

AACTING



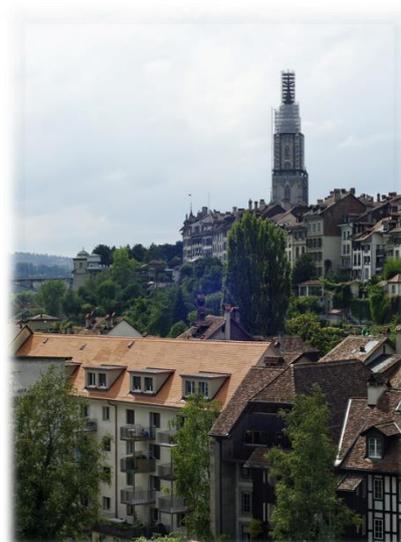
Herd level antimicrobial consumption in animals
Collect | Analyze | Benchmark | Communicate

Quantification, Benchmarking and Stewardship of Veterinary Antimicrobial Usage

Second International Conference



Bern
2-3 July
2019



ABSTRACTS BOOK

Oral presentations

(in alphabetical order)

Effects of the novel concept "outdoor veal calf" on antimicrobial use, calf growth and mortality in Switzerland

J. Becker^a, A. Steiner^a, G. Schüpbach^b, V. Perreten^c, M. Meylan^{a*}

^aClinic for Ruminants, Vetsuisse-Faculty, University of Bern, Switzerland

^bVeterinary Public Health Institute, Vetsuisse-Faculty, University of Bern, Switzerland

^cInstitute of Veterinary Bacteriology, Vetsuisse-Faculty, University of Bern, Switzerland

*Corresponding author: Clinic for Ruminants, Vetsuisse-Faculty, Bremgartenstrasse 109a, 3012 Bern, Switzerland; Tel. +41 31 631 23 44; Fax: +41 31 631 23 44; e-mail address: mireille.meylan@vetsuisse.unibe.ch

The aim of the intervention study 'outdoor veal calf' is to evaluate a novel concept for calf fattening in order to reduce antimicrobial use by 50% without compromising animal health. In Swiss calf fattening facilities both antimicrobial use and mortality are high, and the risk of selecting bacteria resistant to antimicrobials and economic losses are elevated accordingly. Reasons for this situation include related management practices such as commingling of calves from multiple birth farms and crowding, as well as suboptimal barn climate. For decades, pneumonia has been described as the most important reason for antimicrobial treatment, and the growing prevalence of resistant bacteria represents a threat to human and animal health by now. The "outdoor veal calf" concept, implemented in nineteen intervention farms (IF), is based on three main actions: first, purchased calves were transported directly among neighbors from the farm of birth to the fattening facility instead of commingling calves in livestock dealer trucks. Second, each calf was vaccinated against pneumonia immediately after arrival and completed a three-week quarantine in an individual hutch. Third, the calves spent the rest of the fattening period in outdoor hutches in groups not exceeding 10 calves. The group hutches and the covered and bedded paddock provided shelter from adverse weather conditions and direct sunshine, but constant access to fresh air was warranted. Nineteen conventional calf fattening operations of similar size producing according to the current regulations of the label IP-Suisse (with improved animal welfare and sustainability standards) served as controls. Every farm was visited once a month for a 12-month period, and data regarding animal health and welfare, treatments, and production parameters were collected. Mean TI_{DDD} was 5.3-fold lower in IF compared to control farms (CF): 5.9±6.5 and 31.6±27.4 days under treatment per animal year, respectively; p<0.001. Mortality was 2.1-fold lower in IF (3.1%±2.3 vs. 6.3%±4.9 in CF; p=0.032). Animal health and welfare were assessed in live animals, at slaughter and by comparing management practices indicating an overall better health and welfare in IF. The prevalence of pneumonia at slaughter was 26% and 46% in IF and CF, respectively (p<0.001), whereas the prevalence of abomasal ulceration did not differ between groups (IF: 65%, CF: 72%; p=0.216).

Average daily gain did not differ between groups (IF: 1.29±0.17 kg/day, CF: 1.35±0.16 kg/day; p=0.244).

Conclusion

A drastic reduction in antimicrobial use and mortality was achieved in the novel "outdoor veal calf" concept without compromising animal health and welfare. The principles of risk reduction used in designing the concept can be used to improve management and animal health, decrease the need for antimicrobial treatments, and increase profitability in veal operations.

The Creation Of Sector-Specific Targets in the United Kingdom

Presenting Fraser Broadfoot¹, Amy Jackson², Elizabeth Berry³, Fiona Lovatt⁴

¹Veterinary Medicines Directorate; ²Responsible Use Of Medicines Alliance; ³British Cattle Veterinary Association; ⁴Sheep Health and Welfare Group

Following the publication of the O'Neill report in May 2016, the UK government committed in September 2016 to work closely with the key livestock sectors to ensure that ambitious and appropriate sector specific antibiotic reduction targets were agreed by the end of 2017. In response to this commitment, the Responsible Use of Medicines Alliance (RUMA), which represents medicine use in every major livestock sector in the UK, charged its new Targets Taskforce (which was also formed in May 2016 following the O'Neill report), to deliver this key government objective. To ensure the targets were meaningful, it was felt they should be developed by the vets and farmers looking after the livestock. Thus one leading veterinary and farming representative from each of the eight key livestock sectors (beef, dairy, fish, gamebirds, laying hens, pigs, poultry meat and sheep) was invited to the first meeting in December 2016 and the taskforce met bi-monthly thereafter throughout 2017.

When setting targets, some sectors already had data but others needed to make educated estimates or access private datasets. Agreeing targets required in-depth negotiations with leaders in each sector, based on health and welfare challenges and the potential to change. Some sectors, such as poultry and pigs, already had existing multi-stakeholder antimicrobial usage groups whereas others, such as cattle and sheep, created new ones. To support and challenge where needed, the taskforce included observers from government, the British Veterinary Association and the body certifying farm assurance, Red Tractor. The targets, published in October 2017, were endorsed by the Chief Veterinary Officers from across the UK devolved nations. The targets were broad in scope and based on the principle that “prevention is better than cure”. As well as numerical targets relating to reducing overall usage, usage of Highest Priority Critically Important antibiotics (HP-CIAs) and vaccine or teat sealant sales, there were also non-numerical targets focusing on disease prevention, husbandry, health planning, monitoring health and welfare, and communicating best practice. For example:

- **Pig Sector** –improve vaccination, husbandry and biosecurity, and move away from in-feed medication to more strategic water-based or systemic treatments. The aim was to reduce antibiotic use by over 60% from a baseline of 278mg/PCU in 2015 to 99mg/PCU in 2020. Latest data show the sector is well on the way to achieving this, with a 53% reduction to 131mg/PCU in 2017.
- **Cattle Sector** – reduce blanket dry cow therapy and mastitis cases in dairy, and youngstock pneumonia in beef; for both, also improve availability and quality of usage data. Targets included a 20% reduction in antibiotic use for dairy and 10% for beef 2016-2020, including a 50% reduction in HP-CIAs for both. Other targets were a 40% increase in the use of teat sealants and a year-on-year increase in pneumonia vaccine sales. Early indications show reductions in use within dairy and, for cattle overall, a 29% reduction in injectable and 33% reduction in intramammary HP-CIAs 2015-2017.
- **Sheep Sector** – tackle three ‘hotspot’ areas of antibiotic use – neonatal disease (specifically Watery Mouth and Joint Ill), lameness and abortion. A relatively low user, the sheep sector is aiming for a 10% reduction in use overall and a 50% reduction in use of HP-CIAs. #ColostrumIsGold, a communications campaign run largely on social media, has helped towards tackling preventative antibiotic use for the neonatal disease by promoting the benefits of good colostrum management.

Conclusion

The initiative has been so successful, the taskforce won the Prescribing and Stewardship category at Public Health England’s 2018 Antibiotic Guardian Awards. The creation of voluntary targets by the industry has created enormous “ownership” within the farming industry, and highlights the way it is facing the AMR challenge positively and proactively. By bringing different sectors together, the taskforce has allowed a unique opportunity to challenge, share, support and collaborate. One of the group’s key strengths is its independence and single voice for UK agriculture. A one-year update report published in November 2018 has shared progress and challenges. The targets have also been integrated into the new UK five-year strategy to create an overall target of reducing antibiotic use by 25% between 2016 and 2020. The taskforce has continued to meet every six months to discuss progress and will also develop new objectives by the end of 2020 to build on existing achievements.

Use of a livestock-adapted ADKAR[®] change management model for reducing antimicrobial usage in pig- and broiler production in Belgium

N. Caekebeke¹, F. J. Jonquiere², M. Ringenier¹, M. Houben³, M. Postma¹, F. C. Velkers², T. J. Tobias², J. A. Stegeman², J. Dewulf¹, on behalf of the i-4-1 Health Study Group

¹Faculty of Veterinary Medicine, Ghent University, Belgium

²Faculty of Veterinary Medicine, Utrecht University, the Netherlands

³GD Animal Health, the Netherlands

To face the challenge of antimicrobial resistance (AMR) in food-producing animals, the I-4-1 Health project aims to reduce antimicrobial usage (AMU) in pig and poultry production. Already a considerable decline in the amount of antimicrobials was achieved, but reductions are still possible.

To coach farmers towards a more reasonable AMU, factors influencing their behaviour should be identified. One of the change management models already well incorporated in corporate business is the ADKAR[®] model. This model identifies the five different elements essential for the successful implementation of change: Awareness, Desire, Knowledge, Ability and Reinforcement.

A total of 14 pig and 15 broiler farms were selected in Belgium with higher than average AMU. From each farm the following information was collected: farm characteristics, technical performances, vaccination strategies, diagnostics, management and level of biosecurity. Based upon literature and expert opinions, the ADKAR[®] model was modified for use in livestock. Each element was scored 1 to 5, with 5 being the highest score.

During the first farm visit, each element of the livestock-adapted ADKAR[®] model was scored per farm, except for Reinforcement. The pig farmers scored as followed: average scores of A: 3.1, D: 3.0, K: 2.7, A: 2.9. Broiler farmers scored similar with A: 2.9, D: 3.3, K: 3.0, and A: 2.7 on average.

The amount of antimicrobials administered in the year preceding the farm visits was collected. Pigs received antimicrobials during 13,8% of their life span (standardised at 200 days) on average. In broiler production, this was 8,6% on average (standardised life span of 39,3 days).

After a first coaching session six months later on management, biosecurity and AMU, the average ADKAR[®] scores increased in both animal species; A: 3.3/3.2, D: 3.2/3.2, K: 2.8/3.7, A: 3.7/3.2 and R: 3.9/4.3 for pigs/broilers respectively. Preliminary data in broilers suggests that the AMU has declined after the first coaching period to 6.9% of the life span. In pig production, the use of antimicrobials after six months remained stable with 14.1% on average (preliminary data).

Conclusion

After a first coaching session, the average ADKAR scores increased, meaning that the farmers had a change of behaviour to more prudent AMU after only 6 months.

Although a large reduction in the amount of antimicrobials used in pig and broiler production was already achieved, our farm-specific action plan can further help in reducing the AMU by focussing on improvements in biosecurity and the use of alternatives.

Actions undertaken in EU countries for achieving or maintaining a low(ered) antibiotic use in animals

Bénédicte Callens¹, Wannas Vanderhaeghen¹, Jeroen Dewulf², Fabiana Dal Pozzo¹

¹Centre of Knowledge on AntiMicrobial Consumption and Resistance in Animals – AMCRA vzw

²Epidemiology Unit – Faculty of veterinary medicine Ghent University

Appropriate antibiotic use is recognized as the major element to slow the development and spread of antibiotic resistant bacteria in humans and animals. Therefore, the total use of antibiotics and of critically important antibiotics in animal husbandry must decrease worldwide. To achieve a deeply rooted and durable decrease in antibiotic use, countries undertake various actions directed at changing human behaviour. An overview of the actions undertaken for achieving or maintaining a low(ered) antibiotic use in animals among selected European countries is presented here. Countries were included in the overview if one of two conditions were fulfilled: 1) having a great reduction of antibiotic use during the last 5-6 years; 2) having a “historically” low antibiotic use in animals, defined as less than 70 mg/PCU (population correction unit) during the last 6 years, despite having animal species production known to be associated with a high antibiotic use. National antibiotic use level was based on the veterinary antibiotic sales data between 2010 and 2016, expressed in mg active substance per PCU, published yearly in the ESVAC reports by EMA (2018).

Three countries showed a reduction in antibiotic use of at least 45% during the last 5 (Germany) or 6 years (The Netherlands and France). Denmark and the United Kingdom were chosen as models of countries with a “historically” low antibiotic use. Actions taken by all selected countries were divided into five categories, according to the RESET Mindset Model comprising the most important drivers for human behaviour change, which are Rules and regulations, Education and information, Social pressure, Economics, and Tools. Results show that both in strong reducing countries as in countries with a “historically” low antibiotic use, a variation of measures are taken. Yet, in all countries studied, all cues of the RESET Mindset Model were represented in the undertaken actions.

Conclusion

Changing human behaviour is a very challenging task. Successes can only be achieved upon combined actions on the different drivers of human behaviour change. Different parties will therefore be addressed otherwise and will help to advance the fight against antimicrobial resistance.

First evaluation of interventions to reduce antimicrobial usage in the French rabbit industry

Claire Chauvin¹, Juliette Choudjaye¹, Sophie Le Bouquin¹

¹Anses, Epidemiology Health and Welfare Unit, Ploufragan, France

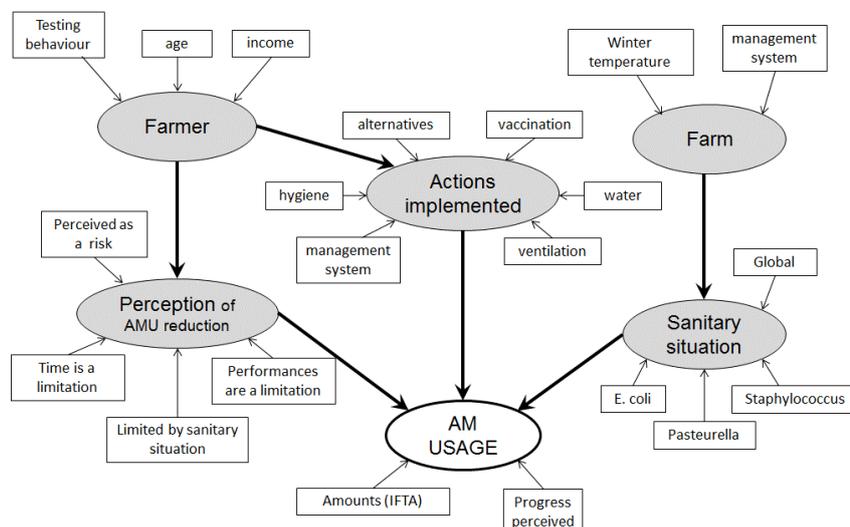
Since 2011, the French professional Rabbit Council (CLIPP) has set up a voluntary action plan for reducing usage of antimicrobials (AMU) in the rabbit-farming sector. The plan included a written engagement of all stakeholders, trainings and recordings of on-farm usages. Positive results on decreasing AMU were rapidly registered. After the first 4 years of implementation, an evaluation was requested to gain further knowledge about farmers' perception regarding AMU reduction, actions implemented, brakes and levers of reduction. A four-page questionnaire was delivered to 405 farmers by regular postal service in the beginning of 2015. Questions concerned the farm and farmer characteristics, inventory of actions implemented during the past 4 years, and perception of farmers on AMU reduction. Relationships between topics relating to characteristics, actions, perceptions and AMU recoded on farm were explored through a partial least squares path modeling approach (PLS-PM).

