



## **A Nuffield Farming Scholarships Trust Report**

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### **Reducing antibiotic use in pig production – is there a need for systemic change?**

**Georgina Crayford**

**Date report submitted**

**July 2018**

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# A Nuffield (UK) Farming Scholarships Trust Report



Date of report: July 2018

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

Title	Reducing antibiotic use in pig production – is there a need for systemic change?
Scholar	Georgina Crayford
Sponsor	AHDB Pork
Objectives of Study Tour	<ul style="list-style-type: none"><li>• To identify the management practices that result in a reduced need for antibiotics.</li><li>• To explore methods of engaging farmers with antibiotic stewardship and delivering behavioural change.</li><li>• To examine how the veterinary sector, government and others might support improved use of antibiotics in the pig sector.</li></ul>
Countries Visited	Finland, Sweden, Denmark, United States, Canada and Australia
Messages	<ul style="list-style-type: none"><li>• For decades antibiotics have masked an array of disease challenges on UK pig farms and this has resulted in a lack of focus and resource being directed towards effective disease prevention.</li><li>• Greater resource must be dedicated to pig health improvement initiatives, including the establishment of a national pig health improvement scheme that aims to reduce the prevalence of endemic disease on all UK pig farms and improve transparency around farm health status.</li><li>• The pig management and hygiene practices that result in reduced transmission of disease are well-established but not well-implemented in the UK.</li><li>• Pig farmers could be encouraged to implement the necessary practices for improved infection prevention through utilisation of participatory farmer-led initiatives and behavioural nudge techniques.</li></ul>

## EXECUTIVE SUMMARY

The responsible use of antibiotics in pig production is critical to protecting animal and human health and to upholding the reputation of the pig sector.

The UK pig sector has set itself an ambitious target to reduce the use of antibiotics in pigs by 62% over five years to 2020. While the progress to date has been extremely impressive, demonstrated by a reduction in antibiotic use of more than 50% in two years, it could be argued that the low-hanging fruit has been harvested and further reductions are likely to be challenging.

The purpose of my Nuffield study was to identify how these reductions might be achieved, with a focus on disease control measures as well as methods to engage farmers with antibiotic stewardship. I met with pig farmers, veterinarians, industry organisations and government representatives in Denmark, Sweden, Finland, the United States, Canada, Australia and in the UK in search of best practice and initiatives aimed at reducing antibiotic use in pigs.

It became clear that in order to reduce antibiotic use, it is important to establish a foundation of good pig health. Easy access to disease-masking antibiotics and a lack of coordination and focus in the UK pig industry regarding control of endemic disease has resulted in a decline in the health status of the national pig herd.

Therefore, my report recommends the development of a national pig health improvement scheme that makes better use of surveillance data, diagnostics and that operates with transparency at its heart. Importantly, the scheme needs to be sufficiently well-resourced to ensure it can operate long-term and across the entire industry.

The hygiene and farm management practices that contribute to effective prevention of disease are well-established but not well-implemented on UK pig farms, probably due to challenging market conditions and underinvestment in farm infrastructure. Pig farmers should be encouraged to review farm practices, invest in applying those that aid disease control and endeavour to implement them consistently and to a high standard.

In order to engage farmers with improving pig health and using antibiotics more responsibly, industry organisations should develop participatory farmer-led initiatives that recognise and utilise the existing expertise of farmers. This approach is far more likely to deliver action on farms than traditional top-down style knowledge transfer.

It must also be recognised that behavioural change is hard and does not happen overnight. However there are techniques that can facilitate change and these should be incorporated into any activity aimed at improving antibiotic use in pig production.

Finally, the aim should not be to achieve zero use of antibiotics in pig production, nor simply reduce the use of antibiotics. The focus should be on reducing the need for antibiotics.

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## **DISCLAIMER**

The opinions expressed in this report are entirely my own and not necessarily those of the Nuffield Farming Scholarships Trust, my sponsor, or my employer. It is recommended that any changes to a farm's health plan and treatment program should only be made following consultation with the farm vet.

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All the photographs and figures are the author's own.

Nuffield Farming Scholars are available to speak to NFU Branches, Agricultural Discussion Groups and similar organisations.

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## 1. Personal Introduction

I grew up in a suburban area of Kent, where I've now returned to live since university. As I am not from a farming background, my interaction with the outdoors as a child was limited to my back garden (where I happily allowed snails to race up my arm and pestered woodlice to roll up into peas) and the local country parks and petting farms.

From a very early age my ambition was to be a vet but, thanks to insufficient work experience, sadly I wasn't accepted on to any veterinary science courses. A few setbacks in life makes for a more resilient person, I say!

Instead, I studied Bioveterinary Science (close enough!) at the University of Liverpool, after which I decided to stick around to do a PhD. The focus of my research was *Salmonella* infection in pigs and hence began my interest in microbiology and pig health. I spent the majority of the next three years culturing pig intestinal cells in a laboratory, infecting them with *Salmonella* and observing what happened next through a microscope lens.

I didn't feel quite suited to academia, so on completion of my PhD I pursued a career within the pig industry. Following a short stint at the levy board AHDB Pork, I took on my current role as Senior Policy Adviser at the National Pig Association in 2014. My job requires me to keep abreast of all pig-related agricultural policy, particularly that related to pig health and welfare, and lobby on behalf of our members to ensure said policy remains sensible.

When I'm not going over policy documents with a fine tooth comb, or meeting with civil servants, retailers or members, you can find me cooking and enjoying great food with friends and family. Or attempting to play the trumpet!



***Not a pig, but one of my favourite photos taken during my Global Focus Program travels, on a dairy farm in western Germany.***

## 2. Background to my Study

The reason I chose to focus on antibiotic use in pig production is simple: antibiotic resistance is something we should all be concerned about. The discovery of antibiotics and their widespread availability revolutionised healthcare, but they have been overused and misused. As a result, bacterial resistance to these vital drugs is rising and it is estimated that by 2050 drug-resistant infections will cause ten million deaths per year, more than is currently caused by cancer, if nothing is done<sup>1</sup>.

If antimicrobial resistance (AMR) is not tackled, infections that are usually easily treatable will become much harder to deal with. Indeed, for some bacteria, this is already a reality. Certain strains of *Klebsiella pneumoniae*, *Escherichia coli* and *Pseudomonas aeruginosa*, which are associated with high mortality and already carry high levels of antibiotic resistance, have now developed resistance to a class of antibiotics known as carbapenems. This is of extreme concern because carbapenems are considered the drugs of last resort to treat infections with these bacteria. Our last line of defence has been breached.

It is no wonder antibiotic resistance is listed on the Cabinet Office's National Risk Register<sup>2</sup> as a significant long-term challenge, alongside climate change and terrorism.

2016 was a landmark year for discussions about antibiotic resistance. First, the final report of a Review on AMR, commissioned by the UK government and led by economist Lord Jim O'Neill, was published<sup>1</sup>. The O'Neill report, as it is commonly known, analysed the global issue of drug-resistant infections and outlined a number of recommendations for how to tackle this growing problem. One of them was to reduce the unnecessary use of antibiotics in agriculture.

***"It [AMR] needs to be seen as the economic and security threat that it is, and be at the forefront of the minds of heads of state, finance ministers, agriculture ministers, and of course health ministers, for years to come."***  
***~ Lord Jim O'Neill***

Another significant milestone occurred when the issue was discussed at a General Assembly of the United Nations. This discussion culminated in a declaration, signed by 193 countries, agreeing that drug-resistant infections must be tackled as a priority. It is safe to say antibiotic resistance is now firmly on the global political agenda.

The UK government has since issued its response<sup>3</sup> to O'Neill's recommendations, in which it outlines a series of commitments, including actions to reduce the use of antibiotics in agriculture. The pig industry, as a user of antibiotics, has a part to play in achieving these reductions. As a sector, it has committed to reducing overall use of antibiotics by 62% over five years, between 2015 and 2020<sup>4</sup>. Achieving this will be no small feat. The British pig industry has done a lot of groundwork to prepare itself for impending restrictions on antibiotic use, but now it has the challenging task of delivering sustainable reductions in the volume of antibiotics administered to pigs. I thought it might be worthwhile to look outside the UK for inspiration for how this might be achieved.

***"We need governments, the pharmaceutical industry, health professionals and the agricultural sector to follow through on their commitments to save modern medicine."***  
***~ Dame Sally Davies, Chief Medical Officer***



### 3. My Study Tour

The countries I selected to visit represent a wide spectrum in terms of their levels of antibiotic use in livestock. I considered it important to visit not only those countries that already have low antibiotic use (Finland, Sweden, Denmark), but also places where excessive use of antibiotics remains commonplace (United States, Canada, Australia). I predicted the latter must surely also be considering how to bring their own levels of use down and perhaps planning to do it in a way that could be relevant to the UK pig sector.

