ISESSAH

2021 Online conference

International Society for Economics and Social Sciences of Animal Health

5th conference

Kuala Lumpur, Malaysia

17th and 18th of November 2021

ABSTRACT BOOK

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Malaysian Agricultural Economics Association

EDITOR PAGE

Proceedings of International Society for Economics and Social Sciences of Animal Health (ISESSAH) 5th Conference 2021

Kuala Lumpur, Malaysia

17-18th November 2021

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CONTENTS

1.0 WELCOME MESSAGES

We want to welcome you to the fifth conference of the International Society for Economics and Social Sciences of Animal Health (ISESSAH). The conference was originally planned to be held as a mix of face to face and virtual based in Malaysia in association with the Malaysian Agricultural Economics Association (PETA). Due to the COVID-19 pandemic it became necessary to have a virtual only meeting. We want to thank you for your patience with these changes. We are pleased about the quality of papers and posters submitted and that so many people have joined the conference.

These are challenging times with a pandemic, emerging and re-emerging diseases and the impacts of climate change. A major driver of these issues is the growing human population and human activities. One of the major activities has been the growth of livestock populations with changing patterns of livestock production, transport, processing and consumption. This has created new challenges with animal health and welfare. The recent focus in human health has been on COVID-19 while animal health continues to struggle with a range of epizootics with particular concern for the spread of African swine fever in Asia affecting the largest pig producing countries in the world. With regards to climate change we have concerns of how climate will change the patterns of disease and how livestock production impacts on climate change. With all these challenges it is easy to forget that people are at the centre – our actions and behaviour are driving diseases and climate change in the Anthropocene world. Therefore, there has never been a greater need for us to understand human behaviour. Pinpointing how our behaviour drives the challenges we are facing is the area of economics and social sciences. This context is needed to set baselines that permit high quality assessments of interventions, again an area for economics and social sciences. There has never been a more important time for us to research the economics and social sciences of animal health and to share our ideas, methods and results on a frequent basis.

We look forward to hearing the talks, viewing the posters and listening to the discussions. In the process ISESSAH will continue to strive to make a contribution towards a safer world.

Jonathan Rushton

President of ISESSAH
University of Liverpool

Nolila Mohd Nawi

President of PETA
Universiti Putra Malaysia

اَلسَّلَامُ عَلَيْكُمْ وَرَحْمَةُ اللَّهِ وَبَرَكَاتُهُ

Salam Sejahtera and Greetings,

On behalf of the Local Organizing Committee in Malaysia, it gives me great pleasure to warmly welcome all participants and our distinguished guests to the 5th International Society for Economics and Social Science of Animal Health (ISESSAH) Online Conference 2021.

Despite the challenges faced due to COVID19, the conference is conducted virtually and will still be an important platform to bring together extension specialist, agricultural economics and social science experts, veterinarians, researchers and, agencies. With the scope "Social science and economics for livestock and aquaculture production, consumption and welfare", we hope 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. Through this conference, we hope to provide opportunities for animal health professionals globally to achieve wider societal benefits from animals in society, as well as, on addressing the current challenges posed by the ongoing economic crisis due to Covid-19.

This year's conference had attracted 65 papers and 100 participants from all over the world. The papers cover a variety of topics from livestock economics, aquaculture economics, veterinary epidemiology and economics, food safety of livestock and aquaculture products and consumer behavior towards livestock and aquaculture products. The achieved results may have a significant impact on our continuous seeking of knowledgeable experience. It is my hope that this conference enhances communication and networking among various stakeholders in the profession and help in nurturing the young generations on their way forward in advancing the field of social science and economics for animal health.

Finally, I thank everyone who have been working very hard in making the event a success. I would also like to apologize for any shortcomings and hope to see you again in the next ISESSAH conference.

وَالسَّلَامُ عَلَيْكُمْ وَرَحْمَةُ اللَّهِ وَبَرَكَاتُهُ

Dr NORHARIANI MOHD NOR
Chairman
ISESSAH 5th International Conference 2021

2.0 PROGRAMME

LOCAL TIME

CONFERENCE ITINERARY

17th November 2021
(Day 1)

08.00 REGISTRATION

08.30 SCIENTIFIC SESSION 1

Session Chairman: Dr. Raden Dikky Indrawan

Retrospective Analysis of African Swine Fever Consequences to Rural Economies and Small Swine Producers in Haiti
Ralph Jean-Pierre
United States

08.50 **Socio-economic evaluation of a voluntary program of antimicrobial use reduction in French pig production: a qualitative approach**
Guillaume Lhermie
Canada

09.10 **From antimicrobial use reduction policy development to practices change: legislative and multilayer analysis of veterinary drug value chain in Vietnam**
Chloé Bâte
Vietnam

09.30 **Is Burkina Faso ready for One Health surveillance?**
Sougrenoma Désiré NANA
France

09.50 **Power, participation and interdisciplinary tension: recent methodological development of participatory epidemiology**
Klara Fischer
Sweden

10.10 **Agent-Based value chain modelling for ex-post economic assessment of antimicrobial use reduction policy**
Ahmed Ferchiou
France

10.30 **Pharma-cartography: navigating the complexities of antibiotic supply to rural livestock in West Bengal, India, through value chain analysis**
Mat Hennessey
United Kingdom

10.50 BREAK

11.00 SCIENTIFIC SESSION 2

Session Chairman: Assoc. Prof. Dr. Nolila Mohd Nawi

Using causal loop analysis to explore pathways for improving dog rabies vaccination in Burkina Faso
Madi Savadogo
France

11.20 **Development of a causal-loop diagram to understand AMU/AMR dynamics and role of interventions in tilapia systems in Vietnam**
Maria Garza Valles
United Kingdom

11.40 **Economic indicators to predict animal mobility in Senegal**
Katherin Michelle Garcia Garcia
France

12.00 **How are AMU-decisions influenced by the system they are embedded in? - an analysis of the Flemish veal and pig sectors.**
Fanny Baudoin
Belgium

12.20 **Estimating the burden of endemic diseases: a Bayesian model illustrated using UK dairy cattle**
Philip Rasmussen
Switzerland

12.40 **LUNCH BREAK**
Poster Presentation

15.00 **OPENING CEREMONIES**
- Doa recitation
- Opening remarks by ISESSAH 2021 Conference Chairman
- Welcoming speech by President of ISESSAH
- Officiating speech by UPM Deputy Vice Chancellor (Academic and International)

15.30 **KEYNOTE SPEECH**
Session Chairman: Prof. Jonathan Rushton
Economic perspective of food safety in food security: trade-off or convergence in emerging economies
Prof. Datuk Dr. Mad Nasir Shamsudin
Professor of Agricultural and Resource Economics, Universiti Putra Malaysia

16.20 **The role of economics and social sciences in the management of a disease crisis**
Prof. Dr. Henk Hogeveen
Professor of Animal Health Management, Wageningen University

17.15 **SCIENTIFIC SESSION 3**
Session Chairman: Prof. Jonathan Rushton
Evaluating economic performance and antimicrobial consumption in French broiler production: improved healthcare management as a win-win strategy
Youba Ndiaye
France

17.35 **Understanding the uptake of diagnostics for sustainable roundworm control by European dairy farmers: a multi-country cross-sectional study**
Fiona Vande Velde
Belgium/Norway

18.00 – 19.00 **ISESSAH Annual General Meeting**

END OF DAY 1

CONFERENCE ITINERARY

18th November 2021 (Day 2)

LOCAL TIME

08.30 — SCIENTIFIC SESSION 4

Session Chairman: Dr. Ir. Etih Sudarnika

Western Canadian dairy farmer perspectives on the role of various stakeholders as they relate to the provision of outdoor access
Anne-Marieke Smid
Canada

08.50 — **An update on adoption pathways for improved livestock supply chain systems in Australia**
Elizabeth Jackson
Australia

09.10 — **Relationship between disease risk and the perceived human and animal impacts of livestock quarantines**
Ashley F. Railey
United States

09.30 — **Policy Mixes to Control Anti-Microbial Resistance in Livestock Production: A Comparative Analysis of National Action Plan Implementation in Relevant Countries**
Massimo Canali
Italy

09.50 — **Modelling the economic performance of small ruminant pastoralists herds in Kajiado county, Kenya**
Jean-Christophe Arnold
United Kingdom

10.10 — **Determination of input-specific technical inefficiency in relation to dairy cattle longevity**
Ruozhu Han
Netherlands

10.30 — BREAK

Poster Presentation

11.00 — SCIENTIFIC SESSION 5

Session Chairman: Assoc. Prof. Dr. Norsida Man

The economics of zoonoses surveillance in traded wildlife: insights from a game theory model
Alexis Delabouglise
France

11.20 — **Personality and attitudes of farm managers of large-scale commercial dairy farms correlates with cow longevity and culling rates**
Triin Rilanto
Estonia

11.40 **Livestock production losses attributable to brucellosis in Northern Tanzania**
Ângelo Joel Mendes
United Kingdom

12.00 **How immediate delousing effects growth of farmed Atlantic salmon?**
Cecilie Walde
Norway

12.20 **Medical practice and/or economic practice? Antibiotic use in veterinary medicine**
Nicolas Fortané
France

12.40 **LUNCH BREAK**
Poster Presentation

15.00 **KEYNOTE SPEECH**
Session Chairman: Dr. Ir. Wilma Steeneveld
Pigs, pests, people, poverty and their entanglements: why interdisciplinary collaboration is needed in African swine fever research
Dr. Erika Chenais
Veterinary Epidemiologist, Swedish National Veterinary Institute

16.00 **SCIENTIFIC SESSION 6**
Session chairman: Dr. Ir. Wilma Steeneveld
Estimating the effects of bovine viral diarrhoea virus-free program on the gross margin of Dutch dairy herds
Xiaomei Yue
Netherlands

16.20 **Application of multi-actor farm health approaches for the improvement of antimicrobial use practices across nine European countries**
Helena Cardoso de Carvalho Ferreira
France

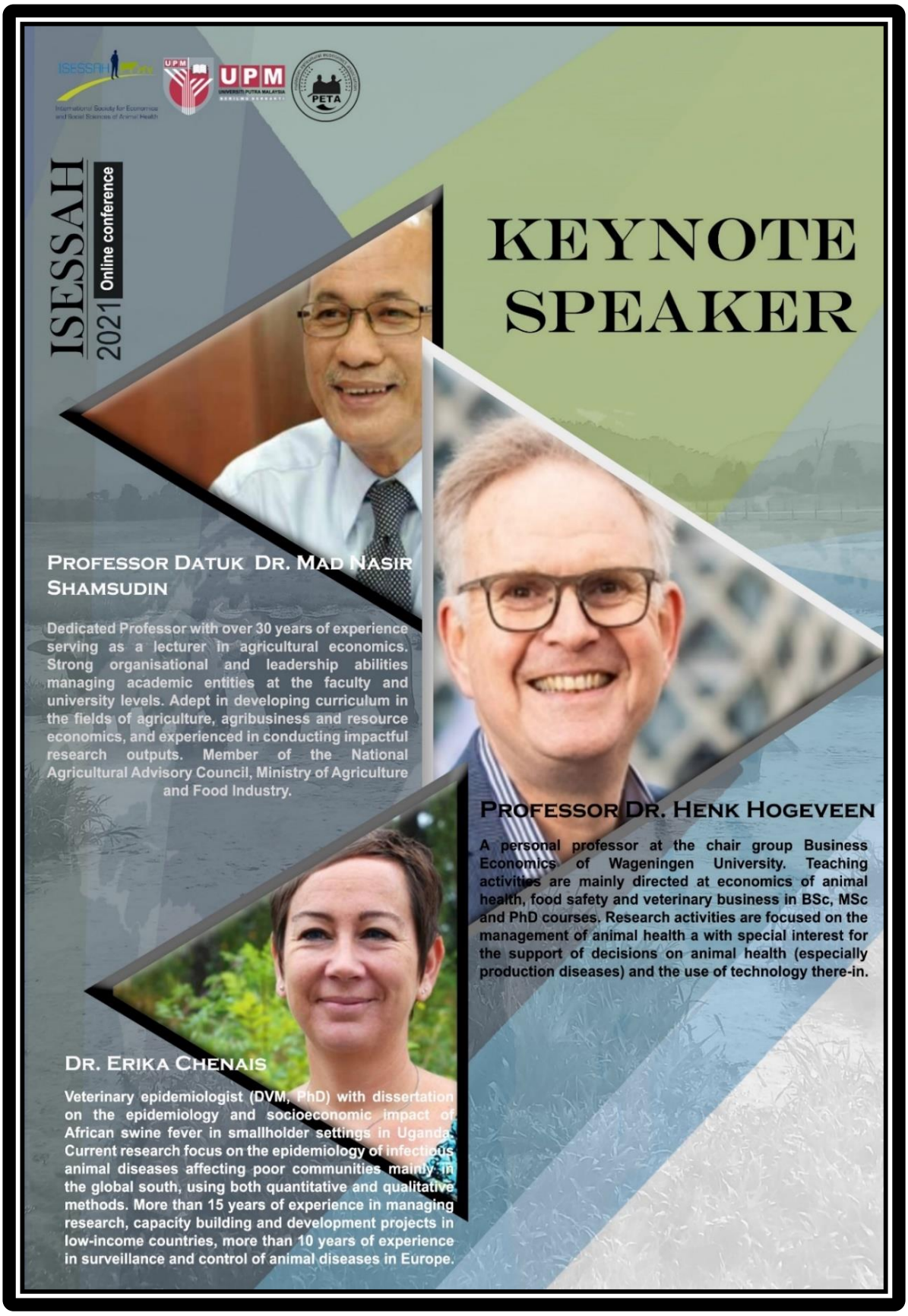
16.40 **What guides the ecological management of animal health? A categorization approach of the advisory networks built by dairy farmers**
Eulalie Ramat
France

17.00 **Participatory evaluation to strengthen public-private partnerships in the veterinary domain**
Poupaud Mariline
France

17.30-18.00 **CLOSING CEREMONIES**
- Closing Remarks by President of ISESSAH
- Best Oral Presentation/Best Poster Presentation
- Virtual Photo Session

END OF CONFERENCE

3.0 KEYNOTE SPEAKERS



Economic Perspective of Food Safety in Food Security: Trade-off or Convergence in Emerging Economies

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Faculty of Agriculture, Universiti Putra Malaysia

The challenge of food security is to assure that all people have access to enough food to lead productive lives, but an integral part of food security is assuring that the food is safe from a chemical, physical or biological risk. Food safety is thus receiving more attention as the links between food and health are increasingly recognized, at the same time, as food trade expands throughout the world, food safety has become a shared concern among both developed and developing economies.

Efforts to improve food safety in emerging economies, however, must be evaluated in terms of their impact on additional costs and returns to farmers, risk reduction, demand by middle-class consumers, food security, poverty alleviation, export earnings, economic gains for the domestic industry, and positive spillovers for food safety in the domestic food system. This will require policymakers to develop better capacity for evaluating policy trade-off as they seek to enhance food security or to expand food trade.

Other than a public health issue, food safety is also economic and market development issues. But a major concern by the emerging economies, including Malaysia, is the financial implications of maintaining acceptable levels of food safety. The negative effect of food safety, however, can be substantial in terms of loss of export market, fall in domestic sales, changes in consumption, large expenditure, and cost of changes in farm practices. Thus there is a trade-off between safety and costs. How much safety can be expected? There must be at an optimum level of safety, which is at the socially acceptable level of optimality.

It would be, however, impossible to provide a risk-free food supply. Since there are costs associated with increasing food safety, society must decide how much, if any, it is willing to spend on food safety and where this expenditure will have the greatest impact. The optimum level for food safety would be where the marginal cost of creating one more unit of food safety equals its marginal benefit. The marginal costs would be the costs to food processing plants to meet new food safety plans and the cost of government programs aimed at educating consumers, retailers and food service workers about safe food handling. The marginal benefits are the reduced illness and mortality associated with a safer food supply.

