AACTING

Herd level antimicrobial consumption in animals
Collect | Analyse | Benchmark | Communicate

Quantification, Benchmarking and Stewardship of Veterinary Antimicrobial Usage

Third International Conference

5-6 May 2022 Hannover, Germany & Online

Abstracts Book

Imprint

3rd AACTING conference Abstracts book

The authors of the abstracts are responsible for the content of the abstracts.

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Hannover 2022

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1. Hygiene Concept

The AACTING conference is a "hybrid conference", i.e. with oral and poster presentations on-site at University of Veterinary Medicine in Hannover as well as online-presentations. Therefore, it is organised following the recent hygiene rules of the State of Lower Saxony and the University of Veterinary Medicine in Hannover (details can be found at https://www.tiho-hannover.de/universitaet/aktuelles-veroeffentlichungen/sars-cov-2). In addition to these rules, please also note the following information:

Vaccine and test certificates

- External visitors, guests and owners of patients will be asked to provide their **vaccine certificate**, an**official test results** or a **status of recovery** unprompted upon entering the premises.
- **Official covid test certificates** need to be officially confirmed and, at the time of the start of the event, cannot be older than 24 hours (antigen tests) or 48 hours (PCR tests)

Minimum distance, mouth and nose protection

- Wherever possible, participants are required to keep a **minimum distance of 1.5 - 2 meters**. This especially applies when entering and exiting the premises.
- Wearing a FFP2 mask is required in all buildings.

Hygiene and ventilation

- In general, the hygiene measures (hand hygiene, coughing/- sneezing etiquette) should be respected. Hand disinfectant will be provided at the venue.
- Ventilation of the venue will be conducted at least during all breaks.

Attendee admittance

- A gathering of people while entering the premises should be avoided

Breaks/Food

- Wherever possible, participants are required to keep a minimum distance of 1.5 - 2 meters.

Objects

- Do not share any objects or devices. Only writing material brought from home should be used, no pens will be provided which could be shared by multiple people.

Generally, attendance and access regulations at Hanover veterinary school apply. (For more information about the safety and hygiene protocol SARS-CoV-2, visit https://www.tiho-hannover.de/universitaet/aktuelles-veroeffentlichungen/sars-cov-2) - Available in German only

Furthermore, at the time of the event, the specified legal protective measures during the organization and implementation of the event are to be respected and practiced. We are especially referring to the latest version of the lower Saxony CoViD regulation www.niedersachsen.de/Coronavirus/vorschriften-derlandesregierung-185856.html - Available in German language only

2. Programme

Day 1: Thursday 5 May 2022

09:00	Registration & Poster set-up	
10:00	Welcome	Gerhard Greif Wannes Vanderhaeghen Lothar Kreienbrock
10:15	***Keynote 1:*** Antimicrobial Use in Animal Health - Global Perspective	Morgan Jeanin, France
	Session 1: Antimicrobial Usage - Collecting information for improvement	Wannes Vanderhaeghen
11:00	Information System on Antibiotics in Veterinary Medicine (IS ABV) – First results, challenges, and the way forward	Isabel Lechner, Switzerland
11:20	Antimicrobial Monitoring Service for UK Dairy Herds – A review of the last 4 years (Stewardship)	Christina Ford, United Kingdom
11:40	Application of Multi-actor farm health approaches for the improvement of antimicrobial use practices across nine European countries	Helena Ferreira, Belgium
12:00	Lunch & Poster viewing	
	Session 2: Antimicrobial Usage - Non-European Experiences	Sandra Brogden
13:30	A descriptive overview on antimicrobial use in terrestrial animals: A southern African perspective	Mohamed Sirdar, Botswana
13:50	Quantitative and qualitative analysis of antimicrobial usage and biosecurity on broilers and sonali farms in Bangladesh	Nelima Ibrahim, Belgium
14:10	Antimicrobial use (AMU) indicators and their utility for various AMU surveillance or study objectives	Agnes Agunos, Canada
14:30	Antimicrobial use in lactating sows, piglets, nursery, and grower-finisher pigs in Ontario, Canada during 2017 and 2018	Angelina Bosman, Canada
14:50	Coffee break & Poster viewing	
15:20	Poster Session	
	Keynote Session	Jeroen Dewulf
16:20	***Keynote 2:*** Comparison of different approaches to antibiotic restriction in food-producing animals	Sylvia Checkley, Canada
17:05	Questions, discussion and conclusion	
17:30	End of first conference day	

19:30 Dinner, restaurant "Ma Vie", Schlossküche Herrenhausen

Day 2: Friday 6 May 2022

08:30	Coffee & Poster viewing	
	Welcome & Keynote Session	Roswitha Merle
09:00	***Keynote 3:*** Antimicrobial use in companion animals	Inge Vangeijlswijk, Netherlands
	Session 3.1: Antimicrobial Usage - miscellaneous	Claire Chauvin
09:45	Knowledge and practices on antibiotic use among smallholder pig farmers in Timor-Leste	Shawn Ting, Australia
10:05	Antimicrobial use on Australian dairy cattle farms – A survey of veterinarians	Michele Tree, Australia
10:25	Assessing the Economic Impact of Antimicrobial Usage and its Reduction on Farm Level on Dairy Farms in Southern Germany	Carsten Hümmer, Germany
10:45	Coffee break & Networking	
11:15	KAbMon – Monitoring antibiotic usage in different groups of calf-keeping farms	Charlotte Jensen, Germany
	Session 3.2: Antimicrobial Usage and Resistance	Annemarie Käsbohrer
11:35	Fijian veterinarian and para-veterinarians' behaviour, attitude and knowledge towards antimicrobial use and antimicrobial resistance: A qualitative study	Xavier Khan, United Kingdom
11:55	Understanding linkage between antibiotic supply, usage and resistance in Beef Cattle Production in Argentina and the UK	Peers Davies, United Kingdom
12:15	Effect of different oral dosage forms of enrofloxacin on environmental contamination and development of resistance of Escherichia coli in pigs	Jessica Meißner, Germany
12:35	Lunch & Networking	
	Session 3.3: Antimicrobial Usage - Perspectives	Jeroen Dewulf
13:35	Alternatives to critically important antimicrobials – hard to find, even harder to succeed	Marju Sammul, Estonia
13:55	Strengthening the benchmarking system in Germany – what is the best way?	Anke Schröder, Germany
14:15	***Panel Discussion:*** The practical application of the Regulation (EU) 2019/6	
15:00	Questions, discussion and closing remarks	
15:30	Farewell	Wannes Vanderhaeghen Lothar Kreienbrock

3. Dinner: "Ma Vie", Schlossküche Herrenhausen

MA VIE
SAAL – TERRASSE – GARTEN

Address:
Alte Herrenhäuser Str. 3
30419 Hannover

Directions by tram
From city center "Kröpcke" with line 4 (Garbsen) or line 5 (Stöcken) to the station "Herrenhäuser Gärten"

Schedule:
Reception: 19:30 h
Buffet: 20:00 h
Last order: 22:30 h
End: 23:00 h

4. Oral presentations (in chronological order)

4.1. Keynote: Antimicrobial Use in Animal Health - Global Perspective

M. Jeannin

World Organisation for Animal Health, Paris, France

For over two decades, the World Organisation for Animal Health (OIE) has engaged in combatting antimicrobial resistance (AMR) through a One Health approach. Monitoring of antimicrobial use (AMU) is an important source of information that together with surveillance of AMR can be used for the assessment and management of risks related to AMR. In the framework of the Global Action Plan (GAP) on AMR, the OIE has built a global database on antimicrobial agents intended for use in animals, in collaboration with other Quadripartite partners: World Health Organization (WHO), Food and Agriculture Organization of the United Nations (FAO), and United Nations Environment Programme (UNEP).

OIE's strategy on AMR and the prudent use of antimicrobials supports the objectives established in the GAP on antimicrobial resistance and reflects the mandate of the OIE, through four main objectives. Following Resolution No. 26, adopted by the OIE World Assembly during the 83rd General Session in May 2015, OIE strengthened its wide and diverse set of actions by launching its first annual data collection on the use of antimicrobial agents in animal health. Thenceforward, a continuous annual increase of countries reporting data demonstrates the countries engagement for the global development of monitoring and surveillance systems, in line with OIE international standards.

OIE's annual report highlights not only quantitative data provided by countries, but it also reflects the current situation of governance of veterinary antimicrobials worldwide, and barriers to quantitative data collection. In order to cope with one of those reported hurdles (lack of IT tools), OIE has developed an Excel-based OIE Calculation Tool that has supported the calculations of 30% of the countries that reported antimicrobial quantities during the sixth round of data collection. A third of these countries were reporting antimicrobial quantities for the first time and in the large majority moved from reporting only baseline information to the highest level of granularity of data, Reporting Option 3. Concomitantly, the development of the future OIE AMU data collection system, seeks to facilitate the understanding, utilisation and data ownership among all OIE Members. Secure and confidential, the system has been designed to ease data submission, and to provide instruments for data consolidation and visualisation, that could be used for decision-making at national level.

OIE has also started to analyse means to collect data at farm level. A targeted collaboration with OIE regional and sub-regional representatives for Asia, as well as with FAO colleagues is currently working on the development of joint regional guidelines providing methodological options for developing farm-level use monitoring projects. Those have been drafted through consultations with more than a hundred participants. Globally, OIE is seeking to understand which countries have initiated farm level data collection projects and which methodological tools could assist in the process.

OIE continues its substantial work as a core member of the Quadripartite, strongly contributing to the establishment of global governance structures against AMR. The AMR-Quadripartite Joint Secretariat also serves as the secretariat for the Multi Partner Trust Fund on AMR (AMR-MPTF), funding both global and country level projects. This has led to enhanced multisectoral country coordination, increased awareness and expanded capacity of official services. One Health coordination is also at the centre of the initiatives update from OIE European regional representation.

The OIE aims to continue to work collaboratively with all country governments to strengthen their capacity to monitor and regulate the use of antimicrobials, improve awareness of antimicrobial resistance and support all countries to adopt the OIE Standards to ensure the prudent and responsible use of antimicrobial agents in animal health.

4.2. Information System on Antibiotics in Veterinary Medicine (IS ABV) – First results, challenges, and the way forward

Isabel Lechner[1], Heinzpeter Schwermer[2], Guy Schnidrig[2], Anaïs Léger[2], Dagmar Heim[2]

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Background

Since 2019, Swiss Veterinarians are obliged to electronically submit all antibiotic prescriptions for livestock and pets to the Information System on Antibiotics in Veterinary Medicine (IS ABV). Prescription data include information on the species, production type (e.g., fattening calves, dairy cows), type and amount of preparation, number of animal-treatment days and treatment indication.

The IS ABV is part of the Antibiotic Resistance Strategy (StAR) and allows the causes of high antibiotic deployment to be investigated and for targeted measures to be developed. It also allows to monitor the effectiveness of current measures and perform national and international comparisons of antibiotic consumption. Furthermore, submitted data shall be used for benchmarking veterinarians and farms, which is foreseen to start from 2023.

Results

A first report on the livestock data of the year 2020 was published in January 2022. Indicators include the number of prescriptions, number of animal-treatments and the amount of actives substance dispensed. A total of 869'310 prescriptions for livestock have been recorded by 387 practices during the year 2020. 47% of prescriptions were recorded as "individual animal therapy", 1 % as "oral group therapy", 0.3% as "non-oral group therapy" and 25% as "dispensing on stock". 906'000 animal-treatments for cattle and 479'000 animal-treatments for pigs were recorded. The total amount of active substance was 22'550 kg, of which 79% was administered to cattle and 14% to pigs. 4.5% of the total amount were critically important antimicrobials. So far, this report only includes absolute numbers, without the context of the population size. For horses, dogs and cats, 548'604 animal treatments a total amount of 1708 kg active substance were registered. Analyses for pets are ongoing and more results will be available from March 2022. The implementation of a benchmarking system is foreseen for the near future, for which the treatment intensity shall be used.

Challenges included the validation of data entries and the handling of outliers. Further challenges arise in the implementation of a benchmarking system, where the source and the definition of a denominator currently pose the biggest concerns.

Conclusions

Although the initial analysis of prescription data and the implementation of a benchmarking system revealed some challenges, the system holds great potential that will be increasingly exploited over the coming years. Other countries may encounter similar difficulties in implementing their own information and benchmarking systems, which makes an international exchange of experiences necessary and highly valuable.

4.3. Antimicrobial Monitoring Service for UK Dairy Herds – A review of the last 4 years (Stewardship)

C. Ford[1], K. Rowland[1], T. Potter[2]

[1] Kingshay Farming and Conservation, Glastonbury, Somerset, BA6 8LU, UK; [2] Westpoint Farm Vets, UK

The Kingshay antimicrobial monitoring service was established in 2017 in response to demands from farmers, vets, and milk processors to enable antimicrobial purchase data to be collected on an annual basis. This data has then been used as part of the health planning process and a targeted approach by the industry to reduce reliance on antimicrobials in agriculture. The number of herds using the service has grown each year with 940 herds being recorded in 2021.

Ensuring robust data, client sales data is obtained directly from the vet practices' practice management software, with herd details such as livestock numbers submitted annually by the farmer.

The report benchmarks against the 6 RUMA (Responsible Use of Medicines in Agriculture Alliance) Targets and provides a summary of administration routes and antimicrobial class. Along with dry cow therapy and a detailed list of products used and the quantity, the report includes comparisons with other herds, and to last year's results.

During the last 4 years total antimicrobial usage has reduced by 28% to 15.5mg/kg PCU for the year ending March 2021. This is 26% lower than the 21 mg/kg PCU RUMA 2020 target, with 79% of herds being under the RUMA target. Another key trend observed was the significant reduction of reliance on high priority critically important antimicrobials (HP-CIAs) with 7% of herds using these products in 2021, compared to 79% in 2018.

