



**Nuffield Farming Scholarships Trust
Report**

Award sponsored by

Agriculture and Horticulture Board



**Animal Medicine Best Practice:
unlocking the potential for UK
farming**

Dr Grace O’Gorman

December 2020

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ISBN: 978-1-912059-42-3

Published by The Nuffield Farming Scholarships Trust
Southill Farm, Staple Fitzpaine, Taunton, TA3 5SH

A Nuffield (UK) Farming Scholarships Trust Report

Date of report: December 2020



*"Leading positive change in agriculture.
Inspiring passion and potential in people."*

Title	Animal Medicine Best Practice: unlocking the potential for UK farming
Scholar	Dr Grace O’Gorman
Sponsor	Agriculture and Horticulture Board (AHDB)
Objectives of Study Tour	<ul style="list-style-type: none"> • To understand the influencing factors on animal health and welfare that support animal medicine best practice • To identify those strategies and actions that unlock opportunity through best practice • To explore future possibilities for animal medicines in the UK
Countries Visited	Ireland, Belgium, the Netherlands, Germany, Denmark, Sweden, Norway, and New Zealand
Messages	<ul style="list-style-type: none"> • Livestock farming supported by public money establishes a social contract placing expectations on health and welfare standards, professionalism, and medicine use. The livestock sector must be ready to recognise, apply and demonstrate best practice. • Effective progress on animal health and welfare is needed to improve resilience and farm profitability, providing a competitive advantage. Delivering improvements at scale needs coordination and a strategy that spans the four nations. • Widespread animal medicine best practice needs a model framework that uses both top down and bottom up approaches, and considers the nature of veterinary services, effective use of data, diagnostics, biosecurity and training. • An evidenced-based approach and international collaboration on the authorisation of animal medicines will support both the availability of medicines in the UK and the future development of innovative solutions.

EXECUTIVE SUMMARY

Livestock farming needs to be sustainable, productive, and profitable to survive and thrive. At the same time, farming supported by public money will increasingly come under pressure to deliver public goods. Expectations from consumers, Government and for international market development, as the UK leaves the EU, mean transparency in and evidence supporting animal health and welfare standards and animal medicines best practice are needed. These challenges are not insurmountable and a strategic approach to animal health and welfare, alongside animal medicines best practice can help deliver solutions.

This study took a closer look at opportunities to identify and evaluate influencing factors, strategies, and actions in relation to animal medicines best practice that could help solve these problems and unlock potential. No single silver bullet will do the job. However, all roads led back to boosting the health and welfare of livestock, which is both facilitated by animal medicines best practice and achieving it encourages best practice.

The levers needed to achieve animal medicines best practice are likely to involve both regulatory and voluntary industry approaches. A national coordinating body with ambition and the vision to invest and build capacity is a good starting point. Dissemination of best practice at scale could be achieved by using an effective rural advisory network. Farm vets should be at the heart of the strategy, as trusted professionals clearly supporting consumer and market confidence. A step change in mindset among both vets and farmers is needed to migrate towards a truly preventative health management approach, based on dynamic use of actionable data, reflexive use of diagnostics, greater use of vaccines and the application of bespoke, effective biosecurity plans. Such measures can improve the use of medicines e.g. vaccines, parasite control products, antibiotics, and pain relief to prevent or treat disease and to protect welfare. Consistent and widespread application of best practice pain management on farm will support claims that we have some of the highest welfare standards in the world.

Whilst we work to improve what we have today, there is also opportunity on the horizon in the form of the future UK regulatory landscape and our approach to innovative animal health solutions. We should strive for global regulatory collaboration and harmonisation, taking an evidence-based approach to animal medicine authorisation that helps to secure the attractiveness of the UK market and the availability of medicines. Applying a trade lens to policy and regulations should support opportunity for farmers on international export markets.

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DISCLAIMER

The opinions expressed in this report are my own and not necessarily those of the Nuffield Farming Scholarships Trust, or of my sponsor, or of any other sponsoring body.

Changes to animal health protocols and use of animal medicines on farm should only be made in consultation with your vet.

Please note that the content of this report is up to date and believed to be correct as at the date shown on the front cover.

Unless otherwise stated all figures are the author's own.

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*Published by The Nuffield Farming Scholarships Trust
Southill Farmhouse, Staple Fitzpaine, Taunton TA3 5SH
Tel : 01460 234012
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www.nuffieldscholar.org*



1. Personal Introduction

I grew up on a beef farm in rural Ireland and have many happy memories of caring for livestock on the family farm. I was interested in animal health from an early stage and became a veterinary research scientist. That journey took me to Kenya to study sleeping sickness in African cattle and complete a PhD. Closer to home, my next project focused on reproduction in dairy cattle. Wanting to understand the bigger picture, I then went on to study veterinary medicine at University College Dublin.

I moved to the UK to broaden my horizons and perspective, working as a lecturer in animal health at Hartpury College, settling into the glorious Gloucestershire countryside. Over five years ago I moved to London to work for the National Office of Animal Health (NOAH), the trade association for the UK animal medicines sector. As a Technical Policy Manager, I'm enjoying the ever changing mix of work, from developing training for livestock farmers in the responsible use of antibiotics, working on animal medicine aspects of EU Exit and more recently the response to the COVID-19 pandemic.

I'm reminded now of the simple pleasure and benefits of the outdoors. My small garden and its capable greenhouse have been a source of solace over many months with COVID restrictions. The phrase 'your health is your wealth' has never had more resonance for me and I'm hopeful that in our brave new world the learnings from human health can translate and become relevant for the health and welfare of our livestock.



Picture taken at the House of Lords, London



2. Background to my Study Subject

Livestock farmers are challenged to farm in more sustainable and productive ways, whilst staying in business. Consumers and Government want to know more about how medicines are used on farm and this scrutiny is set to intensify as farming is directly supported by the public purse. At the same time, the UK is on the cusp of trading in a world market outside of the EU block. These converging paths have raised the stakes and there is a need to take a fresh look at the national ambition for animal health and welfare and how it can deliver on all fronts for farmers and society.

With so many challenges, I wanted to look at how improving farm animal health and welfare and the use animal medicines could be part of the solution. The theory was that better and strategic use of animal medicines (i.e. applying best practice) could help with these challenges and develop further opportunities. The potential benefits could be improving efficiency through considered decision making on inputs, reducing losses from mortality and morbidity, and producing a valued, high health and welfare product for the home and export market.

The animal medicines considered in this study include some the major categories used on farm - antibiotics, vaccines, pain management and parasite control products. Best practice for all medicines means using the right product, at the right time, on the right animal in the right way. However, for each category there are specific best practice objectives, e.g. in using antibiotics, the aim is to use 'as little as possible, but as much as necessary', whilst for vaccines the challenge has been to increase uptake and improve management of vaccines in the livestock sector.

There is untapped potential in using these medicines, where improvements could help progress in reducing endemic disease, livestock mortality and morbidity. Animal medicines could play an important part in preventing or treating disease and alleviating pain and suffering, so contributing to better health and welfare.

My study takes a holistic approach, attempting to avoid silo mentality or falling into the trap of solving a problem in a vacuum. In facing a complex and messy reality, I wanted to capture all sorts of influencing factors and ways to improve the health and welfare of livestock that naturally support animal medicines best practice.

Building a resilient and sustainable farming system must be a priority. We are standing at a crossroads with new trading and regulatory environments, societal pressures on food, welfare, and the environment, all in sight. How we move forward will impact farm life, livestock and how food is produced for years to come.



3. My Study Tour

My study tour centred on Europe and New Zealand.

Each European country (Ireland, Belgium, the Netherlands, Germany, Denmark, Sweden, and Norway) was chosen to investigate specific aspects of my study with transferable potential to the UK.

- Ireland offered an opportunity to understand how industry government partnerships such as the Animal Health Ireland programme and a rural advisory service could deliver comparable benefits for UK farming.
- High production countries such as the Netherlands and Germany might offer different solutions to similar problems at comparable scale.
- Scandinavian countries have a reputation of leadership on the responsible use of medicines and for a 'prevention is better than cure' approach.

New Zealand has a well-developed livestock sector focused on competing in tough global markets, with a high-quality product. It was here I hoped to better understand what it takes to achieve this, whilst addressing the challenges of Antimicrobial Resistance (AMR), Anthelmintic Resistance (AHR) and protecting animal welfare. I also wanted to explore the potential around UK-NZ regulatory cooperation on the authorisation of animal medicines and the benefits it might bring.



