>
<tr>
<td>- Broiler meat</td>
<td></td>
<td>- Veal</td>
</tr>
<tr>
<td>- Turkey</td>
<td></td>
<td>- Beef cattle</td>
</tr>
<tr>
<td>- Turkey meat</td>
<td></td>
<td>- Beef</td>
</tr>
</tbody>
</table>
What do we have at BfR?

- Results of testing *E. coli* from 3 years (2009-2011)
- Broth Microdilution according to CLSI guidelines
- 7196 isolates from animals and food
- 14 antimicrobials
- Harmonised evaluation: 
  **Epidemiological cut offs** (EUCAST)
Resistance in \textit{E. coli} from farm animals, 2009-2011

- Layers, \(N=1955\)
- Broilers, 2010/2011, \(N=648\)
- Turkeys, 2010/2011, \(N=311\)
- Pigs, 2011, \(N=859\)
- Veal calves, 2010, \(N=272\)
- Beef cattle, 2011, \(N=909\)
- Dairy herds, 2009/2010, \(N=187\)

\begin{itemize}
  \item Susceptible
  \item 1 class
  \item 2 classes
  \item 3 classes
  \item 4 classes
  \item > 4 classes
\end{itemize}
Resistance in *E. coli* from pigs and broilers 2011

![Graph showing the proportion of resistant bacteria for various antibiotics in broilers and pigs.](image-url)
## Resistance in *E. coli* from pigs and broilers 2011

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Proportion of resistant bacteria (%)</th>
<th>Broilers, N=246</th>
<th>Pigs, N=859</th>
</tr>
</thead>
<tbody>
<tr>
<td>Susceptible</td>
<td></td>
<td></td>
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<tr>
<td>Gentamicin</td>
<td></td>
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<td></td>
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<tr>
<td>Kanamycin</td>
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<td></td>
<td></td>
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<tr>
<td>Chloramphenicol</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Florfenicol</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cefotaxime</td>
<td></td>
<td>10</td>
<td>0.5</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td></td>
<td>40</td>
<td>0.5</td>
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<tr>
<td>Streptomycin</td>
<td></td>
<td></td>
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<tr>
<td>Ampicillin</td>
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<td></td>
<td></td>
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<tr>
<td>Sulfamethoxazole</td>
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<td></td>
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<tr>
<td>Trimethoprim</td>
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<td></td>
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<tr>
<td>Tetracycline</td>
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</tbody>
</table>

The graph and table above show the proportion of resistant bacteria for different antibiotics in broilers and pigs. Cefotaxime and Ciprofloxacin are highlighted as being particularly resistant in both pig and broiler samples.
Resistance in *E. coli* from animals and meat

![Bar chart showing the proportion of resistant bacteria for various antibiotics. The chart compares veal (Veal, 2009, N=51) and veal calf (Veal calf, 2009, N=361).](chart.png)
Summary: Resistance Monitoring

• Differences between production types

• Differences between animal species

• Higher resistance levels in meat production

• Resistant bacteria on meat
iii. Consequences for the practitioner

Any treatment selects for resistance
⇒ Disease prevention is vital !!

If disease occurs:
⇒ Follow prudent use guidelines....
It’s easier said than done….

Acute infection: timely and consequent treatment

Prudent use: lab diagnosis and targeted therapy

Treatment based on presumptive diagnosis

Diagnosis needs laboratory confirmation
What can the vet do?

• Animal health management

• Focus on prevention of frequent diseases

• Clinical diagnosis, animal side tests

• Lab diagnosis

• Monitor pathogens, resistance and treatment success
What will the vet need from us?

Communication of up to date knowledge:

• Animal Health Management
• Diagnostic opportunities
• Current treatment concepts

➢ CONTINUING EDUCATION!!!!

• Advanced animal side tests
• Easy access to fast diagnostic facilities
Conclusion

• Antimicrobial use needs to be minimized

• Disease prevention is the key

• Prudent use requires excellent diagnostic facilities

• Health data need to be used
Thank you for your attention