Food Safety: Whose responsibility is it?

Egg safety. Should the farmer be solely responsible?

A report for

By Lachie Green

2016 Nuffield Scholar

July 2018

Nuffield Australia Project No 1601

Supported by: Australian Eggs

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Executive Summary

The Australian egg industry is one filled with passionate farmers, world class researchers, and consumers who love the product. That being said, the Australian egg industry also has a reputation as being connected with many food poisoning outbreaks throughout the country. Simply put, eggs often get a bad rap when things go wrong in commercial kitchens.

Eggs in themselves are a wonderful product. Full of nutrition, antibacterial properties, and protein. They provide a reliable, delicious, cheap and easily accessible food source for the world's population. Eggs are a natural product that are in no way sterile, yet eggs are often assumed to be.

This paper, which focuses on egg production and food safety regulation in the United Kingdom (UK), the Netherlands and the United States of America (USA), seeks to identify ways that the Australian egg industry can further protect itself going forward in to the future. Currently, regulation of egg production in Australia is fragmented. There are varying local and state level requirements but no federal legislation that is applied consistently or on a mandatory basis throughout the country. In contrast, the countries studied for this report have common minimum regulatory standards that apply to commercial egg producers as well as schemes that go above and beyond the minimum. In Australia, there is a voluntary accreditation scheme, run by Australian Eggs, that provides requirements and adherence to best practice standards across a variety of different aspects of production including hen welfare, food safety, the environment and egg grading. These are, however, completely voluntary and the competitive or other advantage to being accredited with the system does not apply to all egg producers.

The UK has a similar voluntary accreditation scheme, the Lion Code. This code is widely adopted with more than 90% of eggs in the UK being produced under it. The code is highly robust and has not only consumer faith but regulatory faith. That is, if there are ever any issues with an egg farm, if they are accredited under the Lion Code, the government is readily willing to accept that the farm operates under best practice.

To achieve a similar outcome in Australia, the industry needs to better coordinate with regulators and develop a set of requirements that are applied equally throughout the country and appropriately monitored and enforced. In doing so, commercial advantage can

be gained by those producers exceeding minimum requirements and adopting best practice, while consumers can be assured that no matter where or from whom they buy eggs they are purchasing a safe product. Similarly, newcomers can be given the opportunity to fully understand the requirements of producing safe eggs.

The Australian egg industry would also benefit from ongoing education of the end user of the product on the safe use of eggs. Not only the domestic users of eggs but the chefs, cooks and restauranteurs that use eggs to make food which is sold to the public. Eggs too often get the blame when a food poisoning outbreak occurs, even in situations where eggs were not used in the offending dish. This is an attitude that the industry must strive to alter. Education is the vessel to assist in doing so.

Just as those using the product need to be educated, so to do those regulating the food service industry. The level of understanding surrounding salmonella and how it operates is drastically varied, and effort is required to ensure that those investigating food poisoning outbreaks and auditing commercial kitchens understand the risks associated with mishandling an egg product. After all, an egg producer should not be held liable when they have provided a safe, fit for purpose product that is then mishandled.

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Foreword

My wife Millicent, and I, together with my parents Alan and Shelley, own and operate a free range egg business, 'Green Eggs Pty Ltd'. Our business started in 1999 after my father, a former stockman from western Queensland and my mother, a midwife from a farming family near Ararat, Victoria, both wanted to work together on farm running a viable farming business. Due to the size of our family farm, my parents started considering more intensive industries such as viticulture, pork and chicken meat production.

At this point in time the free range egg market made up only 2% of the industry's entire production and information on hen management was limited due to it being a very closed industry. The beginning was very much a trial and error period but combining mum's nursing background and dad's animal husbandry skills they found their way through the many health and behavioural challenges of the free range environment.

Three years in, they felt the value of the hard work and dedication they were putting in to produce a product of high quality was being undervalued by the wholesaler. They could see the potential in an emerging food culture that wanted to know where, how, and who was producing their food. After negotiations failed to increase on-farm egg price, the decision was made to go it alone and be price makers not takers, selling under our own brand, Green Eggs. By targeting farmer markets, restaurants and cafes, my parents found a market that understood the value of a quality product and believed in the ethos of how it had been produced.

This marketing plan resonated well through the market place and drove our business through many phases of expansion. They believed in producing a product that is true to its nature, taking measures to ensure its quality and safety were never compromised. Hence, they pushed industry quality assurance programs and became the first farm to be accredited under the Australian Egg Corporation's Egg Corp Assured program.

In 2014, a cafe we supply had a food poisoning outbreak relating back to salmonella in mayonnaise that was put into burgers. The café was charged for multiple breaches of the Food Safety Act, but ultimately, they blamed the eggs as the cause and link to the food poisonings. The health department failed to find any salmonella on eggs that were currently

being used in the kitchen to prepare the mayonnaise, yet they still visited our farm and undertook environmental, egg and equipment swabs; all of which came back negative.

Despite no tests returning positive for salmonella, and with no consultation with us, the Health Department released Green Eggs' brand as the cause of the outbreaks. In doing so they published a media release which warned people to thoroughly cook any of our eggs, and they also placed our farm under quarantine. Overnight, our sales dropped 70% and we were left with no support as to what to do, what to change or how to move forward.

We were fully accredited with the leading industry body, had passed a spot audit the same week our name was released to the public, we had detailed records of all our practices, and pride ourselves on running our business under leading standards and best practice at all times. The quarantine notice required us to wash our eggs, but that was the only change that took place in our system. We felt that if we were truly deserving of public naming and shaming, surely our practices would have warranted drastic changes, not just the implementation of an egg washer.