4. Delivering Improvements in Animal Health and Welfare

On my study tour a pattern emerged: the following factors had an important influence on animal health and welfare that resulted in improvements in how animal medicines were used.

- (1) Animal Health Partnerships
- (2) The Animal Health Team
- (3) Data and Actionable Information
- (4) Biosecurity

4.1 Animal Health Partnerships

Animal health services are provided in various contexts, e.g. as part of Government or industry disease control initiatives and herd health planning. The independent evolution of programmes throughout the devolved nations of the UK paints a complex picture of the animal health and welfare landscape. I wanted to understand from the Irish experience of a partnership approach, how to improve animal health and welfare and animal medicines best practice.

Animal Health Ireland and Teagasc: over the past decade, Ireland has intently focused on improving livestock health. Animal Health Ireland (AHI), a dedicated not-for-profit animal health industry-Government partnership, set an inarguable and ambitious vision of profitability and sustainability to be achieved through higher health resilience. As the CEO David Graham explained, the strength of a body such as AHI is in its coordinating role. Momentum was established and progress made with financial investments from Government and industry stakeholders. The elements that collectively helped to make the whole programme successful were achieving buy-in from Government, leadership, and the structure of the programme with technical working and implementation groups. The initial focus of work was to tackle endemic disease in the cattle sector. To determine which animal health issues to prioritise, the process sought to gather and balance both technical and scientific opinion with farmer views. In that way, the prioritisation process itself helped to make the programme meaningful to all involved. Although there were initial difficulties with farmers accepting and paying for greater vet involvement, in the end the programme helped steer vet services towards more preventative herd health work.

Key tools and infrastructure were needed to make livestock health programmes operational. These included the availability of accredited diagnostics labs to test samples and the effective use of the Irish Cattle Breeders Federation (ICBF) database. Operating at scale (national level) and taking an evidence-based approach (using expert technical working groups) helped with widespread best practice improvements. Whilst the benefits to endemic control are the obvious return, this initiative also catalysed improvements in how animal medicines were used as animal health programmes allow medicines to be used strategically and to their full benefit. Good examples of embedded best practice include vaccines used in control or eradication programmes, responsible use of antibiotics and teat sealants at drying-off, responsible use of antibiotics and use of vaccines in youngstock, and appropriate use of parasite control products to slow anthelmintic resistance.



Teagasc: a nationwide extension service can be a vehicle for disseminating best practice and an essential part of animal health infrastructure. Teagasc, the Irish Agriculture and Food Development Authority, is a national body providing integrated research, advisory and training services to the agriculture and food industry and rural communities. Its Farm Advisory Service network supports around 40,000 farmers as paid clients with a farm consultancy service. It provides a recognised and trusted service for farmers, working in regional units, advisors, specialists, and discussion groups are supported by data and reports with KPIs. Teagasc have worked synergistically with AHI and a Memorandum of Understanding between both parties serves to strengthen co-operation and collaboration with the common objective to improve the health status of the national herd.

4.2 Animal Health Team

Livestock are ‘under the care’ of the farm vet, but farmers also have obligations towards livestock and animal medicines. Ideally, those that provide animal health services, such as vets, vet technicians and consultants, should work collaboratively with farmers as part of an animal health team.

4.2.1 Farm Veterinary Services

Farm vet services are evolving, but the challenge remains to move from the commonly met mindset of calling in the vet when a problem arises towards preventative health approaches alongside the necessary emergency work. I spent some time with vets who provide more than the traditional range of services and position them as an investment rather than a cost.

4.2.1.1 Farm vets

Belgium: cattle veterinary practice is characterised by routine work with Belgium Blue caesarean sections. This means vets are on farms regularly, which provides more opportunity for discussion over surgeries and to examine sick calves earlier than they might otherwise have. The cattle practice, Goderis Cow Company, diversified its expertise to include ventilation systems, housing, foot care and performance-based herd health management with nutrition advice. Marc Goderis, the practice owner, cattle vet and a farmer, uses his farm to demonstrate new tools and best practice to his farming clients. The key to the company’s success was demonstrating practical value and improving business success for clients with targets to help farm profitability.

On routine farm visits with a Belgian pig vet, I saw an on-the-spot holistic investigative approach in action. As the farmer and vet walked the farm, they tackled ventilation, nutrition, and other issues impacting animal health and welfare and the subsequent use of medicines. This service delivered immediate results e.g. on-farm post-mortem and longer-term results e.g. through regular health reports and plans for building new pig housing. The regular visits and approach taken helped to position the vet as a trusted advisor and problem solver with broad technical expertise.

Denmark: Dan Borup Jørgensen, MD of a large farm vet practice group Dyr læger & Ko, explained that 80-85% of their work is connected to herd health management where advice is tailored to the farm and their objectives. Average size farms are visited every 2-3 weeks and large farms are seen every week. They value effective communication with farmers and allocate more than half of their vet training to support these skills.

Sweden: Prof. Catarina Svensson at the SLU (Figure 1) challenged me to think about what preventative health work really means. One challenge is thinking that you can’t prevent something you don’t have,



which drives a reactive mindset, rather than a strategic approach. A proposed preventative health model includes taking both a farmer and animal centred approach e.g. using Cow Signals or an ‘ask the cow’ approach with animal-based measurements alongside a discussion with the farmer using available data.



Figure 1: a visit to SLU to discuss the role of the vet and preventative herd health planning

New Zealand: John Harrison, retired CEO of Vet Ent, New Zealand’s largest vet company, explained that there was a culture within the vet profession of not charging for vet services properly and this meant they failed to throw off the ‘we treat sick animals’ label. He strongly recommended a system of one vet assigned to a farm to support change as seen in the Netherlands. One of the Vet Ent farm vets, Krispin Kannan describes the challenge well - much of his work pays dividends later, with time between intervention and reward, so farmers don’t see realised value straight away. Mark Bryan, MD of the vet practice group VetSouth recognises the value of having a research active veterinary group, with four epidemiologists on staff. This has proven popular with farmers, who like to be associated with practices at the forefront, taking part in research trials and work on vaccine efficacy. It is a good example of how vet practices can add value and provide data driven improvements to animal health and medicine use on farm (Figure 2 next page).

Germany: vet schools prepare the next generation of vets: topics such as digitisation of herd health metrics, behaviour change and the economics of animal health were identified during my visit to the LMU vet school in Munich as important areas that needed to be reflected in the modern veterinary curriculum.



Figure 2: VetSouth vision for farming and veterinary services (www.vetsouth.co.nz)

4.2.1.2 Veterinary Technicians

Intertwined with the work of the farm vet is that of the veterinary technician, a role well developed and supported in New Zealand. Debra McCorkindale manages a team of around 20 technicians at VetSouth. Staff undergo in-house training and the team subscribe to a voluntary Code of Conduct, developed by the Large Animal Veterinary Technicians (LAVT) branch of the NZVA (New Zealand Veterinary Association). The code sets out expectations of professional conduct and ethical standards. It describes what they can do e.g. collecting samples for lab tests, intramammary insertion (dry cow therapy and teat sealing), vaccinations, drenching and disbudding (see appendix A). Debra explained how technicians can help with building relationships and problem solving as they spend time and hear more of what's happening on farm.

4.2.1.3 The Vet-Farmer relationship

The economics of animal health is often used to convince farmers to do something. Prof. Sarne De Vlieghe, a mastitis expert from the University of Ghent, cautioned that economic arguments should not be used in the first instance, when e.g. speaking with farmers about mastitis. You needed to show empathy and that you understand the physical and mental impacts on the farmer. The aim is for the farmer to see the vet as their peer as this will give vets a better chance of their advice being followed. This approach was echoed by Mark Bryan (VetSouth) with regards to animal welfare, where he explained vets can help by 'walking with' the farmer. In the Netherlands vets are on farm regularly, building trusted relationships with a mindset that they are not above the farmer, but there to help them solve problems.

Whilst on farm with Liz Hancock, a retired farm vet and farmer from Martinborough, New Zealand, I heard about the benefits of fostering long-term relationships between vets and their farming clients. These included building mutual trust and respect and, in the end, helping to ensure advice is taken on board. In Sweden, I also heard that trust is important in preventative work, and vets need to be engaged, acknowledge farmer competence, and recognise that the farmer is the decision maker on



farm. Time is needed to take the initiative and explain what the vet can do for them. It's a case of chicken and egg, you can only become good at things you do, and there are hurdles such as vets' lack of knowledge about the economics and everyday practices on farm.