Looking at individual usage there is a significant range from 0.28 to 87.51mg/kg PCU in 2021 narrowing from a range of 119.3mg/kg PCU in 2020. Whilst the average usage for the group has reduced year on year, there is variation in individual herds and it is not always the same herds that have the lowest usage (Figure 1), presumably representing the need to respond to disease outbreaks. No association between overall usage and herd size, milk yield, breed and key management factors was identified.

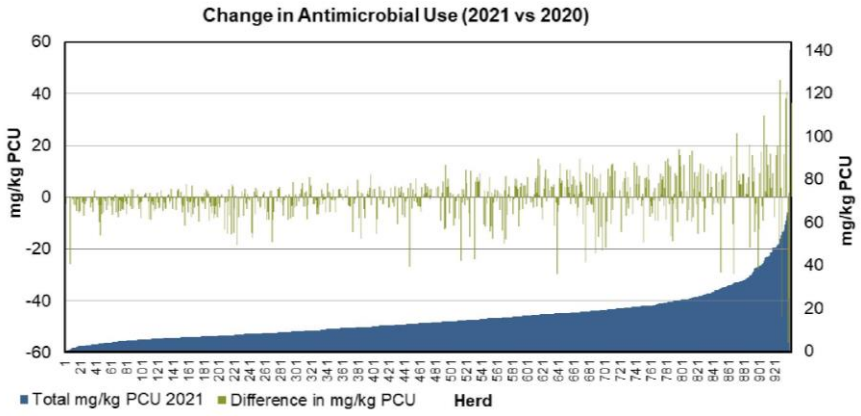

Figure 1 Change in Antimicrobial use of UK dairy herds from 2020 to 2021

Figure 1 Change in Antimicrobial use of UK dairy herds from 2020 to 2021

Conclusion

The Kingshay antimicrobial monitoring service provides farmers with accurate data on their antimicrobial usage. The easy-to-use reports facilitate conversations between farmers and their vets enabling a collaborative approach to reducing antimicrobial usage. Overall, the herds using the service have significantly reduced their antimicrobial usage over the last 4 years, however there is significant variation in usage between herds highlighting that there are further steps many farms can implement to reduce their usage further.

4.4. Application of Multi-actor farm health approaches for the improve-ment of antimicrobial use practices across nine European countries

Helena C. de Carvalho Ferreira[1], Marc Heyndrickx[1], Laura Peeters[1], Stelian Baraitareanu[2], Alexandros Mavrommatis[3], Eleni Tsiplakou[3], George Zervas[3], Ilias Chantziaras[4], Sandija Zeverte-Rivza[5], Aija Malniece[5], Kaspars Kovalenko[5],[DISARM consortium], Erwin Wauters[1]

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Introduction

In an effort to tackle the problem of antibiotic use (AMU), several strategies have been put forward, namely bottom-up approaches that focus on the coaching, education and dissemination of innovative solutions to farmers and other stakeholders involved in animal production (1, 2). In this action research study we describe how a multi-actor farm health (MAFH) approach has been implemented, demonstrating the importance of this type of activities on the perception of farmers towards AMU reduction strategies.

Materials and methods

MAFH teams (MAFHT) were created within the DISARM thematic network, composed of the three core interested parties (farmer/farm manager, feed/other advisor, veterinarian) with the help of a project facilitator. In total, nine European countries (Belgium, Denmark, France, Greece, Netherlands, Latvia, Romania, Spain, UK) were involved. The MAFHT focused on pigs (Netherlands and Spain), poultry (Belgium and Latvia), dairy cattle (Denmark, Romania and UK) and dairy sheep (France and Greece). A total of 30 case studies have been summarized in factsheets presenting the challenges, solutions proposed and perceptions of the economic impact of reduced antimicrobial use.

Results and discussion

Most case studies followed in a period of two years show overwhelmingly positive impact in the reduction of antimicrobial use (AMU) through coaching with MAFHT. Farmers recognized the importance of the MAFHT in identifying critical animal health problems and alternatives or improved procedures that could be employed when aiming to reduce AMU on their farms. Based on the experiences of the MAFHT, an educational tool is also being developed (DISARM toolbox) to facilitate coaching activities.

Conclusion

Data from this study demonstrated that the MAFHT approach can be instrumental in the fight against AMR. In this project we demonstrate that by implementing a coaching strategy that farmers perceive as useful, in different European countries and different animal production systems.

References

1. Caekebeke N, Jonquiere FJ, Ringenier M, Tobias TJ, Postma M, van den Hoogen A, Houben MA, Velkers FC, Sleeckx N, Stegeman JA, Dewulf J. Comparing Farm Biosecurity and Antimicrobial Use in High-Antimicrobial-Consuming Broiler and Pig Farms in the Belgian–Dutch Border Region. Frontiers in veterinary science. 2020;7.

2. Rojo-Gimeno C, Postma M, Dewulf J, Hogeveen H, Lauwers L, Wauters E. Farm-economic analysis of reducing antimicrobial use whilst adopting

4.5. A descriptive overview on antimicrobial use in terrestrial animals: A southern African perspective

MM. Sirdar[1], I. Savadogo[2], M. Jeannin[2], D. Góchez[2], O. Valsson[2], J. Yugueros-Marcos[2]

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The World Organisation for Animal Health (OIE) is responsible for data collection on antimicrobial use (AMU) in terrestrial and aquatic animals. Since 2016, the OIE publish annual reports on Antimicrobial Agents Intended for Use in Animals, and the fifth report was released in April 2021. The report provides details on the annual global use of antimicrobial agents as represented by the quantitative data reported by countries to the OIE. In 2021, for the first time, the fifth report included a section on trends of antimicrobial agents adjusted for animal biomass for the period 2015-2017. A total of 16 Member countries (MCs) representing the Southern African Development Community (SADC), have been participating in the data collection rounds since the first cycle in 2015.

The aim of this study is to highlight the efforts of the OIE regarding data collection on the use of antimicrobials in terrestrial animals, with specific emphasis on data collected for the year 2018 from the SADC region.

The OIE designed a template for data collection, and it is shared each year with all 182 Members of the OIE. All countries were given the opportunity to participate in data collection and submission, even if there is no formalised national data collection system in place. Qualitative data were collected through a Baseline Information Excel sheet. Reporting Options (RO) were provided for quantitative data based on additional sections covering i) antimicrobial classes used in animals (RO 1-3), ii) antimicrobial type of use (RO 1-3), iii) use of growth promotors (RO 1-3), iv) animal groupings (RO 2 & 3) and v) route of administration (RO 3).

A minimum of 12 (n=16; 75%) and a maximum of 15 (n=16; 94%) SADC MCs have participated in each of the six data collection rounds, with at least 75% of participating MCs having submitted quantitative data. A decline in participation was observed during 2019 and 2020, which can be partially attributed among other factors to the disruptions caused by the COVID-19 pandemic. The use of antimicrobial agents as growth promotors was reported by a single country, however six MCs cited lack of legislation in this category of use. In 2018, the majority of countries (n=10; 86%) used “import information” for reporting quantitative data and all quantities reported were predominantly labelled for poultry, bovine, sheep, goats and pigs. Tetracycline was reported as the most used antimicrobial agent (81.4%) followed by sulphonamides. The highest proportions of antimicrobial classes used for terrestrial food-producing animal were tetracyclines, sulphonamides and macrolides respectively. In contrast, sulphonamides followed by penicillins and fluroquinolones were the most used antimicrobial agent classes in companion animals. The average quantities of antimicrobial agents adjusted by animal biomass were reported at 10.36 milligrams antimicrobial agents per kilogram animal biomass. The trend analysis based on data reported by four MCs from 2015-2018 showed an increase from 7.89 – 12.68 milligrams antimicrobial agent per kilogram animal biomass.

Conclusion

Data collection templates and resulting reports were developed, taking into consideration the differences between MCs in their governance and surveillance of veterinary antimicrobials. Almost all SADC

MCs are currently reliant for their reporting on “sales” or “imports” data of antimicrobial agents listed in the OIE List of Antimicrobial Agents of Veterinary Importance. This approach does not highlight the usage patterns and might underestimate the actual consumption of antimicrobials in animals, which necessitates data collection at farm level. Accurate data at farm level will aid formulating improved guidelines on inappropriate use, animal husbandry, disease prevention and control, and enable precise risk and trend analysis.

Guided by the 2016 adopted Strategy on Antimicrobial Resistance and the Prudent Use of Antimicrobials, the OIE plays a vital role in promoting responsible and prudent use of antimicrobials, monitoring AMU and supporting MCs in developing practical and transparent systems and surveillance mechanisms. It is imperative for all SADC MCs to join data collection, increasing accuracy by providing reliable data and providing an excellent tool to monitor evolution.

4.6. Quantitative and qualitative analysis of antimicrobial usage and biosecurity on broilers and sonali farms in Bangladesh

Nelima Ibrahim[1,2], Philip Joosten[1], Shoieb Mohsin[4], Filip Boyen[3], Guillaume Fournié[5], SK Shaheenur Islam[2] and Jeroen Dewulf[1]

[1]Veterinary Epidemiology Unit, Department of Internal medicine, Reproduction and Population medicine. Faculty of Veterinary Medicine, Ghent University, Salisburylaan 133, Merelbeke 9820, Belgium; [2]Department of Livestock Services, Bangladesh; [3]Department of Pathology, bacteriology and poultry disease, Faculty of Veterinary Medicine, Ghent University, Salisburylaan 133, Merelbeke 9820, Belgium; [4]Department of Medicine and Surgery, Chattogram Veterinary and Animal Sciences University; [5]Department of Pathobiology and Population Sciences, Royal Veterinary College, University of London, London, United Kingdom.

Introduction: Antimicrobial use (AMU) is a major contributing factor in the rising threat of antimicrobial resistance (AMR) in worldwide food animal production. Therefore, to control AMR, AMU has to be addressed. On that account, this study aimed to quantify and associate the AMU and biosecurity status of broiler and sonali farms in Bangladesh.

Methods: Data on all antimicrobial treatments within each flock and total antimicrobials purchased over one year on the farms of the sampled flocks were collected from 54 broiler and 51 sonali farms situated in the northern part of Bangladesh. Additionally, this was done for 40 broiler flocks from the southeast region. AMU at flock level was quantified as treatment incidence (TI) per 100 days based on the Defined Daily Dose (TIDDDvet). The biosecurity status of the farms was determined using Biocheck.UGent, a scoring system that quantifies the level of biosecurity on the farm.

Results: Median TIDDDvet at flock level equaled 89 and 90 for broilers and sonali, respectively. TIDDDvet expresses the number of days per 100 animal-days at risk that the flock received a standard dose of antimicrobials, meaning that the birds were treated around 90% of their lifetime with a standard antimicrobial dose. Minimum and maximum values equaled 17.1-221.9 and 40.9-233.0 in broilers and sonali, respectively. In broilers, these antimicrobials were mainly used for prophylaxis (58%), while in sonali flocks, it was mostly for treatment purposes (56%). Ninety-two percent of farms started an antimicrobial treatment on the first day of production. The remaining farms set up treatment within the first week. The most frequently used antimicrobial classes in broilers and sonali, expressed as the percentage of the total number of treatments, were fluoroquinolones (25%; 15%), sulfonamides (19%; 25%), tetracyclines (15%; 19%) and aminopenicillins (17%; 12%), respectively. The average external biosecurity and internal biosecurity equaled 37% and 45% for boilers and 63% and 61% for sonali, respectively.

Conclusion: As the majority of farms were treating their birds for almost the entire production period, it can be said that both conventional broiler and sonali bird production were still fully dependent on AMU. Most likely, this can be partially explained by the low biosecurity scores on the farms, although low biosecurity was non-significantly associated with a higher AMU.

4.7. Antimicrobial use (AMU) indicators and their utility for various AMU surveillance or study objectives

Agnes Agunos[1], Sheryl P. Gow[2], Anne E. Deckert[1], Grace Kuiper[3], David F. Léger[1], Richard J. Reid-Smith

[1] Center for Foodborne, Environmental and Zoonotic Infectious Diseases, Public Health Agency of Canada; [2] Department of Environmental and Radiological Health Sciences, Colorado State University

The Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS), Farm Surveillance routinely monitors trends in antimicrobial use (AMU) and antimicrobial resistance (AMR) in food animal species through a network of sentinel veterinarians and producers. Data are communicated to the industry and relevant stakeholders to support the evaluation of voluntary and regulatory changes in AMU policies and to inform stewardship actions.

Objective of the presentation: The purpose of this presentation is to describe the utility of specific indicators in characterizing AMU trends between and across animal species (multispecies integration), in reporting integrated AMU-AMR trends, in studying AMU and AMR, and in describing trends in AMU in relation to animal health outcomes.

Methods: Farm-level AMU and AMR data from broiler chickens (2015-2019), grower-finisher pigs (2015-2019) and turkeys (2016-2019) were used. Various indicators were determined and assessed for their relevance for each of the surveillance/study objectives. The indicators assessed were: 2 weight based indicators (milligrams/population correction unit [mg/PCU], mg/kg animal biomass using live pre-slaughter weights); 3 dose-based indicators (number of defined daily doses in animals [nDDDvet] using Canadian standards [nDDDvetCA]/1000 animal-days at risk, nDDDvetCA/PCU and nDDDvetCA/kg animal biomass), and: the count based indicator (AMU frequency). As for AMR, the percentage of resistance and percentage of resistance adjusted for animal biomass (used in multispecies trends) were used. Spline curves were constructed to visualize AMU data trends between species. Forest plots of (odds ratios [OR], confidence intervals) based on mixed effects logistic regression models were used to assess variations in effect estimates (and *p* values) using different AMU indicators for studying the relationships between AMU and AMR.