Responses were received from 181 farmers (participation rate of 45%). About 75% of the respondents reported a decrease in AMU. Progress was still possible according to 50% of the farmers. At least one action was implemented by 78% of respondents. Diverse and frequently multiple, these actions related notably to alterations in farm facilities (e.g. ventilation system), husbandry practices (e.g. sorting or feeding practices), alternatives, etc. Both farmer's responses and modeling (cf. Figure) highlighted major importance of the farm sanitary situation in the process of decreasing usage. The actions implemented played a great role, being the second more important factor, before farmer's perception of antimicrobial reduction. These actions were subordinated to farmer's attitude towards changing habits and farm income, which also influenced farmer's perception.

Conclusion

In the French rabbit industry Reduction of AMU was a voluntary collective engagement, widely supported and well-perceived by farmers according to their survey responses. A non-optimal sanitary situation of the farm appeared to be a major barrier to usage reduction, meanwhile actions implemented appeared to be efficient levers of reduction. The economic situation of the holding conditioned both the implementation of mitigation actions and the perception of farmers. In the light of those positive results and in the context of the National Plan ecoantibio, efforts have been pursued, allowing the French rabbit industry to report a more important decrease in the following and recent years.

Figure: PLS-PM final model of the complex relationships between farm and farmer's characteristics, actions implemented, perception of antimicrobial usage reduction and its effectiveness (France, 2015, 181 rabbit farms).



Risk Factors Associated with Antimicrobial Use in Italian Poultry Production

G. Di Martino¹, K. Capello¹, C. Caucci¹, M. Santagiuliana¹, M. Lorenzetto¹, A. Dalla Costa¹, L. Gavazzi² and L. Bonfanti¹

¹Istituto Zooprofilattico Sperimentale delle Venezie, Viale dell'Università 10, 35020 Legnaro (PD), Italy;

²Veterinary practitioner of poultry sector

Antimicrobial usage (AMU) in livestock may contribute to the development of antimicrobial resistance (AMR). The aims of this research were to provide a quantitative and qualitative AMU overview during 2015-2017 in broilers and turkeys and to identify possible risk factors. Farms belonged to one leading integrated Italian poultry industry, which had declared the implementation of a plan containing several actions aiming at the responsible use of antimicrobials. AMU of 6672 and 1264 fattening cycles of broilers and turkeys for a three-year-period (2015-2017) were provided by the Company and analysed; kilograms of live-weight produced in each cycle were also provided. AMU and usage of high-priority critically important antimicrobials (HP-CIAs) were evaluated at national level through the application of the ESVAC guidelines and at farm level using Italian standardized doses. A retrospective analysis was conducted to examine the effect of geographical distribution of the farms, poultry population density and the veterinarian in charge. Spatial analysis was conducted using Geographic Information System (GIS). Moreover, season and gender of animals were analysed as possible risk factors for AMU in broilers and turkeys, respectively. Association between AMU and risk factors was assessed through a Linear Mixed Model.

Overall, AMU and HP-CIAs showed a significant reduction in both the broiler (-78% and -95% N.DDD/kg respectively) and the turkey (-45% and -64% N.DDD/Kg respectively) sector. Significant risk factors for AMU were year, geographical area, density population and veterinarians ($P < 0.001$). AMU was also significantly associated with spring in broiler ($P < 0.001$) while it was not significantly associated with gender in turkeys ($P = 0.0632$).

Conclusion

Overall, a decrement in AMU due to a thorough revision of several management practices was found. The study evidenced some major determinants for drug usage, some intrinsically connected with the type of production (e.g. turkeys versus broilers), but some others due to management.

Antimicrobial prescription trends for canine and feline gastroenteric conditions in veterinary primary care in the United Kingdom: a mixed-methods approach

Fins IS.¹, Radford AD.¹, Noble PJ.¹, Singleton DA.¹, Pinchbeck GL.¹

¹Small Animal Veterinary Surveillance Network (SAVSNET); Institute of Infection and Global Health, University of Liverpool, UK

Antimicrobial agents are frequently prescribed to companion animals with acute gastrointestinal (GI) signs. However, specific antimicrobial prescription guidance has been published (e.g. PROTECT ME) which now sets a '0 target' for companion animals with acute GI signs that are otherwise systemically well. Our aim was to better understand antimicrobial agent prescription frequency and choice in first opinion practice, focusing on such gastroenteric conditions, using anonymised Electronic Health Records (EHRs) and a mixed-methods approach.

This retrospective observational study utilised EHRs from 225 volunteer veterinary practices between April 2014 and September 2018. First visit consultations for investigation and/or treatment of dogs and cats with gastroenteric clinical signs (including diarrhoea and/or vomiting), which additionally had a questionnaire answered by the attending practitioner were included.

A total of 17,819 EHRs were analysed, 82.1% from dogs and 17.9% from cats. The most commonly reported clinical signs at initial presentation were non-haemorrhagic diarrhoea, present in 47.1% of dogs (95% confidence interval, CI, 46.2-48) and 40.8% of cats (CI 39.0-42.6); and non-haemorrhagic vomiting, in 54.2% of cats (CI 52.4-56.1) and 45.3% of dogs (CI 44.2-46.3). Systemic (oral or injectable) antimicrobial agents were prescribed in 29.3% (CI 27.4-31.1) of canine GI consultations, and in 23.5% (CI 21.2-25.9) of feline GI consultations. Only 0.7% (CI 0.2-1.1) of dogs were prescribed a systemic Highest Priority Critically Important Antimicrobial (HPCIA) in their first visit consultation. In contrast, 4.8% of cats (CI 3.8-5.7) received systemic HPCIA prescription in first visit consultations. The use of diagnostic tests was only reported in 13.2% of the EHRs of dogs (CI 12.2-14.3) and in 18.9% of the cats' consultations (CI 17.3-20.4).

In 200 EHRs randomly selected from the initial dataset, a preliminary thematic analysis of the clinical narrative was performed. In 24.5% (CI 19.0-30.9) of these EHRs, antimicrobial agents were mentioned in the clinical narrative of GI consultations. Justification for prescribing was found in only 17.5% (CI 12.8-23.4) in the clinical narrative (n=200). A common justification found was to cover a perceived risk of infection.

Conclusion

Further qualitative analyses of the clinical narrative will classify the content around the justification made by practitioners when prescribing antimicrobials in gastroenteric presentations. Antimicrobials are frequently prescribed in GI presentations. Whilst this suggests a gap with current recommendations targets, there remains a need to assess practitioners understanding of other systemic signs. Continuous surveillance and benchmarking is needed to monitor prescription patterns, aiming to facilitate effective antibiotic stewardship.

The ‘balloon effect’ – intervention triggers shift between antimicrobial classes

- How interventions on one substance effect other substances – for gastrointestinal disorders in weaner pigs

Laura Mie Jensen¹ and Elisabeth Okholm Nielsen¹

¹Danish Veterinary and Food Administration;

The ‘Yellow card’ initiative with threshold values for pigs has been in place in Denmark since 2010. In 2015 it was decided to promote a more prudent use. Differentiation between antimicrobial classes in the ‘Yellow card’ initiative was chosen as the regulatory framework, and the technical dose values were weighted into three categories in 2016 and modified in 2017. The three categories are: **a)** Flouroquinolones, 3.-4. gen. cephalosporins and colistin – factor 10, **b)** Tetracyclines – factor 1.5 and **c)** Other antimicrobials – factor 1.0. The use of fluoroquinolones and 3rd/4th generation cephalosporins is negligible in Denmark; therefore in reality only colistin is weighted with a factor 10. The ‘balloon effect’ of the intervention on tetracyclines and colistin is investigated in this paper.

Tetracyclines and colistin are mostly used for gastroenteric disorders in weaner pigs. The intervention resulted in an immediately change of the consumption. Tetracycline was reduced from app. 12 tons to app. seven tons active compound from 2016 to 2018 and colistin dropped from app. one tons to less than one kg active compound. In both cases an obvious ‘balloon effect’ was observed. ‘Balloon effect’ is when the reduction of one antimicrobial class results in a similar increase in another. Like when you squeeze on a balloon, the air pops up in different places. The reduction in tetracyclines resulted in a marked increase in macrolides, whereas the reduction in colistin was shifted to an increase in aminoglycosides – hence ‘balloon effect’.

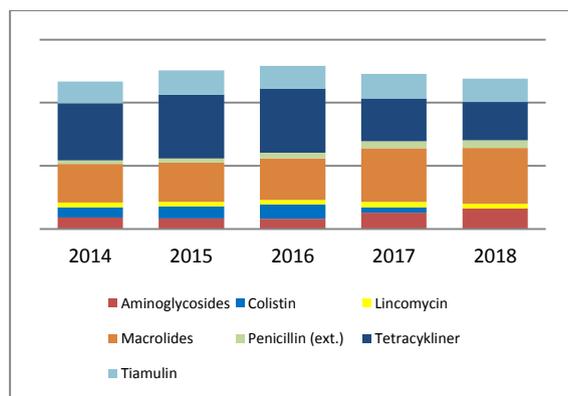


Figure 1. The most used antimicrobials for weaner pigs - gastroenteric disorder - kg-doses (y-axis not shown)

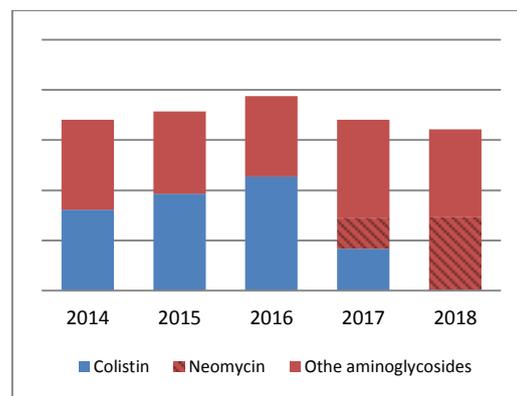


Figure 2. Colistin and aminoglycosides of that neomycin used for weaner pigs - gastroenteric disorder - kg-doses (y-axis not shown)

Figure 1 and 2 demonstrates the ‘balloon effect’ of the intervention. A marked reduction in the use of tetracyclines (40 %) was replaced by an increased use of macrolides (35%, Figure 1). In Figure 2 the reduction and shift between colistin and aminoglycosides, mostly neomycin, is demonstrated. Neomycin was reintroduced to the Danish market in 2017, and seems to be used as an alternative for colistin. The almost complete phase out of colistin has resulted in an increased use of aminoglycoside between 2016 and 2018 of 101 % (Figure 2).

Conclusion

The intervention has triggered a shift between antimicrobial classes. If the access of an important antimicrobial is limited, the consumption may shift to another class or active substance, based on availability and cost-effectiveness and the use is therefore not only reduced but also replaced. An intervention may in some cases result in a total swap hence, the ‘balloon effect’.

Randomness of antimicrobial usage regarding choice of antimicrobial class and dosage on pig, poultry, turkey and veal calf farms

Philip Joosten^{1*}, Steven Sarrazin¹, Liese van Gompel², Roosmarijn Luiken², [EFFORT group], Jaap Wagenaar³, Dick Heederik², Jeroen Dewulf¹

¹Veterinary Epidemiology Unit, Department of Obstetrics, Reproduction and Herd Health, Faculty of Veterinary Medicine, Ghent University, Salisburylaan 133, Merelbeke 9820, Belgium ²Institute for Risk Assessment Sciences, Utrecht University, Yalelaan 2, 3584 CM Utrecht, the Netherlands ³Department of Infectious Diseases and Immunology, Faculty of Veterinary Medicine, Utrecht University, Utrecht, The Netherlands

Antimicrobial resistance (AMR), which is driven by antimicrobial usage (AMU), is posing a major threat to public health worldwide. To stop AMR, we do not only need to reduce AMU, we also need to promote a more responsible usage. Therefore, AMU characteristics in food animal production were explored to identify how usage of these drugs could be improved .

Within the Ecology from Farm to Fork Of microbial drug Resistance and Transmission (EFFORT) project, a European project investigating the epidemiology and ecology of antimicrobial resistance, details on AMU were registered on 181 broiler farms, 180 pig farms, 60 turkey farms and 61 veal calf farms. An in depth description of the set up and methodology can be found in previous EFFORT studies

When comparing the choice of antimicrobial class to treat a similar indication, totally different classes were used between countries, a pattern that was observed within each species. Also dosage of antimicrobials varied a lot between farms. For example, dosage of all 12 colistin treatments, administered through drinking water on the sampled broiler farms, ranged from 3.6 mg to 50.4 mg colistin per kg animal per day. This type of variation was also observed for other products and in other species.

Conclusion

These findings show a randomness of usage when it comes to choice of antimicrobial class and dosing of antimicrobial treatments. Differences in product availability and prices on regional level might explain this. Nevertheless, such randomness in AMU is no longer justifiable and should be addressed if we want to strive for a more responsible AMU.

Economic assessment of policy options to reduce antibiotic prescribing in veal calf production in Switzerland

Anaïs Léger¹, Isabel Lechner¹, Julie Pont², Maren Feldmann², Martin Kaske², Katharina D.C. Stärk¹

¹SAFOSO AG, Switzerland

²Vetsuisse-Faculty Zurich, Switzerland

The economic sustainability of veal calf production in many European countries, including Switzerland, is at least partially reliant on the use of antibiotics. The Swiss national strategy for antimicrobial reduction (StAR) lists actions to decrease AM usage. However, Swiss veterinarians have the right to dispense AMs, and therefore part of their income is generated by the sales of AMs. Without alternative business models, a change of practice may be difficult to achieve. The objective of this study was to explore alternative scenarios of governmental interventions to reduce the AM prescription at veterinary practice and their impact on the income of veterinarians.

AM sales data were collected over a 12-months-period from 30 practices for 90 veal calf clients, using a questionnaire and assessing the bills issued to the clients. A partial budgeting analysis was conducted to assess the economic impact of different scenarios at veterinary practice level. The scenarios combined different policy options (e.g. benchmarking of AM use at farm level) and potential compensating actions for the veterinarians (e.g. increase number of consultancy services). Scenarios were selected and defined based on measures already implemented in other European countries and adapted for Switzerland after discussion within the project consortium.

In the case of the scenarios with benchmarking measures implemented at practice or calf operation level, the results of your model showed that veterinary practices would manage to outweigh the change in AM prescription and sales. However, in the scenario which modeled a substantial decrease of revenues from AM sales (e.g. due to the abolishment of the right to dispose AMs), only a fundamental change in activities and services offered by veterinary practices could help balancing out the income of the veterinarians. In most of the cases, the simulation of this scenario resulted in a negative balance for the veterinarian.

Conclusion

The results will be discussed among veterinarians, industry partners and policy makers to consolidate views. If economically attractive alternatives can be identified, this could be explored in a larger study. To reduce the use of AM in the veal calves value chain, options targeting other actors might be necessary such as transparency along the chain, reducing the number of actors or agreeing acceptable approaches for sharing the costs of externalities.

Automatic Identification of Veterinary Medicines in Treatment Records

Jon G. Massey¹, Kristen K. Reyher¹, Andrew W. Dowsey¹

¹Bristol Veterinary School

Introduction

Accurate quantification of antimicrobial usage (AMU) is important for assessment of responsible medicine use, farm benchmarking, informing behaviour change and regulatory compliance. Such quantification is usually performed in the terms of standardised metrics which require medicine reference data (e.g. active ingredients and their concentrations, standardised doses and course regimens) provided by a regulatory body. Therefore, linkage of veterinary treatment records with reference datasets by correct identification of veterinary medicines is necessary for accurate quantification of AMU.