I visited only developed countries as I believed their situation would be of most relevance to the situation in the UK. Overuse of antibiotics in livestock in developing countries certainly takes place. However, *access* to these important drugs in the developing world is as much a problem as their excess use; something which is not a problem in developed countries.

Table 1 on the next page gives a broad overview of the variation in volumes of antibiotics used in each of the countries visited, although the figures are not directly comparable and some are unofficial estimates.

**Table 1: Pig production figures and antibiotic use levels in the countries visited during the Scholarship**

	National breeding herd	Annual pig slaughterings	Antibiotic use (mg/kg)	Notes on antibiotic use figure
<b>UK</b>	409,000 <sup>i</sup>	9,110,000 <sup>ii</sup>	131 (pigs)	On-farm antibiotic use figure for 2017, collected into the industry's electronic medicine book (eMB) <sup>iii</sup>
<b>Finland</b>	116,000 <sup>iv</sup>	2,145,000 <sup>v</sup>	18.6 (all livestock)	2016 antibiotic sales figure for all livestock <sup>vi</sup>
<b>Sweden</b>	141,000 <sup>iv</sup>	2,551,000 <sup>v</sup>	12.7 (pigs)	2016 antibiotic sales figure for pigs <sup>vii</sup>
<b>Denmark</b>	1,237,000 <sup>iv</sup>	19,108,000 <sup>v</sup>	44.3 (pigs)	Estimation calculated using reported tonnage used in pigs in 2016 <sup>viii</sup>
<b>USA</b>	6,200,000 <sup>ix</sup>	118,219,800 <sup>x</sup>	380 (pigs)	Estimation for Smithfield Foods pork supply chain based on antibiotic use figure for 2016 <sup>xi</sup>
<b>Canada</b>	1,253,000 <sup>xii</sup>	21,424,000 <sup>xiii</sup>	400 (pigs)	Estimation based on a pilot project involving 40 pig farms in Ontario
<b>Australia</b>	267,000 <sup>xiv</sup>	4,850,000 <sup>xiv</sup>	?	No (recent) data available for sales or usage of antibiotics in livestock

<sup>i</sup> GB pig census, Defra, December 2016

<sup>ii</sup> Annual GB Clean Pig Slaughterings, Defra, 2016

<sup>iii</sup> UK-VARSS report, 2017

<sup>iv</sup> EU pig census, Eurostat, December 2015

<sup>v</sup> EU gross indigenous production, Eurostat, 2013

<sup>vi</sup> Eighth ESVAC report (2015 data)

<sup>vii</sup> Swedres SVARM report, 2016

<sup>viii</sup> DANMAP, 2016

<sup>ix</sup> Quarterly Hogs and Pigs Inventory, USDA National Agricultural Statistics Service, March 2017

<sup>x</sup> Livestock slaughter report, USDA, 2016

<sup>xi</sup> Smithfield Foods Sustainability Report 2016

<sup>xii</sup> Hog Inventory, Statistics Canada, Period II 2017

<sup>xiii</sup> Annual hog slaughterings, Statistics Canada, 2016

<sup>xiv</sup> Australian Pork Industry Fact Sheet, figure as at June 2015

## 4. Policy

During my study tour three aspects of policy in relation to antibiotic use emerged as worth highlighting: first, what legislation was actually in place and what impact did it have; second, the auditing of prescription practice; and third, the Scandinavian approach which of all the regimes I came across is the most longstanding, beginning far ahead of any other countries.

### 4.1 Legislation

There is huge global diversity in the regulatory control of antibiotic use in animals. While the use of antibiotics as growth promoters was banned in 2006 in the European Union (EU), the practice is still legally permissible in many countries.

In the United States (US) the Veterinary Feed Directive (VFD), which came into effect on 1 January 2017, introduced a number of important rules around the administration of antibiotics in feed or water to food-producing animals<sup>5</sup>. It is now illegal to use medically important antibiotics for growth promotion purposes and US farmers must now obtain authorisation (read: prescription) from a veterinarian if they wish to use them to prevent, control or treat disease.

On the face of it, this new legislation vastly improves the regulation of antibiotic use in farming in the US. However, having spoken to a number of pig farmers in the Midwest it became clear to me the new rules had made hardly any impact at all. I was surprised to be repeatedly told that the VFD was a “non-issue” for them. One pig farmer’s comment was very telling, “it’s a better story to tell to the consumer”, which suggested to me the VFD is just the start of the journey towards antibiotic stewardship for US farmers.

While such legislation is absolutely necessary, I fear progress will be slow unless it is coupled with awareness-raising, education and active encouragement of farmers to use antibiotics more responsibly.

Canada is also introducing new legislation. Until very recently farmers in Canada were able to obtain and use antibiotics in their livestock without any veterinary oversight. It was even possible for farmers to import unapproved drugs into Canada under “Own-Use-Importation” provisions and a number of these could be directly administered to animals without first being properly formulated into dosage form.

Reassuringly the Federal Government in Canada realised the risks posed by this lack of regulatory oversight and new rules are being phased in over the next year or so. There are now restrictions on “Own Use Importation” of certain unapproved drugs and, by December 2018, medically important antibiotics will only be available on prescription. Additionally, claims regarding the use of antibiotics for growth promotion will be removed from labels. As with the VFD in the US, these new rules are vitally important to ensure the safe and effective use of veterinary medicines and facilitate more responsible use of antibiotics in livestock.

When I visited the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) to meet with one of their Lead Veterinarians, Maureen Anderson, I was pleased to hear about OMAFRA’s education and communication work with farmers and industry bodies around antimicrobial resistance and

responsible antibiotic use. They have created and distributed fridge magnets, posters and infographics to spread key messages to farmers and are encouraging them to build a relationship with their vet. This combined regulatory and awareness-raising approach is exactly what is needed in my opinion.

## 4.2 Prescription Auditing

Much of the discussion and focus in the UK to date has been about setting and delivering against targets for the reduction of antibiotic use in livestock. Hence, the pig sector has committed to reducing its antibiotic *use* by 62% over five years. The government's target for the human medical sector, on the other hand, is to reduce *inappropriate prescribing* by 50% by 2020. Antibiotic stewardship in the veterinary and human sectors is therefore currently being measured in different ways: one according to the crude volume of antibiotics administered, versus the other according to whether or not the drug use is appropriate.

My question has always been this: what exactly is classed as “inappropriate” prescribing? It's always seemed rather ambiguous to me. Thankfully, my visit to the National Centre for Antimicrobial Stewardship (NCAS) in Melbourne, Australia shed some light.



**Figure 1: Melbourne, Australia – where I learned about prescription auditing**

As part of Australia's National Safety and Quality Health Standards hospitals are required to demonstrate that their prescription of antimicrobials is appropriate. Essentially, this makes stewardship auditing compulsory. NCAS was established in 2015, as a Centre for Research Excellence on antimicrobial stewardship, to offer support.

I was impressed to hear about the National Antimicrobial Prescribing Survey (NAPS), developed and coordinated by NCAS. The NAPS is an auditing tool designed to help hospitals and other healthcare

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facilities assess their antimicrobial prescribing practices. Hospitals undertake the NAPS at least once a year. On the day of the audit, data is collected from thirty patients regarding the treatments they have received. The “appropriateness” of the antimicrobial treatments administered to the patients is assessed against established definitions for appropriate and inappropriate treatment.

NCAS produce an annual report summarising the results of the hospital audits anonymously, but more importantly each hospital receives a report of their data which benchmarks them against other hospitals and helps them identify which problem areas need attention.

What sets the NAPS apart from other hospital surveys, is that rather than just collecting data about antibiotic use (what has been prescribed and how much), it determines the appropriateness of the prescribing. The importance of this became clear to me when Rod James, clinical microbiologist and research fellow at NCAS, gave me the following example. Doctor surgeries in the St Kilda neighbourhood of Melbourne were reporting high volumes of antibiotic use and traditional usage surveys would flag them as high users. St Kilda is a popular haunt for backpackers and the majority of antibiotic prescriptions by local GPs were in fact for sexually transmitted infections. The NAPS survey revealed that their high levels of use were completely justified. It’s all about putting the level of antibiotic use into context. High use does not necessarily mean inappropriate use.

