



A Nuffield Farming Scholarships Trust

Report

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**Living and Dying with
Avian Influenza**

Daniel Roberts

July 2018

NUFFIELD UK

NUFFIELD FARMING SCHOLARSHIPS TRUST (UK)

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Nuffield (UK) Farming Scholarships Trust Report



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

Date of report: July 2018

Title	Living and dying with Avian Influenza
Scholar	Daniel Roberts
Sponsor	The Worshipful Company of Farmers and Savills with the Poultry Meat Group: Aviagen, Cobb Europe and Hubbard
Objectives of Study Tour	<ul style="list-style-type: none">• To study how best the UK can mitigate the risk of an Avian Influenza outbreak within the poultry industry.• To understand the pandemic threat posed by Avian Influenza.• To analyse the relationship between Avian Influenza and global poultry trade.
Countries Visited	France, The Netherlands, USA, Canada, Hong Kong, China, New Zealand
Messages	<ul style="list-style-type: none">• The UK needs to be better prepared for a large scale Avian Influenza outbreak and can learn from other countries' experiences.• The OIE needs to review how its recommendations are used by member countries. Unnecessary and unjustified trade barriers are being implemented.• The UK needs to future-proof and risk-assess the growth of its own poultry industry.• 'One Health' needs to form part of the UK's EU exit plans to make it a world leader in human, animal and environmental health.

Executive Summary

Avian Influenza (AI) has wreaked havoc across the globe in the past two decades in both human and animal health arenas, and the United Kingdom will not be not immune. How damaging that will be to both British citizens and industry will depend on tough decisions being made and the willingness of the UK Government, poultry industry and health officials to face the reality that AI poses a significant threat.

Today, the virus has developed the ability to mutate at an alarming rate, spreading from wild migratory birds to commercial poultry and, more alarmingly, to humans. The global cost of dealing with AI outbreaks has run into the billions (GBP), with loss of trade a key contributor.

To date the UK has swiftly isolated and stamped out the small number of outbreaks experienced but it is not a case of *if*, but *when*, 'the big one' arrives on our shores.

While the initial aim of this study was to seek out successful risk reduction strategies it was the disconnect between human and industry planning that became particularly obvious. Accordingly, studies focussed on countries that had experienced AI in different forms.

The Netherlands has experienced sporadic outbreaks in recent years and is heavily reliant on its poultry export trade, but at what cost?

The USA has also experienced sporadic outbreaks and in 2015 they lost over fifty million chickens and turkeys, the worst animal health disaster in USA history.

Hong Kong is in the AI 'hot zone' of East/South East Asia and has experienced AI outbreaks in both humans and poultry. New Zealand, perceived as a bio-secure country with no AI outbreaks, has been touted as a safe supply chain base for poultry trade into the Asian market.

The pandemic threat that AI poses cannot be dismissed. East/South East Asia will continue to be at higher risk of human infection due to its cultural and culinary traditions and educating these communities will be key.

Whilst biosecurity can mitigate the risk, the size and increasing number of factory farms will achieve the opposite. Hard questions need to be asked in the UK about the location of new farms. How much further we grow the industry against the threat to citizen's health must also be addressed by Government, industry and health officials.

Internationally, the World Organisation for Animal Health (OIE) needs to deliver consistency. Too many countries use their rules subjectively. A review is needed for the notification of wild birds and backyard flock sizes. Further support for regionalisation and compartmentalisation will ensure safe trade can continue during an AI outbreak.

In conclusion, in the UK rapid expansion on the back of accelerated demand for cheap protein is increasing the risk of a substantial AI outbreak that we are under-prepared for.

Tough questions need to be asked as to how we balance intensification versus AI risk versus human health. None of those factors exist on their own and need to be considered in a wider future strategy that protects both citizens and humans.



Figure 1: Bird Flu after effects. *Photo courtesy AP*



Figure 2: Poultry shed. *Photo courtesy Pixabay*

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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.

My Nuffield Scholarship study is an independent project and is entirely separate from my work with previous employers and any other organisations I may be associated with.

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1. Personal Introduction

Being born and brought up on a council estate on the outskirts of Lincoln is perhaps one of the least conventional routes into a career in agriculture. I thank my late Grandad for the fond memories of a childhood in Lincoln. It was his decision to move from North Wales to Lincoln in 1958 that set the path to come for his family.

His reason for leaving the village of Trawsfynydd was to find work, something that was hard to come by in the traditional sheep farming hills of Snowdonia. It was a family farm next to that particular village that ignited my passion for farming and the outdoors. On summer holidays in North Wales my parents and sister would visit family and I would spend time with my uncles, rounding up sheep on a quad bike whilst trying to understand the Welsh language.



Figure 3 : The author, Daniel Roberts

Following secondary school, I completed an agriculture course at Moulton College that changed my life. It led to my joining Faccenda Foods in 2001 where I spent the next five years working in the broiler chicken industry.

In 2006 I joined Wootton Organic, rearing a variety of poultry, and found this part of my career the most rewarding and enjoyable due to the on-farm culture and concentration on animal welfare.

In a drive to progress and develop I re-joined Faccenda in 2012 to oversee a number of broiler farms. During this time, I completed a Post Graduate Certificate in Poultry Business Management.

I became aware of UK Nuffield Farming Scholarships through previous Poultry Scholars.

I felt that a Nuffield Farming Scholarship would challenge me in ways in which my career had not and I was immensely proud to receive my Scholarship in 2017.

While the poultry industry has enabled me to reach this point in my career, and I am immensely appreciative of the opportunities it has afforded me, the Nuffield Farming Scholarship has transformed my thinking and my outlook and has led me to pursue a completely different career path and build my own high-end food/farming business.

My Nuffield Farming Scholarship is a study of Avian Influenza (AI) and how the UK can best mitigate the risks of suffering a catastrophic outbreak: an outbreak that would not exclusively impact the poultry industry, but multiple businesses and UK citizens alike.

Living and dying with Avian Influenza ... by Daniel Roberts

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2. Background to study tour

Coming from a poultry farming background I was initially interested in bio-security and how this was helping to reduce the risk of future AI outbreaks. Soon after beginning my study I realised that a holistic approach was required and I was conscious that my project should not become focused on just one element of AI. It became clear that in order for the UK to truly mitigate the risk of an outbreak, a multi-faceted approach would be needed. It also became necessary to research the pandemic threat alongside the industry threat.

This broader mandate was reflected in the title of the project which changed from the original “*Avian Influenza: How can we reduce the risk?*” to: “*Living and dying with Avian Influenza*”.

‘Living and dying’ as a title covers a complete analysis of today, tomorrow and the longer term across humans and poultry. From people dying in Asia because of the traditional, cultural values in the way they interact with their poultry, to the multi-national poultry businesses seeking every avenue possible to stay ahead of AI, this project aims to connect them as they should be connected.

**It’s been over 20 years since the first human death from AI,
when a three-year-old boy named Lam from Hong Kong made global headlines,
and saw Governments and citizens alike swept up on a wave of panic:
because Lam died from contracting the H5N1 influenza virus.**

Why was that significant? Put simply, it was a strain that had previously been supposed to kill poultry and not people and it illustrated that every day we are learning more about this deadly disease and cannot afford to relax or avoid making the hard decisions to protect the UK public and industry.

From that day on, AI - or bird flu as is it commonly known - has continued to wreak havoc in both the animal and human theatres of health.

AI is now endemic in poultry in countries including Egypt and Indonesia whilst other countries such as the UK and USA have experienced sporadic outbreaks in recent years.

In 2015 the USA lost around 50 million chickens and turkeys to their worst AI outbreak in living history. The total economic losses were estimated at over \$3 billion US due to the clean-up operation, lost trade and inflation of egg prices.

AI in the UK still poses a greater risk to the UK poultry industry than any other factor, but it poses an even greater risk if we don’t properly prepare and work together. This virus has the power to cause a pandemic the likes of which we have not seen since the Influenza epidemic that ravaged the globe following World War 1.

To ensure our futures we must not forget Lam, and the human cost of this disease.

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3. The Research Journey

In order to complete my studies, I travelled to 5 different continents including the following countries: Hong Kong, China, United States, Canada, Holland, France and New Zealand; where I viewed different poultry operations, bio-security systems, and AI laboratories as well as interviewing a number of academics and Government officials.



Figure 4: Author (see far left) taking part in a Nuffield International Global Focus Tour in Africa.

These countries were chosen because of relevant AI past outbreaks, intensity of poultry in geographical areas and bio-security campaigns.

As part of the wider Nuffield Farming studies I also took part in a six-week Global Focus Programme ¹ that enabled ten of us to see food systems around the world including: Brazil, United States, Czech Republic, Poland, Ukraine, Kenya and South Africa.

¹ The UK Nuffield Farming Scholarship consists of an 8-week solo study tour in addition to group briefings and attendance at the week-long Contemporary Scholars' Conference. This takes place at an overseas location and is attended by all the current new Nuffield Scholars worldwide.