In the UK, electronic recording systems for veterinary treatments at farm level exist which make use of reference datasets and therefore can produce records directly linkable to reference datasets. Uptake of these systems is generally poor; more common are paper-based records or systems with free-text entry of medicine names. Such free-text records lack identifiers to facilitate direct linkage to reference datasets. Prescription and sales records from veterinary practice management systems in livestock and companion animal sectors do not widely contain reference identifiers; instead these often contain surrogate identifiers (e.g. barcodes or supplier references) for which mappings to reference datasets are not readily available.

Previous approaches to address this linkage challenge have relied on proprietary, manually-curated dictionaries but these can be laborious to maintain, particularly with highly heterogenous datasets.

Methods

A number of string similarity measures were assessed for the purpose of identification of veterinary medicines in treatment records (using internally gathered test datasets) and were found to perform inadequately. Analysis of the structure and semantics of veterinary medicine names revealed reference medicine names to consist of many words, or ‘tokens’, (mean 8.31, SD 3.2) with varying semantics and importance to record linkage. This informed development of a novel multi-token string similarity metric which applies structural or semantic weighting to token matches. Optimal weighting parameters were learned using a genetic algorithm and a test dataset of 300 veterinary treatment records annotated with reference identifiers by an expert panel. Two independent test datasets were expertly annotated and used for evaluation of algorithm accuracy (Table 1).

Results

Application of the novel metric with learned weighting parameters resulted in substantial improvements in accuracy compared to simplistic similarity metrics.

Metric	Farm & veterinary practice (n=415)	Farm only (n=200)
Single-token (Levenstein)	0.12	0.20
Unweighted Multi-Token (Monge-Elkan)	0.18	0.23
Novel Weighted Multi-Token	0.76	0.78

Table 1: String similarity metric accuracy

Conclusion

Simplistic string similarity metrics are inaccurate and hence inadequate for identification of veterinary medicines in free-text treatment records. A novel metric which takes account of name structure and semantics can provide substantial improvements in accuracy thus enabling reliable and fully automated identification of veterinary medicines for the first time.

Comparing three different methods of antimicrobial data collection

V.-B. Pucken¹, B. Lovis¹, FMM. Alves de Sousa², G. Schüpbach-Regula², M. Bodmer¹

¹Clinic for Ruminants, Vetsuisse Faculty, University of Bern, Bern, Switzerland

²Veterinary Public Health Institute, Vetsuisse Faculty, University of Bern, Bern, Switzerland

The increasing incidence of antimicrobial resistance poses a global threat. As a result, surveillance programs monitoring antimicrobial consumption and resistance were implemented in several countries throughout the world. Such programs depend on the correct and detailed collection of antimicrobial usage data. Therefore, the aim of this study was to quantify and compare on farm used antimicrobials using three different data collection methods.

Antimicrobial usage data associated with mastitis treatment were collected from 92 farms for 18 months. The used data sources were: 1) discarded drug packages collected on farm, 2) recordings of treatment journals and 3) prescription data from the veterinarians' practice software. The data of the treatment journal was on the one hand analyzed by using only complete entries. On the other hand, records with missing dosage information were completed by using recommended doses from the *Swiss online compendium of registered drugs for veterinary use*. The antimicrobial data were divided into intramammary preparations used during lactation (IMM), intramammary preparations used for dry off (DRY) and systemic treatments (SYS). We compared the amount of injectors (IMM and DRY), the mg of active substances (SYS) and the treatment incidence (TI) for the defined daily dose (DDD) per 1,000 cow-days (IMM and SYS) and the defined course dose (DCD) per 1,000 cow-days (DRY). Additionally, the variety of antimicrobial products were compared.

The highest quantity of antimicrobials for IMM, DRY and SYS could be collected with the software (Table 1). Although the data from the discarded drug packages was almost as high for the IMM and DRY preparations.

Table 1: Comparison between quantities of antimicrobials collected from different data sources

Data source	Intramammary preparations				Systemic preparations	
	during lactation		for dry off		mg (active substance)	TI (DDD)
	No of injectors	TI (DDD)	No of injectors	TI (DCD)		
Garbage	11294.60	6.12	8235	1.12	4285987	0.34
TX-Journal	5326.60	2.89	3355	0.45	3101505	0.20
TX-J. added	7815.60	4.24	6286	0.85	7280302	0.58
Software	12916.00	7.00	8353	1.13	12920272	1.07

Garbage: discarded drug packages; TX-Journal: recordings of treatment journals; TX-J. added: recordings of treatment journals completed with information from the *Swiss online compendium of registered drugs for veterinary use*; Software: data from veterinarians' practice software; TI: Treatment incidence (DDD per 1000 cow-days or DCD per 1000 cow days)

Looking at the variety of collected antimicrobial products, the highest number of preparations used for IMM und DRY were collected with the discarded drug packages and the highest number of systemic preparations were collected with the software data (Table 2).

Table 2: Comparison of variety of antimicrobial products collected from different data sources

Data source	Intramammary preparations				Systemic preparations	
	during lactation		for dry off		No preparations	%
	No preparations	%	No preparations	%		
Garbage	23	88.46	10	90.91	20	54.05
TX-Journal	21	80.77	10	90.91	27	72.97
TX-J. added	23	88.46	10	90.91	27	72.97
Software	18	69.23	7	63.64	31	83.78
Total preparations	26	100.00	11	100.00	36	100.00

None of the used antimicrobial data collection methods was able to capture the complete information on the used antimicrobials. Either the quantity or the variety was underestimated.

To obtain a most complete dataset a combination of antimicrobial data sources should be considered.

AACTING



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

Quantification, Benchmarking and Stewardship of Veterinary Antimicrobial Usage

Second International Conference

2-3 July 2019, Bern

ABSTRACTS BOOK

Oral presentations

(in alphabetical order)

Actions taken in Germany to tackle antibiotic resistance and their possible influence on antimicrobial usage

Bode C¹, Köper LM¹, Wallmann J¹, Heberer T¹

¹Federal Office of Consumer Protection and Food Safety, Germany

The increasing burden of antimicrobial resistance has caused the ‘German Federal Veterinary Surgeons Association’ to launch the first edition of the ‘Guidelines for the prudent use of veterinary antimicrobial drugs’ in 2000 (last update: 2015). The determination of antimicrobial treatment frequencies was implemented on a legal base in the second half of 2014. Since then, fattening farms of certain categories and sizes have to report different parameters on every antimicrobial treatment bi-annually to the competent authority (CA). The CA calculates individual antimicrobial treatment frequencies (iATF) for each farm and forwards them to the Federal Office of Consumer Protection and Food Safety (BVL). The BVL calculates medians and third quartiles for each farm category. They serve as thresholds for a benchmarking system resulting in interventions at farm level. Farms with an iATF exceeding the third quartile, for example, have to provide written action plans on the reduction of antimicrobial usage for assessment by the CA.

The collection of sales volumes of antimicrobial medicinal products (SVs) delivered to veterinarian practitioners in Germany are annually reported since 2011 by pharmaceutical companies and wholesalers in accordance with national legislation. From 2011 (1,706 t) to 2017 (733 t), a reduction by 972 t was obtained. Noteworthy, the greatest reduction of SVs by more than 433 t was documented from 2014 (1,238 t) to 2015 (805 t). Contrary to the reduction of total sales volumes, amounts of fluoroquinolones and 3rd generation cephalosporins increased throughout the investigated time frame by 20.1% and 13.6%, respectively. Both substance classes are classified as critically important antimicrobials for human medicine of highest priority by the WHO. To promote the prudent use of antimicrobial drugs in Germany, susceptibility testing became obligatory for the use of 3rd and 4th generation cephalosporins as well as fluoroquinolones in cattle, swine, turkey, chicken, cats, dogs and horses in 2018.

Conclusion

The establishment of a benchmarking system in 2014 lead to a reduction of total sales volumes in Germany. However, it should be beared in mind that the main goal of a reduction of antimicrobial consumption is the containment of the spread of antimicrobial resistance. For a profound evaluation of measures, the linkage between antimicrobial consumption and antimicrobial resistance has to be investigated. Detailed data on antimicrobial consumption would be required for this purpose, but a corresponding surveillance program has not been established in Germany so far. Therefore, the evaluation of the taken actions has some limitations.

Antimicrobial use indicators and their effect on relative ranking of grower-finisher herds

Angelina L. Bosman^{1,2}; Carolee A. Carson²; Anne Deckert^{1,2}; Richard J. Reid-Smith^{1,2}; Zvonimir Poljak¹; Sheryl Gow; David F. Léger; Scott A. McEwen¹.

¹Department of Population Medicine, University of Guelph, Guelph, Ontario; ²Centre for Food-borne, Environmental Zoonotic Infectious Diseases, Public Health Agency of Canada, Guelph, Ontario.

Antimicrobial use (AMU) information can be analyzed using various indicators. Indicators are units of measurement adjusted by a denominator that represents the population at risk. We analysed AMU surveillance data collected between May 2017 and April 2018 from 23 grower-finisher sentinel pig herds in the province of Ontario by the Public Health Agency of Canada's Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS).

AMU data were collected by the farm veterinarians using questionnaires. Veterinarians purposively selected herds that proportionally represented the variety of farms in their practice and visited each herd once near the end of a production cycle. Questionnaire data were entered into a PostgreSQL database, and analyzed using R 3.5.2 (packages: dplyr, data.table, lessR, tidyr). If a herd was sampled in 2017 and in 2018, the 2017 sampling was removed.

Denominators used were the population correction unit (PCU) and 1000 pig-days at risk, using an average weight at treatment of 65 kg. Indicators applied included milligrams of active ingredient per PCU (mg/kg pig), Canadian defined daily doses per PCU (DDDvetCA/pig) and Canadian defined daily doses per 1000 pig-days (DDDvetCA/1000 pig-days). Twenty-three farms were sampled, ranging in size from 750 to 2400 pigs. Twenty-two (96%) of the herds were conventional; one herd was part of a raised without antibiotics program (RWA).

Eight herds (35%) did not use antimicrobials during the grower-finisher period. One herd was consistently ranked the highest user and another herd the lowest as measured in mg/kg pig, DDDvetCA/pig and DDDvetCA/1000 animal-days. However, the relative ranking of other herds changed according to the indicator used; therefore, the indicator used must be borne in mind when interpreting AMU data. In addition, if there is a specific AMU target, the choice of indicator used may influence whether the herd's AMU falls above or below the target value. Future work in this study includes examining AMU data collected from farrowing and nursery herds during the same time frame, and assessing producer and veterinarian understanding and preferences for different AMU measures and indicators.

Conclusion

We observed that quantitative comparisons of AMU among study herds could be affected by the choice of AMU indicator, which is an important consideration when interpreting comparative AMU data. While herds with potentially outlying AMU may not be affected by the choice of indicator, other herds may fall above or below a particular level or change in relative AMU depending on the indicator used.

Two efficient European on-farm intervention studies

Claire Chauvin¹, Julie David¹, Manon Houben², Angelique van den Hoogen², Nikolai Ongena³, Hilde van Meirhaeghe³, Pascal Sanders⁴

¹Anses Laboratoire de Ploufragan-Plouzané-Niort, France; ²PorQ, Netherlands; ³Vetworks, Belgium;

⁴Anses, Laboratoire de Fougères, France

In the framework of the EFFORT European project, two interventions studies were implemented and evaluated through *ad hoc* epidemiological designs in European pig and broiler farms respectively.

The intervention consisted in implementing an action plan, specific to the farm, drawn up by its veterinarian, aiming at reducing the usage of antimicrobials.

In Belgium, France and Spain, 109 broiler farms were monitored from 2015 to 2017 according to a before/after study design with control group (MBACI). In France and the Netherlands, 59 farrow-to-finish pig farms were monitored between 2014 and 2017 according to a stepped wedge study design. Throughout the study, at the flock (chicken) or quarter (pig) level, action plans were described and the situation of each farm regarding antimicrobial usage and technical performances was documented. The longitudinal data thus collected were analyzed using two generalized mixed linear models.

A wide variety of actions were proposed by veterinarians and implemented on-farm. Often multiple within the same farm, these actions could have specific (predominant pathogen or specific physiological stage) or general targets (e.g. biosecurity), and relate to the structure of the farm, as well as to health, therapeutic, hygiene or animal monitoring and management practices.

The analysis of antimicrobial usage data showed a significant general trend towards reduction during the study period in both species and all countries. In addition, the implementation of a tailor made set of actions significantly increased this reduction (i.e. a statistically significant effect of the intervention was found in both species). Conversely, the performance data did not show any significant impact of the intervention neither on mortality nor on growth or reproduction indicators collected.

Conclusion

Intervention studies implementation required consideration to practical or contextual constraints, such as the difficulty of setting up control groups, the concomitant generalisation of national policies to reduce antimicrobial use and the potentially delayed and long-term impact of the actions implemented. The results here showed that there was room for improvement within the included farms on top of national policies positive effect. Additional antimicrobial usage reduction could be achieved without any deterioration of technical performance. Practitioners identified multiple ways of improvement, underlining the importance of the farmer-veterinary partnership.

An efficient cephalosporin antimicrobial stewardship program in swine production in France

Claire Chauvin¹, Fabien Verliat², Anne Hemonic³, Sylvie Chouet⁴, Philippe Le Coz⁵, Mélanie Liber⁶, Eric Jouy¹, Agnès Perrin-Guyomard¹, Anne Chevance⁷, Didier Delzescaux²

¹Anses; ²INAPORC; ³IFIP; ⁴AFMVP; ⁵SNGTV; ⁶AVPO; ⁷ANMV-Anses - France

Background: By the end of the first decade of 2000, monitoring systems in place to follow antimicrobial resistance of pathogenic bacteria and antimicrobial usages both raised concerns regarding third- and fourth-generation cephalosporins resistance trends in pig production in France. The French swine production sector mobilized and collectively committed reflection in the following months, which led to a multi-professional voluntary stewardship program enforced in 2011.

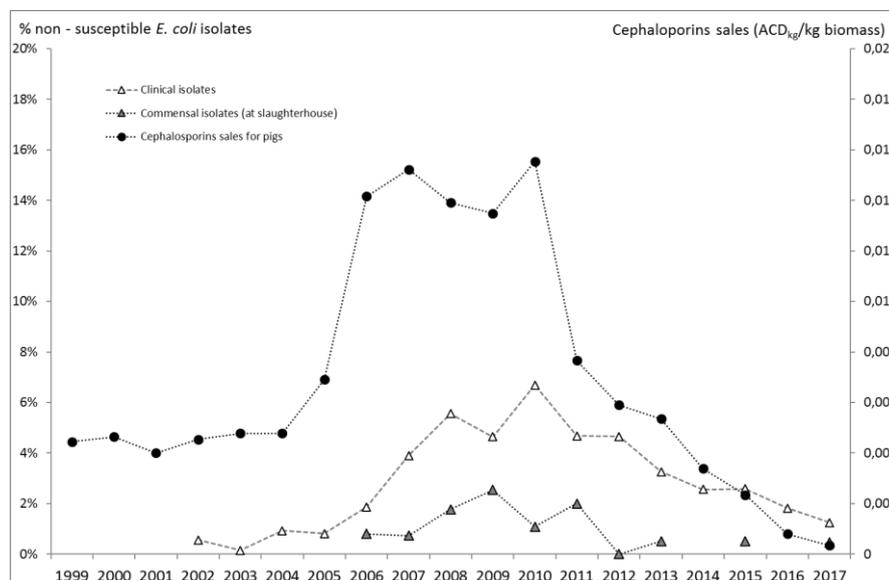
Methods: The stewardship program targeted 3rd and 4th generation cephalosporins. A veterinarian consensus process defined restrictive rules for their prescription. All pig sector professionals including veterinarians, technicians and farmers were informed e.g. through personal letters and press articles. Existing national monitoring systems regarding usage (i.e. national sales annual surveillance) and resistance (i.e. the European regulation application for surveillance of commensal and zoonotic bacteria resistance and the RESAPATH network for pathogens) were completed by an *ad hoc* veterinarians' cephalosporins deliveries collection and an on-farm survey on antimicrobial usage in a representative sample of pig farms. In a second step from 2014, regulatory measures (ecoAntibio National Plan) reinforced the program fixing quantitative reduction objectives and specifying terms and conditions for prescribing and dispensing a list of concerned critical molecules including cephalosporins.