Having developed the NAPS for hospitals, NCAS have since rolled out similar surveys for use in the aged care sector and in general practice. They are also hoping to develop surveys to assess the appropriateness of prescribing in agriculture and for companion animals. However, as I found out from academics at the University of Melbourne’s Veterinary School, this is easier said than done. The problem is that the evidence base for informing the appropriateness of prescribing in animals is much weaker than for human medicine. There are relatively few scientific papers regarding the efficacy of certain antimicrobials for the treatment of specific disease in animals. In fact, most treatment regimes in the veterinary world are based on clinical experience rather than hard data.

The challenge is that without guidelines as to what is deemed appropriate and inappropriate prescribing for animals, the validity of a NAPS-style audit will be questioned. I was told that many vets in Australia are resistant to having their prescribing levels looked at. They are also reluctant to engage with the development of appropriateness guidelines because this would require them to share their treatment regimens, something they desperately want to protect. After all, a vet’s business relies on them being able to treat their clients’ animals better than their competitors can; a marked point of difference with the human medical sector.

Clearly, there are inherent differences between the human medicine and veterinary fields. On the human side, antimicrobial treatment is usually of the individual, compared to on farms where treatment is often of the herd or group. Population medicine is a complex art, one which vets have perfected individually, according to their own knowledge and clinical experience. Sadly, these differences may preclude the roll out of appropriateness auditing in the veterinary sector, although I don’t think it would hurt to explore the applicability of the concept to UK agriculture.

### 4.3 The Scandinavian Approach

Lobby groups such as the Alliance to Save Our Antibiotics (ASOA) frequently compare antibiotic usage levels in the UK pig sector with those of Denmark and Sweden. ASOA has often highlighted that usage in UK pigs is five times higher than in Denmark and twenty-five times higher than in Sweden<sup>6</sup>. However, the fact is that the respective countries are at markedly different points along the antibiotic stewardship journey, Scandinavia having started theirs much longer ago. Change does not happen overnight.

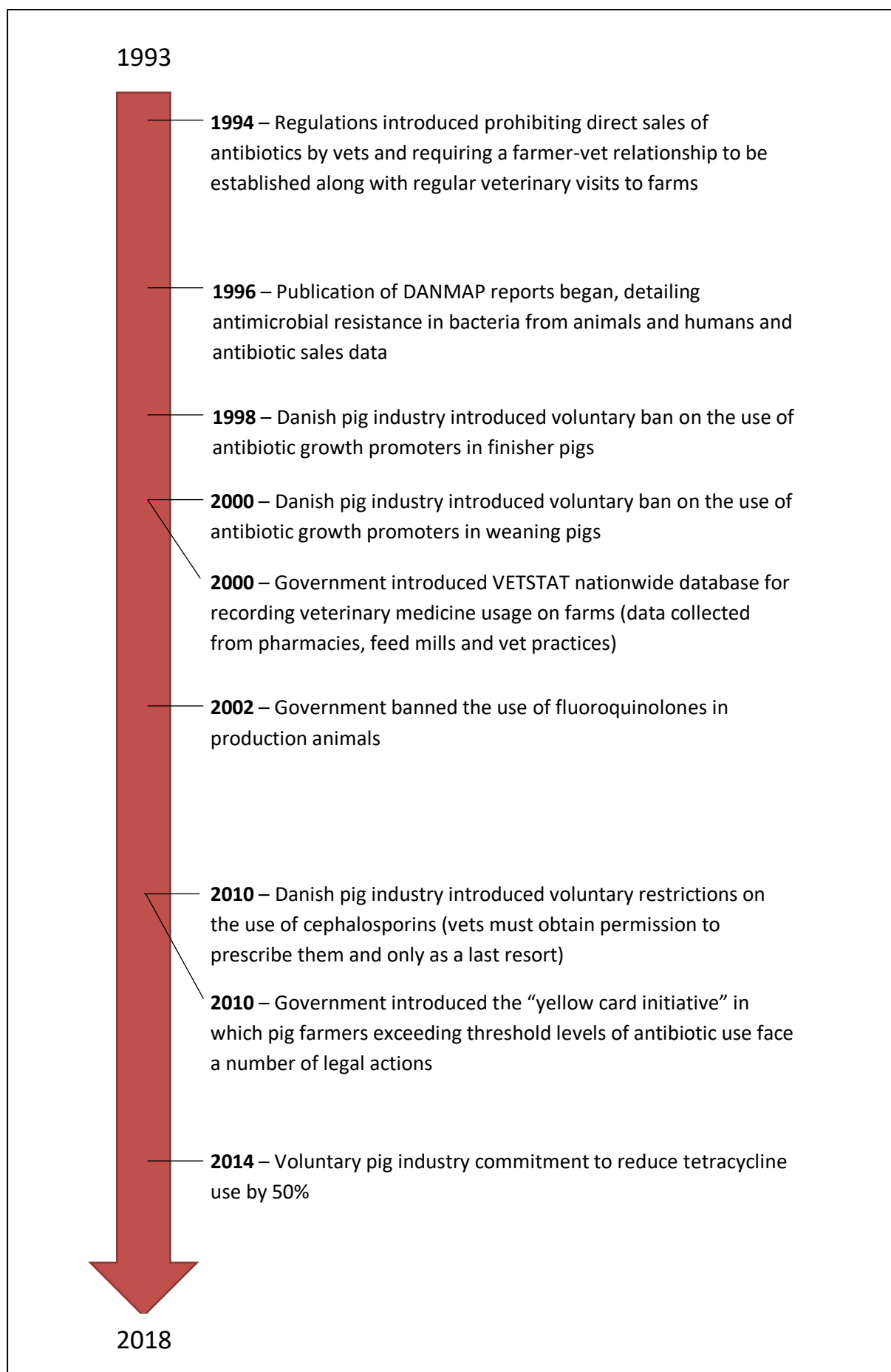
As explained to me by Dr Poul Baekbo, Senior Veterinary Specialist at SEGES, The Danish Agriculture and Food Council, reductions in antibiotic use in pigs in Denmark have been achieved through a raft of policies, introduced over several years (Figure 2)<sup>7</sup>. Notably, the use of antimicrobial growth promoters (AGPs) was effectively banned in Denmark in 2000, much earlier than the introduction of the official ban across the European Union in 2006. In Sweden, AGPs were banned earlier still, in 1986. The reason for my focus on this particular change in policy is because the move away from the use of antibiotics to enhance performance represents a step change in approach.

In speaking to Maria Lindberg at the Swedish Farm and Animal Health service in Uppsala, I learnt that the Swedish veterinary sector struggled initially when AGPs were banned. Therapeutic use of antibiotics increased and Maria explained that vets had to learn how to manage pig health more effectively as the AGPs could no longer be used to mask underlying disease problems. In particular, they had to learn how to wean piglets without the use of antibiotics. Poul Baekbo told me the Danish pig industry had a very similar experience. After the ban on the use of AGPs in weaner pigs they saw an increase in mortality and the levels of therapeutic antibiotic use went up, which lasted for a number of years. Clearly Danish vets had to learn how to wean piglets without the crutch that was AGPs as well.

These examples demonstrate that achieving low national levels of antibiotic use in pig production is something that takes many years and the journey will not always be smooth. My hope is that in five or ten years' time, the UK pig sector will be in a similarly favourable position as Denmark and Sweden.

There are other factors that have contributed towards the low use of antibiotics in Scandinavian countries, which I will cover in Chapter 5.

**Figure 2: Timeline of policies related to antimicrobial use in the Danish pig industry**



## 5. Improving Pig Health

Good pig health is essential for achieving low levels of antibiotic use. There has to be a multi-faceted approach to disease control and in this Chapter I touch on three important elements that I saw during my study tour: regular involvement of the farm vet in herd health planning, coordinated disease surveillance at a national level and good biosecurity.

### 5.1 Valuing Vets

In Denmark, at the same time that rules prohibiting vets from selling veterinary medicines (known as decoupling) were introduced, so was a requirement for farms to receive regular vet visits (6-12 per year). During my visit to Denmark I was told that while vets initially didn't take too kindly to decoupling, they at least had the safety net of a guaranteed number of visits per year with their clients.

To make up for loss of profits from dispensing antibiotics, Danish vets hiked up their hourly rates. Again, initially farmers weren't too happy about this but they soon realised that since they were required to have monthly vet visits and veterinary fees weren't going to go down, the best thing they could do was get their money's worth by making the most of the vet's time on farm. In this kind of situation vets are forced to deliver a consistently high quality service and achieve positive results on farm, otherwise they risk losing that client and their main source of income.