Fortunately, and to their credit, many of our customers and chefs stood up for us, defended our product and helped us get back on our feet. One year later we were back to full sales and production. The main issue however, was that we do not feel that there was any huge change in process from our end and the risk of another one of our customers having a food poisoning issue in the future, could mean the closure of our business, despite no possible further changes we could implement. Importantly, this is a risk faced by all Australian commercial egg producers.

In 2015, I ran into an old friend who I had not seen for a while as he had been completing a Nuffield Scholarship. After talking to him about what Nuffield has done for him in understanding his industry and his personal development, he recommended I apply. He said the time is never right but if you are lucky enough to get one you will never look back.

After talking to my then fiancé about our future together and where and what we were going to do, the opportunity to take on the family business together was extremely exciting but some concerns surrounding the recent salmonella issue was in the back of our minds. Being awarded a Nuffield Scholarship with a topic surrounding food safety and eggs has given me a great opportunity to explore this issue and learn from others in the industry.

This opportunity, that I am very fortunate to have been given through the generosity of Australian Eggs and Nuffield Australia, has given me the confidence to go forth as a next generation egg farmer into an industry which I believe to be resilient, and one worth investing in.

Acknowledgments

I would like to thank Australian Eggs for investing in me to undertake a Nuffield Scholarship. Your support in young people within the egg industry is invaluable to the long-term future and growth of our industry.

Thanks to Nuffield Australia for all your support throughout the program, and for guiding my personal development.

Thank you to all the farmers, researchers, businesses and industries that helped me along my journey around the world.

To my parents and friends who helped keep our business going while I was away, thank you.

To my wife, Minnie. You were the one that pushed me to apply for a Nuffield Scholarship. I cannot thank you enough for seeing in me what this opportunity could and has done for me as we grow our business together in an industry with a bright future, thank you.

Abbreviations

AI	Avian Influenza
BEIC	British Egg Industry Council
CFA	Code of Federal Regulations
EQSM	Egg Safety and Quality Management Program
EU	European Union
FDA	Food and Drug Administration
FSANZ	Food Standards of Australia and New Zealand
HACAPP	Hazard Analysis Critical Control Point Plan
IKB	Integraal Keten Beheer
NCP	National Control Plan for Salmonella
NERO	National Egg Regulatory Officials
SE	Salmonella enteritidis
ST	Salmonella typhimurium
UK	United Kingdom
USA	United States of America

Objectives

The aim of this study was to identify best practices around the world with regard to egg production and regulation from a food safety perspective to allow a rigorous analysis of how these best practices might be adapted and used to improve the regulation and production of safe eggs in Australia.

To do this, the study set out to:

- Understand the current egg climate in Australia; the rules and regulations around egg production, and the use of eggs in the food service industry.
- Identify countries that are leading the way in egg regulation and research as to food safety.
- Identify and understand how those countries practices may or may not work in the Australian context.
- Identify opportunities for consideration by the Australian egg industry and the Australian food service industry as to best practices for the production and handling of eggs.

To achieve these objectives, it was necessary to identify egg markets around the world that were leading the way in these areas. Although China is the largest consumer of eggs on a per head basis (The Top Five of Anything), it was identified that developed countries such as the United Kingdom (UK), United States of America (USA) and the Netherlands were going to provide more relatable information for adaptability to the Australian market. China however, will be of great interest to the Australian egg industry in the coming years as their egg consumption continues to rise and the Australia-China trade barriers continue to be reduced. China may provide exciting study opportunities for future Nuffield Scholars.

Chapter 1: Eggs and Food Safety

The facts about eggs

Eggs are a highly nutritious food that support all necessary proteins, fats and minerals that are required to support and grow life. While eggs are a nutritious food for humans, they are equally nutritious to many bacteria types, including salmonella. If eggs' natural defences are compromised, bacteria can enter the egg. If it makes its way to the egg yolk, the nutrient rich environment can support the growth of the bacteria to a point that has the potential to cause human health issues if consumed. Almost always, in Australia, this comes about due to an egg yolk being used as an ingredient in a mishandled raw egg product. Even where the egg itself is completely free from salmonella or other bacteria, if the yolk is used raw, in a product that is cross contaminated from another source, the yolk provides a wonderful environment for rapid growth of that bacteria.

Eggs date back to the prehistoric era and continue to be laid up to the present day. For this reason, one would suggest that those who lay them have had plenty of time to make them very resilient to foreign bacteria like salmonella to ensure the survival of their species. Figure 1 shows an in-depth diagram of an egg.