Results: All data sources confirmed an abrupt and significant decrease of cephalosporins usage in pig production by more than 90% between 2010 and 2016. Monitoring systems of resistance of commensal and pathogenic *Escherichia coli* isolates also displayed a concomitant and consistent decreasing trend (cf. Figure). No adverse effect could be detected on piglet's mortality series during the same period.

Conclusion

French pig professionals voluntarily defined and launched a stewardship program later reinforced by regulation, which proved to have been highly efficient on both usage reduction and resistance containment. This success has to be analysed in light of the large adhesion obtained to a well-defined multi-professional strategy, which covered both restrictive use of cephalosporins definition and follow-up tools implementation.

Figure: Evolution of cephalosporins national sales in pig and percentages of non-susceptible clinical and commensal pig *Escherichia coli* isolates (France, 1999-2017).



Development of integrated beef cattle and meat sheep antibiotic usage metrics as part of a sustainable antibiotic reduction tool for lamb and beef producers in the UK

Davies PL^{1*}, Corbishley A^{2,3}

¹ Department of Epidemiology and Population Health, Institute of Infection and Global Health, University of Liverpool, Leahurst Campus Neston, Cheshire. CH64 7TE, UK

²Dairy Herd Health and Productivity Service, Royal (Dick) School of Veterinary Studies, The University of Edinburgh, Easter Bush, Midlothian, EH25 9RG, UK.,

³ Division of Immunity and Infection, The Roslin Institute, The University of Edinburgh, Easter Bush, Midlothian, EH25 9RG, UK.

This study represents the first robust, quantitative estimate of the quantity and diversity of antimicrobial active ingredients used in combined commercial beef and lamb production in the UK. Hitherto there was no published evidence on this subject pertaining to this dominant farm type as previous studies have focused upon species specific and production system specific AMU metrics. These established methodologies do not reflect the reality of farm business management in the UK, Ireland and many other countries where co-production of ovine and bovine meat is the norm. Furthermore the recording of antibiotic sales, by species, to these mixed species farms is unreliable and inconsistent if any attempt is made to do this at all by the prescribing veterinary practice. There is therefore no reliable basis on which statutory regulators or industry stakeholders could make decisions upon antibiotic reduction or refinement.

Only one estimate of antibiotic usage in the beef sector (all farm system types) has been published at 19 mg/kg (VARSS, 2018), however there is no publicly available data on the variability of usage between farms and farming systems. We have previously reported significant variation in the sheep sector, both between prescribing veterinary practices and individual farms. Furthermore, our previous work has shown that a small proportion of farms represent a significant proportion of antibiotic usage in the sheep sector. The beef sector is complex, with calves reared from the dairy herd, suckler herds, growing units and finishing units. Farms may participate in any one or all of these different activities. In addition many beef herds are co-managed with sheep flocks producing lamb meat. This paper therefore aims to complement existing livestock sector averages in antibiotic usage, by providing granular information as to AMU at the farm level and how AMU varies between farms and veterinary practices. We also explore different methodologies for calculating AMU and discuss the implications for this on the interpretation and benchmarking of AMU within the beef sector and mixed beef & sheep farms.

323 herds from 12 veterinary practices in total contributed to the study from England, Wales and Scotland. Of these farms; 141 had sheep. 258 had suckler cows. 45 reared calves. 80 had grower/finisher operations. Beef biomass on each farm ranged from 1475-2,187,500 kg. Beef PCU on each farm ranged from 625-2,187,500 kg. Sheep PCU on each farm ranged from 0-259,250 kg. Three herds did not purchase any antibiotics during the study period. Analysis of usage by PCU, DDD and the innovative multispecies combined farm antibiotic livestock units (ABLU) metric is due for completion in May.

The results of this study will inform a second project being conducted by the authors, developing a dynamic benchmarking tool *Sustainable Antibiotic Plan (SAP)*, funded by the UK livestock industry levy boards (AHDB, HCC & QMS). The SAP will be designed to sustainably reduce antibiotic usage whilst maintaining high standards of animal welfare and productivity. SAP will integrate farm management variables and disease burdens into a streamlined herd & flock health planning tool for veterinarians to use with their clients.

Evaluating antimicrobial usage in German broiler farms from 2014 to 2017

Matthias Flor¹, Bernd-Alois Tenhagen¹, Annemarie Käsbohrer¹

¹German Federal Institute for Risk Assessment

Introduction

Since 1st July 2014, due to an amendment of the German Medicinal Products Act (AMG) keepers of meat production animals have to report all veterinary treatments with antibacterial substances to the competent authority. This addresses calves for meat production from weaning up to 8 months, beef cattle above 8 months, piglets after weaning up to 30 kg body weight, pigs above 30 kg, broilers and turkeys. The law also specifies that separately for each production type the competent authority calculates farm-level treatment frequencies twice a year and publishes two national indicators: the median (K1) and the 3rd quartile (K2) of the treatment frequency. Animal keepers above K2 are considered high-users and are required to draw up a written plan in order to reduce their usage of antimicrobials.

Here, we present results from the evaluation of the antimicrobial use data with regard to broiler farms.

Materials and methods

Data collected by the competent authority within the framework of the AMG comprises data on antimicrobial usage as well as notifications about animal keeping. We were granted access to these data in anonymized form, covering the seven half-years from 1st July 2014 to 31st December 2017 (i.e., half-years 14/2 to 17/2). We determined total as well as antimicrobial class-specific treatment frequencies and consumption volumes for all German broiler farms holding at least 10,000 birds and analysed the trends of these two AMU measures in comparison with each other and with regard to the published parameters K1 and K2.

Results

For broilers, K1 and K2 decreased from 14/2 to 15/2 but then increased again until a level similar to 15/1 in 17/2.

Treatment frequency in broiler farms was highest for aminoglycosides, lincosamides, penicillins, and polymyxins. The trends described above for K1 and K2 were best reflected in the frequencies of treatments with aminoglycosides and lincosamides both of which showed statistically significant increases when comparing the first vs the last year of the period under consideration. Conversely, treatment frequencies of fluoroquinolones did not change, and all other substance classes exhibited statistically significant reductions in treatment frequencies.

In contrast to treatment frequency trends as depicted by K1 and K2, total consumption volume per half-year did not show a clear picture. Volume-wise, AMU was dominated by polymyxins, penicillins, macrolides, and aminoglycosides. Aminoglycoside and lincosamide volumes indeed mirrored to some extent the trends of K1 and K2, but showed overall increases from 14/2 to 17/2. These raised consumption volumes of aminoglycosides and lincosamides can be attributed to an increased use of medicinal products combining both substance groups.

Conclusion

In German broiler farms, treatment frequencies and consumption volumes show some specific differences in trends between 2014 and 2017. The detailed analysis of these patterns will support scientific discussion on the pros and cons of different procedures for calculating indicators and to frame the benchmarking system.

Typology of interventions aiming to reduce antimicrobial use in aquaculture systems in low and middle-income countries

M. Garza¹, L.A. Brunton¹, B. Häsler¹, C.V. Mohan², B. Wieland³

¹Royal Veterinary College, University of London, London, United Kingdom,² WorldFish, Jalan Batu Maung, Penang, Malaysia, ³ International Livestock Research Institute, Addis Ababa, Ethiopia

Aquaculture is the fastest growing food sector in Low and Middle Income Countries (LMICs). Increased production has been achieved through intensification of aquaculture systems while neglecting aquatic health management. As a consequence, indiscriminate antimicrobial use (AMU) to treat or prevent disease and increase productivity is common, and often compensates for management and husbandry deficiencies. Regulation and enforcement for the responsible use of antimicrobials is often inefficient or absent. Further, there is a lack of a comprehensive framework to understand existing interventions to reduce AMU in the sector. The objectives of this study were to provide an overview of the policy landscape in regards to AMU, with focus on aquaculture systems in LMICs, and to conduct a typology analysis of past, current, and planned strategies and interventions to reduce AMU in selected study countries. Initially, scoping discussions with stakeholders informed the selection of countries based on the aquaculture development stage, role of the sector, perceived AMU, initiatives against AMR and access of information, to obtain a good spectrum of representation and variability of aquaculture systems. Individuals with knowledge and/or experience in the design and implementation of interventions in Vietnam, Bangladesh, Egypt and the African Great Lakes region, were interviewed to (a) gather documentation on the policy and strategy landscape, (b) identify suitable elements that inform grouping and categories for the typology analysis, and (c) obtain specific data on strategies to inform the analysis. Elements to conduct the typology analysis included nature of the intervention (policy, capacity development, behaviour change, market incentives, etc.), key implementers, time frame, geographic and production system scope and scale. Analysis of the policy landscape revealed differences in policies across the different countries while poor enforcement seems to be common to the selected countries, restricted to market oriented commodities.

Through this study, we provide preliminary evidence on the effectiveness of strategies and interventions applied in aquaculture, and propose an assessment framework to inform the design and implementation of future interventions, including definition of indicators to monitor impact of interventions.

Monitoring Antimicrobial Usage in Cattle: One Species - different Requirements

Hommerich, K.¹; Ruddat, I.¹; Hartmann, M.¹; Werner, N.¹; Käsbohrer, A.²; Kreienbrock, L.¹

¹ University for Veterinary Medicine Hannover, Hannover, Germany

² Federal Institute for Risk Assessment, Berlin

For regular evaluation of antimicrobial resistance patterns and trends, detailed information about antibiotic consumption is needed. Since 2010, the amount of veterinary medicinal products containing antimicrobials delivered to veterinarians is documented and evaluated annually (ESVAC). Due to a cross-species documentation of the quantities sold, it is not possible to allocate the amounts of sold quantities to individual animal species, animal age categories or production types.

Antimicrobial use data at farm or prescriber level provides the basis for detailed evaluations and the opportunity to guide individual management actions. Within the project VetCAB (Veterinary Consumption of Antibiotics), antibiotic usage data in German livestock is collected and evaluated. Based on a cross-sectional study in 2011, the project is continued as a longitudinal study VetCAB-Sentinel with ongoing participant recruitment and data collection since 2013. The data collection is based on official German application and delivery forms, voluntarily provided by veterinarians and farmers. In this study the results of antibiotic consumption data of dairy cows, dairy calves and beef cattle from 2011 to 2015 are shown.

Compared to other livestock populations in Germany, the use of antimicrobials in dairy cows, dairy calves and beef cattle appears to be low, but varies across several associated factors. Temporal changes and the effect of the factors "farm size" and "region" on the treatment frequency were investigated, using multiple linear mixed and logistic regression models. In dairy calves and beef cattle the factor "farm size" has a statistically significant impact. In addition a temporal trend test over the first six half-years shows that an increasing linear trend can be stated in dairy cows and dairy calves ($p=0.017$; $p=0.004$ respectively). If the time-period is extended to all eight half-years under study, this turns into a quadratic effect (dairy cows: $p=0.006$; dairy calves: $p < 0.001$).

Conclusion:

Especially in calf production different requirements due to specific peculiarities lead to inconsistent definitions of the production types. To enable comparisons of the magnitude of antibiotic consumption across regions or countries, a clear definition of the production groups in livestock is fundamentally needed. Furthermore, as "farm size" has a statistically significant impact on the magnitude of consumption of antibiotics, this should be regularly considered over time.

Difficulties in estimating usage of antimicrobials based on sales to beef and dairy farms and associated denominator data from a UK veterinary practice.

R. W. Humphry¹, M.K. Henry¹, A. Reeves¹, C. Correia-Gomes¹, R. Smith², G. J. Gunn¹, S. C. Tongue¹

1. Epidemiology Research Unit, (Inverness campus), Scotland's Rural College (SRUC), Kings Buildings, West Mains Road, Edinburgh, EH9 3JG, U.K.

2. c/o R. W. Humphry, Epidemiology Research Unit, (Inverness campus), Scotland's Rural College (SRUC), Kings Buildings, West Mains Road, Edinburgh, EH9 3JG, U.K.

399 words (<=400)

Plans for reducing usage of antimicrobial agents at the national level are typically based on target setting: that is, identifying current levels of usage, and specifying a target for reduction. Target setting requires appropriate measures of usage which are perceived as being representative of amounts of these agents that are actually used, and perceived to be fair in the sense that they do not unduly bias the overall summary measure in favour of some types of usage or some types of herd demographics. In this study, we identified the antimicrobial agents used in some UK cattle herds, compared different measures to determine how they relate to one another, and evaluated the application of the Population Corrected Unit as a summary of herd-size.

We extracted data on pharmaceutical sales for 75 cattle herds over the period 2011-2015 in a UK veterinary practice and linked these to farm demographic data pertaining to the herd-sizes from the Government's agricultural census. The data were screened for products that contained antimicrobials. The results were aggregated at the herd-year level. We then compared three measures of usage: total mg active ingredient, DDDVet & DCDVet.

Results demonstrate that there was a very strong linear relationship between these three measures of usage. The mean weight of active ingredient sold per kg of all bovine livestock was 12.8 mg/kg per herd p.a. for beef herds and 16.3 mg/kg per herd p.a. for dairy herds. We estimate that, by weight, only 1.88% of the antimicrobials sold was classified as "Highest Priority Critically Important" (World Health Organization 2017).

The use of the Population Correction Unit (PCU) is a method of arriving at a single aggregate measure of herd size that is considered relevant to antimicrobial use. The calculation of PCU is based on the number of animals considered to be relevant, multiplied by a standardised weight for those types of animals. In this study, estimates of usage divided by PCU were highly sensitive to unusually low values for PCU for specific herd-years as a result of the demographic composition in those herd-years. Therefore we propose that estimating usage per PCU is not very appropriate when comparing groups of cattle with very different demographic composition.

Conclusion

We describe our concerns regarding any comparison of antimicrobial usage between groups of cattle where the demographic composition of the groups are very different because of the sensitivity of such measures to the differences in demographics.

Antibiotic usage pattern and average weight at treatment in broiler chicken flocks in Germany, 2013-2018

Svetlana Kasabova¹, Maria Hartmann¹, Hatice Ertugrul¹, Katharina Köllmann¹, Annemarie Käsbohrer^{2,3}, Lothar Kreienbrock¹

¹ Department of Biometry, Epidemiology and Information Processing, WHO Collaborating Centre for Research and Training for Health in the Human-Animal-Environment Interface, University for Veterinary Medicine, Hannover, Germany

² Institute of Veterinary Public Health, Department for Farm Animals and Veterinary Public Health, Vienna, Austria

³ Federal Institute for Risk Assessment, Berlin, Germany

Tackling the problem of rising antibiotic resistance requires valid and comparable data on the use of antimicrobial drugs in livestock. Within the longitudinal VetCAB-Sentinel project (Veterinary Consumption of Antibiotics), antimicrobial usage (AMU) data at farm level are collected and evaluated continuously since 2013. In this current evaluation, antimicrobial usage data of the years 2013 to 2018 were obtained from 2436 broiler chicken flocks and analyzed. Data on AMU encompass all antimicrobial treatments during the complete fattening period of each flock, starting with the placing of the day-old-chicks at the barn. The aim of this analysis was to investigate the real weight of the broiler chickens at the time point of treatment during the fattening period, as well as the proportion of the different antibiotic compound classes as a percentage of the overall treatment frequency (TF). The weight of the broiler chickens at the time of treatment was 60g in median with significant differences between the various antimicrobial classes. The median weight of the treated animals differs in the different antimicrobial classes as follows: aminoglycosides and lincosamides – 40g, fluoroquinolones - 70g, sulfonamides and trimethoprim – 90g, tetracyclines – 110g, polypeptides - 840g, beta-lactams and macrolides – 910g.