One way in which farmers could be encouraged to make better use of their vet was highlighted to me by Dr. Fiona Lovatt, a specialist sheep vet working in the UK. At a conference I attended Fiona neatly characterised farmer expenditure on veterinary services into "good vet spend" and "bad vet spend". Since the examples Fiona gave were specific to the sheep sector, I've created my own examples for pig farmers, inspired by her concept (Figure 3).

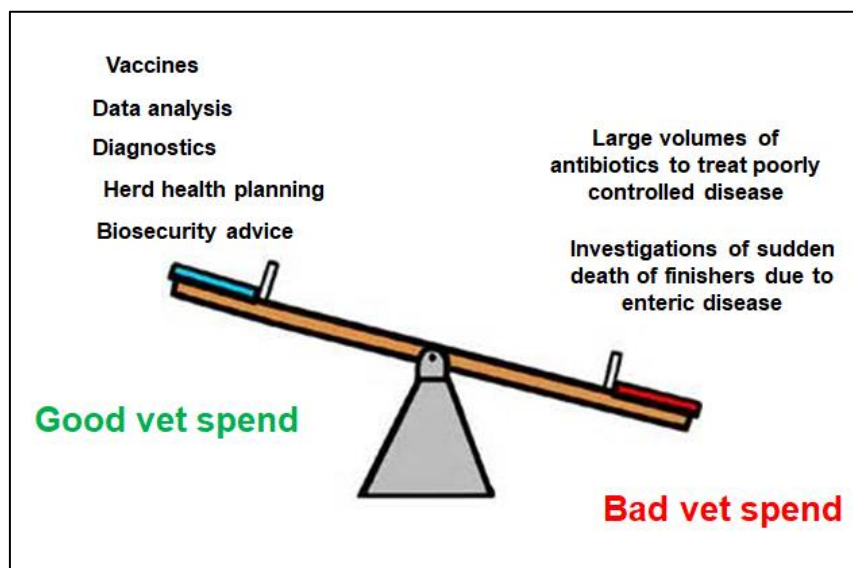


Figure 3: Examples of "good vet spend" and "bad vet spend" by pig farmers



The onus, however, should not only be on farmers to make best use of their vets and be willing to pay the associated veterinary bills; there is also a need for vet practices to ensure they offer a range of valuable services to support their clients.

During my time in Canada, I visited South West Ontario Veterinary Services, a large veterinary practice specialising in pig health, which provides an impressive range of services to their clients. In Canada there is no requirement for pig farms to receive a certain number of veterinary visits each year. To my knowledge the only requirements are that each farm must have an established relationship with a vet (i.e. nominate a dedicated vet practice) and, as part of the national Canadian Quality Assurance food safety programme, an on-farm veterinary assessment is required once every three years.

In the absence of guaranteed income from a minimum number of on-farm visits to their clients, South West Ontario Veterinary Services has to drive revenue through other routes. The practice has a production and technician team which advises clients on barn design, biosecurity, nutrition, production economics and labour management. The practice also has an IT services team which will input production data for clients; the team can then produce sow cards, to-do lists, production graphs and benchmark farms.

The practice also offers anaemia monitoring, since pigs that are deficient in iron are apparently more likely to require antibiotic treatment. Additionally, the vets perform colostrum experiments, whereby they measure the quality and uptake of colostrum by piglets, thus enabling the farmer to make informed decisions about the fate of small piglets (euthanise or nurture) according to the amount of colostrum they've received.

Finally, the practice has established a relationship with many of the top diagnostic labs in North America, which facilitates rapid, accurate, quality controlled disease testing. They are able to obtain results of PCR testing for Porcine Reproductive and Respiratory Syndrome virus (PRRSV) within 24 hours, which I understand is a markedly faster turnaround time compared to UK government labs.

## 5.2 National Disease Control Programmes

The UK pig herd is unfortunately burdened with a range of persistent endemic diseases, including *Streptococcus*, *Brachyspira hyodysenteriae* (swine dysentery), *Salmonella*, *Haemophilus parasuis*, PRRSV and *Mycoplasma hyopneumoniae* (enzootic pneumonia). Vaccination against these is often either not possible, reliable or commercially viable and while the diseases may not result in high mortality, they can certainly result in frequent use of antibiotics.

PRRSV is particularly challenging because the virus suppresses the immune response of infected pigs, which often results in secondary bacterial infection(s) and can also affect pigs' responses to vaccination for other diseases. Elimination of the virus is difficult, particularly in pig dense areas, and there has been an upward trend in the rate of diagnosis of PRRSV from pigs in the UK in recent years.

In the previous chapter I mentioned there were other factors behind the low use of antibiotics on pig farms in Scandinavia. Their attitude to disease control is a significant factor. The Danish, Swedish and Finnish pig sectors all have national schemes for monitoring key production diseases and these provide an excellent foundation for good pig health, resulting in reduced reliance on antibiotics. Below I have briefly described the three national schemes:

### **a) Finland**

In Seinäjoki, Finland I visited Animal Health ETT, an association that works to protect and promote the health and welfare of food-producing animals by coordinating national animal health programmes and overseeing animal and feed imports. The association was established by food companies when Finland joined the EU in 1995, because there was concern that EU rules would not sufficiently protect the country from disease risks. Animal Health ETT is now maintained by Finnish meat processors, dairies and egg-packers.

Animal Health ETT delivers the national health scheme for pigs, known as Sikava. Launched in 2003, the Sikava scheme classifies pig herds according to their health status and participants of the scheme must adhere to a number of different requirements regarding disease management. Although it is a voluntary scheme, the main pork processors operating in Finland, who contribute to the financing of the scheme, demand that their suppliers participate.

Data about the farms in the scheme are held in a centralised database managed by Animal Health ETT, including results of laboratory tests, medication records and other parameters such as mortality rates. The pork processors are given permission to view their suppliers' data in the Sikava database, plus they upload abattoir meat inspection results for their supplying farms.



**Figure 3: High health Finnish pigs**

The participating farms must have a “Health Care Contract” with a vet and receive a minimum of three vet visits every year, although I was told that most farms have more regular visits than this (one of the farms I visited has a vet visit every six weeks). Interestingly, the farms are required to manage finisher pigs on an all-in-all-out basis – more on this in Chapter 6. Most importantly, the farms must be free from *Salmonella*, enzootic pneumonia (EP), mange, atrophic rhinitis and swine dysentery.

There are three levels to Sikava’s classification:

1. **Basic level:** herds in Sikava which don’t fulfil the national level requirements as detailed above.

2. **National level:** most farms are in this level. They must meet the aforementioned requirements and must not exceed limit values for certain parameters such as mortality and number of condemnations.
3. **Special level:** around 50 farms are classified in this level. These are high-health units supplying breeding stock to other farms. These farms have to meet extra biosecurity requirements, receive more veterinary visits and conduct extra diagnostic tests.

The disease-free requirements of the Sikava scheme are not necessarily a tall ask because EP has been eradicated in Finland, the country is considered to be *Salmonella*-free and they have also virtually eliminated swine dysentery. Finland has also never had PRRSV, which is a notifiable disease there.

Therefore, it must be relatively easy to maintain a national health scheme like Sikava when the diseases the farms have to remain free from are not present in the country or only present at very low levels. Rather than a national health *improvement* programme, Sikava's value is really in encouraging farmers to *maintain* their disease-free status. The online recording of clinical signs of disease as part of the scheme is a useful feature I believe, but no actions seem to be required when diseases other than the five listed ones are suspected or diagnosed.

Nonetheless, the transparency of the scheme, such that pork processors can both view and contribute data about supplier farms, is commendable. Likewise, the fact that the scheme is funded primarily by the meat processors demonstrates excellent commitment by those companies to supporting primary producers to maintain healthy herds. They have clearly recognised that a healthy pig industry is beneficial for business.

## **b) Denmark**

I already knew of Denmark's renowned Specific Pathogen Free (SPF) system before I visited, but my understanding of it was limited so I was keen to find out more.

The SPF system was established as far back as 1968 by the Danish pig industry and it is described as the "back bone" of Danish pig production. Farms wishing to join the system must undergo a full depopulation/repopulation programme. I was told that 95% of nucleus and multiplication herds in Denmark are SPF herds and 22% of these have the highest health status, meaning they are negative for all of the listed diseases: EP, *Actinobacillus pleuropneumoniae* (APP), atrophic rhinitis, swine dysentery, PRRSV, mange and lice.

Herds do not have to be free from all the listed diseases to be classed as SPF, in which case the diseases they are positive for will be stated. For example, if the herd has *Mycoplasma hyopneumoniae* it will be listed as "SPF + Myc". Eighty per cent of replacement stock in Denmark are sourced from SPF herds, ensuring herds are stocked with high health pigs. In total, around 70% of the 4000 sow herds in Denmark are SPF.