There are several factors in which a market economy can "fail" in providing the optimum - asymmetry in knowledge of risks, aspects of food safety which are public goods, existence of externality, social costs of food safety, and may be the divergence between scientific evidence and consumer perception. Supply and demand analysis is also further complicated by the fact that safety attributes are not usually directly observable by consumers, and often are either not observable to producers or observable by them only at a cost.

There are also potentially significant externalities associated with the impact on human health. These health effects will be dependent on the safety of the product, on one hand, and any potential beneficial effects on health (for example the nutritional value of the food) on the other. The key issue here is the extent to which the costs associated with human disease, for example health care and loss of productivity, are borne by society as a whole rather than the individual consumer. To the extent that these costs are borne by society, it is unlikely that the supply and demand functions will fully embody the economic consequences of the consumption of the food.

Currently, the market provides few incentives for producers to provide levels of food safety beyond those mandated by government regulations, or to offer the public other than the most rudimentary information about the safety of their food product. The cost of having products linked to outbreaks of food-borne illness, both to reputation and sales, provides some incentive for producers to ensure the safety of their products. However, the complexity of the process whereby food travels from farm to table makes warranting food safety risky business for producers. The liability associated with claims of perfect safety, if proven false, is a significant disincentive for producers to advertise their food as "safe." Constrained from advertising "safe" food and thus reaping market rewards, producers have no vested interest in making information about the safety of their food product more available to consumers.

Most government regulations will have some type of economic effect on producers and consumers. Regulations governing how food products, for example meat and poultry, are produced can raise costs of production. Regulations require resource commitments which, in turn, may raise costs and product prices. On the other hand, the regulations, which improve the safety of the food supply, will generate benefits for consumers by reducing the number and severity of food-borne illnesses.

Consumers would be more willing to buy the food products, since they are now getting a safer good for their money. This represents a shift out of the demand curve, with consumers now willing to buy more of the safer food and to pay a higher price. However, the individual consumer is not able to capture all of the benefits of having the safer food; some of these benefits go to society. Therefore, in some cases, consumers might not be willing to pay as much as it costs for the product to meet the most socially beneficial safety standard. In such cases, the net effect would be a decrease in sales with a higher price, although this higher price better represents the true cost of supplying the food product with the higher level of food safety. Thus from the economic perspective, with market failure, there is convergent to the social optimality with appropriate government interventions.

Food safety issues are also becoming increasingly important in international trade. As countries begin to lower agricultural tariffs and become increasingly integrated into world markets, they purchase more food from abroad. With the improvement in consumers' income, they also focus more on the attributes of their food, its safety, nutrition, and environmental friendliness. Increased income is translated into willingness to pay for such characteristics. With this trade development, the food safety presents a challenge to food suppliers in developing countries to have access to export markets. The process of adaptation by the developing countries to standards and expectations originally set for developed country consumers, however, could potentially bring benefits in emerging economies.

Looking to the future, the growth in demand within developing countries for highly valued products, such as meat, fish, and horticultural products, will increase the returns to improved food safety for both domestic producers and consumers. The perishable high value food products that most often give rise to safety concerns will become important building blocks of South-South trade. But the benefits from food safety improvement will only be captured if policymakers in developing countries understand both food safety risks and their impact on public health, and the synergies between development of the domestic food system and food export industries. In addition, developing countries must establish processes for food safety policy development that are inclusive, in that they take into account the interests of many different groups, and competent, in that they are based on the best available information about the magnitude and distribution of benefits and losses.

Governments can take a number of policy initiatives to induce producers to provide higher levels of food safety. Governments could, in theory, tax unsafe food, raising the firm's costs of providing unsafe food, and therefore creating an incentive to provide safer food. However, this assumes that the amount of unsafe food that is sold can be measured, which would be difficult. Most governments, therefore, turn to regulations, setting minimum safety standards that food producing firms have to meet before they can sell their products. Basically, this is an attempt to increase the amount of food safety provided by the market, as the market alone will usually not provide the socially desirable level of food safety. Regulations can specify particular processes that a firm must use to produce food, or they can simply specify a level of safety for the final food product. The latter are generally considered more efficient, as they allow the firm to select the least expensive method of arriving at the desired product. As the food system has grown complex, however, safety can no longer be managed solely through reliance on command and control regulations. There is also a desire to rely more heavily on performance standards and other approaches that allow firms flexibility in how they achieve public health, economic and trade objectives. Thus, increasingly, it is recognised that several stakeholders have a role to play in the successful implementation and operation of a food safety control system. These include agricultural producers, food industry, importers and exporters, industry organizations, academic, and research institutions.

Other measures that the emerging economies can initiate includes capacity building to participate in the international forum that allows them to engage in and influence regulations governing food safety and negotiate market access. Investments in infrastructure, which is a public good, such as the development of rural sanitation and water supply infrastructure that support better hygiene at the beginning of the food supply chain as well as marketing infrastructure can also improve food safety. These kinds of public sector investments can also set the stage for better export market performance.

In conclusion, the food safety initiatives, due to the externalities, seem to be a divergent from social optimality, implying that there is a trade-off between improvement in safety and costs. However, the benefits from food safety in terms of public health, economic returns and trade market access, with regulated markets, there is a convergent between food safety and costs, implying that the food safety initiatives are socially optimal.

The Role of Economics and Social Sciences in the Management of a Disease Crisis

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In the past decades, the world has seen a large number of larger or smaller contagious animal disease crises. In order to successfully eradicate or mitigate these diseases, it is clear that knowledge from the fields of (veterinary) microbiology and epidemiology is essential. Without proper diagnostic methods and knowledge on the behaviour, source and transmission of causing pathogens, it is impossible to identify measures of control and to design programs of control. However, besides knowledge from the natural sciences, in order to successfully mitigate animal disease outbreaks, economic and social knowledge is also essential, a lesson illustrated by the societal challenges surrounding the Covid-19 outbreak. However, often it is unclear what the added value of the social sciences is in the planning and execution of animal disease mitigation programs. The social sciences consist of a large number of various disciplines each with their own theories, models and methods. Without pretending to be complete, in this presentation, the various disciplines and their usefulness for animal disease crisis management will be described.

Crisis management

Management of animal health disease outbreaks can be seen as crisis management. Although the crisis activities during an outbreak generate most interest, crisis management is much more than that and contains a number of activities (Figure 1). Proper crisis management contains of 1) the design of activities to prevent the occurrence of a crisis or to reduce the severity of a crisis (prevention); 2) the development of plans to control a crisis in case of an outbreak (preparation); 3) The activities to mitigate the outbreak when it actually occurs (response); and 4) activities to recover from the outbreak (crisis recovery). During each of these 4 stages of crisis management social sciences can play an important role.

Figure 1. Crisis management cycle (Boin et al., 2005. The politics of crisis management: Public leadership under pressure. Cambridge University Press).

Social sciences

According to the European Science Foundation, the social sciences are those scientific disciplines that examine and explain human beings. This encompasses a wide range of activities, from understanding how our mind works as to how societies function as a whole. There is no consensus about the various disciplines within the social sciences, but often the following disciplines are mentioned: Anthropology, Communication studies, Economics, Education, (human) Geography, History, Law, Linguistics, Management studies, Political sciences, Psychology and Sociology. The boundaries between these various social science disciplines are often difficult to draw, but a number of these disciplines are important in animal disease crisis management. Of all these disciplines, it is the discipline Economics that has been applied to animal disease crisis management the most. The applications of other social sciences disciplines to animal disease crisis management is much more scarce and scattered.

Economics

Economic studies have been carried out for all elements of animal disease crisis management. After or during animal disease outbreaks, often studies on the "cost of disease" are carried out. Frameworks on how to describe the costs of disease are developed. Often these types of studies have a narrow focus towards the direct costs of disease because it is much harder to study the indirect economic effects such as change in prices. Moreover, studies on the costs of measures to prevent and control animal disease outbreaks vs the benefits (tangible or intangible) are quite common and used by stakeholders to decide on the level of prevention to be applied. Quite some work has been done on animal disease prevention, especially regarding biosecurity at the regional and farm level. Moreover, economic studies are known in the value of surveillance programs and on the optimization of the intensity of surveillance programs. Although from all disciplines in the social sciences domain, economics is the discipline that is applied the most in the management of animal diseases, the total number of studies is still relatively small compared to studies from the natural/veterinary sciences.

Communication studies

This is a social sciences discipline that is mentioned quite often, especially when discussing voluntary measures. Communication sciences encompasses a wide range of topics. Interestingly, studies on communication sciences have been applied relatively much regarding the management of endemic, production diseases, rather than epidemic contagious diseases. Especially linked to face-to-face communication in farm-advisor consultancy situations. Regarding more epidemic animal diseases, it is often foreseen that measures are mandatory and that communication is therefore "just telling that a measure has to be taken". But also then, proper communication may assist in a higher level of compliance and its effect is important. Therefore, in all aspects of animal disease crisis management, we need to think on the aspect of communication. An important part of aspect in communication research is the evaluation how animal disease actors react to certain forms of communication. Therefore, we should learn during outbreaks and apply this knowledge in the stage of preparation and response. Moreover, in order to improve the compliance of actors to preventive measures, proper communication should be brought in place. The position of various communication channels is hereby important.

Management studies

An interesting social sciences discipline are the management studies. As crisis management framework introduced before comes from this social sciences discipline. Management studies is aimed towards optimal administration of an organization. Organizations can be have very clear boundaries (such as a company) or have much more fuzzy boundaries, as is the case in the animal disease crisis management organizations. These consist of a large number of stakeholders and actors who are not necessarily hierarchically connected to each other. Not too much research has been carried out on improved organization of animal disease crisis management. Using knowledge from other social sciences, in the animal disease outbreak preparedness activities, the development of effective organization of animal disease outbreak response activities does deserve attention. Moreover, the research field supply chain management should contain outbreaks of animal disease in the supply chain into account.

Psychology

A large part of the research discipline of psychology is aimed at the study of mental processes under various circumstances. Psychology is often linked to mental illnesses. However, an important part of the discipline of psychology is aimed at explaining the behaviour of individuals under various circumstances: the field of social psychology. A large part of the Economic theory, in general, tries to explain human behaviour, for instance based on utility theory where human behaviour is seen as carrying out those activities that maximize the total utility of those actions, given the constraints in resources that actors have. When looking at the behaviour of farmers, often it was assumed that maximizing utility was equal to maximizing profit (because farms are businesses). However, we learned that the activities of farmers are often not economically rational. It is here where social psychology comes in to place in order to understand farmers' decision making. Quite a large number of studies, have been using theories, such as the theory of planned behaviour, and methods from the field of social psychology in order

to explain farmers' behaviour or to predict future behaviour. Studies that are often presented under the heading of "behavioural economics".

Sociology

In the field of social psychology, the behaviour of individuals is studied, trying to explain and predict the behaviour of individuals and sometimes aimed at finding measure how to steer the behaviour of individuals towards a direction that is seen as useful, e.g., to take preventive measures to reduce the probability of disease introduction. Sociology is merely studying the society as a whole, seeing the society as a system. Interesting methods from this discipline are linked to social network analysis, studying the interaction between individuals in a social network regarding disease management.

Concluding remarks

Animal disease crisis management contains a number of activities. The large majority of research aimed to improve animal disease crisis management is focussing on the natural sciences, sometimes combined with an economic analysis to get insight in the cost-effectiveness of proposed measures. It is, however, of crucial importance that we have insight in the (expected) behaviour, including drivers of that behaviour, of actors in animal disease crisis management. In order to obtain that insight, it is important to include social sciences other than economics. These social sciences should be empirical, learning from previous animal disease outbreaks and experimental approaches. But the insights gained from those empirical studies should be integrated in predictive studies to enable decision makers to get insight in potential behaviour of actors when their ideas around animal disease crisis management would be implemented. There is a wide range of theories, models and methods from the various social sciences disciplines that can be used to improve decision making regarding animal disease crises. In this contribution only a limited overview is provided. Because of the immense depth and width of the social sciences, it is important that in these types of studies, experts from those research fields should be invited in the research team. We need to ensure that truly interdisciplinary research teams are working on the research questions at hand. Moreover, in order to help the natural scientists to understand the importance of the various social sciences, we should work on a portfolio of showcases that we can use to explain and illustrate the various approaches from the social sciences.

Pigs, Pests, People, Poverty and Their Entanglements: Why Interdisciplinary Collaboration Is Needed in African Swine Fever Research

Dr Erika Chenais*
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The influence of human actions on animal disease epidemiology is increasingly recognized, with human behaviour often acknowledged as a driver of disease transmission. So far, most focus in veterinary epidemiology has been on changing identified risk behaviour, not on understanding the contextual, societal and systemic factors that determine the actions people can take. It is however becoming evident that understanding such societal factors is of paramount importance. Public health examples of the same can be found in the COVID-19 pandemic, where large differences in disease incidence between social groups have been attributed to e.g. information efforts having unequal reach, cultural preferences and behaviour within particular groups of people, and in the 2014-2015 Ebola epidemic where understanding of local culture was critical for achieving control. Better knowledge of factors that govern the daily realities, needs and decisions of animal owners will promote a paradigm shift in animal disease epidemiology, leading to better disease control. This key-note presentation will focus on a disease with global spread for which better understanding of the local sociocultural, economic and political dimensions of animal keeping and disease transmission is essential for achieving sustainable control: African swine fever (ASF).

ASF is a lethal, viral fever of domestic pigs and European wild boar. Since 2007 an ASF epidemic is ongoing in Europe and Asia, recently reaching also the Americas. In most situations, human activities drive ASF spread, and disease propagation can be hindered by consistent application of basic biosecurity. Consequently, farming systems with low levels of biosecurity such as smallholder farming pose risks for ASF spread. Smallholder pig farming is frequent all over the world, providing livelihoods for many poor and marginalised people. The difficulty of controlling ASF in low biosecurity-smallholder systems constrained by poverty results in a dual problem of disease transmission and disease induced poverty traps. To prevent ASF transmission in these systems, attention needs to be given to context-specific systemic factors influencing pig farming choices and local disease epidemiology, and to particular constraints resulting from poverty. This can only be addressed using transdisciplinary, participatory research methodologies combining different disciplines of social science and veterinary epidemiology.

4.0 SELECTED SPEAKERS

Retrospective Analysis of African Swine Fever Consequences to Rural Economies and Small Swine Producers in Haiti

Ralph Jean-Pierre

After thirty-seven years of African Swine Fever (ASF) eradication on the island, the Dominican Republic confirmed the first cases of the disease on July 28, 2021. Although both the Dominican Republic and Haiti officially eradicated ASF in the 1980's, the socioeconomic effects of the outbreaks persisted decades later. ASF infection caused substantial consequences to the Haitian swine industry, through high mortality rates, strict culling policies, and international market restrictions that affected pig farmers and other stakeholders. We have developed a Haitian pig sector model (HPM) to assess the long-term impacts of eradication and repopulation strategies from the 1980's outbreaks on pig availability and producer's income.

HPM is a three-sector, four-region, partial equilibrium model that investigated the dynamics of traditional pigs, commercial pigs, and maize (used as food and feed) in Haiti, the Dominican Republic, the rest of the Caribbean, and the rest of the world. The model quantified the dynamic effects of ASF-related shocks in these sectors using data from 1977 to 2009. Income and population changes were the primary elements that influence variations in the model over time.

The baseline "no-ASF" scenario projects swine economic conditions to reflect the pre-ASF industry increasing trends. In 1977, live pig production in Haiti grew by an average of 9.68% for 5.26% increase in meat processed, population and per capita income slightly increased respectively by 2.02% and 0.78%. We compare this baseline scenario to ASF-induced demand and supply shocks to assess the cost-effectiveness of control measures, repopulation strategies, and Haiti's path to development. Preliminary results suggested that Haiti's 1977 swine population dropped by more than 50% six years after ASF detection. Despite repopulation initiatives, the country failed to reach pre-ASF pig production levels until 2005. The rural population, mostly small pig farmers, lost a significant portion of their savings and fled the agricultural sector. In the 25 years after ASF eradication, rural share of Haiti's total population decreased by 21%. The recent ASF discovery on the island of Hispaniola reinforced questions regarding the cost-effectiveness of 1980's eradication procedures and appropriateness of repopulation strategies both for animal health and producers' livelihoods.