Els Goosens, a veterinary advisor, working for the farming union Boerenbond in Belgium, can see both the vet and farmer viewpoints. She thought that there should be more vet capability around economics and communication with vets having a broader view of the priorities on farm, since vet intervention is only a small part of the bigger picture. Speaking with Prof Volker Krömker whilst visiting dairy farmers in Germany, I heard that most changes needed on farm are gradual or small, not huge ones: evolution rather than revolution is needed.

Prof. Catarina Svensson advocates a client centred approach that works with the motivation of farmers who carry out actions on farm, asking the farmer 'how do we achieve this?' rather than handing out advice and telling them what to do from the top down. It means listening, understanding the motivations and the practicalities, and helping farmers express their own motives. Behaviour change is difficult, and vets need to master motivational interviewing techniques to get a good response. There are benefits for vets including improving the effectiveness of the professional services they offer to clients.

4.2.2 Farmers

Farmers as business owners, decision-makers and animal caregivers are at the coalface when it comes to making animal health and welfare improvements. In the UK, they administer some of the prescribed medicines used on farm. This has a practical basis, allowing timely and economical treatment of animals. Given this responsibility, I wanted to explore how farmers could be better supported in achieving best practice.

4.2.2.1 Training of farmers

There is a growing expectation that farmers administering medicines should have received training. The UK dairy sector has made progress with a mandatory Red Tractor dairy standard that at least one person on farm responsible for administering medicines has undertaken training. Training could play a greater role in both consistently improving animal medicines best practice e.g. how medicines should be recorded, stored, administered, and disposed, and also recognising signs of animal health and illness and knowing when to treat or when to call the vet.

In Sweden, many farmers go to agricultural colleges and as Prof Svensson has observed with the structural changes in the dairy industry, those with education seem to be surviving better. There are strict controls around farmers using medicines, with a system of delegated conditional use with prescriptions. When animals have specific signs, farmers may use these medicines, but the vet must follow this up. Farmers must take a course to join this system and to be able to recognise those signs.

In Denmark there are mandatory training requirements for pig farmers, including on the use of medicines. Vets can deliver training that includes topics such as injection technique and withdrawal periods. In the dairy sector, there is also mandatory training, which is required before the vet can prescribe medicines. A herd health agreement means farmers can have some medicines on farm. Typically, vets start treatments for sick cows, with the farmer completing administration of the course of treatment. Most intravenous (IV) treatment is via the vet and a second special training course is needed for farmers to administer e.g. IV calcium treatment. Farmers are trained to recognise and treat some common conditions such as mastitis where 'the farmer becomes an extension of the vet's arm'.



4.2.2.2 Management and initiative

In Germany, at Brokering Milch, a 550-cow dairy farm, I saw a high level of awareness and attention to good management practices including following treatment protocols (Figure 3). The health of cows and calves was monitored closely, testing colostrum with strict hygiene for milk replacer. The farm has ambitions: taking the initiative, they are working with a local group of young farmers to develop an employers' group programme to train new farm employees with the skills needed.



Figure 3: Brokering Milch, a German dairy farm

On another 170-cow dairy farm in Germany, the priority was to know about issues as soon as possible to keep on top of them e.g. mastitis was something that 'always needs to be kept in check'. The farm manager took charge and made decisions, being close to cows and knowing when vet treatment was needed. The focus was on management factors, nutrition and housing and taking great care with hygiene around using milk replacer. The ambition was to build up resilience by being in the top 20% of producers, so they could weather free market fluctuations.

4.2.2.3 Government Support and Societal Expectations

Norway has state supported veterinary care and a corresponding societal expectation to care for animals, the environment and protect food. The market is regulated with guaranteed minimum prices for produce. Dr Adam Martin, a vet working there explained this means that farmers can plan and invest with a high degree of predictability. However, with producer support payments representing over 60% of farm income in 2012, he warns "... in return society expects modernisation, efficiency, high product quality at a price it finds reasonable".



4.3 Data and Actionable Information

A theme that permeated almost every discussion I had was that of data and how to make it useful. The inescapable reality is that we need to get to grips with and harness true value from data, for the individual farm and the national interest (Figure 4).



Figure 4: from the office of Dr Fernanda Dorea, SVA

4.3.1 Diagnostics

Diagnostics, such as a pen-side test or post-mortem examinations, can improve how medicines are used. When you have a diagnosis, you can increase the precision of treatment and the possibility of a good clinical outcome, by using exactly what is needed e.g. the most appropriate antibiotic.

Dr Clare Phythian, a sheep vet in Norway explained that post-mortem facilities need to be accessible or located near farmers, as without them less samples are submitted. The post-mortem lab she works in is subsidised and carries out a full range of services for local farmers (Figure 5).



Figure 5: Rural post-mortem facilities at NMBU, Norway



Dr. David Speksnijder, a farm vet in the Netherlands, has expertise and practical experience with driving responsible antibiotic use. He is helping to trial point-of-cow care diagnostics to support decision making that could be linked to vet advice (Figure 6).



Figure 6: pen-side diagnostics trial in the Netherlands

There is a balance between costs involved with diagnostics, vet time and treatment. The economics of diagnostics needs to make sense. As Prof Axel Heiser from Massey University explained, they need to be affordable and have a clear benefit. One difficulty can be around the type of sample that is easiest/cheapest to take versus what provides the best answer.

4.3.2 Data systems

New Zealand: Dr. Scott McDougall, MD of Cognsoco at Annexa Veterinary Services, described a familiar story where lots of data is collected, but it's hard to get farmers to pay for that data to be analysed and see the value in this: farmers don't see the issue when all is OK and they 'don't have a problem'. Farmers need to believe that there is threat to change their thinking from the default quick fix to paying for preventative advice. Mentoring is needed through the process to help farmers stick with the plan over several years. Personalised feedback loops should be farm specific, farmer driven, and advice is kept to a few key points. Jane Lacy-Hulbert from DairyNZ adds that in addition to national tools, there is a need for the individual farmer to have someone they trust, an independent person there to challenge them (Figure 7 next page).



Figure 7: visit with DairyNZ (Jane Lacy-Hulbert, Nita Harding), Scott McDoughall, Derek Armstrong (AHDB)

Dr Carolyn Gates, associate professor at Massey University, is working to make data more useful by developing economic decision-making models to help vets and farmers make better informed animal health decisions. Dairy companies want Herd Health Plans, but these can be improved through creating a more active Plan, integrated with economics and supporting the farmer's business goals. Her BVD planning tool could be used for vet-driven decision support and, by including an economic angle, this may also help with the challenge of vets charging for advice. There are further possibilities around antibiotics, vet prescribing and understanding what happens on farm. The opportunity is there to provide the evidence for responsible antibiotic use, but also to use motivators and nudge factors in a quick feedback loop within existing systems that gather data, including recording outcomes.

Sweden: Dr. Fernanda Dórea works on data driven surveillance at the National Veterinary Institute (SVA) in Sweden. Sweden has a lot of data to work with, but not many endemic diseases compared to the UK. Her task was to add value to this data. Her research on epidemiology and syndromic surveillance focuses on data analysis for decision making in animal health with a goal of transforming data into information in the most effective and accessible way (Figure 8 next page). One of her studies is looking at early detection of production and health problems to reduce losses in pig production. The potential benefit is that continuous analysis and monitoring of data already recorded at the farm level could improve profitability, monitor productivity, avoid losses, and support health developments and disease surveillance. It could also add to the body of evidence for disease-free status.

The approach requires building trust and a close collaboration with industry and taking a problem-based approach from the farmers' viewpoint, rather than the Government point of view. Importantly, time needs to be taken to explain what the system is trying to do and how it can help. She is asking both vets and industry what information is most relevant to them rather than making assumptions and then is looking at syndromic data to identify problems at an early stage. Signals and thresholds



will need to be established but the goal is gathering all available data and making it actionable. One notable feature of her system is that raw data does not have to come off the farm, it can be analysed in situ and the farmer can then give permission to send an aggregated signal to e.g. SVA if needed. The concept could see field vets using an app to support decision making and considering local disease history – learning from historical data to predict what might happen next. Vets may be more likely to use the resource and submit data when, in return, they are getting help with their decision making.