The Global Focus Programme is an optional extra and consists of 6 weeks where a small group of Nuffield Farming Scholars, from a mixture of the countries where the scheme operates, have an intensive tour of a mix of countries worldwide.

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While not ostensibly for my research topic, the Nuffield International Global Focus Programme moulded the research and enabled me to engage in higher thinking that resulted in a wider scope for this report.

Basic Facts about Avian Influenza in UK as of August 2018

- Avian Influenza can affect all species of poultry including wild birds
- If disease in any birds, domestic or wild, is suspected, telephone Defra helpline immediately: 0345 933 55 77
- Currently there is no viable vaccine against A.I.
- Government policy consists of complete slaughter of all birds on infected premises. In addition no movement of avian stock in surrounding areas is permitted, neither can their product be sold.
- Suspicion of A.I., whether in domestic or wild birds, is legally notifiable.
- Flocks of over 50 birds must, by law, be registered. The figure of 50 refers to the total number of all species of poultry, including game birds, kept on the individual holding.
- Where the total number of all birds on a premises or holding is less than 50, registration is optional, but strongly recommended.
- To register, telephone Defra on 0800 634 11 12 Mondays to Fridays.

4. Why stopping AI matters

The human face of tragedy

Leon Groeneveld is a hard-working South African fresh duck farmer.

After years of graft, Leon was dealt devastating news late last year when it was confirmed his ducks had tested positive for AI.

The owner of The Duck Farm in Joostenbergvlakte ended up losing 35,000 ducks, with 10,000 succumbing to the virus while another 25,000 ducks were forcibly culled.

For Leon, that meant putting his entire business on hold.

“It's like an enemy you fight, you don't know where it comes from. It is just totally impossible to stop this thing. One week, we had an operation where we slaughtered 5,000 to 7,000 ducks a week. We are now on zero, there is nothing to be sorted, no eggs to be produced so basically our business has come to a halt,” he said.



Figure 5: Chickens. Source Pixabay

The devastation has led to the retrenchment of 80 of his staff members.

“Some of the guys have been on the farm since before I got there. I can only supply work now to 16 of the 96 staff.”

A family-owned operation since 2008, the farm has been producing ducks since 1964 and this was the first time in its history that production had been halted.

While most UK producers have been spared the heartache that Leon has endured, the risk remains.

This is why it is vital that we must ask ourselves critical questions at this juncture, because at the end of the day we are all like Leon and we all deserve to be protected.

5. Beginning with bio-security

This report begins with bio-security because it is the most widely recognised primary control measure available to mitigate the risk of an Avian Influenza (AI) incursion into UK poultry farms.

The good news is that, today, new poultry houses and farms are being built with higher standards of biosecurity than ever before, with the aim of keeping AI, as well as other diseases, out.

The modern-day conventional broiler farm has purpose-built facilities to ensure strict biosecurity measures are adhered to.

However, despite the increase in new builds the average age of a broiler house in the UK is around 30 years old and subsequent retro-fitting of improved bio-security systems has proved problematic with compromises having to be made.

All too often a lack of space leads to less than stringent standards on these operations and it could be argued that some do not pose any significant barrier to AI.

Nudge behaviour plays a role in encouraging these older operations to invest more in bio-security, with the UK broiler industry, in particular, recording a positive uplift in bio-security standards following a campaign to reduce campylobacter levels in 2014.

The Food Standards Agency (FSA) worked closely with retailers and poultry producers in a concerted campaign, to ensure campylobacter contamination levels were reduced on raw chicken products and packaging.

Since the campaign began, there has been year-on-year reductions in the levels of the highest form of contamination and on-farm bio-security interventions, driven by the campylobacter reduction campaign, (and subsequent pressure from the public) have been acknowledged as improving overall bio-security standards.

The Georgia Poultry Laboratory Network (GPLN) in the United States confirmed just how important the emphasis on improving bio-security standards is when *Mycoplasma Synoviae* (MS) levels were significantly reduced after improving on-farm biosecurity standards.

The disease affects bones, joints and respiratory systems of birds and impacts on production but, due to better bio-security practices, it has nearly been eliminated across the United States.

The Georgia poultry industry is an innovative example in successfully improving many issues across the industry including AI – where they were able to stop the spread of the disease from other States into their borders by encouraging vigilance and high bio-security standards.

Following the AI 2015 outbreak in the Mid-West of the United States, the **Georgia Poultry Federation** developed a campaign entitled 'ALL IN or ALL GONE'.

Poultry farmers received weekly emails and had access to valuable educational resources online, along with regular AI updates.

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GPLN Executive Director, Dr Louise Dufour-Zavala, believes the AI workshops that took place in Georgia following the Mid-West outbreak, were key to informing and educating poultry farmers.

This is important, as is the fact that Georgia kept AI out, because of its status of being the largest producer of broiler chickens in the USA - producing over 1.2 billion in 2017 at a value of \$4.3 billion US. Any outbreak would have been devastating to the local economy.

The importance of the 'ALL IN or ALL GONE' campaign was not underestimated by the poultry farmers of Georgia, given the fact that their families and communities are reliant on an industry that employs over 100,000 people directly and indirectly.

5a. Chapter Summary and Recommendations:

1. The 'ALL IN or ALL GONE' campaign is something that could be replicated in the UK to raise awareness and educate.
2. It would give poultry industry employees a 'go-to' platform, exclusively on AI, that ensured poultry producers were kept up to date and were prepared prior to high risk seasons.
3. DEFRA and the NFU Poultry Board, along with cross sector poultry businesses from the UK, could be key stakeholders in producing such a tool.
4. To encourage better bio-security practices in the UK poultry industry to mitigate AI risk, the UK needs to consider:
 - Employing nudge theory campaigns similar to the Campylobacter campaign to encourage investment and better practices
 - Setting up a digital platform and APP that producers can access for latest information and best practice on AI



Figure 6: Gainesville, Georgia.



Figure 7: GPLN logo

6. Backyard bio-security risk

It is impossible to know how many backyard flock owners there are in the UK, or pinpoint exactly where they are located. This poses a serious risk of an AI outbreak because of general lack of education about the disease among hobby owners who may not appreciate the importance of reporting fatalities.

This problem continues to escalate as the popularity of owning backyard poultry has increased in recent years with owners wanting fresh eggs for breakfast or poultry in the garden that can be shown at local poultry fairs.

If flock sizes are lower than 50 birds they do not have to be legally registered with the Department for Environment, Food and Rural Affairs (DEFRA) although all poultry keepers are advised to register, no matter the size of flock.

However, AI outbreaks in backyard flocks have to be registered with the OIE (World Organisation for Animal Health) through the APHA (Animal and Plant Health Agency) no matter the size – creating severe disruption to the UK's ability to trade.

During the 2016/17 UK outbreak 6 of the 13 cases were attributed to backyard flocks and valuable resources were taken up with APHA (Animal and Plant Health Agency) employees who were searching protection and surveillance zones for backyard flocks that could be infected - thus wasting valuable time.

Education will be key if the UK is to mitigate the risk and disruption that backyard flocks pose.

The level of AI awareness in the UK – as observed by the author over the past year - and level of resources available at various backyard poultry outlets to deal with an outbreak, should one occur, have been minimal. **Considering the role these backyard flocks play in AI outbreaks and the economic impact they create, some sort of identification system needs to be mandatory.**

At minimum a simple leaflet should be provided to new poultry keepers to educate them on the risks of AI, along with encouragement to register with local authorities. This is what New Zealand local authorities do with dogs where they are registered on a year-by-year basis. This would need to be incentivised. In New Zealand, any dog owner without registered tags on their dogs is fined.

Further to this could be a campaign aimed directly at backyard keepers, similar to the USA's 'Defend the Flock' campaign.

