ISESSAH 2023 book of abstracts

Understanding stakeholder behaviour and socio-economic implications of practices and policies of animal health

Helsinki, Finland, 13th - 15th of June 2023

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Edited by the organizing committee.

ISESSAH
International Society for Economics and Social Sciences of Animal Health

NJF Nordic Association of Agricultural Science

UNIVERSITY OF HELSINKI

Luke
NATURAL RESOURCES INSTITUTE FINLAND

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Welcome

Dear conference participant,

warm welcome to ISESSAH 2023 conference, which is organised for the first time in Finland.

The International Society for Economics and Social Sciences of Animal Health (ISESSAH) aims to improve animal health and welfare policies, programme and projects through more nuanced use of concepts and tools available in economics and social science disciplines. The annual conference is a key tool to promote this objective. This year's conference is organised in collaboration between ISESSAH, the Nordic Association of Agricultural Science (NJF), Natural Resources Institute Finland (Luke) and University of Helsinki. The conference is organised in Viikki campus, which is the home of Luke and two key faculties of University of Helsinki, namely the faculty of agriculture and forestry and veterinary faculty.

We have an interesting conference program that will allow the participants to reflect their research, exchange ideas and to create new contacts and cherish existing networks. The programme includes five invited talks, about 50 oral presentations and 28 posters, some of which are elaborated as flash presentations. The first day finishes with a welcome reception and the second day with a conference dinner. Conference registration desk is at your service throughout the conference. You can also ask for assistance from the members of the local organising committee.

This book of abstract includes abstracts of presentations given at the conference. I hope that you will have a productive and enjoyable conference.

Jarkko Niemi, chair of the organising committee

Invited speakers of ISESSAH 2023

- **Jens Rommel,** Associate Professor at Decision-making and Managerial Behavior research group, Department of Economics, Swedish University of Agricultural Sciences, Sweden
- **Beth Clark,** Lecturer in Food Marketing at School of Natural and Environmental Sciences, Newcastle University, United Kingdom
- **Arnaud Rault,** Researcher focussing on animal health economics at Oniris, BIOEPAR (Biology, Epidemiology and Risk Analysis of Animal Health unit), National Research Institute for Agriculture, Food and Environment (INRAE), France
- **Taina Aaltonen,** Deputy Director General at Ministry of Agriculture and Forestry, Finland, Chief Veterinary officer of Finland and delegate of Finland to the World Organisation for Animal Health
- **Ina Toppari,** Executive manager at Animal Health ETT r.a., Finland.

Local organizing committee

- Jarkko Niemi, Natural Resources Institute Finland (Luke), chairperson of organizing committee
- Timo Sipiläinen, University of Helsinki, Finland
- Minna Väre, Natural Resources Institute Finland (Luke)
- Anna Stygar, Natural Resources Institute Finland (Luke)

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- Jarkko Niemi, Natural Resources Institute Finland (Luke), chairperson of organizing committee
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- Erwin Wauters, Flanders Research Institute for Agriculture, Fisheries and Food, Belgium

- Wilma Steeneveld, Utrecht University, The Netherlands
- Katja Schulz, Friedrich Loeffler Institute, Germany
- Jada Thompson, University of Arkansas, United States
- Timo Sipiläinen, University of Helsinki, Finland
- Minna Väre, Natural Resources Institute Finland (Luke)
- Anna Stygar, Natural Resources Institute Finland (Luke)

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ISESSAH 2023 abstracts

Tuesday, June 13th, 2023

Session 1: Experimental economics and stakeholder behaviour

Invited talk: Exploring the Potential of Experimental Economics to Improve Animal Health Outcomes: Recent Advances and Future Directions

Jens Rommel, Associate Professor at Decision-making and Managerial Behavior research group, Department of Economics, Swedish University of Agricultural Sciences, Sweden

The talk starts with a concise history of experimental economics. It then discusses current challenges in the application of economic experiments with farmers. Finally, in an outlook, I outline fields of action for applying more economic experiments in the animal health social sciences.

Psychosocial factors associated with farmer behaviour in a disease epidemic

Naomi S. Prosser[1], Edward M. Hill[2,3], Paul E. Brown[1,4], Jasmeet Kaler[1], Eamonn Ferguson[5,6], Michael J. Tildesley[2,3], Matt Keeling[2,3], Martin J. Green[1]

[1]School of Veterinary Medicine and Science, University of Nottingham, United Kingdom, [2]The Zeeman Institute for Systems Biology and Infectious Disease Epidemiology Research, School of Life Sciences and Mathematics Institute, University of Warwick, United Kingdom, [3]Joint UNIversities Pandemic and Epidemiological Research, [4]Bioinformatics Research Technology Platform, University of Warwick, United Kingdom, [5]School of Psychology, University Park, University of Nottingham, United Kingdom, [6]National Institute for Health and Care Research Blood and Transplant Research Unit in Donor Health and Behaviour, University of Cambridge, United Kingdom

Farmers are heterogenous in their use of disease control measures, and this is traditionally not incorporated into disease transmission models used to inform policy. Psychosocial factors such as trust in and psychological proximity (closeness) to others are associated with decision-making by farmers for disease control in their livestock, however this has not been investigated in the context of a disease epidemic. We investigated psychosocial factors associated with farmer behaviour in a disease epidemic scenario and use this to parameterise farmer behaviour in a disease transmission model. We designed a novel graphical user interface (GUI) to illustrate the spread of a hypothetical disease epidemic and used it in online interviews to elicit when sixty British farmers would choose to vaccinate their cattle. An online survey was then used to investigate a range of psychosocial and behaviour change characteristics in the interviewed farmers, using multiple validated measures. We used multinomial logistic regression to identify the psychosocial and behaviour change factors that were associated with when the farmers decided to vaccinate.

Farmers who had high trust in Governmental judgements about infectious disease control and low trust in other farmers to control disease were more likely to vaccinate early than mid epidemic. Farmers who rated advice from the veterinary profession as high quality were more likely to vaccinate mid-epidemic than late in the epidemic. Finally, farmers with high physical opportunity and fewer cattle were more likely to vaccinate early epidemic. Incorporating this information into a disease transmission model changed the projected development of the epidemic, compared to assuming homogeneity in farmer behaviour.

Assessing hunters' participation in zoonotic diseases surveillance using an experimental game

Aude Pouliquen[1], Gilles Aurélien Boupana Mapeyi[1], Hadrien Vanthomme[2], Marie-Marie Olive[1], Daniel Cornelis[2], Sebastien Lebel[2], Gael Darren Maganga[3], Marisa Peyre[1], Alexis Delabouglise[1]

[1]CIRAD, UMR ASTRE, France, [2]CIRAD, UMR Forêts et Sociétés, France, [3]Centre Interdisciplinaire de Recherche Médicale de Franceville, Gabon

Strengthening the surveillance of zoonotic diseases emergence in the wild meat value chains is a critical component of the prevention of future health crises. Community hunters could act as "watchmen" of zoonotic pathogens surveillance systems in wildlife, by reporting early signs of the possible presence of a disease in the game animals they observe and manipulate on a regular basis. An experimental game was developed and implemented in the department of Mulundu, a forested area of Gabon, in central Africa. Our objective was to improve our understanding of community hunters' willingness to report signs of zoonotic diseases in game animals to a sanitary authority. 88 hunters, divided into 9 groups of 5 to 13 participants, participated in the game, which was run over 21 rounds. In any round the players participated in a fictitious hunt, and each of them had a given chance of capturing a wild animal displaying clinical signs of a zoonotic disease, and therefore

having to decide whether to sell or to report this suspect catch. The second option implied a lowered revenue from the hunt but an increased probability of early detection of zoonotic diseases with benefits for the entire group. The analysis of the results showed that false alerts - i.e. suspect clinical signs that are not caused by a zoonotic disease - led to a decrease in the number of reports in the next round (odds ratio (OR): 0.44, 95% 95% Confidence interval (CI): 0.25-0.77, p<0.01). Hunters who had a farming activity besides hunting reported suspicion cases more often than others (OR: 2.05, 95% CI: 1.09-3.87, p<0.03). The number of reports of suspected cases increased with the number of played sessions (Incremental OR: 1.12, 95% CI: 1.07-1.18, p<0.01) suggesting a sensitizing effect of the participation in the game. We demonstrate the added value of using experimental games for improving the understanding of people's decisions to participate in health surveillance systems.

Information asymmetry and its influence on consumer perceptions for farm animal health and welfare
Maria Rodrigues, Nicholas Hanley,
University of Glasgow, United Kingdom

Do consumers care about the health of farm animals? Using a sample of n = 515 consumers, we assess the relationship between consumers preferences, herd sickness levels and farm animal health (FAH) and farm animal welfare (FAW) by analysing UK consumers purchasing decisions in the context of two endemic livestock conditions Bovine Viral Diarrhoea (BVD) in cattle and lameness in sheep. These two endemic diseases are known to have an adverse effect on farm animal health and welfare (FAHW) but they do not impact human health. The analysis uses discrete choice experiments related to four products: beef and milk, and lamb and wool to measure the willingness to pay (WTP) of the UK public to ensure high FAHW. The study provides robust evidence that UK consumers care about FAHW independently of the sickness level in herds/flocks, when sickness levels do not compromise the safety of the products consumed.
We further test whether information asymmetry on the safety of animal products might affect consumers' preferences for the health and welfare of farm animals. Respondents were divided into two treatment groups. The first treatment group was provided with explicit food/product safety information (n = 258) and the second treatment group was not given any food/product safety information (n = 269). The results indicate that i. despite the uncertainty caused by the ongoing COVID19 pandemic at the time, the British public's preferences could still be captured separately for FAH and FAW. ii. regardless of whether explicit product/food safety information for human consumption and use was provided, consumers preferred higher animal health whilst also preferring higher animal welfare. iii. the magnitude for WTP estimates for FAH and FAW although positive were dependent on the food/product safety information. However, upon testing it was found that there was no statistically significant difference in the willingness to pay coefficients between the two treatment groups.

Parallel session 2A: Perspectives to veterinary work

The MAP (motivation, action, prompts) Model: A tool to structure behaviour change conversations on farm,
Alison M.G. Burrell[1], Laura Gribben[2], Áine Regan[3], Moira Dean[1]
[1]Animal Health Ireland, Ireland, [2]Queen's University Belfast, United Kingdom [3]Teagasc, Ireland

The increased focus on preventative medicine in agriculture to improve social, environmental and economic sustainability has seen a demand on farmers to make considerable changes to their behaviour and farm routine. A role shift has been observed by veterinary practitioners and agricultural advisors to provide guidance on animal health improvement and to support these changes on farm to prevent disease and reduce spread. Research has found that training in psychological evidence-based communication strategies to support behavioural change would be beneficial for animal health professionals delivering herd health consults.
The MAP of Behaviour Change model was originally designed by health psychologists to provide healthcare professionals with a framework when having conversations about change. It involves using person-centred communication skills such as open questions and reflective listening and delivering behaviour change techniques based on their current stage (motivation, action or prompts).
A blended-learning training programme was adapted from the NHS Scotland MAP of Behaviour Change and delivered by health psychologists to a pilot cohort of Teagasc farm advisors (n=8). This consisted of an eLearning module and in-person skills workshop to practice and consolidate learning.
A mixed-methods evaluation of the MAP training programme is being carried out to examine the acceptability of MAP as a training package in animal health, measure participants' pre-/post-training perceived

competencies in using behaviour change techniques and capture post-consult reflections on how MAP is used in herd health management.
Training facilitators' qualitative reflections post-training indicate that adapting the MAP model fits with the remit of a farm advisor and should be rolled out to support those delivering herd health consults such as advisors and vets. Further training in client-centred communication strategies will further support those having conversations for change on farm.

Implementing a National Veterinary Prescribing Champion Programme for Welsh Veterinary Practices: Arwain DGC

Gwenllian Rees, Aberystwyth University, Wales

Arwain DGC is a national collaborative programme funded through Welsh Government, aimed at improving responsible antimicrobial use in cattle and sheep in Wales. Here, we outline the design and implementation of a complex antimicrobial stewardship intervention aimed at developing the national Veterinary Prescribing Champion programme for Welsh farm animal veterinary practices. We describe the process by which participants were facilitated to design and deliver bespoke individualised stewardship activities at practice level, and co-design a national prescribing code of conduct and series of clinical treatment guidelines, by forging participant "champion" identities and communities of practice. We outline the key phases identified as important when designing this complex intervention, namely (1) involving key collaborators in government and industry to stimulate project engagement; (2) grounding the design in the literature, the results of stakeholder engagement, expert panel input, and veterinary clinician feedback to promote contextual relevance and appropriateness; and (3) taking a theoretical approach to implementing the intervention to foster critical psychological needs for participant motivation and involvement using Self-Determination Theory. We also present the national code of prescribing conduct and series of clinical treatment guidelines co-developed by the Veterinary Prescribing Champions with academics at Aberystwyth University and the University of Bristol, which draws on the evidence base for prescribing and combines it with the clinical and contextual experience of farm animal veterinary practitioners who will ultimately be the end-users. We highlight the extensive stakeholder engagement and consultation process which has enabled this project to successfully deliver these key outputs.
The Code and Guidelines will be launched to the profession in early June 2023 and will be available in their final form for presentation and discussion at ISESSAH 2023.

Solving dilemmas during the annual health check-up in French organic dairy farming: an analysis of vet activity through video-recording and self-confrontation

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In livestock farming, there are many issues related to the control of drugs: animal health, limitation of environmental residues and limitation of resistance to antibiotics and antihelmintics. In France, over-the-counter delivery is allowed only after an annual health check-up. During this check-up the veterinarian and the farmer have the opportunity to discuss about health indicators and preventive approaches. The authors are here addressing the skills used by veterinarians to foster a joint health management activity in the annual health check-up. Three health check-ups on organic dairy farms were video-recorded. The authors conducted self-confrontation interviews after each record, one with the veterinarian, the other with the farmer. The authors used frameworks from veterinary science, animal science, management science and professional didactics to build the analysis grid. The analysis was conducted using NVivo software. The results show that veterinarians encounter dilemmas during the health check-up of a farm. These dilemmas come from the discrepancies between three levels of activity: ensuring the health check-up itself; maintaining the working relationship with the farmer and managing the service offers. These dilemmas require numerous arbitrations: between the issues to address and the given time; between the needed indicators and the unavailable data; between a partner position and an evaluator position; between the prudent drug use and the veterinarian's business model. Veterinarians solve these dilemmas thanks to own routines and adopt different vet-farmer positioning: as a trainer, as a business partner, as a coach. These results demonstrate the intense cognitive

activity of veterinarians during the health check-up. They open perspectives for vet education and call for shared professional norms.

The configuration of the "ideal veterinarian": Individual and collective embodied skills of veterinarians focusing on French poultry production

Sebastian Moya[1], Gareth Enticott[2], Mathilde Paul[1]
[1]INRAE, France, [2]Cardiff University, United Kingdom

Antimicrobial resistance (AMR) can be caused by the misuse of antimicrobials by stakeholders in livestock production. There is a need to change the behaviour of veterinarians regarding the antimicrobial use (AMU). The aim of this study is to understand what the "ideal veterinarian" means in relation to AMU through a configuration of what a veterinarian "should and should not" be or have. Sixteen in-depth interviews were conducted with French poultry production veterinarians and analysed through thematic analysis. The veterinarians interviewed stressed that the "ideal veterinarian" must be critical and holistic, questioning all elements in the cases he/she faces. This veterinarian must also be open to new ideas, be humble and confident in his or her knowledge, and be constantly learning and updating. In the field, the "ideal veterinarian" must give priority to preventing animals from getting sick through prevention. However, if animals do become ill, he or she must act quickly and rigorously, especially in emergencies. The mediating role that this veterinarian should have with all stakeholders was also relevant for the interviewees, who emphasised the respectful and honest reception and transmission of messages. The "ideal veterinarian" should give priority to farmers and adapt to them and their needs and constraints. This veterinarian should also consider collaboration with other veterinarians, especially if they are from different specialities. Finally, the veterinarians interviewed highlighted that the "ideal veterinarian" should balance personal and professional time in order not to lose the passion for the profession. There is a symbolic configuration of individual and collective embodied skills that are framed by the veterinarians' own capacities and their interaction with others. This configuration can help to understand and establish the identity of the "ideal veterinarian" with respect to the AMU, which can also question what is socially and scientifically understood as "ideal".