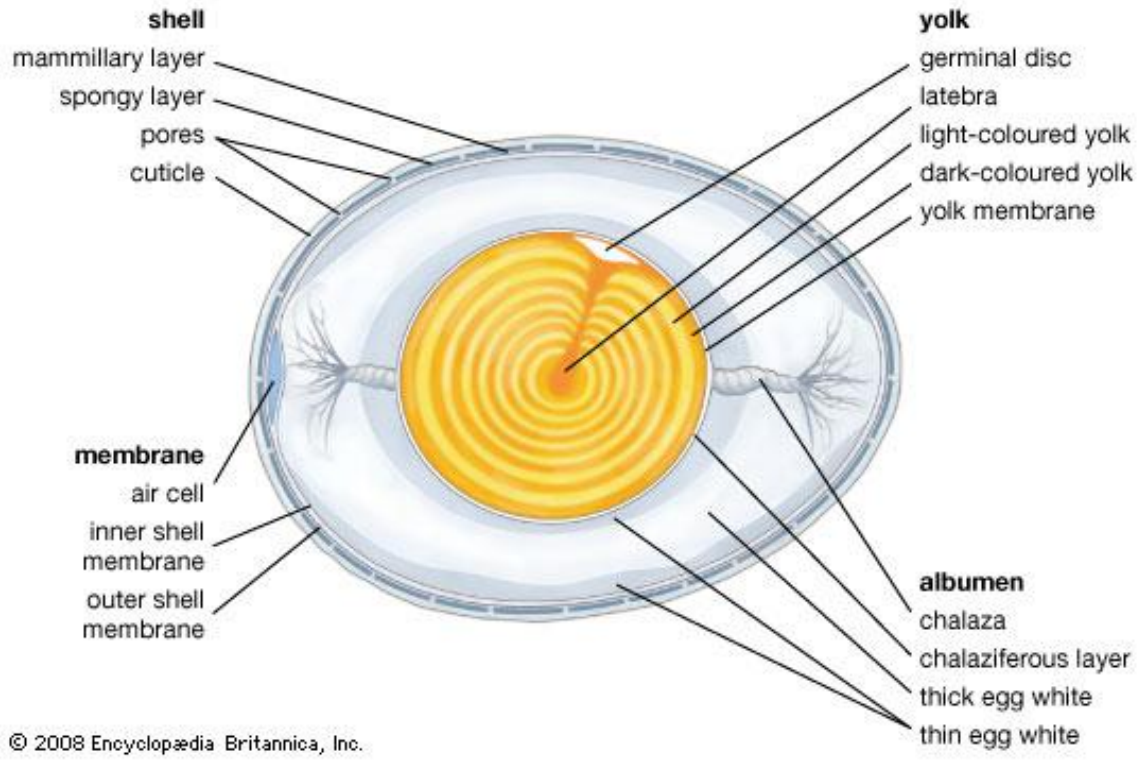

Figure 1: The Egg (Source: Encyclopaedia Britannica, 2008)

For foreign bacteria to enter the egg it must pass through all of the barriers that naturally occur in the makeup of the egg. These include:

The shell

This is a major barrier for bacteria and although the structure of the shell is semi-permeable the hen coats the egg with a waxy layer called the cuticle to further seal up pores in the shell. An intact clean sound shell with a good cuticle, has the potential to keep out most bacteria that the shell comes in contact with the egg.

Outer and inner shell membrane

A double layer membrane on the inside of the shell further screens out any bacteria that happens to make it through the shell.

The albumen

The albumen is the “white” of the egg, and by its nature is an alkaline environment which discourages bacterial growth. The albumen contains lysozyme and other proteins that fight bacteria by breaking down the cell walls of the individual bacteria. It is also very viscous and slippery which decreases the ability of bacteria to move around the albumen (Spitzer, (2015).

Bacteria require iron and nitrogen in order to grow and replicate, both of which are not found in the albumen, thus making bacteria growth within it difficult and slow.

The Yolk Membrane

The yolk membrane is very selective of which bacteria gets past it. Although the yolk does have some proteins that fight bacteria, the yolk membrane is the last physical defence barrier before bacteria reaches an environment that has potential, under the right conditions, to support bacterial growth.

The facts about salmonella

There are more than 2,500 different serotypes of salmonella, 100 of which are most commonly related to current food related illnesses.

Salmonella has been commonly linked to many products and food stuffs in the past including:

- Rice
- Melons
- Chicken

- Beef
- Nuts
- Unpasteurised milk and juice
- Fruits and Vegetables
- Spices
- Pet food and treats

It has also been found to be naturally occurring on and within certain animal environments, including:

- Reptiles (snakes, lizards, turtles)
- Frogs
- Birds
- Poultry

Due to the large spread of carrier species and varying environments in which salmonella has been found to exist and grow, people come in contact with salmonella very frequently but might not necessarily be aware of their exposure nor their health be affected.

When salmonella is found to be the cause of a food related illness, care needs to be taken to investigate the incident properly due to the large amounts of sources the bacteria could have been introduced from. Eggs are just one of the many products that can be found to carry varying loads of salmonella, some of which will often be at levels not harmful to humans. It is when food is prepared in an unsafe way or misused that the bacteria can quickly grow to levels high enough to make people unwell.

Salmonella and its relationship to poultry

Salmonella has been linked to poultry for decades, first to chicken meat and then eggs. The two most talked about serotypes of salmonella are *salmonella enteritidis (SE)* and *salmonella typhimurium (ST)*. SE is not endemic here in Australia unlike other countries. Both SE and ST can infect a healthy laying flock without causing clinical symptoms, but both also have the potential to contaminate eggs, even where no symptoms exist in the hen. Contamination from salmonella species in Australia can occur during the laying process or from the laying environment and production surfaces when the egg can be contaminated by bacteria excreted in the faeces.

Salmonella can enter the egg through cracks in the shell or through the natural pores in eggshells under conditions favourable to the bacteria. While salmonella is unlikely to cause a problem in clean and intact eggs, if eggs are cracked or dirty there is a greater likelihood of contamination of the internal contents of the egg, and a higher risk of illness from consuming the eggs.