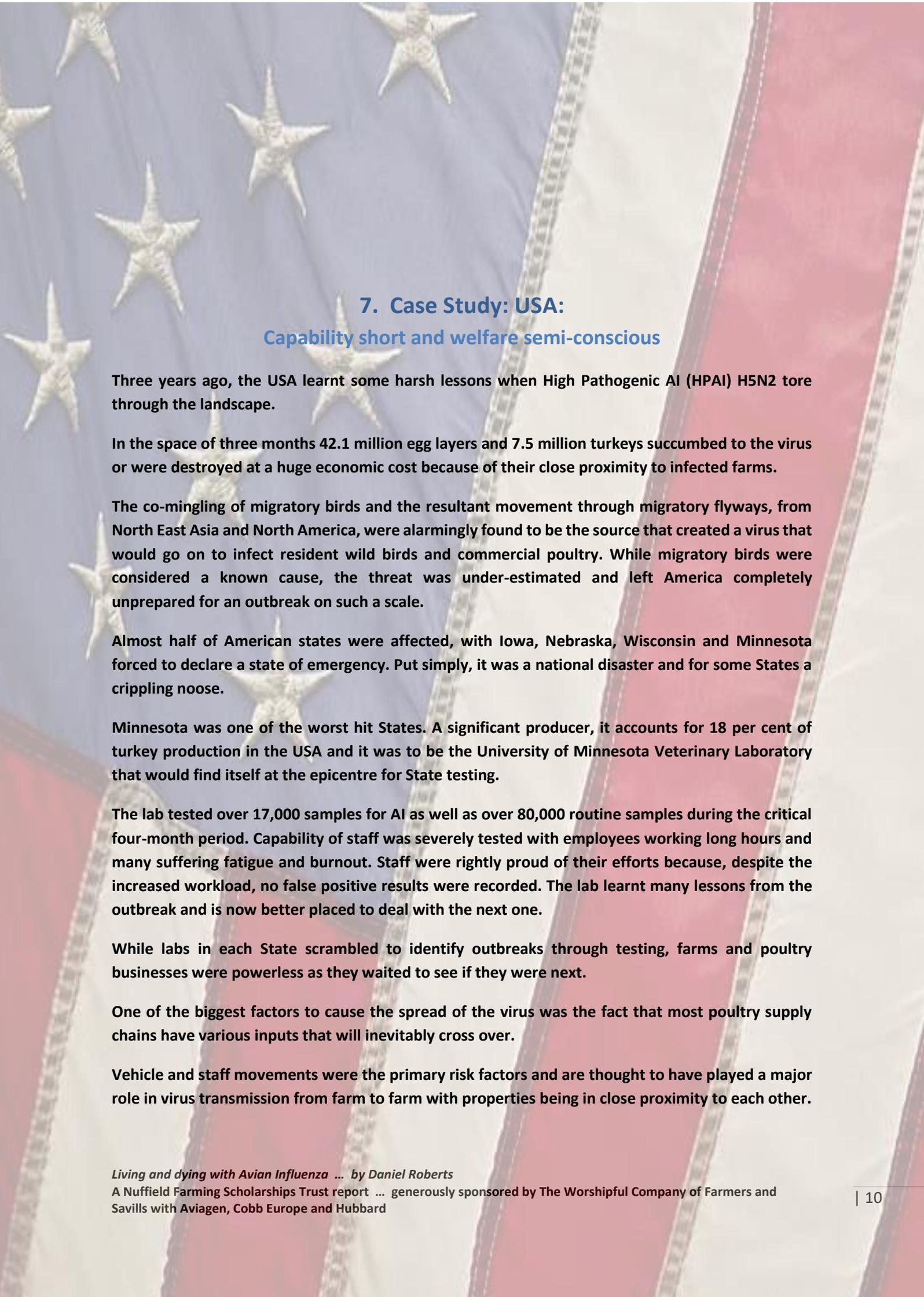
'Defend the Flock' is not exclusively backyard-focussed but it is comprehensive in its messaging and drives engagement through its branding. The 'Defend the Flock' and 'ALL IN or ALL GONE' campaigns could complement each other in raising awareness and educating farmers and backyard owners alike.

6a. Chapter Summary and Recommendations:

1. Given the genesis of the last outbreak where a significant number of outbreaks occurred in hobby operations, backyard poultry owners pose a major risk to the UK poultry industry and UK public.
2. Because of this – and to further protect the UK industry serious conversations need to occur that:
 - Find a solution as to the best way to identify backyard flocks. Dog registration systems used in other countries by local authorities could be an example
 - Work out the best way of engaging with the backyard owner and consider building a public campaign similar to the US's 'Defend the Flock' example



Figure 8: Rural live bird market in Cambodia.



7. Case Study: USA: Capability short and welfare semi-conscious

Three years ago, the USA learnt some harsh lessons when High Pathogenic AI (HPAI) H5N2 tore through the landscape.

In the space of three months 42.1 million egg layers and 7.5 million turkeys succumbed to the virus or were destroyed at a huge economic cost because of their close proximity to infected farms.

The co-mingling of migratory birds and the resultant movement through migratory flyways, from North East Asia and North America, were alarmingly found to be the source that created a virus that would go on to infect resident wild birds and commercial poultry. While migratory birds were considered a known cause, the threat was under-estimated and left America completely unprepared for an outbreak on such a scale.

Almost half of American states were affected, with Iowa, Nebraska, Wisconsin and Minnesota forced to declare a state of emergency. Put simply, it was a national disaster and for some States a crippling noose.

Minnesota was one of the worst hit States. A significant producer, it accounts for 18 per cent of turkey production in the USA and it was to be the University of Minnesota Veterinary Laboratory that would find itself at the epicentre for State testing.

The lab tested over 17,000 samples for AI as well as over 80,000 routine samples during the critical four-month period. Capability of staff was severely tested with employees working long hours and many suffering fatigue and burnout. Staff were rightly proud of their efforts because, despite the increased workload, no false positive results were recorded. The lab learnt many lessons from the outbreak and is now better placed to deal with the next one.

While labs in each State scrambled to identify outbreaks through testing, farms and poultry businesses were powerless as they waited to see if they were next.

One of the biggest factors to cause the spread of the virus was the fact that most poultry supply chains have various inputs that will inevitably cross over.

Vehicle and staff movements were the primary risk factors and are thought to have played a major role in virus transmission from farm to farm with properties being in close proximity to each other.

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Wind and air movement is also thought to have played a major role in virus spread as, given favourable conditions, even outside of a host bird, the virus can survive for weeks rather than days.

One factor that didn't help the containment effort was the sheer size of some of the farms that needed to be depopulated. In Iowa, the largest egg producing state in the USA, there are multiple egg laying facilities that house millions of birds on individual sites in multi-tier poultry houses. When these farms became infected it became a monumental effort to destroy and remove the infected poultry, taking weeks rather than days to complete.

The method used for culling infected birds was carbon dioxide gassing, as foam application proved ineffective in multi-tier systems. Once the dead birds had been removed they were 'windrowed' in a composting process that kills the virus. These windrowed compost structures stretched for miles across the affected States – a stark visual cue to the destruction of livelihoods and an industry.

Today the United States Department of Agriculture (USDA) insists all infected poultry are destroyed within twenty-four hours because of the significant amount of virus produced by infected birds.

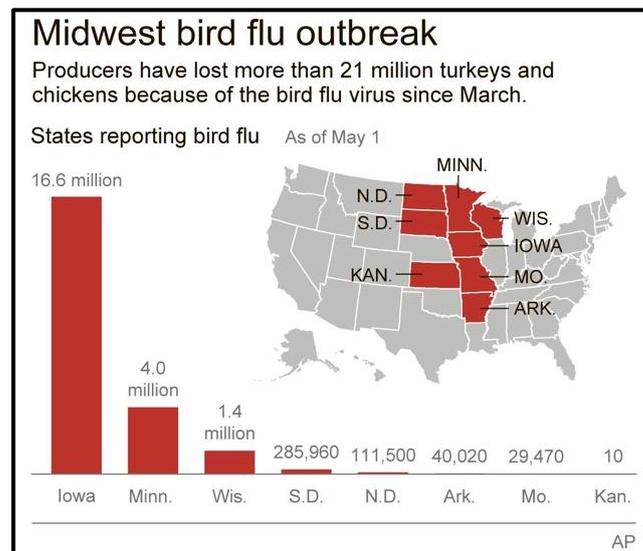


Figure 9: Taken from "Iowa Becomes Third State to Declare State of Emergency Over Bird Flu". Reuters, May 2015

In small poultry houses this is achievable with carbon dioxide gassing and foam spraying but in facilities that house millions of birds the aforementioned euthanising options are ineffective.

Following the 2015 outbreak, the USDA approved a euthanasia method known as 'ventilation shutdown' which allows the temperature of the house to increase because the ventilation system is switched off. Supplementary heat may be used to increase the temperature.

This method will be targeted at large layer sheds (150,000 layers is an average size for many of the larger US operations) where the use of carbon dioxide can be operationally difficult to apply evenly and manage. Containerised Gas Units (CGU) have to be used instead of the whole-house system. Essentially the birds die of heat stress as they wait for their internal organs to fail so this method has a vast array of critics who believe it is cruel but it does enable a quick turnaround and evacuation of infected sheds.

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Because of this the USDA insists that ventilation shutdown is the least-preferred method of euthanasia during an AI outbreak, and will make the decision for its potential use on a case-by-case basis.

However, if an outbreak of the scale of 2015 repeats itself the author believes the USA will show no hesitation in using ventilation shutdown.

There are two key elements that support this opinion:

1. Consumer preferences versus welfare

The USA poultry industry exists inside a society that has devalued protein to such an extent that welfare standards are considerably lower than in the UK.

Where certain practices would be considered abhorrent (chlorinated chicken being the latest example) to British consumers, they are not considered to be so by American consumers unless it is those with expendable income.