Are veterinary students ready to use antibiotics? – A Swedish perspective

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Antimicrobial resistance (AMR) is a global crisis, and veterinary antimicrobial use (AMU) is instrumental. Current efforts focus on the working veterinarian, leaving behind the future professionals of the field: the veterinary students (VS). This study aimed to comprehend the AMU process as understood by Swedish VS in their final year.

For this purpose, 11 final-year VS were interviewed using a social practice theory framework, where conversations focused on highlighting materials, competencies, and meanings that frame their future antimicrobial prescribing practice. Verbatim transcriptions of the resulting data were subjected to a reflexive thematic analysis, integrating a comparison with Swedish antibiotic treatment guidelines and conversations with Swedish veterinary experts. Four clinical scenarios were investigated, mastitis and metritis in dairy cows; pyoderma and pyometra in dogs.

Conversations revealed that VS had a robust critical approach to AMU aligned with national guidelines in several areas. VS did not appear to be notably lacking in knowledge. Instead, they needed more confidence in prescribing antimicrobials when deemed necessary, most likely due to a perceived lack of hands-on training. Other practices vital to combat AMR were not heavily featured in the clinical training, such as follow-up practices or considering a herd perspective in individual cases. Furthermore, assumptions in the students' answers and guidelines did not seem to be discussed in teaching. For example, the rationale for treatment differentiation across species is often connected to assumptions of meanings (e.g., animal economics or the human-animal bond).

Future revisions of veterinary education programmes may address these deficiencies by incorporating more external training, distributing practical exercises throughout all years of study, or extending the program.

Parallel session 2B: Technology

Building on the old foundations - prospects for digitalization of cattle health sector, *Ants-Hannes Viira[1], Martin Kukk[1], Hardi Tamm[2], Anne Põder[2], Pekka Kilpeläinen[3], Tuija Kallio[3], Elisa Tikkanen[3], Per-Ola Ulvenblad[4], Pia Ulvenblad[4], Henrik Barth[4], Natascha Schlereth[5], Getachew Abate Kassa[5]*

[1]Estonian University of Life Sciences, Estonia, [2]Estonian Dairy Cluster, Estonia, [3]University of Oulu, Finland, [4]Halmstad University, Sweden, [5]Technical University of Munich, Germany

Digitalization in agri-food sector receives a significant attention from business, academia and policy. However, the main emphasis seems to be on the applications of remote sensing and sensor technologies, especially in arable farming. While animal welfare, health and reduction of antimicrobial resistance related risks are important policy areas, the discussion on prospects for wider digitalization and better integration of value chain actors and consumers remains scarce. We argue that already established and well-known databases in the cattle sector could serve as a foundation for digitalization of cattle health sector.

In the project SustainIT, by applying desk study, semi-structured interviews with stakeholders, and Living Lab discussions, we mapped the existing cattle related databases in Finland, Sweden, Germany and Estonia. We found that despite differences in the institutional settings, i.e., the ownership, organization and the division of duties of the databases, all four countries have similar core databases that store similar data and offer similar reports, advisory and quality assurance services to their clients – cattle registry, livestock performance, milk quality, breeding information, health and welfare situation, diseases and treatments with veterinary drugs, including antibiotics.

Against this background we investigate a case study from Estonia. From the beginning of 2023, Estonian dairy farmers can apply for a subsidy scheme that supports implementation of herd health management programme, which targets prevention of health problems and diseases. This is a data intensive programme for farmers and veterinarians. We argue that developing integrations between farm level herd management software and existing databases could serve for better implementation of such programs, change the work routines of veterinarians, and lay foundations for using animal health information in downstream segments of value chains to respond to changing consumer expectations.

AMU recording on Irish dairy farms: barriers & facilitators to using technology

Hannah Martin, Laura Gribben[1], Alison Burrell[2], Aine Regan[3], Conor McAloon[1]

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Antimicrobial use (AMU) data is essential to monitor the impact of AMU reduction strategies in animal health. The use of technology and herd recording software to record AMU will be vital to scale the collation of this data in the future. The aim of this study was to determine the barriers and facilitators to Irish dairy farmers recording their AMU using a herd recording software.

Thirty-three Irish dairy farmers involved in a study on AMU were asked to record their AMU using a herd recording software over a 12-month period. At the end of the 12-month period ten of these farmers were selected to take part in semi-structured interviews focusing on the farmers opinions on recording AMU and the use of herd recording software. Interviews were transcribed and analysed qualitatively using thematic analysis. Six of the ten farmers used the herd recording software in some capacity (users) and four did not use the software at all (non-users). After interviewing all farmers, a number of barriers and facilitators to farmers recording their AMU and using a herd recording software were identified. The age and generation of the farmer was identified as a barrier to the uptake of technology to record AMU, as well as a fear of repercussions, a lack of training and education, a lack of knowledge around the benefits of digital data, and a lack of incentive to digitise records. Facilitators identified by the farmers included the benefits of having instantly available data for making herd management decisions, reduced paperwork, increased organisation for inspections and a potential positive impact on the image of the dairy industry.

To increase the uptake of new technology to record AMU at farm-level farmers will need support in terms of education and training around the software available to them and reassurance around the perceived risks of repercussions with sharing data in a digital format.

Farmers' perspective to Precision Livestock Farming system innovations that can support animal health management

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Precision livestock farming (PLF) is suggested as a tool to contribute to the sustainable transition of livestock farming as a market system innovation for farm animal value chains. PLF systems can be used for example to send warning signals when one or more animal health or welfare indicators deviate from the farm's norm. However, PLF system innovations can be approached with reluctance by farmers, because such innovations require them to share data with other actors of the value chain.
This study examines the preferences of farmers regarding the features of a PLF system innovation in a conjoint study, consisting of 367 pig and dairy farmers from three European countries (Finland, the Netherlands, and Spain). Results indicate that the farmers attached the greatest importance to the governing structure that manages their data; to the opportunity to use an on-farm early warning system to monitor the health of farm animals; and to share the collected data with value chain actors mainly for business innovation and certification purposes, such as animal welfare labelling. The results suggest that farmers need to be placed at the centre of PLF system innovation when animal health and other data are managed and shared to promote sustainable change in livestock farming.

Economic and welfare trade-offs with sub-optimal mobility classification algorithms

Francis Edwardes, Mariska van der Voort, Henk Hogeveen
Business Economics Group, Department of Social Sciences, Wageningen University and Research, the Netherlands

Sub-optimal mobility (SOM; syn. lameness) in dairy production is a costly health condition with negative animal welfare effects. Using precision livestock farming (PLF) technologies in SOM management could reduce the economic burden of SOM while increasing animal welfare. PLF technologies, such as sensors, ultimately distinguish between cows in different groups of SOM (i.e., no-SOM, mild SOM, and severe SOM) and alert the farmer of cows requiring attention. The quality of a sensor lies in the performance of the underlying diagnostic test (i.e., a classification algorithm) that distinguishes the different SOM groups. To classify cows to one SOM group, cut-off threshold values are used, which results in probabilities for correct and incorrect SOM group classification. However, changing these cut-off threshold value will affect the economic and welfare burden depending on the diagnostic test built into sensor. The objective of this research is to assess the relative economic and welfare gains for various diagnostic test scenarios compared to a no sensor scenario, and to assess the marginal economic and welfare effects apropos trade-offs within correct and incorrect SOM group classification probabilities. Hypothetical diagnostic tests were generated and used as input for a stochastic cow-level bio-economic simulation model. Preliminary results showed that economic and welfare gains were generally highest for a diagnostic test that distinguished no-SOM better from mild SOM and severe SOM. Maximum economic and welfare gains were 48% and 95%, respectively. Top 20% economic gains (>39%) had median correct classification probabilities of 0.93 (no-SOM), 0.4 (mild SOM), and 0.43 (severe SOM). Top 20% welfare gains (>93%) had median correct classification probabilities of 0.38 (no-SOM), 0.02 (mild-SOM), and 1 (severe SOM). Future results will provide important information for sensor developers apropos the marginal economic and welfare value in the performance of their underlying diagnostic tests.

Economic efficiency of using sensing technologies to monitor the welfare of growing pigs

Anna H. Stygar[1], Matti Pastell[1], Pol Llonch[2], Eddie A.M. Bokkers[3], Jacinta D. Bus[3], Iris. J.M.M. Boumans[3], Lene Juul Pedersen[4], Jarkko K. Niemi[1]
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Investments into sensor technologies can add value to the farm management process by improving data processing and implementation of everyday herd management decisions. However, despite these benefits, there is still a substantial lack of evidence on the economic efficiency of sensor application in the pig value chain.
The aim of this study was to assess the economic efficiency of different sensor technologies used to monitor the welfare of growing pigs. Bio-economic models based on dynamic programming were used to determine the effect of sensor application at various production stages. Model parameters were set to represent average

costs and benefits in the Netherlands, Spain and Denmark. The preliminary results are discussed based on selected welfare indicators: pen fouling, tail biting and respiratory diseases. The economic benefits obtained from the use of technology depend, among other things, on the severity of the welfare problems on farms, the rate of spread of unwanted behaviours or pathogens, the type of technology used or the price premium that farmers can obtain when selling the products. Sensors can be economically efficient, especially when the rate of spread of unwanted behaviours or pathogens is high, as in the case of pen fouling. On the other hand, the economic value of sensor application to control tail biting and respiratory disease will vary from low to high depending on the current level of farm management.
The technologies can only assist, but not replace the manager in effective decision making. Therefore, any substantial reduction in the prevalence or severity of welfare problems could only be achieved through the application of skilful management supplemented by reliable technologies.
This study was conducted within the ClearFarm project which received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 862919

Session 3: Flash presentations & poster session

Farmers' Knowledge, Attitudes, and Practices Regarding the Best Management Practices in Shrimp Farming in Sri Lanka [flash presentation]

M.N.D.F Abeykoon[1], Keisuke Kato[1], Takahiro Sajiki[2], Hiroichi Kono[3].
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Shrimp farming in Sri Lanka has been emerged as the most profitable aquaculture venture and, however the devastating disease outbreak is a major obstacle to shrimp industry in Sri Lanka. The government has introduced Best Management Practices (BMPs) as a policy measure to prevent shrimp diseases. Nevertheless, there is a lack of knowledge about the effectiveness of this policy. Therefore, this study is aimed at assess the effectiveness of BMPs by determining the level of knowledge, attitudes, and practices (KAPs) of shrimp farmers regarding the BMPs and identify the socio-economic factors affecting the KAPs.
A KAP questionnaire survey was conducted on randomly selected shrimp farms (N= 131) in Puttalam district of Sri Lanka, 2021. Data on farm and farmer characteristics, shrimp production, knowledge, attitudes, and practices on BMPs were collected. The KAPs levels were divided into three categories as poor (<50%), fair (50-75%) and good (> 75%). Ordinary Logistic Regression models were applied to identify the socio-economic factors that influencing KAPs of shrimp farmers regarding the BMPs.
Results revealed that majority of farmers had "good" knowledge (91%) of BMPs and "fair" level of practices (97%) of BMPs. Farmers' knowledge of BMPs was positively associated with farming experience and trainings while negatively associated with farmers' age. Further, the results indicated that there are other factors that discouraging farmers to practice BMPs even though they have a good knowledge about BMPs.
Good practice of BMPs in shrimp farming is important to prevent disease outbreaks which lead to production and economic loss to the farmers. Therefore, it is required to provide more training, improve extension service and strengthen the monitoring system in order promote BMPs among the shrimp farming communities. Moreover, it is important to identify and minimize the constraints faced by farmers in implementing BMPs.

Behavioral adaptations to handle mastitis outbreaks in dairy production [flash presentation]

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Mastitis is a common illness in dairy farming with substantial negative economic consequences to farmers and with public health concerns in relation to the use of antibiotics as medical treatment. Farmers can adopt preventive animal health management measures to control disease incidence and to prevent further spread on the farm once identified. However, little is known about why farmers adopt certain control measures and if such decisions are conditioned upon their subjective assessment of when these measures are needed. Furthermore, it is also unclear how farmers adapt their use of control measures to the dynamic prevalence of mastitis. Based on goal-system theory, we used a three-stage scenario study design to explore the motivational basis for the adoption of control measures. The first stage identified the basis for measures used when the somatic cell counts (SCC), an indicator of mastitis status, exceed a certain endogenous reference point decided

by the farmer. The second and third stage explored the situations when the initial measures taken were found insufficient, and when eventually the SCC returns to an acceptable level, respectively. For this, 30 randomly selected Swedish dairy farmers were interviewed using the Laddering technique to unfold the stage-dependent goal-means chains when handling mastitis within their herd. Findings points to that when the SCC increased between the scenarios, the farmer's decision making became less complex and focused more on reinforcing routine measures related to hygiene, calling the veterinarian or culling the infected animal. The farther the SCC was from what farmers considered acceptable, i.e. the reference point, farmers continued working with their routine measures but with additional focus on antibiotic treatment or culling. These findings suggest that animal health recommendations needs to be tailored to the motivation of the farmers to handle the situation at the individual farm.

Through the lens of social science: why some people do not seek post-exposure prophylaxis after being bitten by dogs [flash presentation]

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Rabies is a deadly zoonotic disease responsible for around 59,000 human deaths annually. Dogs are the main reservoirs for the virus. Fatality from dog-mediated rabies is preventable by post-exposure prophylaxis (PEP). However, some people do not seek PEP after being bitten by dogs and, unfortunately, die from the disease. Traditional epidemiological methods like questionnaire surveys may retrieve only superficial reasons for not doing so. This study hence employed two well-established social science techniques, namely 'empathy map' and a 'customer journey,' to scrutinize the insights on the decision-making process of whether to receive PEP. Chonburi province, a repeated outbreak area in Thailand, was chosen as our study site. We divided participants into three groups: people with a history of being bitten by dogs and receiving PEP or not receiving and those without any history of dog bites. Our project is still ongoing. Some interpretable results are expected at the time of the conference. Ultimately, we plan to use what we learn to tailor an effective communication method to convince people to get PEP once being bitten. These efforts may help us to reach the goal of ending human deaths by dog-mediated rabies by 2030.

The impact of Peste des Petits Ruminants in smallholder systems of Nigeria [flash presentation]

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Peste des petits ruminants (PPR) is endemic in most of Sub-Saharan Africa and is the target of national vaccination campaigns, but its actual impact on the productivity of livestock and the livelihood of smallholders has not been accurately evaluated. Three parallel studies were conducted in Plateau and Bauchi states in the central and northeastern parts of Nigeria: (1) an epidemiological survey in 420 rural villages aimed at estimating PPR prevalence on the basis of serology tests, (2) a household questionnaire survey conducted with 420 households in 42 villages for quantifying revenues and costs of small ruminant production and demographic dynamics of livestock herds, and (3) focus group discussions with smallholder farmers in 42 villages to identify lost revenues and additional costs caused by diseases with clinical signs compatible with PPR, risk coping strategies implemented by households and the reasons for implementing them. An efficiency model was implemented to predict the loss of production and income associated with PPR. Three effects of PPR outbreaks were accounted for, namely (1) deaths of animals, (2) sale of animals at a reduced price and (3) expenditures in medical treatments. The demographic structure and value of production were modelled, under a fixed feed resource constraint, in two scenarios corresponding to (1) risk of PPR outbreak at the estimated incidence and (2) absence of risk of PPR. In Plateau state, outbreaks of diseases matching the clinical definition of PPR caused the death of 36% and 34% of the herd and the rapid sale or slaughter of 23% and 17% of the herd for goats and sheep respectively. PPR reduced the income derived from goats and sheep by 10 USD per adult female goat and 17 USD per adult ewe per year, both amounts largely exceeding the cost of PPR vaccine purchase. Obstacles

to the adoption of vaccines by smallholders mainly include (1) a limited access to information on vaccines and (2) a lack of access to vaccines delivery.