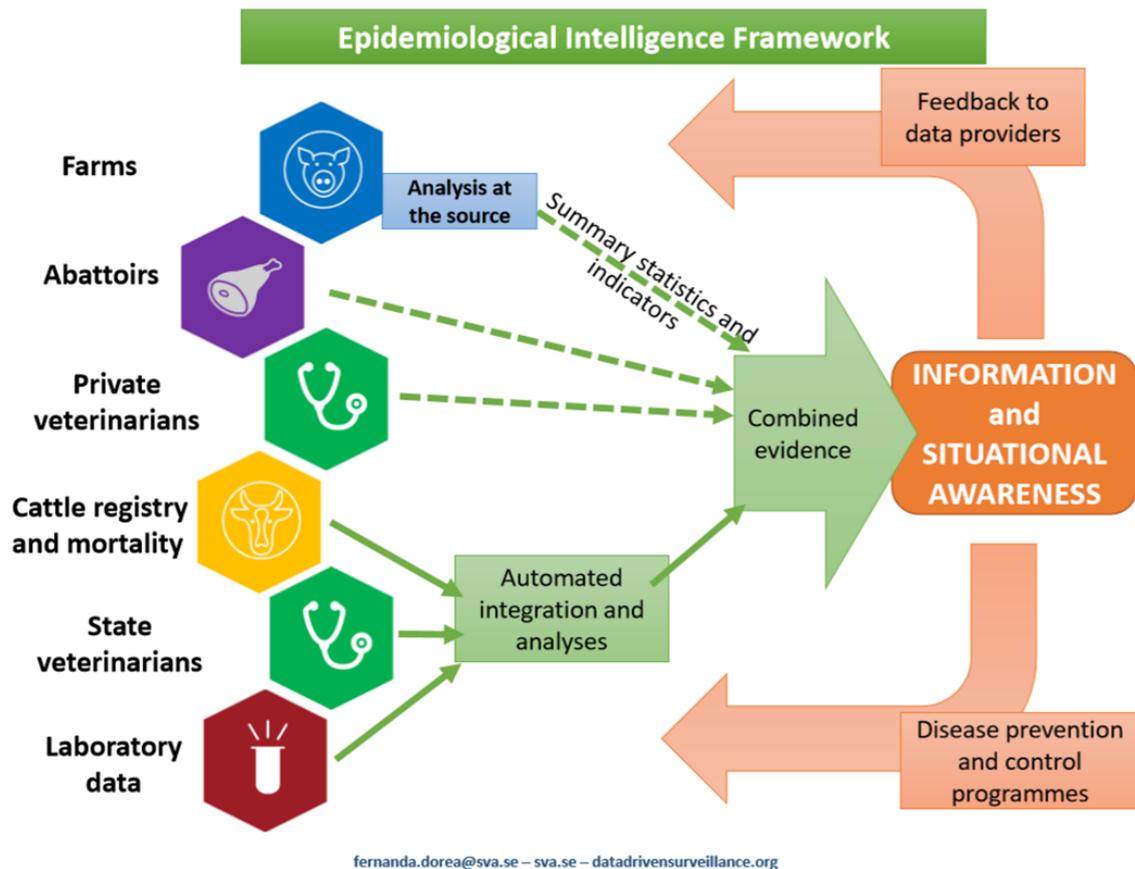


Figure 8: Data - Intelligence framework model developed and kindly shared by Dr. Fernanda Dórea

Norway: in Norway I saw enhanced sharing and use of data with national statistics from abattoirs updated regularly. Farmers keep treatment records and vets also supply records of their treatments to Government. During a visit to a Fatland abattoir, which slaughters cattle, pigs and sheep, I learned about the role and work of the Food Safety Authority (Mattilsynet) and how data is used. At the abattoir, the vet technicians use an in-house automated digital system for syndromic surveillance. If there is a concern, carcasses are tagged and assigned for vet inspection. Data from this process is shared with Government departments, and there is also flow of information back to farmers. The sharing of data on e.g. health parameters is co-ordinated by Animalia (type of levy body) with the abattoir providing animal health and welfare advisors, who can then visit the farm.



4.4 Biosecurity

Biosecurity conjures up images from dipping boots to border inspection posts. Regardless of context, ineffective biosecurity erodes animal health and farm resilience. Taking preventative health and animal medicines best practice seriously means biosecurity must be part of the plan.

4.4.1 Tools

Belgium: practical biosecurity evaluation and advisory tools have been developed by Prof. Jeroen Dewulf and his team at Ghent University. Bert Damiaans, a PhD researcher, helped develop these tools for the cattle sector (dairy, beef and veal), building on their tools for poultry and pigs. The result is Biocheck.UGent, a free, independent, scientific, and risk-based scoring system to evaluate the quality of on-farm biosecurity. He explained that every sector has specific challenges and even low risk activities, if they occur a high number of times, result in an important risk. The survey tool provides feedback and specific recommendations, which the farmer could implement with the help of the vet.

Farm design can be a help or a hinderance to good biosecurity. Good biosecurity is very difficult to achieve in old buildings where the design does not allow the best flow and opportunity for separation. Having a vet involved in design can reduce health and welfare problems down the line. On a pig unit in Belgium I saw first-hand how the collection of buildings, which have grown organically over time, were working against the best efforts of both stockmen and vet. Plans were afoot for a new unit and because of the established problem-solving relationship between farm staff and vet, the vet was actively involved in advising on the design and biosecurity requirements for new buildings, including pen design, rodent control, ventilation and the overall flow and layout.

New Zealand: Beef + Lamb New Zealand is working on an integrated plan where farmers can benchmark, design strategies, and talk to their vet or advisor. Will Halliday, senior advisor on biosecurity and animal welfare, explained that this approach supports the vet-farmer relationship. With on-farm workshops and a template plan, topics such as quarantine, entry points and visitor protocols are explored with associated actions. The template plan could be expanded to include BVD elements like vaccination status and medicines records. The workshops take a holistic approach, looking at wider 'pathway management', to eliminate dozens of risks. A self-assessment is used to identify risks and list practices, asking 'what could I do?' as a trigger. Farmers are acknowledged as experts and facilitated to help them realise what they could do and to 'bring it home'. The goal is a new normal around what is expected for effective biosecurity, but this needs substantial behaviour change.

4.4.2 Protocols and practices

Travelling with cattle vets in the Netherlands, visiting their dairy clients, I was struck by the simple practical biosecurity protocols that were consistently used (Figure 9 next page). Farms had dedicated boots and overalls for the vet, who would not bring their own gear onto farms (Figure 10 next page). The act of changing into farm clothes was an active cue to the risk involved and the need to protect livestock. The University of Utrecht vet practice provides two sets of overalls and boots to each of their farms. They use a direct approach to insist that visitors wear farm overalls, highlighting national disease programmes and the need to minimise risk of disease introduction and spread.

The Danish pig industry uses a Specific Pathogen Free (SPF) system with a major focus on infection status on farm for various diseases, including knowing the status of those supplying stock, use of proper quarantine and high levels of biosecurity.



Norway has much less endemic infectious disease pressures and a different starting point compared to the UK. It is easier to control local outbreaks of disease due to large geographic separation and low animal population. Nevertheless, there is very little movement of live animals into the country, and local movement restrictions to within certain districts or directly to slaughter, which naturally decreases the spread of disease. Vets in Norway have a fundamental awareness of biosecurity. Farms have a biosecurity area at the point of entry, barriers in place and dedicated boots and overalls.



Figure 9: Utrecht University farm vet practice - spotless vehicle for farm visits



Figure 10: overalls and boots available on farm for vet visits



5. Best Practice Opportunities

Four major farm animal medicine categories warranted specific attention; these are antibiotics, vaccines, parasite control and pain management products.

5.1 Antibiotics

Antimicrobial Resistance (AMR) and antibiotic use policy is high on many national agendas. Each country has chartered its own course, some have taken a top-down legislative approach, whilst others have developed bottom-up industry initiatives. In the UK, the RUMA (Responsible Use in Medicines in Agriculture Alliance) Targets Task Force, a voluntary industry initiative, established in 2016, developed bespoke plans and targets for each sector. Sales of antibiotics for farm animals in the UK fell by 53% from 2014-2018 to 29.5mg/kg.