After canvassing opinion in multiple supermarkets, it became clear that the American consumer valued three things: low cost, variety and high volume.

It's not just the supermarkets that have met the growing demand for cheap poultry-meat and eggs: America's takeaway culture provides important expanding market for producers.

Two years ago, for the first time in US history, Americans spent more at restaurants and takeaways (54.9 billion USD) than they did on their groceries shopping (52.5 billion USD) and this is expected to be a continuing expanding trend. Chick-fil-A, a chicken-based restaurant, is one of the fastest growing fast food restaurants in the country, that outsells McDonalds on sales on a per restaurant basis.

The USDA predicts that the average citizen will consume around ten ounces of protein per day this year - despite government recommendations of just over five ounces per day. It could be argued that the government is turning a blind eye to its own health recommendations, especially as US poultry production is expected to reach record highs by the end of this year, driven by ever-increasing consumer demand for what is termed a cheap, flexible protein.



Figure 10: Poultry shed. Source: Pixabay

But this has come at a welfare cost and one that the American consumer seems oblivious to. For the average American citizen, the closest they come to poultry welfare is the labelling of the products they buy. Terms such as 'no antibiotics ever' and 'hormone free' ensure that the consumer can buy without a conscience. Whilst speaking with an unnamed poultry producer it became clear that this was the

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case, with the producer commenting he was happy to pay extra to print welfare messages that would ensure the consumer purchased the product. This, despite the fact that no hormones have ever been used in US poultry production.

Where the producers, authorities and consumers of the US are concerned, ignorance is bliss, and ventilation shutdown will escape what would be a national outcry in the UK, should it be deployed.

2. Economics and scale

The scale of the US poultry industry does little to alleviate the fact that if it does go wrong, it will go wrong astronomically. The largest egg producing state in the US, Iowa, was a case in point. Producing around 16 billion eggs per year from almost 55 million layers meant 10 per cent of the USA's egg production was lost in a matter of weeks, with the cost to the egg industry estimated at more than \$4 billion US dollars.

The ripples were felt far and wide with resulting price fluctuations due to the decrease in supply not only affecting the consumer, but also large multinational companies including Unilever and McDonald's. Because of this, egg imports were estimated to have quadrupled in 12 months during the outbreak.

The UK is also at risk of suffering a significant economic crisis due to the number and intensity of poultry operations across the nation. Currently the UK has 644 chickens per square kilometre and with the broiler industry expected to increase 3-4 per cent year-on-year this number will increase. When compared to other big broiler producing nations apart from the Netherlands (2557 birds per sq/km), the UK has a large poultry footprint on a small total amount of land. The US has just 200 birds per sq/km while Thailand at 530 per sq/km and Hong Kong at 472 per sq/km illustrate the intensification of British systems.



Figure 11: Vegan protest. Source AP

7a. Chapter Summary and Recommendations:

2. No matter what the outcome needs to be, it is clear that in the UK euthanising by means of ventilation shutdown would not be accepted, particularly as the country is attempting to elevate itself as having the highest welfare standards in the world following EU Exit.
3. Any such perceived deterioration in standards would be detrimental to the UK trade offer and to consumers' confidence in producers.

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4. This then poses a problem and means that other methods of culling, that are slower and less efficient, elevate vulnerabilities and potentially could cause further spread of any outbreak.
5. Iowa also demonstrates the vulnerability of the UK, as the intensity of the industry could see the industry almost erased. In that vacuum, there remains a void in which alternative protein could seize market share or consumers could lose trust in British poultry, in favour of overseas imports.

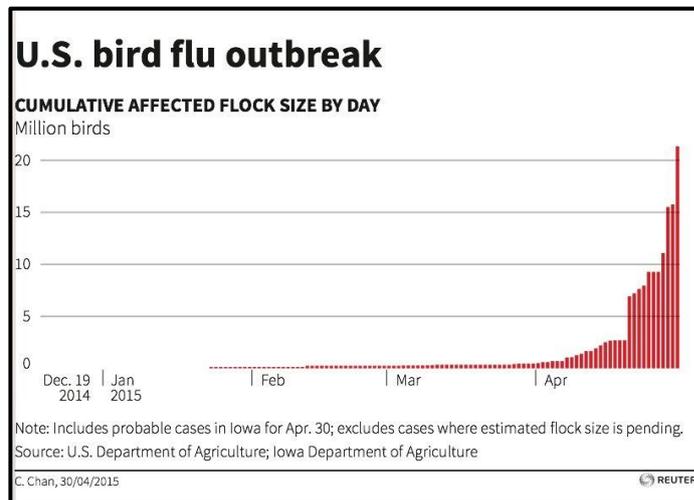


Figure 11: “The US is in the middle of its biggest bird flu outbreak ever.” Source Business Insider, May 2015.

2



Figure 13: Defend the Flock logo

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8. Predicting the unknown: challenging the paradigm

In recent years the United Kingdom has been successful in isolating AI outbreaks and ensuring that large-scale lateral viral spread does not take hold.

This is shown by the contrast in the 2016/17 season compared to the 2017/18 season with 13 outbreaks, followed by none the following year. The two seasons also encapsulate the unpredictability of AI.

That unpredictability makes planning for a large-scale outbreak difficult. Because of this, Livetec Systems Director, Julian Sparrey, advises that bio-security reviews should be conducted regularly and well ahead of the wild bird migratory season.

Livetec Systems (UK) will be a vital link in the chain should any AI incursion occur. They have developed Containerised Gassing Units (CGU) and a Nitrogen Foam Delivery System (NFDS) that can be used to euthanise poultry during a UK outbreak. They are well placed to respond quickly with trained and qualified personnel. However, it is clear that if a large-scale outbreak were to happen, the resources of Livetec, the Animal and Plant Health Agency (APHA) and DEFRA would soon be stretched.

Iowa's example, where the size and scale of outbreak outstripped the resources available, despite their obvious efforts to develop capability, shows the enormity of the problem for the UK.

The 2016 HPAI Preparedness and Response Plan³ was created by the USDA and the Animal and Plant Health Inspection Service (APHIS) following the devastating AI outbreak of 2015 and should be considered as an important report and be integrated into any UK planning around a worst-case scenario.

While mock outbreaks have been carried out in the UK to build experience and knowledge, there is little that can be done to prepare for a wide-spread outbreak. Because of this, it is imperative that industry and Government significantly invest in sending people overseas to learn best practices.

Poultry businesses and government organisations need to be continually challenging their own risk assessment and crisis management procedures to ensure they are not caught unprepared. The key points raised by the USA Preparedness and Response Plan could help move the UK's AI risk assessment and crisis management procedures to the next level through a deeper learning process in anticipation of a large-scale outbreak.

Those key points are:

- Promoting improved on-farm biosecurity practices in order to prevent future HPAI (Highly Pathogenic Avian Influenza) cases to the greatest possible extent.
- Improving HPAI surveillance in wild birds as a means to provide 'early warning' risk information to States and industry
- Expanding Government and industry response capabilities, including availability of personnel, equipment, depopulation, disposal and recovery options.

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- Improving US capabilities to rapidly detect HPAI in domestic poultry and to depopulate affected flocks within 24 hours to reduce the environmental load of HPAI viruses and their subsequent spread.
- Streamlining the processes of payment of indemnity and the cost of eliminating viruses so that producers receive a fair amount quickly, to assist them in returning to production.
- Enhancing our ability to communicate in a timely and effective way with producers, consumers, legislators, media and others regarding outbreaks and other information.
- Making preparations to identify and deploy effective AI vaccines should they be a cost-beneficial addition to the eradication efforts in a future AI outbreak.

8a. Chapter Recommendations:

In conclusion, it is this author's contention that the UK does not currently have the capability to contend with a major outbreak and needs to invest significantly in order to mitigate the risk of a devastating incursion.

9. The wild bird conundrum

Wild birds are the single biggest risk of AI incursion in the UK.

Birds, especially water fowl, can carry Low Pathogenic AI (LPAI), without exhibiting any signs or symptoms. These viruses, carried around the globe by wild migratory birds, have the ability to change the influenza virus through reassortment, and further infect native wild birds and commercial poultry. (Reassortment is the process of influenza viruses swapping genes).

The UK has the advantage of being able to 'see what's coming' as the footprint of AI in Europe can be a precursor to any arrival on UK shores. We do know, however, that when AI arrives, it is in the form of wild migratory birds which will inevitably co-mingle with domestic wild birds.

Currently, any wild birds that are found dead, injured or are showing clinical signs of infection are submitted to poultry testing laboratories as part of passive surveillance, to be confirmed positive or negative. This passive surveillance is compulsory under the European Union (EU) and subsequently co-funded by the EU.

Wild bird notifications then have to be submitted to the World Organisation for Animal Health (OIE). Wild bird notifications have attracted unjustified trade barriers despite the OIE urging nations not to. This could deter countries from notifying, which significantly increases the risk of an outbreak spreading.