The economic impact of Peste des Petits Ruminants in Central Anatolia region of Turkey [flash presentation]
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Peste des Petits Ruminants (PPR) is an economically important disease that affects the regions where the majority of sheep and goats are raised in Turkey. The aim of this study was to determine the financial losses caused by PPR in sheep and goat species in the Central Anatolia Region and contribute to the effective monitoring of animal health policies through showing negative effects of animal diseases on livestock sector in Turkey. In the study, the data for the economic analysis were derived from the 50 surveyed enterprise which had PPR outbreaks in Central Anatolia in 2018 and 2019, from Delphi survey that conducted with 24 veterinarians, and from the literature and various institutions. As a result of the study, the total economic loss in the Central Anatolia Region was 332.330 US$ in 2018 and 193.066 US$ in 2019. Considering the average of both years, mortality-related losses have the most important share in the total losses at the rate of 71,96% for sheep and 86,34% for goats. The loss of body weight, treatment costs and losses due to lack of reproduction (loss of body weight due to abortion and increased inter-kidding reveal) were 13,65%, 7,05% and 7,34%, respectively, in sheep and 4,78%, 7,16% and 1,72%, respectively, in goats. Regarding the three alternative control strategies of the disease, it has been determined that the most economically scenario is the vaccination strategy of animals older than 3 months for 3 years. In conclusion, PPR caused high mortality in the affected enterprises and a significant economic loss. According to the joint strategy of FAO and WOAH on the control and eradication of PPR globally, eradication of the disease is targeted by 2030. In this context, the result of this study contributes to the awareness of the economic importance of the disease for producers and can be helpful in terms of guiding the national strategy to be applied in disease control and policies to be taken regarding the disease.

Social network analysis and artificial Informational asymmetry: control and prevention of theileriosis in rural areas in Zimbabwe [flash presentation]
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The acceptance and adoption of a particular practice or technology is essential in political and economic development. Social networks play a key role in the diffusion process and in developing countries use of social networks to pass agriculture information is an area that lags behind. Theileriosis has been one of Zimbabwe`s challenge in the recent years accounting for over 500,000 cattle deaths between 2018 and 2022. Dipping cattle is the main method used by the veterinary services but research shows there is information asymmetry when it comes to practice of cattle dipping. The aim of this study is to establish the factors that affect farmers in constant participating in cattle dipping and to outline the social networks that support farmers to be active in cattle dipping.
Qualitative and Quantitative data we collected from 360 farmers using a questionnaire with sociodemographic questions asking information about their affiliation to social networks and participation. Analysis of information was centered at calculating centrality and betweenness to estimate the effect of a network position. A five-point Likert scale to understand current farmer practice and social networks they are affiliated to. The survey was conducted in October 2022 and the data collected was analyzed in Gephi software for social networks.
Farmers had high participation if groups and social networks that were related to crop production and this was because many of these were initiated as a way of input subsidy. Participation in livestock related groups was low. The main actors that transmitted livestock information were veterinary extension officers and neighbor farmers.
Social networks if effectively used have a potential to fill the information asymmetry in rural areas. Livestock production model should use a model as used with crop production to attract the participation of all farmers or use the same networks used by crop production extension officers.

Posters

Class-differentiated restriction of therapeutic antibiotics and farmers economic performance: Evidence from Denmark

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The livestock sector is a significant contributor to antimicrobial resistance (AMR) due to its high consumption of antibiotics. In Denmark, pig production is a major contributor to AMR, resulting in the implementation of the Yellow Card initiative in 2010. Initially, the initiative implemented a blanket quantitative restriction on antibiotic use, applying the same quota to all antibiotic classes. However, in 2016, the initiative was differentiated, and multiplication factors were added for each antibiotic class to reduce the consumption of some classes over others. The multiplication factors are based on the importance of the antibiotic class as the last line of treatment for humans, with higher multiplication factors assigned to those classes that are prescribed as the last line of treatment. However, the impact of this intervention on antibiotic use and economic performance has not been studied. In this study, we are applying a difference-in-differences (DID) estimation strategy to examine the impact of this stewardship intervention on subsequent antibiotic use and economic outcomes and exhaustively explore the main mechanisms. We are using a panel data (2008-2021) obtained from the Veterinary Medicine Statistic Program database (VETSTA) and SEGES innovation. The intervention is expected to reduce antibiotic use, and the reduction will vary depending on the antibiotic class. We also hypothesize that farm profitability will decrease due to increased expenditures on alternative mechanisms, such as vaccines, feed additives, and additional labor hours.

Knowledge, attitude and behaviour of Dutch dairy farmers regarding reproductive hormone use.

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Reproductive hormones are regularly applied in Dutch dairy farms to treat reproductive diseases and to induce heat. To promote a more prudent use, it is essential to gain insight in farmers' mindset regarding reproductive hormones. This study aimed to associate dairy farmers' knowledge and attitude with their reproductive hormone use behaviour. An online questionnaire on reproductive hormone use was distributed among dairy farmers in the Netherlands which was filled out completely by 143 respondents. Data on herd characteristics and hormone use (never, sometimes, always) were collected. A knowledge score (0-10) was developed based on 10 knowledge questions. An explanatory factor analysis was conducted to identify latent structures among 19 attitude variables, resulting in four factor variables. A multivariate multiple regression analysis was performed to associate knowledge with farmers' attitude while a multinomial logistic regression was conducted to associate knowledge and attitude with behaviour. All models corrected for 8 herd characteristic variables. The mean knowledge score was 6 and 17% of the farmers indicated that they never used hormones while 57% and 26% of the farmers indicated that they always and sometimes used hormones, respectively. A higher knowledge score was positively associated with using hormones (sometimes-user: OR=1.5; always-user: OR=1.3). The same direction was shown for three of the attitude factors, namely hormone efficacy (sometimes-user: OR=1.6; always-user: OR=2.7), using hormones properly (always-user: OR=1.4), and good fertility management (sometimes-user: OR=1.3). Meanwhile, a preferred attitude on risks of using hormone was negatively associated with using hormones (sometimes-user: OR=0.8; always-user: OR=0.6). In conclusion, knowledge and attitude were associated with hormone use behaviour and can thus likely be used to promote a more prudent use of hormones in Dutch dairy herds.

Rural farmers knowledge, attitudes and practice towards theileriosis prevalence and control in Mhondoro Ngezi Zimbabwe

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Tickborne disease is a threat to livestock production in Zimbabwe accounting for about 500,000 cattle deaths since 2018. The government has put in place measure and strategies to tackle this disease which has reduced the national herd and weakened the productivity of the remaining cattle. Dipping of cattle is the main strategy with the weekly cycle best suited to fight the disease. The understanding of theileriosis signs and following the proper dipping cycle is key in eradicating theileriosis. This study aimed at analyzing the level of knowledge, attitudes and practice towards theileriosis with the main aim examining if the dipping practice corresponds with the professed knowledge theileriosis.
Qualitative and Quantitative data we collected from 360 farmers using a questionnaire with sociodemographic questions and a five-point Likert scale to understand farmer knowledge, attitude and practice on tick borne disease. The survey was conducted in October 2022 and the data collected was analyzed through Stata 17 calculating the multiple linear regression.
Integrated crop and livestock as source of income was reported by 58% of the farmers, with 98% using the free-range rearing system. The major group of 84% of farmers could tell the signs with 90% knowing only which body part is mainly affected and what type of cow affected. 98% farmers had a positive attitude towards the main strategy of dipping however, research reveals that only 65% of the farmers participate in the weekly dipping. There is a challenge in the frequency of dipping the only method to control ticks at present, despite higher knowledge about the disease and its control
Farmer practice can be controlled by encouraging participation as a community and thus establishment of local level dipping committee will effectively increase participation. A closer look into social networks may improve on how farmers can be made to accept a practice for best results.

Perceptions of commercial and household pigkeepers regarding African swine fever and the control measures in Estonia and Ukraine – a participatory approach

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African Swine Fever (ASF) was identified in Ukraine in 2012 and Estonia in 2014. Pigkeepers play a crucial role in implementing control measures to minimize the risk of disease introduction into their farm. This study used a participatory approach to reveal pigkeepers' awareness of ASF signs, transmission routes, and preventive measures. Additionally, their acceptability of ASF control measures and perceptions towards stakeholders involved in ASF control were investigated.
Ten focus groups were organized in Estonia (2019-2020) and Ukraine (2021). Voluntary participation included 35 commercial pigkeepers in Estonia and 52 household farmers in Ukraine. During the meetings, qualitative and quantitative data were collected using verbally expressed opinions and participatory tools (proportional piling, face emojis), respectively.
Regarding ASF signs in pigs, both groups ranked highly non-specific signs, including fever and inappetence, demonstrating a general awareness of ASF. Commercial pigkeepers ranked transport as the riskiest transmission mode of ASF spread; households ranked – rodents. The most effective preventative measure was designated to training in biosecurity in the commercial sector and disinfecting pig housing in the non-commercial sector. Farm-level ASF control measures were generally more accepted by households. Pigkeepers were aware of their role in ASF control, and in Estonia they tend to trust authorities more than in Ukraine.
This study demonstrates a good awareness of commercial and household pigkeepers regarding ASF signs and preventive measures. The households were less aware of the significance of various ASF transmission routes and thus evaluated the importance of preventive measures differently. Detailed clarifications about the necessity of some ASF control measures are needed to improve their compliance. There is a need to find effective ways of sharing accurate information on ASF transmission routes and preventive measures with households.

Measurement of Organizational Agility Using Fuzzy Agility Index, Case Study: Amul Saleh Dairy Company

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The recent trend in the manufacturing sector is to develop highly customized products to satisfy the niche needs of customers. To satisfy this requirement, a newer manufac-turing technique has been deployed; this is called Agile Manufacturing. The objective of agility measurement and identify the main obstacles to improving agility, helping managers to better achieve an agile organization. Fuzzy Logic is a method that provides another great tool for measuring organizational agility. Four main dimensions to assess the agility in the model are organization management agility, products design agility, processing manufacture agility, and Manufacturing Strategy Agility. For collecting data have been used from two questionnaires with Finally Linguistic variables of seven options. The first questionnaire included the im-portance of criteria and indicators and other performance ratings. Agility level of Amul Saleh Dairy Company to be obtained using this data and calculate index fuzzy agility and match the FAI (fuzzy-agility-index) with an appropriate level using The Euclidean distance method. Final-ly, Fuzzy performance-importance index is determined for identification of the main obstacles to improving agility level. By studying this index Were identified factors such as; The use of virtual organizations, the institutionalization of the proposals of employees, product innovation as important factors of improving agility level in Amul Saleh Dairy Company.

The innovative side of the urban interaction among animals and human stakeholders: building a Hum–Animal smart city in Lucca

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Cities are expected to host most of the increasing world population in the next future, not without problems due to emerging crisis. Also, animals in cities are growing in numbers as urban settings already host wild animals, food producing animals and an increasing number of pets. Each of them generates a daily interaction with the urban environment and the humans as well, stimulating new demands, opportunities and possible solutions. Though, little attention is given to an integrated urban hum-animal planning. In public and scientific debate, the possibility to face emerging urban challenges is always linked to the promotion of the so-called Nature-Based Solutions (NBS) to generate innovative answers. Whatever, although animals can be considered as an opportunity for human's health and well-being, in NBS they are totally understated. In this regard, the IN-HABIT (INclusive Health And wellBeing In small and medium size ciTies) project, funded by the European Commission, through an action research approach would provide innovative and good practices towards participatory methods and public-private-people partnerships (PPPPs) able to valorize different aspects of the human-animal relationships in urban settings. The IN-HABIT project recognizes the potential of human-animal bonds for the well-being of citizens building a new strategy and an integrated urban hum-animal policy to link urban planning, social sector, culture, economic activities, tourism, education and waste management in the city of Lucca. Data were collected from the co-designing participatory activities for infrastructural solutions ("Animal Lines") and soft NBS in the city. The study offers some first lessons regarding both the potential and some limits in the process of transformation exploring the topic of animal NBS in innovative cities and it represents a starting point for an ongoing conversation about how the presence of animals in cities can be seen as a positive implication in the humans' life.

Training, motivation, and feedback culture in milk production

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Bovine mastitis is still the most costly disease in dairy herds and a really significant reason for compromised animal welfare. We have much knowledge of mastitis and udder health management, allowing for evidence-based improvement. In recent years, the motivation and perception of the farmer with regards to reducing mastitis, has received increasing attention, with communication research on how to implement procedures such as the NMC 10-point plan successfully. However, implementing new procedures on modern dairy farms

goes through employees, who may speak another language, and with little or no dairy farm background. Therefore today, motivation has a new dimension: Consultants need to motivate the farmer to motivate his staff to follow SOP and procedures, which can be elements from the NMC-point plan.
In the present study, our objectives are (1) to identify the correlation between labor management and BMTSCC and (2) to identify the correlation between labor management and new infection rate.
The participating dairy farmers enrolled from the Danish National Cattle Data Base data. The criteria for participating were: DHI recording, > 90 % Holstein cows, parlor milking, conventional herd, herd size > 100 cows located in the western part of the country. The dairy farmers were contacted and encouraged to participate if they had employees in their milking team.
Data analysis is in progress, with some initial descriptive statistics highlighting the problem regarding motivation, training, and feedback to all levels of staff. There seems to be a large discrepancy between the goal of the dairy farm, and the approach to training and motivating the staff.
A modern dairy farm employing staff as part of the workforce is struggling to train and motivate technicians. Systematic training, motivation, and feedback culture need attention to maintain skilled staff.

Economic externality and human behaviour behind Zoonosis -A Case of Bovine Tuberculosis in Madagascar

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The outbreak of endemic zoonotic diseases (Zoonosis) is becoming a serious problem in developing countries. Zoonosis has big economics burden and public health consequences. It is an externality issues in economics. When externalities exist, the efficiency of resource allocation is not guaranteed and market failure occurs. This study aims to determine the incidence of bovine tuberculosis (bTB) from an epidemiological survey conducted in Madagascar in 2021, to analyse the human behaviours behind the outbreak.
Field survey of 114 farmers was conducted in Analamanga Region which is in the dairy triangle area in Madagascar. Further, 155 blood samples from their dairy cows were collected and inspected using by bTB test kit to identify the prevalence of bTB.
The epidemiological survey shows that 32.3% of dairy cattle were bTB positive. Limited dependent variable model (Tobit analysis) was performed with bTB infection status at the farm level as the dependent variable. Farmers' behaviours and adoption of livestock techniques were adopted as explanatory variables. The results indicated the incidence of bTB tended to be higher among farmers who used artificial insemination (AI) technique. Further the incidence of bTB were lower in extensive management farmer.
Artificial insemination is a new livestock production technology in Madagascar. The analysis suggests that the introduction of a new livestock technology (AI) may be the cause of bTB outbreak in Madagascar livestock farming. It is important to inform dairy authorities about the necessity of appropriate disinfection method to prevent bTB.

Identification of the foodborne hazards present in food and beverages in the Kingdom of Cambodia from 2000 to 2022: a systematic literature review

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The burden of foodborne (FBD) in Cambodia is not known. We conducted a systematic literature review (SLR) to synthesize information on the incidence of FBD in humans, associated health burden and prevalence of hazards in foods. This study will help better understand the hazards in selected agricultural products in Cambodia and their impacts to provide evidence to improve the food control system for Food Business Operators and regulators.
The review followed the established "Preferred Reporting Items for Systematic Reviews and Meta-Analyses" (PRISMA) guidelines. A review protocol was developed based on previous SLRs conducted by the International Livestock Research Institute (ILRI). Searches were done in three databases namely Scopus, PubMed and Google Scholar. Publication titles and abstracts will be screened based on the inclusion and exclusion criteria of the

study protocol. The screening will be done independently by Reviewer 1 and 2. Full paper review will be conducted manually. Articles found acceptable after the full-text screening will be considered for data extraction. Any disagreements are to be addressed by the third reviewer. For quality control, 5% of the included and excluded articles will also be reviewed by the third Reviewer. The output of the review process will then be reported according to PRISMA guidelines.
Evidence on different types of foodborne hazards (or hazard proxies) exceeding Cambodian and European Union standards/limits or hazard proxies in food and beverages in Cambodia in the past 22 years, the geographic location and association between presence of hazard and level of hazard with type of value chain and the incidence, prevalence, mortality, and associated health burden of FBD resulting from these hazards.