Results and discussions: Grower finisher pigs had the highest mean value in 4 AMU indicators assessed while broilers exhibited the highest nDDDvetCA/1,000 animal-days at risk and turkeys had the lowest mean AMU for all 5 indicators. For AMU-AMR association analysis, variations in effect estimates were observed. Specifically, the nDDDvetCA/1,000 animal-days at risk exhibited higher OR's with wide 95% CI compared to the other dose-based indicators. For describing AMU trends and for studying AMU-AMR associations, nDDDvetCA/kg animal biomass was the indicator selected because of comparability of the metric used (adjusted for species-specific DDDvetCA standards), availability of the data (from either farm or abattoir records) and ease of communication with stakeholders. The count-based indicator detected the impacts of voluntary and regulatory AMU changes on specific disease syndromes affecting flocks/herds.

Conclusion: The complementarity of various AMU indicators and syndromic monitoring are essential components of an integrated surveillance program to enhance infection prevention and control and reduction of AMR through stewardship.

4.8. Antimicrobial use in lactating sows, piglets, nursery, and grower-finisher pigs in Ontario, Canada during 2017 and 2018

Angelina L. Bosman[1] Anne E. Deckert[1,2], Carolee A. Carson[1], Zvonimir Poljak[2], Richard J. Reid-Smith[1,2], Scott A. McEwen[2]

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Quantitative data on antimicrobial use (AMU) on swine farms are needed for the development and improvement of good antimicrobial stewardship practices to reduce the risk of antimicrobial resistance in bacteria that can cause illness in animals and humans. In Canada, there is a lack of quantitative information on AMU in lactating sows, suckling piglets, and nursery pigs. To address this data gap, this study aimed to determine which antimicrobials are currently used in farrowing, nursery, and grower-finisher herds in the province of Ontario, Canada, and to quantify AMU using various metrics.

We collected data on herd demographics, biosecurity, herd health and AMU during one production cycle from 25 farrowing and 25 nursery herds between May 2017 and April 2018, and obtained data from 23 grower-finisher herds during the same time frame from CIPARS (the Public Health Agency of Canada's Canadian Integrated Program for Antimicrobial Resistance Surveillance). We applied various AMU metrics to the data, including total kilograms, milligrams per kg animal biomass (mg/kg biomass), and the number of Canadian defined daily doses per pig (doseCA/pig) and per 1,000 pig-days (doseCA rate).

The highest use of antimicrobials, according to all metrics used, were administered in feed in all production stages. Overall, nursery pigs used more antimicrobials in mg/kg biomass and the doseCA rate, while grower-finisher pigs used more antimicrobials in total kilograms and the doseCA/pig. In suckling pigs in some herds, there was routine disease prevention use of ceftiofur, an antimicrobial categorized as very highly important in human medicine by Health Canada. The top antimicrobial active ingredient used in-feed as measured by the doseCA rate was bacitracin in lactating sows, chlortetracycline in suckling and nursery pigs, and salinomycin (the top non-ionophore was lincomycin) in grower-finisher pigs. The top antimicrobial used in each stage of pig production often varied by the metric used. Producers reported the use of antimicrobials for growth promotion in suckling and grower-finisher feed.

Conclusion

This study provided novel information on the quantity of AMU in lactating sows, suckling piglets and nursery pigs in Ontario, and demonstrated that the metric used to quantify AMU can affect the relative ranking of antimicrobials used. The information from this study should be of use to policy makers, researchers, veterinarians and producers working towards improving antimicrobial stewardship practices. Our findings confirm that it would be useful to include farrowing and nursery herds in routine AMU surveillance in Canada.

4.9. Keynote: Comparison of different approaches to antibiotic restriction in food-producing animals

4.10. Keynote: Antimicrobial use in companion animals

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Antimicrobial use (AMU) in companion animals is of importance because of the close interaction between dogs or cats and their owners. Dogs and cats are reported to sleep in bed or lick the face of the owner, and by doing so might share bacteria. Antimicrobial use selects for resistant mutant bacteria, and this intimate contact may hamper future treatment of infections when resistant bacteria are shared.

With the Veterinary Medicinal Products Regulation EU 20919/6 (VMP-reg), in 2030 the obligation for EU member states to report antimicrobial use in companion animals comes into force. This presentation gives an overview of recently published methods to measure AMU in companion animals, and will present what will be needed to collect AMU data in companion animals starting in 2029, to fulfill the obligation from the VMP-reg.

Challenges in numerator and denominator for AMU quantification will be discussed, and some examples of practical solutions applied in research of the Faculty of Veterinary Medicine Utrecht and of the Netherlands Veterinary Medicines Institute (SDa) will be shown.

While systemic use is obligatory to monitor and report in the near future, collecting data and reporting on topical AMU is voluntary. The measurement of topical use is difficult, and for that reason not much is known about the volume of topical use in comparison to systemic use, let alone the impact of topical AMU in selecting for resistant bacteria. We have reviewed methods to quantify topical medicines application, and have developed a method for quantifying topical AMU in a comparable manner to systemic AMU. The first results will be presented.

4.11. Knowledge and practices on antibiotic use among smallholder pig farmers in Timor-Leste

Shawn Ting[1], Abrao Pereira[1], Steven Davis[1], Paulo Vong da Silva[1], Amalia Alves[1], Cristibela Dos Santos[1], Jenny-Ann Toribio[2], Olavio Morias[2,3], Joanita Jong[3], Tamsin Barnes[4]

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Introduction: Studies investigating the knowledge and practices of antibiotic use among farmers have never been conducted in Timor-Leste. Such studies would help characterise antibiotic knowledge and use at the farm level so appropriate strategies can be developed to avoid overuse and misuse, and facilitate implementation of the National Action Plan for Antimicrobial Resistance.

Methods: This was a cross-sectional study using a structured face-to-face interview that was conducted between August and September 2020 in three of 13 municipalities in Timor-Leste: Liquica, Aileu, and Bobonaro. The study focused on pig farmers because pigs are the most commonly owned animal by agriculture households (81%) and pigs have a high socio-cultural and economic significance. The minimum sample size required was 151 based on the following assumptions: estimated prevalence of 50%, 8% desired precision and 95% confidence level. Descriptive analyses were conducted using Stata 17.0.

Results: 165 farmers were interviewed, and less than 10 farmers refused participation. Few farmers reported knowing what antibiotics are (n = 21, 12.7% [95% CI: 6.3–23.9]). Of these, the most commonly source of knowledge were friends and veterinary technicians. When asked about how an antibiotic worked, only one (4.7%) of the 21 farmers correctly explained that antibiotics "kill or inhibit bacteria." Only 6 farmers were confident that their pigs had received antibiotics (n = 6, 3.6% [95% CI: 0.8–14.9]). Most farmers responded that their pigs have never received antibiotics (n = 121, 73.3%), and the most common reason was no access to veterinary services. The remaining farmers (n = 38, 23.0%) did not know whether their pigs received antibiotics, and the most common reason was that the farmer was unsure of the content that was injected into their pig. For farmers whose pigs had received antibiotics, the only reported route of administration was through injection for the purpose of treatment. The commonly used antibiotics reported by farmers were oxytetracycline and sulphonamides. The antibiotics were sourced from agriculture shops or veterinary technicians. No farmers kept written records of antibiotic use, and only two farmers reported waiting at least a few days after giving antibiotics before selling or slaughtering pigs.

Discussion: This study found that there was poor knowledge on antibiotics, and that antibiotic use was very low among pigs belonging to smallholder pig farmers. The low level of knowledge on antibiotics was unsurprising as no awareness or education campaigns targeting farmers had been conducted prior to the survey. Possible reasons why antibiotics use was low on smallholder pig farms are the low input-output system of pig production in Timor-Leste, and the lack of access to veterinary services. This study also indicates that use of antibiotics for disease prevention and growth promotion in pigs among smallholder farmers is uncommon. It is also positive that none of the commonly used classes of antibiotics

by smallholder pig farmers in Timor-Leste (i.e. tetracyclines and sulphonamides) are critically important antimicrobials.

Conclusion: This study showed that the knowledge on antibiotics is very poor among smallholder pig farmers in Timor-Leste, and there was a low level of antibiotic use. Therefore, it is crucial to improve access to government veterinary services for farmers in Timor-Leste while disseminating knowledge on antibiotics and prudent use practices.

4.12. Antimicrobial use on Australian dairy cattle farms – A survey of veterinarians

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Background: The implications of reduced antimicrobial efficacy on disease management and treatment dictate that a high importance is assigned to reducing the risk of antimicrobial resistance (AMR) developing. Being the sole authorized prescribers of antimicrobials in Australia, registered veterinarians have a functional role in terms of mitigating AMR risk in animal health care.

Methods: In the present work, we investigated the antimicrobial prescription patterns, and the factors affecting antimicrobial selection, amongst Australian dairy veterinarians through the administration of a structured online questionnaire. Questions related to respondents' demographics; opinions surrounding antimicrobial use, resistance, and stewardship; decision-making drivers of both prescription and selection of commonly prescribed antimicrobials; and awareness on the guidelines for antimicrobial usage and sources of information concerning antimicrobials.

Key results: A total of 135 responses (14.1% response rate) were received. There was a high agreement regarding label indications (96%), consequences of off-label prescription (95%), and the presence of an antimicrobial resistance (AMR) risk (73%), when prescribing antibiotics. A fourdimensional categorical principal components analysis (CATPCA) model indicated most of the variation in opinion was due to AMR risk, trade-offs, prescription concerns and active concerns. The first active substance most dairy veterinarians chose for a scenario involving mastitis and dry cow therapy (DCT) treatment was cloxacillin. Decision-making drivers of antimicrobial choice when providing an authority to purchase antimicrobials for mastitis and DCT treatment were predominately clinical factors; however, diagnostics were rarely used in determining antimicrobial choice due to price, diagnostic accuracy (sensitivity, specificity), and cost benefit issues. Non-clinical decisionmaking drivers included the perception of practicality for Australian Veterinary Association (AVA) prescription guidelines, opinions surrounding AMR risk and prescription concerns, consideration of Expert Advisory Group on Antimicrobial Resistance (EAGAR) scores, number of years worked with dairy farms, and the number of dairy farms they regularly consult for. When available at the practice, prescription policies were considered to impact on animal welfare outcomes and on the probability of AMR emergence. The major information

sources influencing decision making on antimicrobial prescription for the Australian dairy veterinarians were clinical experience (93%) and product labels (81%).

Conclusions: Australian dairy veterinarians are generally aware of the risk of resistance to antimicrobials and the need for stewardship, with clinical factors having the most impact on antimicrobial prescription. However, non-clinical factors incorporating awareness of guidelines and their attitudes on antimicrobial resistance risk and prescription concerns impact on the choice and prescription of antimicrobials.

Implications: The development of prescription policy and guidelines, alongside effective communicative extension programs to increase veterinarian uptake, provides an avenue to mitigate AMR risk in Australian dairy cattle.

4.13. Assessing the Economic Impact of Antimicrobial Usage and its Reduction on Farm Level on Dairy Farms in Southern Germany

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Background

While there are many studies on the costs of certain illnesses for German dairy cows (e.g. Schmiedel 2008, Walter 2013) there is a lack of studies with a comprehensive outlook on the economics of Antimicrobial Usage (AMU), AMU reduction and animal health. The goal of this project is to develop a model to assess the economic impact of AMU on German dairy producers at the farm level.

Methods

To reach this goal three steps are necessary. In the first step the farm-level AMU on German dairy farms was evaluated over a time period of three years. This was first done in 2019 on 24 Bavarian dairy farms that participated in the BEST Beef programme of McDonald's Germany. Since then the method has been applied on 60 additional dairy farms, mostly in southern Germany. To quantify the AMU the method of Animal-defined daily dosages (ADDD) (e.g. Obritzhauser 2018, Kuipers et al. 2016) was chosen to allow for differing dosages between antimicrobials.

In the second step the data gathered in step one was set into an economic context. Additional data on productivity and costs for veterinary treatments were collected on four farms. These costs were analysed in a static valuation based on marginal partial costs.

The third step will be the development of a wholistic economic model (see outlook).

Results

a) Quantification of AMU on German dairy farms

Table 1: average total AMU in ADDD on 24 Bavarian dairy farms

average total AMU in ADDD on Bavarian dairy farms (n = 24)	2016	2017	2018	3-year average
	3.31±1.94	3.50±2.3	3.87±2.17	3.56±2.14

Table 2: three-year average AMU in ADDD on 24 Bavarian dairy farms by field of application

average AMU in ADDD by field of application	udder health	reproductive health	claw health	respiratory tract	gastro-intestinal tract	other causes
	1.66	0.82	0.27	0.24	0.11	0.42

b) Static valuation of economic impact of AMU on a marginal partial costs basis

Table 3: three-year average costs of medication per ADDD given to cows with mastitis on 4 Bavarian dairy farms

cost for medication per ADDD given to cows with mastitis in EUR	range	average
	3.82 – 5.94	4.88

Outlook

In the final step of the project, a model to evaluate the economic impact of AMU and AMU reduction will be developed. To observe the impact of AMU reduction a partnership with smaXtec, a developer and producer of an animal health management system based on boli given to cows, has been established. Through the combined analysis of the AMU, animal productivity, continuous health monitoring by smaXtec, and other factors, a wholistic picture of the impact of AMU reduction will be gained.

The economic valuation has to reflect the dynamic character of AMU reduction. Thus, not only a static valuation, but also a dynamic valuation based on partial cost will be used, where marginal costs are offset against marginal gains. As farmers are often well used to marginal calculations, the expected findings on whether there is a marginal net gain can therefore be used to show the benefits of AMU reduction to farmers. A second dynamic valuation based on total costs and gains and including environmental factors will show the total economic benefit of AMU reduction.

4.14. KAbMon – Monitoring antibiotic usage in different groups of calf-keeping farms

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Introduction

In Germany, a national monitoring system for antimicrobial usage in farm animals kept for meat production is in place. An evaluation demonstrated a broad spectrum of production systems in the group of cattle up to 8 months of age that did not allow for comparisons of the amounts of antimicrobials used per farm. To this end, one aim of the project KAbMon was to develop a categorization scheme. In addition, aims of the study were to determine associations between management factors and the treatment frequencies as well as the occurrence of antimicrobial resistances.