The British Poultry Council (BPC) reports that various countries including Turkey, are flouting the OIE's recommendations of not banning trade due to wild bird notifications; even though some of the UK farms and hatcheries that do export day old chicks and eggs have some of the highest biosecurity standards in the world.

It's clear that the OIE needs to consider the reporting process and, if this could be altered to ensure more active surveillance is carried out, then the risk of spread due to non-reporting is mitigated. It must make sure that its processes are not responsible for a major wide-spread outbreak that could have been prevented.

Here, in the UK, active wild bird surveillance in high risk areas such as East Anglia needs to be supported and implemented immediately to allow for a better understanding of which type of viruses are circulating. This would allow businesses, at the very least, to ensure biosecurity levels are raised, depending on the threat level.

A study by Hesterberg, Harris and Brown⁴ confirmed that for the detection of HPAI in wild birds, active surveillance was most effective. During active surveillance LPAI (Low Pathogenicity Avian Influenza) was identified giving an indication that AI was present in the wild bird population.

Wild birds are known carriers of LPAI, and in recent years there have been more incidents of wild birds dying as a result of HPAI, but not before some species have flown through migratory fly-ways, potentially shedding the virus as they go.

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9a. Chapter Recommendations:

In conclusion, the UK must undertake active surveillance of wild birds to ensure the earliest detection of an outbreak. This will take considerable investment but is vital in mitigating the risk.



Figure 14: Wild turkeys, Minnesota University

10. Case Study: The Netherlands

Trade vs. Health?

The Netherlands suffered a disastrous AI outbreak in 2003 that wiped out almost one third of its 100 million-strong national poultry flock. The outbreak was able to spread rapidly due to confusion as to where the outbreak originated, and subsequently infected a total of 255 farms.

More alarming was the human cost of the outbreak with 453 of the 4500 people working on the outbreak suffering health complaints, 349 contracting conjunctivitis, 83 reporting an influenza-like illness with 3 of the 83 exhibiting clinical signs of the H7 virus that had initially infected poultry.

The antiviral drug, Tamiflu, was given to workers with 50 per cent found to have built up some immunity to the virus. Unfortunately, the virus claimed the life of a Dutch veterinarian after she contracted pneumonia after being infected.

In 2014 there were 5 separate outbreaks with 2 found to be connected and a total of 345,000 birds were culled. Issues arose with this particular outbreak after the Dutch Ministry ordered a complete country-wide standstill for three days of all live bird and egg movements as well as poultry feed and associated poultry products. Further to this, the Ministry introduced a system whereby live poultry could only be slaughtered in the regions in which they resided. This “region” system was found to have huge imbalances because 25 percent of the country’s broilers were located in a region which had only 5 percent of the total slaughter capacity.

Welfare issues were hugely damaging to the industry with feed supplies running out, and birds growing too big to be slaughtered at certain processing plants.

The standstill and regionalisation strategy displayed poor planning that was reactive rather than pro-active, especially as the broiler industry is fast paced and relies on daily movements of eggs, feed and live birds. The Dutch Ministry learnt that poultry movements still need to continue during an outbreak to ensure welfare is not compromised.

Despite dealing with sporadic AI outbreaks over the last 15 years, the Dutch poultry industry still has the highest density of chickens per square kilometre of any other country on the planet, in part due to its export trade and size of the country.

Annually, 6.5 billion of the 10 billion eggs produced are exported as well as 50 per cent of meat and hatching eggs. The export value of Dutch day-old chicks and hatching eggs from broilers, layers, turkeys and ducks equated to \$309 million Euros during 2016. This is a small contribution to the \$79 billion worth of annual agricultural export value of these products but places The Netherlands second only to the USA as an individual country.

When questioned about the size and intensity of the national flock and its potential to increase the risk of an AI outbreak and subsequent lateral spread, the Dutch Ministry’s opinion was that reducing the size of the national flock would not be a viable option due to loss of international trade. This

means they will continue to run a fine line between risk and benefits to its poultry industry in relation to AI and trade.



Figure 15: Author in The Netherlands

10a. Chapter Recommendations:

1. The Dutch example shows that the UK must develop strategies ahead of time that deal with all implications of outbreaks - such as animal welfare issues - as AI has a wider global trade implication for all livestock industries

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2. With the UK's broiler industry growing at a rate of 3-4 per cent every year questions must be asked about the growing intensity of poultry industries. The UK, at 644 per sq/km, is beginning to surpass some Asian countries in the number of chickens per square kilometre. As evidenced elsewhere in the report, intensification is a significant contributing factor in AI outbreaks. While the Dutch have put the value of trade ahead of the health of citizens, the UK must at least discuss and consult on where our industry is heading.



Figure 16: Disease control, Reuters

11. Location and free-range, major contributors to AI risk

While much of the AI discussion centres around controlling an outbreak, there is further strategic analysis that needs to be undertaken to encompass the broader questions of preventing the outbreak at earlier stages.

Two key questions need to be discussed in order for that to happen. Those questions centre around granting permission to build new poultry sites in certain topographies and what the operation should look like.

East Anglia is an example of where this earlier preventative strategy could have a large impact.

Comparable with the topography of The Netherlands (a country with one third of its land below sea level), East Anglia has the lowest elevation range in the UK. Both geographical areas have an abundance of waterways and wetlands that makes them attractive areas for domestic, migratory birds and water fowl, creating a perfect cross virus transmission pathway.

When a wetland topography is then combined with a free-range poultry system, the chances of an outbreak are increased substantially.

Dutch poultry farmer Rimer Dijkstra, who farmed 16,000 organic and 32,000 free range laying chickens in Friesland, experienced two AI outbreaks within the space of seven months in 2016.

The egg layers were grown to free range and organic standards and accordingly, had access to pastures.

Importantly, Dijkstra attributed the outbreaks to the free-range system he operated and the fact that dead wild birds infected with AI were found around the farm.

By the time of the second outbreak, the Dutch Government had ordered that Dijkstra, along with all other Dutch poultry farmers, should keep their birds indoors because of the heightened risk posed by infected wild birds.

Sadly, Dijkstra's desire to run an operation built on the basis of providing his chickens a better life, and the consumer a good animal welfare story, cost him around \$300, 000 Euros and, heartbreakingly, 73,500 of his birds were culled in total from the two outbreaks.

Due to Dijkstra's desire to continue as a poultry farmer despite the turmoil, the farm restocked again in early 2017, although he conceded that he could not face another outbreak either financially or mentally.

Currently, over 50 per cent of UK egg production is attributed to free range systems and, according to the British Free-Range Egg Producers Association (BFREPA), there has been a ten per cent increase in production, year on year for the past three years. However, consumption has only increased by five percent in the same time period, meaning the free-range egg industry is potentially in danger of saturating the market whilst at the same time unnecessarily increasing the risk of an AI incursion through operating free-range systems.

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However, shifting away from free-range systems to prevent AI would provoke a consumer and animal welfare campaigner backlash and would damage UK trade ambitions post-Brexit, where the aim is to market UK produce as being world leading in animal health and welfare standards.

Despite the apparent difficulty in weighing up welfare versus poultry and human AI risk, the author concludes UK poultry businesses and diversifying farmers should be made to risk-assess and present findings on the location of any new poultry farms to ensure the potential co-mingling of commercial and wild birds is kept to a minimum, especially in high risk areas such as East Anglia.

If the operations are free-range, serious consideration needs to be given to the AI risk that they will pose, especially if the poultry business forms part of a diversified farming operation.

This is particularly true when considering livestock and arable fields which can attract higher numbers of wild birds, especially after harvest.