In order to join the SPF system, a farmer must sign a written agreement to follow the "SPF Health Rules" of which there are many. These include requirements around biosecurity, health inspection, trade of pigs between farms and transport of pigs. For example, SPF pigs must be transported in a dedicated specially-designed truck fitted with a HEPA filter.

The key strength of the SPF system is its transparency. A database of all pig units in Denmark is held by SEGES, a private advisory and research organisation owned by pig producers and a part of the Danish Agriculture and Food Council. Anyone can search the database to find out the health status of a particular farm. A pig farm I visited in Denmark had their health status pinned to the external wall for anyone to see (Figure 5).



**Figure 5: Sign displaying the SPF status of a pig unit in Denmark**

There is even an online tool which plots the pig units onto a map for easy visualisation of proximity to other units. A new feature of the map is the inclusion of a figure indicating a farm's risk of reinfection with PRRSV or *M. hyo*, which comes in useful when producers are deciding whether to invest in restocking with SPF pigs.

This transparency, facilitated by the open-access database, means that buyers of breeding stock and weaner pigs are able to source sensibly, according to their own farm's health status, thus avoiding introducing new diseases via incoming stock. Buyers of SPF pigs also receive a formal "Health Declaration" containing additional information about the health of the purchased pigs beyond the listed diseases, including *Salmonella* levels and clinical signs of other diseases.



SPF herds are colour coded; red for the highest health herds (nucleus or multiplication units) and blue for production herds (weaner suppliers). Both red and blue herds receive additional monthly visits from an external vet who checks the pigs for clinical signs of disease. Blood samples are collected monthly from pigs on red herds, annually from blue herds, and tested for a number of diseases.



**Figure 6: Blood sampling of pigs as part of routine testing for the Danish SPF system**

Not only has the SPF system helped many pig units in Denmark remain free from certain diseases, it has delivered *improved* health in the industry. In 2007 approximately 77% of nucleus and multiplication herds in the scheme were negative for PRRSV, compared to 100% today. Likewise, the proportion of PRRS-negative production herds (blue herds) increased over the same time period from around 55% to nearly 75%. This has largely been achieved through farms destocking and restocking with SPF pigs. The system has also resulted in an increase in the proportion of EP-negative red herds, from 45% to 70%, although the number of EP-positive production herds has remained stable over time.

An important incentive for Danish pig farmers to take part in the SPF system is trade. One third of pigs produced in Denmark are exported as weaners – the buyers of those pigs will pay a decent premium for high health stock.

### **c) Sweden**

In Sweden I met with a vet working for Farm and Animal Health, a private veterinary consultancy company funded by farmers and meat processors via a levy collected on every pig, cow and sheep produced. Farm and Animal Health delivers national cattle, sheep and pig health programmes and is contracted by government to deliver statutory disease control and surveillance schemes as well.

Sweden, similarly to Finland, is in the enviable position of being free from a number of major pig diseases including PRRSV and *Salmonella*. All nucleus and multiplication herds in Sweden are also negative for atrophic rhinitis, swine dysentery and mange.

Sweden's PRRSV surveillance programme consists of both passive surveillance of herds experiencing clinical signs and active sampling of all nucleus herds, multiplication herds and sow pools (sites where gestating sows from multiple farms are pooled, before they return to the home farm for farrowing). Blood samples are collected from a sample of pigs twice a year on these farms and there is also continuous sampling at the abattoir of pigs from randomly selected production herds. The passive surveillance acts as an early warning system and is facilitated by the fact that PRRSV is notifiable on suspicion.

The *Salmonella* surveillance occurs in a similar way, following a programme of regular faecal sampling of herds and investigation of any unit experiencing clinical signs. Similarly to Finland, this approach to controlling certain diseases is perhaps only feasible where outbreaks of those diseases are extremely rare, otherwise the cost associated with frequent investigation of positive farms would be huge.

What struck me most about these three examples from Finland, Denmark and Sweden is that they all have a dedicated organisation for overseeing farm animal health on a national scale. With this comes strong focus on disease control to protect and maintain pig health, with dedicated funding assigned for this purpose. Notably the funding comes from industry, including strong support from the meat processors. Also, as I've said, transparency appears to be a key feature of a successful disease control programme.

### 5.3 Biosecurity

In Denmark good biosecurity is the norm. The SPF system has fostered a culture in which biosecurity measures are a way of life. The Danish LA-MRSA strategy launched in 2014 also made certain biosecurity measures mandatory for all pig keepers, including that all workers must change out of their farm clothes and wash their hands before leaving the unit. Danish legislation will also soon require all pig farms to have shower facilities and anyone visiting must shower on entry and exit. Compare that to the UK, where currently it is only a "recommendation" in the Red Tractor Pigs Standards (version 4.0) that handwashing facilities are available on farm.

In the US and Canada, recent experience with the devastating porcine epidemic diarrhoea virus (PEDV) has resulted in stringent hygiene measures for livestock trucks. A large integrated pig business that I visited in Iowa uses its own trucks for transporting livestock and these are cleaned in the company's own truck wash facilities, where they are washed and then baked at 60°C for twenty minutes. Apparently the truck wash facilities at the abattoirs are poor, hence that individual pig business's decision to invest in their own. In Ontario I met another large pig business which had their own state of the art under cover wash bay for trucks. I also visited a 7,500 sow unit in Iowa which had a shower facility and an air filtration system to limit the risk of bringing in PRRSV and other diseases with the incoming air.



**Figure 7: Under cover truck wash facilities for livestock vehicles in Iowa, United States**



**Figure 8: Large 7,500 sow unit with air filtration in Iowa, United States**

Ontario Pork, the representative body for Canadian pig producers in Ontario, told me that in the past a significant amount of national funding has been available to producers for biosecurity improvements and training. Funding was available at 50% cost-share where the investment involved something

*Reducing antibiotic use in pig production – is there a need for systemic change?* by Georgina Crayford  
A Nuffield Farming Scholarships Trust report ... generously sponsored by AHDB Pork

innovative; 35% otherwise. This funding would even cover new buildings, as long as they had a Danish-style bench or shower entry.

In the UK, the word “biosecurity” tends to bring on a certain amount of eye-rolling amongst pig producers. There are certainly farms that have excellent biosecurity and maintain it 100% of the time, but there are many out there where biosecurity tends to get forgotten particularly during busy periods. Biosecurity in the UK pig industry is not terrible, but there is certainly room for improvement. If, somehow, biosecurity best practice could be established as a culture, for example where it was the norm to shower on/off units and hand-washing was habitual, I think that would go some way to minimise spread of disease within the industry.



## 6. Management and Husbandry

There are two aspects of management and husbandry I found on my travels that were worth exploring further. First, the approach to hygiene and how that can reduce diseases on farm and second, the role of changes in pig husbandry practices in delivering improved disease prevention.

### 6.1 Hygiene

Throughout my travels I was interested to explore the importance of hygiene in reducing disease on pig farms and therefore reducing the need for antibiotics. On a one-day trip to the Netherlands I had the pleasure of visiting agricultural supplies firm Schippers to learn about their Hy-Care concept which, as the name suggests, focuses on hygiene.

Following substantial reductions in antibiotic use in pigs in the Netherlands from 2009 to 2012, levels have plateaued and further reductions are proving to be challenging<sup>8</sup>. Also, although Dutch pig farmers are spending significantly less money on antibiotics, their spend on vaccines has increased.

Given that background, Schippers sought to explore how they might help pig farmers achieve improved pig health, without them having to invest in brand new buildings or undergo a depopulation/repopulation programme. They decided to focus on hygiene measures and conducted studies to document the associated positive effects on pig health and productivity. They worked with twenty Dutch farmers to implement the Hy-Care concept on real pig farms and as a result those farms have achieved a 90% reduction in antibiotic use.

I visited their demonstration farm to learn more about the hygiene measures.

First, I entered a small cinema room where I was introduced to the Hy-Care concept via a virtual reality headset which put me inside a virtual pig unit and described the principles of hygiene. Next, I was walked through a long corridor separated into different sections dedicated to demonstrating the different hygiene practices: shower facilities for visitors, colour-coded boots and overalls, hand-washing, methodical movements around the unit to limit disease spread, pen and wall coatings to aid cleaning, the importance of detergent, fly control and water system hygiene.

