Global animal production perspectives and correlated use of antimicrobial agents

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General Overview

Presentation overview

- The global population of people and livestock
- Agricultural systems and relevance to livestock production
- Information on use of antibiotics
- Conclusions

Acknowledgment of main information sources:
- FAO: FAOSTAT information, livestock related publications (Livestock’s long shadow (2006), FAO The State of Food and Agriculture - Livestock in the balance (2009), FAO/ILRI map of livestock production systems v.5 of 2011)
- Vetnosis, an Endinburh, Scotland based a research and consulting firm specialising in global animal health and veterinary medicine
- FDA 2011 SUMMARY REPORT On Antimicrobials Sold or Distributed for Use in Food-Producing Animals
One World – one health

Human health, animal health and ecosystems are inextricably linked

**Human health**
At least 60% of all human diseases have their origin in animals

**Animal health**
Diseases in food producing animals globally amount to a loss of 20% in production

**Ecosystem**
Any emerging disease in the last 30 or 40 years results from encroachment into wild lands and changes in demography
(Peter Daszak, EcoHealth Alliance)
Map of human population - numbers


Poultry, 2010-2011 average

Pigs, 2010-2011 average
Where do most animals live
FAOSTAT 2010-2011 average numbers, regional distribution

Cattle & Sheep
Europe 7.66%
Africa 16.61%
Asia 41.28%
Oceania 2.38%
Americas 32.07%

Poultry
Europe 9.96%
Asia 55.61%
Oceania 7.97%
Africa 7.89%
Americas 25.94%

Sheep & Goats
Europe 7.46%
Africa 29.42%
Americas 15.68%
Asia 50.94%

Pigs
Europe 19.48%
Africa 3.27%
Americas 15.68%
Oceania 0.54%
Asia 55.61%
Classification of livestock production systems

LIVESTOCK PRODUCTION SYSTEMS

GRAZING SYSTEMS
- Extensive
- Intensive

MIXED FARMING SYSTEMS
- Irrigated
- Rainfed

INDUSTRIAL SYSTEMS


Source: FAO.
Diversity of livestock production systems

Global animal production perspectives and correlated use of antimicrobial agents
# Livestock production systems

## Systems and productivity

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Grassland</th>
<th>Mixed, rain-fed</th>
<th>Mixed, irrigated</th>
<th>Land-less</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population (million head)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cattle &amp; buffalo</td>
<td>406</td>
<td>641</td>
<td>450</td>
<td>29</td>
</tr>
<tr>
<td>Sheep &amp; goat</td>
<td>590</td>
<td>632</td>
<td>546</td>
<td>9</td>
</tr>
<tr>
<td><strong>Production (million tonnes)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beef</td>
<td>15</td>
<td>29</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>Mutton</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>0.1</td>
</tr>
<tr>
<td>Pork</td>
<td>1</td>
<td>13</td>
<td>29</td>
<td>53</td>
</tr>
<tr>
<td>Poultry meat</td>
<td>1</td>
<td>8</td>
<td>12</td>
<td>53</td>
</tr>
<tr>
<td>Milk</td>
<td>72</td>
<td>319</td>
<td>204</td>
<td>-</td>
</tr>
<tr>
<td>Eggs</td>
<td>1</td>
<td>6</td>
<td>17</td>
<td>36</td>
</tr>
</tbody>
</table>

Livestock production systems & antibiotics

Antibiotic use in animals – characteristics and drivers

● No specific studies on the relation between production systems and antibiotic use

● Characteristics of use in animals
  - Often population based treatment
  - Often young animals
  - Cost of treatment an important consideration
  - Great range of species, and different bodyweight within some species
  - Large difference in dose between different classes of antibiotics
  - Ease of treatment (via feed or water, long-lasting injections)
  - Prevention of clinical manifestations
  - Some similar classes as used in humans, some of these being critical to both fields
    some classes are animal use only, but top sellers are different

● Characteristics of different production systems
  - Landless: concentrated number of animals, good veterinary oversight, good biosecurity
    and husbandry conditions
  - Grassland: fewer animals, but less veterinary oversight, use of medicines by less trained
    persons
Livestock production systems & antibiotics

Antibiotic use in animals – characteristics and drivers

- Disease-related factors
  - Disease risk factors of major livestock diseases
  - Predominant diseases in the different production systems
- Climatic factors, e.g. season, climate in general
- Feed quality and regimen
- Population dynamics (e.g. number of animals per holding, housing systems, biosecurity, system for adding new animals, disease dynamic in new stock etc.)
- Aim of intervention – keep as many animals as possible healthy for diseases affecting most animals in a holding or return individual animals back to health
- Production aspects – less feed use, less effluent, higher productivity
Antibiotic use monitoring

Objective

- To obtain data on antimicrobial use – ideally number of therapeutic courses given by species at the farm level for:
  - Benchmarking (high versus "average" use)
  - Set and monitor responsible use targets
  - Investigate potential links between use & resistance prevalence for risk assessment