Figure 17: Wetland area, Photo source: Pixabay

11a. Chapter Summary and Recommendations:

There are higher risks of AI in free range operations and in properties that feature wetland topography on or near them. To manage those risks, authorities must consider at the time of granting consent:

- If the operation will be near or sits within a waterfowl wildlife haven
- If the operation should be housed instead of free-range to decrease the risk
- If certain areas of the UK should have a moratorium placed on them due to the heightened threat they pose

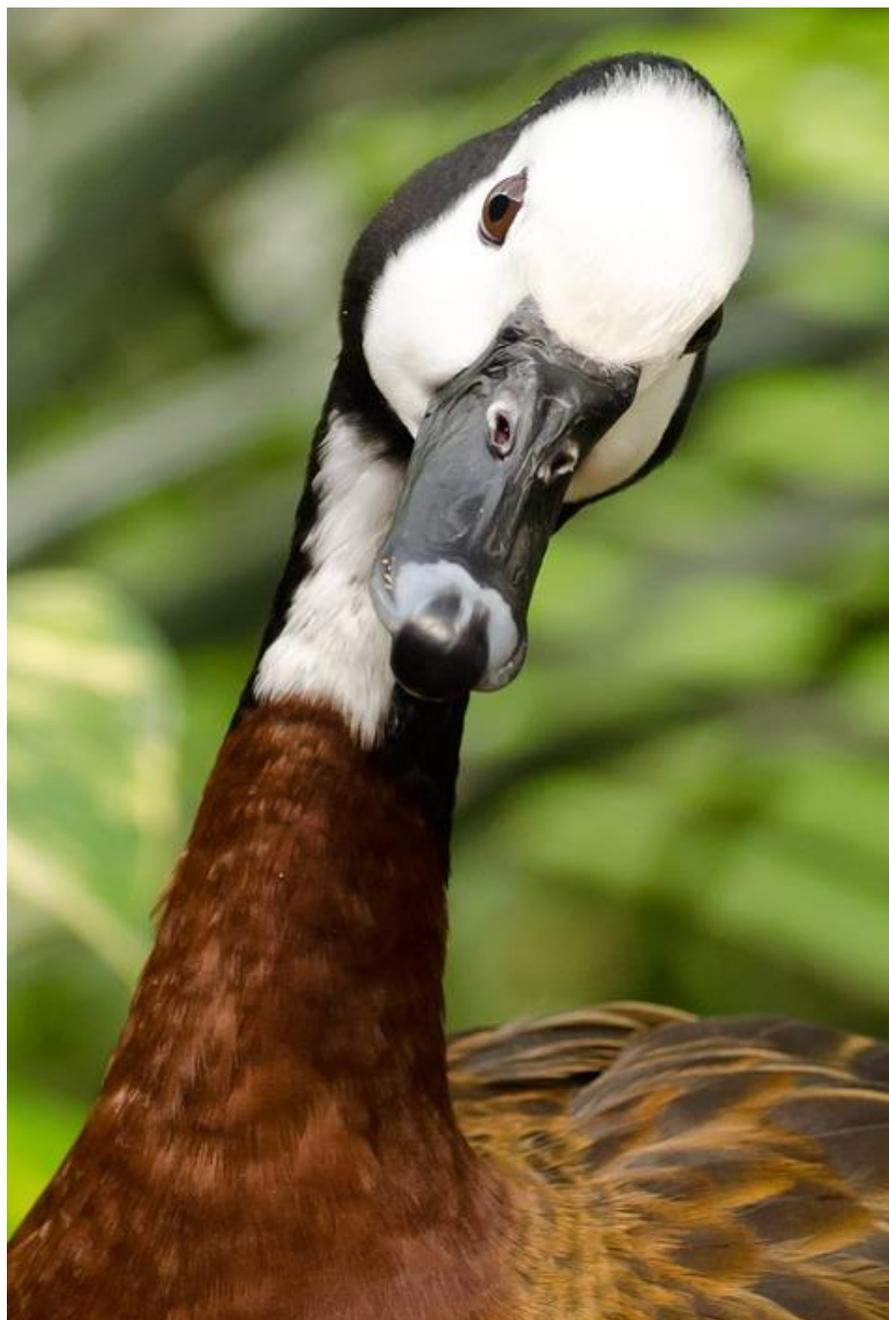


Figure 18: Wild bird, Photo source: Pixabay

12. Trade

While short term disease control measures take precedence in an AI outbreak, it is often the long-term trading implications that have the largest impact.

Trade protectionism is often employed by nations when it comes to issues like AI, where undue fears of negative effects on domestic industries can be inflated and used to halt trade. There have been moves by the OIE to mitigate those effects, but to limited success.

12a. Compartmentalisation

The poultry trade is an important economic earner for the UK with the hatching egg industry (including day old chicks) earning £143 million alone in 2017⁵.

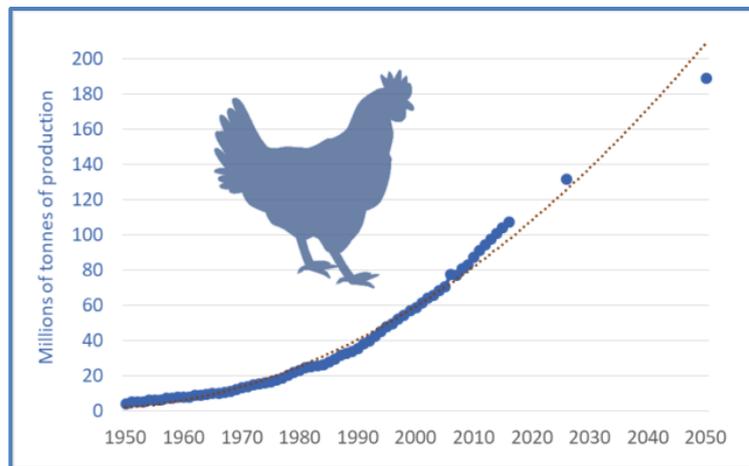


Figure 19: Projection of world chicken stocks⁶. Source: *Chicken Meat Production, darrinqualman.com, January 2018*

To ensure this trade avenue can continue successfully during a UK AI outbreak the two main poultry meat breeding companies, Aviagen and Cobb Europe, have successfully gained compartment status (farms and hatcheries that have strict bio-security standards, monitored by Government officials).

Proposed by the World Organisation for Animal Health (OIE) in 2003, compartmentalisation is now a valuable control system that allows trade to flow – and one in which the UK leads with an enhanced standard for compartments, created by DEFRA and the primary breeding companies, serving as a leading example of collaboration to ensure the continuation of a safe and secure global supply chain.

Aviagen was the first primary breeding company to achieve a global compartment status and this proved hugely beneficial in 2015, when it successfully exported poultry breeding stock to South Africa while the UK was in the middle of an AI outbreak.

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In 2016 the Japanese government agreed to compartmentalisation and this has now allowed Aviagen to supply high value grandparent stock to Japanese businesses, even in an AI outbreak in the UK, ensuring minimal disruption to the domestic supply chain in that country.

12b. Regionalisation

Regionalisation or zoning is another concept developed by the OIE and was introduced in 1993, before the explosion of modern era AI in 1997. Defined by natural, artificial or legal boundaries, regions are identified geographical areas that the OIE has recommended and can be isolated from within a country hosting an AI outbreak.

For example, in December 2016, the East Lindsay district of Lincolnshire was identified as a geographical area infected with AI. If countries adhere to the OIE's regionalisation recommendations, they would continue to accept breeding stock from the UK - just not from the infected region.

According to Article 4.3.2 of the OIE Terrestrial code on AI the importing country should recognise the existence of a zone or compartment when:

- The appropriate measures recommended in the Terrestrial Code are applied
- The veterinary authority of the exporting country certifies that this is the case

Unfortunately, some of the 181 members of the OIE will blatantly dismiss the recommendations and will place unjustified trade bans across an exporting country even if just a small pocket has had an AI outbreak confirmed.

The frustration in unfair trade bans has been highlighted in an article by the EU⁷ which welcomes the lifting of unjustified measures whilst at the same time calling for trading partners to respect international obligations.

The EU cannot permanently cease trading with partner countries so is left with little option but to accept unnecessary trade bans, with no teeth to intervene from the OIE.

12c. Time for change

In 2015, the USA won an important AI case at the World Trade Organisation (WTO) against India, over what it termed was an inappropriate trade ban.

India had imposed a 7-year ban on live poultry and poultry products from the USA under the proviso of protection against AI.

However, the WTO ruled that India had been inconsistent with international norms and all parties agreed that India should implement new rulings.

Despite India raising concerns that its domestic poultry industry would suffer, the WTO upheld its verdict. This case highlights how countries will attempt to exploit situations such as AI in order to protect their own industries. Encouraging countries through trade negotiations, particularly post

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Brexit, to accept compartmentalisation and regionalisation will be important for the UK poultry industry.

Further WTO dispute cases in relation to unjustified protectionism and AI may, in the future, have the ability to positively change the way countries interpret the OIE's Terrestrial Code. However, given the length of the case between the USA and India and the resources needed to undertake such a case, this is unlikely.