Overall, veterinary medicinal products belonging to nine different antimicrobial classes were used. Over the last six years, a significant increase in the usage of lincosamides and aminoglycosides and a moderate increase in the usage of sulfonamides/trimethoprim could be observed. During the same period, the percentage of the TF for fluoroquinolones, macrolides and polypeptides was on the decrease. The share of the beta-lactam class remained almost stable over the last six years.

Conclusion

Within this current analysis of the broiler chicken farm collective we could show that the median weight of the broiler chickens at the time of treatment is up to 940g lower than the standard weight for broilers proposed by ESVAC (European Surveillance of Veterinary Antimicrobial Consumption). It may vary considerably, depending on the antimicrobial classes used due to the fact, that different antimicrobial classes, used to combat age-specific diseases, are applied at different stages of the fattening period. Additionally, decreasing usage of critically important antimicrobials, such as fluorquinolones, macrolides and polypeptides in broiler chicken flocks could be shown. This might be the consequence of an increasing awareness of the global antibiotic resistance situation as well as antibiotic monitoring and benchmarking systems in Germany and related measures for disease prevention.

Impact of the calculation method used on the observed trend in the treatment frequency in Germany

Annemarie Käsböhrer¹, Bernd-Alois Tenhagen¹, Matthias Flor¹

¹German Federal Institute for Risk Assessment

Background

Antimicrobial resistance (AMR) is considered currently one of the major public health threats. It is generally recognised that antimicrobial usage (AMU) is a major driver for the spread of AMR. In various action plans, the need to lower AMU is addressed as an important step to tackle this issue, but efficiency of approaches taken to achieve this needs still to be assessed.

In Germany, since the year 2011 data on sales of antimicrobials are collected on a legal basis. While these data, after standardization by PCU, are used for comparisons of countries, more detailed data are needed to support policy-making and strengthening AMU reduction strategies on the level of individual livestock holding.

Approach taken

To strengthen efforts in Germany, since July 2014, farmers are required to record all antimicrobials used in fattening production groups, e.g. in fattening pigs. Usage data and data about the animal population at risk of being treated are collected on farm level. For each application of an antimicrobial, both the amount of a specific drug as well as the number of animals treated and the duration of that treatment are recorded. Every 6 months, an evaluation is run, and a farm-specific treatment frequency is calculated for each animal production group. Both benchmarking values, the median and the third quartile, showed a decreasing trend over time for weaned and fattening pigs.

The objective of this study was to assess the impact of the calculation method used on the overall trend of the treatment frequency as regularly published. For this purpose, the usage patterns were analysed in more detail taking into account the antimicrobial classes applied and the duration of the treatments, the amount of the drug used for the individual treatments as well as the impact of changes in the selection of drugs. The latter also takes into account that in the national system, each substance class in a combination product is considered separately when calculating the treatment frequency.

Results and discussion

Among fattening pigs, two production groups were considered separately, weaned pigs up to 30 kg live weight, reflecting the first phase of the fattening period and fatteners with more than 30 kg. For both groups a significant reduction in the average treatment frequency was published.

In our additional analysis, we assessed whether a switch to more efficacious substance classes in terms of duration of treatment has occurred, whether usage of fixed combinations was avoided, or whether long acting antimicrobials were used more frequently. Also, of interest was whether changes in the usage pattern of colistin, as recommended by European Medicines Agency could be observed. All these changes in treatment behaviour would have direct impact on the calculated treatment frequency and the amount of antimicrobials used.

Conclusion

The outcome of this analysis will be used to give scientific input into the political discussion on how to develop the approach further, as up to now, one of the criticisms raised by stakeholders is directed towards the calculation method itself as well as the handling of fixed combinations therein. The legal framework allowed conducting this more detailed analysis based on all data collected for the purpose of evaluation of the current legislation. Thus, after the outcome has been presented to the government, a scientific discussion on the pros and cons of the different calculation methods is supported by these outcomes. This will be very important for our understanding of the current AMU practice and for strengthening the efforts taken to lower antimicrobial use and antimicrobial resistance rates in livestock production.

Reduced usage of High Priority Critically Important Antimicrobials in pigs as a result of legal regulations and private initiatives in Switzerland

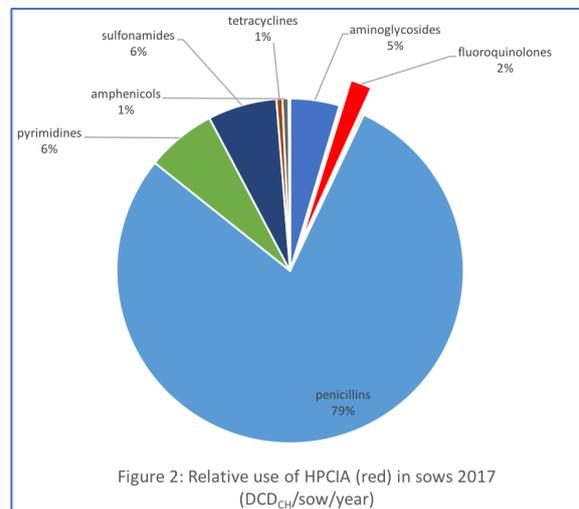
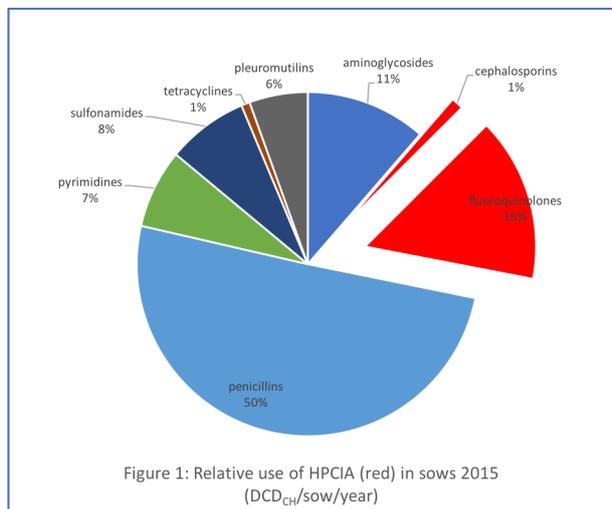
Dolf Kümmerlen¹, Thomas Echtermann¹, Felipa von Gerlach¹, Cedric Müntener², Xaver Sidler¹

¹Division of Swine Medicine, Department for Farm Animals, Vetsuisse Faculty, University of Zurich, Zurich, Switzerland

²Institute of Veterinary Pharmacology and Toxicology, Vetsuisse Faculty, University of Zurich, Zurich, Switzerland

In order to improve transparency and to monitor antimicrobial usage in pig production in Switzerland, the SuisSano programme was started in 2015. Participating farms had to report antimicrobial usage on their farms by veterinary prescriptions. All prescriptions had to be assigned to four age groups: suckling piglets, weaned piglets, fattening pigs and sows. When reporting antimicrobial usage to the farmers within the SuisSano programme, treatments with High Priority Critically Important Antimicrobials (HPCIA) were multiplied with factor four, in order to encourage farmers to use these products less frequently. Since April 2016, in Switzerland the use of HPCIA has also been restricted by legal regulations. For the presented work, antibiotic usage in the study farms was calculated based on Defined Course Doses per animal per year (DCD_{CH}) and analysed by antibiotic classes for the years 2015, 2016 and 2017. The number of participating farms providing complete datasets was 312 in 2015, 483 in 2016 and 598 in 2017. In 2017 24696 sows, 690817 piglets, 599313 weaners and 347618 finishing pigs were included in the study, representing approximately 20% of the total pig production in Switzerland. While the total usage was constant in piglets and finishing pigs, it decreased in weaners and increased in sows. The relative usage of HPCIA in all age groups decreased from 25% in 2015 to 10% in 2017. In sows the relative usage decreased from 17% in 2015 to 2% in 2017 (Fig. 1,2), in piglets from 20% to 5%, in weaners from 42% to 26% and in fattening pigs from 8% to 3%.

The reduced usage of HPCIA described in this study was most likely induced by legal regulations and the impact of multiplication of such treatments within the SuisSano programme. The reduction of HPCIA usage within the total pig production in Switzerland may be less pronounced. Some bias cannot be excluded because of the voluntary character of the SuisSano programme and participating farmers may be more motivated than others to reduce antimicrobial use on their farms.



Building and sharing knowledge about resilience factors to tackle antimicrobial resistance in One Health systems

Anais Léger¹, Didier Wernli¹

¹Global Studies Institute, Geneva University, Switzerland; ²Affiliation; ³Affiliation

Resilience is the capacity of a system to cope with and/or adapt or even transform during and after a disturbing event. This approach has been used for many years in environmental studies and more recently in human health. Preliminary studies have been conducted to operationalize the concept of resilience in the fight against AMR. As a global challenge characterized by strong interactions between humans, animals and the environment, our understanding of AMR can benefit from a social ecological approach rooted in systems and complexity science. Therefore, this study aims to identify factors underpinning the resilience of One Health system to AMR. We present here the first part of the study, the aim of which is to build select variables for resilience and success/failure factors of AMR interventions and build a database.

We developed the database based on previous research work in resilience description and assessment. The database is organised in six parts: (i) publication and research design, (ii) social system, (iii) bio-ecological system, (iv) triggers and goals, (v) governance, and (vi) assessment of the intervention. The first part gathers details about the scientific publication(s) associated with the intervention that helped to populate the database. Then the social system describes the actors of the intervention and their social and institutional settings. The bio-ecological system collect the microbiological, clinical and ecological aspect of the intervention. The governance part describes the policy mechanism used to attain the goal of the intervention and assess the involvement of institutions and sectors. The final part gather questions about the assessment of the outcomes of the intervention. It specifically focuses on success and failure factors identified by the authors.

We started to populate the database from published interventions targeting *Escherichia coli*.

Therefore, we conducted a systematic review for AMR interventions at sub-national, national and international level in online databases. We combined the work with other work packages from the project and added non-published interventions reached from an online survey conducted in spring 2019.

Conclusion

This work is part of a research project named [AMResilience](#) that aims to identify the resilience factors for AMR interventions in a One Health approach and also develop implementation science regarding AMR. This work is a preliminary step to identify the success factors of resilience in an AMR context. Our database will be available online and participative. An analysis of success factor is currently being conducted.

Correlation analysis of vaccine usage and disease prevalence with flock level antibiotic usage in UK sheep flocks

Fiona Lovatt^{1,2}, Peers Davies^{3,4}

¹ Flock Health Ltd, Eggesburn Farm, Eggleston, Barnard Castle, Co Durham, DL12 0BD; ² University of Nottingham, Sutton Bonington, Leicestershire, LE12 5RD; ³ University of Liverpool, Leahurst Campus, Neston, Wirral, CH64 7TE; ⁴ Pro-Ovine, Nutwell Estate, Lymington, Exmouth EX8 5AN

In 2016, the UK government identified reducing antibiotic usage as a priority and called for the implementation of sector-specific targets on antibiotic use with progress developed and implemented via the Responsible Use of Medicine in Agriculture (RUMA) Target Task Force (TTF)¹. The TTF sheep group identified that though sheep sector usage was low, there was limited accurate data on actual antibiotic usage on UK sheep farms. Hence they set targets that concentrated on disease 'hotspots' and aimed to improve communication with farmers with respect to preventative measures such as vaccination.

This study aimed to evaluate the magnitude and variation in antibiotic usage on sheep-only farms and to assess key factors that might impact on farm level usage such as disease prevalence and vaccine uptake. Veterinarians supplied antibiotic usage data from sheep-only farms and engaged farmers through a questionnaire which collected vaccine usage data, farm level disease and management information.

Data was collated from 152 flocks via 12 veterinary practices across Britain, contributing a total of 526 'flock years'. The antibiotic usage on these flocks in the three years from 2015 to 2017 were a mean of 15.2-16.9 mg/kg and median of 9.1-10.9 mg/kg. The method of administration was dominated by parenteral antibiotics which made up 86% of the total usage with oxytetracycline at 49% of the total usage, penicillins at 28%, aminoglycosides at 10% and macrolides at 8%. Fluoroquinolone prescriptions made up 0.31% of the total which was the total proportion of high-priority critically important antibiotics, as defined by the European Medicine Agency. Total usage in these flocks was fairly consistent from 2015 to 2017, with little variation in the quantities of oxytetracycline administered. From 2015 to 2017 the quantity of penicillin-type antibiotics increased while all other classes decreased.

Over half the sheep flocks in this study had entrenched usage patterns with 27% defined as 'low users' with a usage that was below the median for each year and 29% defined as 'high users' with a usage that was above the median each year. However there was no significant difference between low and high users in the proportional usage of antibiotic classes or in the route of administration suggesting that there are not defining practices that are associated with high use.

Overall farm antibiotic usage was weakly associated with the proportion of ewes lambing indoors and also with reported average levels of lameness in ewes and lambs. The power in this study was limited by low vaccine penetration.

Conclusion

This study primarily highlighted the need for the collation of antibiotic usage data from a wider proportion of farms throughout the UK sheep industry. Although appropriate vaccine usage remains of key importance in responsible disease prevention, vaccine sales data and antibiotic usage data are not necessarily correlated variables.

Further work is required on veterinary and farmer attitudes and practices to identify why there are entrenched high antibiotic users and how they might be encouraged to emphasise on preventative flock health and develop more responsible use of medicines across all their management practices.

¹ RUMA Targets Task Force <https://www.ruma.org.uk/targets-task-force/>

A proposed methodology for data collection and measuring medicines use within the UK beef industry to inform target setting and encourage responsible use

Jon G. Massey¹, Judith L. Capper², David C. Barrett¹, Rachel Adams¹, Lisa Morgans¹ and Kristen K. Reyher¹

¹Bristol Veterinary School; ²Livestock Sustainability Consultancy

Responsible on-farm medicines use is a key concern for all food system stakeholders, many of whom are setting targets requiring commercial or regulatory compliance. Producers and veterinarians must therefore demonstrate responsible, evidence-based medicines use to maintain animal health and safe food production.

Various livestock medicines benchmarking metrics are in use (e.g. mg/kg liveweight, average daily dose, etc.), with the relevance, applicability and adoptability of each metric depending on data quality and availability. However, UK beef farms are uniquely heterogenous, spanning a wide range of cattle breeds, herd sizes, production systems and marketing strategies, which poses significant challenges for quantifying antimicrobial usage (AMU). Any targets for responsible medicines use within the UK beef sector must therefore be defined in terms of metrics that take account of the challenges presented by this heterogeneity in both their definition and their data collection requirements.