For salmonella to thrive it needs a nutrient rich environment and moisture, combined with time and temperature. When these elements are combined, if salmonella is present the risk of the bacteria replicating to levels harmful to humans is greatly increased. Examples of this occur when raw eggs are used to make products such as mayonnaise and aioli. Although the products themselves might be free of salmonella, kitchens and other food preparation places are regularly exposed to salmonella from the range of foods that may contain salmonella. As a result, all it would take is poor personal hygiene or equipment that had not been cleaned properly to introduce the bacteria like salmonella into the nutrient rich mixture containing raw egg. In the right environment salmonella will grow rapidly, and within a matter of hours could potentially be contaminated to a point where ingestion is likely to make the person sick.

Chapter 2: Eggs in Australia

Understanding the Australian market

With approximately 252 egg farms in Australia and a consumption rate of 231 eggs per capita it is not surprising to learn that the industry in Australia is worth more than $739 million (Australian Eggs Limited, 2017).

Egg production in Australia is made up of several different production systems including cage, barn laid, free range, organic and speciality eggs. In the first quarter of 2017, the Australian government passed legislation setting out that in order for eggs to be marketed and sold as free range, the eggs must be laid by hens that had regular access to outdoor ranges, were able to roam and forage whilst outside, and were subject to a maximum stocking density of 10,000 hens per hectare (Australian Consumer Law, 2017).

Interestingly, Australia's free range production systems account for more than 40% of the total egg production, with barn laid only reaching approximately 8.5% of total production. Caged eggs are still the predominant production system with almost 50% of the eggs produced in Australia being produced by hens in cages.

Regulation of egg farms is varied and changes between states as to the level of regulation and strength of enforcement of such.

Regulatory environment of egg production

The Food Standards of Australia and New Zealand (FSANZ) apply to both food businesses such as cafés and restaurants, as well as primary producers.

The FSANZ Standards are interpreted and implemented by each state. This means that there is disparity in the way they are implemented and enforced. Standard 3.2.1 clause 3 sets out requirements for food businesses and states:

General food safety program requirements. A food business must:

a) systematically examine all of its food handling operations in order to identify the potential hazards that may reasonably be expected to occur;
b) if one or more hazards are identified in accordance with paragraph (a), develop and implement a food safety program to control the hazard or hazards;
c) set out the food safety program in a written document and retain that document at the food premises;

d) comply with the food safety program; and
e) conduct a review of the food safety program at least annually to ensure its adequacy."

Similarly, Standard 4.2.5; Division 2; clause 3 sets out:

General food safety management:

1) An egg producer must systematically examine all of its production operations to identify potential hazards and implement control measures to address those hazards.
2) An egg producer must also have evidence to show that a systematic examination has been undertaken and that control measures for those identified hazards have been implemented.
3) An egg producer must operate according to a food safety management statement that sets out how the requirements of this Division are to be or are being complied with.

In practice, these standards have meant that producers must identify and control safety hazards such as ensuring feed is not contaminated and having a Hazard Analysis Critical Control Point Plan (HACAPP) in place. Similarly, the sale of cracked or dirty eggs to the table market is prohibited, and any producers wishing to sell such eggs must only do so to processors who will pasteurise the eggs. It is also required of producers that they stamp each and every egg with the farms unique identification so that traceability of any eggs is made more straightforward.

As mentioned above, the states implement these broad standards based on their interpretation of appropriate compliance. This has the potential to create a sense of confusion and misinformation amongst not only producers but regulators. It is well known in the industry that the level of understanding and information surrounding salmonella, and its relationship with chickens and eggs, and then through to the food sector, is extremely varied (Hewson & Chia, 2016). The level of comprehension of how salmonella operates amongst producers, government regulators, health officials, the food sector and the public at large is startling in the context of the risks involved and presents an ongoing challenge for the industry. While ST is likely to be present on almost every poultry farm in this country in some form (Anonymous industry vet, 2016), the perspective of health officials is generally that salmonella presence on egg farms is the result of negligence on the part of the farmer. This is a huge issue for the industry, and one which needs to be given a great deal of attention.

> *"As elimination of salmonella from egg farms is impossible, the risk of human illness needs to be appropriately managed. However, this is a technically complex issue with varying risks (and varying understandings of the risks) between on-farm and in-food service."* (Hewson and Chia, 2016).

In Australia, Australian Eggs is the industry body responsible for research and development and marketing on behalf of producers and the egg industry as a whole. Australian Eggs have an independent accreditation system that is voluntary and does provide more detailed guidelines as to production in areas including bird welfare, food safety, and storage and dispatch. Whilst these requirements are robust and detailed, they are not mandatory. Those producers that are accredited, are given the general advantage of demonstrating compliance with high standards but as they compete with egg producers are not accredited and focus on price competition, this does not always provide a meaningful advantage in the market place.

Further, there are very few strict regulations placed on those wishing to become egg producers. States vary, and some states are much further ahead in regulating egg production. As mentioned however, the level of understanding with regard to salmonella, eggs and food safety is hugely varied. This presents major issues for the industry. When there are regulators and health officers that do not have a detailed understanding of salmonella and then food service providers using eggs in potentially unsafe ways, the whole egg industry is faced with a huge problem. Why should egg farmers wear the brunt of a food poisoning outbreak when at the point of sale the egg was fit for purpose and safe, and then because of improper handling the egg has become the source of a food poisoning outbreak? Not only does this not seem fair but it also seems to present huge financial and reputational risks both to individual farmers and to the industry as a whole.

Australians love to eat out, and Australia has an international reputation for being a foodie destination. Perhaps it is these things, combined with no consistent approach or understanding of salmonella, that sees approximately 12,800 cases of egg-related salmonellosis per year in Australia.