12d. Chapter Summary and Recommendations:

1. Since the OIE released its regionalisation and compartmentalisation codes in 1993 and 2003 AI has and will continue to challenge the international trade arena with many examples of countries challenging the concept of fair trade. In an era of protectionism, and rapidly accelerating trade disputes between large nations such as the US and China, this threatens to be a long-term problem for the UK should it experience another outbreak.
2. While Britain is seeking new trade deals outside the EU and wants to pursue a liberal trading position on the global stage, it must protect itself in any future negotiations against nations that don't recognise WTO or OIE standards.
3. To that end, it is now time for the OIE and the WTO to develop better strategies to ensure their codes of recommendations are being adhered to, so that AI outbreaks need not be financially crippling for decades to come. All nations visited reported frustrations with the OIE's international standards 10.4. on AI and have called for potential amendments due to the evolution of the virus.
4. Wild bird, backyard and commercial outbreaks in the form of HP (high pathogenicity) and LP (low pathogenicity) have to be notified to the OIE. As previously mentioned AI notifications can and have been used as unnecessary and unjustified trade barriers. The OIE seeks clarity through scientific evidence from member states although the playing field is far from level. The following points should form part of future discussions:
 - Do wild bird notifications have to be registered on the OIE website? Wild bird notifications could still be reported but not placed on the OIE website, thus removing the misuse of trade barriers. LPAI is prevalent in wild birds across the globe and endemic in some countries meaning the risk is constant and to some degree manageable.
 - Should each OIE member country have the same regulations when identifying the size of their backyard flocks? In the UK backyard flocks of 50 or more birds have to be declared, compared to France where anything less than 3200 ducks can be declared as backyard.
 - Can backyard flocks of less than 50 birds be classified as wild birds and therefore fall under the case made in the first asterisked point above of reporting the notification, but not placing on the OIE website, again removing the potential misuse of trade barriers?
 - Should there be a differentiation made between LP and HP when notifying AI? LP can show little or no clinical signs and can sometimes disappear although there will always remain the danger of LP mutating to HP.
5. The risk to human health will always remain of paramount importance. However in the changing landscape of AI in wild birds, backyard flocks and commercial poultry, it would be prudent to remain open minded to ensure regulation evolves with AI and does not stymie scientifically proven proposals that would benefit all.

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13. Case Study: Canada

Canada is an important case study for the UK in regard to dealing with an outbreak of AI. They learnt harsh lessons when the virus wiped out 19 million birds in 2004 in what was their worst outbreak to date. (More birds were preventively culled than were infected with AI)

Canada was not prepared and the outbreak took over a week to confirm - allowing the disease to quickly spread. During the first 90 days Chicken Farmers of Canada (CFC) received over 10,000 calls from members of the public concerned about the safety of eating poultry and the potential for human infection. This was fuelled by officials at the time being quoted as saying that 17 million birds were about to be culled, creating huge concern among the public.

The ensuing panic highlighted the importance of having clear communication lines that reassure and inform the public and industry. All resources need to be on the front line of the outbreak and not diverted to fight fires and be front facing because of unnecessary anxiety.

CFC and Egg Farmers of Canada (EFC) are the two main poultry organisations that oversee the broiler and egg industries and work closely with farmers to ensure high levels of biosecurity are adhered to on a province-by-province basis due to the size of the country and varying poultry densities in each province.

The amount of meat and eggs produced is governed by a supply-managed commodity quota system which allows the industry to control potential oversupply into the domestic market. This is a good example of a country thinking long term and implementing a strategy to ensure the industry does not intensify to the point that it creates risk and it is something the UK should aspire to.

EFC in particular, have demonstrated that planning ahead during AI 'peace-time' will enable operations to continue with minimal disruption during an outbreak.

During the 2014/15 outbreak an immediate standstill around the infected premises was instigated even before the virus was isolated to ensure the risk of lateral viral spread was mitigated.

EFC have the ability to supply up to 500,000 egg trays into an AI surveillance zone, thus allowing farmers the ability to continue to pack eggs rather than destroying them. Every autumn and winter they also ensure heightened levels of biosecurity are in place across all provinces. There is a great sense of collaboration across the poultry industry and it serves as a leading example to the UK of what can be achieved on a domestic level.

On an international level Canada is part of the North American Avian Influenza Working Group (NA-AIWG) which is a sub-committee reporting into the North American Animal Health Committee (NAAHC).

The NA-AIWG comprises of Canada, the USA and Mexico and, through collaboration, they share information relating to animal health programmes, prevention, preparedness, detection and control, recovery of AI in domestic poultry and the risks posed by migratory birds in North America.

The close triumvirate relationship allows AI outbreaks to be narrowed down to the infected premises in accordance with the OIE's recommendations, thus allowing trade to continue with minimal disruption.



Figure 20: Protest in Canada

13a. Chapter Recommendations:

- The UK needs to look at Canada's collaborative culture and work on establishing the same principles, particularly between broiler and egg industries which are often working in silos.
- Communication strategies are vital in an outbreak but should be developed ahead of time to manage public expectations and anxieties.

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14. One Health, No Health and the role of intensification in outbreaks

'One Health' is a relatively new concept in modern world terms. Formed to improve health and well-being through the prevention of risks and the mitigation of effects of crises that originate at the interface between humans, animals and their various environments, the international movement recognises that the health of humans, animals and ecosystems is interconnected⁸.

With a mandate of applying a coordinated, collaborative, multidisciplinary and cross-sectoral approach to address potential or existing risks that originate at the animal-human-ecosystems interface, One Health is a visionary concept that will prove vital in future outbreaks of AI.

Using a holistic approach to collaborate across sectors that have a direct or indirect impact on health means both human health and the industries involved are working towards the best outcome.

As key stakeholders in 'One Health', the World Health Organisation (WHO), World Organisation for Animal Health (OIE) and the Food and Agriculture Organisation of the United Nations (FAO) work closely together and this world-leading four-year-old strategy has been embraced by the European Commission and the United States. Working together, they hope to be better prepared for the impact of zoonotic diseases such as AI and other public health risks and food safety issues.

One Health will be a necessity as the global interaction between humans, farmed animals and the environmental ecosystem becomes further intrinsically linked as the human population increases, thereby reducing the amount of space available for an increasing demand of intensively farmed protein.

This is shown by the doubling of the human population in the past fifty years; while the number of farmed animals has more than quadrupled, with poultry leading the way. This shows no sign of slowing down, thereby increasing the risk of cross-over infection. In the last 20 years alone, China has increased its poultry numbers to 5.5 billion. - a rise of over 100 percent, while the UK has nearly doubled its annual table bird output since 1985, to almost 1 billion in 2018.

When that growth, alongside the increasing human population density, is factored in, the magnitude and capacity of something like AI to be devastating globally is magnified.

It also serves to reiterate the fundamental importance of a 'One Health' approach in order to mitigate future risk for both the public and industry. Governments and multinational businesses alike need to be involved on a horizontal level and must be accountable on a social and corporate level. It is the citizens and consumers that they both protect and feed who are most at risk if this type of collaboration doesn't occur.

14a. Chapter Summary and Recommendations:

1. Collaboration in the UK, including but not limited to the following group, would have the potential to strengthen the understanding and knowledge of a 'One Health' approach in relation to AI. The working group would have the potential to create a shared consensus that could provide clarity should a zoonotic strain of AI infect the human population and, more importantly, both public and industry would be considered in any future risk mitigation strategies:

PHE – Public Health England

DEFRA – Department for Environment, Food & Rural Affairs

APHA – Animal and Plant Health Agency

FSA – Food Standards Agency

BPC – British Poultry Council

BFREPA – British Free-Range Egg Producers Association

BEIC – British Egg Industry Council

2. Post EU exit the British Government and Defra must work to ensure that One Health is an important vehicle in the UK. Currently One Health works alongside the European Commission but post-Brexit the UK will need to ensure it partners with One Health and the working group suggested above to ensure the maximum facilitation of a collaborative approach that will ensure public safety.
3. The role intensification of poultry systems plays in creating and spreading outbreaks cannot be ignored. The UK working group, as suggested by the author, needs to consider some difficult questions around how much further the industry intensifies versus the risk of a catastrophic outbreak. This may mean considering a moratorium.

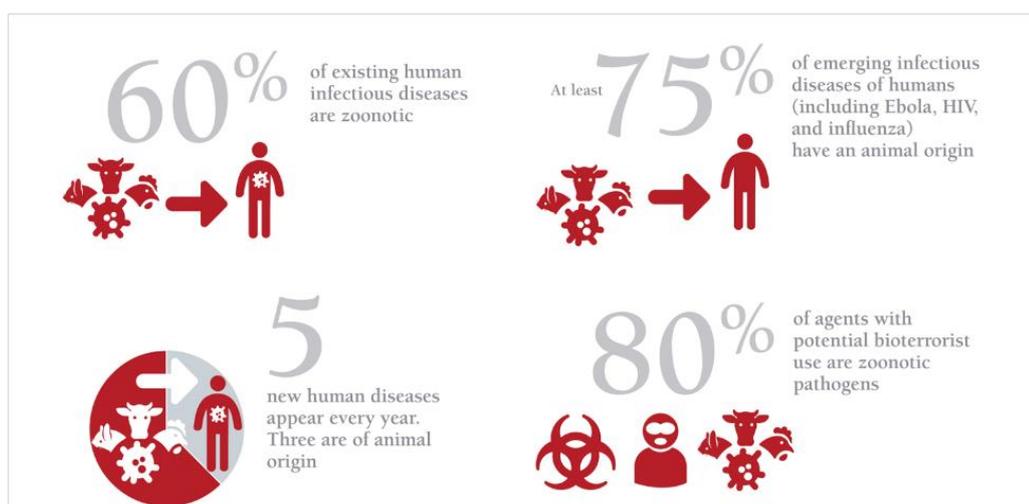


Figure 21: Source OIE statistics

15. Case Study: Hong Kong: One Health in Action

A good example of 'One Health' in action is in Hong Kong where a recent study of the live poultry trade was carried out by the Food and Health Bureau.