The Netherlands has used a Green/Amber/Red traffic light system of low to high use to benchmark herds. Prof Tine Van Werven recommended their one vet-one farmer system, where farmers cannot have antibiotics on farm unless they have a 1-2-1 relationship with a vet. Benchmarking vets has also been a feature and vets with more than 10% of farms in the red zone, land in the red zone themselves, but vets do have an opportunity to explain why prescriptions are high e.g. disease outbreak. Every farmer knows how much antibiotics they use, and vets know what diseases are on farm, so this helps identify the problems. When antibiotics were being decreased, a change of mindset for vets and farmers from 'cure' to 'prevention with biosecurity, management and vaccination' was needed. Vets had to place extra focus on management factors such as nutrition, hygiene i.e. milking routines, teat hygiene and exposure to bacteria, calving area, keeping cubicles clean and vaccination. Farmers are encouraged to use their thermometers and to check the treatment plan before they use antibiotics. More often, supportive care, including pain relief, will feature in the treatment of mastitis. The success of the approach was dependent on vets and farmers re-examining management practices and putting in place protocols to mitigate the risk of infection and the need to use antibiotics in the first place.

New Zealand has low antibiotic use by international standards. In 2015, the NZVA set as aspirational goal that by 2030 New Zealand Inc would not need antibiotics for the maintenance of animal health and wellness. The eye-catching ambition statement reflects NZVA taking a leadership role to instigate change. The CVO, Helen Beattie, explained the ambition does not mean zero antibiotics, but they want to promote systems that don't need antibiotics to support them (Figure 11 next page). When vets use their red, amber, green traffic light system to select antibiotics (green is a lower risk antibiotic), they should ask 'what's the best first choice?' rather than thinking they must use green first, then amber then red. A report commissioned by NZVA, 'Antibiotic resistance: challenges and opportunities', states AMR could be an innovation and export trade opportunity, benefiting the value of export receipts and allowing access to valuable international markets alongside protecting the efficacy of antibiotics.

A practical example of NZVA work is on Selective Dry Cow Therapy (SDCT) and using teat sealants. Standards and training for vets are being developed to help improve the use of teat sealants. There has been some vet risk aversion to teat sealing. Given the numbers of animals involved, it means vet technicians or farmers take on some of this work. As a cattle vet consultant explained, farmers who have been drying off cows for years may not want to do training, but a strong risk factor for cow mortality is lack of training. Accountability could help e.g. having each farm worker use their own colour marking for cows treated, taking end-to-end responsibility for teat sealant practices. The approach taken by VetSouth is to provide a trained team of vet technicians to deliver a high-quality and insured service. Farmers are made aware of the all the factors that they need to consider when teat sealing so they can make an informed decision.



Figure 11: my visit to the NZVA, Ash Keown, Large Animal Vet Manager & Helen Beattie, CVO

The value of participatory, farmer-led approaches to responsible antibiotic use was evident in the Sustainable Health Group project run by VetSouth and Dr. Lisa Morgans. The Sustainable Farming Fund project 'driving changes in disease management' is based on using farmer facilitated groups to develop strategies to drive positive changes on farm. The project works with farmers by facilitating their discussions, to help them to develop and implement their own strategies to improve responsible use of antibiotics on farm. It is a good example of a bottom-up approach: farmers are not just being told what to do, the approach is more accessible and less prescriptive. There was real value in discussing topics, such as calculating antibiotic use on farm, dry cow management, care of fresh cows, lameness, underdosing and waste disposal, outside of a typical farm vet visit. Examples of changes were greater use of pain relief and focusing on hygiene. The plan involves monitoring changes in attitude after interventions and helping farmers to connect with others to form cohesive groups, such as linking, e.g. calf rearers and dairy farmers, which may help both groups to see why the interventions were important (Figure 12).



Figure 12: visiting VetSouth to discuss the Sustainable Health Group project



5.2 Vaccines

Vaccination to prevent, control, or eradicate disease is needed to reduce the need to use antibiotics in the first instance.

5.2.1 Managing and administering vaccines:

A noticeable difference between the UK and several European countries I visited was the involvement of vets in administering vaccines on farm. This was sometimes a mandatory requirement or with exceptions/conditions attached whereby farmers could administer vaccines e.g. based around the vet/ farmer relationship with livestock under the care of the prescribing vet or on a contract between vet and farmer. In Belgium, some farmers said they preferred the vet to take care of administering vaccines as they were not cheap and needed to be given correctly. There, the vet practices send out reminders when vaccines are due and keep vaccination records.

Dr. Axel Heiser, principal scientist at AgResearch in New Zealand, spoke about the animals' response to vaccines. Although vaccines have a range of efficacies, they are expected to offer protection. However, one of the biggest factors of difference in efficacy is the farm itself and this could be due to how vaccines are administered or stored.

5.2.2 Getting the most from vaccines:

Dr. Heiser suggested that there was a place for Government to provide vaccination recommendations e.g. when/where to vaccinate (rather than e.g. being driven by practical timings) and the wider livestock industry could then work to implement these.

Higher rates of vaccination are associated with some eradication or control programmes. In the Netherlands it was commonplace to see vets administer e.g. BVD vaccines. At the ULP vet practice, I learned that you also need to get the management of livestock right: vets at the practice develop specific programmes for their clients in the Herd Health Plan. Vaccination rates were benchmarked between some vet practices and ULP to see extent of vaccination.

The Danish approach, which is focused on disease prevention, also advocates taking a holistic approach, not relying on one tool, such as using vaccines, alone. For example, in veal calf production, the disease challenges can be high with stocking density being an important factor, so good hygiene with vaccination is needed.

The bottom line is that there is potential to get more from the use of vaccines. **Vaccination does not replace good management routines, but good management is needed to get the most from vaccination.** They are part of a herd health toolkit that supports the responsible use of antibiotics

5.3 Parasite Control

Parasite control is part of managing grazing livestock to avoid productivity and economic losses, and to protect welfare. Although there are not the same human health concerns as with AMR, anthelmintic resistance (AHR) is a serious issue where parasite control products can lose their efficacy. Controlling parasites may appear deceptively simple on the surface, but the reality of sustainable control is far more complex.



Prof. Edwin Claerebout at Ghent University recommended a holistic approach placing parasite control in the context of the whole farm system. Tools to measure economic impact could be used in the decision-making process, but the results needed to be considered in the context of other issues. The key is to integrate the economic impact factors into production management software to make balanced and evidenced decisions. However, the challenge remains of big data collection on farm needing further development to enable these holistic assessments to deliver desired benefits. Another recommendation was to focus on training for vets and farmers that would help to ensure a consistency in the message delivered to both groups. Farmers would benefit from knowing more about the fundamentals of *why* they are using certain products because the current emphasis tends to be on *how* to use them. Knowledge and a deeper understanding of why products are used could then be shared more widely with farmer peer-to-peer learning in meetings or discussion groups using a bottom up approach. Increasingly, we need to look at behaviour, intention versus action, and how to influence these as there is no single magic bullet - a sustainable parasite control approach is needed that considers several elements.

The 540-hectare, 29,000 sheep and 1,500 cattle Kumenga Farm, on New Zealand's North Island is taking part in a landscape level sheep parasite resistance project. Farmed by Mike McCreary and Liz Casey, their ambition to be one of the most efficient lamb finishing farms in the world. The project, supported by Silver Fern Farms, PGGW Wrightson and Beef + Lamb NZ, is facilitated and has the assistance of local vets. It takes advantage of the breeder-finisher (and processor) relationship to reach out across the supply chain and develop a landscape level approach to worm control and resistance management. The project aims to develop a store stock protocol that manages drench resistance, shows improvements in lamb performance, actively involve breeders to develop their awareness of impacts on the finishing farm, introduces susceptible worm genetics and shows improvements in drench efficacy testing. A monitoring plan and decision-making process will be developed on farm, considering costs involved and incentives needed.



Figure 13: Kumenga Farm, New Zealand where I attended a parasite resistance workshop. Pasture blocks (shown on right hand side) - pasture management is an important part of parasite control.



At Kumenga, I joined a dynamic farm workshop and heard about the challenges that built up over time in controlling resistance (Figure 13). It looked at the big picture and overall impact, the *why and the how*, covering testing, parasite life cycle, quarantine measures, drenching and pasture management, and discussing management options. As Mike said, '*we are farming the worms as well as the sheep*'. The messages were that sustainable control is not just about drenches, efficacy can be improved by management, but each farm is unique and needs its own plan.