Australian Food Culture

Ask any Australian what their favourite food is, and the likely responses will range from Thai and Italian to coffee and Sunday brunches. Just as likely is the barbeque in the backyard, or

fish and chips on the beach. Australia has a wonderful foodie culture, and spending an afternoon in any major city or rural town shows why this is so. From excellent coffee, to top shelf wines, to world class chefs and culinary delights, Australia is a top destination for those wishing to experience some of the world's best culinary experiences.

Australian's, on average, tend to eat out three to four times a week, that is more than 50 million meals a week eaten out. Dining out in Australia is not only a cultural rite of passage, but it is a huge contributor to our economy. With the average Australian family spending $94 a week on dining out, that is approximately $45 billion a year, more than Australia's coal exports (Intermedia Group Pty Ltd, 2017).

Visiting New York, as the beginning of the United States research for this paper, it was clear how well-known Australia is for its food culture. Australian barista's are making names for themselves up and down Manhattan. Jobe Watson, an Essendon Australian Rules footballing great, became famous for his coffee making skills in his café, 'Hole in the Wall', on Fifth Avenue. For any New Yorkers, or expat Australians seeking out a skinny latte and a slice of smashed avocado on toast, Little Collins, on Lexington Avenue is a hot spot. Finding it hard to find a seat in the tiny but packed little café, there are Melbourne Street signs hanging off the wall, and vegemite toast on the menu. The popularity and sheer number of Australian inspired dining options illustrate that Australian food culture is expanding past the borders and making a name for itself around the world.

With television shows like My Kitchen Rules and MasterChef Australia, home cooks are becoming reality stars, and chefs are taking on a fame akin to rock stars. Not only are the contestants gaining unprecedented fame, but home cooks are becoming more and more experimental and cooking terminology is becoming part of everyday vernacular. Not only has this increased experimentation in the home kitchen but it has also led to a huge increase in the expectation placed on restaurants and cafes.

The average consumer has come to expect more from the dining out experience, and their level of education around the food they eat is now greater than ever. The paddock to plate movement has taken hold and the discerning consumer wants to know what they are eating and where it has come from. This has seen a large uptake in the popularity of farmers markets, and more information about producers being presented on the menus of restaurants and cafes.

This has allowed the forward-thinking producer to capitalise on this market and market directly to their consumer. However, it has also meant that the risks to consumers can be greater too. As mentioned, Green Eggs can attest to the risks associated with food service providers making more experimental products in-house. With experimental food practices, and the increased number of food service providers entering the market, food safety is of the utmost importance. The potential risks that unsafe food and food service practices present is enormous. A$45 billion industry is one that is worth protecting, not to mention the value and flow on effects that could potentially impact our agricultural sector.

Chapter 3: The United Kingdom

Understanding the UK egg market

With a population of over 65 million people, all of whom eat somewhere between 191-194 eggs a year, it is not surprising to learn that the United Kingdom (UK) is the sixth largest egg producer in the European Union (Compassion Foods, 2012). The UK has many similarities with Australia, and these similarities formed part of the reason it was decided to study egg production and the regulatory environment of the UK for this paper. Culturally, the Brits are very similar to Australians. Sharing a love of cricket, a keen desire to look out for each other, and a shared love of eating and sharing food with family, the UK seemed to be a good place to start exploring global best practice concerning egg production and food safety.

Home to approximately 36 million laying hens the UK has an incredibly robust egg production industry (Egg Info UK, 2016). Producing over 10 billion eggs a year, including exports of approximately 135 million eggs, it is not surprising that the UK is 85% self-sufficient in egg production. In the UK, production is made up largely of cage systems (50%), a large part free range (48%) including approximately 2% which is organic, and only 2% barn laid (Egg Info UK, 2016). In the UK, as throughout the EU, conventional cage systems have been banned since 1st January 2012. In the UK, reference to caged systems refers to 'enriched' colony cages. The enriched colony cages include a nest box, perching space, scratching areas and provide a minimum of 750cm² per bird. Most of these enriched cages throughout the UK are designed to house between 40 and 80 birds, which allows better use of the space and increased opportunities for the birds to move around the colony and utilise the areas that are designed to allow the birds to engage in natural behaviours such as scratching and perching.

The EU egg marketing legislation also stipulates minimum requirements for using the term free range eggs. Like Australians, the British consumer demand has led to an increase in the popularity and demand for free range eggs. In the UK for a hen to be deemed free range she must have continuous daytime access to areas that are mainly covered with vegetation and a maximum stocking density of 2,500 birds per hectare. There are also rigid requirements for the barn layout for free range birds and include perches which allow at least 15cm of perch per hen, at least one third of the ground surface must be litter, and the internal stocking density must be no more than nine birds per square metre.

With a strong and robust representative industry bodies, the UK egg industry is both well supported and well regulated. There is a focus on the voluntary accreditation system, The Lion Code, for this paper.

UK Regulatory Environment: The Lion Code

The Lion Code is a scheme that sets out not only requirements for food safety, but also animal welfare, environment standards and all other aspects of egg production (The British Egg Industry Council, 2010). It has had huge success in drastically reducing instances of salmonella and now more than 90% of British eggs are produced under the code.

Established and run by the British Egg Industry Council (BEIC), the Lion Code has effectively eradicated salmonella in British eggs (Egg Info UK, 2016). The BEIC was formed in 1986 in an attempt to represent the UK egg industry in all areas from breeding and hatching to rearing of layer hens and the egg production process, all the way through to packing, processing and marketing. The BEIC is a representative body for the UK egg industry in matters to do with the Government, the European Commission and Parliament and all other regulatory bodies.