Material and methods

A categorization scheme was established on basis of expert opinion: Group A farms keep calves from birth on (suckler cows or dairy farms). Group B farms purchase calves up to the age of 10 weeks while farms in Group C purchase older calves. Subsequently, farms (n=107) were visited for evaluation of the housing system and to collect faecal samples as well as data on treatment frequency and farm management. Isolates of E. coli (n=1923) were tested for phenotypical resistance to fourteen antibiotics.

Results

From 2018 to 2020, treatment frequencies did not vary substantially. Treatment frequencies of the groups B and C were adjusted for the time period the calves remained on the farm. Despite the adjustment, treatment frequencies were higher in group B compared to group A and C. Multifactorial regression modelling revealed that the adjusted treatment frequency was stronger associated with structural management factors (group and number of origins of purchased calves) than with factors concerning housing or health management: If a farm purchased calves from ten times more origins, the treatment frequency raised by 0.97 (SE: 0.48). The higher the treatment frequency was, the more frequently antimicrobial resistance patterns were observed in the E. coli isolates (half-year 1/2018: adj. R-Square=0.023, $p < 0.05$).

Conclusion

Experts´ opinions led to a categorization scheme that allows a comparison between farms regarding their antimicrobial usage. Significantly more antibiotic treatments were recorded for farms that purchase calves under the age of ten weeks compared to farms that raise calves from birth onwards or farms that purchase older calves. Purchasing calves from many different farms was associated with a higher treatment frequency. The association between treatment frequency and resistance score emphasises the need for reduction of antimicrobial usage.

4.15. Fijian veterinarian and para-veterinarians' behaviour, attitude and knowledge towards antimicrobial use and antimicrobial resistance: A qualitative study

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Introduction. Antimicrobial resistance (AMR) is a global health issue for humans and livestock. The appropriate use of antimicrobials in livestock production systems have been advocated to mitigate the risks of AMR. A key driver of inappropriate antimicrobial use (AMU) in Fiji is farmers' lack of knowledge on AMU and AMR. With the shortage of veterinarians in Fiji, para-veterinarians have taken on a greater role in delivering veterinary services. However, the knowledge on para-veterinarians role in AMU and AMR is unknown. Therefore, this study aimed to explore and understand Fijian veterinarian and para-veterinarians' behaviour, attitude and knowledge, towards AMU and AMR.

Method. Face-to-face, one to one semi-structured qualitative interviews were conducted between September and November 2019 with Fijian para-veterinarians and veterinarians working in livestock production located in the Central and Western divisions of Viti Levu, Fiji. A sample of at least 10 participants from the public and private sectors were targeted using purposive and snowball sampling methods. The Theory of Planned Behaviour (TPB) informed the development of the semi-structured interview guide. The interviews were audio-recorded and analysed inductively using Braun and Clarke's reflexive thematic analysis and deductively using the TPB framework. An interpretive approach underpinned the design and conduct of this study.

Results. Two veterinarians and eight para-veterinarians participated in the interviews. Our analysis generated three key themes: 1) Antimicrobials prescribed based on availability rather than clinical need, 2) Para-veterinarians awareness and knowledge of AMR, and 3) Limited resources impede effective consultation and veterinary service delivery. Para-veterinarians lacked knowledge and understanding of AMU and AMR. They prescribed and dispensed antimicrobials unwittingly without knowing the risks associated with inappropriate AMU. Para-veterinarians did not clinically examine the animals and based their decision regarding which antimicrobials to dispense from the clinics on farmers' perceived diagnoses.

Conclusion. The study demonstrated the need to increase para-veterinarians' awareness of AMU and AMR. The training of Fijian para-veterinarians on the appropriate use of antimicrobials in livestock should be considered as part of the antimicrobial stewardship (AMS) programme. The improvement in veterinary services infrastructure is recommended to allow farmers' better access to veterinarians and antibiotics used only under the supervision of veterinarians. Future studies exploring drivers of AMU in the agri-food value chain should help in development of AMS programmes optimising appropriate use of antimicrobials and mitigating AMR risks in the agri-food value chain at the country level.

4.16. Understanding linkage between antibiotic supply, usage and resistance in Beef Cattle Production in Argentina and the UK

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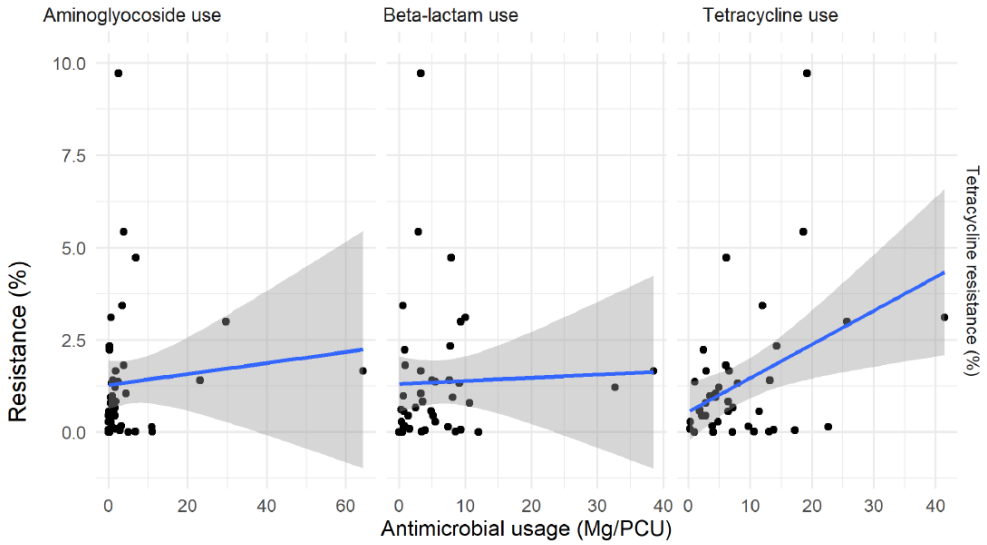
Global demand for beef and beef products is expanding, driven principally by increasing consumption in Asia. This increased global demand has driven rapid expansion and intensification of beef cattle production systems in South America, particularly in Brazil, Argentina and Uruguay. In contrast the beef farming sector in the UK has been in decline over the past three decades with greater emphasis upon smaller, less intensive farming systems. In this study we characterise and quantify the antibiotic supply chain in both countries and identify critical control points where antibiotic inputs in the beef industry in both countries can be monitored as well as the common and divergent challenges (logistic, commercial and social) that would be encountered in their adoption. To do this we conducted detailed interviews with stakeholders throughout the antibiotic and beef supply chains and collected quantitative AMU data from 105 beef farming systems, across the production cycle, in Argentina and the UK. For each farm we also measure the abundance and diversity of antibiotic resistance by a combination of genomic and phenotypic methods to describe the correlation between antibiotic usage and antibiotic resistance in the beef industry of both countries in the most comprehensive international comparison study of its kind to date. Machine learning and stability selection techniques were used to model the contribution of AMU and management practices with AMR prevalence. Backwards stepwise regression was performed to model mg/PCU of AMU classes against resistance. Increased tetracycline usage (mg/PCU) at farm level was significantly associated with tetracycline resistance but the effect size was extremely small with a 10mg/PCU increase in AMU associated with a 0.9% increase in tetracycline resistance.



Conclusion

Antibiotic usage varies significantly between the UK and Argentina in terms of both diversity of antibiotic ingredients used and the purpose for which they are prescribed. The variability between farms in AMU and AMR is significant in both countries whilst the correlation between AMU and AMR is modest, suggesting again that other factors, in addition to the administration of veterinary antibiotics, determine the AMR profile of beef cattle herds. These other factors are poorly understood at present. Our use of stability selection in this study suggests that farm management variables and AMU are relatively limited in their association with AMR, and it is likely that AMR levels on a farm are enormously complicated and multi-factorial, requiring more detailed, longitudinal studies to understand the biology of AMR selection under commercial farming system conditions.

4.17. Effect of different oral dosage forms of enrofloxacin on environmental contamination and development of resistance of Escherichia coli in pigs

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Antibiotics are crucial for the treatment of bacterial infections in human and veterinary medicine. Antibiotic treatment in pigs is often performed in large numbers via water or feed, which poses the risk of development of bacterial resistance and carryover of drugs into the environment.

Thus, the aim of the present study was to gain information about the influence of fluoroquinolones on the environmental contamination and the development of bacterial resistance of commensal intestinal E. coli in pigs in dependence on three different oral dosage forms.

Therefore, for each dosage form (powder, pellets, granulate) six pigs were treated once a day with 2.5 mg/kg enrofloxacin as test substance. Treatment was performed on day 1-5 and day 21-26. Four non-treated pigs housed as sentinel animals in the same stable with no direct contact to the treated animals. Resistance development was monitored by determination of the minimal inhibitory concentrations of E. coli by using epsilometer test. The epidemiological cut-off value (≤ 0.125 µg/ml enrofloxacin) and the clinical breakpoint (≥ 4 µg/ml enrofloxacin) were used as critical parameters for interpretation of the results. Dust and aerosol samples of the stable were analyzed by high-performance liquid-chromatography to examine environmental contamination.

Enrofloxacin and its active metabolite ciprofloxacin were detected during antibiotic treatment in aerosols and sedimentation dust. Oral medication via powder and granulate feeding resulted in higher environmental contamination than pellet feeding. A susceptibility shift was observed in all groups, although only a small number of resistant isolates was detected after powder feeding. Pellet feeding resulted in the highest development of resistance.

Conclusion

With respect to the results of our study it cannot be recommended which oral dosage form should be used for oral antibiotic treatment via feed in pigs. In our experiment, pellet administration showed advantages in environmental contamination compared to powder and granulate, but it resulted in the highest antibacterial resistance development. Thus, there is still substantial need for research regarding the infeed administration.

4.18. Alternatives to critically important antimicrobials – hard to find, even harder to succeed

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Minimizing the use of critically important antimicrobials (CIAs), while avoiding an increase of other antimicrobials and without jeopardizing animal welfare, requires finding alternatives and preventive measures. We have two extreme cases in Estonia. From 2011 to 2020, the sales of polymyxins have decreased 94% to 0.27 mg/PCU in 2020 (EU median 0.77 mg/PCU by ESVAC data). Opposite, the use of 3rd-and 4th-generation cephalosporins has increased and exceeded the median of EU countries (0.18 mg/PCU) almost four times in 2020.

In Estonia, the amount of sold colistin (polymyxins) for animals increased constantly and almost doubled from 2010 to 2013, and 90% of colistin was used in pig production. Due to the high incidences of Escherichia coli induced diseases in piglets, treated orally with colistin, the prevention of these diseases received the focus. The diseases as post-weaning diarrhoea could be prevented. In Estonia, E. coli vaccines in pigs were underused until 2013, and after drastically increased vaccination against E. coli strains since 2014, the overall colistin use decreased remarkably. According to linear time-series model with autoregressive integrated moving average (ARIMA) the consumption of colistin in pigs decreased on average by 0.23 mg/PCU for every 10,000 E. coli vaccine doses (95% CI-0.39, -0.06; p = 0.006) over ten years.

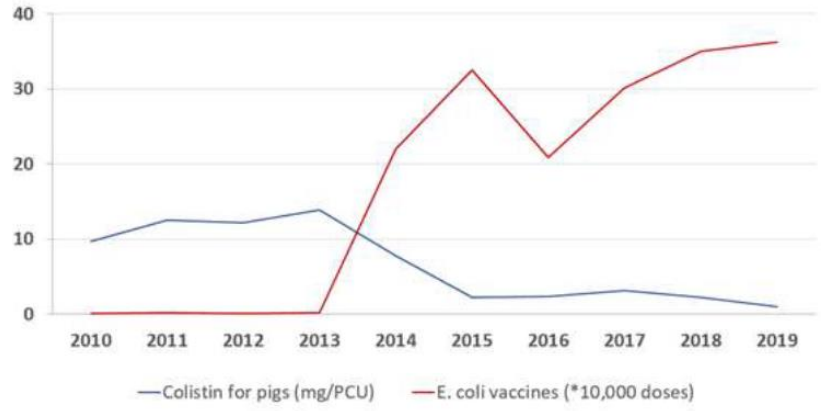

Figure 1. Consumption of colistin and Escherichia coli vaccines for pigs in 2010–2019, in Estonia

However, Estonia has still not been successful in minimizing the use of 3rd-and 4th-generation cephalosporins. We have detected irresponsible use in half of the Estonian dairy farms. Cephalosporins were accounted for from all applications of dairy cows per indication as follows: arthritis 49%, respiratory diseases and fever 47%, foot diseases 45%. The intramammary cefquinome was used widely for dry cow treatment by a few dairy farms. Although the use of antimicrobials is regulated with strong recommendations to avoid CIAs for the treatment of food-producing animals, and CIAs use may be based only on antimicrobial susceptibility testing, in conditions of wide access to different antimicrobials, we require much better antimicrobial stewardship.

Conclusion

Accurate monitoring of the indications of CIAs may lead to a minimum level of CIA use in foodproducing animals. The Estonian example proves that among other improvements at the farm level, vaccination of piglets against E. coli strains could contribute to reduced colistin use in pig production.

4.19. Strengthening the benchmarking system in Germany – what is the best way?

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Antimicrobial usage (AMU) is an important driver of antimicrobial resistance (AMR). Therefore, part of the German policy against AMR is to reduce AMU to the therapeutically necessary minimum. Fol-lowing the same reasoning, the Farm to Fork Strategy of the European Commission requires Member States to reduce antimicrobial sales in the veterinary sector by 50% (by 2030). The new EU legislation on veterinary medicinal products requires Member States to report data on antimicrobial sales and AMU to the European Medicines Agency. The objective is to present and assess sales and usage data in relation to antimicrobial resistance data at Member State level in a harmonised way. However, in order to reduce AMU, national action is needed based on valid and harmonised data at farm level. In Germany, a bench-marking system is already in place since 2014 covering the main meat producing animal species (anti-biotics minimisation concept). To strengthen the reduction efforts and to stream-line the national efforts with the new EU legislation, a revision of the national benchmarking system is under progress taking into account the results of the evaluation of the antibiotics minimisation concept finalised in 2019.