Socioeconomic characteristics that influence the development of dairy farms in Alto Putumayo, Colombia

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The community of dairy farmers of Alto Putumayo, is made up of traditional families, coming from cultural, social, historical, and territorial influences, from the Awá, Camsá or Kamëntšá (indigenous communities) and the population settled in the area.
Factors identified that contribute to the low levels of productivity, competitiveness, and sustainability of the dairy farms are the small extension of land destined for this activity and the low coverage of agricultural technical assistance.
A qualitative research design was used in this study through in-depth interviews. We used this qualitative technique because: we lacked enough information on cattle farmers dynamics that involve low develop in livestock systems; we wanted to know what reasons were behind the thoughts from farmers about that implementation of technical sanitary and productive programs. Finally, we wanted farmers to expose their problems and needs in relation to improve their productive systems.
Livestock work is inherited, by tradition, although now it is more complex because young people migrate to the cities and do not want to continue with that tradition. Productive practices are transmitted from one generation to another, this will influence the level of technology that they want to implement. In addition, there is a dairy population that is changing its activity for agriculture.
On the other hand, there are few formal livestock associations, these respond to individual interests, but no collective decisions are made that allow progress. Finally, the institutions in charge of animal health or productive chains only carry out control visits but do not provide technical assistance to dairy farmers.
The development of the dairy sector in Alto Putumayo depends on the new generations of farmers and the support of institutions and NGOs that provide permanent monitoring to health and productive programs.

Evaluating methodologies to explore antibiotic use on smallholding pig farms in peri-urban Kenya

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Understanding patterns and practices of antibiotic use (ABU) in livestock is crucial to inform recommendations for improved antibiotic stewardship and measure impact of interventions. Because use practices develop over time, in response to economic, regulatory and clinical/animal health contexts, no single methodology for determining ABU stands out as the most effective across all contexts.
To explore strengths and limitations of different methodologies aimed at understanding ABU on smallholding pig farms in a peri-urban area of Nairobi, Kenya, 4 methods were trialed in parallel over 1 month on 13 farms. These were evaluated using mixed-methods for their ability to collect accurate and reliable ABU instances; facilitation of discussion around ABU practices. Methods were: waste bucket analysis; medicines use records; weekly semi-structured interview and; the 'Drug Bag' sorting technique (doi.org/10.1080/16549716.2019.1639388).
There was a low correspondence between all methods; no one method captured all reported ABU. Waste bucket analysis was least successful. Participants reported that part bottles were generally administered, often by animal health professionals, leaving no empty packaging available. The 'Drug Bag' collected most reported

ABU instances, but was over-inflated due to misrecognition of medicines, duplication of products with the same active ingredient and misremembering of 1-month.
Results emphasize challenges of gaining accurate understanding of ABU. Study planning should involve pilots of multiple methods for suitability and researchers should consider using multiple methods in parallel. Results also raise caution for comparisons between ABU studies; success of each methodology was highly influenced by study context. Comparisons of studies using different methods in the same context or of studies using the same methods but in different contexts may be flawed, especially where the most suitable method for a particular context has not been considered.

Bioeconomic stochastic model of the consequences of paratuberculosis in a typical small Slovenian herd

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The aim of this study was to perform an impact assessment of paratuberculosis (PTB) or Johne's disease in a typical Slovenian dairy herd of approximately 18 cows. PTB is a worldwide endemic disease of cattle caused by Mycobacterium avium subsp. paratuberculosis (MAP). We developed a stochastic bioeconomic model to use published data and to account for uncertainties in production losses due to lack of empirical data and lack of reliable tests to diagnose MAP infections.
We developed a bioeconomic model at the dairy cow level based on farm structure data, cattle demographics, production parameters and purchase prices in 2020 obtained from the Slovenian competent authorities. The prevalence of the disease within the herd was based on our previous model of the spread of MAP in a small herd. The model with Monte Carlo simulations was developed with @RISK (Palisade). It includes production and reproduction parameters, incidence of mastitis, abortions and retained placenta. We modelled total revenue, variable costs and gross margin. We created three sub-models for MAP negative, subclinical and clinical cows.
Results showed that compared to total revenue per negative cow, revenue per subclinical and clinical cow was on average 8.10% and 18.23% lower, respectively. The costs for a subclinical cow were on average 0.02% higher, while for a clinical cow it was 32.76% higher. Sensitivity analysis showed that of the MAP effects on gross margin for subclinical cows, increased incidence of clinical mastitis and retained placenta had the greatest impact, while for clinical cows it was most influenced by premature culling. Due to the low prevalence within small herd, the gross margin per MAP positive herd was on average 7.61% lower than the negative herd. This suggests that the economic losses of MAP are not as great as in larger herds. However, if MAP were to be recognised as a zoonosis, it would severely impact the livelihood of farmers with positive herds.

How does the commercialization of milk influence the implementation of sanitary programs in dairy farms of Alto Putumayo?

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In Alto Putumayo, milk production is a traditional process that was introduced during colonization and represents the main economic support for livestock families. In addition, it provides milk for the entire department.
The system for setting the price of a liter of raw milk guarantees a competitive price for producers because it includes a base payment plus an extra on the compositional and hygienic quality of the milk. In addition, bonuses if the herd is free of brucellosis, tuberculosis or certified in good livestock practices.
A qualitative research design was used in this study through focus groups in milk producers (2) and milk marketers (1). We wanted to understand the commercial chain of milk in the study area and to know the reasons why the commercialization of milk could influence the fact of implementing or not sanitary programs in dairy farms.
A convenience sampling was used due on the availability of those who wanted to participate in this research. To analyze the discourses of farmers and marketers we use critical discourse analysis. This technique allows one to understand meanings in greater depth and perceive complex phenomena.

In Alto Putumayo, raw milk is sold directly to the final consumer, to intermediaries, associations, or direct processors. Only associations pay the competitive price proposed by the government. Unfortunately, only 26% of the producers belong to an association, the rest sell their product individually.
Most marketers set the price of milk based on the availability of the product and the demand for dairy products, regardless of their hygienic, compositional, or sanitary quality. This price may be lower than that proposed by the government, however, in few cases the price paid may exceed the competitive price.
Dairy farmers from Alto Putumayo consider that there are no economic, social, or ethical incentives that promote the implementation of sanitary programs.

Impact and farmer perception of sheep and cattle endemic diseases in Great Britain

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The cattle and sheep sub-sectors in Great Britain are an important part of the landscape and culture, as well as providing macro- and micronutrients, other valuable by-products, and creating livelihoods. With a changing environment on the horizon and increasing human populations, it is more important than ever to identify areas to promote sustainability in livestock food systems while minimising negative impact. Animal, human, plant and environmental health and welfare are inextricably linked and animal diseases, particularly endemic, apply pressure across these systems. Therefore, we aimed to document the impact of diseases on cattle and sheep farms. We captured primary data through an online survey on farm management whilst also capturing farmer perceptions, having access to another source of data on farmer perceived disease priorities and conducting a systematic literature review on the economic impact of endemic diseases. It was found that research was weighted towards the dairy industry. Lameness, mastitis and endo-/ectoparasites were the top researched and prevalent diseases in both beef and sheep animals, with documented animal-level costs of mastitis and lameness at £ 77-£ 548/cow/year and ectoparasites at £ 40-£ 47/ewe/year. Tetracycline and Group 3 anthelmintics were most used with little to no resistance being reported. Few externalities are captured in economic analyses and, disease interactions and total disease burden are often not considered at farm management level or in analyses. Interestingly male animals were not mentioned in the survey in relation to diseases. The survey also highlighted that although farmers are concerned about animal health, the perception of consumers to livestock farming and subsidies are more important than other issues that may negatively impact them. We therefore propose that a wider, more inclusive conceptualisation of disease impact will be needed to move towards more sustainable, long term healthy animals for farming.

A case-control study on farm factors associated with a Yellow Card in Danish pig herds with weaned piglets.

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To reduce veterinary antimicrobial usage (AMU), Denmark introduced a legislative penalty called the Yellow Card Initiative, targeting Danish pig herds with an AMU above the current limit value. Herds assigned a Yellow Card are restricted and required to lower the AMU. In weaned piglets, the age group where group medication is frequently used, respiratory and intestinal indications are the primary cause of treatment. Husbandry practices, like weaning age and weight, can also adversely affect piglet health. In Denmark, pig production accounts for over 75% of veterinary AMU. Increasing the knowledge of herd characteristics in farms with a high AMU may contribute to post-weaning health and promote the prudent use of antimicrobials. Therefore, the study aimed to characterize herds assigned a Yellow Card in weaned piglets and identify herd-specific risk factors associated with a Yellow Card.
The study was designed as a case-control study comparing Danish pig herds with a Yellow Card in weaned piglets (case herds) to comparable herds with a low AMU (control herds). Information on farm management, herd health, weaning, housing, feed regiments, hygiene, and biosecurity was collected from each farm through telephone interviews with the farmer.
The study enrolled 24 case herds and 28 control herds. Preliminary results indicate no significant difference between case and control herds regarding feeding choices, weaning age, weight, employees' experience, age of buildings, treatment age, and weight. When entering and leaving the buildings, all herds reported using a designated entrance room that met Danish SPF standards. Case herds had less room for pigs to eat, were more

likely to have outbreaks of gastrointestinal diseases in newly weaned piglets, and used group medication. It translated into biosecurity measures related to pipe cleaning and feed/water acidification.
Consequently, pig producers must ensure adequate room for weaned piglets to eat, suggesting that improved feeding strategies may result in a decline in AMU. In addition, measures targeting a reduction in group medication are necessary. The results of this study indicate that herds may display a high degree of similarity, which suggests that individual herd effects have a crucial impact.

A pilot study evaluating a model for benchmarking Danish veterinarians on prescribed antimicrobials
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Despite a low antimicrobial use (AMU) in the Danish livestock production, responsible AMU is continuously a subject receiving political focus. The main concern is combating expendable AMU to reduce the risk of antimicrobial resistance. New initiatives are listed in the national action plan from the Danish Veterinary and Food Administration (DVFA) from 2021 on antimicrobial resistance in livestock animals and food products. These include Benchmarking of veterinarians on antimicrobials prescribed. The goal is to implement the benchmarking system in VetStat - The Danish database of all prescription drugs sold to animals in Denmark. The aim is to increase the awareness and understanding of the veterinarians antimicrobial prescription patterns in comparison with other veterinarians. Furthermore, the benchmarking system is expected to be useful as a visual tool in relation to the DVFAs supervision of veterinarians responsible for Veterinary Advisory Service Contracts (VASC). As part of a previous project in the Danish Veterinary Consortium, a benchmarking system was designed using antimicrobial prescription data from Danish pig and cattle veterinarians responsible for VASCs. Two models were developed and run within each species for predefined age groups; the first model compared veterinarians based on proportion of farms with a high AMU and the other model compared veterinarians based on mean percent treated animals per day. The objective of this pilot study is to introduce the second benchmarking model and collect feedback from veterinarians on how they understand and perceive the system. The results will be presented for the DVFA and included in the further work process of implementing a benchmarking system in VetStat.
For selected pig and cattle practices in Denmark, the benchmarking system will be presented including graphs showing the benchmarking of the individual veterinarians. Feedback from the veterinarians will be collected through a semi-structured questionnaire. Other reflections and suggestions from the veterinarians will be recorded.
The results and conclusion from this pilot study will be presented at the conference.

A scoping review on the impact of bovine paratuberculosis on production parameters and economic effects
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Paratuberculosis (PTB), or Johne's disease, is a worldwide disease caused by Mycobacterium avium subsp. paratuberculosis (MAP) that leads to chronic enteritis, primarily in ruminants. Even subclinical infection significantly reduces the animals' performance and consequences of the disease lead to high economic losses for the cattle industry. To estimate the economic burden of bovine PTB and to evaluate the benefits of a potential control program, accurate estimates of the production effects associated with the disease are required. Therefore, the objective of this scoping review was to systematically search and extract data from empirical studies on the effect of MAP infection on performance parameters.
The studies were collected from three electronic databases and from the reference lists of relevant reviews. Of the total 1605 studies, 1432 studies did not meet the criteria in the title and abstract screening and a further 106 were excluded during full-text review. In total, data were extracted from 67 publications. Preliminary results show that the magnitude of reported performance losses varied depending on several factors, such as the type of diagnostic test applied (e.g. ELISA, fecal PCR or culture), disease status (e.g. highly positive, etc.) or number of lactations. Studies reported a reduction in milk yield, changes in milk quality (e.g. higher somatic cell count, lower fat and protein content), reduced fertility (e.g. prolonged calving interval and service period, higher abortion rate, higher non-return rate), reduced weaning weight, slaughter weight and slaughter value, or a higher risk for mastitis.

Our literature synthesis provides a comprehensive overview of the disease burden associated with PTB. Results from this scoping review provide evidence-based inputs for the development of economic models for the estimation of the costs and benefits associated with different disease control scenarios.

Communal farmer's knowledge, perception and practice of foot-and-mouth disease (FMD) in the FMD control zone of South Africa

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Cattle in the FMD protection zone are not simply means of social and cultural relations among farmers, but they are also marketable commodities that can play a critical role in poverty reduction. However, farmers in this zone are typically smallholder, communal farmers who do not have access to more lucrative markets within the FMD-free zone.
The study area was Vhembe and Mopane districts in Limpopo Province and a total of 12 dip-tanks were randomly selected and a cross-sectional study was performed to assess the level of knowledge, attitudes, and perception of FMD among small-scale, communal cattle producers with vaccination using a structured questionnaire and a two-stage interview process.
A total of 275 interviews were conducted at dip-tanks and 110 at homesteads. Most (75%) interviewed farmers were male and the majority (67%) were 60 years of age or older. Forty-five percent of interviewed farmers were involved in livestock farming as the main activity and 38% did not have a formal education. Sixty percent of interviewed farmers knew the name of FMD in local language and 35% reported that the cause of the disease was buffalo. The majority described the clinical signs of FMD in their animals including lameness (34%), salivation (24%), weight loss (8%), death of calves (2%). According to interviewed farmers, co-grazing with infected cattle (32%), contact with buffalo (12%) and transporting cattle (1%) were among the main causes of FMD spread. Thirty-one percent of farmers believed that the injection of antibiotic such as oxytetracycline is an effective treatment for FMD in cattle. Also, forty-six percent of farmers strongly agreed that FMD vaccine is effective in preventing outbreaks in cattle.
Collecting information from farmers can help identify practices at the local farm/household level that potentially cause FMD spread and is an important step towards FMD control.

Drivers for infectious disease transmission on pig farms and its early warning: perspectives from simulation modelling

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In modern pig production systems, pigs of different ages are reared in separate housing units, following specialised production and biosecurity programmes. However, little is known about how pig production, biosecurity, and pathogen characteristics impact pathogen transmission and surveillance sensitivity at the farm level.
We developed a suite of mechanistic models to simulate the transmission of a hypothetical novel pathogen on a pig farm operating under modern production systems. By performing global sensitivity analyses using partial rank correlation coefficients and Sobol indices on these models, we investigated the impact of pig production, biosecurity, and pathogen characteristics on outcomes relevant to pathogen transmission and surveillance sensitivity on a pig farm.
We identified the within-pen basic reproduction number, biosecurity between pens within houses, and herd size as the most influential factors for (a) the farm-level basic reproduction number, (b) the number of newly infected pigs, and (c) the probability of detecting pathogen transmission given background mortality and morbidity. When pathogen transmission was followed over two years, biosecurity between farms, biosecurity between pens in different houses, and immune duration were identified as additional influential factors for the

latter two outcomes. Background and infection-induced morbidity and mortality had only a marginal influence on the probability of detecting pathogen transmission given background morbidity and mortality.
Our results suggest that pathogen transmission on a pig farm is influenced by various factors related to pig production, biosecurity, and pathogen characteristics. Notably, our study found that biosecurity levels are negatively associated with surveillance sensitivity when the latter is evaluated based only on background morbidity and mortality. This highlights challenges in balancing the impact and timely detection of pathogen transmission.

Biosecurity gaps in seven major poultry producers (breeder and layer farms) in EU– a farmers perspective
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Good practices prevent diseases and economic losses, and ensure high production standards in poultry farming. A qualitative assessment was done in poultry breeder (n=46), enclosed layer (n=37) and free-range layer (n=21) farms, part of the H2020 NetPoulSafe project, with a semi-closed questionnaire with focus on 46, 45 and 54 biosecurity measures (BM) respectively in each production. The farmers responded to the frequency of implementation and the reasons for non-compliance. Most measures (75% of all the answers collected) were frequently implemented due to regulatory control. However, a compromise was noticed on implementation of some measures. Wheel disinfection (BM1), cleaning and disinfection of the rendering tank after each collection (BM2) and egg storage room (BM3) after each collection, showering of personnel (BM4)/ visitors (BM5) and farm-specific clothing and shoes for egg transport drivers (BM6) were less implemented compared to other measures. A descriptive analysis of the collected data showed that from the total respondents, only 78% breeder, 59% enclosed layer and 62% free-range layer farms practiced BM1; only 46% breeder, 67% enclosed layer and 42% free-range layer farms practiced BM2; only 47% breeder, 63% enclosed layer and 69% free-range layer farms practiced BM3 and only 75% breeder, 67% enclosed layer and 56% free-range layer farms followed BM6. In only 65% breeder, 11% enclosed layer and 19% free-range layer farms, farm personnel showered before entering into the poultry house and in only 72% breeder, 24% enclosed layer and 24% free-range layer visitors showered before entering into the poultry house, often reported “excessive measure” in some productions. The main reasons for non-compliance were “lack of time”, “not knowing risks/advantages”, “expenses incurred” or “not considered useful”. This study suggests that intervention is needed in order to further improve biosecurity compliance in the participating farms.