My tour guide highlighted that none of the measures in the Hy-Care concept are new ideas. Rather, their demonstration unit aims to help farmers appreciate the importance of the various measures, using interactive sets and visual tools (Figures 9 & 10). For example, invisible ink was used to excellent effect, to represent the presence of dirt and pathogens, visible under UV light but not to the naked eye. This helps participants to visualise the otherwise invisible world of bacteria. Ultimately, the goal is to encourage farmers to implement *all* of the measures *all* of the time by embedding the importance of hygiene in their minds.

I found the Hy-Care concept compelling and the demonstration unit is a fantastic example of innovative knowledge transfer to farmers. Although, I admit I was left wondering whether there could be any negative effects of rearing pigs in such a stringently clean environment.



**Figure 9: Inside the Schippers Hy-Care demonstration farm where strong visual aids help demonstrate the importance of hygiene**



**Figure 10: Would you allow your children to drink water from the drinkers in the pig pens?**

## 6.2 Health by Stealth (health by management rather than health by antibiotic)

Ninety-two per cent of pigs produced in Australia come from farms assured by the Australian Pork Industry Quality Assurance Program (APIQ). A requirement of the APIQ program is that the farm must have a Herd Health Plan which includes a description of any routine medications being used on the farm<sup>9</sup>. Therefore, it is standard practice for farms to have an Approved Medication List (AML) outlining which products should be used for which ailment, along with the necessary dosage. The AML is written by the farm's vet and the farm can order any products from the list, with the farm staff deciding when to treat.

An independent vet that I met in Australia, Peter McKenzie, felt that many farmers see their AML as a "licence to medicate". He was highly critical of this approach as he felt AMLs were enabling routine overuse of antibiotics on many pig farms with limited veterinary oversight. Other farmers and vets I met with in Australia argued otherwise. Although, interestingly, I have learnt that the requirement to have an AML has been dropped from APIQ since I visited.

Thankfully Peter was keen to fill me in on how he is trying to do things differently with his pig farmer clients. His approach to improving pig health and reducing antibiotic use centres on good animal husbandry, or "health by stealth" as he has cleverly coined it. The focus is on proper pig management as the cornerstone for producing healthy pigs.

The concept is incredibly simple and I doubt any farmer or vet would disagree with it, but the reality is that for many years easy access to cheap antibiotics, alongside increasingly tight margins and tough market conditions, has allowed inadequate husbandry to proliferate on pig farms. Peter stated that "it requires significantly greater skill to produce health by management than health by antibiotic" and this is often a barrier as potential clients claim their staff are not up to the required level of management.

During my discussions with Peter, he frequently cited what is widely known as the "Madec 20-point plan"<sup>10</sup> as being the blueprint for achieving good pig health through proper management. It was not something I'd heard of before, but I have since learned that many pig farmers and vets around the world know of this 20-point plan.

Following extensive field research Dr Francois Madec, a French veterinary epidemiologist, developed the plan in 1999 (hence why I'd never heard of it, I was only ten years old then!), to advise pig producers and vets on how to control porcine circovirus type 2 (PCV2) which devastated pig industries worldwide in the late 1990s. The measures outlined in the 20-point plan centre around:-

1. **Limiting pig-to-pig contact**, e.g. employing all-in-all-out production, minimising mixing, keeping pigs in small groups with solid pen divisions, only cross-fostering piglets within the first 24 hours;
2. **Minimising pig "stress"**, e.g. reducing stocking density, providing more space at the feeder, optimising air quality, ventilation and temperature control;
3. **Implementing good hygiene**, e.g. strict cleaning and disinfection protocols for pig pens and equipment.

Adapted versions also include a focus on providing good nutrition, for example through ensuring optimal water quality and that piglets receive sufficient colostrum.

In the absence of any effective methods of controlling or treating PCV2, the Madec 20-point plan was adopted readily as farmers were desperate to get on top of the associated wasting disease which saw losses of up to 50% on some pig farms. Since the development and widespread adoption of effective PCV2 vaccines, farmer motivation to strictly apply these management and biosecurity practices has waned. Old habits have crept back in and, with the daily pressures of business and tight profit margins, there isn't the time, energy or cash to maintain such stringent practices.

How, then, might pig keepers be incentivised again to tighten up their husbandry and hygiene standards to achieve good pig health through management? Clearly the economic damage associated with PCV2 was a strong enough incentive back in 1999, but is the threat of antimicrobial resistance enough to achieve the same response? Somehow we need to make responsible antibiotic use and disease prevention a priority for farmers. More on this in Chapter 7.

It is no surprise that throughout my Nuffield travels many of Madec's principles were cited as reasons for reduced antibiotic use by the pig farmers and vets I met. Farmers in Sweden and Finland claimed increased space allowance (as dictated by national law) facilitated low antibiotic use; healthy sows with optimum nutrition supplying good quality milk to their piglets was mentioned in Sweden and Denmark; all-in-all-out management of pigs was also frequently raised, as was multi-site production.

I met with a large pig production business in the UK which significantly reduced antibiotic use across its many farms within just a couple of years. The production manager highlighted that their system of pig management lends itself well to achieving low use of antibiotics. For example, it operates split site production mostly, where breeding units and finisher units are separate, providing a break in the disease cycle. The units are managed on an all-in-all-out basis, along with batch-farrowing to facilitate segregation of pigs into discrete groups and to limit the number of stressful mixing and movement events, as well as allowing sufficient time for proper cleaning and disinfection between batches.

Peter, the Australian vet, works with his clients to identify which on-farm management changes are needed to improve pig health and reduce reliance on medication. He highlighted that his way of working differs to the usual "diagnose and dispense" approach of his veterinary colleagues. He blames Australian vet schools for failing to effectively teach veterinary students about population medicine and the importance of good management and hygiene in preventing disease.

He also highlighted the considerable challenge he faces in getting farmers to "buy in" to his approach. The first question most new clients apparently ask is "What are your prices for medication?" when it should be "What can you do to improve the health and productivity of my pigs while reducing antibiotic use?". Over the years he has perfected the art of change management, something he sees as being vitally important in helping farmers move away from routine medication through consistent implementation of the recommended management practices.

***"Change management is a structured approach for ensuring that changes are thoroughly and smoothly implemented and that the lasting benefits of change are achieved. The focus is on the wider impacts of change, particularly on people and how they, as individuals and teams, move from the current situation to the new one."***<sup>11</sup>

Peter has even called for certain management practices, including all-in-all-out management and batch farrowing, to be incorporated as requirements of the APIQ program, perhaps through the

establishment of a two-tier system whereby those employing these management practices achieve “APIQ Gold” status.

I visited a pig farm in New South Wales which has been working with Peter for a couple of years, to see the effect of his approach for myself. In the past the farm was a heavy user of ceftiofur (a highest-priority critically important antibiotic as defined by the European Medicines Agency<sup>12</sup>) for piglet scours which they believed to be caused by *E. coli*. When the farm started working with Peter he determined that the problem was in fact clostridial enteritis, a disease which is exacerbated by frequent antibiotic treatment and substandard hygiene. He encouraged them to start using a probiotic, which they now spray onto the vulva and udders of sows before farrowing and administer to piglets on the day they are born. The farm has experienced spectacular results and the delight of the farm manager was clear when I met him. After all, scouring piglets is no fun for anyone.

I discovered that the farm had stopped using the probiotic a couple of times, only to find piglets scouring again within days. This highlighted the challenge faced in getting new behaviours to stick. It is made all the more difficult when a new practice delivers reduced disease; the farm staff are fooled into thinking that the problem has gone away and they lapse back into old ways, always looking for shortcuts and ways to save time and money.

Impressed by the effect of management changes on piglet health, the farm is now considering switching to batch farrowing to overcome hygiene issues in the farrowing house. They are also trialling a new way of managing piglets around weaning to minimise stress at this key stage, as well as implementing enhanced cleaning and disinfection protocols. This was all recommended by Peter, who has clearly won the trust of the farm manager and demonstrated to the farm staff the value of improving husbandry and hygiene practices.

Within eighteen months, use of antibiotics on this farm reduced by 80%.

## 7. Changing Behaviours

Nothing in the previous chapter represents anything particularly new; the hygiene and husbandry measures I mentioned should all be familiar to pig farmers. In my opinion, a lot of what needs to be done to improve pig health and reduce reliance on antibiotics is already known. Of course, more research into rapid pen-side diagnostics, alternative non-antibiotic treatments and effective control measures for intractable pig diseases would be beneficial. But vast improvements could be made to pig health if existing knowledge and best practice, particularly regarding pig management, were to be implemented consistently and to a high standard.