In the current benchmarking system, data on AMU is reported on farm level for each treatment including the animal species and production type, the number of animals treated, the number of treatment days, the type and amount of the antimicrobial used. Furthermore, data on the animals under risk in the pro-duction category of each farm is collected to calculate the therapy frequency. Discussion during the updating process covered considerations of scientific factors and factors relevant for implementation. Scientific aspects included,

- the coverage and definition of animal species and production groups,
- the calculation procedure for the therapy frequency and how to consider highest priority antimicrobials,
- the approach to record the exact number of animals under risk,
- and to differentiate between observation and benchmarking.

Aspects relevant for the implementation included

- the proportionality of efforts for stakeholders and administration for data collection and re-port-ing,
- the complexity of the system and its supervision,
- the heterogeneity of animal species and production systems and their specificities,
- and the principle of data austerity.

Conclusion

To achieve reduction of AMU, a strengthened benchmarking approach is necessary which goes beyond reporting requirements as laid down in the new European legislation. A broader use of digitalisation in

Germany by veterinarians, farmers and competent authorities should accompany the legislative measures to improve a continuous surveillance system which is proportionate, easy to handle and fit for purpose and ensures valid data for risk management purposes. This approach will be an important step to support the implementation of the new “Guidelines on integrated monitoring and surveillance of AMR” as adopted by the Codex Alimentarius Commission in November 2021 in Germany and beyond.

5. Poster presentations (in alphabetical order)

5.1. Usage of Systemic Antimicrobials in UK Equine Practice

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Surveillance of antimicrobial usage (AMU) is essential for preserving clinical effectiveness and minimising the potentially devastating consequences of antimicrobial resistance on animal and human health. Veterinary electronic patient records (EPRs) offer a potentially valuable source of AMU data. This work used veterinary EPRs to describe systemic AMU in UK equids and explore factors associated with the use of bacteriological culture in equids prescribed systemic antimicrobials.

Electronic keyword searches were applied to VetCompass-collated EPRs to identify all systemic antimicrobial prescriptions for equids attended by veterinarians from five UK practices between 14th October 2016 and 13th October 2017, and from an expanded group of 39 practices in 2018. For equids attended in 2016/17, frequency of systemic AMU was described overall and by antimicrobial class. Clinical indications were determined manually and reported by disorder group. For the five practices with data available in both periods, the proportion of equids prescribed systemic antimicrobials in 2016/17 was compared to that for 2018 using chi-squared tests. Mixed effects logistic regression modelling evaluated factors associated with the use of bacteriological culture in equids prescribed systemic antimicrobials by veterinarians from 39 practices in 2018.

Systemic antimicrobials were prescribed to 6,461 (22.3%, 95% CI 21.8-22.8%) of 28,994 equids attended in 2016/17. The most common classes were potentiated sulphonamides and tetracyclines, prescribed to 44.1% (95% CI 42.9-45.4%) and 39.6% (38.4-40.8%) of equids receiving systemic antimicrobials, respectively. Category B antimicrobials (3rd and 4th generation cephalosporins, quinolones, polymixins) were prescribed to 11.2% (95% CI 10.4-12.0%) of equids receiving systemic antimicrobials. The most common indications were prophylaxis (34.9%), integumentary (33.0%) and musculoskeletal conditions (29.6%). In 2018, overall AMU increased with 7,128 (23.1%, 95% CI 22.6-23.6%) of 30,858 equids prescribed systemic antimicrobials (P=0.02). Category B AMU decreased to 9.9% (95% CI 9.3-10.7%) of equids prescribed systemic antimicrobials (P=0.02).

Risk factor analysis included 14,760 antimicrobial courses prescribed to 12,538 equids. Bacteriological culture was performed for 722 (4.9%) courses. Increased odds of culture were observed for courses including Category B antimicrobials compared to those that did not (OR 7.57, 95% CI 5.80-9.88, P<0.001) and courses prescribed to hospitalised compared to non-hospitalised equids (OR 3.28, 95% CI 2.62-4.11, P<0.001). Odds of culture were lower for all breed groups compared to Thoroughbreds (P<0.001). Odds of culture varied by practice accreditation status (P<0.01).

Conclusion

Research using veterinary EPRs can support AMU surveillance. Observed AMU levels are consistent with previous studies. Category B antimicrobials were frequently prescribed without prior culture.

5.2. Global Analysis of Antibiotic Use in Factory Farms

Zahra Ardakani[1], Massimo Canali[1], Maurizio Aragrande[1], Caetano Luiz Beber[1]

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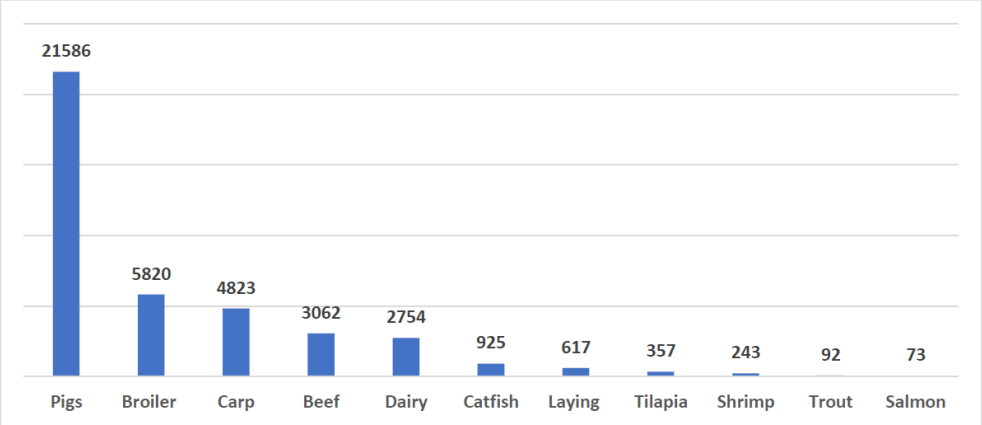
Population growth and higher household incomes are leading to an increase in the consumption of livestock products including meat, milk, and eggs. To meet this demand, the intensification of livestock farming systems is mainly occurring in factory farms. These refer to "a large industrialized farm; especially a farm on which large numbers of livestock are raised indoors in conditions intended to maximize production at minimal cost". To maximize profit, factory farms keep livestock on high stocking densities at large scale, which favours the spread of zoonoses in the herds. Thus, large amounts of antibiotics, which are considered a cheap solution, have been used to control the diseases, or even as growth promoters. This leads to the development of strains of bacteria that are resistant to those antibiotics, which infect both humans and animals. Antibiotic resistance is a significant public health threat. The goal of this study is to estimate the amount of antibiotic used in factory farms for terrestrials (Laying hens, Cattle, Poultry, Dairy, and Pig) and aquaculture (Carp, Catfish, Tilapia, Shrimp, Trout, and Salmon) in the world. Using the FAOSTAT data (average of 2017-19), different methods are combined in order to approach the most reliable estimates for the proportion of animals raised in factory farms in the different regions of the world (World Bank regions), as well as for antibiotic consumption in these systems.

Conclusion

After identifying the proportion of factory farms in the total production for each species, we estimated their antibiotic use in mg/PCU1. The results show that factory farms have used 40352 tons of antibiotics, which 33839 tons is related to terrestrial and 6513 is for aquaculture animals. Pigs in terrestrials and carp in aquaculture have used the most antibiotics. East Asia and Pacific, led by China as the main consumer, is the region where factory farms present the higher consumption. Figure 1 shows antibiotic used in factory farms per species. Regulations on antibiotic use, such as a ban of antibiotic growth promoters and restrictions on routine mass medication, are powerful tools that are being discussed and already implemented in many countries in order to reduce antibiotic consumption.

Figure 1: Total Antibiotic Used in Factory Farms (tons) by Species; Source: Own Calculation



[1] Population Correct Unit (PCU)

5.3. Development of therapy recommendations for urinary tract infections (UTI) in dogs and cats

A. Bethe[1], C. Weingart[2], A.-K. Schink[1], J. Brombach[1], B. Walther[3], R. Köck[4], R. Merle[5], W. Bäumer[6], B. Kohn[2], A. Lübke-Becker[1]

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Urinary tract infections (UTI) are among the leading causes of antimicrobial prescriptions in dogs and cats. Thus, this study aimed to develop recommendations for antimicrobial therapy based on prospectively collected data of urine cultures and antibiotic susceptibility testing (AST). The results shall minimize and improve the antimicrobial use in small animal practice as an important strategy to reduce the selection of antimicrobial resistant pathogens.

Data of 470 urine samples were collected from dogs (n=258) and cats (n=212), mainly suffering from sporadic (dog: n=117, cat: n=96) or recurrent cystitis (dog: n=108, cat: n=105). Minimal inhibitory concentrations (MIC) for 12 antimicrobial agents licensed to treat UTI in Germany were determined for 308 isolates of clinical relevance (dog: n=191; cat: n=117) following CLSI guidelines.

As a result, 214 samples were culture negative or showed nonspecific bacterial growth.

Among samples exhibiting specific bacterial growth, Escherichia coli (dog: n=89, cat: n=55) was the most common pathogen, followed by Staphylococcus pseudintermedius (n=31) and Streptococcus canis (n=16) in canine samples and Enterococcus faecalis (n=14) and Staphylococcus felis (n=14) in feline samples.

Based on our results potentiated aminopenicillins and 1st generation cephalosporins should be considered as first line therapy in sporadic UTI of dogs and cats since 97% of the canine and 96% of the feline E. coli isolated from this indication were classified as susceptible to amoxicillin-clavulanate (AMC) and cephalexin. Moreover, these agents are known for their beneficial pharmacokinetic properties and high tolerability. Of note, AMC-susceptibility rates of E. coli obtained from recurrent UTI were considerably lower, ranging between 84% in canine and 72% in feline isolates, emphasizing the necessity of AST before initiating antimicrobial therapy. Our AST data do not justify the use of 3rd-generation cephalosporins or fluoroquinolones for empirical treatment of bacterial cystitis in cats and dogs.

Conclusion

The high proportion of culture-negative urine samples highlights the importance of bacteriological examination to avoid unnecessary antimicrobial treatment. However, if empirical therapy is indicated, sediment analysis should be performed. In the presence of rods (likely E. coli) in sporadic infections, 1st generation cephalosporins or amoxicillin-clavulanate are recommended, while sulfamethoxazole-trimethoprim remain a therapeutic option in cases when AST results preclude use of beta-lactams.

When the sediment analysis indicates the presence of cocci or rods in recurrent infections, AST is urgently demanded to avoid treatment failure.

5.4. VetAmUR: Antimicrobial usage and resistance in German livestock

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Antimicrobial resistance is a public health challenge and is mainly driven by antimicrobial usage in all sectors. Many activities exist to collect data on antimicrobial usage, but national or international monitoring systems for antimicrobial resistance and usage on the individual farm level are spare. To increase the understanding of the impact of antimicrobial usage on antimicrobial resistance, valid farm level data need to be collected and analysed simultaneously. For this purpose, the research project Veterinary An-timicrobial Usage and Resistance launched in 2021 in Germany.

Data on antimicrobial usage bases on the application and delivery forms, mandatory by law since 1975, including data on the identity, number and type of animals treated, drug name and dosage, treatment days, indication and application form. Additionally, participants are encouraged to document the specific period within the fattening process when application took place. Data on antimicrobial resistance are harder to obtain, since their collection are neither regulated nor harmonised as usage data are. As such, data collection process is shaped individually for the participating veterinarians.

The presentation will show ongoing work to handle individual variation in data structures to develop an overarching data structure to achieve information, which can be analysed to connect resistance data with usage data within the same farms.

Conclusion

The individuality of resistance data collection and documentation – including different testing methods used as well as different evaluation standards applied to determine susceptibility to antimicrobial substances – highlights the need for the development of a common and flexible data structure which supports the integrated analysis of antimicrobial usage and antimicrobial resistance data on farm level as well as the comparison of resistance patterns in veterinary pathogens from different veterinary practices or regions.

5.5. Assessment of the French colistin action plan

Elsa Coz[1], Eric Jouy[2], Géraldine Cazeau[3], Nathalie Jarrige[3], Agnès Perrin-Guyomard[4], Anne Hemonic[5], Alexandre Poissonnet[5], Delphine Urban[6], Anne Chevance[6], Marie-Laure Delignette Muller[1], **Claire Chauvin[2]**

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Introduction: The discovery of the plasmid resistance gene to colistin *mcr-1* in 2015, profoundly changed the way this widely used molecule in veterinary medicine in France was considered. National management measures have been set up to reduce its use in animals, in line with European recommendations. Two objectives were defined: that of the AMEG in 2016, to reach a consumption of less than 5mg/kg in 3 to 4 years and that defined by the Ecoantibio2 national plan of a 50% reduction in the cattle, pig and poultry sectors in 5 years compared to the 2014-2015 use. In order to assess the effectiveness of these measures, French sales, usages and resistance surveillance data were analysed.

Material and Methods: Colistin use in animal production was documented through follow up of annual sales of veterinary antibiotics and specific tools such as INAPORC Panel. Bacterial resistance was monitored i) at the slaughterhouse in application of European regulations (minimal inhibitory concentration by microdilution) and ii) also through the RESAPATH network, which collects clinical antibiograms results (disk diffusion). Given the difficulties of interpretation of inhibition zones diameters, the use of hierarchical mixture models was necessary to estimate annual proportions of resistant *E. coli* clinical isolates (and their credibility interval) for the main pathologies-animal species combinations. Series obtained were graphically represented and their correlation analysed.