Do the attitudes and personality of calf care workers affect calf mortality?
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This study aimed to describe the attitudes and personality of calf care workers (CCWs) in large Estonian dairy herds and to analyze the potential associations with yearly calf mortality risk (MR).
CCWs from 102 freestall farms rearing at least 100 cows were included (n = 161). Anonymous questionnaire was filled by each participant and included general questions about the respondent as well as various statements to reveal their personal characteristics and attitudes towards calves, calf mortality and farming in general. Data on the number of births and deaths were gathered from the farm records and the national registry, and MR during the first 21 days (YAG) and 22–90 days (OAG) was calculated for each herd. Spearman correlation analysis was used to identify associations between MR and the studied statements. Variables with a p-value of <0.25 were included in further analyses to identify CCWs subgroups and reveal the explanatory capacity of CCWs’ attitudes and personalities on MR.
The mean MR was 5.4% (range 0.0-23.3%) during the first 21 days and 2.7% (range 0.0-12.7%) during 22-90 days of age. CCWs in high-mortality herds (HMH) were dissatisfied with the calf mortality level in both calf age groups. In the YAG analysis, CCWs from HMH were more likely to strive to ensure the calf drinks in case it does not do so willingly. They also felt that high mortality increases their workload and that the calf health situation is out of their control. CCWs working with OAG in HMH emphasized less the impact people working with calves have on calf mortality. CCWs’ personality domains explained less than 5% whereas their attitudes and satisfaction explained almost 20% of the variability in calf mortality risk.

The results unequivocally indicate that people working with calves have a substantial impact on calf health outcomes. In HMH, CCWs need more support and proficient assistance to mitigate calf health problems.
This work was supported by Estonian Research Council grant PSG268.

Biosecurity enhanced through training evaluation and raising awareness

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The BETTER COST Action will evaluate how biosecurity is currently used and use participative approaches to understand motivators and barriers for biosecurity implementation.
Biosecurity is of paramount importance to prevent the introduction and spread of pathogens and, consequently, to preserve the health of farmed animals. Despite the benefits, biosecurity is limited due to:
Lack of knowledge on ways for improvement.
Shortage of adequate ways to enhance communication.
Diversity of methodologies to assess and measure the implementation of biosecurity measures and their cost-effectiveness.
A low number of trained professionals.
To approach these challenges, we will:
Evaluate how biosecurity is currently used and use participative approaches to understand motivators and barriers for biosecurity implementation.
Compare existing methods used to evaluate biosecurity, to promote the development of tailored options in farms.
Identify training needs through the evaluation of existing training materials;
Recommend priority research areas for future biosecurity improvement in animal production systems.
The overall aim is to reduce the risk of infectious disease introduction and spread by improving the implementation of biosecurity measures in animal production systems. The objectives of BETTER are to:
Map the implementation of biosecurity measures in animal production systems and in animal transport.
Identify biosecurity measures that could be realistically implemented in settings where is more challenging.
Identify the main knowledge gaps in biosecurity and ways for improvement;
Identify barriers and motivators influencing decision making in the process of implementing biosecurity measures.
Provide guidelines and good practices for innovative evidence-based communication strategies in relation to adopting biosecurity measures.
Evaluate the existing methods for quantification of biosecurity and benefits of implementation.
Evaluate the existing methods for quantification of biosecurity and benefits of implementation.
Capacity building on biosecurity.
COST Action BETTER (CA20103) is supported by COST (European Cooperation in Science and Technology).

Wednesday, June 14th, 2023

Session 4: Economics, modelling and biosecurity

Invited talk: Modelling the interplays between economic agents to better figure biosecurity actions

Arnaud Rault, Researcher focussing on animal health economics at Oniris, BIOEPAR (Biology, Epidemiology and Risk Analysis of Animal Health unit), National Research Institute for Agriculture, Food and Environment (INRAE), France

Although biosecurity in livestock farming is a highly technical practice, chosen for its veterinary effectiveness, economic science provides a valuable contribution to this field. From the level of the individual to international

trade, biosecurity choices involve trade-offs, and sometimes have significant repercussions on the well-being and economic choices of other economic agents. Through a few examples, this presentation aims to reveal the contribution of economics to understanding the role of interplays between biosecurity choices and the importance of information sharing for effective collective management of animal diseases.

Economic assessment of post-outbreak surveillance strategies in emergency vaccination foot-and-mouth disease outbreak control in Austria

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Recent global epidemics have shown that the successful control of foot-and-mouth disease (FMD) outbreaks remains exceptionally challenging. Simulation studies supporting FMD contingency planning in Austria have demonstrated that the control of large-scale epidemics can be effectively supported by alternative measures, such as emergency vaccination. However, its use is followed by expensive and resource-intensive post-outbreak surveillance.

The European Foot-and-Mouth Disease Spread Model (EuFMDiS) was used to simulate a number of emergency vaccination scenarios to control a potential FMD outbreak in Austria. The economic and epidemiological impact of alternative approaches within this policy, such as vaccination of target herds, was assessed. The recently enhanced EuFMDiS model was used to analyze the post-outbreak surveillance procedures which are required to demonstrate disease-free status in accordance with WOAH standards and European legislation. Alternative, less intensive post-outbreak surveillance sampling regimes and approaches were compared in terms of effectiveness and economic efficiency.

In the simulated outbreaks, targeted vaccination, e.g. only of commercial cattle herds, showed an effectiveness comparable to that of mass emergency vaccination. In addition, it reduced the number of animals vaccinated and the cost significantly. Implementation of less resource-intensive post-outbreak surveillance approaches, including the use of aggregate samples such as bulk-milk testing of dairy cattle, led to increased economic efficiency with no reduction in the effectiveness of the post-outbreak surveillance.

Employing emergency vaccination to control FMD outbreaks has a substantial impact on the intensity of post-outbreak surveillance, making the avoidance of the existing limitations of conventional testing methods by means of alternative cost-effective surveillance approaches a strategy deserving consideration.

Veterinary coaching to stimulate biosecurity compliance

Hilde Van Meirhaeghe[1], Arthi Amalraj[2], Maarten De Gussem[1], Jeroen Dewulf[2]

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Farmers' readiness to accept changes is pivotal to biosecurity application and therefore improving biosecurity requires changes in the attitudes and behaviour of farmers. Veterinary "Coaching" was tested to assess their efficacy in stimulating compliance. A longitudinal study is ongoing on 18 pilot farms in Belgium; broiler (n=5); enclosed layer (n=2); free-range layer (n=2); turkey (n=2), breeder (n=4) and hatcheries (n=3). The hygiene evaluation tool - Biocheck.Ugent and ADKAR® change management model were used as supporting tools for coaching. For ADKAR, whenever the farmers scored low (< 3) for the element "Awareness", the risk factors arising from poor hygiene was discussed. For the element "Desire " (< 3), to provoke an interest, the benefits of the change were explained. For the element " Knowledge", depending on the specific problem in the farm, an educative approach was used in the form of visual aids and PowerPoint presentations. For the element "Ability" lower scores were dealt with by discussing topics such as making structural changes and investments towards better biosecurity. A list of measures were proposed to improve on the farm. An action plan was drawn for the following 6 months and is later reviewed by the coach and the veterinarian. The biosecurity status was re-evaluated after 6 months. The total biosecurity score obtained by the pilot farms were: broiler (65%); enclosed layer (65%); free-range layer (68%); turkey (70%) and breeder (71%). Breeder farms in Belgium scored

highest for external biosecurity (70%) and turkey and free-range layer farms had the highest internal biosecurity scores (80%). The mean ADKA scores for the participating farms were 3.8, 4, 3.8 and 3.9 for the elements Awareness, Desire, Knowledge and Ability respectively. Farm biosecurity scores and profiling helped the coach and veterinarian to design an intervention plan specific to each pilot farm.

Economic and environmental impacts of extending dairy cattle longevity by reproductive management

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Prolonging dairy cattle longevity is regarded as one of the options to contribute to a more sustainable milk production. Since reproduction failure is the primary reason of culling, this study investigates the effect of extending cattle longevity on farm's gross margin and greenhouse gas emissions (GHG) by altered reproductive management.
An adapted model of Kok et al. (2017) is used to stochastically simulate the dynamics of a Dutch dairy herd of 100 cows, by modelling individual cow lactations and calving intervals, while accounting for culling for fertility reasons, mastitis, lameness and other reasons (i.e. general culling). Moreover, the model computes the GHG emissions using a life cycle approach. To extend cattle longevity, two altered strategies for reproduction management were evaluated: 1) the insemination extension strategy, in which the maximum number of inseminations (AI) per cow before she is culled for infertility was raised from 4, to 5 or 6 times, and 2) the reduction in subfertility culling standard strategy, in which the milk production threshold for culling non-pregnant cows was reduced from 20 kg to 15 or 10 kg/day. The model was run for 500 herds of 100 cow places for each reproductive management strategy alternative.
Age of culled cows increased with the increased maximum number of AI from 2040 to 2195 days. The change was larger from 4 to 5 times AI (108 days) than from 5 to 6 times AI (47 days). Annual gross margin increased from €165,847 to €167,570, while GHG decreased from 0.926 to 0.915 CO2-equivalents per kg FPCM. With the decrease in the subfertility culling standard from 20 to 10 kg/day, the age of culled cows increased from 1968 to 2132days. Annual gross margin decreased with € 168,188 to minimal €161,210, while GHG increased with 0.002 CO2-equivalents per kg FPCM.
Implications: The increased maximum number of AI and subfertility culling standard can benefit a dairy farm economic and environmental sustainable development.

Parallel session 5A: Farm-level modelling

An empirical analysis of the effect of milk quality parameters on the economic performance of smallholder dairy farms in West Java, Indonesia

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In order to improve dairy management practices and to reduce the economic burden of impaired milk quality, it is important to know its economic impact. Much work in the past focussed on developed dairy systems while there is very little known on the economic burden of impaired milk quality in low- and middle-income countries. The aim of this study was to associate two milk quality parameters, i.e., somatic cell count (SCC) and total plate count (TPC), with economic performance in smallholder dairy farms from West Java, Indonesia. The study utilized a farmers' survey and laboratory bulk milk test data from 118 farms in April 2022, as well as dairy cooperative's recording data from January to May 2022. Farm economic data contained monthly average variable costs (concentrate, animal health, roughage, miscellaneous) and milk revenues, based on which the annual gross margin (EUR) per 100 kg of produced milk was determined. Multiple linear regression modelling was used to associate 62 independent variables with the gross margin of each farm. SCC and TPC were forced into the model as covariates of primary interest. A backward selection process was applied to develop the final multivariable model. The average gross margin was €18.3/100 kg milk (95% CI: €17.7-€19.0/100 kg milk). SCC was negatively associated with gross margin (-€0.75/100 kg milk) while there was no significant correlation with TPC. Herd size as well as the ratio of lactating and dry cows were positively associated with the gross margin (+€0.20 and +€4.36/100 kg milk, respectively). Furthermore, farmers that received two mastitis

treatment trainings in the last 12 months had a higher gross margin (+€2.20/100 kg milk) compared to farmers that were not trained. This study indicated that better milk quality and udder health may lead to improved economic performance of smallholder dairy farms in Indonesia.

Economic comparison of intensive and extensive hormone-based fertility programs in dairy herds,

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Hormones can be beneficial to improve dairy cow's reproductive performance. This study aimed to compare the economic consequences of various fertility programs that differ in their hormone use intensity. An existing individual cow-based, dynamic, and stochastic bio-economic simulation model simulating production dynamics of a 200 cow-herd in daily time steps was extended with reproductive diseases and fertility inputs. Four hormone-based fertility programs were modelled. The baseline scenario reflected the current Dutch extensive hormone-based fertility program in which PRIDsynch was applied to an anoestrus cow, Ovsynch to a cystic cow, and prostaglandin to a sub-oestrus cow. More intensive hormone-based fertility programs included were the Fixed-Time Artificial Insemination (FTAI) scenario, FTAI with Heat Detection (FTAI+HD) scenario, and the Heat Detection (HD) scenario. In the FTAI scenario, Double-Ovsynch was applied to each cow in the herd and ended with FTAI. In the FTAI+HD scenario, Double-Ovsynch was applied as in the FTAI scenario but with an additional oestrus detection probability after the insemination. In the HD scenario, PRIDsynch was applied to cows without oestrus and non-pregnant cows without CL and Ovsynch to non-pregnant cows with CL. The annual mean net economic return (NER) was calculated for all scenarios. The FTAI scenario gave €9,766 higher costs compared to the baseline, followed by the FTAI+HD (€9,630) and HD (€6,939), respectively. The FTAI+HD gave highest annual revenues with the difference of €31,406 compared to the baseline, and the HD gave the lowest difference (€16.482). Compared to the baseline, the highest NER was observed for the FTAI+HD scenario with €21,776 higher net revenues, followed by the FTAI and the HD scenarios with €18,885 and €9,543 higher net revenues, respectively. Fertility programs in which hormones are intensively used gave economic advantages over the current extensive hormone-based fertility program.

Economic efficiency and antimicrobial use reduction of implementing different SDCT in Canadian dairy herds

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Mastitis is one of the most common diseases in dairy cattle with high impact on farm economy, farmers' workload and AM consumption. The objective of our study is to study the economics of different mastitis management scenarios at dry off. A stochastic dairy simulation model (DHS©) based on a weekly Markov chain model was used to simulate herd dynamics, reproduction, production, culling decisions, health outcomes, and management of health events. A specific module was developed for to simulate quarter-level IMI dynamics. They are simulated for each quarter using baseline risks for each etiological agent (S. aureus, Str. uberis, E. coli, Klebsiella spp., Non-aureus staphylococci, and streptococci). For contagious mastitis, the computed risk considers contamination between quarters of a cow and between cows in the herd. Each infected quarter moves between different states: subclinical, clinical grade 1, 2 or 3 associated to impacts on milk production quantity and quality at quarter level, the conception and mortality rates at the cow level and the treatment to be applied. Blanket dry cow therapy with internal teat sealant was included as a baseline drying-off management scenario to which alternative management approaches will be compared. A statistical analysis was performed to evaluate and compare efficiency of bacteriological diagnosis on farm, SCC count and the use of internal teat sealant for AMU reduction and mastitis cost reduction. Scenarios including bacteriological test showed a reduction of -275.92 AM treatments at dry off, 5361.75$ savings in mastitis treatment cost and additional 53h. Compared to a BCDT, SDCT scenarios based on SCC count with thresholds superior to 100000 SCC showed a higher efficiency in cost and workload reductions. We successfully developed a realistic and stable bio-economic model simulating quarter-level IMI in dairy cows which will be used to investigate the economic impact of various mastitis management strategies.

Animal welfare and farm performance: A Welfare-efficiency analysis of Irish dairy farms

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Given the increasing interest in animal welfare, its economic aspects, and the advances in the production economics literature, it is surprising that limited information exists on the combined measures of animal welfare and the economic performance of farms. Therefore, this paper proposes a measure of welfare efficiency of dairy farms, defined as the ratio between the production of intended output and negative externalities arising from the production process in regard to dairy farm mortality, and investigates the determinants of efficiency measures. Data Envelopment Analysis is applied to a panel of Irish dairy farms surveyed between 2013 to 2020, and several interesting results are obtained. First, technical efficiency shows an average score of 0.831. Second, welfare efficiency scores show considerable scope for reduction of mortality rate, with an efficiency of 0.19%. Third, milk recording is positively associated with technical efficiency, but does not affect welfare efficiency performance. Overall, farmers who use capital and information-intensive technologies tend to be more technically efficient. Fourth, the share of paid labour is negatively associated with both technical and welfare efficiency. This finding stresses the importance of the family farming model in supporting productivity growth and other societal concerns. Finally, a complementary relationship is found between technical and welfare efficiency, suggesting that better mortality control can be achieved by increasing technical efficiency. In terms of future research, much more focus will be required on the determinants of welfare efficiency. Also, efficiency analyses based on farm-level data containing information on farmers' perceptions and attitudes toward animal welfare would be extremely beneficial to policymakers.