Socio-Economic Evaluation of a Voluntary Program of Antimicrobial Use Reduction in French Pig Production: A Qualitative Approach

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Introduction

The French government implemented in 2011 a 5-year voluntary program (Plan EcoAntibio) aiming at reducing antimicrobial use (AMU) in animal production. Our aim is to evaluate its socio-economic effects in the pig sector, which experienced a 20% AMU decrease over the period.

Material and methods

We first draw a stakeholder map and identify indicators to track the effects of the program on all the actors of the value chain. We then conduct a semi-structured interview, designed to gather information regarding 6 evaluative questions: 1. effects of the program on the different actors (evolutions of practices, actors games, structural effects); 2. Effects on farm revenue, 3. Effects on other supply chains; 4. Acceptability and most influential measures; 5. Effects on pig health; 6. Effects of alternatives to antimicrobials.

Results and discussion

33 stakeholders were interviewed between January and April 2021. 6 out of 33 declared that the program contributed to AMU reduction. Yet, 26 pointed that an ongoing dynamic, started earlier with private initiatives, and concomitant policies likely explained the success of the program. Technical effects appear moderate: the plan likely amplified the implementation of vaccination and biosecurity programs, and transition towards higher-quality diets. No structural modifications were observed, and relations between stakeholders in the pig sector did not change or were strengthened. The plan had no significant impact on the pigs' growth and the stakeholders' income. Ultimately, the program provided a public space and encouraged the implementation of regulations of AMU.

Implications

Conducting a retrospective evaluation of public policies helps in better design effective programmes targeting AMU reduction. A quantitative retrospective evaluation of the relative contribution of a voluntary program remains complex, due to the difficulty to design a counterfactual scenario. Yet, we showed that the Plan EcoAntibio did not affect in depth the economics of the pig sector. Whether a new program will have similar effects is difficult to say, as the dynamic of AMU reduction seems to plateau. The marginal costs of reducing AMU are likely to be higher in the current setting than at the onset of the first program in 2011.

From Antimicrobial Use Reduction Policy Development to Practices Change: Legislative and Multilayer Analysis of Veterinary Drug Value Chain in Vietnam

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In response to the threat of antimicrobial resistance (AMR) and the call of the Tripartite Organization (WHO, FAO, OIE), Vietnam has introduced new regulations to reduce the use of antimicrobials (AMU) in livestock production. However, it is not clear how these regulations are understood and implemented by the different stakeholders. This study aims to identify the position of the stakeholders in the veterinary drug value chain in relation to the change of legislation.

An iterative stakeholder mapping and analysis was conducted in several steps. First, we carried out a chronological review of Vietnamese national legislation on AMU. Then, we led a focus group discussion (n=12 participants) to outline the drug value chain and identify the actors involved along with the nature and strength of their interactions. Finally, we conducted individual semi-structured interviews (n=25) to explore the position of these actors towards the national strategy as well as the barriers and motivations for its implementation.

The mapping of the drug value chain and the characterization of stakeholders allowed us to identify the presence of a formal and informal antibiotic network. Relationship between public and private actors are mostly one-sided and related to control measures from the responsible authorities. But private partners were also consulted on law design. All stakeholders were aware that AMR is a problem in Vietnam. They agreed that the legislative strategy developed by the government is a good strategy but difficult to apply in the short term. A practice of self-administration facilitated by an easy drug access and scarce on-farm control, combined, with a profit-orientated way of farming led farmers to disregard the laws.

The development of effective legislative strategy requires communication and collaboration between authorities and private actors including local veterinarians. Better law enforcement, stricter penalties and better control on antibiotic access need also to be applied through improved technical capacities. We believe that access and communication on alternatives medicines must be promoted to achieve an effective AMU reduction. These set of recommendations need to be combined and further discuss with all involved actors through a transversal participatory process.

Power, Participation and Interdisciplinary Tension: Recent Methodological Development of Participatory Epidemiology

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Participatory epidemiology (PE) was initially developed in veterinary epidemiology research for collecting epidemiological data in contexts where conventional quantitative data are unavailable. PE has been praised for its capabilities to engage participants, visualize data, and enable people with no or low levels of formal education to communicate their knowledge in ways that researchers can relate to. PE has however struggled with striking the balance between embracing the participation of local participants and providing data that are accepted and publishable in veterinary epidemiology journals.

This abstract summarises findings from a recent article collection about the methodological development of PE. The articles in the collection make evident that PE now benefits from an unquestioned position along with other methods in veterinary epidemiology, allowing attention to be spent on other methodological aspects than fighting for its scientific validity. Flexibility in the use of PE tools and novel application of PE is found to enhance the possibility to reach marginal groups, promote openness to local knowledge and be of use to triangulate findings. The issue of power in participation is addressed, elaborating on how the tradition of collecting group answers undermines marginal perspectives. The mode and level of participation, and to what extent findings are relevant and meaningful to local participants as well as to the research community is reviewed. Challenges and benefits of interdisciplinary work in animal health are discussed and interdisciplinary collaboration is found beneficial for improving the understanding of cultural context and underlying reasons behind epidemiologically important risk behavior.

The article collection makes clear that contemporary PE is increasingly interdisciplinary, and that methodological experimentation and reflection have led to the embracement of methods outside the traditional PE toolbox. The advancement of PE has led to a vibrant debate about power and participation, but also the revealing of tensions in interdisciplinary work.

Moving forward, the next step in the methodological development of PE would be to call for more, and above all true, interdisciplinarity, from project formulation and implementation to publication. This will lead not only to methodological development but more importantly, to research outputs that are of higher local relevance *and* hold better scientific quality.

Agent-Based Value Chain Modelling for Ex-Post Economic Assessment of Antimicrobial Use Reduction Policy

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Resulting from the mobilization of a multitude of players, France was one of the first European countries to put in place voluntary regulatory measures aimed at reducing the use of antibiotics in livestock farming. The objectives of the Ecoantibio1 plan were achieved and exceeded in 2016, however, efficiency evaluation of the policies put in place is complex because policies were multi-objective and concern interdependent strategic sectors. The pork sector is chosen as the analysis scale for this economic evaluation because it is the most standardized in terms of the use of antibiotics and for which an appellation "without antibiotics" has been developed. To assess the efficiency of the Ecoantibio plan on the sector, a multi-agent bioeconomic mathematical programming model representing the pork sector was developed under Python. The model represents the main players in the sector and their interactions and makes it possible to (i) distinguish the classes of antibiotics (critical and non-critical) and their types of use (systematic, metaphylaxis, curative, etc.) through technique-sanitary farm management matrices (ii) represent the different physiological of animals associated with highly variable uses of medicinal inputs through a state machine for driving bands (iii) and simulate regulatory and voluntary measures (via learning actors). The simulated actors are breeders (different systems), cooperatives, veterinarians, service boxes, the pharmaceutical industry and consumers. The voluntary change in practice can take place in the model by confronting, on the one hand, the persuasiveness of veterinarians, general awareness (networks and spots) and attractiveness through market differentiation of products; and on the other hand through a factor of receptivity and opportunism of the breeders.

The simulations were carried out throughout the plan (week step) and the model was validated by producing the consumption by the family of antibiotics before the period of the ecoantibio1 plan, the level of production of the entire sector throughout the plan period and reducing animal exposure to antibiotic families at the end of the Ecoantibio plan period. The preliminary results show a low economic impact of the reduction in the use of antibiotics on the income of farmers. these results were compared in the field and are consistent with the results of surveys carried out among pig producers.

Pharma-Cartography: Navigating the Complexities of Antibiotic Supply to Rural Livestock in West Bengal, India, Through Value Chain Analysis

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Antimicrobial resistance threatens the provision of effective healthcare and livestock production worldwide with predicted negative socio-economic effects. Antimicrobial stewardship is of particular importance to the people of rural West Bengal, India, who face high burdens of bacterial diseases, and depend on agriculture as a source of food and income.

We used a value chain analysis approach to investigate how relationships, behaviours, and influence are established and governed during antibiotic distribution. Interviews were conducted with key informants (n=17), value chain stakeholders (n=22), and livestock keeping households (n=36) in Kolkata, and two rural sites Noorpur and Rangabelia, India. Value chain mapping and thematic analysis were conducted. A framework for assessing power dynamics, based on the identification of power types operating in value chains was applied to interpret key findings and identify entry points for antibiotic stewardship.

Three value chain maps were developed; one showing the flow of antibiotics from manufacture to stockists; and two local level maps showing distribution to final consumers in the two study areas. The maps show that antibiotic distribution occurred through numerous formal and informal routes, many of which circumvent antibiotic use legislation – demonstrating a lack of institutional power to govern antibiotic use. This was partly due to the limited access to veterinary services and limited availability of antibiotics through the public sector. A 'veterinary lacuna' existed resulting in livestock keepers having higher reliance on private and informal providers, who often lacked legal mandates and formal training to prescribe and dispense antibiotics. Many antibiotic prescribers also lacked access to stewardship guidelines and instead relied on the demonstrative power of more experienced prescribers to guide antibiotic use.

We argue the absence of robust institutional power to govern value chain activities makes attempts to curb informal prescribing unsustainable and risks negative impacts on both human and animal health. Recognising the role of informal antibiotic prescribers in livestock healthcare provision and antibiotic access and engaging all actors in stewardship interventions may help to build the level of constitutive power – the accepted norms, conventions, and best practices – operating in the value chain and help improve the quality of antibiotic use.

Development of A Causal-Loop Diagram to Understand AMU/AMR Dynamics and Role of Interventions in Tilapia Systems in Vietnam

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Indiscriminate antimicrobial use in aquaculture to treat and prevent disease leads to the emergence of antimicrobial resistant (AMR) microorganisms with potential detrimental impacts on connected ecosystems and public health (1). Vietnam has been reported as one of the top users of antimicrobials in aquaculture while utilising a wide variety of interventions with potential effects on antimicrobial usage (AMU) and AMR (2). Barriers to implementation and uptake have been described, however, the effect and interactions of these interventions as well as the social and economic drivers of AMU in the systems is not understood. This study aimed to understand the multidimensional impacts that AMU drivers and AMR interventions may have in the aquaculture system through the application of systems dynamics approaches. A causal-loop diagram of tilapia systems in northern Vietnam was developed using interviews and group model building workshops with aquaculture stakeholders in two key regions – Bac Giang and Hai Duong. These provinces are key producers of tilapia, and were selected based on the current volume of production and transformation of the systems. Group model building with diverse stakeholders enables their participation in the process, provides a means to incorporate different views and perspectives, and facilitates learning and shared understanding between participants. The participants in these activities included producers, input providers, private and public aquatic health service providers, and other aquaculture decision makers at the local and national levels. The development of the causal-loop diagram allowed the identification of key variables and potential causal relationships, feedback loops, and areas for action to improve surveillance systems, AMU and thus mitigate AMR. This study will contribute to a policy analysis of current interventions and recommendations for areas of action, and to identify potential barriers to implementation and uptake of interventions.

Economic Indicators to Predict Animal Mobility in Senegal

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Introduction

Livestock's mobility plays an important role in the dissemination of major diseases in West Africa, including Foot-and-Mouth disease and Rift Valley Fever. Therefore, there is a need to identify reliable predictors of livestock movements. So far, a majority of studies have focused on the analysis of static movement networks. We aimed at modelling the temporal dynamics of cattle movements in Senegal using both market and environmental predictors.

Data analysis

Official registrations of cattle movements across departments (the administrative units of Senegal) were supplied by the Senegalese veterinary services. We fitted a mixed-effect generalized additive model with a latent negative binomial distribution to predict the number of animals moved between departments at each month during the year 2019. Pairs of departments – department of origin and department of destination - were considered as a random effect. We incorporated the current values and month-to-month variation of environmental variables - biomass and rainfall – regional average cattle market prices as linear terms. The specific effect of calendar months was modelled with a thin-plate spline function.

Results

Calendar month, monthly change of pluviometry at the department of origin, and monthly change of market price at the region of origin were retained in the final model and their effect was statistically significant. The number of cattle moved between departments was substantially increased during the period June-September, probably as a result of the Tabaski festival in August. A drop in cattle market price of 10 000 FCFA at the region of origin increased the number of circulating animals by a factor of 1.31 (95% confidence interval: 1.08 - 1.59); a drop in monthly rainfall of 10 mm/m² in the department of origin increased the number of circulating animals by a 1.2 factor (95% confidence interval: 1.01 - 1.42).

Discussion

We demonstrate that both environmental (rainfall) and economic variables (market prices) can be used to predict the temporal dynamics of livestock mobility. Cattle owners are incentivized to sell their cattle or to move them to other places when the rains are scarcer, indicating future difficulties at feeding their animals, and when the market price diminishes.

How Are AMU-Decisions Influenced by the System They Are Embedded in? - An Analysis of the Flemish Veal and Pig Sectors

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Introduction

In livestock production, antibiotics are not only a therapeutic but also an economic asset, resulting in (preventive) group treatments. To address this, European policies have adopted a mission-oriented approach to reduce antimicrobial use (AMU). Achieving these goals requires, in addition to technical innovations, addressing the way antimicrobials are used by changing the behavior of farmers and veterinarians. Unfortunately, studies that also consider the system in which these actors operate and thus analyse the socio-economic factors that may influence behavior are generally underrepresented (1). Here, we present a mission-oriented agricultural innovation system (MAIS) (2) approach and analyse the Flemish pig and veal production systems identify patterns driven by institutional, economic, social and technical factors that influence AMU.

Materials and methods

Relevant stakeholders were identified and characterized based on literature and 15 key informant interviews that were recorded, transcribed and coded. This was supplemented with quantitative data (e.g. AMU data) and qualitative data from five online living labs. This data is currently being analyzed by adapting frameworks that assess Agricultural innovation systems (AIS) in order to study MAIS (2), followed by the development of causal loop diagrams.

Results and discussions

Our approach will result in a structural and functional analysis of the Flemish pig and calf production systems, allowing for an understanding of roles of and interactions between stakeholders, capacities, market structures, institutions, and governments in the context of AMU. These results will subsequently be translated in causal loop diagrams to better visualize the processes that influence AMU.

Implications

Identifying the processes that influence AMU and the underlying variables will help identify solutions to further reduce AMU in livestock and achieve the set goals. This should lead to a reduced prevalence of antimicrobial resistance and a preserved efficacy of antibiotics.

Estimating the Burden of Endemic Diseases: A Bayesian Model Illustrated Using UK Dairy Cattle

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Introduction

The Global Burden of Animal Diseases (GBADs) is a collaboration aiming, in part, to measure and improve societal outcomes from livestock. One GBADs component is to estimate the economic impact of endemic diseases among livestock. However, if individual disease impact estimates are aggregated without consideration for associations among diseases, there is a potential to double-count impacts, overestimating the total burden. Accordingly, the authors propose a method to adjust an array of individual disease impact estimates so that they may be aggregated without overlap.

Materials and methods

Using Bayes' theorem, conditional probabilities are derived from inter-disease odds ratios in the literature. These conditional probabilities are used to calculate the excess probability of disease among animals with associated conditions, and these excess probabilities are used to adjust disease impact estimates so that they may be aggregated. The aggregate impacts, or the yield, fertility, and mortality gaps due to disease, are then attributed and valued, generating disease-specific losses. The approach is illustrated using 13 diseases endemic to UK dairy cattle.

Results and discussion

Diseases endemic to UK dairy cattle resulted in total adjusted losses of €470/cow/year, equivalent to herd-level losses of €70,000/year. Unadjusted direct aggregation suggested losses 15% to 60% greater. Reduced milk yield accounted for 40% of adjusted losses, while reduced fertility, increased mortality, and private veterinary expenditures accounted for 25%, 15%, and 20%, respectively. Although lameness was identified as the costliest condition (30% of total losses), variations in the prevalence of liver fluke, Neospora, and paratuberculosis (only a combined 20% of total losses) were nearly as impactful individually as variations in the incidence of lameness. Associations between lameness and subclinical ketosis, paratuberculosis and lameness, and mastitis and subclinical ketosis were identified as particularly impactful.