Results: The use of colistin in France has strongly decreased between 2010 and 2019, falling below 5mg/kg in 2015. In 2019 the target of 50% reduction was exceeded in all concerned productions (poultry, pigs, bovines). Resistance to colistin was rare or absent in commensal bacteria isolated from slaughterhouse surveillance, dismissing the assessment of usage reduction impact. In contrast, the analysis of susceptibility tests carried out on clinical isolates in the context of digestive disorders in pigs and calves showed an initial increase in resistance between 2006 and 2011 and a steady reduction thereafter (Figure 1). The correlation calculated between the two measures of use and resistance over this period was strong and significant.

Conclusion: Application of European and national mitigation measures of colistin use was efficient in France leading to a marked decrease of consumption. A simultaneous decrease of colistin-resistance of clinical *E. coli* isolates could be observed. These results support the hypothesis of a link between colistin use and resistance and the positive impact of usage reduction measures adopted.

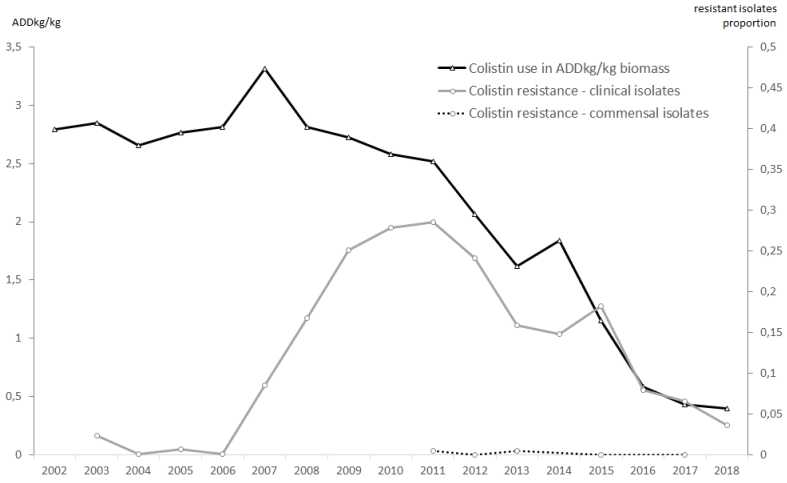

Figure 1: Colistin use (sales data, *Anses-ANMV*) and *E. coli* resistance (in commensal (slaughterhouse surveillance) and clinical isolates (*RESAPATH*)) in pig production in France (2002-2018).

5.6. Evolution of Antimicrobial usage over 5 years according to different indicators in veal calves

Anne Chevance[1], Magdéléna Chanteperdrix[2], Delphine Urban[1], Gérard Moulin[1]

[1]French agency for veterinary medicinal products / French agency for food, environmental and occupational health safety, 35306 Fougères, France; [2]The French Livestock Institute, 35 652 Le Rheu Cedex, France

Background

In France, a network of farms and veterinarians have accepted to participate to a permanent observatory to monitor the use of antibiotics in the veal calves production. The observatory collects antibiotic use from 40 volunteer farmers. For each batch of animals, different indicators are calculated to evaluate the actual antimicrobial use.

Analysis

The evolution of the AMU between 2016 and 2020 for veal calves is compared according to 5 indicators:

- The number of treatments per animal
- The amount in mg of active ingredient per veal calf
- The ALEA, obtained by dividing the number of course doses by the biomass of the animal population potentially treated
- the dose-based unit of measurement DDDvet as defined by EMA divided by the number of animals
- the dose-based unit of measurement DCDvet as defined by EMA divided by the number of animals

For each treatment, the number of treatments per veal is directly obtained by dividing the number oftreated veal calves (provided by the farmer) by the number of animals per batch. The amount in mg of active ingredient per veal calf is a weight-based unit of measurement. The number of DDDvet per animal (nDDDvet/animal), the nDCDvet/veal and the ALEA are dose-based units of measurements.

Results

All indicators confirmed a decrease of antibiotic usage in veal calves production between 2016 and 2020.

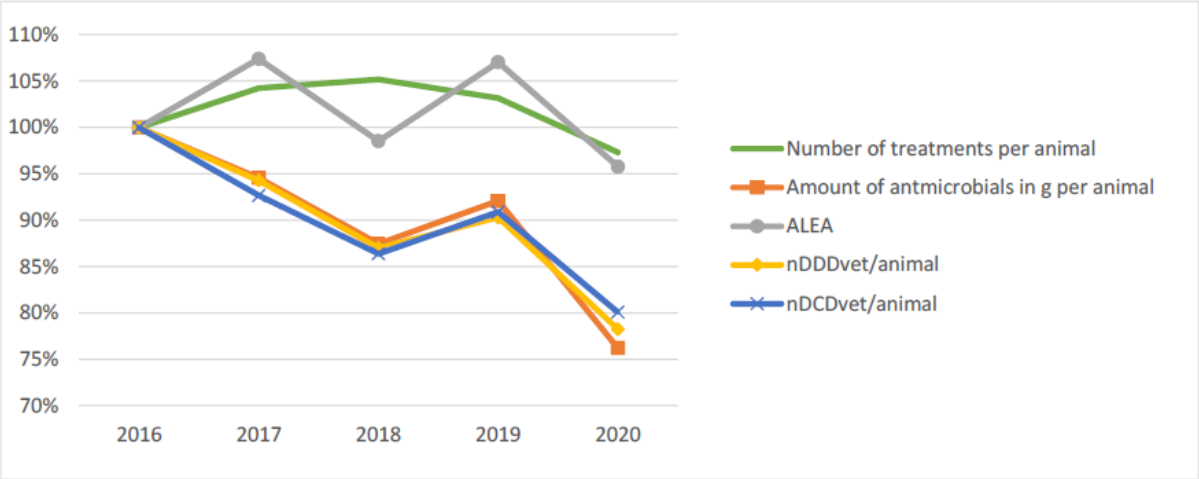

Figure: Change in use of antimicrobials in veal calves sector according to different indicators

For the number of treatments per animal, the actual weight at treatment is considered whereas for the other indicators, no weight or a reference weight of 150 kg is taken into account. In 2018, the increase in actual AMU (the number of treatments per animal) is explained by the decrease of the weight at treatment. In 2018, nearly 86 % of treatments are intended to animals less than 50 days whereas for the other years, this proportion of animals treated before 50 days of age never exceeds 83 %.

For highly organised sectors of animal production, the use of antimicrobials are very standardised, and trends observed with weight-based indicator are similar to trends observed with dose-based units.

The ALEA is more representative of the actual AMU than the other indicators.

Conclusion

Commonly used indicators do not reflect precisely changes in use associated with a change in weight at treatment. The closer to the real dose used (as for the number of treatments per veal and the ALEA), the more the indicator reflect the actual farm-level AMU. The ALEA, a dose-based indicator calculated with a reference weight, is in line with the national and European criteria for the expression of AMU.

Moreover, under some conditions, this indicator represents the number of treatments per animal that isparticularly meaningful for the farmers.

5.7. Antimicrobial use on dairy farms in Ontario, Canada

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[1]Department of Population Medicine, University of Guelph, Guelph, Canada.

Antimicrobial resistance (AMR) is an important challenge in public health. Measuring antimicrobial use (AMU) is necessary to evaluate the effects of new policies and interventions, monitor changes in AMU over time, to benchmark farms, and to associate AMU and AMR. The aim of this study was to measure AMU on dairy farms in Ontario, Canada. Empty drug packaging from 31 farms in Southern Ontario were collected from August 2020 to February 2021. Medicated feeds were not included. Canadian defined course doses (CDCD) per 100 cows were calculated. Antimicrobials were classified by route of administration and category of importance for human health according to the World Health Organization. The mean herd size was 186 ± 137 milking cows. The average AMU was 101 ± 66 CDCD per 100 cows during the period of observation. The second most frequent route of administration of antimicrobials was injectable (36%), followed by oral (34%). Intramammary antimicrobials represented the 28% of total AMU in this study, of which 72% were antimicrobials for drying off and 28% were for use during lactation. The intrauterine route was the least common in this study (1%). Antimicrobials currently not used in humans (i.e. ionophores), represented the 34% of total AMU in this study. In addition, 34% of antimicrobials were classified as highly important antimicrobials (HIA) followed by critically important antimicrobials (CIA; 24%). Penicillin represented the 54% of HIA, followed by first generation cephalosporins (10%) and combinations of sulfonamides and trimethoprim (10%) and amphenicols (8%). Injectable antimicrobials were the most common route for HIA (63%) followed by intramammary (34%) and intrauterine antimicrobials (4%). The most common route for CIA were intramammary (59%), followed by injectable (41%). Third generation cephalosporins (primarily ceftiofur) represented the majority (80%) of CIA used by the farms included in this study, followed by macrolides (15%) and polymyxins (2%). Important antimicrobials were not found in this study. Herd size was not associated with the category (P = 0.41) or route (P = 0.13) of antimicrobials used.

Conclusion

Intra-mammary antimicrobials were the main source of AMU on dairy farms and represented the majority of CIA used in this sample. Additional studies associating AMU with herd characteristics, rates of disease, and treatment protocols are necessary to identify opportunities to reduce AMU on dairy farms.

5.8. Contrasting Farm-Level Treatment Frequencies based on Used Daily Dose vs. Defined Daily Dose for the German Antibiotics Minimisation Concept

Matthias Flor[1], Bernd-Alois Tenhagen[1], Annemarie Käsbohrer[1]

[1] German Federal Institute for Risk Assessment

The German Antibiotics Minimisation Concept defines a farm-level benchmarking process based on half-yearly treatment frequencies that applies to six animal groups for fattening: piglets (from weaning up to a weight of 30 kg), pigs (weight above 30 kg), calves (from weaning up to an age of 8 months), cattle (older than 8 months), chickens, and turkeys. The treatment frequency defined in the Minimisation Concept takes into account the (1) number of animals treated, the (2) treatment duration, and the (3) number of active antimicrobial substances, for each individual treatment, and is equivalent to a Used Daily Dose treatment frequency.

With data from the German benchmarking system for the seven half-year periods from 2014-2 to 2017-2 (BMEL 2019), we have emulated the approach by Kasabova et al. (2019) and compared Used Daily Dose (UDD) treatment frequencies with Defined Daily Dose (DDD) treatment frequencies that can be calculated based on the DDDvet values published by EMA and standard animal weights assumed at the time of treatment. As standard animal weights, we consider the weights used for calculation of PCU's (EMA 2018) as well as the weights defined in an ESVAC reflection paper (EMA 2013). We show that DDD treatment frequencies can deviate considerably from UDD treatment frequencies, most likely, because weights at time of treatment differ from the standard weights suggested by EMA, and that this can affect how farms are ranked in the benchmarking process. Benchmarking of poultry farms is impacted to a larger degree than benchmarking of pig or cattle farms.

Conclusion

Treatment frequencies based on Used Daily Doses take into account the actual weights of animals at the time of treatment. While using Defined Daily Doses as a surrogate does require less extensive data recording it introduces uncertainty into the calculation of treatment frequencies by which fast growing animal species are affected the most.

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5.9. Reduction in use of antimicrobials for pigs – Setting a new political target without subsequent regulatory interventions

Pia Holm Jul[1], Laura Mie Jensen[1]

[1]Danish Veterinary and Food Administration

Since 2010, Denmark has set national targets for the use of antimicrobials in production animals. The current target relates only to pigs and runs from 2019 to 2022. In 2019, the Danish parliament decided that the Danish pig production should reduce the use of antimicrobials with 8% before end of 2022 compared to the level of use in 2018, reducing the consumption with 2% each year. The current target was set based on the scientific advice from the Danish Advisory Committee on Veterinary Medicines, keeping in mind that the farmers also have to phase out medicinal zinc by June 2022. Previously the national targets have been followed by regulatory interventions limiting the use of antimicrobials, which has resulted in a 25% reduction in the use of antimicrobials for pigs since 2010 (Figure 1). However, this time the reduction target was not followed by regulatory interventions. Instead, the industry was encouraged to find their own initiatives. Since 2010, we have seen a reduction in the use of antimicrobials alongside an increased pig production resulting in a reduced use measured in mg/kg PCU-pig1. However, as seen in Table 1 and Figure 2, the change in use of antimicrobials in pigs over the last few years is more or less driven by the number of animals produced.

Table 1. Antimicrobial use in pigs in kg active substance for the years: 2010, 2018, 2019 and 2020

	2010	2018	2019	2020
kg	98,949	74,011	71,681	74,383
mg/kg PCU_{pig}	53.3	41.1	41.6	42.4

Presumably, the decrease in use of antimicrobials in 2019 is therefore not an actual decrease, but rather a result of a reduced number of pigs produced. The increase in use in 2020 is however slightly larger than the increase in pigs produced, resulting in an increase in mg active substance/kg PCUpig1.