Challenges

- Globally available - value based sales data – influenced by many factors
- Sales data does not inform about actual field use practices
- Data must relate to the context of actual use on-farm for clinical practice changes; national, cumulative data provides only a high-level view
- Use data should come from the vet or on-farm records
- Data should be collected by species
- Harmonized data collection methods are desirable
  - OIE Terrestrial Code Chapter 6.8
  - ESVAC approach for Europe
  - US FDA approach
Global animal health market information

Sales by product category

Total 2011 Global Animal Health Market
$ 22 billion

- Medicinal Feed Additives*/Anti-infectives: 26%
- Others: 74%

*Medicinal Feed Additives includes Anti-infectives, Parasiticides

Data courtesy of Vetnosis
Global animal health market information

Sales by region

Total 2011 Global Animal Health Market
$ 22 billion

- America: 47%
- Europe: 32%
- Others **: 21%

**may not add up to 100 due to rounding

Data courtesy of Vetnosis
Antibiotic use data availability

What is currently available - examples

Europe:
- Country-specific report that look at antibiotic use information and resistance levels (e.g. Danmap (DK), Maran (NL), Germap (DE))
- In some EU countries, use data at the level of veterinarian and/or farmers are being collected (Denmark, Netherlands & plans in Belgium Germany)

US:
- FDA – annual total kg of antimicrobials sold for use in food producing animals

New Zealand:
- Survey of amounts in kg sold from 2004 to 2009

Japan:
- sales information in monetary value at irregular intervals
# Antibiotic use data

## Europe

<table>
<thead>
<tr>
<th>Country</th>
<th>Total amount of antibiotics sold in tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>63</td>
</tr>
<tr>
<td>Belgium</td>
<td>300</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>72</td>
</tr>
<tr>
<td>Denmark</td>
<td>120</td>
</tr>
<tr>
<td>Estonia</td>
<td>8</td>
</tr>
<tr>
<td>Finland</td>
<td>15</td>
</tr>
<tr>
<td>France</td>
<td>1,011</td>
</tr>
<tr>
<td>Hungary</td>
<td>209</td>
</tr>
<tr>
<td>Iceland</td>
<td>0.9</td>
</tr>
<tr>
<td>Ireland</td>
<td>93</td>
</tr>
<tr>
<td>Latvia</td>
<td>6.6</td>
</tr>
<tr>
<td>Lithuania</td>
<td>16</td>
</tr>
<tr>
<td>Netherlands</td>
<td>464</td>
</tr>
<tr>
<td>Norway¹</td>
<td>5.7</td>
</tr>
<tr>
<td>Portugal</td>
<td>177</td>
</tr>
<tr>
<td>Slovenia</td>
<td>9</td>
</tr>
<tr>
<td>Spain</td>
<td>1,748</td>
</tr>
<tr>
<td>Sweden¹</td>
<td>14</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>469</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4,802</strong></td>
</tr>
</tbody>
</table>

¹ Without data for farmed fish
Antibiotic use data availability

US

Table 1. Antimicrobial Drugs Approved for Use in Food-Producing Animals: 2011 Sales and Distribution Data Reported by Drug Class

<table>
<thead>
<tr>
<th>Antimicrobial Class</th>
<th>Annual Totals (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td></td>
</tr>
<tr>
<td>Aminoglycosides</td>
<td>214,895</td>
</tr>
<tr>
<td>Cephalosporins</td>
<td>26,611</td>
</tr>
<tr>
<td>Ionophores</td>
<td>4,123,259</td>
</tr>
<tr>
<td>Lincosamides</td>
<td>190,101</td>
</tr>
<tr>
<td>Macrolides</td>
<td>582,836</td>
</tr>
<tr>
<td>Penicillins</td>
<td>880,163</td>
</tr>
<tr>
<td>Sulfas</td>
<td>371,020</td>
</tr>
<tr>
<td>Tetracyclines</td>
<td>5,642,573</td>
</tr>
<tr>
<td>NIR</td>
<td>1,510,572</td>
</tr>
<tr>
<td>Export</td>
<td></td>
</tr>
<tr>
<td>Tetracyclines</td>
<td>15,321</td>
</tr>
<tr>
<td>NIR</td>
<td>185,333</td>
</tr>
</tbody>
</table>

Ionophores in the EU are considered feed additives

NIR/NIRE: Not independently reported/Not independently reported Export where there are less than three distinct sponsors actively marketing products [Aminocoumarins, Amphenicols, Diamino-pyrimidines, Fluoroquinolones, Glycolipids, Pleuromutilins, Polypeptides, Quinoxalines, and Streptogramins]
Conclusions

Information gaps

- Understanding of antibiotic usage across agricultural production systems is incomplete – specific studies may be necessary

- Models of varying complexity and level of detail exist regarding antibiotic use in animals but available information is disparate

- Beware of comparing ‘Apples and Oranges’;
  - Volume of antimicrobials use is relevant, not the value of antimicrobials sold
  - Volume information needs to be put into a complex context in order to become data that allow comparison between countries
  - Volume does not take into account differences in the potency of compounds
  - Understand the pit-falls of comparing information and the impact of trade on data

- Aim to have:
  - Volume data
  - Species data
  - Methodology to account for dosage differences
  - Collect at prescriber level

- Start with volumes data