Implications

This approach allows for disease impact estimates to be aggregated without double-counting. It can be applied to any livestock system in any region with any set of endemic diseases, and can be updated as new prevalence, impact, and disease association data become available. This approach also provides researchers and policymakers a tool to rank prevention priorities and identify potentially important disease associations.

Evaluating Economic Performance and Antimicrobial Consumption in French Broiler Production: Improved Healthcare Management as a Win-Win Strategy

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Introduction

To better orient towards sustainable antibiotic prescribing practices, it is important to assess the impact of the consumption of antimicrobials on the profitability of farmers, since Antibiotic uses impact animal health, public health, and economics (Lhermie et al. [2015]). The main objective of this paper is to evaluate the relationships between the economic performance of farms, and the management of animal health.

Material and methods

We collected an original dataset covering 1,086 lots of broilers raised and harvested in France between 2017 and 2019. The dataset consists of technical and economic information, as well as drug consumption at the flock level. We perform different estimation strategies to (i) analyze the determinants of economic performance of farms, (ii) quantify the impact of veterinary practices on farmers' income. We also hypothesize and test a non-linear relationship between antibiotic uses and economic performance in line with the canonical Environmental Kuznets Curve (Stern et al. [1996]). To alleviate endogeneity issues, we carry out an instrumental variables (IV) method.

Results and discussions

Estimation results show that (i) the farmers not using antimicrobials have fairly similar gross revenue than the farmers using antimicrobials at low levels; and (ii) the more farmers use antimicrobials, the more their marginal revenue decreases. Additionally, we also find that the use of high priority critically important antimicrobials, as defined by the World Health Organization, have negative and significant effects on the profitability of farms. Finally, we show that farmers having a higher consumption of medical prevention, such as vaccine, also are more performants.

Implications

Understanding the quantitative association between antibiotic use and economic performance is important for designing antibiotic stewardship policy. Our results highlight the importance of a judicious veterinary management for improving the profitability of farms.

Understanding The Uptake of Diagnostics for Sustainable Roundworm Control by European Dairy Farmers: A Multi-Country Cross-Sectional Study

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To mitigate emerging anthelmintic resistance in cattle, sustainable worm control strategies should be adopted, such as the use of diagnostic methods to take informed treatment decisions. A multi-centre study was set up to understand the factors affecting European farmers' adoption of diagnostics and to gauge for differences between regions. A conceptual framework was developed, based on theories in the field of behavioural and health psychology and insights from previous studies, and validated through a multi-lingual survey in different European countries. The data were collected by participating countries of the European Co-operation in Science and Technology (COST) action COMbatting Anthelmintic Resistance in ruminants (COMBAR). Four countries provided sufficient data to be included in the data analysis: Norway, Italy, Germany and Austria. The two latter were pooled. Three models were estimated and validated through structural equation modelling, which allows for describing general trends and differences between the participating countries. Norway, and Germany and Austria showed similar trends that align with previous studies. Risk perception of anthelmintic resistance had no influence on the adoption intention of diagnostics, a positive influence was found for attitude towards diagnostics and subjective norms (i.e., perceived opinion of others), and a negative influence of attitudes towards anthelminthics. Additionally, routine (i.e., perception of the current treatment) had an

indirect effect on adoption intention through attitudes. Italy's data deviated from previous findings, presenting a positive effect of the perceived severity of the risk for anthelmintic resistance on adoption intention, and perceived behavioural control (i.e., perceived ability to perform a specific behaviour) of adopting diagnostics. Finally, Norway's data set allowed for including a measurement of current behaviour in the model, by combining self-reported practices with diagnostics. A direct positive effect of descriptive norms (i.e., perceived actual behaviour of others) on farmers' behaviour was detected, while no other effects were found (i.e., intention or routine). This indicates that a direct, perhaps unconscious, effect of community is stronger than internal motivations.

Western Canadian Dairy Farmer Perspectives on the Role of Various Stakeholders as They Relate to the Provision of Outdoor Access

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Provision of pasture or outdoor access differs considerably among countries. In Ireland, New Zealand and Australia dairy farms are largely pasture-based; whereas most dairy farms in Canada and the United States are largely confinement based. Globally, there is a high level of public support for providing pasture or outdoor access to dairy cows. This mirrors animal data showing dairy cattle preference and motivation for pasture and other forms of outdoor access. However, not much is known about dairy farmers perspectives on outdoor access for dairy cows. This study investigated Western Canadian dairy farmer's perspectives on the roles of different stakeholders (i.e., the dairy industry including dairy farmers, the dairy cow, and the public) regarding outdoor access for dairy cows. Data were collected through 1) 11 focus group discussions with a total of 50 Western Canadian dairy farmers, and 2) semi-structured individual interviews with 6 dairy farmers of Hutterite colonies. Data were analyzed using template analysis. Although most participants in this study did not provide outdoor access on their farms, many mentioned that they like to see cows on pasture or outdoors. Farming under the Canadian supply management system was viewed by many participants as preventing them from providing outdoor access, given the requirement of this system that they manage their farms in a way that ensures a consistent flow of milk production. While some participants believed that dairy cows prefer spending time outside under favorable weather conditions, others thought that cows prefer to stay indoors when housed in a modern, ventilated free-stall barn. Participants perceived pasture or outdoor access for dairy cows as desired by the public; public education was generally thought to play an important role in improving public perspectives on current dairy farming practices. The results of this study show the diverse views that Western Canadian dairy farmers have on a range of stakeholders that are involved in their decision to provide outdoor access on their farm. Our findings are important to further inform the discussion around the future of outdoor access for dairy cattle in Canada.

An Update On Adoption Pathways for Improved Livestock Supply Chain Systems in Australia

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This paper draws on two themes that are emerging from the literature on digital transformation. Through three case studies of Australia's red meat industry, we consider the importance of value creation in the adoption of digital agriculture. We also draw on the concept of the "technology fallacy" which suggests that organisations, people, learning and processes lay at the epicentre of digital transformation, rather than the technology itself. In this paper, we take a supply chain view of the problem of slow adoption and the need for change in human and organisational processes to understand 1) the potentials for digital agriculture in livestock supply chains in Australia, 2) the implications for innovation within them and, 3) some of the organisational realities that determine how change is likely to occur. We find that there is reason for both optimism and pessimism in digital technology to support supply chain collaboration (with the added-value of capturing animal welfare) being adopted beyond the farm gate but this same technology is being met with scepticism amongst some producers who are disrupting adoption pathways. We suggest that the adoption process of digital livestock supply chain systems in Australia is unpredictable, not only because of the disparate attitudes of major stakeholders but also because of the large-scale and complexity of the system. Finally, we argue that the wide-spread adoption of digital technology in Australian livestock supply chains systems is the sole method of competing on the basis of quality in global market for red meat.

Relationship Between Disease Risk and The Perceived Human and Animal Impacts of Livestock Quarantines

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Introduction

Perceptions of health risk inform decisions about protective behaviors, including adhering to disease control policies. In Uganda, where livestock makes up a significant portion of GDP, quarantine policies to reduce livestock movements during foot-and-mouth disease (FMD) outbreaks occur at least annually and often for varying durations, while in neighboring Tanzania, quarantines are not strongly enforced. In the presence of uncertainty about disease risk due to heterogenous quarantine policies, perceptions may result in inaccurate assessments of quarantine impacts. To understand the role of perceptions in responding to quarantines, we first sought to define how perceptions are related to FMD disease risk and household socioeconomics.

Methods

Our 2018 dataset included 254 households across 4 districts along the Uganda-Tanzania border. Households responded to questions concerning an FMD outbreak, basic demographics, and livestock management practices. FMD risk was evaluated through personal (household FMD exposure) and general risk (village exposure). Perceived impacts were collected for sales of livestock products (milk and meat), sale of livestock, and movement restrictions (human, livestock, and grazing). Bivariate analyses and logistic models were used to evaluate the influence of disease risk and household socioeconomic factors on each impact.

Results

Households in Uganda and Tanzania rated livestock grazing and livestock sales as very important quarantine impacts ($p<0.01$). Uganda households further rated milk sales and human movements as very important ($p<0.01$). Logistic models found that personal risk through FMD infection in the household was related to perceived economic impacts (milk, livestock, and meat sales) ($p<0.01$) whereas general disease risk was related to the perceived effect on human movements ($p<0.10$). Concern for livestock sales and movements were reported amongst households who received income primarily from livestock activities ($p<0.01$).

Implications

Our analysis suggests that households perceive quarantines as significant barriers to trade and trade activities. Quarantines appear to additionally influence human activities, which suggests expanding the evaluation of quarantine impacts beyond direct livestock outputs. The following evidence from outbreaks in FMD-free countries may include psychological and social impacts, especially as quarantines in Uganda occur at least annually and the fluidity of the border between Tanzania and Uganda facilitates the movement of people.

Policy Mixes to Control Anti-Microbial Resistance in Livestock Production: A Comparative Analysis of National Action Plan Implementation in Relevant Countries

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Introduction

Policy strategies targeting prudent antimicrobial use (AMU) in livestock farming have been set at global and country levels by recognizing the risks of antimicrobial resistance (AMR). In the framework of the European Project ROADMAP, this study evaluates the strategies addressing AMU and AMR in animal farms and the food supply-chain as Policy Mixes; a concept relying on the notion that complex issues, like AMR, should be addressed through multiple combined and interactive measures (1).

Methodology

A qualitative comparison of the policies implemented in nine countries involved in ROADMAP and other eight relevant countries was performed based on information from the Tripartite AMR Country Self-Assessment Survey (TrACSS/2019-2020). The TrACSS self-assessment of each country on the implementation of National Action Plan in the four areas of Awareness, Evidence, Practices, and Governance(2) was translated into scoring and the progress achieved was measured by the ratio between the score obtained and the maximum reachable.

Results and discussions

Among the European countries examined, Denmark obtained the highest score (98% of the maximum achievable) followed by the Netherlands (93%) and Sweden (90%). Belgium, Germany, France, Spain, and Switzerland were between 85% and 88%, followed by Italy (80%) and the UK (76%). Among the non-European countries examined, Japan scored 92%, the United States of America (USA) 85%, Australia 69%, and Argentina, Brazil, India, and Vietnam between 54% and 56%. Awareness and Governance were the weakest policy areas mostly due to inadequate involvement of stakeholders in participatory processes in many countries. This can also be affected by limited integration of the multiple actions needed within the Policy Mix. The Evidence area also showed frequent shortcomings related to AMU and AMR monitoring capacity.

Implications

Results of some countries confirmed the possibility to overcome the trade-off between a reduce AMU and production performances. The achievements obtained in reducing AMU are the outcomes of several main contributing factors such as long experience of evidence-based guideline implementation, strong participatory local commitment, and integration between actions at local and national levels.

Modelling The Economic Performance of Small Ruminant Pastoralist Herds in Kajiado County, Kenya

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Despite the importance of livelihoods, food security, and cultural identity of pastoralist systems in low-income countries, very little is known about their performance and efficiency. Yet, its knowledge can provide fundamental support to governments and industries to better target interventions and policies and assess the impact of shocks. This study aimed to develop a model to measure the economic performance of small-ruminant pastoralists' herds in low-income settings. A retrospective survey of 130 small-ruminant pastoralists' flocks was conducted in Kajiado county, Kenya. Data on production and economic parameters for 12 months were collected via an interview with pastoralists. Pastoralist flocks were classified as low, medium, or high performers [1]. The data was then used to develop integrated herd production and economic models to simulate an annual period of production of pastoralists' small ruminant flocks with the different performance levels, feeding management practices, and trading activities. The gross margins of the different pastoralist groups were estimated, as well as the total financial impact of disease mortality. Sensitivity analyses were conducted to assess the relative importance of different reproductive performance indicators. Findings show that, on average, small-ruminant pastoralists' gross margins were KSH 3,016 – KSH 3,123 per reproductive female for those not purchasing feed for their animals (78% of flocks). Those paying for feed had a negative return of KSH -3,311. The economic return for goat production was 2.43 greater than sheep production. For the average mixed flock, the economic return of high performers was 2.04 greater than medium performers and 12.19 greater than low performers. The economic return for pastoralists focusing only on pastoralist production with trading activities was 3.82 less than those focusing only on pastoralist production. Farmers' losses due to mortality were 17.81% of the starting flock value. Net prolificacy rate in sheep and net fecundity rate in goats had the greatest economic impact. The study provides a new understanding of the economic performance of small ruminant pastoralist systems in Kajiado county. The models could be used as a tool to assist decision-making towards improving the economic performance of flocks, and thus to ensure the sustainability of these systems.

Determination of Input-Specific Technical Inefficiency in Relation to Dairy Cattle Longevity

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Introduction

Prolonging cattle longevity promotes sustainable milk production. However, insights on the effect of cattle longevity on farm's technical efficiency is lacking. Since dairy farmers have greater autonomy to adjust inputs rather than output (milk production), this study aims (i) to measurethe input-specific technical inefficiency of dairy farms and (ii) to explore its association with cattle longevity under Dutch production conditions.

Materials and Methods

Combining performance data and accounting data of commercial Dutch dairy herds from 2007-2014 resulted in a dataset with information on 1,037 herds. A two-stage approach was used for the analysis. First, input-specific technical inefficiencies were computed using the Data Envelopment Analysis (DEA). Unlike accounting analysis, technical efficiency takes the nonmonetary factors into consideration and minimizes the impact of price volatility on farm's inputs and outputs. Output was measured by total farm revenues. Inputs included labour availability, land size, livestock units and the expenses on capital, seed & protection, veterinary services, livestock purchase & contract services, feed and others. Secondly, a bootstrap truncated regression analysis wasapplied to identify the association of cattle longevity with input-specific technical inefficiency.

Results and Discussion

Of the evaluated inputs, utilization of livestock units and feed is most efficient (inefficiency scores of 0.16 and 0.26, respectively). This contrasts with the poor input efficiency of capital and other goods & services; these inputs can be reduced with 52% without affecting output. Results in the second stage illustrate that age of culled cows is significantly negatively associated ($P< 0.05$) with each of the input inefficiencies, except for veterinary services. This is in contrast to the significant associations of input inefficiencies with lifetime milk production, which are mostly positive. The positive association of lifetime milk production with the input inefficiency of labor and veterinary services might be due to an increased risk of health disorders triggered by increased milk production levels per cow. The strength of the evaluated associations was generally low.

Implications:

In the Netherlands, dairy farms can improve their economic performance (technical efficiency) by extending the cow age at culling, as long as the production intensity at cow level remains unchanged.

The Economics of Zoonoses Surveillance in Traded Wildlife: Insights from A Game Theory Model

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Introduction

In view of the critical role played by wildlife in the emergence of new infectious diseases, surveillance systems of zoonoses integrating the wildlife populations are urgently needed. Yet, examples of effective integration are scarce, especially in low-income tropical countries. Some major constraints to the integration of communities in contact with wild animal populations are the illegal nature of most animal hunting activities of these communities, and the conflicting imperatives of incentivizing participation in surveillance by those communities and limiting the quantity of traded animals.

Method

We use a game theoretical approach to predict the response of a community of hunters to the introduction of a wildlife health surveillance system based on the monitoring of a limited number (quota) of animals that hunters are allowed to trade legally. Hunters are assumed to maximize a defined utility function. At each time step, they decide whether to capture and trade a wild animal or not. In the case of hunting, they have to decide whether to comply with the trade surveillance design or not. If they comply and the quota is not filled for the community they belong to, their animal is traded legally and captured by the surveillance system. If they comply but the quota is filled, they have to trade illegally. Hunters who trade illegally may have to pay a fine if their traded animals are seized by the authorities. Conversely, hunters who trade legally may face negative consequences if a zoonotic disease is detected in one of the animals (confiscation of animals, altered reputation).