The BEIC is funded mainly through voluntary levies from the industry and it is responsible for the functioning of the British Egg Information Service which provides the public with information regarding egg nutrition, recipe ideas, egg safety and all things egg production.

The Lion Code is a voluntary scheme that covers the entire production chain, from hatching, to feed production, to laying farms through to packing, processing and the environment. The scheme is independently audited to ISO17065. The Lion Code, along with the UK National Control Programme for Salmonella in Layers, ensure that all egg farmers with over 100 laying hens are compliant not only with EU regulations but also with British requirements. The two programs work side by side and ensure the most stringent standards throughout the production chain.

Under the Lion Code (in conjunction with the NCP) the following is required (The British Egg Industry Council 2010):

- During rearing all hens must be vaccinated at one, six and 12 weeks of age with a live vaccine. Stringent records must be kept of all hen movements, vaccinations including batch number, dates, administration information etc;
- Every laying farm must conduct self-audits every six months, one of which each year will be an official audit;

- Birds must only be obtained from approved farms. All flocks must be accompanied by a Lion passport certificate and an Animal Transport Certificate. These must all be kept and available for inspection.
- Laying hens must be sampled for Salmonella Typhimurium and Salmonella Enteritis every 15 weeks during lay, beginning at 22-26 weeks of age.
    - If negative; the farm continues as usual and will retest in 15 weeks' time.
    - If positive; the lab is obligated to report it to the Animal and Plant Health Agency, who then come out to the farm and conduct an official test. If the official test also comes back positive then eggs from this flock are placed under restriction and can only be placed into the processing market where they will be heat treated.
- The cold chain from lay to end user must not be broken and must not exceed 20oC.
- All Lion eggs shall be graded with a maximum best before date of 27 days from lay.
- Record keeping requirements are very strict. These include, for example, the maximum and minimum daily temperatures in the sheds, detailed records of rodent and vermin control programs; weekly checks and records of all automated equipment systems including, feeders, drinkers, lighting, ventilation systems and temperatures.
- Birds must have uninterrupted period of darkness for at least one third of the day.
- Strict bird welfare standards are applied. Including;
    - A maximum flock size per house of 16,000 birds. In any house where there is more than 6,000 birds the house and yard must be split into colonies of no more than 4,000 birds;
    - Perching requirements;
    - Houses must have at least one third of the floor space as litter, that is at least 5cm deep;
    - There must be at least 10cm of feed line available per bird;
    - There must be at least one nest box to every five birds; and
    - There are requirements not only on stocking density but how the yard is set up to ensure the birds use the yards. This includes details about coverage and distances to cover.
- Very strict cleaning and disinfecting requirements are in place. These include a requirement to steam clean or perform 'fogging' in conjunction with approved

disinfectants. This must be done at the end of each and every flock. It is known that salmonella can live in dust, and therefore it is a requirement under the Lion Code that all dust be removed.

There is no question that the Lion Code and NCP requirements are strict. The farmers interviewed for this paper, however, have no doubt that the Lion Code has had extremely positive impacts for the UK egg industry.

Case study: Doug Wanstall, Bank Farm Poultry

Doug Wanstall, a fellow UK Nuffield Scholar runs and owns (with his father and uncle) a farming enterprise of approximately 445 hectares (1100 acres) and a free-range egg production system of 170,000 laying hens. It is based in Ashford, near Kent, just over an hour's drive south of London.

Arriving at the farm it is clear that this is not just any egg farm. Not only does Bank Farm Poultry produce eggs but they also rear their own birds and produce their own feed for their chickens. All of Doug's chickens are free range, and whilst visiting the farm it is clear to see that this operation is certainly one to be envied. Doug and his team believe that reducing stress in the birds assists not only from a food safety perspective but also from production perspective. They ensure that their birds have routine and excellent protection from foxes. It is not only these elements that reduce stress though. Doug believes that by providing the birds with a good quality litter, feather pecking is reduced, which is often not only a cause of stress for hens but also an indicator that the birds are suffering stress.

There are studies to suggest that salmonella is more likely to be shed by a bird when she is stressed, and of course less likely to produce an A class egg. By keeping their machines in order and ensuring that the birds are fed a diet full of good quality fibre, Doug believes they are less likely to feather peck.

Similarly, by raising their own birds, the Bank Poultry Farm team can ensure that the birds are raised not only in strict compliance with the Lion Code, but also to their own high standards, with a focus on keeping the birds active and low stress.

When discussing with Doug the Lion Code, and its practical application for egg farmers, Doug noted interesting points. If a farm had a positive salmonella test for either *ST* or *SE,* come back whilst the flock were in lay, most farmers, in his experience, end up culling the entire flock, cleaning down and repopulating. This was staggering to hear. As discussed, above the

research and rhetoric regarding *salmonella typhimurium* in Australia is that it is endemic to poultry farms and elimination of salmonella from egg farms is impossible (Hewson & Chia, 2016). Doug could not recall this happening amongst his peers. He explained that the Lion Code has practically eliminated salmonella from poultry farms.

When discussing food safety with Doug and in particular food poisoning outbreaks, Doug could not recall any instances of food poisoning related back to eggs. He commented that these instances are very rare, and when they do occur they are not in relation to Lion Eggs.