Interviews, questionnaires, on-farm medicine records and prescribing records were used to investigate the quality and quantity of medicines data available on UK beef farms to develop adoptable, appropriate and effective data collection methodologies. Focus groups involving producers, veterinarians, suitably-qualified persons (SQPs) and beef industry stakeholders were convened, with novel participatory methodology used to gain insight into opportunities for and barriers against data collection. Although keeping detailed medicine records is a legal requirement, no standard approach exists for beef operations, with considerable variation in the quality, accessibility and extent of these data. Records are often confounded by multiple beef operations on a single holding or the co-presence of sheep or dairy operations. Furthermore, many beef producers do not weigh their cattle and growing cattle move between operations without transferral of medicine records. Nevertheless, metrics that allow benchmarking and comparison of medicines use between cattle groups or timepoints (e.g. % of cattle treated) and allow AMU to be quantified and compared (total mg/standard beef cattle unit) are both achievable by and applicable to the current UK beef cattle industry.

Establishing these metrics and applying them to targets and benchmarks will encourage producers to improve animal health and responsible medicines use. In future, greater data linkage between cattle productivity, health, medicines use and movement information combined with adoption of electronic cattle identification may enable benchmarking on an individual animal lifetime basis. This work was partially funded by the Agriculture and Horticulture Development Board. Discussion group participation and expert input from the project's industry stakeholders plus numerous veterinarians, SQPs and producers is gratefully acknowledged.

Surveillance and monitoring systems for antimicrobial usage in livestock animals in six European countries

Octavio Mesa-Varona, Bernd-Alois Tenhagen

German Federal Institute for Risk Assessment, Department Biological Safety, Max-Dohrn-Str. 8-10, 10589 Berlin Germany

Antimicrobial use (AMU) has been shown as the major trigger for the selection and spread of antimicrobial resistance (AMR). Surveillance and monitoring systems for AMU and AMR in animals are essential to control and assess the AMR trends. A consensus has been reached to collect AMU sales data from animals on EU-level using the weight of active ingredient. However, in several countries further data are collected. Those datasets that do not report their data at European level may use other units and data sources making comparisons problematic.

Within the ARDIG-project, relevant data sources such as peer-reviewed articles, databases, national and European grey reports among others were thoroughly reviewed in order to identify public information from six countries about surveillance and monitoring systems and their databases in animals. The searching terms “antimicrobial use”, ”Spain”, ”Germany”, ”UK”, “United Kingdom”, “Netherlands”, “France”, “Norway”, “Europe”, “animal”, “surveillance”, “system” and “monitoring” were used to identify all data sources.

A lack of standardization on surveillance and monitoring systems for AMU across countries has been encountered with regard to the data source (prescription/sales) and the units (Weight of active ingredient, mg/PCU, therapy frequency, and DDD/animal/year among others).

Conclusions: Surveillance and monitoring systems for AMU in animals, as a part of the One Health approach, need to be harmonized among the countries. There is a wealth of information available, but lack of harmonization limits substantially the usability of available data. AMU data analyses among countries should be done with caution and efforts should be undertaken to improve standardization.

Antibiotic and zinc oxide usage in Danish organic and non-organic free-range pig herds with reference to in-door conventional herds

C. L. Nielsen¹, H. Kongsted¹, M. A. Krogh¹, J. T. Sørensen¹

¹Dept. Animal Science, Aarhus University, Denmark

Antibiotic usage is associated with the development of antimicrobial resistance. Additionally, usage of zinc oxide, which is widely used, causes environmental pollution and may coselect for antimicrobial resistance as well. In Denmark, the majority of antibiotics used for animals is used for pigs.

Especially, a large amount is used for treatment of gastrointestinal infections in weaners. Previous studies have shown that organic pig herds use significantly less antibiotics compared to conventional herds. No overview of the usage of zinc oxide in different production systems exists and the variance in antibiotic usages between herds within systems is not known.

Hence, it is of interest to compare the usage of antibiotics and zinc oxide between and within different production systems to find and quantify possibilities for production with less antibiotics. The objective of this study was to compare the usage of antibiotics and zinc oxide in three different production systems in Denmark: 1) free-range organic, 2) free-range conventional and 3) indoor conventional pig herds from 2016-2018. In Denmark, all antibiotics and zinc oxide prescriptions are registered in a national database specified on three age groups and six indications. Likewise, the number of pigs in each herd is registered centrally specified on age groups. Extracted data from those registers were used for the study. All organic and free-range herds with minimum 50 sows or 150 finishers were included. For conventional herds a random subsample fulfilling the same inclusion criteria were included. The treatment incidence of antibiotic and zinc oxide usage was calculated as the mean number of the animal daily doses per 100 animals per day on herd level, specified on age groups, indications and antimicrobial classes for each of the three production systems.

In table 1 number of herds fulfilling the inclusion criteria for the study is shown. Of these all organic and conventional free-range herds and 200 indoor conventional herds per year were included. Results on the treatment incidences for antibiotics and zinc oxide will be presented at the conference. Detected differences will be discussed in relation to different management strategies and legalisation in the different production systems and implemented intervention schemes to reduce the antibiotic usage.

Table 1: Number of herds fulfilling inclusion criteria stratified on year and production type

	2016	2017	2018
Free-range organic	58	80	102
Free-range conventional	18	25	29
Indoor conventional	4775	4343	4217

Reducing antibiotic use in weaned pigs by change of management during suckling

C. L. Nielsen¹, H. Kongsted¹, M. A. Krogh¹, J. T. Sørensen¹

¹Dept. Animal Science, Aarhus University, Denmark

Weaned pigs consume the majority of antibiotics used for animals in Denmark. Therefore, strategies to prevent the need for antibiotics in this age group are pivotal. The objective of the study is to investigate management strategies to reduce the occurrence of diarrhoea and infections in weaned pigs. Two management strategies will be investigated: Higher weaning age and fostering with own mother. We hypothesize those strategies cause less illness, reduced antibiotic usage and increased weight gain in pigs after weaning. The study includes 6000 pigs from 432 litters in four Danish conventional sow herds. Herds with at least 500 sows are recruited by convenience and voluntariness from the farmers to participate. The study has a 2X2 factorial design. Within each batch, litters are randomly included and assigned to one level of four management strategies: weaning age of four weeks vs. five weeks and fostering in mixed litters (cross-fostering allowed) vs. fostering with mother. Only litters born of healthy, non-first parity sows are included. Each sow lays with the number of piglets equal to her number of active teats and the most uniform piglets in the litters are included. In mixed litters, the herds usual cross-fostering-strategy is applied. No routine use of antibiotics is allowed. In each batch, all four experimental groups are weaned in the same stable to ensure exposure to the same environment and other management factors. Treatment with antibiotics is only allowed if clinical signs of disease is present. Zinc oxide to prevent weaning diarrhoea is not allowed. To assess the effect of different strategies we measure the following outcomes: Antibiotic usage (farmers decision to treat), weight gain and mortality. Furthermore, we use quantitative PCR to detect infection with PCV2, E. coli F4 and F18, L. intracellularis and B. pilosicoli. Finally, complete clinical examinations are conducted. It is expected that results from the study can be used as inspiration for alternative management during suckling in Danish pig production as the study is conducted in private herds.

Herd health management in dairy herds in Austria - data integration with emphasis on antimicrobial use

Walter Obritzhauser¹, Clair L. Firth¹, Klemens Fuchs², Martin Mayerhofer³, Annemarie Käsbohrer¹, Christa Egger-Danner³

¹Unit of Veterinary Public Health and Epidemiology, University of Veterinary Medicine, Vienna, Austria;

²Data, Statistics and Risk Assessment, Austrian Agency for Health and Food Safety (AGES), Graz, Austria; ³ZuchtData EDV-Dienstleistungen GmbH, Vienna, Austria

In order to enable efficient management and provide effective advice to dairy herd managers, a variety of different data sources often have to be combined to provide herd health-relevant information. In the electronic herd book of the Austrian Cattle Data Network (*Rinderdatenverbund*, RDV), herd data, milk performance records, breeding records, as well as veterinary diagnoses, results of bacteriological milk cultures, and data on the administration and dispensing of veterinary drugs are recorded and can be accessed by the farmer and treating veterinarian online via computer or mobile phone.

The electronic medicines book is part of the electronic herd book app and provides a modern tool to document the use veterinary medicinal products and enables efficient auditing of such medications. Both the farmer and the herd veterinarian are able to fulfil their legal obligations via the online data transfer of information on the dispensing of veterinary medicinal products and the use of such medication to the central Cattle Data Network. The farmer is kept constantly updated of drug withdrawal periods. This electronic documentation allows for the calculation of metrics with respect to antimicrobial use. These metrics provide added value to the milk performance and herd health dataset. Individual herd-specific data can also be compared with metrics from other herds (benchmarking).

Over a trial period of one milk performance recording year (October 2015-September 2016), data on antimicrobial use on 249 dairy farms (convenience sample) were collated as part of the research project, ADDA – Advancement of Dairying in Austria. The number of treatment days over 365 production days per farm (TD365), based on the European Medicines Agency units of Defined Daily Doses (DDDvet) and Defined Course Doses (DCDvet, for dry-off preparations), was used as a metric to calculate antimicrobial use. The population-at-risk was all bovine animals (cows, calves, youngstock, any male animals) on farm during the observation period. Antimicrobial use (excluding dry-cow therapy) in this study population ranged from 0 to 10.7 treatment days per animal and year (365 production days), with a median TD365 of 1.20. While 75% of the farms analysed administered less than 2.3 daily doses per animal and year (75th percentile TD365=2.26), a small number of farms used up to four-times this level (outlying TD365 values). Antibiotics were used most frequently to treat udder disease (median TD365=0.65, 75th percentile TD365=1.46). Dry-off preparations were used in half of the cows in this study population (after adjusting for calving interval and replacement rate per farm, corrected median TD365=0.55; 75th percentile TD365=0.93). Antibiotics from the WHO-defined group of the Highest Priority Critically Important Antimicrobials (HPCIA) were most frequently used for the treatment of foot and limb disorders (87.6% of all doses administered for this indication), followed by udder diseases (48.5%). Over all disease indications, four out of five HPCIA doses administered (81.6%) were 3rd and 4th generation cephalosporins.

Conclusion

Based on the analysis of this study population, the number of antimicrobial doses administered on Austrian dairy farms is low, particularly compared to most other countries. Nevertheless, every second dose used on these dairy farms was a HPCIA, according to the WHO classification. It is, therefore, necessary that the legal framework in Austria should be adapted to take this antimicrobial use into consideration.

More targets to achieve one national goal on antimicrobials in Denmark

Elisabeth Okholm Nielsen¹, Laura Mie Jensen¹ and Pia Jul¹

¹Danish Veterinary and Food Administration, Animal Welfare and Veterinary Medicine Division

Following a rise in total antimicrobial consumption in food-producing animals in Denmark and raised public awareness of the risk of antimicrobial resistance, the Danish Government decided in 2010 on a reduction goal of 10 % in antimicrobial use in food-producing animals, relative to 2009 level. This was achieved by 2013. A new national goal was set in 2015, for a further 15 % reduction in antimicrobial use in pigs by 2019 compared with 2014. The national reduction goals have been set in kilograms active compound.

The Danish authority has mitigated the national reduction goals by primarily addressing the pig and cattle farmers with the highest consumption. The ‘Yellow card’ initiative targeting the antimicrobial consumption was introduced in 2010, with support from the Danish Veterinarian Association.

The targets for age groups on herd level are measured in doses per 100 animal days

The national goal has to be translated into herd level measures in order to benchmark farmers. The Danish authority has defined herd level targets for cattle and pigs in the ‘Yellow card’ initiative. Age-group targets measured in doses per 100 animal days are presented in Table 1. To promote reduction of the national use, the targets in the pig sector have been reduced several times. The targets for the cattle sector have stayed unchanged.

Table 1: ‘Yellow card’ initiative herd level targets April 2019

Age groups	Cattle sector		Pig sector		
	Cows	Calves	Sows	Weaner pigs	Finishers
Standard weight	600 kg	200 kg	200 kg	15 kg	50 kg
Doses per 100 animal days	2.1	1.2	3.2	17.2	4.4

The ‘Yellow card’ initiative have communicated the national reduction goal

The veterinarian and farmers needed a measure that related to the everyday life. This measure should ideally be able to inform the farmer in close to real-time on how much antimicrobial is prescribed. To cover different production types, a target for each age group was defined. The number of animals in the herd is captured by a national database.

Conclusion

The Danish national goal for reduction of antimicrobial consumption in food-producing animals is defined in kilograms active compound of prescribed antimicrobial medicines. To achieve this, herd level targets are defined in the ‘Yellow card’ initiative. The targets are defined as species and age group specific doses per 100 animal days. The ‘Yellow card’ initiative has been an effective way to inform farmers and veterinarians and has enabled them to keep track of the consumption, as well as the development in each age group in the herd. In total, the antimicrobial consumption for the Danish cattle and pig sector has been reduced by 25 % from 2009 to 2018.

Effect of voluntarily and regulatory interventions on antimicrobial consumption in the Danish pig sector 2010-2018

Elisabeth Okholm Nielsen¹ and Pia Jul¹

¹Danish Veterinary and Food Administration

In Denmark, we have monitored all sales of prescription medicine including antimicrobials for production animals since 2000. The data on usage on herd level is available for the herd owner and the herd veterinarian. Large cattle and pig farmers are obliged to have a veterinary advisory service contract with their veterinarian. The Danish veterinarian cannot have income from selling medicines or vaccines, and all antimicrobials are prescription only. The Danish government introduced the first reduction goal in 2010 to be met in 2013; a new goal was set in 2015 to be met in 2019. A political action plan from 2015 was a response to the rise in livestock-associated methicillin-resistant *Staphylococcus aureus* (LA-MRSA) carrier frequency in pigs designated several interventions. Regulatory and voluntarily interventions from 2010-2018 are listed in Table 1, the consumption of antimicrobial is shown in Figure 1.

Table 1: Specific and general interventions aiming at reduced and more prudent use 2010-2018

Year	Pig sector interventions
2010	'Yellow card' initiative. Overall 10% reduction goal to be met in 2013
2010	* <i>Stop 3rd/4th gen.cephalosporins</i>
2014	Regulation on flock therapy
2015	New national reduction goal on 15%
2016	Fluoroquinolones and cephalosporins factor in the 'Yellow card' Initiative
2017	Colistin factor in the 'Yellow card' Initiative
2010-18	Five thresholds changes in Yellow card in this period

* Voluntary initiative by the pig sector

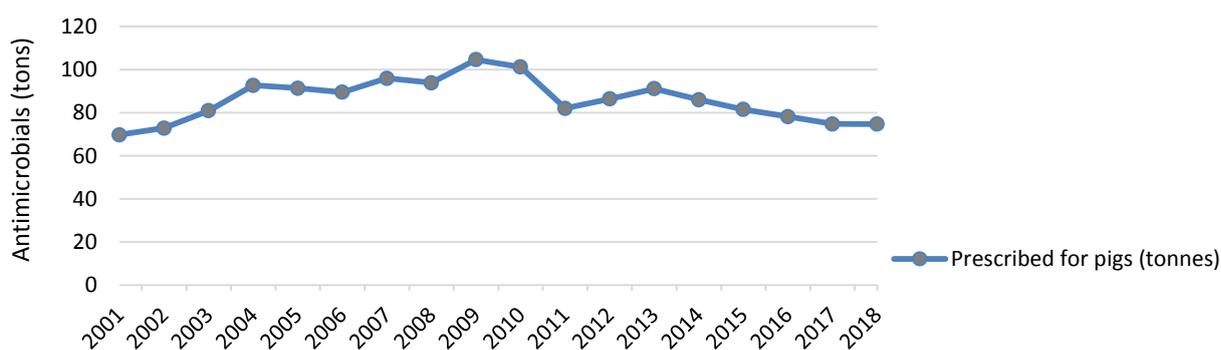


Figure 1: Development in consumption for pigs in Denmark

Conclusion

Regulatory and voluntarily interventions on antimicrobials critically important to treatment of humans have been very effective, as the consumption of fluoroquinolones and cephalosporins today is around 1 kg. The large pig sector have had many interventions as they account for approximately 75 % of the total use of antimicrobials for animals in Denmark. This is reflected in the reduction in the pig sector illustrated in Figure 1. From 2010 to 2018 the pig sector has reduced the antimicrobial consumption by 28 % relative to the consumption in 2009. Veterinarians and owners of pig herds have ongoing focus on solutions to prevent or handle infections without use of antimicrobials – and still ensuring that sick animals are treated sufficiently to keep good animal welfare in the herds.