New Zealand has a national worm management strategy (WormWise) started by Beef + Lamb New Zealand and the Government, MPI Sustainable Farming Fund, which now includes representation from NZVA and Agcarm (animal medicines industry). It focusses on managing worms in cattle and sheep with a vision to ensure that internal parasites will no longer pose a risk to animal welfare, sustainability, and productivity of livestock. The strategy includes workshops to help farmers implement the practical information provided in resources such as the WormWise handbook on sustainable worm management.

In the UK, Prof. Jacqui Matthews highlighted areas for improvement such as the challenge of getting vets and farmers engaged with evidenced-based parasite control. Newer wormers, Group 4 - Orange and Group 5 – Purple compounds, need to be integrated into control programmes. This should be based on the updated guidelines on specific timings and uses, as recommended by SCOPS. She recommended more focus on the appropriate use of diagnostics and explained how this starts with veterinary education. Her experience is that the veterinary curriculum is very heavy, and parasitology can get lost along the way with vet students not developing a great interest in the area. Diagnostic tests are valuable if they used correctly, but she sees that many faecal egg counts are done wrong and recommends that final year vets should really understand test sensitivity, specificity, and interpretation of results.

5.4 Pain Management

5.4.1 Valuing animal welfare

In Sweden I felt there was an acute awareness of the pain management needs of animals and increasingly vets, particularly younger vets, were providing this. There appeared to be an association between the value placed on protecting welfare and the use of effective pain management. Farmers cannot disbud calves and vets, or special technicians, carry out this work. There are however some problems with medicines or indications not licenced in Sweden due to the small market size. Generally, the use of non-steroidal anti-inflammatories (NSAIDs) was said to be very common with their expense not viewed as much extra on top of the vet call out fee and although lameness levels are very low, they felt that they could do better with managing pain from claw disease. A high use of NSAIDs was also apparent in Norway, where their use was also connected to protecting animal welfare.

5.4.2 Improving performance

In Denmark, I heard about a paradigm shift in pig production where pain relief for sows was more likely to be provided. The recommendation was to take an 'animal centric approach', to *think with the animal* using new technology, good nutrition/feeding management, and pain relief to improve performance.



5.4.3 Supporting responsible antibiotic use

At a vet practice in the Netherlands, the approach to mastitis included providing pain relief as part of supportive care where appropriate. An experienced veterinary technician in New Zealand explained that many lameness cases needed pain relief and the foot lifted rather than antibiotics.

5.4.4 Quality of pain management

Vets on farm in Belgium and the Netherlands routinely provided good quality, best practice pain management, where vet disbudding of calves used sedation, local anaesthetic, and an NSAID to prevent and control pain and suffering (Figure 14). In the UK, it has been reported that although progress has been made, the need still remains to increase the use of NSAIDs, particularly for painful procedures such as disbudding in calves, to more effectively control pain and safeguard welfare (for more information see Appendix B).

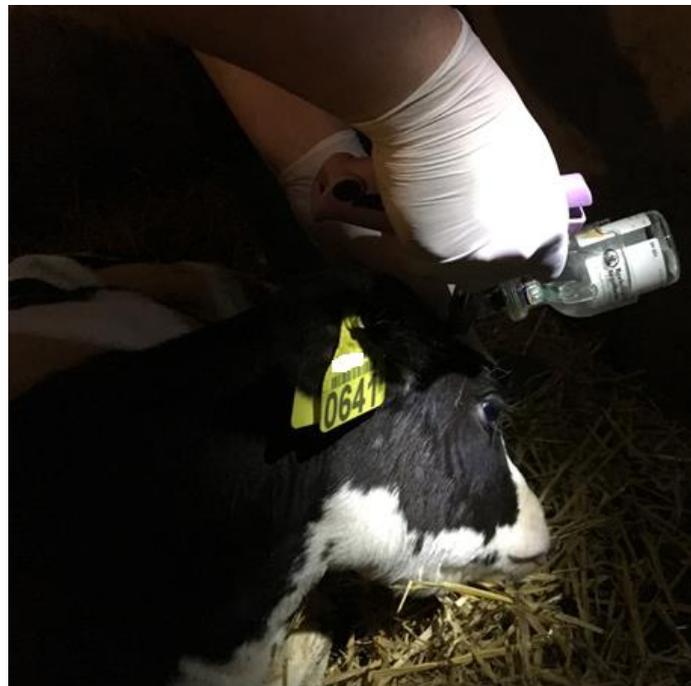


Figure 14: farm vet in the Netherlands providing best practice pain management for disbudding



6. The Future of Animal Medicines

I have considered how animal medicines available today could best deliver benefits for animal health and welfare, and farming in the UK. The question remains as to what the future holds and what path the UK will take outside the EU. Key themes emerging are an ambition for global regulatory cooperation and a science-based policy for new technologies, including novel medicines. Trade considerations are taking centre stage and will influence the future landscape for animal medicines. As the end of the transition period with the EU approaches, regulatory divides and trading barriers are emerging between GB and NI (alongside UK and EU) signalling the potential for market fragmentation, and challenges for the supply of animal medicines.

6.1 Policy, Regulation and Trade

The UK leaving the EU provides an opportunity to consider policy and how medicines will be regulated in the future and global ambitions. New Zealand is a natural candidate for regulatory collaboration with the UK to ensure medicines continue to be available and to generate greater UK market attractiveness for future products.

I discussed the possibilities with Gavin Hall, Head of Licensing Administration Branch and General Assessment Team at the Veterinary Medicines Directorate (VMD), the UK regulator. Up to this point, a medicine, authorised via the Centrally Authorised Product (CAP) route in the EU, would allow marketing and sale in all member states. As this changes with EU Exit, there is a need to maintain the attractiveness of the UK market: co-operation with countries such as New Zealand, Australia and Canada could be part of the solution. The VMD are actively working at a strategic level with these countries to explore possibilities and establish Memoranda of Understanding. The end goal might be something called a decentralised procedure (authorisation in parallel in UK and NZ), allowing animal medicine companies to have one regulatory team working on the process in two countries as a single project. The UK and NZ regulators could each make a final decision having shared knowledge and working to ensure a robust data and risk assessment. Practicalities would need to be worked out, particularly in relation to trade and labelling requirements. Notwithstanding the technical and process challenges, there is appetite and precedent for cooperation. The UK (via the EU) and NZ (as an observer) are already parties to the International Cooperation on Harmonisation of Technical Requirements for Registration of Veterinary Medicinal Products (VICH).

In New Zealand, I spoke with Warren Hughes, Principal Adviser, ACVM (Agricultural Compounds and Veterinary Medicines) at the New Zealand Ministry for Primary Industries (MPI). Their regulations aim to manage risks to (1) animal welfare, (2) public health, (3) agricultural security, and (4) trade in primary produce. Their risk framework forms the basis of appropriate regulatory oversight and controls. The process of authorising an animal medicine starts with an external independent data assessment. This is followed by an in-house MPI risk assessment where a decision is made on whether risks can be managed, by taking into consideration requirements on animal welfare, target animal safety and efficacy, residues in food producing animals and biosecurity.

Regulatory controls also extend to the recognition of vets as an important part of risk management particularly for Restricted Veterinary Medicines (RVM), which only a veterinarian can authorise or prescribe. There are a number of requirements a veterinarian has to comply with by MPI and Veterinary Council of New Zealand (VCNZ - the body that oversees veterinarians) when authorising RVMs including their ability to authorise RVMs in anticipation of use by a client. Veterinarians can also use a tool called Veterinary Operating Instructions (VOIs) to allow some on-farm practices to take place without a vet present (e.g a vet tech) where there is no reasonable expectation that a veterinary



judgement or diagnosis is required and is for repeatable treatments. Detailed written guidance and training (vet responsible for this) is required. MPI provides guidance on appropriate use of a VOI and requirements and the veterinarian has to comply with the relevant section of the VCNZ Code of Professional Conduct. This instruction is valid for no more than 12 months and includes animals to be treated, route of administration, procedures, storage of medicines, record keeping and reporting of adverse events. Non-compliance with either MPI or VCNZ rules could mean a vet is no longer allowed to authorise RVMs.

MPI set MRLs (Maximum Residue Levels: the maximum allowed concentration of residue in a food product obtained from an animal that has received a veterinary medicine). MRLs are to ensure good agricultural practice (GAP) is being followed while ensuring food safety. The UK currently recognises MRLs set by a European Medicines Agency. Trade considerations are one of the factors considered in determining an MRL alongside Good Agriculture Practice (GAP) and human health risks. International MRLs (set by each country/region) are considered to ensure MRLs based on New Zealand GAP can facilitate trade. Once a MRL is determined, this is the key component in establishing the withdrawal periods that farmers must adhere to when using medicines.