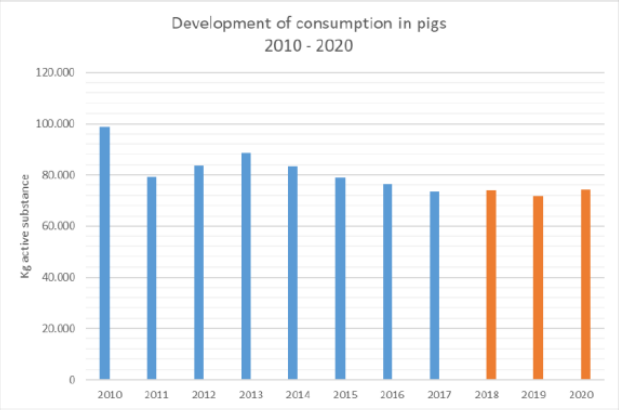

Figure 1. Consumption of antimicrobials for pigs in kg active substance from 2010-2020

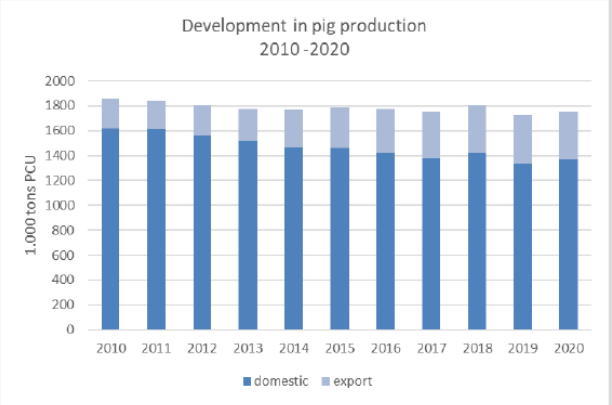

Figure 2. timeline for PCU_{pigs} since 2010 from ESVAC[1]

The data from 2021 has not yet been finalised, but preliminary results show a use around 72,350 kg active substance, resulting in a reduction in kg active substance around 2.2% compared to 2018. This is far from the political target of 6% that should have been achieved, to stay in line with the reduction target.

Conclusion

For the first time Denmark has set a target without regulatory initiatives to support the reduction. The struggle for reducing antimicrobial consumption in pig production indicates that after 10 years of reductions, it is getting more difficult for the farmers to reduce their use. The large historical reduction in antimicrobial use for pigs has proven the reduction potential, but a voluntary target might not be enough at this stage.

[1] Kg PCUpig from the ESVAC database https://esvacbi.ema.europa.eu/analytics/saw.dll?PortalPages

5.10. Getting ready to report on use data – transforming an existing system to fit the future

Laura Mie Jensen[1], Pia Jul Holm[1]

[1]Danish Veterinary and Food Administration

The future is coming together with the legislation on Veterinary Medicinal Products (VMP). The reporting of use data requires the development of advanced data collection systems, collecting use data with high level of details and accuracy. Denmark has had a system (VetStat) for collection of prescription data since 2000. VetStat collects data from pharmacies and feed mills concerning all veterinary products, supplemented with use data from the veterinarians when products have been used in practice.

To prepare VetStat for the future, we have modernized the platform, as well as the user interface. We have increased the level of data availability for all citizens, lowered the reporting level from farm to herd, prepared for collection of use data for all types of animal species and increased the focus on data quality by developing a validation engine and an error-handling module.

Collecting data for more than 20 years, has given VetStat an advantage in the battle of getting ready. The old VetStat did already comply with many of the criteria of the VMP, but reporting high detail use data on many different animal species, challenge even this old system. Quality ensuring and data validation has been one of the focus points in the transition of the system. Creating a system with build in data validation on record level, demands high level of background knowledge concerning the reporter, the veterinarian and the recipient (pet- and herd owner), as well as knowledge of the products and the animal species. The 'engine' make sure that the records are valid, if not, the records are sent to error handling at either the veterinarian, the feed mill or VetStat-administration. Records with errors coming from the pharmacy are in most cases pushed out to the veterinarian. The veterinarians are responsible for the prescription and therefore responsible for the records reported by the pharmacy. Veterinarians and feed mills are obligated to correct records with errors within a certain time.

Table 1 – Common errors seen in the first six months after the launch of the new VetStat

Product information	*Veterinarian and practice*	*Herd and farm*	*Animal information*
Product is no longer on the market	ID of veterinarian does not exist	Herd ID does not exist	Animal species does not exist on the farm
Amount is too big or small compared to the pack size	ID of practice is identical to ID of veterinarian		Age group does not correspond to animal species
Product is not known in the system			

In the first six months after the launch of the new VetStat in June 2021, we received close to 1.4 mill records, of which approximately 300,000 records included one or more errors (Table 1). This demonstrate that even with a long history of collecting prescription data, the task of ensuring data quality is not easy to solve. Some of the errors have been due to 'to strict' validation rules, but most of the errors are due to deficient reporting and lack of understanding of the later use of the records. Communication between the system owner and the data reporter (veterinarian, feed mill and pharmacy) is of high importance. Both in the early days of the development, as well as in the period up towards the launch of the system. It is of great importance to ensure understanding of the task, responsibility and necessity. Judging from the amount of errors, this task has not been lifted to complete success yet.

Conclusion

To get ready for the future Denmark has modernised our current database with focus on data validation and quality. Increased data validation has resulted in surprisingly many errors. In the next phase of implementation of the new platform, we will focus on educating the many different users of the database. Decreasing the number of errors will be crucial in order to increase data quality.

5.11. VetCAST – an important milestone towards improved European antimicrobial susceptibility testing in veterinary medicine

Gudrun Overesch on behalf of the VetCAST steering committee[1], Peter Damborg[2], Ronette Gehring[3], Ludovic Pelligand[4], Kees Veldman[5]

[1]Institute of Veterinary Bacteriology, Vetsuisse Faculty, University of Bern, Switzerland; [2]Department of Veterinary and Animal Sciences, University of Copenhagen, Denmark; [3]Institute for Risk Assessment Sciences, University of Utrecht, the Netherlands; [4]The Royal Veterinary College, United Kingdom, [5]Department of Bacteriology and TSEs, Central Veterinary Institute of Wageningen UR, Lelystad, the Netherlands

Antimicrobial resistance (AMR) of bacteria has become a global threat in both veterinary and human medicine. Its development is promoted by the use of antimicrobials leading to the selection and spread of resistant microorganisms and/or the resistance-encoding genes. To face antimicrobial resistance, prudent use of antimicrobials is one of the major challenges of the 21th century. Thereby, antimicrobial susceptibility testing (AST) plays a key role as the rational basis of targeted antimicrobial therapy.

The European committee on antimicrobial susceptibility testing (EUCAST) is dealing with all technical aspects of phenotypic in vitro AST and functions as the official breakpoint committee of the European medicines agency EMA and ECDC for humane medicine.

In contrast, AST for veterinary pathogens in Europe is widely hampered by the fact that European clinical breakpoints (CBPs) are lacking. This affects the possibility for veterinary practitioners to prescribe antibiotics rationally, because there is no robust basis for determining whether a bacterial strain is clinically resistant or not. Therefore, VetCAST as a veterinary subcommittee of EUCAST was founded in 2015. VetCAST aims to improve European harmonized AST in veterinary medicine according to the standards of EUCAST. Hence, identification of missing or insufficient veterinary CBPs is one of the main goals. This will be accompanied by the initiation and coordinative support of European research aimed at filling current gaps in veterinary AST as well as provision on education on AST and antimicrobial therapy in the veterinary field in Europe.

In first instance, the strategy for setting clinical breakpoints in the veterinary sector in Europe was defined by members of the VetCAST steering committee, published in 2017. This includes defining epidemiological cut-off values (ECOFFs) based on the minimal inhibitory concentration (MIC) distributions of wildtype (WT) populations and the probability of attaining target values of pharmacokinetic and pharmacodynamic (PK/PD) parameters given currently registered antimicrobial dosage regimens. In 2020, a first rationale document on species-related CBPs for florfenicol and *Pasteurella multocida* and *Mannheimia haemolytica*, isolated from bovine respiratory tract infections, was accepted by the EUCAST committee. Moreover, training to academia, regulatory agencies and industry trough workshops contributed to the spread of knowledge concerning AST. Currently, VetCAST focuses on defining new ECOFFs for a variety of other relevant bug/drug combinations as a first step towards setting more veterinary clinical breakpoints. Engagement in and support of European initiatives like the ESGVM and the COST Action ENOVAT helps further technical AST development in Europe.

Conclusion

VetCAST is an important milestone towards improved European AST in veterinary medicine, which builds the rational basis for targeted antimicrobial usage by veterinarian practitioners in the future. The current status of ongoing activities, including challenges and future plans, will be presented.

5.12. Quantification of antimicrobial usage in Danish poultry production in 2015-2019

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Reduction of antimicrobial usage for animals is on the agenda all over Europe. The EU Veterinary Medicines Regulation 2019/6 will require Member States to monitor antimicrobial use in broilers by 2023. In Denmark, national sales data on veterinary prescriptions of pharmaceuticals have been collected in the VetStat database since 2000, but their validity for poultry species have not yet been investigated. This study aims to investigate the potential of VetStat data to quantify antimicrobial usage on national and herd level in poultry species in Denmark in 2015-2019.

As poultry farmers in Denmark are not allowed to keep prescribed antimicrobials for more than 5 days on the farm, it was assumed that antimicrobial sales data constitute an acceptable proxy for monthly on-farm usage of antimicrobials for Danish poultry.

Data from VetStat was obtained for the period of 2015-2019. A total of 3,194 prescription records of antimicrobials targeted to poultry was identified. Of these records, 622 (19%) were not correctly recorded with a poultry herd type and/or indication.

A dataset from the Danish Zoonoses database including records of all active Danish conventional broiler herds in 2015-2019 was obtained to identify herd type and size to aid quantification of herd level antimicrobial usage.

The total antimicrobial usage in Danish poultry species in 2015-2019 was estimated to 1,913 kg active compound in 2015, 1,351 kg in 2016, 1,256 kg in 2017, 1,260 kg in 2018 and 1,516 kg in 2019. Of 238 conventional broiler herds (>500 broilers), 68% had used antimicrobials in 2015-2019. Median (mean; SD) of herd level antimicrobial usage in Animal Daily Doses per 1,000 birds per herd-month in conventional broiler herds was 3,465 (10,761; 18,123) in 2015, 0 (4,451; 10,581) in 2016, 0 (4,568; 14,091) in 2017, 0 (2,504; 9,222) in 2018 and 0 (2,867; 11,250) in 2019.

Conclusion

Data from VetStat can be used to quantify antimicrobial usage in poultry in Denmark, but mismatch between recorded target species, herd type and indication in 1 in 5 records calls for further validation of data entries and improved recording procedures. The study also indicates that antimicrobial usage in Danish broiler herds varies over time and between herds.

Further studies are needed to investigate the reasons behind the relatively low antimicrobial usage in Danish broilers and associations to health, welfare and management parameters, including use of vaccines. Such investigations would allow development of recommendations to ensure prudent use of antimicrobials.

5.13. VetCAb: Antibiotic consumption in German livestock – a longitudinal anal-ysis between 2013 and 2020

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The consumption of antibiotics in all sectors represents a main driver of antimicrobial resistance – one of the biggest challenges to general and veterinary public health. Following a longitudinal approach the Veterinary Consumption of Antibiotics Sentinel project VetCAb-S collected data on antibiotic consumption in German animal husbandry at the farm level between 2013 and 2020 – stratified by different production types. This collection based on the application and delivery forms, which are mandatory by law since 1975, included data on the identity, number and type of animals treated, drug name and dosage, treatment days, indication and application form.

During the study period, we observed trends and changes regarding antibiotic consumption via the ther-apy frequency, i.e. treatment incidence based on used daily doses, and therapy profiles based on these. Animal species evaluated include broilers, cattle (fattening, dairy) and pigs. Using longitudinal statisti-cal modelling we also identified and examined factors, which could be associated with antibiotic con-sumption such as farm size and type.

Around 300,000 application and delivery forms from between 1,651 to 2,548 farms (most for cattle) were included into the analyses. In general, we observed a reduction of the median treatment frequency in almost all production types between the first and last half-year of our study: e.g. broilers reached a reduction by -61.7 % and weaners a reduction by -95 %. Dominating antibiotic classes differ greatly between animal species and production types: e.g. broilers (aminoglycosides, lincosamides, polymyx-ins) in comparison to pigs (penicillins, tetracyclines and macrolides/polymyxins) and weaners (poly-myxins) in comparison to fattening pigs (macrolides).

Conclusion

From these results, we conclude, that longitudinal studies represent a good way to monitor changes in antibiotic consumption. Furthermore, it is crucial to divide animals by production type and age when analysing treatment frequency and therapy profiles since different age groups and production types struggle with different diseases and challenges and therefore need different antibiotics as well as varying amounts of antibiotic substances. We identified factors, which – again depending on animal species and production type – are associated with the therapy frequency such as region, veterinarian, farm size and farm type.

In a next step, within our new research project Veterinary Antimicrobial Usage and Resistance (VetAmUR) we aim to connect antibiotic consumption and antimicrobial resistance patterns on the farm level.

5.14. RefA²vi: Towards the formalization of a French professional reference network on the use of antibiotics at poultry farms level

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[1]ITAVI, [2]ANVOL-CIPC-CIDEF-CICAR, [3]Anses

Since 2019, in order to meet the expectations of citizens, retailers and public authorities, the RefA²vi professional network has been formalized to produce exposure's indicators on antibiotics usages at farm level. The first indicator, "nDDkg", corresponds to the sum of the daily doses administered for all drug presentations. The second, "nCDkg", is the sum of all course doses or treatments, for all drug presentation. In these two indicators doses amounts are related to the total mass of broilers or turkeys slaughtered (i.e. including untreated flocks) in the population surveyed. The data are collected from volunteers production organizations (POs) that declare all the treatment data they collect, and the production data of their flocks. A consistency check is carried out (e.g. on treatment duration and dates in relation to practices and flocks' set up and slaughter dates,) and when required, clarifications are requested from POs.

Over the least 3 years (2018-2020), the network covered about 40 % of the tonnage slaughtered in France for broilers and turkeys.

A decrease in exposure indicators was observed between 2018 and 2020 for both broilers and turkeys. The nDDkg decreased by 32 % for broilers and 45 % for turkeys. The nCDkg decreased by 30 % for broilers and 43 % for turkeys. In 2020, Fluoroquinolones represent only 2 % of the total exposure. The nCDkg for fluoroquinolones has decreased by 48 % for broilers and 32 % for turkeys. In the same way, colistine's exposure was markedly reduced by 79 % for broilers, and 57 % for turkeys. Penicillins were the 1rst antibiotic family used in 2020, for both broilers and turkeys. Then, sulfonamides were the 2nd most used antibiotic family for broilers, due to the very strong decrease of polypeptides.