Herd-level economic impact of suboptimal dairy cow replacement due to constrained heifer supply

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Dairy cow replacements have a major effect on the profitability of dairy farms. Most of the developed decision support optimisation tools consider a single cow replacement decision in isolation, assuming the availability of a replacement heifer to replace the cow when culled. However, in reality, most dairy farmers make replacement decisions considering the performance of all cows in the herd, while accounting for a limited supply of replacement heifers. The aim of this study was to study on herd level the economic impact of suboptimal replacement decisions due to a constrained replacement heifer supply by combining a simplified single-cow replacement optimisation model with a herd dynamic simulation model to account for the interdependency among dairy cows within the herd. A standard Dutch dairy herd of 100 cows was simulated for a period of 10 years with monthly time steps under three different scenarios of heifer supply. Dairy cows were characterised by lactations (12 levels), months in lactation (18 levels), months in pregnancy (10 levels) and milk production potential (10 levels), resulting in 9720 feasible states. In the end, we compared the gross margin of milk for the herd per year under the scenario to a base scenario where the model followed the optimal replacement policy under the assumption of unrestricted heifer supply. Compared to the base scenario, availability of 1 heifer per month, 5 heifers per month or, a stochastic supply between 1-5 heifers per month (avg. 2.5/month) resulted in 37%, 6% and 4% reduction in the annual gross margin, respectively, Moreover, 7%, 0% and 5% of all the decisions made in the above three scenarios were forced decisions. In conclusion, we found that constrained heifer supply reduced the annual gross margin of the herd and resulted in suboptimal decisions. The novel approach of combining a cow place optimisation with herd simulation could potentially be used to study herd level economic impact of cow level decisions.

Parallel session 5B: Behaviour

Are farm manager's attitudes and personality associated with dairy calf mortality?

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This study aimed to describe the attitudes and personality of farm managers (FMs) and analyze their associations with yearly calf mortality risk (MR).
FMs from 114 Estonian dairy farms rearing at least 100 cows were included. Each FM filled a questionnaire including general questions about the person and various statements revealing their personality traits and attitudes toward calves and calf mortality. Data on the number of births and deaths were gathered from the

farm and the national registry. MR during the first 21 days (YAG) and 22–90 days (OAG) was calculated for each herd. Spearman correlation analysis was used to identify associations between MR and the studied statements, and variables with a p-value of <0.25 were included into further analyses to identify FMs subgroups and reveal the explanatory capacity of FMs' attitudes and personalities on MR.
The mean MR was 5.9% (range 0.0-26.8%) during the first 21 days and 2.7% (range 0.0-12.7%) during 22-90 days of age. FMs of high-mortality herds (HMH) were dissatisfied with herd's calf mortality level. In YAG analysis, FMs from HMH attributed greater responsibility to veterinarian, calf care workers and themselves in reducing calf mortality, were less satisfied with the work of their employees, and were more eager to try new products and practices in the farm. In OAG analysis, FMs from HMH were not sure their knowledge is sufficient to achieve low calf mortality and felt that factors affecting mortality are not easily changed. They also stated that reducing mortality costs too much and they have other priorities in the farm. FMs' attitudes alone explained 32.7% (YAG) and 27.5% (OAG) of the variability in herd MR while their personality had marginal effect.
The results indicate that prioritizing calf health is an important precondition to achieve good health status of calves, but FMs in HMH need additional advice and support to combat calf mortality.
This work was supported by Estonian Research Council grant PSG268.

Biosurveillance system: exploring human behavior for effective animal disease surveillance

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The COVID-19 pandemic has highlighted the interconnectedness between human and animal health and the importance of biosurveillance in preventing, detecting and controlling infectious diseases. The spread of the virus from animals to humans and its subsequent spread among humans and back into animal populations underscores the importance of integrating human and animal health surveillance systems. The pandemic has also highlighted the importance of human behavior in the success of biosurveillance programs. For instance, compliance with public health measures, such as mask-wearing and social distancing, has played a crucial role in controlling the spread of the virus. Similarly, the timely reporting of suspected cases and adherence to quarantine protocols has been essential in preventing the spread of the virus. Communication and collaboration between One Health sectors (public health, animal health, and environmental health) has proven essential in early disease detection and control.
The prevention and control of emerging and re-emerging infectious diseases requires an integrated One Health approach that incorporates human, animal, and environmental health under one surveillance system (biosurveillance system) to identify and mitigate potential outbreaks. Animal health surveillance provides crucial information about the spread of infectious animal diseases and human behavior plays a significant role in determining the success of such surveillance systems.
Human behavior impacts all aspects of planning and implementing biosurveillance systems. For example, human behavior can pose a significant barrier to the timely reporting of animal disease outbreaks. Farmers may delay in reporting a disease outbreak in their animals because of the social stigma associated with being the first infected farm. Similarly, hunters delay or fail to report suspect disease in wild animals if they fear losing access to hunting areas.
New technologies, such as digital disease surveillance tools, have the potential to enhance the effectiveness of biosurveillance systems. However, the adoption of such technologies is often limited by factors such as cost, technological literacy, and privacy concerns. For example, some farmers may not have access to the necessary technology, while others may be unwilling to share data due to privacy concerns. Therefore, it is essential to consider the human factors associated with technology adoption when developing and implementing new bio-surveillance technologies.
In conclusion, the adoption of a One Health approach to biosurveillance that takes into account human behavior can create a system that is well-coordinated and built on trust, cooperation, and collaboration between multiple sectors. Ultimately, biosurveillance is critical in safeguarding public health, and effective surveillance systems are critical in achieving this goal.

Veterinarians and farmers' role in cattle farms' biosecurity: who must set the example?

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Biosecurity (BS) measures are essential tools for maintaining a favourable health situation in farms. They allow the control of a large number of risk factors for the introduction and spread of pathogens within and between farms. In pig and poultry farms, recent health crises led to biosecurity measures' strengthening. Conversely, BS practices in French cattle farms are poorly documented and are thought to be far from recommendations.
The aim of this study was to investigate veterinarians' and farmers' BS practices and perceptions in two French administrative areas and their relations for BS application.
Semi-directive interviews of fourteen veterinarians and sixteen farmers were led and analysed in 2021. They were asked about their knowledge about BS, their BS practices and their view about BS in cattle farms.
Interviewed veterinarians had a fine knowledge about BS but their practices were not consistent with it as they did not apply basic BS measures like boots cleaning and sanitization. Most saw themselves as the professional that must set an example but did not assume this role. Indeed, they tended to adapt their practices to the level of BS of the farm they visit: in a cattle farm with a low level of BS, veterinarians could tend to less follow basic BS standards and therefore deteriorate even more its BS.
Farmers had little knowledge about BS measures and applied few. Most perceived it as constraining and of little use. They identified veterinarians as a potential counsellor but some pointed out peer testimony could be a good lever to convince them to improve their BS practices.
Each stakeholder seemed to expect something from the other. Veterinarians expected better appliance of BS in farms to motivate their own BS practices; farmers needed veterinarian's advices. Levers to improve BS should adjust to both. Some should improve farmer's BS knowledge, convince them of its utility and help them putting BS into practice; other should support veterinarians' expert role.

Stakeholders' perceptions, expectations and decision making regarding innovative approaches to control microbiomes

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Microbes play an important role when farmers are aiming at viable livestock production with healthy animals, and farmers and other stakeholders play a key role in adopting practices that utilize microbiomes. The aim of this study was to gain understanding on the perceptions and expectations farmers and other supply chain stakeholders regarding microbial ecosystems and adoption of innovations that benefit from microbiome.
The data were qualitative information collected through a literature review and focus group discussions. A review of farmers' decision-making to explain the adoption of innovations and farming practices and five focus group discussions involving farmers, advisors and other stakeholders in five European countries (Finland, France, Poland, Ireland, Belgium) were carried out. The themes considered were: 1) identification of microbiomes on farms; 2) Stakeholders' knowledge and 3) opinion on the role of microbiomes in animal production, health and greenhouse gas emissions; and 4) Opinions on innovations relating to early life, dietary transition and environmental issues.
Although financial aspects are strong drivers for the adoption of practices, endogenous factors such as the perceived impact of diseases, the lack of knowledge, and technical skills were found barriers for the adoption of new practices. The importance of early establishment of a "good" microbiome for young animals (e.g. through provision of high quality colostrum and ensuring appropriate hygiene) was understood well. However, many participants were reluctant towards feed additives especially because of doubts about their long term effects, including risks to animal and human health.

Doing disease at scale: The case of farm animal lameness

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We build on the turn in geography towards a greater consideration of the more-than-human world to explore the complexity of endemic livestock disease via a novel approach, considering the multiple, scaled realities of these conditions. We use lameness as an example, exploring it at four scales emergent from the way it is 'done' on farms; the foot, animal, farm and nation. Lameness is at once simple – an abnormality that causes an animal to change the way it walks or stands, and complex. This complexity arises from its multiple causes, symptoms and presentations in different species and animal types, and the various management practices associated with it. We focus on sheep and cattle, drawing on work with 29 farmers and 21 farm advisors in northern England, exploring how lameness becomes different at these scales, and what the implications of this are for how it is managed. We engage with Annemarie Mol and John Law's writing on 'doing disease' and how bodies and

diseases exist in multiple realities. Part of the complexity of lameness is because of the way it is practiced at these scales. Lameness is made of different phenomena, diagnosed and managed using different senses and technologies, has different effects and produces different problems (e.g., health, welfare, economic, reputational). At certain scales particular actors have authority. However, overlaps exist between scales and actors in the way the condition is done. In particular between farmers and vets. Problems arise when the realities experienced by certain actors are not accorded enough consideration by others. Our analysis suggests that there needs to be greater acknowledgement of difference and specificity between and within the spatial scales farm animal lameness is enacted. Interventions need to be adaptable to these differences and involve collaboration between farmers and advisors. We conclude by suggesting further work is needed to fully explore lameness over multiple temporal scales.

Session 6: Policy and industry perspectives to animal health

Invited talk: Political decision making in the context of animal diseases

Taina Aaltonen, Deputy Director General at Ministry of Agriculture and Forestry, Finland, Chief Veterinary officer of Finland and delegate of Finland to the World Organisation for Animal Health

Invited talk: Voluntary animal disease control programs, their success and motivating factors in Finland

Ina Toppari, Executive manager at Animal Health ETT r.a., Finland

Making sense of high-level investment in animal health systems [flash presentation]

Mariana Marrana[1], William Gilbert[2], Adriana Nilsson[3], Keith Hamilton[1], Jonathan Rushton[2]

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Intergovernmental Organisations (IGOs) are funded by a combination of statutory contributions from its member countries and voluntary contributions from member countries and other donors. The funding mechanism of the World Organisation for Animal Health (WOAH, founded as OIE in 1924) has historically differed from that of the IGOs under the United Nations (UN) system. WOAH's first voluntary contributions were first received in 2006, in support of its newly founded Laboratory Twinning Programme, and have since increased to 70% of the total annual contributions. Additionally, until 2021, WOAH member countries could choose the level of statutory contributions they wished to allocate to WOAH confidentially, while UN members' statutory contributions were determined using a GDP-based formula. Since May 2022, although the free choice system remained, statutory contribution levels ceased being confidential between members of the organisation.

In this study, we propose to answer four questions: 1) How the choice of contribution bracket was affected by the end of the confidentiality principle; 2) How WOAH members' statutory contributions and total contributions are correlated with the share of livestock biomass in the country; and 3) Determine the weight of laboratory twinning funding as a percentage of WOAH members' voluntary contributions over time.

Data was aggregated at World Bank income level to protect the identity of individual member countries. This research was conducted making use of a combination of internal WOAH records and public UN reports, and data was analysed using MS Excel.

This study was unprecedented in looking at national investment in animal health per share of livestock biomass unit, and has the potential to be integrated within the pool of resources and data of the Global Burden of Animal Diseases (GBADs) Programme.

Towards output-based surveillance of transmissible cattle diseases: challenges and opportunities

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Currently, control programmes (CPs) for transmissible cattle diseases usually consist of a detailed action plan from sampling to data collection and reporting. These CPs are so-called input-based. Apart from the mandatory CPs required by the EU, the design of CPs generally varies between and within countries. This makes the results of different CPs not easily comparable and less useful for different stakeholders involved in cattle trade or disease control. The solution would be to move to output-based control (OB), where the results of different CPs would allow comparison of disease status and epidemiological and economic effectiveness.
The objective of the SOUND control COST Action was to examine the current state of cattle disease CPs, assess the potential of mathematical and statistical methods to support a OB framework, and address the potential challenges in implementing such CPs. Different methods and approaches were used to gather the required information and opinions and synthesise the results into a comprehensive overview of the challenges and opportunities we face as we move towards OB control. Several face-to-face and online meetings, workshops, discussion groups and surveys were organised with experts and stakeholders from 33 countries in Europe and beyond.
The first steps that need to be taken to support the implementation of the OB framework are timely and reliable data collection, as model outputs are only as good as the data available. The second important issue is capacity in terms of infrastructure and availability of experts. Modellers face challenges related to country-specific disease states, validity, confidence and uncertainty, and how to link and sustain models and data collection. The consortium concluded that OB surveillance is a desirable and achievable goal. Trust and communication with the various stakeholders are key if OB surveillance is to make cattle trade a less risky endeavour.

Paying for veterinary care on a fixed-price basis: a win-win option in dairy farming in western France
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Animal health management is one of the most important levers in health and animal welfare, farming productivity and farmers' income. Veterinarians have hence developed preventive herd health approaches over the last decades and supported long-term changes in farmers' practices. However veterinarians' business model in France is based on fees for visiting sick animals and on sales of drugs. Vet costs are often considered as a burden since the outcome of late vet interventions may be thin. In contrast, a small number of practitioners are experiencing fixed-price care contracts (e.g. flat rate /cow/year or /1000 kg milk/year). The authors aim here at assessing the benefit for dairy farmers of these contracts. 17 semi-structured interviews were conducted, 3 interviews with veterinarians offering such contracts and 14 interviews with clients of them. A thematic analysis was conducted using the software NVivo. The themes addressed, especially to farmers, were the initial motivations for joining a fixed-price contract, the evolution of vet-farmer relationship, the evolution of prevalence on the main dairy health issues, the evolution of production and reproduction performances, and the motivations for maintaining or not this contract. The results show that the fixed-price contract fostered more frequent and earlier calls to the vets, improving the diagnosis, the treatment and recovery of animals and the proper use of medications. Compliance and performances have been improved. The cost-benefit analysis carried by both partners (factual analysis for the veterinarians, more approximate analysis for the farmers) show that the fixed price contract is considered as a win-win option. Veterinarians have been associated to a larger extent in farmers' strategic choices to improve herd health. The farmers also unanimously attributed a significant reduction of mental load to this fixed-price care contract. The results of this work will likely help farmers, veterinarians and public authorities define more efficient animal health management strategies.

Parallel session 7A: Costs of disease

Multiple burden framework for dairy cattle diseases
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To date, the societal burden of dairy cattle diseases are mainly quantified by looking at economics. However, the societal impacts of the diseases cover a much wider set of aspects, such as loss of animal welfare, increased environmental pressure and decreased public health. There is thus a need to incorporate environment, public health and animal welfare effects to the currently well-established economic decision support frameworks. As

of now, there are only very limited descriptions of methodologies to combine multiple burdens of dairy health and reproduction. Therefore, the aim is to first review scientific literature on the quantification of burden of dairy production diseases and reproduction, and subsequently to provide a framework for future quantification of multiple burdens to be used to support the evaluation of interventions aimed at improving the disease and reproductive status of dairy cattle.
A literature search for the years 2010 to 2022 resulted in 7,568 articles focusing on production diseases and/or reproduction in dairy cows. In total 1,254, 428, 77 and 292 articles mentioned the importance of economic, animal welfare, environment and public health, respectively. The number of articles mentioning the importance increased for all 4 burdens over the years. The number of articles actually quantifying an economic, animal welfare, environment or public health burden of production diseases or reproduction was 146, 2, 10 and 28, respectively. The approach used for quantification was either a calculation based on data (50%) or a modelling approach (50%), mainly stochastic simulation. In total 12 articles actually quantified multiple burdens.
The articles quantifying a burden of production diseases or reproduction are extensively reviewed, and based on these insights a framework was developed for future quantification. Suggestions on how to include animal welfare, environmental and public health burden in stochastic simulation models are presented.