Results and discussion

We find that it is theoretically possible, with this system, to monitor a sufficiently large number of animals and, thereby, achieve a high surveillance sensitivity, without increasing the frequency of trade of wild animals. However, one condition for ensuring hunter participation is that the cost incurred by participating hunters in case of outbreak detection is kept sufficiently low. If the cost is too high, one option for policymakers is to provide financial compensations to hunters. Yet, this compensation must be well adjusted in order not to incentivize overhunting of wild animals.

Personality and Attitudes of Farm Managers of Large Scale CommercialDairy Farms Correlates with Cow Longevity and Culling Rates

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Dairy cow longevity is constantly decreasing in many countries influencing economic profitability and environmental impacts of the dairy sector, as well as indicating deteriorating health and welfare of cows. We aimed to determine how farm managers´ satisfaction, attitudesand personality traits are associated with dairy cow culling and longevity in large commercial dairy farms.

Postal questionnaires were distributed to 116 dairy farm managers of freestall farms having at least 100 cows. A questionnaire registered personal information on farm managers´ backgroundand included statements gaining their satisfaction, opinions and attitudes regarding dairy cow culling and longevity, and farming in general, as well as a Ten Item Personality Inventory scoring. For each study herd, the last 12 months cow culling rate (CR, excluding dairy sale) and herd mean age of culled cows (MAofCC) was obtained. Screening the associations between farm managers´ responses and CR and MAofCC was conducted using Spearman correlation analysis. A K-mean clustering algorithm was applied to create farm managers subgroups based on their attitudes and opinions on cow culling and longevity and personality traits.

The mean number of cows in study farms was 514.4, yearly mean herd CR was 33.0% and MAofCC was 60.6 months. Farm managers mostly expressed a low satisfaction with cow longevity (57.8%) and culling rates (47.4%) in their farms. In total, 59.5% of farm managers acknowledged high milk yield as a limiting factor in longevity. Majority of managers agreed that improving cow longevity is economically profitable (88.8%) but only 33.6% favoured goodlongevity over high milk yields. Dissatisfaction with culling rates and longevity, and production-oriented management style were the characteristics of group of farm managers having highest CR and poorer longevity. Farm managers were more extraverted in farms with higher CR.

Our findings highlight the need for better explaining economic consequences of longevity. Improving the visibility of herd longevity and culling rates together with benchmarking could bring these into focus. Dairy sector agreement and supporting measures might provoke a changein the attitudes and priorities of farm managers which is important to combat the problem of shortening cow lifespan.

Livestock Production Losses Attributable to Brucellosis in Northern Tanzania

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Introduction

Brucellosis is a bacterial zoonosis responsible for significant human and animal health burdens in most of the developing world. Livestock production losses attributable to the disease have been estimated in many settings. However, the methods used to measure and value these losses vary widely and, in most cases, do not capture the differences between production systems, which may hamper efficient resource allocation for disease control.

This study aimed to estimate the losses attributable to brucellosis in cattle, sheep, and goats from northern Tanzania's pastoral and non-pastoral production systems using a newly developed bio-economic model.

Methodology

This study analysed epidemiological and economic data from three sources: The University of Glasgow, the World Bank and the International Livestock Research Institute. The study area included eight regions of Tanzania: Arusha, Manyara, Kilimanjaro, Tanga, Dodoma, Singida, Simiyu, and Mara.

Households were divided into pastoral and non-pastoral (agro-pastoral and smallholder) production systems based on ethnic, environmental and livestock management practices using multiple factor analysis and hierarchical clustering on principal components. The losses attributable to livestock brucellosis were estimated using a dynamic, stochastic, herd-growth model, within a multi-year partial budgeting framework, which captured both current and foregone losses at the household and regional levels.

Results and Discussion

The median annual losses were equivalent to 4.6% and 0.6% of the annual income in pastoral (n=384) and non-pastoral households (n=1,157), respectively. Pastoral households incurred relatively greater losses due to the higher prevalence of the disease in their livestock and the higher harvest rates. The total estimated loss attributable to brucellosis per year in the study area was 19.3 million international dollars (purchasing power parity). The spatial distribution of losses was highly heterogeneous, with the highest

losses estimated in regions where pastoral households were concentrated (Arusha and Manyara).

Implications

Brucellosis causes considerable economic losses in the livestock sector of northern Tanzania, particularly in pastoral households. The model framework used in this study could be adapted (i) to estimate losses attributable to other livestock diseases that are characterised by high reproductive morbidity and low mortality, in similar settings, and (ii) to evaluate the cost-effectiveness of potential disease control intervention.

How Immediate Delousing Effects Growth of Farmed Atlantic Salmon

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Introduction

Salmon lice infestation is one of the most costly health problems in salmonid aquaculture. Most of the immediate delousing methods involve a period of starvation prior to treatment, and several of the methods causes stress, injuries, and death of the treated fish. As mortality and growth reduction seriously affect the cost-efficiency of salmon production, it is essential to explore the effect that different delousing methods have on both mortality and growth. In a recent study, we described how mortality increases after different delousing methods (1), and the present study aimed to estimate the distribution of the change in growth rate and duration of suboptimal feeding post-treatment.

Materials and methods

Three large Norwegian aquaculture companies supplied data from the daily production of Atlantic salmon at cage level, from 2014 to 2019. Immediate delousing treatments were categorised into thermal, mechanical and hydrogen-peroxide, medicinal and freshwater bath and combination. We estimated the change in growth rate after treatment using registered daily feed amount, the number of fish in each fish group, a fixed feed conversion ratio and adjusted for the difference in temperature by the formula for thermal growth coefficient. We found the change in growth rate after treatment by subtracting the average growth rate before treatment from the daily growth rate after treatment.

Results

The analysis included 614 fish groups and 2286 delousing operations. The fish groups were treated on average four times during a production cycle. Before treatment, they were starved on average 6.5 days. After treatment, feeding was reduced for an overall median period of nine days. All delousing methods caused a reduction in growth rate, and the distributions of change and duration of growth rate varied with methods.

Discussion

When deciding which control strategy would be optimal, information on current treatment strategies and their effect and side effects is essential. The biological losses (mortality and reduction in growth) with distributions found in this and the previous studies are fundamental inputs in a forthcoming partial budget model comparing different immediate delousing methods.

Medical Practice and/or Economic Practice? Antibiotic Use in Veterinary Medicine

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The problem of antimicrobial resistance has been put up on worldwide political agendas over the last ten years. This has encouraged the implementation of various strategies to reduce the use of antibiotics in livestock farming. Government plans and policies, labels and specifications from the agri-food industry and "best practice" guidelines from the veterinary profession are now increasingly being drawn up to regulate the conditions of use, prescription and sale of antibiotics for animals. In Europe, these dynamics seem to be bearing fruit since antibiotic use has been reduced by 34% since 2011 (EMA, 2020).

This movement also goes hand in hand with profound changes in the veterinary profession (Fortané, 2019, 2020). Indeed, while antibiotics have historically been a central technology in veterinary practices and knowledge in terms of animal health management (Kirchhelle, 2020), drastically (and rapidly) reducing their use requires the development of new ways of working, from the understanding of animals and their diseases to the labour and economic organisation of veterinary businesses. This is what this article proposes to analyse in the French case, based on ongoing research on veterinarians in different sectors. By the time the manuscript is submitted, some fifty semi-directive interviews will have been conducted with farm animal veterinarians, covering their animal health management practices (particularly diagnosis and prescription), their relations with livestock farmers, their working conditions and employment status, and the economic and contractual dimensions of their professional activity. The article proposes to discuss the following findings.

Firstly, there is a development of new approaches to animal health, which is certainly reinforced by the movement to reduce the use of antibiotics but is also based on independent professional dynamics. Antibiotics are a central tool in the clinical knowledge of veterinarians: the disease is analyzed "at the bedside" of the animal, by identifying the symptoms that make it possible to establish a diagnosis and initiate treatment. However, for many years now, other approaches have been developed and articulated with the "classic" clinic in such a way that veterinary expertise in animal health is now plural: biological analyses, epidemiological data, zootechnical knowledge and even " alternative " conceptions of health (including ecological/ecosystemic approaches).

It is therefore important to describe in detail how this multiple knowledge is put into practice on a daily basis, and what is the place of antibiotics according to the different "configurations of expertise". This will allow us to establish a praxeology of veterinary reasoning and to see how this can vary according to context: in the pig and poultry industries, for example, preventive approaches are much more developed than in the dairy industry (where there are many more veterinarians). Documenting this praxeology will enable us to finely grasp how the production and prescription of preventive and/or 'alternative' medicines call for new veterinary skills

and areas of specialisation (implementation of self-vaccination, formulation and testing of phytotherapeutic products, etc.).

Secondly, there have been significant changes in the supply of veterinary services. As veterinary expertise becomes more diverse, the professional and economic models on which it is based are also changing. While the sale of antibiotics was for a long time the main, if not the only, source of income for veterinarians, the latter must now diversify their remuneration and learn to value the variety of their expertise. Special attention to the economic dimensions of veterinary activity will therefore lead us to consider the heterogeneity of veterinary business models and how veterinarians are remunerated.

It is therefore important to show how veterinary businesses are changing in terms of labour organisation and financial structure. Indeed, we now observe in France a concentration of veterinary businesses through the development of holding companies (usually called "networks of practices") to pool certain resources and offer more services or goods on the animal health market (e.g. audits on biosecurity, training for livestock farmers or the sale of hygiene and nutrition products). This vast movement is corollary to the decline in the use of antibiotics but is developing at different paces and in different ways depending on the sector and region.

Finally, the article will discuss the link between these two sets of results: to what extent is the evolution of veterinary practices and knowledge linked to changes in professional and economic models? What does the decline in the use of antibiotics mean in concrete terms at these different levels? Medical anthropology and the sociology of the professions provide food for thought. First of all, a professional jurisdiction is also a market (Abbott, 1988). Knowledge is therefore a service that acquires an economic value in a system of market relations between veterinary businesses, farmers, cooperatives and agri-food industries. Furthermore, medicines have a 'social life' (White et al., 2003) which means that their uses are linked to their conditions of production, distribution and circulation, which implies paying attention to the concrete modalities of their purchase and sale by veterinarians. In the end, antibiotic use could clearly be conceived both as a medical and an economic practice and this is only by considering these two intertwined dimensions that we could fully analyse the place and role of pharmaceuticals in veterinary medicine.

Estimating The Effects of Bovine Viral Diarrhoea Virus-Free Program on the Gross Margin of Dutch Dairy Herds

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Introduction

Bovine viral diarrhoea virus (BVDV) infection is associated with economic losses on dairy farms, and therefore an increasing number of countries in Europe implemented BVDV control programs. Several studies have simulated the effects of BVDV control programs, but empirical studies from an economic perspective are lacking. This study aimed to investigate the economic effects (i.e., gross margin, **GM**) of the Dutch BVDV-free program based on longitudinal annual herd performance and accounting data from Dutch dairy herds between 2014 and 2019.

Materials and Methods

Selected from a database of 456 herds, Propensity Scoring Matching was used to match 43 case herds with 109 control herds. Case herds were defined as herds where the BVDV status changed from not participating in the BVDV-free program to BVDV-free during the study period. Control herds were BVDV-free during the entire study period. To compare the differences in GM (euros per kg milk per year) of case and control herds before and after BVDV-free certification, the time-varying Difference-in-Differences estimation methodology was used.

Results and Discussion

Results showed that herds that changed their BVDV status not-participating to BVDV-free program did not significantly change the GM compared to herds that were BVDV-free during the entire study span. We also did not find any significant differences in underlying herd performance measures (milk yield per cow per year, bulk milk somatic cell count, and calving interval). The non-significant effects observed in our study may be due to the unknown BVDV infection status of the case herds. Other reasons could be that the costs of BVDV-free certification did level out the potential positive economic consequences of being BVDV-free.

Implications

Our study provides information for stakeholders in the Dutch dairy industry, such as policymakers and dairy farmers, to understand the economic consequences of the BVDV-free program and emphasize the importance of proper data collection to enable ex-post studies during implementation of disease eradication programs.

Application of Multi-Actor Farm Health Approaches for The Improvement of Antimicrobial Use Practices Across Nine European Countries

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Introduction

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

Materials and methods

MAFH teams (MAFHT) were created within the DISARM thematic network, composed of the core interested parties (farmers, feed/other advisors, vets) with the help of a project facilitator in nine European countries (i.e. Belgium, Denmark, France, Greece, Netherlands, Latvia, Romania, Spain, the United Kingdom). These teams focused on pigs, poultry, intensive dairy production and the grazing sector including dairy, beef and sheep. A total of 30 case studies have been summarized in factsheets presenting the challenges, solutions proposed and perceptions of the economic impact of antimicrobial use (AMU).

Results

Results from the previous two years show overwhelmingly positive feedback of the economic impact of reducing AMU through coaching and MAFHT. Farmers recognized the importance of the MAFHT in identifying alternatives that could be employed when aiming to reduce AMU in their farms. Based on the experiences of the MAFHT, an educational tool is also being developed (DISARM toolbox) to facilitate coaching activities.

Implications

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

What Guides the Ecological Management of Animal Health? A Categorization Approach of the Advisory Networks Built by Dairy Farmers

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Today's livestock is subject to various political, economic, and social expectations on farming practices. In the case of dairy production, farmers must face the challenge of ensuring quality milk production while reducing their use of chemical medicines for the health of their herd. It is now well-known that agricultural professionals (technical advisors, veterinarians, processors, peers etc) may individually help farmers in learning new practices, but we do not know how a farmer chooses these professionals and learns with them how to ecologically manage the health of their herd. This raises questions about the coordination and coherence of the recommendations made by each of these professionals, and to what extent they help farmer change towards more ecological practices. We thus choose to think of this set of professionals as an "advisory network". The aim of this study is to explore the organizational diversity of advisory networks built by dairy farmers.

We conducted in-depth interviews with 26 dairy cattle farmers in the Massif Central Region of France, chosen for their ecological management of animal health. We carried out a qualitative analysis of the speeches, exploring the advisory relationships between each farmer and his advisors as well as the knowledge exchanged between them. Using the repertory grid tool, we identified a typology of advisory networks modeling the various organizational forms built by farmers regarding the social and cognitive distribution of advising for health management.

These types show how a farmer uses distributed human and cognitive resources, whether it is a centralized network around few trusted advisors or it is a large network structured around an autonomous farmer. Beyond the risk of classifying a farmer in a category for his lifetime, our sample puts forward various degrees of autonomy of farmers in managing health, related to their trajectory, their experience of pathologies, and relationships with advisors.

This categorization of advisory networks for health management opens avenues to investigate the convergence or divergence of health representations among farmers and their multiple advisors. Qualifying these networks regarding their potential for farmer's learning will also raise some important highlights for farmers' and advisors' education and training.

Keywords: advisor network, advising, distributed organization, health management, dairy farming

Using Causal Loop Analysis to Explore Pathways for Improving Dog Rabies Vaccination in Burkina Faso

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Introduction

Dog vaccination is an effective pathway to control rabies if a minimum of 70% dog vaccination coverage is achieved. For more than six decades, dog vaccination has been adopted as part of rabies control measures in Burkina Faso. However, the required vaccination coverage in canine population remains challenging and rabies remains endemic. This study describes the use of systemic approaches to explore the dynamics underpinning dog vaccination complexity and explain the possible causes of low vaccination coverage in dog population.

Methodology

In-depth individual interviews were conducted including various stakeholders selected from animal health, human health, and wildlife sectors, as well as municipalities and communities. All interviews were audio-recorded, transcribed and thematic analysis was performed to extract variables and dynamic linkages. Extracted data were used to develop causal loop diagrams (CLDs) using the Vensim® software.

Results

The causal loop analysis showed 13 reinforcing loops and 4 balancing loops. The reinforcing loops pointed out the importance of community engagement, trust in vaccination, health belief, social pressure, workforce allocation, logistic provision, vaccine planning and management, national governance efforts, as well as synergy and partnerships in dog vaccination. As for the balancing loops, they exhibited vaccination dynamics associated with dog husbandry practices, rabies prevention practices, vaccination staff workload and owner frustration. The results revealed the importance of community awareness raising, empowerment of the vaccination workforce as well as enhanced governance and leadership in dog vaccination.