Animal health and welfare standards and medicines will feature in discussions and policy around future trade. Esther Guy-Meakin, Senior Manager for International Trade at Beef + Lamb New Zealand, described their dynamic trading position, based on engaged and knowledgeable farmers who know their markets and are used to overseas requirements. Following subsidy abolition, a competitive commercial environment emerged with a fundamental belief in market dynamics, leading to developing a high-quality premium product, rather than commodity, market. With Free Trade Agreements with over 130 countries, all with different regulatory frameworks and consumer demands, they have focused on setting a benchmark that their producers comply with, with processes for different priority markets. Factors that come into play include animal welfare standards, use of antibiotics and other medicines and environmental outcomes. Veterinary aspects of agreements e.g. showing equivalence with the EU for WTO trading with quota constraints, involve an outcome based regulatory system, where different regulations can achieve the same outcomes. For export it boils down to meeting the highest standard required.

6.2 Innovation and Novel Medicines

On my travels I came across lively discussions of how innovative and novel medicines could help support best practice. From these, my thought was how to give UK farmers a competitive advantage by helping them achieve better environmental, animal health and welfare outcomes. This would be against the background of aligning societal expectations of traditional livestock production with national ambitions to lead on innovative Research and Development.

International conference discussions included the need for robust and sensible regulation for innovative novel veterinary medicine development but, if overly restrictive it would stifle innovation and the emergence of new products, so a balance between robust regulation and a smooth rational route for new products to market was needed. It was felt that Governments needed to work closely with industry using a science led approach to modernise restrictive regulatory frameworks.

I came across non-regulatory barriers too. e.g. through consumers via farm assurance. In Germany, a farm vet described how a novel immunological product used as a non-surgical castration option in pigs received push back, but retailers there worked to help inform consumers, explaining the benefits of such an approach.



7. Discussion

Starting out on my study journey I had an idea of what animal medicine best practice would look like, but what I hadn't fully appreciated was how dependent its application was on other factors. These included health programmes, the nature of veterinary work, the use of data and diagnostics and the approach to biosecurity. These factors, when focused on improving animal health and welfare, naturally led to better use of medicines. No single country on my study tour got everything right, but collectively like the pieces of a puzzle, they formed a bigger picture of what was possible.

The most striking example of making effective progress on endemic disease, and by extension animal medicine best practice, is the Animal Health Ireland programme. The clear vision and focused determination of industry in partnership with Government over a 10-year period paid dividends. The progress has included not only the anticipated outcome of reducing the burden of disease, but also shaping better use of medicines, including vaccines, antibiotics, and parasite control products, by providing national programmes basing their use on expert technical guidance. National coordination and standardisation, with a ready means of disseminating best practice e.g. via a rural advisory network, will help improve how medicines are used at scale.

Delivering care to livestock will have an impact on how medicines are used. I enjoyed spending time with vets in Belgium and the Netherlands where I could see first-hand the services they provided, including duties such as administering vaccines and disbudding calves. This helped reduce variability in results e.g. vaccines were stored at the right temperature and administered correctly at the appropriate time. Vets also helped with calves receiving best practice pain management. These are examples of best practice where farmers were happy for vets to take on more responsibility, helping them to get the most from their investment in these medicines.

I often heard about the challenges of vets and farmers truly getting on board together with a preventative health mindset, that could form a basis for better use of medicines. How vets work with farmers really matters. I saw vets with diversified services viewed as trusted advisors and problem solvers, spending time on herd health. Empathy, building up trust over time and working with farmers as expert equals is key. If vets really want farmers to implement their recommendations, they need to invest in their own communication and behaviour change skills and understand the priorities and motivations of the farmer.

There are growing expectations around professionalism in farming in relation to medicines and animal health and welfare, including training. The temptation is to see this as an extra cost or needing a license to farm. However, increasing farmer knowledge and understanding of animal health and medicines can improve farm businesses by reducing mortality, increasing efficiency (reducing morbidity) and producing food with less environmental impact. Many countries I visited had tight restrictions around how medicines were used, often with requirements for vet only administration or farmer use with a contract or training. This has benefits on consumer confidence in the food supply chain. In the UK we are inching towards the same view that all those who administer medicines on farm should have completed training.

Data, and making best use of it, was a constant theme encountered on my travels. The ideal data system, which only captures what is needed, provides real time useful information back to the farmer and vet, and helps form a better picture for national statistics, does not exist in the UK yet. Promising systems are under development in e.g. Sweden and New Zealand. An ideal system could include data elements related to production, health/welfare, medicine, treatment outcome and economics. Such



data would support timely and rational decision-making in a vet facilitated feedback loop. Data systems won't be cheap or built overnight, but if I had to make a single investment in animal health to drive best practice, I'd make this one.

Amid an ongoing global pandemic, biosecurity could not be more relevant, nor its value better understood. Half of my travels were spent in Europe a year before the global pandemic and the other half were in New Zealand right at the beginning of the outbreak, but both journeys featured biosecurity as a major theme. Engagement with biosecurity is a battle and farmers are fatigued with the same non-specific messages. What I learned in Belgium and the Netherlands was that you need to bring biosecurity to life. This was most effective where new norms were created by e.g. vets not bringing any clothing/boots on farm. I also heard about a promising practical biosecurity evaluation and advisory tool. I could see real value here where this would help farmers re-engage with biosecurity by offering them a bespoke assessment of their farm and some specific advice based on their own risks. Animal medicine best practice would follow as, for example, vaccination might be recommended to help keep disease off farm and less antibiotics used due to reduced infection on farm.

I looked at four major categories of animal medicines used on farm, i.e. antibiotics, vaccines, parasite control and pain management products, in more detail to see where improvements could be made. Each medicine category requires a considered approach, to reflect their unique challenges, solutions, and opportunities to unlock more potential.

There has been a global focus on using antibiotics responsibly in people and animals - to reduce resistance and have effective antibiotics in the future. The UK livestock sector has made considerable progress so far by taking a largely voluntary industry approach. The next steps should help with consistent responsible use and may need a combined and voluntary and regulatory approach. Either approach could be applied to the examples of best practice that were recommended to me such as having a one-to-one vet farmer contract or agreement and benchmarking veterinary prescriptions. More opportunity and support for participatory, farmer led approaches should also be provided. This comes back to the need to allow farmers to identify the best solutions for their own farm.

There is unrealised potential in vaccination, particularly in the ruminant sectors, where rates are variable and best practice around storage and administration have room for improvement. I observed vets routinely administering vaccines in Belgium and the Netherlands, but the best solution for the UK depends, to some extent, on what animal health programmes and support mechanisms are available. For example, national disease control or eradication programmes would increase uptake, Government support with herd health planning and biosecurity would help embed bespoke vaccination protocols on farm. In each case, farmers who vaccinate should have more help to ensure they implement best practice and get the most from their investment e.g. through better veterinary oversight or training.

Sustainable and well implemented parasite control is challenging and complex, particularly the translation of expert guidance, using knowledge of the farm, into bespoke plans. The approach taken by Kumenga Farm in New Zealand showed me that when farmers are brought together to work at the landscape level this can help everyone understand the impacts of resistance and the benefits of sustainable parasite control. It can also provide an opportunity for learning and shared experience for farmers and the vets. Although we tend to think about parasite control in terms of managing parasites, livestock, and the landscape, the key is including people.

Each country I visited was making progress in providing pain management on farm. Their reasons were varied, ranging from a high value placed on animal welfare, to improving productivity and to supporting responsible antibiotic use. Effective management of pain in farm animals is a professional and ethical responsibility for vets and farmers. Best practice includes ensuring these responsibilities



are prioritised and properly discharged. Everyone involved in caring for livestock, and those who can influence management practices, should strive to ensure that all British livestock receive best practice pain management for all painful procedures and conditions on farm.