Assessing the economic consequence of interventions for controlling salmon lice using a stochastic partial budgeting approach

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Impacts of salmon lice is a major concern for a sustainable production of farmed Atlantic salmon in Norway. The parasite is controlled by a mixture of preventive measures and immediate treatments, and most farmers need to treat their salmon several times during the production. Currently, the dominating treatment method is use non-medicinal treatments; heated water (thermal) or brushing/flushing the lice of the fish (mechanical). Most of the treatment methods causes increased mortality and decreased growth of the salmon in a period after delousing. The variation in mortality and growth, especially related to thermal treatments, is high, making it hard for a farmer to decide which control measure to apply to keep lice levels below a set limit. Increased mortality and decreased fish growth affects the profitability of the farmer, and causes poor welfare and sustainability.
To assess the economic consequence (change in profit) of preventing, replacing or improving current methods for delousing Atlantic salmon in Norway, we have applied a stochastic partial budget approach. We have simulated a production cycle of two different smolt-groups, to find the outcome (harvested biomass, average end weight of the salmon, number of dead fish and feed consumption) of production cycles without or with two, three or four delousing treatments.

The results shows that sales values and feed consumption constitutes the largest share of the change in profit between scenarios. The results also indicate that a farmer could spend a substantial amount per cage per production cycle on preventing or improving non-medicinal treatments before he reaches break even. Replacing one thermal treatment with another immediate treatment method has minor economic benefit. Thus, there exists a great economic incentive for improving non-medicinal treatments by securing good animal health and welfare. Identifying risk factors related to improving non-medicinal treatments should therefore be prioritised.

The economic burden of the porcine respiratory disease complex and related interventions - A systematic review

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Respiratory disease is regarded as one of the most serious health problems in contemporary swine production. The term porcine respiratory disease complex (PRDC) emphasizes the complexity of events leading to disease development and its severity, including the involvement of (several) viral and bacterial pathogens, such as porcine reproductive and respiratory syndrome virus (PRRSV), porcine circovirus 2, swine influenza virus, Mycoplasma hyopneumoniae, and Actinobacillus pleuropneumoniae. Understanding the financial consequences of endemically prevalent pathogens within the PRDC would assist on-farm decision-making regarding disease prevention and control, but no study has mapped the current state of research in this field. Therefore, this systematic review aimed to identify the economic impact of the most significant PRDC pathogens and the effects of interventions from existing literature, while evaluating the comparability between studies.

By following the PRISMA method, a total of 58 studies were deemed eligible for the purpose of this systematic review. Main findings from selected publications were: 1) The studies mainly considered endemic scenarios on commercial fattening farms; 2) PRRSV was by far the most studied pathogen (with a reported economic impact ranging from €1 to €11 per fattening pig and €78 to €443 per sow); 3) Comparing effects of interventions was not possible due to too large variation in the expression of outcomes; 4) Seven different economic methods were applied across studies to calculate the economic impact; 5) Numerous cost components were considered in calculations, which varied widely between studies, even when using the same methodology. The latter findings affect the comparability of studies considerably, as does the variety of countries, production systems, and years of study. This systematic review further discusses the current lack of comparable research, and highlights the importance of a uniform economic approach in future research.

The potentials in Norwegian Salmon Farming by improving vaccines

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The Norwegian Salmon Aquaculture sector has since early 2000 been a profitable business for the farmers. Due to an on average high mortality rate i.e. about 15 % in the sea phase, The Norwegian Veterinary Institute (2022) – and others, claims that the sector has a critical welfare situation.

Vaccines has been a crucial and successful disease-handling tool in order to overcome several bacterial infections in the sector, such as Furuncolosis. Further, there are some vaccines marketed to protect against virus infections such as Pancreases Disease (PD). However, the effects of these vary. Recently a new PD vaccine was introduced – a DNA vaccine. Røsæg et al. (2021) have studied the effects of the PD vaccines in the marked, and showed a preferable outcome of the newcomer.

By using a simulation tool, AquaTools® (Næve et al., 2022), the effects on mortality, production volume and economic result for an estimated minimum, most likely and maximum effect of the new vaccine, was estimated, in the PD, SAV3 variant (i.e. the indication), region of Norway. Further, we estimated consequences for society in respect of Atlantic salmon meals being available (Norwegian Seafood Council). In addition, the impact on work forces (person-year) as well as the value creation i.e. contribution to GDP (Richardson et al., 2019, SINTEF Ocean AS).

Most likely the effect of the vaccine would be 14 800 more tons of salmon being sold per year from the region, representing about 74 million meals (200 g), leading to 450 more person years and a contribution of 740 mill NOK to the GDP. The total profit for the farmers in the region would increase by about 1 billion NOK and there would be a reduction in mortality of about 6 % (2.7 million salmons).

Hence, the simulations strongly indicates that there is a significant potential in improving vaccines – i.e. the most central disease handling tool, within the Atlantic salmon farming sector, both for the salmon as such, the farmers and the society.

The Use of Complementary and Alternative Approaches to Animal Health on UK Dairy Farms and their Influenced on Antibiotic Use: A Qualitative Study

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Since there is little research to explore the current use of CAM on farms or its impact in reducing antibiotic use, this study provides valuable insights. The topic warrants consideration to; (1) determine if CAM use has potential to reduce unnecessary antibiotic use, (2) ensure that antimicrobials and other conventional treatments are used where appropriate.

20 farms with a range of management systems and herd sizes were recruited. Interviews were conducted with 24 farmers via face-to-face, telephone or videoconferencing modalities necessitated by the Covid-19 movement restrictions. 16 farms were visited to collect observational data using ethnographic fieldnotes and photographs. Interviews were conducted using topic guides and explored participants' experience of CAM and potential influence on antibiotic use. Interviews were audio recorded, transcribed and thematically analysed using NViVo software.
UK dairy farmers used CAM due to their own personal experiences, farmer networks and the sense of autonomy it provided. Contracts with milk buyers and organic guidelines influenced CAM use. A range of CAM information sources were consulted by farmers including, CAM organisations and pharmacies. Farmers associated CAM with holistic health management and animal welfare. CAM formed part of a wider ethos regarding holistic farming and land use. Some farmers valued experiential knowledge of CAM over scientific evidence. Barriers to CAM use included: the perception that CAM approaches were reserved for organic systems, little access to CAM related resources and tensions with other stakeholders' views.
Farmers continue to use CAM, and their conceptualisation of it is complex. Several resources and stakeholders were consulted by farmers to understand CAM and conventional medicine. Farmers interest in CAM warrants open discussion between all stakeholders. This may support dairy farmers to reduce antimicrobial use responsibly, with veterinary support.

Parallel session 7B: Poultry

Estimating costs of notifiable poultry diseases in seven European countries

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Poultry farmers aim to make their activities cost-effective: good production with few losses, which means healthy animals, that comply with the regulations on biosecurity and production standards, thus providing safe food products. In order to understand the economic impact of improving biosecurity, it is necessary to understand the value of implementing adequate biosecurity. Poor biosecurity increases the risks of exposure and within farm circulation of pathogens such as Avian Influenza and Salmonella. In the event of an outbreak, massive economic losses are to expected, but farmers maybe not be fully aware of the cost of such an outbreak in their farm.
In the NetPoulSafe project (https://www.netpoulsafe.eu/) we have followed poultry farms of different categories (layers, broilers, breeders, hatcheries, turkeys and ducks). In these farms, partners are collecting information on all the estimated costs (culling/stamping out/loss of revenue due to empty farms) and compensations provided by governmental institutes (or insurance companies if applicable) when an outbreak of Avian influenza, Salmonella Pullorum, Salmonella Gallinarum and S. Arizonae is confirmed on a poultry farm. These results will be used to create informative dissemination materials (available online), that will target farmers and advisors in each participating country, with up to date estimations of the costs of an outbreak of a notifiable disease, tailored to poultry farms of different categories (layers, broilers, breeders, hatcheries, turkeys and ducks). With such interactive info sheets we expect to increase awareness in farmers and advisors of the consequences of poor biosecurity compliance. Ultimately we expect this will stimulate adoption of adequate biosecurity measures and create a powerful, easy to use simulation tool for farmers to gauge the economic impact of outbreaks of notifiable diseases.

Economic impact of chicken diseases and other causes in backyard farms in low-income and middle-income countries: systematic review and meta-analyses,

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Backyard chicken farming is usually subsistence, thus address food insecurity and poverty. Chicken flocks are raised by families on a low-input, low-output basis with low biosecurity, enabling the incursion of pathogens in the chicken flock and contact with livestock and wildlife. Water scarcity and poor nutrition reduce productivity

and predispose chickens to be more susceptible to disease and disability. These causes of mortality and morbidity contribute to the burden of chicken diseases in farms and, up to now, no research has quantified its economic impact. A systematic literature review was conducted to assess the impact of diseases and other causes in backyard chickens. A protocol following the PRISMA guidelines was developed targeting backyard farms (including free-roaming) and low-biosecurity commercial farms. The search was restricted (1981-2021) and included 10 languages. Only studies that quantitatively assessed the relationship between disease/other causes and, productivity/mortality were considered. Diseases and nutritional issues had to have been diagnosed by an animal professional and/or by laboratory test. Meta-analyses on mortality and an estimation of the economic losses by cause were conducted. Out of the 40,121 studies identified, 83 were selected. Results showed that a limited number of studies were available to assess productivity (weight gain, egg production). Meta-analyses demonstrated that the three main causes of mortality per year are viral diseases (32.3%), a combination of viral and bacterial diseases (22.8%) and predation (21.2%). The three primary sources of economic loss in backyard chicken farms are viral diseases (39.8%), bacterial and viral diseases (26.8%) and bacterial diseases (11.8%). Infectious diseases are thus the main causes of death in backyard chickens and also lead to the highest economic burden. However, non-infectious causes like predation should not be neglected.

Danish egg producers' knowledge, practices, attitudes and perceptions of laying hen mortality,

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Mortality is a widely accepted animal welfare indicator in laying hens, with implications for animal health, productivity and environmental sustainability. Previous studies have mainly focused on quantifying mortality rates in laying hen flocks between production systems, but little is known about how egg producers perceive and act upon mortality and which causes of mortality are considered important. This was also supported by a recent study showing that egg producers' perceived cause of mortality of individual birds rarely corresponded to the pathological findings. Understanding the reasons behind management decisions around mortality may guide further reductions in mortality in laying hens. This study investigated egg producers' knowledge, practices, attitudes and perceptions of mortality in laying hens. We conducted 12 semi-structured interviews with Danish egg producers keeping laying hens in barn/aviary (n=7) or organic production systems (n=5). Data analysis was inspired by a grounded theory approach. Egg producers described their herd mortality as either normal, meaning an accepted part of egg production, or high if more than usual dead hens were collected on a regular basis. Perceptions of normal mortality varied. Egg producers generally found it important to know the cause of mortality, but rarely pursued the reasons behind mortality, when mortality numbers were perceived as normal. The majority perceived the mortality level in their flocks as beyond their control. Several pointed out difficulty in identifying the reason behind mortality in individual birds as opposed to multiple birds found dead at once. We concluded that egg producers in this study have many strategies to combat mortality, but that mortality was institutionalized, making reductions to mortality below the norm challenging. Measures to reduce mortality should take into account the egg producers perceived lack of control and ability to identify causes of mortality in individual birds.

A principal-agent assessment of contract broiler farming and antibiotic use. A case study from West Bengal, India,

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Broiler production is a rapidly growing sector, both globally and within India. However, studies report high levels of antibiotic use in Indian broilers which is concerning given growing concern for antibiotic resistance in animals and people. Contract farming, introduced to India in the late 1980s, has come to dominate broiler production. This study considers the nature of contract relationships and how these may influence antibiotic usage and stewardship development.

We used a principal-agent framework, an economic approach, to examine contract broiler relationships, using West Bengal, India as a case study. This framework focuses on the informational asymmetry between service providers and seekers and the costs needed to avoid aberrant outcomes. Interviews were conducted with stakeholders (n=37) and broiler farmers (n=21), using online and face-to-face interviews. Reflexive thematic analysis, using a blended approach of deductive and inductive coding, was used to analyse data.
Themes generated describe how during contract farming in open housing systems environmental challenges create an incomplete service acquisition-provision relationship. Here, antibiotics, and their alternatives, are used by contract company stakeholders for risk mitigation to create suitable environments for broiler production. Contract farming provides broiler farmers with uncertain opportunities, limited by credit inequality. Farmers appear to value local knowledge and use contract mobility as a tool to navigate uncertainty, though antibiotic use did not appear to be a major part of these decisions.
Efforts to reduce antibiotic use in Indian broilers could look at alternative ways of mitigating production risk, such as bolstering contract company confidence in antibiotic alternatives or providing routes to infrastructural upgrading, such as through access to credit or formation of broiler farmer associations.

What lies beyond urbanisation? Uncovering linkages of poultry production and consumption in urban India

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The consumption of poultry products has increased substantially in recent decades in India. Urbanisation along with rising incomes, foreign influences, and developments in the poultry sector has been flagged as important factors for the change in consumption practice. However, cultural and social factors must be considered to understand consumption completely. Previous studies found that along with income, cultural and intrahousehold dynamics are important barriers to poultry consumption. The rapid expansion of capitalist agricultural processes in peri-urban areas has concentrated production risks linked to the safety of poultry products in cities. However, often these risks are not understood uniformly by consumers with different social backgrounds. Addressing consumption at the intersection between consumer norms and the market poultry provisioning, the paper analyses the linkages of poultry production and consumption in urban Chennai (Tamil Nadu, India), where the poultry market has expanded dramatically. We use data collected between November and January 2021-22 in Chennai via focus group discussions with consumers according to their caste, religion, income, and gender and semi-structured interviews with Indian poultry sector actors. Arguing that consumption has co-evolved with production, the paper devolves into understanding how capitalist urban agriculture developments and economic and social changes have created different consumption outcomes in terms of quantity and safety across different consumer groups. Some of the factors that inform consumption differences in Chennai include changes in systems of provision and stratification of poultry products across the city, incongruous political influences and the surge of misinformation regarding the safety of poultry, and ongoing changes in social connotations attached to poultry products. These findings are crucial to improve consumer protection outcomes along with the Indian poultry sector policy planning.

Thursday, June 15th, 2023

Session 8: Perspectives to behavioral changes in animal health management

Invited talk: Using behaviour change frameworks in endemic disease management

Beth Clark, Lecturer in Food Marketing at School of Natural and Environmental Sciences, Newcastle University, United Kingdom

Understanding stakeholder behaviour is essential for the successful implementation of strategies to improve animal health including endemic disease management. This talk will discuss the merits of applying a behaviour change framework, the Behaviour Change Wheel (BCW), to understanding farmer and farm advisor lameness management in UK sheep, beef and dairy systems. It reflects on how farmers' and advisors' capability, opportunity and motivation (COM-B), at the core of the BCW, might influence lameness management practices in these farming systems, and considers the interaction between these three factors, and between stakeholders. Findings are based on interviews with 29 farmers and 21 farm advisors in the north of England. Results of a thematic analysis were categorised based on the COM-B framework focusing on barriers and enablers of lameness management in relation to capability, opportunity and motivation. Three key areas emerged to improve lameness management on farm: 1) removing physical and social barriers for lameness management; 2) improving psychological capability and motivation for lameness management, and 3) facilitating relationships and developing communication between farmers and their advisors.
The use of a behavioural change framework has provided a useful means of conceptualising the factors and understanding the complexity and underlying behavioural mechanisms that contribute towards the persistence of lameness. In particular, the inclusion of both farmers and their advisors in our analysis has highlighted the value of exploring both farmer and advisor perspectives on behaviour concurrently in the animal health context, with the potential to contribute a better understanding of the challenges and vicious cycles underlying behaviours which inhibit the implementation of recommended lameness management best practice.