### 7.1 Behavioural Nudges

I've learned that there is no need to reinvent the wheel. But there is a vital need to consider and optimise human behaviour if the wheel is to turn smoothly. With this in mind I went to meet with Rob Moore, cofounder and director of Behaviour Change, a not-for-profit social enterprise based in London that develops interventions to tackle societal issues that require behaviour change.

Rob suggested brainstorming the potential benefits to farmers of reducing antibiotic use and using these to engage them with the issue. Previously I had struggled to come up with compelling arguments to encourage farmers to reduce their antibiotic use as it was perceived that the benefits are mainly societal, i.e. reduced risk to public health from drug-resistant infections. It's much harder to get somebody to do something in the interest of the "collective good", so Rob's suggestion of considering what might be "in it for them" seemed much more sensible.

Ultimately this is about shifting the locus of motivation from external (i.e. "You must do this because society says so") to internal (i.e. "I want to do this because it will impact me personally"). Rob explained that potential losses are more pertinent than potential gains. Therefore an example could be: overuse of antibiotics on your farm could result in certain diseases becoming untreatable, resulting in higher mortality rates. Framing the problem of AMR in this way instantly demonstrates the direct impact it could have on the farmer, thus hopefully motivating them to change their behaviour.

Indeed, the unit manager of a pig production business I visited in Canada remarked to me that their motivation for reducing antibiotic use was the realisation that, if they could improve pig health enough to deliver a reduced reliance on antibiotic medication, the pigs would be more likely to reach their genetic potential in terms of productivity.

Other farmers could be encouraged to come to the same realisation by presenting realistic estimates of the cost of disease to a farm, encompassing loss of productivity, labour costs, treatment costs and mortality rates. Then presenting these alongside the costs associated with the necessary measures to eliminate or control disease. I appreciate this is not an easy thing to do, but these figures would certainly be powerful.

A further suggestion from Rob was to identify which are the specific behaviours that need to change. He highlighted that using fewer antibiotics is not a behaviour, it's an outcome. A specific undesirable behaviour to target could therefore be, for example, treating a sick pig that should instead be euthanised because its chances of recovery are slim, another would be overstocking pigs. The idea

therefore is to divide up the individual behaviours that cumulatively result in overuse of antibiotics and tackle them separately with a tailored approach to each.

Similarly, Peter McKenzie, the Australian vet I described in Chapter 6, explained that in the past he'd given his clients a long list of management changes that were needed, but this approach proved too overwhelming and consequently very few of the recommendations were implemented. He now recommends two or three changes at a time, to focus the minds of the farm staff, ensuring these changes are sufficiently embedded before making the next recommendations.

Rob at Behaviour Change also went through some useful tools that can help ensure new behaviours stick. He explained the importance of delivering information in the right place, at the right time. We discussed the current use of regional workshops and events to deliver information to farmers about how to reduce antibiotic use. Rob pointed out that while this type of event can be useful for raising awareness of an issue, it is likely the information conveyed will be forgotten as soon as the farmer returns to the farm and gets back to the daily routine. There is greater chance of getting farmers to absorb knowledge and advice if it is delivered on farm, where the farmer can visualise implementing the recommendations and necessary changes.

Another nudge technique exploits the fact that people tend to behave according to social norms. Certain behaviours can be encouraged by either establishing a new social norm or by destroying an existing one.

I suggested highlighting to farmers that the proportion of weaner feed containing antibiotics has reduced to 18%, to emphasise to those farmers still relying on medicated weaner feed that they are in the minority. However, Rob suggested framing it differently, to instead highlight that 82% of weaner feed doesn't contain antibiotics, because ultimately people prefer to be doing what the majority is doing; the social norm.

He provided a useful example from outside of farming to highlight the distinction. Instead of doctor surgeries publicising that "132 people missed their appointment last month" which could lead people to think that it's normal to miss appointments, surgeries should instead highlight, for example "98% of appointments were attended last month". People instinctively want to avoid being in the minority 2%.





**Figure 12: Social norms nudge theory in action in a park in Tunbridge Wells, Kent**

On a similar note, I fear that pig farmers in the UK are experiencing something known as “normalisation of disease”. This concept, which I was introduced to at a recent conference, describes how people can become unmotivated to do something about a disease once it is established as “normal”. For example, somebody that is obese may eventually just accept that they are overweight and consequently stop trying to lose weight. It is possible that pig farmers now see post-weaning diarrhoea, for example, as a normal part of pig production and hence have stopped trying to find solutions, opting instead to rely on medication to deal with the symptoms.

Finally, Rob emphasised the importance of ensuring the right messenger delivers information to farmers. He advised using people that are trusted by farmers to convey messages around the need to use antibiotics more responsibly. We agreed that vets and other farmers are probably the people that farmers trust the most when it comes to advice about pig health.

## 7.2 Farmer-Led Initiatives

I attended an extremely informative workshop in February 2018 organised by academics from the University of Bristol and the Royal Agricultural University. The workshop advocated farmer-led and



farmer-focused initiatives, delivered in conjunction with an experienced facilitator, as a method of engaging farmers with a variety of issues and challenges. The researchers put up a quote from an old scientific paper about this participatory approach, which read:

***“Solutions developed by farmers through these approaches often lead to on-farm practice change as they are more practical and implementable than solutions delivered by outsiders”<sup>13</sup>***

I was pleased to discover at this workshop that I am not alone in my view that production of guidance booklets and leaflets for the purpose of disseminating information to farmers is a somewhat fruitless task. While the content of the guidance may be accurate and valid, it relies on a farmer seeking out the information and taking the time to read, digest and then implement it. Most farmers, let’s face it, are not inclined to do so, unless the material is related to a topic that is really, really important to them.

The researchers highlighted that people are more likely to change their behaviour if they think it is their idea. Therefore, instead of top-down policy and knowledge-transfer, greater success could be realised by stimulating farmers to think about how *they* would deal with something. This approach forms the basis of farmer-led initiatives, in which the existing expertise of farmers is recognised and utilised. Projects run by the University of Bristol have successfully used this farmer-led approach with groups of dairy farmers, resulting in the participants implementing actions on their farms to reduce antibiotic use<sup>14</sup>.

A key reason why this approach is successful is because it engages the farmers involved with a particular issue and encourages them to take ownership of it. Ultimately, successful implementation of change is about people. That’s why the Australian vet had become so adept at change management.

***“Plans themselves do not capture value; value is realised only through the sustained, collective actions... of employees who are responsible for designing, executing, and living with the changed environment.”<sup>15</sup>***

Change is hard. If you don’t believe me, try going to sleep on the other side of the bed tonight! You wouldn’t do it just because I’ve suggested it to you. But if you decided in your own mind that sleeping on the other side of the bed could be beneficial, perhaps because the other side is less lumpy and therefore less likely to give you backache, then you might be more inclined to give it a go!

Another important feature of the farmer-led participatory approach is the involvement of a facilitator – someone trained in running these kinds of sessions and in getting the most out of the participants and the process. The facilitator must be able to deal with the complexity that arises from the fact that every farm is different, which guarantees that there is no “one-size-fits-all” solution.

## 8. Discussion

At the start of my Nuffield travels I planned to determine whether one particular system of pig production should be promoted over other systems in order to deliver reductions in antibiotic use in the UK pig sector. What I meant by “system” when I first penned my title was the generalised term for different types of pig production, such as free range, outdoor-bred and conventional indoor.

I quickly came to the realisation that this was an overly simplistic way of looking at things. Also, there are far greater market forces and other considerations at play determining the proportion of pigs reared extensively or intensively (for want of a better word) in the UK.

Besides, it would be virtually impossible to conclusively say that one particular production system results in lower use of antibiotics compared to others, without performing complex data analyses since pig farms do not fit into simple classifications of “system”. There are some practices, of course, that tend to occur in certain production systems and not others, but when all husbandry practices, environmental factors, disease profiles, structural differences and business models are taken into account, no two pig farms are the same.

Nonetheless, I have come to believe that systemic change in the broader sense is needed in the UK to deliver reduced antibiotic use in pig production. That is, systemic change in the way:

- Pig health is managed, both at national and farm level,
- Farmers are engaged in dealing with complex industry issues,
- Veterinary resource is utilised.

For decades antibiotics have provided a cheap, effective solution to endemic disease challenges in pigs. They have enabled pig production to continue, in spite of severe under-investment in farm infrastructure resulting from a volatile market and pressures on margins.

The problem is that antibiotics are an untargeted approach to dealing with pathogens, since they tend to wipe out all kinds of bacteria, not just the target ones. This in turn upsets the microbiome which can have serious and, as yet, mostly unknown or poorly understood consequences. It is essential that farmers and vets move away from using antibiotics “just in case”.