Implications

Causal loop diagrams contributed to visualize the issue of dog rabies vaccination in a low-income setting. Going beyond a first impression of overwhelming complexity, this conceptualization represents a first step to identify a set of actionable solutions. The method may be applied to explore other critical rabies-related questions such as post-exposure prophylaxis, epidemiological surveillance, dog population management, laboratory diagnosis, and the One Health collaboration issues, to improving the disease control.

Keywords: Burkina Faso, Rabies control, Dog vaccination, Facilitators, Barriers, System dynamics, Causal loop analysis.

Participatory Evaluation to Strengthen Public-Private Partnerships in The Veterinary Domain

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Public-private partnerships (PPPs) in the veterinary domain are widespread worldwide and can help to strengthen the capacities of Veterinary Services (1). Few evaluations have been made of these initiatives.

An evaluation framework was developed based on a quantitative survey, literature review, two round expert consultation and one in-depth participatory impact assessment in Ethiopia. This framework was tested during a participatory evaluation of PPP for controlling the foot-and-mouth disease in Paraguay (n= 57 semi-structured interviews, n=3 focus-group discussions, n=1 workshop). The feedback from the stakeholders helped us to improve this framework.

The evaluation framework considers the context, quality of the public-private partnerships process, and outcomes. To evaluate the process (governance, collaboration, communication, training, evaluation) of PPP, a tool was developed. The developed tool allowed a semi-quantitative evaluation, consisting of ten sections divided into rating evaluation criteria (2). To evaluate the outcomes and impacts of PPPs, the contribution of these PPPs to the sustainability (health, economic, governance, societal, environmental) of a territory is taken into account.

As part of a World Organisation for Animal Health initiative on PPP in the veterinary domain, this evaluation framework was developed to help the stakeholders to minimize the risks and to reinforce their PPP, with an explicit goal of triggering positive changes in the partnership. Stakeholders can use this framework before the implementation of the PPP in order to improve the elaboration, during the PPP with a corrective willingness and after the PPP in order to learn lessons. Stakeholders involved in PPPs and accustomed working together are better able to respond to a threat (such as an epidemic). Participatory evaluation can strengthen the collaboration process by considering the perspectives of different stakeholders.

Is Burkina Faso Ready for One Health Surveillance?

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Introduction

Integrated approaches to health such as One Health (OH), are promising to improve epidemiological surveillance of complex health hazards. In Burkina Faso, under the influence of international organisations and in the light of recent health crises, collaborative efforts have been developed for the governance and implementation of surveillance of zoonotic diseases. Using the case study of anthrax, we conducted a stakeholder analysis to identify determinants that may influence the implementation of an effective and sustainable OH surveillance system.

Methodology

The study has been conducted in three steps, using literature review and semi-structured interviews: (1) an analysis of the international, national and local governance for the surveillance of zoonotic diseases, (2) a characterization and mapping of the surveillance system for anthrax in Burkina Faso, and (3) the identification of determinants influencing the engagement of stakeholders in collaboration for surveillance.

Results and discussion

The mapping of the surveillance system for anthrax in Burkina Faso underlined that surveillance activities exist in the human, animal and environment sectors, but that they mainly operate independently.
Based on informants' perspective, we identified key determinants that can be either levers or barriers to integrated surveillance and that can be classified as systemic, organizational or interactional.
Most of the identified barriers are related to a lack of proper OH governance to provide direction, coordination, as well as financial and technical support for OH surveillance. The country is receiving huge external support to establish governance mechanisms and technical tools for integrated surveillance. However, those activities are mainly driven by the agenda of the technical and financial partners, in line with international regulations and standards. They usually fail in producing the expected results in a long term because of a lack of engagement of national actors to maintain them with domestic resources.

Implications

This study underlined the difficulty to translate the global governance at national level and the need to strengthen the leadership for achieving OH at country level. This could be achieved through the co-conception with all categories of stakeholders of governance mechanisms that articulate the desired outcomes at the different levels of decision-making (subnational, national and supranational).

5.0 POSTER ABSTRACTS

Degree of satisfaction with supplier relationships in a regional sourcing of fattening pigs in relation to antimicrobial use

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Introduction

Antimicrobial reduction in livestock production is of great importance for the One-Health approach (1). Due tohigh selection pressure, bacteria with resistance properties can spread more widely in pig fattening (2). In the present study, the nationwide half-yearly treatment frequency in fattening pigs over 30kg were investigated depending on their origin and on the quality of the supplier relationship.

Methodology

40 farmers from pig farms in North-Rhine-Westphalia (NRW, Germany) were surveyed on the origin of the fattening pigs and the quality of the supplier relationship. Data collection was conducted online using the survey tool 2ask between September and November 2020. Through the nationwide half-yearly treatment frequency for 2019, farms were recorded below a critical threshold level of antimicrobial use. Overall satisfaction with the supplier relationship was determined using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Descriptive statistics were used to evaluate the data.

Results

The farmers surveyed sourced the pigs regionally (NRW) in 59% and nationwide (including foreign countries) in39%. Overall, the values for regional sourcing (n=24) were below a critical threshold level in 46%, the overall satisfaction with the supplier partner was rated with a mean value of 4.3. In case of nationwide sourcing (n=16), the values were 31% and 3.9, respectively.

Discussion

In this study, a regional sourcing of fattening pigs indicates higher overall satisfaction with supplier relationships and higher shares below a critical threshold level in fattening farms as compared to nationwide and foreign country supply. Regional sourcing opportunities for fattening pigs are declining (3), leading to geographically dispersed supply chains.

Implication

Strengthening regional piglet production could lead to more satisfying supplier relationships and decreased use of antimicrobials. This could strengthen the One-Health approach and societal acceptance of livestock production in pandemic times.

Public Attitudes toward the Management of Surplus Dairy Calves: Results of a Mixed-Methods Online Survey

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Introduction

Dairy farmers' social license to operate may be questioned if routine management practices fail to align with public expectations. Two common management practices are separating the calf from the cow after birth and in some regions slaughtering of surplus calves within the first weeks of life. Our aim was to describe and contrast public attitudes towards these two practices.

Materials and Methods

Participants from the US and Canada sampled to be representative of key census data variables were assigned to one of four online scenarios following a 2x2 factorial design: whether or not the calf was separated from the cow early after birth and whether the calf was slaughtered within 2 weeks or after 12 months. Attitudes were assessed quantitatively on 7-point items and qualitatively through an open ended-question. Generalized partial credit models and linear regression analysis were used for quantitative data. Inductive thematic analysis was used for qualitative responses.

Results and Discussion

The attitudes of the 998 participants differed: The Separated/EarlySlaughter group had the lowest attitude value, followed by NotSeparated/EarlySlaughter, Separated/LateSlaughter, and the NotSeparated/LateSlaughter group. Qualitative analysis revealed three themes: ethical appraisal regarding the treatment of animals; production system support; coping with dissonant attitudes. Both LateSlaughter groups were more likely to endorse the production system due to the perceived good purpose of the calves. EarlySlaughter groups brought up the length of life more often than LateSlaughter groups, and Separation groups mentioned cow-calf separation more often than NotSeparated groups.

Failure by the dairy industry to provide assurances that the surplus dairy calf has a reasonable length of life and that this life has purpose (i.e., contributes to the beef supply) places the industry at odds with public values. If these criteria are met, the public will also become concerned about early cow-calf-separation.

Implications

Dairy industries that currently rely on early life slaughter as a means of dealing with surplus calves should explore alternative practices that allow the calves to live longer and contribute to the beef supply. Globally, the industry is encouraged to engage in discussions about the future of cow calf separation; this issue will likely become increasingly contentious.

Bovisanet: Building a Participatory Network of Sentinel Veterinarians for Monitoring Health in Spanish Dairy Cattle

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Introduction

The veterinary sentinel surveillance network for dairy cattle (BoviSaNet) was established in the frame of the operational group for the improvement of dead animal collection and health alert systems (MESRASA). The purpose of BoviSaNet is to monitor the health status of Spanish dairy cattle and to increase the sensitivity for early detection of exotic diseases.

Methodology

BoviSaNet was created using a participatory approach. At first, individual exploratory interviews were conducted, face to face or by telephone, with private veterinarians (different professional profiles). Interviews were aimed at drafting a proposal for the sentinel network and identifying possible participants among private veterinarians (i.e. snowball sampling). Identified people were invited to participate at online focus groups to define the characteristics and structure for the monitoring system. Health indicators of interest were selected by veterinarians considering the availability of the information, the accuracy of the collected data, and their professional interest in monitoring a particular parameter. In addition, a digital platform and mobile app were developed *ad-hoc* for data reporting and the reception of automatic feedbacks. The project was carried out as a pilot in two selected areas: Galicia (north-west of Spain) and Catalonia (north-east of Spain).

Results and Discussions

Participants of the network are private veterinarians including clinical practitioners, veterinarians of the Livestock Sanitary Defence Groups, reproduction specialists, hoof-trimmers, and milk quality consultants. Selected indicators were mastitis and somatic cell counts, abortions, retentions of placenta, ketosis (measured by beta-hydroxybutyrate), abomasum displacement, lameness, eliminations, and deaths (divided into three groups: unexpected deaths, accident, and eliminations for a specific cause) together with diagnostic data of specific diseases, such as Bovine Viral Diarrhoea or Paratuberculosis, among others.

Implications

The developed system will contribute to enhance the early detection of emerging infectious diseases and, also, to disseminate information among farmers and veterinarians. At the same time, BoviSaNet can contribute to the creation of reference values for the collected parameters and to identify health problems and gaps in farms' practices.

Evaluation of Cost of Classical and African Swine Fever Epidemics Using a Tool

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Knowing the cost of Transboundary Animal Diseases is critically important for veterinary services to prioritise resource allocation and to prepare and plan future possible events and interventions. The objective of this work is the application of a tool to evaluate the cost of three different situations

Material and methods

The model has been built in Excel and considers up to eight farm types. It calculates a total of 110 items related to the cost of the disease, the outbreak investigation, the applied control measures, the surveillance activities, and the training and awareness activities. The results specify the costs by different stakeholders (veterinary services, farmers or others). The model has been tested with three situations: the outbreaks of classical swine fever (CSF) in Colombia in 2015-16, the African swine fever (ASF) in the Philippines in 2019, and a scenario of a possible ASF outbreak in North Macedonia.

Results

CSF in Colombia: 5 commercial farms and 86 backyard farms were affected in 2015/16. The total cost for two years was 2.9M US$, the highest cost was the vaccination (1.1M). The cost is affected and connected farms was 0.2M and 0.5M respectively.

ASF in Philippines: in 2019, 18000 farms (mostly from backyard farms and few commercial farms) were affected. The control costs entailed a total of 52M US$ that included outbreak investigation, stamping out, surveillance, awareness campaigns and other costs such as cleaning and disinfection and disposal. Cost in connected farms was not calculated.

A hypothetic scenario of an ASF outbreak in North Macedonia was used, in which 18 family and backyard farms with 267 animals would be infected. The total cost would be 3M US$: 1.8M in connected farms, 0.6M of indirect costs and only 50,000 US$ in affected farms.

Discussion:

The developed tool is flexible and applicable to different diseases, environment and it can be adapted to different control measures and local settings and circumstances. The three cases show big differences in the number and type of affected farms and the control measures, consequently, the costs are also very different.

Epidemiological Impacts of FMD Outbreaks at Farm Level in 4 Outbreak Areas of Thailand and Economic Assessment in Dairy Farms

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Introduction

Foot and mouth disease (FMD) is one of the most important infectious animal diseases that burdened Thailand's livestock production. Even though Thailand has been regularly affected by FMD, only a few studies of epidemiological and economic assessment at the farm level had been conducted. Therefore, this study aims to study the epidemiological impact of FMD at the farm level in 4 districts of Thailand affected by the FMD outbreak between 2015 and 2016 and assess the economic impact of FMD in dairy farms.

Materials and methods

The epidemiological data were collected in FMD affected farms consisted of 193 FMD dairy farms, 55 beef farms, and 25 pig farms in 4 districts. The morbidity rate and mortality rate at the farm level were calculated. The negative binomial regression was used to analyse the effect of related factors, i.e., study areas, animal groups and FMD vaccination practices. In addition, the economic data was collected in 60 FMD affected dairy farms. The FMD economic impact at the farm level was calculated as the sum of milk production losses, mortality losses, additional labour costs and veterinary service and medicine costs.

Results and discussions

The morbidity rate in calf was significantly lower compared to other animal groups. The vaccination did not reduce the morbidity rate in cattle. The results might be explained by the short longevity of the vaccine-induced immunity and poor matching strain. However, the FMD vaccination significantly lowered the morbidity rate in the pig. Therefore, the result supported the benefit of FMD vaccination in pig farms. The average FMD economic losses per head in dairy farms amounted to 56.1 USD (ranged from 2 – 376.5 USD). The large variation was caused by the difference in milk production loss between farms which could be explained by the amount of milk production before the outbreak, the severity of clinical signs and the management and treatment after the outbreak.

Implications

FMD epidemiological and economic impact on the farms were substantial, which strengthen the incentive of FMD control. The data could support the analysis for policy decision making.

Farmers' Intention to Adopt New and Improved Technologies on Disease Prevention in Shrimp Farming

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In Malaysia, giant tiger prawn (*Penaeus monodon*) and white shrimp (*Litopenaeus vannamei*) are mostly farmed in brackish water. Nowadays, the disease problems have become significant issues that affected shrimp production. Generally, shrimps lack a specific immune system and become a pathogen's easy target hence, shrimp farmers mainly use low-cost antibiotics and antimicrobial drugs on a farm level. Overuse of these antibiotics and antimicrobials drugs has triggered antimicrobial resistance (AMR) in shrimp farming. However, the adoption of new technologies related to antibiotics is reported to be low at the farm level due to the high price and farmers' unwillingness to adopt the technologies. Hence, the new affordable and improved technologies should be developed and made available in the market. The objective of the study was to determine the shrimp farmers' intention to adopt new and improved technologies on disease prevention in shrimp farming. Stratified sampling was used to select 20 shrimp farms located in Peninsular Malaysia. A structured questionnaire was established as a research instrument and used to get responses from selected 20 shrimp farmers. The results based on Pearson correlation analysis showed that attitude and perceived resources have moderate significant relationships towards farmers' intention to adopt new and improved technologies at a 1% level of significance, respectively. Meanwhile, Chi-square analysis indicated that only income has a significant association with farmers' intention to adopt new and improved technologies at a 1% level of significance. This study concludes that investigating the factors that influence the shrimp farmers' intention to adopt new and improved technologies on disease prevention is important to provide prior information on the risk of AMR in shrimp farms.

TRANSFORM: Sustainable and Market-Driven Data-Based Approaches to Reduce Risk of Disease, Antimicrobial Resistance and Zoonoses in Southeast Asian Animal Production Systems

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Introduction

In recent years Southeast Asian countries have experienced unprecedented growth and intensification of animal production systems due to increased protein demand alongside the emergence of new export markets [1]. This has been accompanied by a concomitant increase in hazards associated with the spread and dissemination of transboundary infectious diseases (TADs), antimicrobial resistance (AMR), and zoonoses. To mitigate such risks, innovative and sustainable, market-driven strategies that add value to producers and consumers are needed.

Funded by USAID, the TRANSFORM consortium (Cargill, Heifer, IPC and Ausvet) will develop market-driven approaches to risk-mitigation of TADs, AMR and zoonoses. The goal is to increase the availability of safe and affordable animal-based protein.

Based on the needs of public and private value-chain stakeholders, Ausvet will develop and make available data-driven decision support tools that are expected to result in increased, sustainable capacity to prevent TADs, manage zoonoses and mitigate AMR, alongside a more effective and rapid response to new, emerging threats.