The aim of the study was for Hong Kong to find a way forward for the live bird markets to continue to exist whilst at the same time safeguarding the health of its citizens. Human and animal health experts as well as poultry trade operators were involved in open discussions to ensure all stakeholders held ownership on an agreed pathway forward.

Hong Kong is one of the most densely populated regions on the planet. At its heart are live bird poultry markets that provide its citizens with live or freshly slaughtered poultry - a cultural tradition that stretches back thousands of years.

However, in 1997 Hong Kong found itself at the epicentre of modern day AI when a three-year-old boy contracted the H5 N1 influenza virus. Up until that point it was thought the strain only infected poultry, yet for the first recorded time, it had made the leap to humans, killing the young boy and a further five people in Hong Kong. Aside from the human impact, authorities in Hong Kong culled 1.5 million birds in a bid to stamp out any further spread.

Since 1997 until the present-day Hong Kong has culled over 4 million birds and there have been no further human fatalities. There have been and continue to be further human infections of H5N1 and more recently H7N9. Most of these cases have originated in mainland China and have infected people visiting from Hong Kong.

What is impressive is Hong Kong's acknowledgement that human health is paramount when dealing with AI – a stance that needs to be replicated in the UK. Their 'stamping out' approach, although not accepted by everyone, reduces the risk of a lateral spread of AI from bird to bird and therefore mitigates the risk of humans coming into contact with infected poultry.

Secondly but equally as important is Hong Kong's recognition of the importance of live and freshly slaughtered poultry at live bird markets, to the cultural fabric of society. Today, Hong Kong has stringent measures in place to safeguard its poultry industry and therefore its population from the risks that AI poses but it hasn't come at the cost of an ancient cultural tradition.

Authorities have let live bird markets continue to trade while the risk is low but have the option of restricting the sale or closing markets altogether should the risk increase. The reasons for this are two-fold. The first is to allow an important cultural tradition to survive and the second is the even bigger risk of the black market trade.

As already shown with cock bird fighting in places such as Thailand and Vietnam, if ancient cultural traditions are threatened by AI, they will move underground and away from the eyes of the authorities. In recent years this has been especially prevalent with cock bird fighting in Southeast Asia.

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The Hong Kong approach to AI is to collaborate and educate in a cross-Government effort much like what One Health is aiming to do. The safeguarding of animal health through stringent measures on farm and at live bird markets will reduce the risk of an AI incursion into the Hong Kong flock and reduce the risk of lateral spread should there be an incursion.

The success of this approach has already shown to be highly effective with no further human fatalities since 1997 despite Hong Kong being the hotspot for AI. The only confirmed human cases have been imported after residents visited mainland China.

It's clear from the Hong Kong example that the risk of a zoonotic strain of AI infecting humans will be mitigated so long as safeguarding standards are maintained and everyone is working together.

16. Intensification

The role of increasingly intensified global poultry systems in the spread of AI cannot be ignored and will need to be addressed in any future strategic planning within the UK if we are to truly mitigate the risk of a catastrophic outbreak to industry and to British citizens.

The China model serves as a warning to the UK poultry industry with a study by Gilbert, Xiao and Robertson⁹ showing links between the rapid intensification of the China poultry industry, especially in wetland areas and wild waterfowl habitats, and the emergence of H5N1 and H7N9 strains of AI.

The report states that *'the emergence of AI viruses is linked to intensification of the poultry sector, both in high-income countries as well as in rapidly growing economies such as China, where the intensification of chicken and duck production at the interface with wild birds supported the emergence and maintenance of several viruses of global health public relevance including H5N1 and H7N9.'*

H7N9 serves as a good example of the most recent impact of AI in China. H7N9 was first recorded in China in 2013 and has infected both humans and poultry, killing nearly four hundred people to date and infecting hundreds more.

According to the WHO, evidence of human-to-human transmission is low. However, the primary risk of human infection is through direct contact with infected poultry and human exposure to H7N9 which increases during cultural celebrations, especially around Chinese New Year, when human and live bird poultry movements increase.

These traditions form the very basis of a 'One Health' framework in its most organic form: humans travelling back to their homelands to enjoy food, especially in the form of animals grown for meat, whilst enjoying the environment and community in which they grew up.

Therefore, a successful 'One Health' framework requires a holistic approach that encompasses all and an understanding of the citizens and their traditions as well as the threat of zoonotic diseases, which, in part, has been caused by the industrialisation of agriculture, just as they did in Hong Kong with live bird markets.

While H7N9 is one of the lesser virulent strains to affect poultry in recent years, its economic costs are no less severe. According to a 2016 FAIRR report¹⁰, during a three-month period, poultry industry losses were estimated to be above 1.5 billion US dollars.

New Hope Lihue, China's largest poultry supplier in 2012, saw its profits drop by 15 per cent during the first half of 2013 as a direct result of the H7N9 Avian Influenza outbreak.

(see next page for Chapter Summary)

16a. Chapter Summary:

1. Whilst the UK is not comparable to China in respect of the difficulties of cultural traditions that can help spread AI, it is at no less risk of a substantial economic impact should an outbreak occur – particularly because of the density of poultry operations across a small geographical area.
2. It has often been assumed that large scale AI outbreaks are in the domain of low income countries with intensive, industrial poultry farming, but the Gilbert, Xiao and Robertson report showed high income countries with intensified systems are equally at risk.
3. Finally, AI and its potential economic impact is not strictly limited to the poultry industries alone. The economic impact of an AI pandemic would be catastrophic for the global economy, not to mention the human population and society.
4. The World Bank in its report on 'The Economics of One Health'¹¹ suggests that an influenza pandemic with 71 million fatalities would lead to losses of 3 trillion US dollars or 4.8 percent of the global GDP. It is clear that all countries need to review their poultry systems and operations and work collaboratively to avoid such a disaster.



Figures 22 and 23: Hong Kong Live Bird Markets, Kowloon District

17. Overall Conclusions and Recommendations

The UK is not as prepared as it could be for an AI outbreak and lacks a co-ordinated long-term strategy that is pro-active and considers the poultry industry and the rights of citizens to be protected.

In order to do that the author makes the following recommendations for DEFRA, the Department of Health and Social Care, Public Health England, Food Standards Agency, Animal and Plant Health Agency, the National Farmers Union and national poultry organisations and committees (BPC, BEIC, BFREPA)

1. A wider strategy needs to be considered by a working group under the auspices of Defra with experts and practitioners from every aspect of the disease and its control, together with representatives of producers of various types of poultry: to consider where free range properties are located, and if any more should be permitted to open up, especially in wetland areas where wild birds are known to congregate.
2. That group would work with One Health and Public Health and alongside Government to come up with a collaborative long-term strategy.
3. The OIE (World Organisation for Animal Health) and WTO (World Trade Organisation) need to urgently develop better strategies to deal with countries that are using current reporting procedures to exercise protectionist trade behaviours.
4. The UK must undertake active surveillance of wild birds to ensure the earliest detection of an outbreak.
5. A bigger investment needs to be applied, by Government and industry alike, to building capability before an outbreak, particularly as the UK leaves the EU. Active surveillance of wild birds needs to be a spending priority.
6. Backyard poultry owners pose a major risk. Because of this a solution must be found that enables all flocks to be identified – no matter how small. The working group in (1) above should consider how local authorities could help in this area, using examples such as the NZ dog registration scheme to show what can be achieved.
7. A public campaign similar to the US's example 'Defend the Flock' should be considered to educate the backyard chicken owner.
8. To encourage better bio-security practices in the UK poultry industry, a new digital platform that all producers can access with best practice and latest information should be considered.
9. For those lagging behind on bio-security standards, nudge behavioural theory should be employed alongside a co-ordinated campaign to increase standards.

18. After Nuffield

My Nuffield UK Farming Scholarship has been a transformational journey over the past 18 months and has challenged my professional outlook, whilst also providing a platform for tremendous personal growth. After a lifelong career in the UK poultry industry I have decided, following my global experiences, to leave Faccenda Foods (now Avara Foods) to be part of a small farming business.

After discovering many global insights around food and farming systems I came to the conclusion that large scale agribusiness was not going to be part of my future plans. My aim is to show that a small farming system can be sustainable, both environmentally and economically, whilst at the same time reconnecting consumers to the story of where their food comes from.

The business is in its infancy but will primarily focus on producing unpasteurised goats' cheeses. Please email me (djrobs1981@gmail.com) for further information until the relevant web platforms are in place.

With grateful thanks to Mike and Poey Vacher and the rest of the UK Nuffield team.

Dan Roberts

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Figure 24: Africa GFP in the USA. Author is 5th from right.

Living and dying with Avian Influenza ... by Daniel Roberts

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