Conclusion

RefA²vi is a pooling of private data with the support of the interprofession, the technical institute and under the supervision of the national agency, at the service of professionals. Although it is still quite young and not exhaustive, it is informative, particularly with regard to the by species estimation ("broilers" and "turkeys" for the moment), which allows a more detailed analysis than the "all poultry" indicators.

An overall reduction in antibiotic use has been observed over the three years of the network's life, which is in line with the national sales data published by the Anses-ANMV.

5.15. Antimicrobial usage in Italian dairy farms

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Although steadily declining, the use of antimicrobials (AMU) in the Italian livestock production is still among the highest in Europe. However, the different production sectors do not contribute equally to the overall AMU. Although dairy farming is an important part of the Italian animal production and the AMU in this sector is expected be low, data on the topic are still limited. The aim of this study was to investigate AMU in Italian adult cows and its relationship with farm size and milk production.

Data on 2018 milk production (litres of milk per cow per day) and AMU were collected in 204 Italian dairy farms. The AMU was estimated by calculating a treatment incidence 100 (TI100), considering the Defined Daily Doses Animal for Italy as metric, a standard weight of 600 kg and 365 days at risk. The relationship of AMU with farm size and milk production was investigated through linear models.

The investigated farms housed 34 806 cows with a median of 122 cows per farm and an interquartile range (IQR) of 138. Median milk production was 31.5 litres (IQR = 5.5). Regarding AMU (Figure 1), median TI100 was 1.77 (IQR = 1.59). 94.6% of the farms administered antimicrobials in the Category B ("restrict") of the European Medicines Agency with a median TI100 of 0.54 (IQR = 0.83). Third- and fourth-generation cephalosporins were the most used classes, accounting for 30.9% of the overall AMU. Dry cow therapy (29.5%) and mastitis (26.6%) were the most common reasons for AMU. Total AMU and Category B AMU were both positively related to milk production ($p<0.0001$ and $p=0.0005$, respectively; Figure 2), while no significant association with farm size was found (both $p>0.05$).

Conclusion

In general, AMU was not particularly high but the frequent use of Category B antimicrobials, the large differences among herds and the presence of a small group of farms with much higher consumption than the others (Figure 1) highlight the importance of implementing an antimicrobial stewardship even in sectors where AMU is apparently low. Consistently with previous Italian studies, dry cow therapy and mastitis caused the majority of AMU, confirming the importance of promoting udder health and implementing a selective dry cow therapy. Finally, AMU was higher in farms with higher production, where a reduction of usage might be challenging as it would require an approach as comprehensive as possible (optimizing biosecurity, nutrition, management, etc.).

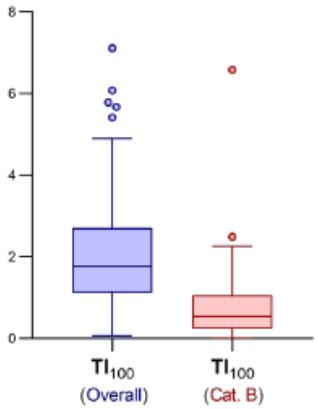

Figure 1. Distribution of overall (blue) and EMA's Category B (red) antimicrobial use in 204 Italian dairy farms, expressed as treatment incidence per 100 days (TI_{100}).

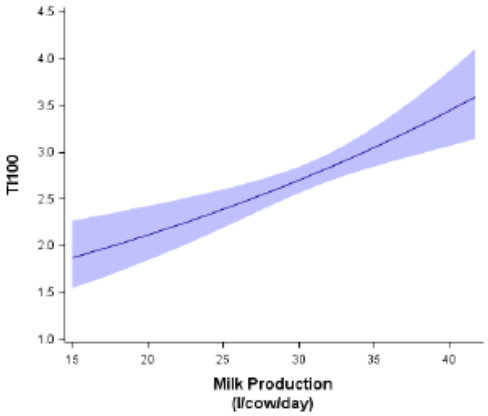

Figure 2. Predicted relationship between antimicrobial use (expressed as treatment incidence per 100 days) and milk production. The band indicates the 95% confidence interval of the predicted values.

5.16. The same and yet different? - Evaluation of electronic data regarding antimicrobial usage in dogs, cats and horses at two veterinary teaching hospitals in Germany

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The need of documentation of AMU in individual animal was addressed by the European Union with the passing of the regulation (EU) 2019/6, which came in force on 28th January 2022.While several AMU monitoring programs in veterinary medicine exist for farm animals in Germany, there is no system for individual animals despite their important role. However, with the increasing usage of electronic practice management software (EPMS), it is possible to analyse large-scale electronic field data generated for medical and accounting purposes.

We evaluated data of the Department of Small Animal Medicine and Surgery and Clinic for Horses, which were generated by the same EPMS, easyVET, for accountancy and documentation purposes. For small animals data between 1st of January and 31st of December 2018 were evaluated, for horses between 1st of January and 31st of December 2017. For both clinics data were extracted via export from easyVET and provided in Excel format (Microsoft, 2010).

Exported variables were related to the animal itself, the case inlcuding the reason for presentation of the animal and used drugs including number and corresponding unit. Regarding horses, the status as food-producing animals was included, as horses can be categorised as food-producing or non-food-producing animals in Germany.

The evaluated data were not collected for research purposes and represent a secondary data use. Therefore, comprehensive plausibility checks are necessary and missing values are possible. Especially missing values e.g. of the bodyweight can limit the evaluation. Results regarding used active ingredients from dogs and cats are comparable, but differ from the ones used in horses.

As an AMU-result active ingredients most often used in dogs and cats were penicillins, nitroimidazoles and quinolones in 2017 and 2018, respectively, contrary to horses where sulfonamides, nitroimidazoles and penicillins were used the most. The use of quinolones plays a minor role in horses.

When comparing results from different animal species, various influencing factors have to be taken into account. We identified potential influencing factors regarding animal species and the individual animal itself. These are: Regulations (national and international), guidelines, license of drugs, side effects, allergies, preliminary treatment including antimicrobial susceptibility testing, diagnosis and pre-existing conditions.

Conclusion

This study shows that data generated by an EPMS can in general be evaluated well but complex data-management and plausibility checking is needed before use. Due to different influencing factors, comparability of the results is limited.

5.17. A comparison of two methods to estimate proportion of used antibiotic substances in Swedish piglet producing herds

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Background and Objectives

Using defined course doses proposed by ESVAC (DCDvet) or suggested Swedish DCD (DCDse) for quantifying antibiotic use has been shown to lead to considerable differences due to how these units were developed and to diverging dosing recommendations (Sjölund *et al*., ESPHM 2019). DCDse is the national maximum dose while DCDvet is the average from nine countries. How these units will affect the proportions of different antibiotic substances used have not been studied at herd level which this study aimed at.

Material & Methods

Antibiotic usage data for 2016 and 2017 were obtained from treatment records for 47 and 52 breeding herds, respectively, affiliated with the health advisory company Farm & Animal Health. The number of DCDvet and DCDse per year was calculated per product based on the amount of active substance used and standardized weights (4, 12 or 220 kg for sucklers, weaners or sows, respectively). The proportions of antibiotics used in the different age categories were then calculated for each year.

Results

Benzylpenicillin was the most used antibiotic for all age categories in both years except in 2016 for weaned piglets where colistin for oral use dominated using DCDse (35%). The proportions of benzylpenicillin were 63%, 39% and 77% in 2016 and 67%, 47% and 76% in 2017 using DCDvet for sucklers, weaners and sows, respectively. The corresponding proportions using DCDse were: 68%, 28% and 81% in 2016 and 73%, 37% and 80% in 2017. The second most used antibiotics, irrespective of unit used, were colistin and macrolides for weaners, trimethoprim-sulphonamides for sucklers and sows and aminopenicillins for sucklers. There were some shifts in antibiotics used between years with an increase in benzylpenicillin use but a reduction in colistin use in sucklers and weaners. For sows, use was similar between years irrespective of unit used for quantification.

Discussion & Conclusion

When DCDse were first proposed, considerable differences to DCDvet were seen for some antibiotics where DCDse for benzylpenicillin was +70%. This large difference between the two different units could however not be seen in the proportions of benzylpenicillin used in the studied herds. Possibly, this could depend on the other antibiotics used and whether there were differences between the two units for these antibiotics. The observed reduction in colistin use demonstrates a rapid adaptation by veterinarians in prescription profiles after the discovery of plasmid-mediated polymyxin resistance.

5.18. Quantifying veterinary antimicrobial use in Timor-Leste using import data between 2016 and 2019

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Introduction: Monitoring of antimicrobial use in animals at the national level enables a country to identify trends and inform policy measures to promote prudent use. Recently, there has been a growing concern of rising antimicrobial usage in livestock in developing countries due to farming intensification. Hence, a study was undertaken to quantify national usage levels in animals in Timor-Leste, which is a developing country located in Asia.

Methods: Import data was used as a proxy for antimicrobial use in animals for this study because there is no local manufacture and re-export of antimicrobials. All import applications for veterinary medicines that were submitted to the Ministry of Agriculture and Fisheries between January 2016 to December 2019 were screened to identify veterinary antimicrobials. The total weight of active ingredient imported for each year was calculated and adjusted for animal biomass using data obtained from the FAOSTAT database. Individual antimicrobials were also grouped into an antimicrobial class/subclass based on OIE guidelines, and the weight in each class/subclass was determined.

Results: Between 2016 to 2019, 229.8kg of active ingredients of veterinary antimicrobials were imported into Timor-Leste, with a mean of 57.4kg (s.d. 31.0kg) per year. After adjusting for animal biomass, an average of 0.55 mg/kg biomass (s.d. 0.27mg/kg) was imported per year. The most imported classes of antimicrobials by weight were tetracyclines (35.5%), penicillins (23.7%) and macrolides (15.9%). See Figure 1.

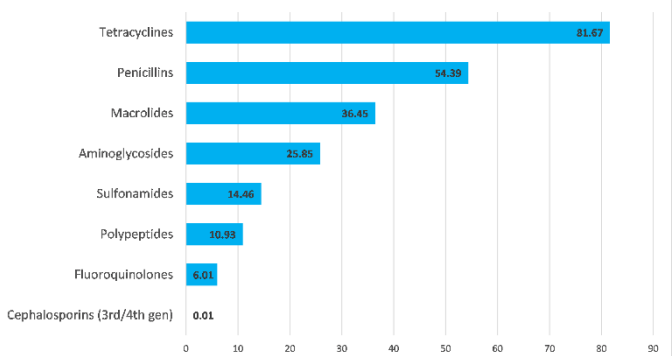

Figure 1: Kilograms in each antimicrobial class

Discussion: The results show that the use of veterinary antimicrobials in Timor-Leste after adjusting for biomass is very low compared to the global average of 144.4mg/kg biomass in 2016. The low level of use is likely due to the subsistence agriculture system in Timor-Leste where there is poor access to veterinary services and medicines. However, antimicrobial use may increase in the future due to farming intensification as seen in other developing countries. The commonly used antimicrobial classes are also consistent with global and regional trends in Asia. It was positive that colistin which is an antibiotic of last resort for human medicine was imported at very low quantities (i.e. less than 5%). This study likely provided an underestimation of actual use because of under-reporting. However, even if the

result was doubled, Timor-Leste would still demonstrate very low antimicrobial use levels in animals. Future monitoring could focus on collecting data more proximal to the site of usage such as at end-user level to elucidate species and production type usage patterns.

Conclusion

This study showed very levels of antimicrobial use in animals in Timor-Leste consistent with its subsistence agriculture system. This study also developed in-country capacity to monitor antimicrobial use according to OIE guidelines.

5.19. Centralized health management registers for Finnish cattle and swine herds – Naseva and Sikava

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Animal Health ETT is a private NGO association maintained by slaughterhouses, dairies, and egg packing companies. ETT coordinates cattle and swine health management by administrating registers Naseva for cattle farms and Sikava for swine herds. A comprehensive cooperation network exists between ETT, authorities, farmer´s associations, veterinarians, and other stakeholders.

Herd health management is based on an agreement between a veterinarian and a farmer, health plan, regular herd visits by veterinarian and data collection into registers. Herd veterinarians visit farms regularly, visit interval depending on the farm´s production type and herd size. Several observations of health, welfare and biosecurity are made by veterinarians during visits. Animal welfare is observed using Welfare Quality® principles. Register data consists of e.g., herd visit observations, slaughterhouse data, laboratory results of pathogens and medication data.

Registers have interfaces to other databases and different computer softwares. These include official animal registers, meat inspection and cow control data as well as laboratory results. Medication data is transferred to registers from veterinary and production management softwares or recorded by the farmer. NasevaHealthApp has been developed for reporting usage of medicines in cattle farms. Medication data is available for herd veterinarians, advisors as well as slaughterhouses, dairies, and cow control software.

Results

The coverage of Sikava and Naseva registers is nearly 100 % of Finnish commercial production. Naseva aims to have medication recordings of 70 % of the farms in the system. At the moment, 56 % of farms have medication data in Naseva. Swine farmers with health classification status are obliged to report medicine usage in Sikava. There has been improvement from 78 % (2016) to 99 % (2020) of holdings having medication data in the register. However, medicine recordings are not comparable between Sikava and Naseva.

Conclusions and discussion

The usage of antimicrobials can be monitored in the registers. Connection between registers and veterinary softwares is important because veterinarians sell most of the medicines to the farms (without profit).

It´s not easy to reach full coverage of medication data when the farmer is responsible for the recordings. To improve the quality of the data, there is a new interface to get sales data automatically from veterinary software.

Several graphs describing the usage of antimicrobials are under development in both registers. This could motivate farmers and veterinarians to record medications more actively.

References:

Animal Health ETT (www.ett.fi)
Naseva – Centralized Health Care Register for Finnish Cattle Herds (www.naseva.fi)
Sikava – Health Classification Register for Swine Farms (www.sikava.fi)