Materials and methods

Ausvet (TRANSFORM) will target poultry (Indonesia and Vietnam) and swine/shrimp production (Vietnam). The project will design distinct, converging strategies for the integrated as well as the smaller (independent) sectors. An enhanced cloud-based data platform based on iSIKHNAS (developed to manage health/production issues and successfully adopted in Indonesia) [2] will be developed. Initial landscape and stakeholder mapping will outline the economic and animal health contexts, alongside the challenges, priorities and needs of different stakeholders. These consultations will inform the development of platforms/data tools that meet their specific needs. These will initially be piloted in a small number of units before being rolled out at large scale.

Expected results

We expect long-term adoption of the data platform/tools by key value-chain players in Vietnam and Indonesia, to be financially supported by the stakeholders themselves. The proposed tools will link with existing surveillance/farm management systems, adding value to the meat/shrimp product through improved disease control, reduced antimicrobial use/AMR and zoonotic risks. In addition, TRANSFORM will establish effective synergies with current One Health initiatives in the region, fostering collaboration between the industry and the veterinary and health authorities.

Topics, Actors, and Metaphors in the Communication on Bovine Tuberculosis inSpain and France, 2018-2020

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Introduction

How stakeholders conceptualize tuberculosis (bTB) might influence the acceptability of the eradication programme. The objective of this study was to characterise sources, topics, and audiences of communication on bTB in Spain and France, and how the disease is framed by different actors involved in its eradication (farmers, veterinarians, public administration, and scientists). This work is part of the INNOTUB project (https://innotub.eu/) aimed at improving control and surveillance of tuberculosis in livestock and wildlife in the trans-Pyrenees region.

Methodology

"Bovine tuberculosis" was the keyword used for screening texts to sample. To ensure homogeneity, the same criteria were applied for Spanish and French samples. The criteria included: year of publication (2018-2020); geographic area (national; Catalonia or Pyrénées Atlantiques); diversity of sources (institutional, scientific, and non-institutional communication); and the level of dissemination. All texts were available in digital format. The number of publications to select from each source was established under the criteria of "repetition". The sample was analysed through Content Analysis and Critical Metaphor Analysis (CMA).

Results and Discussions

The sample included 153 (Spain) and 66 (France) digital texts. The main topics covered were bTB detection and control (about 50%), followed by wildlife and domestic reservoirs (about 25%). However, variations were observed among groups. Administrations and scientists from both areas used mainly the "war" metaphor, focusing their communication on the disease management and, to a lesser extent, on the role played by wild reservoirs. Farmers' communication showed more diversity, using different metaphors (i.e., "war", "container", "movement" and "religious"), and communicating, besides bTB, about other topics that worriedthem (e.g., themselves, their herds, or relationships with the administration). In Spain, veterinarians' communication was similar to that of farmers, while in France it resembled institutional communication.

Implications

The interpretation of those metaphors used in the different texts enabled to explore the existing views on bTB among the different actors involved eradication campaign. Results evidenced heterogeneity on bTB understanding among them and highlighted the need to find a common "narrative framework"; to reduce the use of "war" metaphors and to widen the topics covered.

Barriers and Facilitators to the Implementation of a Regulation Restricting the Use of Antimicrobials in Dairy Production in Quebec, Canada

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Introduction

In February 2019, a new regulation restricting the use of antimicrobials of very high importance in human medicine (3rd and 4th generation cephalosporins, fluoroquinolones, and polymyxins; also defined as category I antimicrobials by Health Canada) in food-producing animals was implemented in Quebec, Canada. After the implementation of this regulation, there was a significative reduction in category 1 antimicrobial use in dairy production in the province. However, there was a considerable amount of variation between herds (1). Therefore, it is important to better understand barriers and facilitators associated with the application of this regulation.

Objectives

The objective of the study was to identify barriers, facilitators and consequences for dairy farmers and veterinarians of implementing such regulation.

Methodology

Individual semi-structured interviews were performed with 15 veterinarians and 27 dairy producers from the province of Quebec. A thematic analysis was performed using NVivo 12.0. The theory of the Behaviour Change Wheel was used to identify the different themes, which are access to training, motivation, capability, opportunity for implementing the new regulation and consequences of the implementation of the regulation.

Results and discussion

Main barriers identified included fear of economic impact, access to veterinary services, lack of alternative antimicrobials, delays in diagnostics. Participants mentioned both positive and negative consequences of this regulation. Indeed, if some producers observed a degradation of animal health and welfare in some condition, other underlined that preventive medicine was reinforced on farms, with positive economic outcomes.

Implications

This study is the first to document the implementation and impacts of this type of regulation on dairy farms in North America. Our results will allow to better understand the factors that are important to take into consideration to facilitate the implementation of similar regulation in the future and to minimize its negative impacts.

A Cost-Effectiveness Evaluation of Bovine Tuberculosis Surveillance with a Stochastic Multiscale Model

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Keywords

Bovine Tuberculosis; system surveillance reforms; cost-effectiveness evaluation; stochastic multiscale model; France

Introduction

Since 2001, France has been officially recognized free from bovine Tuberculosis (bTB). However, lately, bTB prevalence has increased (1). Therefore, the government plans to reinforce the surveillance system by modifying the detection method. Our study aims to estimate the additional costs that farmers may incur and the effectiveness of the new surveillance system in the short and mid-terms.

Material and methods

To achieve that, we built a stochastic multiscale economic model enabling to evaluate costs at the farm level and effectiveness at the regional level under 2 scenarios. In the scenario 1, farmers use a new detection test and in high bTB prevalence municipalities, the minimal age of testing is decreased to 12 months and animals over six weeks old are tested at the gate. In the scenario 2, it's the same as the scenario 1 but the minimal age of testing is decreased to 6 months instead. Calibration of the model is performed by using data from the French National Cattle inventory, bTB surveillance data of the 2019/2020 campaign, and surveillance costs for farmers and veterinarians. Sensitivity and specificity of the two tests are set in our model.

Results and discussion

Our preliminary results suggest that farms with history of bTB will benefit from a new surveillance system, as they will save around 10 euros/cow. For other farmers, it will cost in average 7 and 6 additional euros per cow in the scenario 1 and 2, respectively.

Implications

For the vast majority of French farms, implementing a new surveillance system will generate additional costs. Regardless of the effectiveness of the scenarios, the societal benefit i.e., maintaining the status free from bTB will come at a cost. For policy-makers, the remaining question is who should support such costs. This is even more important for small farmers, with costs per cattle 4 to 5 times to other farmers.

Estimating the Cost of Rearing Crossbreed Dairy Young Stock in Malaysia

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Young stock rearing is a long-term investment on a dairy farm. This study aims to estimate the costs of rearing crossbreed dairy young stock includes uncertainty in mortality. A heifer cost simulation model was created in Microsoft Excel spreadsheet (Microsoft, Redmond, WA, USA) utilizing @RISK add-ons (Palisade Corporation, Ithaca, NY). Fifty-two stages were defined to reflect the development of a dairy young stock from birth to first calving age and two states were defined (healthy and dead) to reflect the status of the dairy young stock with 2,000 replications. The model assumed commercial farm management systems at Johor (60% and 70% Friesian blood level crossbreeds) and Sabah (87.5% Friesian blood level crossbreeds) with mortality rate 22.5% and 16%, respectively and used Gompertz function to model the bodyweight. Our model assumed the first calving age are 30 months (347kg), 31 months (355kg) for 60% and 70%, respectively and 24 months (585kg) for 87.5% Friesian blood level crossbreeds. The stochastic model estimated average (5%-95%) total cost of rearing dairy young stock from birth until first calving age was RM7,396.46 (USD1,776)/heifer. The average mortality cost was RM53 (USD13)/heifer. In Malaysia, there are 80% of smallholder farms (from 852 dairy farms) that do not keep young stock bodyweight data, and only few large farms that keep bodyweight data causing the difficulty in conducting the research. Dairy farmers are suggested to record the mortality rate to improve the cost estimations as it is important health indicator that may lead to economic losses (Fentie et al., 2020). The feed cost is the major contributor to the total cost of rearing and can be influenced by feed price (Haryo et al., 2017). Besides, growth performance and costs of rearing dairy young stock are varied due to different farm management, genetic and environment of the dairy farm indirectly delaying first calving age that incur higher cost of rearing (Roessler et al., 2019). Considerably more work will need to be done by including the inputs such as conception rate, estrus detection rate to increase the accuracy of costs estimation.

Decision-Making Theory into Practice – The Role of Behavioural Economics

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Introduction

Neoclassical economic approaches assume rational human behaviour and perfect cognitive ability in decision-making. Behavioural economic approaches are based on a view that humans have limited cognitive ability and therefore their decision-making is not rational, especially when tackling difficult problems quickly (1). Empirical evidence shows that people use rules of thumb (heuristics) as a shortcut to make decisions quickly, and without detailed information (2).

Methodology

Observations and interviews will be used to uncover examples of empirically validated heuristics in use during decision making for resource allocation in animal health. This will be supported by reviewing the literature to prepare a shortlist of heuristics of interest and the likely circumstances in which they may be encountered.

Discussion

A combination of irrational human behaviours may be assumed to result in an aggregate position that mimics rationality and therefore neoclassical economic approaches provide important models that can be used to predict the behaviour of large populations. In aiming to understand decision-making of less variable populations, such as small communities, households or individuals, behavioural economic approaches may be more useful. Programmes such as the Global Burden of Animal Diseases (3) must provide evidence for the assumption that additional information for decision-makers can result in more rational resource allocation. Describing examples of heuristics (and corresponding biases) commonly encountered in animal health decision-making will provide valuable information to support the testing of assumptions for impact and the optimal presentation of new evidence in a way that will maximise its use.

Implications

The theoretical approaches and analytical frameworks of behavioural economics merit exploration for members of the Society who are interested in understanding how the limited cognitive ability and irrational behaviour of people can impact on decision-making.

Using Stated Choice Experiments to Evaluate the Acceptability of Biosecurity: Application to African Swine Fever Prevention in French Island of Corsica

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Introduction

African Swine Fever has prompted governments and the swine industry in Europe to adopt drastic measures for limiting contacts between domestic and wild pigs, including a strict confinement of farmed pigs in France. In many cases, this implies a radical shift in farming practices, the acceptability of which is likely to be limited. One example is the free-range pig farming sector in the French island of Corsica, for which some specific amendments were proposed, including the continuity of free ranging but only for neutered or pregnant animals and the mandatory collection of carcasses in ranging areas. This study assesses the interest of stated choice surveys in analyzing the acceptability of biosecurity plans by pig farmers.

Method

A stated choice survey was designed and implemented. Individual participants were submitted with a set of 15 pairs of hypothetical biosecurity plans which differed on four specific attributes: (i) percentage of implementation cost covered by subsidies, (ii) mandatory collection of carcasses by farmers, (iii) ovariectomy of gilts performed by a farmer or a veterinarian and (iv) age at sterilization. For each pair of alternative plans, farmers were asked (i) whether at least one of them was acceptable and, if yes, (ii) his preferred alternative. The data was analyzed using a conditional logit model.

Results

Forty free-range pig farmers were interviewed in total. On average, farmers had a strong preference for subsidies covering 75% of the individual costs compared to 25% (odds ratio (OR) of plan acceptance of 6.9, 95% confidence interval (CI): 4.4-10.7). They also had a slighter but significant preference for keeping the collection of carcasses optional (OR: 1.26, 95% CI: 1.04-1.53) compared to making it mandatory and enforcing an age at sterilization below 5 months (OR: 1.34, 95% CI: 1.09-1.69) compared to keeping it flexible.

Discussion

Despite the heterogeneity in farmers' preferences, the stated choice approach allowed us to identify some constraints on the acceptability of the biosecurity plan which go beyond purely financial considerations, like the workload related to the collection of carcasses and the risks for animal welfare and growth performance if the neutering is performed too late.

Cost and Benefit Analysis: Alternative Disinfection and Limited Compensation in the Eradication of African Swine Fever in Bangka Regency, Indonesia

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African swine fever (ASF) is a viral hemorrhagic disease that is very deadly and contagious in domestic and wild pigs, caused by the ASF virus. The incidence of pig deaths in Bangka Regency with 600 deaths and has been confirmed in the laboratory with positive ASF results. The purpose of this paper is to provide an overview of the cost and benefit analysis of the disinfection strategy and limited compensationwith the assumption of cure or control of this disease, the incidence in the first year is 70%, the second year is 80% and the third year is 90%. The results obtained during the three years of the eradication program were NPV 213,092,320, BCR 1.03 and IRR 59.73. These two programs (disinfection and providing limited compensation) mean that the net present value (NPV) is positive while (B/C ratio) > 1. Thus, if this program can be implemented properly it will have an impact on profits, and avoid loss.

Keywords: ASF, Profit, BCA

An Empirical Analysis on the Association between Persistency of Dairy Cows and Economic Herd Performance

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Persistency of dairy cows represents the cow's ability to maintain a slow rate of decline in milk production after the peak. So far, the association between lactation persistency and economic performance was investigated with simulation models, and only some empirical studies focused on single cost components (e.g., feed costs). An empirical study investigating the association between persistency and overall economic herd performance is thus lacking. This study aimed to investigate the association between cow lactation persistency and economic herd performance, based on longitudinal Dutch accounting data. Herd and farm accounting data (n = 1,956 herds) over the years 2007–2016 were available. Persistency was defined as the time (in days) for milk production to drop by half after the peak. Cow persistency was calculated through lactation curve modeling and then summarized to a herd persistency on a calendar year basis, for two parity groups (heifers (P1) and multiparous cows (P2+)). After data editing, 1738 herds were used for analysis. Data was analyzed using generalized linear mixed modeling, with income over feed cost as the dependent variable. The independent variables consisted of herd persistency, year, herd size, herd intensity, expansion rate, soil type, milking system, successor availability, equity, calving interval, age, relative milk price, and use of outsourced heifer rearing. Herd was included as a random effect to account for the heterogeneity among herds. The average median herd persistency for heifers and multiparous cows is 357 and 240 days (STD = 70 and 33). The income over feed cost per cow was on average €2,240 per year (STD = 421), equivalent to 6.24 per day (STD = 1.15), with the lowest value in the year 2009 and the highest value in the year 2013. Income over feed cost was significantly positively associated with the herd persistency of both parity groups. Herds with higher herd persistency had performed economically better. The effect of persistency of multiparous cows is ten times that of heifers. This indicates that, within current practice, increasing herd persistency can improve the herd economic performance, especially for the persistency of multiparous cows.

Production and Consumption Impacts of Foot-And-Mouth Disease at the Uganda-Tanzania Border

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Introduction: Foot-and-mouth disease (FMD) outbreaks occur persistently in Uganda and Tanzania. FMD is well-known to reduce livestock income and milk production. We expand this by identifying the economic impacts 1) between types of milk consumers/producers in Tanzania and Uganda, and 2) on households experiencing FMD outbreaks compared to uninfected households. This provides an improved understanding of the scope of the problem to target local and regional control policies.

Methods: Data come from a 2018 survey of 254 households in the Kyaka and Nsunga wards (Tanzania) and the Endinzi, Lwamaggwa, and Kakuuto counties (Uganda). Households reported on livestock and livestock product sales, milk, and beef consumption, as well as related food prices from before and after an FMD outbreak. We use difference-in-difference and first difference approaches with fixed effects to evaluate the impact of FMD on household production and consumption.

Results: Over half of the households in Tanzania and Uganda (53% and 74%, respectively) reported an FMD outbreak. Households with and without FMD consumed on average 8 cups of milk per day, 3 kilos of beef per week, and sold livestock each month. FMD outbreaks reduced livestock sales by 20%. Households that reported producing and consuming milk experienced a decrease in milk consumption by 50% per day due to FMD while there was no effect on households who buy milk. Additional analyses suggested that milk prices negatively impacted milk consumption during an FMD outbreak, while the presence of milk cooperatives and income from livestock increased milk consumption.

Implications: Our results found that FMD outbreaks in endemic border regions primarily reduced milk consumption and livestock sales. Our findings support price effects as negatively impacting milk consumption and show that the effect is augmented in Uganda and amongst households who both produce and consume milk. Additional structural factors in Uganda, potentially through price setting by local cooperatives, was related to milk consumption, which would support policy recommendations for price stabilization. Given that the price effects cut across both infected and uninfected households and countries, stabilizing prices would likely have a larger impact on household nutritional security than directing relief directly to infected households.