The UK has decisions to make that will impact the future of animal medicines. Post EU Exit, there is risk to the attractiveness of a smaller and possibly fragmented UK market for animal medicine companies. One solution could be global regulatory cooperation. Collaborating and sharing expertise with countries taking complementary approaches to the authorisation of animal medicines, e.g. New Zealand, Australia and Canada, could offer a more secure future for the availability of animal medicines in UK. I can see real potential in this approach and genuine efforts from UK and New Zealand regulators to make it work. National legislation will also evolve and present opportunities to support future animal medicine regulation and best practice. The debate remains, around the appetite to embrace innovative solutions to some of the most pressing health, welfare, and environmental concerns of our time.



8. Conclusions

1. Livestock farming supported by public money establishes a social contract placing expectations on health and welfare standards, professionalism, and medicine use. The livestock sector must be ready to recognise, apply and demonstrate best practice.
2. Effective progress on animal health and welfare is needed. Good animal health provides a competitive advantage that bolsters resilience and helps farm profitability. Coordination to deliver improvements at scale needs a strategy and vision that spans the four nations.
3. Widespread animal medicine best practice needs both a top down and bottom up approach that includes influencing factors such as the nature of veterinary services, effective use of data, diagnostics, biosecurity, and farmer training. Within this model framework, best practice can be more effectively delivered for antibiotics, vaccines, parasite control and pain management medicines.
4. An evidenced-based approach and international collaboration in the authorisation of animal medicines will support both the availability of medicines in the UK and the future development of innovative solutions.



9. Recommendations

The following thematic recommendations require collective actions from policymakers, the veterinary and farming industry and their representative bodies working in partnership to design and deliver a model to sustain and progress UK animal health and welfare and animal medicines best practice.

1. Animal Health Framework:

- Establish a dedicated body for farm animal health and welfare
- To provide leadership and deliver coordination across the UK
- Led by the farming and veterinary sectors, and supported by Government

2. Farm Veterinary Services:

- Veterinary education should include a focus on the economics of animal health linked to farm business priorities, along with communication and behavioural change skills

2. Data Systems:

- Invest in and build a national data capture and analysis system
- Utilise production, animal health and welfare, medicines, and treatment outcome data
- Provide farmers and their vets with timely actionable insights and use economic decision-making models
- Harness aggregated data to paint a national picture of animal health and welfare evidencing best practice and leverage this for trade opportunity

3. Biosecurity:

- Reboot strategy on livestock biosecurity
- Incentivise use of holistic and bespoke biosecurity assessments
- Incentivise and help farmers to make improvements in housing and facilities on farm
- Facilitate vets to advise and deliver on e.g. assessment outcomes and housing recommendations
- Establish new norms, such as vets not bringing their own clothing and boots on farm
- Recognise and celebrate excellence in farm biosecurity

4. Antibiotics:

- Use both regulatory and voluntary mechanisms, such as industry initiatives and legislation to sustain and progress widespread responsible antibiotic use
- Include benchmarking for vets and farmers
- Establish a requirement for a one-to-one farmer-vet relationship
- Require all those on farm who administer medicines to livestock to have appropriate training
- Support facilitated farmer-led participatory approaches to designing and implementing actions on farm
- Collect and improve use of treatment outcome data
- Leverage UK progress for trade opportunity

5. Vaccines:



- Strengthen the role of vet in supporting farmers with vaccination best practice, through e.g. herd health planning and biosecurity implementation
- Record and benchmark vaccination use
- Government could follow the human health approach and provide recommendations on livestock vaccination

6. Parasite Control:

- Support dissemination and implementation of evidence-based guidance on farm
- Use landscape level programmes to improve understanding and help design tailored solutions
- Use an integrated approach with production and parasite data to help decision making
- Increase understanding in the value, use and interpretation of diagnostics

7. Pain Management:

- Support the need to use best practice pain management on farms for all painful procedures or illness to protect welfare and performance

8. Future of Animal Medicines:

- Collaborate with international regulatory agencies on new authorisation pathways for animal medicines
- Take a robust, science-based approach to policy and regulation that supports innovative animal health solutions
- Support regulation that gives farmers a competitive advantage and trade opportunity



10. After My Study Tour

I was one of the lucky scholars who completed their planned study travels, arriving back from New Zealand before the UK went into lockdown with the ensuing COVID-19 pandemic. It's fair to say that time has taken on new meaning since then. Yes, it proved to be an opportunity to take stock of what you value, but it also threw into sharp light the impact of what only epidemiologists really thought possible on every single aspect of life, including how we work, farm and care for livestock. Everyone became familiar with the terminology, the intricacies of data and diagnostics and biosecurity measures that represented our best chance of managing the pandemic without a vaccine. Weaknesses were uncovered with resource and capacity lacking. We place our hope for normality on science and innovation and the successful development of vaccines.

All these themes feature in my study, where the challenge is to build resilience through animal health and welfare and animal medicines best practice. It reminds me every single day of what needs to be done and I've had the opportunity to share my experiences and insights with policy makers and industry to support the development of legislation in the form of the Agriculture Bill and in the case of England, the Animal Health and Welfare Pathway – as a vehicle to incentivise best practice and improvements in animal health and welfare. Nuffield is not a 'one and done' and the lessons learned, and experiences shared, have a lifetime of mileage and memories.



Travelling to New Zealand (February 2020)



Acknowledgements and Thanks

My sincere thanks to my generous sponsor AHDB for making this fantastic opportunity possible.

To the Nuffield Farming Scholarship Trust, you have warmly welcomed me into your farming community. It's a real honour and a privilege to be part of the Nuffield farming family.

With special thanks to Mike Vacher and Helen Woolley for all their hard work and excellent leadership throughout.

To my editor, Alison, thank you so much for your hours of work, your patience and skill – it's greatly appreciated.

The 2019 Nuffield Farming Scholars are now my lifelong colleagues and friends. You are some of the most remarkable, inspiring, and supportive group of people I have ever had the pleasure to meet.

I've been very fortunate to have people from every country I visited welcome me. I've enjoyed my time with you immensely – on farm, with vets on the road, at universities, with industry organisations and Government officials. A huge thank you to each one of you, for generously sharing your time, experiences, and insights.

NOAH, the National Office of Animal Health, has been a champion of animal health and welfare for over 30 years. Their support and encouragement has made this journey of a lifetime possible. My special thanks to the Chief Executive, Dawn Howard, for her mentorship and to my Manager, Donal Murphy, for his enduring support whilst carrying the workload during my many weeks of travel.

To my family and friends, my life-long supporters of all I get myself into. And finally, to my husband Danny, who keeps the show on the road and never raises an eyebrow on the suggestion of another adventure.

Grace O' Gorman



Appendix A:

New Zealand voluntary Code of Conduct for veterinary technicians

This Code of Conduct for veterinary technicians was developed by the Large Animal Veterinary Technicians (LAVT) branch of the NZVA.

The code sets out expectations for professional conduct and ethical standards. It describes what they can do e.g. collecting samples for lab tests, intramammary insertion (dry cow therapy and teat sealing), vaccinations, drenching and disbudding.

On the use of vet medicines, they must:

- a. Not prescribe restricted veterinary medicines (RVMs).
- b. Comply with the requirements of a Veterinary Operating Instruction for the use of any RVMs.
- c. When dispensing products or veterinary medicines comply with practice SOPs and ensure the client is aware of the correct method of use, route of administration, withholding times and special precautions relevant to that veterinary medicine.
- d. Report to a veterinarian any suspected adverse reaction to any product or veterinary medicine and
- e. Refer to a veterinarian any situation where the technician believes RVMs should be prescribed.

Appendix B:

best practice pain management in cattle

- British Veterinary Association (BVA)/British Cattle Veterinary Association (BCVA) statement: Analgesia in calves: www.bcva.org.uk/system/files/whatwedo/Analgesia%20in%20calves.pdf

“Specifically, we recommend the use of non-steroidal anti-inflammatory drugs (NSAIDs) in addition to local anaesthesia when conducting disbudding and castration in calves”.

- Remnant, JG., Tremlett, A., Huxley, JN., Hudson, CD.(2017) Clinician attitudes to pain and use of analgesia in cattle: where are we 10 years on? Veterinary Record 181, 400.

“However, uptake of NSAID use was much lower for a number of routine procedures in calves than would be expected from the pain scores they were assigned. A need remains to increase use of analgesic products, especially NSAIDs in calves, in line with best practice recommendations”.

“There is a concerning mismatch between frequency of analgesic use (at least in terms of NSAID) and perceived severity of pain in routine calf procedures such as disbudding and castration, an area which clearly warrants further work”.

978-1-912059-42-3



Published by Nuffield Farming Scholarships Trust
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