I have already seen significant mind-set change in the UK pig sector during the two years I’ve been doing my Nuffield study. However, while significant reductions have already been made (antibiotic use in the UK pig industry halved between 2015 and 2017<sup>16</sup>), further reductions are needed in order to meet the industry’s 2020 target.

It is impossible to rear pigs in sterile environments, so pigs will on occasion succumb to bacterial disease requiring treatment with antibiotics. Therefore, the aim should never be zero use of antibiotics. However, in order to further reduce antibiotic use and then to sustain that low level, the focus really needs to turn to reducing the *need* for antibiotics, primarily by getting better at preventing disease. After all, prevention is better than cure.

The way to do this is by improving pig health support services and I would strongly recommend the development of a national pig health improvement scheme that makes better use of surveillance data,

diagnostics and operates with transparency at its heart. Improved knowledge of the health status of farms would facilitate more targeted control programmes and help to ensure that when pigs are moved between farms they are not accompanied by unwanted infectious diseases. Importantly, the scheme needs to be sufficiently well-resourced to ensure it can operate long-term and across the entire industry.

The industry also needs to make better use of the limited number of specialist pig vets. This is a two way process. Farmers need to recognise that they may require more frequent vet visits than the current Red Tractor requirement of four per year, particularly if their current pig health status is poor. Equally, practices supplying veterinary services to pig farms may need to adapt their business model to better support the industry as it shifts from a reliance on medication to a focus on infection prevention and proactive herd health planning. Indeed, a number of specialist pig practices in the UK are already doing so.

Concurrently, improvements to on-farm management and hygiene practices are essential and the necessary changes will need to be introduced carefully, with consideration of human behaviour to maximise uptake. Operating a farm on a system of all-in-all-out production, batch farrowing and minimal mixing of pigs is not rocket science, but it does take careful planning of pig flow. Transitioning from continuous production can be challenging and will often require considerable investment, but costs would soon be recouped through increased productivity and reduced medication thanks to improved pig health.

Finally, in order to engage those farmers that are currently unengaged with antibiotic stewardship (I should highlight that plenty of pig farmers are already fully engaged with this issue), initiatives should be developed that put them in the driving seat and encourage them to make the issue a priority. This will require a radical change to the way in which information is currently delivered to farmers by organisations such as AHDB.

AHDB Pork delivers some excellent initiatives supporting farmers with a wide range of challenges. However, I feel a disproportionate amount of their activity is focused on delivering improved productivity and there has been a distinct lack of resource directed towards projects aimed at reducing endemic disease.

The development of the pig industry electronic medicine book (eMB) for recording antibiotic use has been hugely successful and extremely valuable to the industry. But other health-related projects, such as the Think Biorisk biosecurity app and recent guidance documents on responsible antibiotic use and optimising water systems, have been largely passive, relying on farmers being motivated to seek out the information themselves and implement it.

The industry needs to recognise that improvements to overall pig health, through reduction of endemic disease, will ultimately result in increased productivity. As such, I would encourage AHDB to direct greater resource and focus towards more ambitious projects to deliver improved pig health.

One such project could involve conducting on-farm assessments of pig units to identify the key practices and behaviours that are likely contributing to poor disease management and overuse of antibiotics. A bespoke plan could then be developed for that farm, outlining a series of actions aimed at reducing and preventing disease.

The farm's vet should also be involved in the process to ensure the recommended actions are appropriate from a veterinary perspective. Indeed, it is likely that many farms will have been receiving recommendations from their vet for years, so a key element of this project would be that a consideration of human behaviour and change management would be an integral part of the approach, to ensure that the recommendations are fully adopted and implemented.

One way of ensuring this would be to put the farmer at the centre of the project by adopting the participatory approach that I described in Chapter 7. Groups of farmers could be brought together to participate in such an initiative, to learn from each other and hold each other to account regarding implementation of the necessary actions.

Alternatively, or perhaps additionally, something like the Schippers Hy-Care demonstration farm could be set up in the UK. Pig farmers could then be invited to see certain practices in action and the interactive nature of the visit would hopefully make the information more memorable and therefore more likely to be taken up. The demonstration facility need not only be used for exhibiting hygiene practices, but also husbandry practices and a whole range of other useful training.

Of course, these types of projects are very comprehensive and would require a significant amount of resource. It is much cheaper to develop guidance documents and web tools, but these are nowhere near as effective in my opinion.

## 9. Conclusions

1. For decades antibiotics have masked an array of disease challenges and resulted in a lack of focus and resource being directed towards effective disease prevention on UK pig farms.
2. Eradication or improved control of the major endemic pig diseases would provide a foundation of good pig health, which is necessary for reducing the need for antibiotics.
3. Vets are crucial for delivering improved pig health and reduced reliance on antibiotics, but their role and the services they provide will need to adapt as the pig industry moves away from reliance on medication to proactive infection prevention.
4. The pig management and hygiene practices that result in reduced transmission of disease are well-established but not well-implemented in the UK.
5. Change is hard and does not happen overnight. Behavioural nudge techniques and farmer-led initiatives can help to deliver necessary change amongst pig farmers.

## 10. Recommendations

### Policy-makers:

- Recognise there is a limit to how low antibiotic use in pig production can go. Focus should now be turned to reducing the need for antibiotics and responsible use of these products where they are needed.
- Actively collaborate with the pig industry to develop a comprehensive national pig health improvement programme.

### Industry organisations:

- Dedicate greater resource to pig health improvement initiatives, including the establishment of a national pig health improvement scheme that aims to reduce the prevalence of endemic disease on all UK pig farms and improve transparency around farm health status.
- Shift activity away from top-down knowledge transfer towards more participatory farmer-led initiatives that recognise and utilise the existing knowledge amongst farmers and engage them with antibiotic stewardship.
- Make better use of behavioural nudge techniques in all communications and activities aimed at encouraging farmers to do something differently, to ensure good uptake. Operate a more bespoke approach with individual farms, whereby training and support is tailored to their unique needs.

### Farmers:

- Evaluate the cost of antibiotic medication and the impact of long-term endemic disease in detracting from the bottom line. Consider whether your business would continue to be viable if certain diseases became untreatable due to antibiotic resistance, or if certain antibiotic products were no longer permitted to be used in livestock.
- With support from relevant industry organisations and advisers, including the farm vet, conduct a comprehensive assessment of the farm's management and hygiene practices and establish whether any changes are necessary to deliver improved infection prevention.
- Be willing to invest in the necessary changes and consider how to engage staff with the changes to ensure they implement them consistently and to a high standard.
- Consider whether four veterinary visits per year are sufficient to deliver improved pig health on your farm and if necessary dedicate a greater proportion of the budget on veterinary services.
- Be proactive rather than reactive when it comes to managing disease.

## 11. After My Study Tour

The transformation I have undergone as a result of becoming a Nuffield Scholar and everything else it entails has been quite remarkable. I now feel much more confident speaking about this topic and a range of other topics, backed up by the knowledge and experience I have gained over the last two years.

I feel much more at ease with networking now and my inquisitiveness has also increased, no longer accepting what I'm told at face value but striving to dig into the detail and context. This improved ability to think critically will stand me in good stead in the future I'm sure.

In terms of what I plan to do next to progress the recommendations of this report, I believe there is no time like the present to get on with things. As the UK prepares to exit the European Union and Defra considers what a future domestic agricultural policy might look like, I have been making sure to highlight some of my suggestions, through my position at the National Pig Association (NPA.)

In the NPA's response to the consultation on Defra's Health and Harmony paper I made a strong case for improved animal health and reduced antibiotic use to be seen as a "public goods", as it is clear that in the future public funding will be directed towards activities that deliver public good.

In the same consultation I also highlighted the value and previous success of farmer-led initiatives in delivering greater uptake of best practice amongst farmers including practices resulting in better antibiotic stewardship. As such, I urged Defra to include easy-to-access funding mechanisms to support the running costs of farmer action groups within any future agricultural policy.

The Health and Harmony paper also proposed the establishment of an Animal Health Pathway, involving "a clear vision and programme of partnership action... to tackle non-statutory endemic disease and health conditions", which NPA expressed strong support for in our consultation response. It is likely that I will take the lead (within the NPA) on working with Government and other organisations such as the Pig Veterinary Society and AHDB Pork to progress this concept.

I have also already been in contact with colleagues working in AHDB Pork's knowledge exchange team, to explain how the farmer-led participatory approach could be employed to encourage more pig farmers to engage with antibiotic stewardship.

There is plenty to do and lots of opportunity to drive change and I hope to be able to support the pig industry throughout.



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