Pig Keepers' Perceptions Regarding the Control of African Swine Fever – A Participatory Approach

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African Swine Fever (ASF) has been present in Estonia since 2014, and pig keepers have a central role in controlling the spread of infection in domestic pigs. Participatory epidemiology (1) may shed light on livestock keepers' existing attitudes and compliance towards implementing control strategies. By conducting focus group discussions and using participatory tools, this study aimed to reveal pig keepers' awareness of ASF clinical signs, possible transmission routes, and preventive measures. Furthermore, their acceptability of control measures in Estonia was investigated.

Increased mortality and fever, inappetence, and lethargy were the most indicative ASF signs for the pig keepers, which showed a high level of awareness. The highest risk of virus introduction to the herd was designated to vehicles, rodents, birds, insects, and people. Fencing was the most liked preventive measure, while training employees and visitors on biosecurity was considered the most effective one. Among farm-level ASF eradication measures, the least accepted was culling of all animals on the farm due to the negative impact on workers' psychological wellbeing. Some participants revealed resentment of misunderstanding why healthy pigs are culled instead of being processed for the canned meat. Restrictions on trade and moving pigs as a consequence of ASF spread were negatively perceived. Concerning ASF territorial restrictions (zoning), lower meat prices and economic losses were seen by pig keepers as consequences of the greatest impact. Pig keepers ranked trust in veterinary authority and Ministry of Rural Affairs regarding their role in ASF prevention and control as high while perceiving themselves as the trust-worthiest stakeholder within the ASF network.

This study demonstrates high awareness of Estonian pig keepers regarding recognition, prevention measures, and transmission routes of ASF. Still, detailed explanations on the necessity of some ASF control and eradication measures, additional incentives are needed to improve compliance and alleviate the consequences of ASF control and eradication. More collaboration should be fostered between stakeholders in the ASF network. Accordingly, these findings are noteworthy to other countries when adjusting different ASF control strategies for successful eradication.

Economic Impact of Classical Swine Fever Outbreaks between 2013-2020 In Colombia

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Introduction: Classical swine fever (CSF) is one of the diseases with the greatest impact on swine health and industry. In the 90s the CSF outbreaks that occurred in several countries of the European community caused significant losses, as is the case of the Netherlands (1), Germany (2) and Belgium (3). The objective of this study is to assess the economic impact of 156 CSF outbreaks that occurred between 2013 and 2020 in Colombia.

Materials and Methods: The evaluation was made based mainly on information from the official veterinary service-ICA and the Colombian Association of Pig Farmers.
The direct costs of the disease, outbreak control and investigation activities, vaccination on farms, active and passive surveillance and the training and awareness campaigns were calculated. The prices were adjusted to 2020 to avoid inflationary disruptions.

Results: The outbreaks caused a total cost of US$10.2 million. The biggest cost was the vaccination of pigs with an average annual cost of US$1.1 million (US$8.5 per farm). The total cost of surveillance was US$1,047,906 which includes the active surveillance in high-risk facilities and farm visits to CSF suspicious farms. The cost of disease and control activities was US$466,473. Of them, US$148,059 were losses to producers due to dead animals, the rest were mainly caused by inspection of affected, and neighboring farms and compensations to the farmers. The cost of visits to affected and neighboring farms had an average cost per outbreak of US$395 and US$903 respectively, while US$83 was spent on diagnostic tests and US$963 on movement control per outbreak. In 37 outbreaks, pigs were slaughtered with an average cost per outbreak of US$2,645.

Discussion: The annual cost of CSF outbreaks in Colombia was cheaper compared to other countries mainly because animals from infected farms were not slaughtered. In addition, the measures implemented were not effective enough to eradicate the disease.

Characterization of Smallholders Cost Production and Marketing Practices in The Atlantic Region of Colombia

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Introduction: In Colombia 95% of CSF outbreaks have occurred in backyard production (1).
Greater knowledge of smallholders production systems and pig marketing can help direct health strategies for more effective disease control (2). The objective of this study was to assess the costs of production and marketing practices of pigs in smallholders productions in the Atlantic region (North of Colombia) a CSF endemic zone with vaccination.

Materials and Methods: In 2020, 140 surveys to producers of backyard farms were applied by field veterinarians of Porkcolombia to know the management practices, production costs and marketing of pigs. The descriptive analysis was carried out in excel.

Results: The average of sow per farm was 3.5, the 31% of pig premises are reared outdoor systems, the 54% and 58% of producers feed with agricultural products or swill respectively and the 81% supply a median of 1.2 kg/day of animal feed with an average cost per kg of US $0.44. Only 26% of producers used veterinary services with an average cost per visit of US $18.6. The producer works on the farm a median of 3 hours/day and the mean daily salary in the zone is US $7.2. The purchase price of sows and piglets has a median of US $102 and $30.8 respectively. The 43% of producers sell pigs to their neighbors and 81% sell to marketers. The profit to the producer from the sale of fattening pigs was US $52.1/pig, which is only profitable without considering the cost of labor equivalent to US $397.

Discussion: The backyard production in North of Colombia is a subsistence production based on a low-cost and low-income system and considered by producers as an emergency banks. Most of the marketing of these backyard pigs is not controlled by the authorities, so it is a critical factor to consider in the sanitary programs, as well as to stimulate the implementation of biosecurity measures.

Economic Analysis to Support an Investigation on High Somatic Cell Count Problem in Dairy Cattle in Chiang Mai, Thailand

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Introduction

Mastitis in dairy cattle leads to important losses due to a reduction in milk yields, the withdrawal period after treatment, and an increase in somatic cell count (SCC) which reduces the milk's commercial value. Dairy cooperatives point to the high SCC problem as an important factor leading to suboptimal levels of milk quantity and quality. This study aims at describing farm characteristics and milking practices associated with high SCC, identifying risk factors, and assessing the economic loss due to high SCC in three dairy cooperatives in Chiang Mai, Thailand.

Materials and Methods

A cross-sectional study was conducted on 208 dairy cattle farms from July to September 2018. Structured interviews were conducted to collect the data. Univariate and multivariate analyses were performed to determine the degree of association between factors and high SCC. A retrospective cost assessment of high SCC was conducted to estimate the losses in affected farms, and two potential coping strategies were assessed: 1) culling, 2) treating the cow.

Results and Discussions

More than 12% of farms had high SCC. Inadequate pressure and inadequate pulse rate of the milking machine were identified as significant risk factors according to the

multivariate analysis (P < 0.05 and P < 0.1, respectively). Both factors decrease the natural protection of teat tissue, increasing the likelihood of bacterial infection.

The average economic loss of high SCC in affected farms was 557 USD for three months. When comparing coping strategies, treating the affected cow is the most effective strategy. With a probability of successful treatment of 54%, treating an affected cow would lead to 1,158.7 USD in gains over three years (vs doing nothing).

Implications

The results of the economic analysis can be used to raise awareness among farmers and cooperatives. Cooperatives can recruit more veterinarians after balancing the losses of high SCC and the cost of new recruitments to support farmers in preventing high SCC.

Key words: somatic cell count, dairy cattle, investigation, economic analysis

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Prescription of antibiotics by poultry veterinarians in France: Influenced by entrenched group practices

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There is currently a significant problem of antibiotic resistance in public health, which can be contributed through the overuse and misuse of antibiotics in livestock sectors (Prestinaci et al., 2015; Charani et al., 2013). Qualitative studies carried out so far focused mainly on farmers; however, veterinarians' prescription behaviour has remained overlooked. In this regard, the present study explored the psychosocial factors which shape veterinarians' prescriptions. A total of 16 in-depth interviews were conducted, using a semi-structured guide among poultry veterinarians in France. A thematic analysis was performed using with NVivo software. Results highlighted the influence of interactions with peers in the clinical decision-making process. We found that the key role of "field training", during which junior veterinarians who just graduated are accompanied by senior veterinarians might influence this interaction. During this training phase, seniors can directly influence juniors' prescriptions of antibiotics through direct intervention, or indirectly through imitation by the juniors. Two other instances of peers' influence on veterinarians were also found. The first is related to the corporate veterinary practice groups. These groups promote direct influence between veterinarians, through rectification and promotion of practices, and indirect influence, through informal guidelines or protocols specific to each corporate practice group. The second is related to producers' organizations, which generate influence on veterinarians through farmers and technicians. This study showed that veterinarians' prescriptions are cornered by entrenched practices, in which interactions with peers play an important role. Therefore, interventions tackling antimicrobial stewardship should not only focus on farmers-veterinarians' interactions but also implement practices through clinical leadership and veterinarians' social networks to influence prescribing practices.

Quantifying Animal Health Care Accessibility in France Using Two-step Floating Catchment Area Method

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Introduction

To minimise the shortage of veterinary personnel in France, several public policies were implemented by the French government. In this context, the DDADUE law aims to grant aids to rural veterinarians or animal health companies that actually practise in eligible regions. To define these regions, the level of accessibility to animal health care has to be quantified. In this paper, we implemented the Two-Step Floating Catchment area (2SFCA) approach to measure the level of accessibility of animal health care in all the areas of France.

Material and methods

A database provided by the Department of Agriculture and Food has allowed us to identify all beef and sheep farms from various locations in France.

The Two-Step Floating Catchment Area (2SFCA) approach was used to measure the level of accessibility. This approach is a special case of gravity model that measures spatial accessibility in two steps by catching areas twice based on population demand and animal health care supply. The distance measurement between the farms and the veterinary locations was quantified by the time-distance which is the most realistic and precise measure.

Results and discussion

The 2SFCA indicator showed the level of accessibility of each region. The results are presented in a map that summarizes the situation of each region in different colours. Then, the areas were classified into 4 groups depending on the level of accessibility. It appears clearly that regions with the lowest level of accessibility are the Provence-Alpes-Côtes d'Azur (PACA), the south of Occitanie, and Nouvelle Aquitaine. Moreover, we also did a sensitivity analysis by keeping only veterinarians under 60 years.

Implications

Our results highlighted the veterinary shortage area in France by quantifying the accessibility to animal health care. The map discussed above would provide enough justification for policymakers to identify the area with a low level of accessibility and to take appropriate measures to improve the accessibility and to find the optimal locations of new animal health centers in the area.

Motivating Factors for Calfkeepers and Association with Neonatal Calf Mortality in Estonian Dairy Farms

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Herzberg's motivation theory is widely used among job satisfaction and job motivation researchers. Well-motivated employees are more productive and committed; however, among dairy farm workers this has not been thoroughly researched yet. The present study was designed to assess job satisfaction and motivation among calfkeepers in Estonian dairy farms and analyze its association with neonatal calf mortality.

Anonymous pre-developed questionnaires were sent to calfkeepers of 120 freestall farms with at least 100 cows, and responses from 102 different farms were received. The questionnaire included general questions about the respondent (n = 6) and statements in a 7-point Likert scale about job satisfaction (n = 9) and motivating factors (n = 14). Data for calculating calf mortality was collected from each farm regarding the year before the visit. Associations were analysed with Spearman correlation analysis.

Calfkeepers considered good calf health to be the most motivating factor in their work (average score 6.9 out of 7), followed by working environment (6.6) and quality of co-workers' work (6.6). Salary and its' dependence on work results were rated as the least motivating factors among those investigated (average scores 5.1 and 4.9 out of 7, respectively). Workers who stated they like their job also felt better motivated to do it well (correlation coefficient $r = 0.41$, $p < 0.001$). Calf mortality was found to be lower in farms where calfkeepers felt satisfied with calf mortality level ($r = -0.29$, $p < 0.001$).

Calfkeepers were most satisfied with working schedule and supervisors' attitude (average scores 5.9 and 5.6 out of 7, respectively) and least satisfied with self-education opportunities (4.4) and salary (4.5). A weak negative correlation was found between calf mortality and calfkeepers' satisfaction with working conditions and quality of working equipment ($r = -0.17$, $p = 0.047$ and $r = -0.21$, $p = 0.015$, respectively).

Calfkeepers are motivated mostly by the good health of calves, pleasantness of the job, work-related achievements, good contribution from co-workers and recognition from supervisors. Improvements regarding factors that calfkeepers are least satisfied with, e.g. salary, self-education and working conditions should also be made to eradicate dissatisfaction and create a baseline for further motivation of employees.

Systematic Review of Methods Used to Evaluate the Socioeconomic Impact of Endemic Foot-And-Mouth Disease: Implications for Disease Control and Policy

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Foot-and-mouth disease (FMD) is commonly cited as one of the most important livestock diseases because of its large economic consequences, which must be robustly evaluated to support disease control policy. This study described and assessed methods used to evaluate the economic impact of FMD and its control in endemic contexts.

A systematic literature search following WHO's guidelines for rapid reviews was conducted in six academic search engines, using descriptors for FMD and economic disease impact, identifying peer-reviewed and grey literature. Studies were included if they applied an economic calculation or framework to a context with endemic FMD, producing a result articulated as a financial figure. Data collected from each article included country of study, animal population, geographical level of analysis, time horizon and type of economic analysis. Each paper was evaluated using a quality assessment tool containing a checklist of 42 reporting criteria.

Sixty-four articles were included, from 12087 identified in the searches, describing results for 26 countries. Cattle were the species most often considered (in 80% articles), followed by mixed-species articles (44%). Over half of the articles (56%) described economic impact of FMD retrospectively, often only accounting for a selection of direct costs at farm or household level. Where calculated, national or regional results were often based on scaling household or animal level estimates using population data. Few papers included disaggregation of public and private costs, or benefits, of FMD control, or accounted for economic or social influences of scale in vaccination programmes. Median quality score calculated was 41% (range 8%-86%). Methods were generally poorly reported confirming previously described difficulties in using published data to evaluate economic impact of endemic FMD.

This is the first systematic study that assesses economic methods used to evaluate endemic FMD. Results show many analyses included have gaps in both premise and methodology; and if used when planning and budgeting FMD control programmes in endemic contexts, for example to feed into the Progressive Control Pathway for FMD, this could result in inefficient resource allocation.
Methodological elements required to improve the robustness and applicability of economic impact studies examining endemic animal disease will be discussed.

Unravelling the Economic Value of Belgian Blue Crossbred using Stochastic Partial Budgeting

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The crossbreeding of the Belgian blue breed to the local beef cattle in Malaysia is to upgrade and enhance the growth traits. This is because the beef cattle industry in Malaysia lacks quality breeds (Ariff et al., 2015). The essential to rear beef cattle crossbreed with superior body growth is to fulfill the aim of increasing the national beef self-sufficiency level (SSL) from 22% in 2020 (DVS, 2021b) to 50% in 2025 (DVS, 2021a). The selection of the Belgian blue breed is merely due to its unique double muscling trait that causes heavier liveweight, and 20% more meat yield than the normal muscled breeds (Arthur, 1995), hence, more muscle can be converted to beef. It is assumed that more beef brings more income to the farmers. This study is undertaken to estimate the economic value of the Belgian blue crossbreds using the stochastic partial budgeting to determine the economic value of the crossbred farming as the proposed change, relative to the local breed farming as the base. Stochastic partial budgeting analysis was conducted with the inputs retrieved from the field survey among (n=106) Belgian blue crossbred farmers, literature reviews and experts' opinions. The liveweight measurement was also being conducted on the field involving (n=138) Belgian blue crossbred calves that were selected randomly, which further analyzed using non-linear polynomial growth function to estimate the liveweight of the crossbred calves at the mean selling age practiced by the farmers. All of the inputs and liveweight analysis were based on the comparison with the local Kedah Kelantan breed situation as the base plan. Based on the survey, the mean selling age of the crossbred cattle is 21 months old. Replacing the age value in the non-linear function, the estimated liveweight of the crossbred calves is 856.51kg. Whilst based on the literature, the local Kedah Kelantan cattle at the same age is estimated to be 286.60kg. From the partial budgeting, the net benefit of the Belgian blue crossbred farming is RM 14,155.69. However, a more complex model through stochastic partial budget needs to be established so that the profitability of the Belgian blue crossbred farming can be determined.

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