Impact of changes in UK farm assurance standards on sales of antimicrobials.

Potter T. J¹, Dare J¹, Rowland K², Simpson R²

¹Westpoint Farm Vets, Dawes Farm, Warnham West Sussex UK RH12 3SH; ²Kingshay Farming & Conservation Ltd, Bridge Farm, West Bradley, Glastonbury, Somerset UK BA6 8LU.

Within the UK farm sector, assurance schemes are widely adopted by producers to enable consumer confidence. The leading scheme is Red Tractor assurance which has a membership of over 40,000 beef, lamb and dairy producers across the UK. On the 1st of June 2018 new standards came into force with a specific focus on the responsible use of antimicrobials. The key requirements were;

- All farms must collate their annual medicine usage and review with a vet.
- Vet review of collated medicines usage data includes discussion on use of critically important antimicrobials (CIAs).
- 3rd and 4th Generation Cephalosporins, fluoroquinolones and colistin are used only as a last resort under vet direction guided by sensitivity or diagnostic testing.

As a result of the changes in the assurance standards, veterinary practices saw an increase in the number of requests for medicines usage reviews and the discussions from these resulted in significant changes in the antimicrobial sales patterns. To demonstrate this effect, the antimicrobials sales data from a large, multi-centre, farm animal only veterinary practice to their beef, sheep and dairy clients were analysed. The analysis included sales data from a total of 473 farms and looked at both total sales and sales of CIAs. Following the changes in the assurance scheme requirements in June 2018, there was a significant reduction in the sales volumes of CIAs. In the 6 months leading up to June 2018 the average monthly volume of CIAs sold was 11,331 mg. From July 2018 to December 2018 the average monthly volume of CIAs sold was 2,234 mg. Total antimicrobial sales also fell over the same period (383,318mg compared to 324,576mg).

These results demonstrate the dramatic effect that changes in farm assurance schemes had on the sales of antimicrobials, especially CIAs. The requirement for the collation and review of antimicrobials by a vet increased the engagement of farmers on the topic of responsible use of antimicrobials and ensured that there was an overall reduction in usage, not simply a substitution of alternative products for the CIAs as demonstrated by the reduction in total sales.

Benchmarking antimicrobial prescribing practices for UK dairy farms to promote responsible use.

Potter T. J¹, Dare J¹, Rowland K², Simpson R²

¹Westpoint Farm Vets, Dawes Farm, Warnham West Sussex UK RH12 3SH; ²Kingshay Farming & Conservation Ltd, Bridge Farm, West Bradley, Glastonbury, Somerset UK BA6 8LU.

A bespoke antimicrobial sales report was developed to provide veterinary surgeons with a tool to proactively engage with their dairy clients on the topic of responsible use and provide a means of benchmarking prescribing practices across their client base. The reporting system combines farm population and production data collected by the veterinary surgeon with antimicrobial sales data from the practice management system (RoboVet. Vetsolutions. UK).

Data is presented from the last 12 months and includes a total of 163 dairy farms from across the UK. The dataset represents a total of 36,463 adult dairy cattle with an average annual yield of 7,874 litres. The average herd size was 225 milking animals. The reports provide a breakdown of antimicrobial sales by class with critically important antimicrobials being specifically highlighted. The average herd usage of injectable critically important antimicrobials was 0.509mg/kg PCU (range 0.000 to 4.554 mg/kg PCU). Total antimicrobial use is expressed in mg/kg PCU with anonymised values from the all producers also being presented to allow benchmarking across all farms and promote discussion with producers. The average total antimicrobial use was 22.9mg/kg PCU (range 0.4 to 140.6 mg/kg PCU).

The reports also present data on lactating cow and dry cow tube usage along with the overall usage of teat sealants in order to facilitate discussions on selective dry cow therapy. Usage of lactating cow tubes ranged from 0.022 to 5.341 defined daily doses with an average of 0.877. Dry cow tube usage ranged from 0.004 to 1.611 defined daily doses with an average of 0.487.

As well as meeting the requirements for antimicrobial usage as stipulated by UK farm assurance schemes, the reports have proved a valuable tool for promoting dairy farmer engagement with the topic of responsible antimicrobial use. By providing a breakdown of the class of products used vets have been able to provide tailored advice to farms on specific areas for improvement and the use of anonymised benchmarking has provided context to the data and increased farmer engagement.

Quantification of antibiotic consumption in Austrian pig breeding farms

C. Prigge¹, L. Schwarz², B. Pinior¹, A. Käsbohrer¹

¹Institute of Veterinary Public Health, University of Veterinary Medicine, Veterinärplatz 1, 1210 Vienna, Austria; ²University Clinic for Swine, University of Veterinary Medicine, Veterinärplatz 1, 1210 Vienna, Austria

In Austria, 74 % of the amount of antimicrobials dispensed to livestock in 2017 was applied to pig farms. To reduce the usage of antimicrobial substances an increased focus on a higher standard of hygiene and an optimized livestock management needs to be implemented. The aims of the present pilot study were i) quantify the use of antibiotics at farm level ii) to identify influencing factors on the frequency of antibiotic use and iii) to determine differences between farms with regard to their health status.

In total 30 pig breeding farms were visited from April 2017 to April 2018. Overall 15 of these farms had a frequent occurrence of clinical symptoms of a gastrointestinal disease in piglets, referred as „case farms“. The other 15 herds did not show such an accumulation of clinical symptoms and were assigned to the group „control farms“.

To reveal the impact of potential factors and to be able to compare the farms, it is necessary to quantify the use of antibiotics on farm level. The national monitoring program provides only data on the amount of antimicrobial agents but the application of variables on these data to calculate the frequency of treatment (i.e. TF, nUDD, TH_{VetCab}) is not possible.

Thus a variable was developed in the presented study to describe the frequency of antibiotic use. This variable (TH_{VetAustria}) is the sum of daily doses divided through the sum of animal days. The sum of the daily doses was calculated from the amount of delivered antimicrobial agents, the defined daily doses for animals and standardized body weights, used as nominator. The farm performance data and the estimated number of days in the life phases of the pigs, were utilized as denominator.

Additionally, we considered the proportion of daily doses for different classes of antibiotics and compared these between case-control groups as well as between sows and piglets.

Conclusion

This study indicated differences in the use patterns of antibiotics between case-control groups as well as between sows and piglets. The assessment of the frequency of antibiotic use provides more detailed information than the investigation of quantities of antibiotics delivered to farms. TH_{VetAustria} will allow a detailed analysis of the impact of factors such as the biosecurity status of the farms on their level of antimicrobial use.

Demonstration of analysis on data collected under Aacting guidelines

Sinead Quealy¹, Narjis Hasan², Amie Sullivan³

¹VirtualVet; ²VirtualVet; ³VirtualVet

VirtualVet is a privately held company operating an on-farm data collection service focused on animal remedies. As part of our work we capture valuable veterinary antimicrobial and antibiotic usage (AMU) data. We promote the importance of collecting these data in near real-time by explaining the seriousness of antimicrobial resistance (AMR) to farms, farmers and wider public health. We work with our farmer and agri-food processor clients to better understand the risks associated with overuse of antibiotics. We supply benchmarking reports to them to enable them to discuss with their vets possible interventions to reduce AMU on their farms. To test the validity of the data we capture, we set about comparing the actual AMU on a randomised selection of three cohorts of cattle: 2019 born calves, 2015 born dairy cows and 2018 born beef cattle. The reason for treatment in each group was also analysed, with a view to establishing possible AMR present in repeated treatments to the same animal for the same reason.

We set out to demonstrate the advantages of the published Aacting guidelines, working to interpret each of the points set out in section 4, for ongoing deployment in real-world settings. Our business model has developed to serve the needs of industry and government. This has resulted in several monitoring objectives [4.1 (a)]; per herd for our farmers, per animal for processors, aggregated on a county/country level for monitoring and governing etc. For the analysis contributing to this paper, we have determined the industry requirements from our work reporting to agri-food processor. VirtualVet’s farmer engagement team acts as the collection and quality assessment layer for each aspect of treatment data sent in for thousands of animals in near-real time, thereby fulfilling the role of “active control with respect to completeness and accuracy of the collected data [4.1 (f), (g), (h) & (i)]”.

We have selected three sub-categories of bovines, from multiple sources captured on our portal [4.1 (b)] to get the AMU index as an indicator of ‘mgs of Antibiotic Active Ingredient used per kg of animal mass’ in food producing animals, using the weight-based and dose-based approaches as described in section 4.2(a) of the Aacting guidelines. Similarly, for 4.2(a) count-based approach, we will produce an index showing the ‘number of days treated/Year/Animal’. This can be compared to a similar index for average on aggregated animal data on City/County/Region, National and Global level, enabling more granular benchmarking of individual animals, possibly contributing to breeding decisions on-farm. The animal weight for the weight & dose-based calculation is selected for each sub-category using the PCU defined on the national standard [4.2 (b)].

This work will lead to the creation of functions to generate AMU index(es) using the information captured by VirtualVet (animal date of birth, gender, breed, treatment duration, medicine, active ingredient, concentration, number of animals treated, total administered dosage and total sample size [4.1 (c) & (d)]) in a dynamic and responsive process.

For example, the formula to generate the index showing ‘mgs of Antibiotic Active Ingredient used per kg of animal mass’ in food producing animals would be:

which can be simplified to:

$$\sum_{i=1}^{n_{TE}} \frac{n_{Ai} \times C_i \times DDD_i \times n_T}{n_A \times PCU_S}$$

$$\frac{\sum_{i=1}^{n_{TE}} n_{Ai} \times C_i \times DDD_i \times n_T}{n_A \times PCU_S}$$

where n_{TE} : no. of treatment events; n_{Ai} : no. of animals treated in the treatment event i ; C_i : Active Ingredient Concentration for the Antibiotic used in treatment event i [mg/ml]; DDD_i : Defined Daily Dosage of the Antibiotic used in treatment event i [ml]; n_T : Treatment Duration (in no. of days) for the treatment event i ; n_A : no. of animals in the selected sub-set at the time of the treatment event; PCU_S : national defined PCU for the selected animal sub-set category [kg]

Conclusion

VirtualVet continues to collect near real-time on-farm antibiotic usage for our farmer and agri-food clients. We report the mg/PCU and mg/KG amounts based on the above equations, assisting farmers, their vets and the agri-food processors to better establish meaningful and informed targets which promote the implementation and reward the embrace of excellence in animal husbandry and welfare.

DISARM – Managing Antibiotic Resistance through Multi-Actor Farm Health Plans and a Community of Practice.

Nathalie Rousset¹, Anne Hémonic², Erwin Wauters³, Nial O’Boyle⁴, Frederik Leen³, Laura Palczynski⁴

¹ ITAVI, French technical Institute for Poultry, France

² IFIP-Institut du Porc, Pig Institute of the French pig chain, France

³ Flanders research institute for agriculture, fisheries and food, Belgium

⁴ Innovation for Agriculture, United Kingdom

Without urgent, coordinated action of many stakeholders, we are headed for a post-antibiotic era. To reduce the threat of antibiotic resistance, part of the solution will come from a more prudent and responsible use of antibiotics in livestock farming.

The Community of Practice

In the new EU Horizon 2020 thematic network DISARM (Disseminating Innovative Solutions for Antibiotic Resistance Management), launched in January 2019, we build a Community of Practice (COP) in which farmers, veterinarians, suppliers, processors, policy makers and researchers collaborate to identify, co-create and disseminate best livestock farming practices.

Multi-actor Farm Health Plan

The obtained knowledge and insights from the COP will be used in piloting and promoting a multi-actor farm health plan (MAFHP) approach. Previous research has well documented the potential beneficial effect of coaching farmers for improving animal health while reducing the use of antibiotics. Further, previous studies have also highlighted the need for farm-specific approaches to improving agricultural production. Based on this knowledge, it is the fundamental idea of DISARM that, in order to stimulate a more responsible use of antibiotics, we need viable approaches for coaching farmers towards farm-specific improvement plans. In DISARM we pilot and test a coaching approach to facilitate multi-actor teams consisting of the farmer, the herd veterinarian, nutritionist, the equipment supplier and potentially other relevant stakeholders to collaborate in the development of farm-specific action plans. Guidelines for the successful development of such MAFHPs will be published in an on-line toolbox. Forty farms across 8 European countries evenly divided across the poultry, pig, dairy, beef and sheep industry will pilot this MAFHP-approach. The results obtained at these farms will be used as dissemination material to further stimulate the use of the toolbox and the adoption MAFHP’s in the European livestock industry. Additionally, these innovator pilot farms will act as ambassadors to promote the approach among their colleagues during events and workshops.

Conclusion

The legacy of the project aims to leave a wealth of information, engagement, and awareness within a well-connected CoP, with the ability and tools to continue the effort, propagating to the wider industry. This strategy aims to not only impact at a regional and member state level but provide influence on global animal husbandry practices; vital to stimulate the shift towards more responsible antibiotic stewardship.

Antimicrobials use (AMU) in Italian fattening units during a four years period: preliminary results

Federico Scali¹, Giovanni Santucci¹, Antonio Marco Maisano¹, Francesca Giudici¹, Giorgio Bontempi¹, Alberto Amicabile¹, Massimiliano Lazzaro¹, Enrico Giacomini¹, Adriana Ianieri², Sergio Ghidini², Silvio Borrello³, Giovanni Loris Alborali¹

¹Istituto Zooprofilattico Sperimentale Lombardia Emilia Romagna; ²University of Parma, Department of Food And Drug; ³Italian Ministry of Health

Italy is a large consumer of antimicrobials in Europe and pig farming may represent one the major cause of antimicrobial use (AMU) in the country. Nevertheless, information on AMU in Italian pig farms are still limited. During the last few years, education campaigns regarding rational AMU became common but nationwide stewardship, for Italian farms, has not been implemented yet. Aim of this study was to investigate any variations on AMU patterns in Italian fattening units during a four years period (2014 to 2017).

A sample of 259 fattening units, in which at least one year of data were available, was selected among farms involved in the development of ClassyFarm system. Data were collected retrospectively from paper sources. AMU was expressed as treatment index 100 (TI₁₀₀) using Defined Daily Doses Animal for Italy, a standard pig weight of 100 kg, and 180 standard days at risk. Correlation between AMU and farm size were investigated using Spearman's rank correlation. Friedman test was used to investigate differences among years in 52 out of 259 farms (20.1%) in which data were available from 2015 to 2017.

Table 1 reports sample size, average AMU and usages of WHO's highest priority critically important antimicrobials (HPCIA). From 2014 to 2017, TI₁₀₀ of colistin was respectively: 0.29, 0.45, 0.25, and 0.05. A negative correlation between reared pigs and AMU was found in 2015 ($\rho = -0.27$, $P < 0.001$) and a positive correlation between AMU and frequency of HPCIA use in 2016 ($\rho = 0.22$, $P = 0.007$). In the 52 farms, significant differences among years were found only for HPCIA (P = 0.002).