Doug believes that although compliance and the seemingly endless paperwork are often complained about, the Lion Code is the best thing that has happened to the egg industry in this country (Wanstall, personal communication, 2016).

Case study: Glenrath Farms, Scotland

Karen Campbell is one of the directors of the world's largest free-range egg farm, Glenrath Farms. Situated in the Scottish Borders, the Campbell family has been in operation since 1959, and has grown enormously since its inception.

There are 18 direct family members involved in running the huge enterprise, and founder John Campbell was knighted in 2016 for his services to farming and charitable entrepreneurship. Producing 1.4 million eggs a day this is no small farm and driving amongst some of its sheds with birds roaming the hills its clear to see how dedicated the family are.

Attending a Lion Code audit at the farm, there was a clear emphasis made on strict record keeping. The audit was conducted over two days and the vast majority of that time was spent on checking records with intense scrutiny. There was no room for a test to be conducted a day or two either side of when it was due, that would have incurred the issuing of a correctional action required notice. As the biggest egg producer in Scotland, it is no surprise that Glenrath Farms were very well prepared and fully compliant with the code. All of Glenrath's production sites are fully accredited under the Lion Code, and like Doug Wanstall, Karen believes that the Lion Code is a huge safeguard for the Scottish egg industry (Campbell, personal communication, 2016).

Chapter 4: The Netherlands

Dutch Egg Market

As one of the largest producers of eggs in Europe, the Netherlands is considered a world leader in egg production. Nestled between Germany and Belgium in north-west Europe, the Netherlands is a relatively small country, by land size, yet they are not to be underestimated in their agricultural ventures.

Known for its flat landscape, full of tulip fields, canals, lots of cyclists and picturesque windmills it was surprising to learn that the Netherlands is self-sufficient by 300% when it comes to egg production, and 240% self-sufficient in the broiler market (Clements, 2013).

While there is limited data on current consumption rates in the Netherlands, since 2009 consumption has been on the rise. According to the Dutch egg producers that were interviewed for this paper, the Dutch currently eat somewhere between 190-200 eggs a year (Tomeson, R, 2016). Whilst the exact number of birds currently laying in the Netherlands is not documented, in 2012 there were almost 42.8 million laying hens, producing approximately 10.3 billion eggs a year. The Netherlands are in an envious position as to their trade options. Being a small country on land size, with relatively flat country, freight is straight forward and access to markets close by. In 2013 the Netherlands contributed 41.4% of Europes total shell egg exports exporting a large majority of their eggs into neighbouring Germany (Windhorst, 2016).

Germany enacted a ban on conventional cages, three years before the rest of Europe, taking effect as of 1st January 2009. This saw a fall in egg production by 22.5% from 2000 to 2009 in Germany as farms converted from conventional cages to predominantly barn systems (O'Keefe, 2012). To meet the shortfall in the German egg supply, Germany had to import almost nine billion shell eggs, 5.8 billion of which the Dutch exported to Germany.

As the largest exporter of eggs globally the Netherlands are certainly leading the way in production and thus their food safety standards need to be explored and understood so as to provide qualitative information for use in our industry within Australia (Compassion in World Farming Statistics, 2013).

Dutch regulatory environment

In order to understand the Dutch regulatory environment some context is required. The Dutch government adopted an authoritative policy vision in 2005. In doing so they formulated strategic plans to improve the efficiencies of their regulatory systems. The hope was that they could reduce regulatory burden amongst industries and reduce the regulatory efforts that imposed heavy burdens on the industry and were in fact aimed at the poor performers in industries (Havinga, van Warden& Casey D, 2015).

The Dutch Ministry of Agriculture decided on a policy framework that centred round the idea of Oversight of Controls (OC) or Toezich op Controle. The policy attempts to consolidate the framework and relations between public and private regulators and the industry. This policy document is quite complex but for the purposes of this paper, it is important to note that the OC was formulated in an attempt to highlight the responsibility of the government for ensuring the quality of regulation and thus the requirement that the government formulate the requirements of regulation and the standards to which third party auditors will audit the participants to.

The poultry industry was the first to take up a new mode of regulatory cooperation under the OC. The potential for reducing inspections and regulatory complexities provided opportunities to significantly reduce time and cost implications for the industry.

In the Netherlands, a member of the European Union, all the EU regulations that apply to food safety and egg production also apply to the Netherlands. One of the ways that Dutch egg producers ensure they are compliant with all the regulations with regard to salmonella control is the Integrated Chain Control, referred to as the IKB - Integraal Keten Beheer – quality assurance certification.

IKB Accreditation

IKB Egg is a voluntary scheme that deals with all aspects of production of eggs, from primary producer through to packing stations. Certification with the program guarantees details surrounding quality, origin and methods of production of the egg. It is a requirement of Dutch retailers that any egg to be sold within the Netherlands in these retailers be an IKB accredited egg.

IKB accreditation also ensures that all the required standards and regulations with regard to salmonella control are met. Specifically, relevant for this paper, are the procedures

surrounding salmonella prevention. The IKB accreditation system is concerned with sampling and preventing two primary types of salmonella, Salmonella typhimurium and Salmonella enteritis.

Under the IKB accreditation laying hens must be sampled (Avined, 2015):

i. Between 22 and 26 weeks of age, and then every 15 weeks. At least two pairs of shoe covers need to be tested per hen house.