Do consumer and farmer preferences on measures to enhance animal health and welfare coincide? Results from two surveys in 9 European countries

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While organic and free-range animal production are often considered to enable high level of animal welfare and citizens have a more positive view of these farming systems than intensive farming, also organic and free-range production have challenges concerning animal health and welfare.
The aim of this study was to identify and compare supply chain actors' (farmers, veterinarians, experts) and citizens' views on animal health and welfare improving measures in organic and outdoor pig and poultry production. The data were obtained via two surveys carried out in nine European countries (Belgium, Denmark, Finland, France, Germany, Italy, the Netherlands, Romania, UK) in 2021. The surveys examines a set of several measures to enhance animal health or welfare and tradeoffs their adoption would involve. The data were summarized and statistical differences concerning the importance of measures were tested,
According to the results, most pig and poultry practices suggested in the surveys were considered both applicable by supply side actors and desirable by citizens. However, for some practices supply and demand side views differed, and also differences between countries were observed. For example, while supply side actors found antibiotic-free production more often inapplicable than applicable, approximately half of the citizens found it desirable. While more than one third of citizens had no strong preference for or against the desirability of several practices suggested to them, supply side actors tended to either clearly favor or object most measures that were tested in the study. The results suggest that the supply of and demand for high animal welfare farming do not

fully match each other. This is because of differences in producers' and consumers' preferences, economic reasons in farming and unambiguous consumer expectations.

Consumer perspectives on animal welfare and food purchasing decisions: an international comparison

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Consumer diets and food purchasing behavior are going through major shifts fueled on one side by environmental and sustainability concerns about the animal husbandry, farm animal welfare scandals, public health challenges, but on the other side also by economic volatility and cost of living concerns. Easy access to information has increased the consumer awareness of various animal welfare challenges, but also has resulted in an overload of often contradictory information. Previous research has demonstrated that while consumers see animal welfare as an increasingly important topic, their understanding of modern farming practices is limited and the attitudes towards animal welfare are often not reflected in their actual purchasing behavior.
The paper focuses on consumer perspectives on what animal welfare aspects consumers prioritize and how those and other factors relate to their food purchasing decisions. The analysis is based on a consumer survey carried out in four countries within the project SustainIT. The data was collected from 4816 respondents in Finland, Estonia, Sweden and Germany on the consumers perceptions on their dietary and food consumption habits and attitudes towards animal health and welfare.
The results indicate that consumers considered the lack of disorders and diseases, lack of pain and suffering, and low use of medication most important aspects relating to animal health and welfare while buying food. The taste and price were the most relevant factors in food purchasing decisions, however, significant differences exist between countries in case of various other factors, and in particular in how much importance is attached to the animal welfare labelling while making purchasing decisions. This is reflected also in significant differences across countries in willingness to pay more for specific animal welfare aspects.

Parallel session 9A: Antimicrobials

Antibiotic supply chain map of the Argentinian beef industry: A mixed methods approach (qualitative and quantitative methods)

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Antimicrobial resistance (AMR) is an existential threat to human health globally. The evolution of resistance mechanisms in pathogenic and non-pathogenic bacterial species is driven, in part, by exposure to antimicrobials. Antimicrobial usage (AMU) in food producing animals represents a large proportion of all AMU. Argentina is the fourth-largest beef producer globally and the largest beef consumer per capita, yet antimicrobial usage in the beef sector and the nature of the antibiotic supply chain or its stakeholders are largely unstudied. The aims of this study were: (1) to map the antibiotic supply chain for the beef feedlot cattle sector in Argentina; and (2) to identify critical access points for data collection. The study used a mixed methodology of qualitative and quantitative methods, including semi-structured interviews with agricultural merchants (n = 8); surveys from farmers (n = 50) and veterinarians (n = 89); a focus group discussion; a review of grey literature; and web mining. The antibiotic supply chain in Argentina is complex, with multiple parallel supply routes via which beef producers accessed antibiotics. Farmers obtained antibiotics through manufacturers, wholesalers, retailers, and veterinarians. Antibiotics were traded without veterinary prescriptions. Veterinarians accessed antibiotics from veterinary pharmacies, manufacturers, and agricultural shops. The macrolide, tetracycline, and beta-lactam ratios were 2:1, making this the most-used antibiotic class. Antibiotics' sales data linked to each farm ID is deemed a feasible access point to monitor antibiotic usage in Argentina. A common objective to maintain the efficacy of antibiotics for humans and animals and equivalence with international competitors to ensure trade access should be a good opportunity to join efforts by the stakeholders in the supply chain to make AMU surveillance possible in Argentina.

Antimicrobial resistance and antimicrobial use in veterinary medicine viewed by companion-animal veterinarians

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Fighting antimicrobial resistance (AMR), one of the top ten global public health threats, requires major improvement of antimicrobial use (AMU) for animal health. Studies on how veterinarians perceive and address this issue have largely focused on food-animal vets. We aimed to investigate the AMR perception and AMU practices of French companion-animal vets (pet vets) and conducted interviews with 23 practitioners of different gender, experience and specialty, in rural/urban locations. Our results show that AMR is a well-known issue thanks to the French Ecoantibio plans but not a major concern for the profession compared to vet shortage or the corporatisation of vet medicine. Most respondents felt that they had "done the job" of reducing AMU although there was still room for improvement. Deliberation during prescription took into account knowledge, the specificity of treated cases, a desire to limit risks and did not ban deviations from recommended or regulated practices. Vets working exclusively with companion-animals (as opposed to with both companion- and food-animals) felt less the role of “guardian of public health”; their decisions regarding AMU were less influenced by clients and economic aspects; their perceived margin for further AMU reduction was lower; and they less feared pharmacologic controls and decoupling of drug prescription and sale. Pet vets were attached to free choice and independence in their treatment decisions. Some AMR control measures advocated by human health actors, such as banning amoxicillin/clavulanic acid for vet use, raised fears of impairing their capacity to heal animals, therefore conflicting with their professional identity. These results will help health authorities balance information/accountability and restriction/repression AMU control measures within companion-animal care, a sector representing 81% of the French vet practitioners and the only one for which AMR has been observed to increase in the last years.

Change in dairy farming practice following a regulation restricting very high importance antimicrobials in human medicine in the province of Quebec, Canada

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Restricting the use of antimicrobials in animals does not only impact the animals, but also producers and veterinarians' daily practice. Therefore, the objectives of the study were to identify changes in dairy farming practices for dairy farmers following the implementation of a new regulation restricting the use of antimicrobials of very high importance in human medicine (3rd and 4th generation cephalosporins, fluoroquinolones, and polymyxins; defined as Category I antimicrobials by Health Canada) in animal production in the province of Quebec, Canada.

Material and methods: 1 year prior to the implementation of the regulation, a questionnaire was distributed to a group of 101 dairy producers from the province of Quebec. A similar questionnaire was distributed to the same group of producers 1 year after the implementation of the regulation. The questionnaires were about antimicrobial use practices in farms.

Results: The results show a significant change in antimicrobial use practices on dairy farms. Following the implementation of the regulation, Category 1 antimicrobials are mainly used after a diagnostic test or after the approval of a veterinarian. Additionally, there is an increase in selective dry cow therapy. Producers are following the veterinarian's recommendations more closely: there is an increase in diagnostic testing, temperature monitoring, and a decrease in systematic treatment of animals.

Conclusion: Our results allow a better understanding of the impacts of a regulation restricting antimicrobials in dairy farms.

Beyond knowledge dissemination and awareness-raising: what are relevant interventions to help farmers reduce their antimicrobial use?

Fanny Baudoin, Erwin Wauters

Social Sciences Unit, Flanders research institute for agriculture, fisheries and food (ILVO), Belgium

In response to the need to reduce antimicrobial use (AMU) in livestock production, the primary focus has been on awareness-raising and knowledge dissemination. Although this has undoubtedly contributed to a substantial

AMU reduction, there have been differences between similar countries or production systems, and in some sectors the reductions have been rather small. This suggests that awareness and knowledge alone are not sufficient to foster desirable AMU practices and that additional interventions are needed. Identification of such interventions can be facilitated through a better understanding of the (contextual) factors that, in addition to end-user's knowledge and perceptions, influence AMU. In this study, we explored such factors (i.e. technical but more importantly structural, social and economic factors) in 14 livestock sectors in 7 European countries, Vietnam and Mozambique. For this, we first developed a heuristic method based on the mission-oriented innovation systems approach to analyse the extent to which actors of a production sector/system were able to carry out important innovation activities given the current state of the case/system, defined by its infrastructures (financial, structural and knowledge), institutions (rules and norms), market structures, networks and actor's capabilities. Data was collected through stakeholder interviews, focus groups and document analysis. In total, more than 70 lock-ins were identified across all cases. Second, we identified common leverage points across cases, related to, i.a., the structure and governance of supply chains, the over-reliance on voluntary measures, the economic decision-making logic of key stakeholders, limited capacity and willingness to radically change production systems when needed, and the perceived low urgency of reducing AMU. Finally, we identified potential interventions and gave examples of how they could be implemented in the case studies

Complying with antibiotic withdrawal periods on smallholding, peri-urban pig farms in Kenya

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Non-conformance to antibiotic withdrawal period (ABWP) guidelines represent a food safety concern for antibiotic toxicities, allergies and antibiotic resistance emergence. In the Kenyan domestic market for pigs, ABWP conformance is not stipulated in government legislation and evidence suggests that non-conformance is common. An evidence-based understanding of the extent to which cultural practices and context affect conformance was sought for pig farms supplying a local independent abattoir (LIA) in peri-urban Nairobi.

Awareness, intentions and practices around conformity to ABWP were examined using a mixed methods approach, drawing upon semi-structured interviews (farmers and government animal health professionals [AHPs]) and focus groups (private AHPs). Thirteen pig farms supplying a LIA were visited weekly for one month and individual instances of antibiotic use were identified and associated practices discussed.

All participants described an awareness of ABWPs and intentions to conform, motivated by caring for others and wanting to prevent harm. Although farmers and AHPs considered conformity to ABWPs mandatory, without government legislation and enforcement, ABWP conformance at the local level currently relies predominantly on farmer goodwill and diligence. Variable local contexts and circumstances, however, mean that, in reality, ABWP practices do not consistently reflect intentions. Identified drivers for possible/ actual non-conformance to ABWPs included farmers' economic difficulties, lack of formal medicine recording, an absence of consistent abattoir monitoring and resource emergency, such as water scarcity on farm.

This study demonstrates the importance of contextual factors to the outcome of compliance with ABWPs. Analysing farmers' awareness and intentions around ABWPs in isolation may not recognise the significance of such factors so effective and meaningful antibiotic stewardship needs to operate within appropriate cultural practices and opportunities.

Parallel session 9B: Infectious diseases

Spatiotemporal drivers of the African swine fever epidemic in Lao PDR

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African swine fever (ASF) is a devastating transboundary disease of swine. Following the first report of ASF in China in August 2018, ASF spread through South-East Asian nations in 2019. Without control and containment measures, ASF can decimate smallholder pig holdings and disrupt value chains. This study aimed to describe the

spatiotemporal spread of the 2019 Lao PDR ASF epidemic, identify environmental and social risk factors, and recommend measures that could reduce ASF spread.
A retrospective spatiotemporal study was conducted at the village level. Information on the date that ASF was first reported from each case location was collected and the outcome variable of interest 'epidemic day' was created. Risk factor information from different sources were extracted for each case location. The association or correlation between epidemic day and risk factors for the spread of ASF were investigated using Kruskal-Wallis tests and Spearman rank correlation statistics.
The epidemic started on June 16 and lasted for 190 days, displaying a right-skewed epidemic curve. The directional distribution was rotated approximately 305°, from Southeast to Northwest Laos. Significant risk factors for ASF associated with epidemic day were location in terms of distance from the closest protected natural area (P=0.02), pig ownership (P=0.005), road networks (P=0.003) and poverty indices (P<0.001). Cases were reported earlier in this epidemic at locations that were closer to protected natural areas, of higher pig ownership, more connected via the national road network, and which experienced elevated poverty.
Recommendations include: improving knowledge of swine value chains to inform disease risk and control; monitoring pig transportation; implementing stricter biosecurity measures on the domestic pig population; and providing biosecurity support and education to smallholder pig farmers in poverty.

The effect of compliance to epidemiological and economic outcomes of FMD control in Thailand

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Epidemiological and economic models have been widely used to evaluate foot and mouth disease (FMD) control measures. However, these models are commonly structured under the assumption that the measure is well executed, while in reality, farmer's compliance is often less than perfect. Here, we used a stochastic between-farm transmission simulation model to study the effect of compliance to FMD control measures. The model was constructed based on FMD outbreak data from two study areas, and the outputs were subsequently analysed in economic analysis. Four FMD control measures, i.e. culling infected farms, ring vaccination, animal movement restriction and infected farms isolation, were assessed. The results show that control measures did not have a positive economic return in a low farm-density area due to small outbreaks in the situation without control. On the contrary, in a high farm-density area, the FMD outbreaks were large without control measures. Given the 100% compliance, all measures could control the outbreaks but resulted in different costs. The animal movement restriction was the most expensive option, while the ring vaccination was the cheapest. Implementing control measures resulted in reducing the costs for non-compliant farms and increasing the costs for compliant farms, except for the ring vaccination which the compliant farms had lower costs than the non-compliant farms. When compliance was very low, the total cost of outbreaks with control measures exceeded the situation without control measures. It implies that farmers might have low incentives since non-compliers gained more benefits, but if more farms became free-riders, the control measures would be ineffective. Therefore, the government needed to focus on farmers' compliance to ensure the success of control measures. The results highlighted the importance of area differentiation and attention to farmers' compliance when designing FMD control measures.

The indirect costs of African swine fever outbreak: A comparative analysis between Scotland and Great Britain

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The indirect costs of African swine fever outbreak have consequences for the pork supply chain but also carry an economic burden on other livestock industries as consumption switches due to changes in supply and the consequent shifts in prices between commodities. Previous impact assessments, however, have mostly been limited to the farm-level or single market analysis. These overlook the impact on other related markets that will be affected from a disease outbreak. In this study we employ time series analysis to examine the indirect cost of a hypothetical African swine fever outbreak on pork meat and other related markets. We used monthly producer and retail prices in our analysis to quantify the costs across the supply chain. This was applied to Scotland and Great Britain as a whole to show how the supply-demand-price interactions and subsequent indirect costs may differ. Our results showed that, in Scotland, pork and lamb producers incur a loss while beef and chicken producers made additional gains, as consumption switched to these commodities. Overall, the net impact on all Scottish livestock markets was negative as gains in beef and chicken markets only offset part of the losses in the pork and lamb markets. These costs ranged from between £1 million and £22 million, depending on the size of the outbreak and whether producer or retail price was used. In Great Britain as a whole, however, pork and

chicken producers incur a reduction in their revenues while beef and lamb producers experience an increase in their revenues. The revenue gains achieved by beef and lamb producers were higher than the losses by pork and chicken producers leading to net positive effect on Great British livestock markets. These net gains were estimated between £115 million and £2.72 billion. We argue that including the indirect costs in the impact assessment of animal health diseases offers more information on the livestock sector as whole and could support additional investment in their prevention. Moreover, our analysis illustrates the severe economic consequences of African swine fever incursions on the pork industry and on the competitive environment of the livestock sector.

Seasonal Cattle Transhumance in Central Myanmar: Farmers' practices and socio-economic factors related to bovine brucellosis.

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In Myanmar, livestock transhumance is a common seasonal practice to cope with local environmental constraints. The central dry zone is characterized by transhumant herds from pastures and water-scarce areas to abundant places. Multiple infectious diseases affect livestock as a result of seasonal transhumance. The country's cattle transhumance, including transhumant practices, access to veterinary services, and farmers' perceptions of infectious cattle diseases, is currently poorly understood. This study was carried out to characterize seasonal transhumance practices and to describe farmers' socio-economic factors concerning the prevalence of bovine brucellosis.

Materials and Methods: 115 transhumant farmers were interviewed cross-sectionally in three parts of Central Myanmar during their presence at the study sites (from July to August 2022). Brucellosis prevalence was determined by collecting blood samples using the Rose Bengal Plate Test. Data were analyzed using multivariate linear regression in STATA.

Main Results: 85% of transhumant farmers' income comes from cattle breeding and 41% move for pasture and water between February and June. Farmers with more experience typically move cattle over shorter distances (minimum 15 kilometers) for longer periods ($p<0.01$). Disasters limit access to veterinary services and training is given to herd owners with farming experience who can attend. Herds with a low cattle density are more likely to have brucellosis, with a prevalence rate of 16.67% ($p<0.05$).

Conclusion: Good access to veterinary services is required for transhumant farmers, as is the establishment of farmers' awareness programs to increase understanding of disease risks associated with livestock transhumance.

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