Conclusion

Results of this study should be considered preliminary. Indeed, sample size of 2014 was limited and most of the 2017 data was not included because still under review. Additionally, farms were generally different among years and only one age group (finishers) was considered. From 2014 to 2017, AMU and HPCIA use were almost halved (table 1) which may be partially due to education campaigns. Nonetheless, overall AMU was stable in farms where data was fully available from 2015 to 2017. Restrictions on colistin use, which are in place since July 2016, may have significantly influenced its reduction. Trends regarding AMU in Italian pig farms should be further investigated considering a larger sample with all age groups.

Table 1: sample size and antimicrobial use in Italian fattening units during the study period

Year	2014	2015	2016	2017
Reared Pigs (No)	302,299	1,400,539	1,200,334	368,743
Farms (No)	54	208	135	70
Average AMU¹ (TI₁₀₀)	13.11	10.20	9.15	7.34
HPCIA² (TI₁₀₀)	1.36	1.83	1.59	0.71
HPCIA² Distribution (%)				
<i>Polymyxins</i>	21.5	24.8	15.7	7.0
<i>Macrolides</i>	73.5	62.1	73.8	73.8
<i>Fluoroquinolones</i>	1.9	3.4	4.1	4.6
<i>Other quinolones</i>	2.6	9.4	6.2	14.4
<i>III and IV gen. Cephalosporins</i>	0.5	0.4	0.3	0.3

1. Antimicrobial use

2. Highest priority critically important antimicrobials for human medicine

Evaluation of the German Antibiotics Minimisation Concept

Anke Schröder¹

¹ Federal Ministry of Food and Agriculture;

With the German Antimicrobial Resistance Strategy (DART), first published in 2008 and updated as DART 2020 in 2015, the German Federal Government presented a concept aimed at reducing the further development and spread of antibiotic resistance. It contains a number of measures for recognising, averting, and combatting antibiotic resistance in Germany.

With the Sixteenth Law amending the German Medicinal Products Act (16. AMGÄndG), which came into force in 2014, a benchmarking system was introduced using nationwide determination of key figures on the frequency of antibiotic treatment of fattening animals. This is associated with obligations for controls and actions on the part of animal owners aimed at reducing the use of antibiotics. Animal owners must report data regarding the number of animals kept and their antibiotic treatment, compare the situation within their own operation with nationwide key figures, and – if the key figures are exceeded – take measures, in collaboration with the veterinary surgeon, to minimise the use of antibiotics. The key figures are determined every six months on the basis of data collected during the previous period. Through the 16. AMGÄndG, the competent authorities of the federal states for the first time receive data on the use of antibiotics in fattening farms. The reported data may not be published, but were used for the evaluation of this new antibiotics minimisation concept as foreseen by the 16. AMGÄndG. Within the evaluation, these new informations are correlated with antibiotics sales data and results of the two established monitoring programs on antibiotic resistance.

The decrease of the antibiotics sales data in Germany by 57 % between 2011 and 2017 is already an indicator for the effectiveness of the German antibiotics minimisation concept, but does not allow a differentiated analysis of trends in antibiotic use at species level. The development of the biannually published key figures which are set separately for the six animal categories also reflect the impact of the 16. AMGÄndG.

Conclusion

The evaluation of the German antibiotics minimisation concept gives insight into antibiotic use data and therapy frequencies at species and – for pigs and cattle – even at age group level stratified by substance class.

Comparing antibiotic usage data for Swedish pig herds using European and national defined course doses

Marie Sjölund¹, Ida Clemensson Lindell², Kerstin Annér², Elin Karlsson², Maria Lindberg²

¹National Veterinary Institute SVA, ² Farm & Animal Health; Uppsala, Sweden

Background & Aim

The European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) project has previously proposed defined daily doses (DDDvet) and defined course doses (DCDvet) for quantifying antibiotic use (1). Previous studies have shown that these units may not accurately reflect the actual usage at national level due to diverging dosing recommendations (2). The aim of this study was to compare suggested national DCD for Sweden (DCDse) to those proposed by ESVAC when applied to herd level usage data.

Material & Methods

DCDse had been defined for all products containing antibiotics approved for use in pigs in Sweden during 2016 and 2017, in addition also those sold with special license (3). The highest authorized daily dose and the longest treatment period according to the national Summary of Products Characteristics for each active substance (AS) formulation combination were used to assign DCDse.

Antibiotic usage data for 2016 and 2017 were obtained from the treatment recording system of the Swedish farm health advisory company Farm & Animal Health for 47 and 52 breeding herds, respectively, affiliated with Farm & Animal Health. The number of DCDvet and DCDse per year were calculated per product based on the amount of AS used and standardized weights (4, 12 or 220 kg for sucklers, weaners or sows, respectively). The number of DCDvet or DCDse per animal or farrowing per herd and year was calculated based on total numbers of DCDvet and DCDse in the herd and information on number of animals or farrowings.

Results

The median number of DCDvet per suckler was 0.90 in 2016 and 0.76 in 2017, and the corresponding medians of DCDse per suckler were 0.50 and 0.42, respectively. For weaners the median DCDvet per animal was 0.14 in both 2016 and 2017 and the corresponding medians of DCDse per weaner were 0.09 and 0.10, respectively. The median number of DCDvet per farrowing was 0.41 in 2016 and 0.37 in 2017 and the corresponding medians of DCDse per farrowing were 0.23 and 0.20, respectively.

Discussion & Conclusion

Using either DCDvet or DCDse for quantifying antibiotic use on herd level lead to considerable differences which was expected, as DCDvet is based on averages from a number of countries, while DCDse was based on maximum doses of products authorized in Sweden. This was apparent since DCDvet was higher for all age categories compared to DCDse. These differences are further accentuated if products containing AS where DCDvet and DCDse differ substantially dominate use, i.e., procaine benzylpenicillin (DCDse +70%) and trimethoprim-sulphonamides for parenteral use (DCDse +53% to +168%). However, irrespective of using DCDvet or DCDse, a reduction in antibiotic usage was seen for sucklers and sows between 2016 and 2017 whereas use for weaners remained stable between the two years. This means that DCDvet and DCDse can be used to follow trends over years even though they may not accurately reflect the actual number of treated pigs.

References

1. EMA/224954/2016, Defined daily doses for animals (DDDvet) and defined course doses for animals (DCDvet)
2. Postma *et al.*, Assigning defined daily doses animal, J Antimicrob Chemother 2015, 70, 294-302
3. Sjölund *et al.*, Comparison of proposed national defined course doses to previously established European course doses for quantifying antibiotic use in pigs, Accepted for The European Symposium of Porcine Health Management, Utrecht 22-24 May 2019

ECOANTIBIO: A successful public policy to fight against antimicrobial resistance in the veterinary sector in France

Delphine Urban¹, Cécile Adam², Olivier Debaere², Jean-Pierre Orand¹, Anne Chevance¹, Gérard Moulin¹, Jean-Yves Madec³

¹French agency for veterinary medicinal products / French agency for food, environmental and occupational health safety, 35306 Fougères, France; ²General Directorate for Food, Ministry for Agriculture and Food, 251 rue de Vaugirard, 75732 Paris Cedex 15, France; ³French agency for food, environmental and occupational health safety, 69364 Lyon Cedex 07, France

The Ecoantibio plan is a public policy set up by the French Ministry of Agriculture and Food, aiming to reduce the contribution of antimicrobial use (AMU) in animals to antimicrobial resistance (AMR). It relates to all animal sectors (including pets) and covers all French territories.

The first Ecoantibio plan was published in November 2011, which set a quantitative objective (reduce animal exposure to antimicrobials by 25% in five years) and a qualitative objective (reduce animal exposure to critically important antimicrobials (CIA)).

This plan combined regulatory and incentive tools. Main regulatory tools are (i) the ban of antibiotics for preventive use, (ii) CIA can only be used to cure animals after diagnosis, bacterial identification and antibiotic susceptibility testing; and (iii) ban on discounts for antimicrobial sales. In order to encourage the main stakeholders to take actions, communication campaigns promoting careful AMUs and vaccinations were launched. Other pillars were also included, such as setting up guidelines on good practices and research funding to cover knowledge gaps.

Over the last five years (2012-2016), overall exposure has decreased by 36.6%. The decline in exposure to antimicrobials was observed for all species compared to 2011 (cattle: -24.3%, pigs: -41.5%, poultry: -42.8%, rabbits: -37.6%, cats and dogs: -19.4%). In 2016 exposure to newer-generation cephalosporins and fluoroquinolones decreased by 81.3% and 74.9% respectively, compared to 2013, all species combined. Initial quantitative and qualitative objectives have therefore been achieved and mostly exceeded. The decline in exposure to antimicrobials has been accompanied by a decline or stabilisation in resistance for the vast majority of antimicrobials tested.

Nevertheless, as these achievements needed to be consolidated in a One Health perspective, a second Ecoantibio plan was published in April 2017 and is part of the interministerial roadmap for controlling AMR. This second plan focuses on training, research and communication.

Conclusion

Ecoantibio is an example of a successful public-private partnership, thanks to veterinarians and farmers' involvement. The quantitative target of this first Action Plan was achieved due to the dynamic for the prudent and responsible use of antimicrobials in veterinary medicine in France.

Legislation as an efficient driver to reach national targets for the use of critically important antibiotics in veterinary medicine in France

Delphine Urban¹, Anne Chevance¹, Jean-Pierre Orand¹, Stéphane Larréché², Cécile Adam², Gérard Moulin¹

¹French agency for veterinary medicinal products / French agency for food, environmental and occupational health safety, 35306 Fougères, France; ²General Directorate for Food, Ministry for Agriculture and Food, 251 rue de Vaugirard, 75732 Paris Cedex 15, France

Newer-generation cephalosporins and fluoroquinolones are considered as particularly important in human medicine because they are among the only alternatives for the treatment of certain serious infectious diseases in humans. The aim of the French Ecoantibio Plan is to reduce the contribution of antimicrobial use in animals to antimicrobial resistance. Alongside voluntary and incentive measures, legislative and regulatory actions have been taken during the first action Plan (2012-2016).

A law published in 2014 set a reduction target of 25% over three years (2014-2016) in the exposure of animals to critically important antibiotics for human health (CIA), i.e. 3rd and 4th generation cephalosporins and fluoroquinolones. A Decree and an Interministerial Order to frame the use of CIA in veterinary medicine were published in March 2016. The two most important provisions for prescribing and selling CIA are: (i) the ban of CIA for preventive purposes; (ii) the mandatory clinical examination followed by bacterial identification and an antibiotic susceptibility testing before prescribing CIA for curative or metaphylactic purposes.

The ALEA indicator (Animal Level of Exposure to Antimicrobials) is calculated by dividing the body weight treated (Number of Defined Course Doses) by the biomass of the animal population potentially using antimicrobials, for the oral and parenteral routes only. Change in the ALEA is representative of the change in the number of treatments performed. ALEA for newer-generation cephalosporins had decreased by 94.2% in 2017 compared to 2013 (all species combined). An 87.8% decrease in exposure to fluoroquinolones was observed in 2017 compared to 2013. The ALEA decline for CIA was observed for all species.

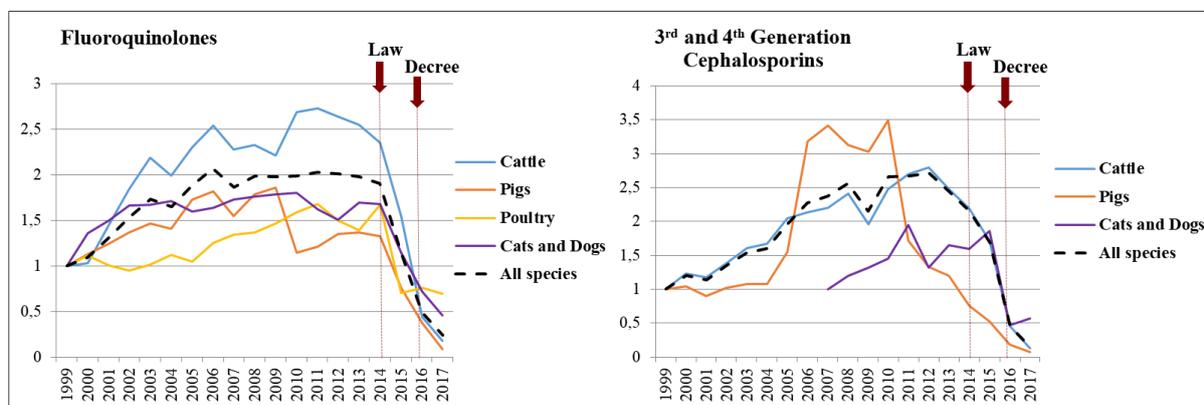


Figure: Changes in the ALEA indicator for critically important antibiotics in France

This sharp decrease observed in CIA use can be explained by several factors:

- (i) prior to the Ecoantibio plan, professionals voluntarily engaged themselves in a reduction process focusing on CIA,
- (ii) options taken in the Decree were largely explained and communicated and were finally well accepted by the professionals
- (iii) the Decree has acted as a mandatory tool inducing an important change in practices.

Conclusion-----

The targeted 25% reduction in the use of newer-generation cephalosporins and fluoroquinolones in three years was largely achieved in 2016, and this drop in exposure continued in 2017. These encouraging results can clearly be linked to legislative measures seeking to regulate the prescription and sale of drugs used in veterinary medicine containing CIA.

A prudent approach to antibiotic treatment of high-risk calves at arrival to a dairy beef facility

T. E. von Königslow¹, D. L. Renaud¹, T. F. Duffield¹, C.B. Winder, D. F. Kelton¹
¹University of Guelph, Guelph, Ontario, Canada

The veal and dairy beef industries experience high levels of morbidity and mortality during the growing period impacting calf welfare and economic sustainability. A large proportion of calves enter these industries with identifiable health abnormalities putting them at high-risk early in the growing period. A conventional method used to address this high-risk period is the provision of oral group metaphylaxis. To facilitate a reduction in antimicrobial use (AMU) and subsequent antimicrobial resistance (AMR), a prudent targeted approach to antimicrobial therapy could be implemented. The objective of this study was to compare morbidity and mortality for calves in the first two weeks following arrival to a dairy beef facility between groups receiving conventional group antimicrobial therapy (CT) and those receiving selective antimicrobial therapy (ST) based on risk assessment at arrival. All calves received a risk assessment upon arrival to the facility using a standardized screening protocol. Calves were housed in individual pens with 54 calves to each room. Rooms were randomly assigned to receive either CT consisting of oral antibiotics fed in milk for 7 days; or, ST consisting of long acting injectable antibiotics, oral electrolytes or both assigned by a standardized treatment protocol based on individual risk assessment. Calf treatment records were used as a proxy for morbidity. Morbidity and mortality records were evaluated for 1032 calves from 19 rooms [January 15th to August 8th, 2018]. There were no significant differences between CT and ST groups with respect to risk designation in calves ($P = 0.13$) but there were a significantly larger proportion of dehydrated calves observed in the CT group ($P < 0.01$). Preliminary analysis comparing morbidity between CT and ST groups found no significant difference between the treatment groups (Pearson χ^2 , $P = 0.23$). Only 18 calves died during the first two weeks of the growing period; with 7/18 deaths reported from the CT group (< 1%) and 11/18 deaths reported from the ST treatment group (1%) (Fisher's exact, $P = 0.25$).

Conclusion

Preliminary analysis suggests no difference in morbidity and mortality between ST and CT strategies in the first 2 weeks post-arrival. With increased focus on antimicrobial stewardship including efforts to reduce AMU where possible, ST strategies may present an opportunity to reduce the pressures that promote AMR through a reduction of AMU without sacrifice to calf health and welfare early in the production cycle.