   This sampling is referred to as regular sampling done by the farmer. Regular sampling refers to routine samples taken by the poultry farmer or workers during their life span.

ii. At least 21 days before slaughter the farms vet must take regular samples of at least 2 shoe covers per hen house.

iii. Once a year one hen house must be officially sampled by the accreditation body.
   This testing is funded by the Animal Health Fund (the Diergezondheidsfonds). This fund is built from levies that poultry farmers pay and was established to assist in the fight against contagious animal diseases.

Where a positive test comes back there are strict regulations around how the flock and farm are to be managed. Firstly, the relevant bodies, including the farm, must be notified as soon as possible. Secondly, the farmer can either accept the positive test results or if they believe there might be an error they can request a verification investigation be run.

While the results are pending on a verification sample, the eggs produced by that flock must not be sold as shell eggs to the table egg market. They have to be marked with a separate stamp code and sold either into the processing industry or be destroyed.

If the verification samples come back positive for either SE or ST the farm is given an infected status, and for the life of that flock all eggs must only go into the processing market. The sampling at 15 weekly intervals is not required for the remainder of that flock, nor is the sampling prior to slaughter required. The flock will be slaughtered as an infected flock.

This approach is certainly no nonsense. The current research available in Australia suggests that salmonella will be ever present on poultry farms. To adopt an approach whereby a positive result results in an irreversible infected status is quite heavy handed. It is important to remember that the Netherlands export a huge portion of the eggs they produce and there

are huge economic justifications for ensuring that eggs produced in the Netherlands, and with the IKB accreditation stamp are of the safest quality.

Chapter 5: The USA

American Egg Market

The USA is the world's second largest producer of eggs, and with a population of over 320 million this is not surprising. It is also the world's second largest broiler meat exporter. In April 2017, the USA produced 7.5 billion table eggs (American Egg Board, 2017). This is a staggering number of eggs, more than Australia's yearly production!

Spread across a large geographical area, many states produce table eggs but more than 51% of the egg production in the USA comes from the five largest egg producing states; Iowa, Ohio, Indiana, Pennsylvania and Texas.

Layers on Hand and Eggs Produced – States and United States: During June 2016 and 2017

State	Table egg layers in flocks 30,000 and above		All layers		Eggs per 100 for all layers	
	2016	2017	2016	2017	2016	2017
	(1,000 layers)	(1,000 layers)	(1,000 layers)	(1,000 layers)	(eggs)	(eggs)
Alabama	1,504	1,277	9,119	9,071	1,852	1,853
Arkansas	3,885	3,631	13,769	13,582	1,987	1,995
California	11,563	11,356	12,085	11,962	2,346	2,381
Colorado	4,019	4,122	4,471	4,574	2,467	2,488
Florida	7,838	6,640	8,221	7,002	2,304	2,362
Georgia	9,569	9,706	18,779	19,354	2,084	2,102
Illinois	4,748	4,610	5,225	5,086	2,494	2,314
Indiana	29,238	31,266	30,214	32,090	2,347	2,459
Iowa	49,918	53,415	51,271	54,787	2,321	2,399
Maryland	2,479	2,678	2,647	2,843	2,410	2,438
Michigan	12,863	14,101	13,109	14,326	2,437	2,354
Minnesota	9,360	9,856	9,800	10,365	2,296	2,476
Mississippi	1,416	1,456	5,600	5,707	2,027	2,029
Missouri	7,187	6,585	10,646	10,216	2,420	2,402
Nebraska	9,094	7,928	9,202	8,036	2,418	2,516
New York	5,239	5,332	5,609	5,699	2,432	2,444
North Carolina	6,577	6,950	14,286	15,154	2,064	2,126
Ohio	31,956	29,174	32,816	30,098	2,337	2,406
Oregon	2,197	2,228	2,336	2,367	2,521	2,602
Pennsylvania	24,954	25,432	27,205	27,451	2,480	2,419
South Carolina	2,987	2,523	4,271	3,739	2,259	2,174
South Dakota	1,926	2,607	2,068	2,749	2,268	2,415
Texas	16,173	16,944	20,510	21,331	2,196	2,211
Utah	4,496	5,117	4,534	5,155	2,263	2,390
Virginia	1,194	842	2,944	2,645	2,164	2,238
Washington	6,577	6,796	6,742	6,961	2,382	2,548
Wisconsin	5,035	5,352	5,723	5,992	2,315	2,390
Other States [1]	22,952	23,455	31,940	32,408	2,242	2,161
United States	296,944	301,379	365,142	370,750	2,287	2,317

[1] Includes data for States not published in this table.

Figure 2: Chickens and Eggs statistics. Source: National Agricultural Statistics Service (NASS), Agricultural Statistics Board, USDA (2017)

Currently there are only 63 companies that produce more than 85% of the total production, all of which have more than a million laying hens and 15 of these companies have more than five million hens. The scale of the egg industry in the USA is quite confronting and is a very large contributor to their economy.

American egg consumption is on the rise; in 2016 it was 267.4 and 274.6 in 2017 which is a significant increase (American Egg Board, 2017). Perhaps explained by the fact that 90% of

Americans believe that eggs are a nutritious choice for breakfast and a large majority of that believing eggs are a better choice than cereal. In general egg sales in the USA are up 3.8% compared to the same period in 2016.

Being such a large industry, it is not surprising that there is a lot of money, research and support behind the industry. During the period of December 2014 through to June 2015 however, the American poultry industry had the worst Avian Influenza (AI) outbreak the country had ever experienced when more than 42 million birds were affected. The industry took a massive hit and although at the time of writing this paper the industry had recovered, it is certainly scarred from the events and aware of the huge risks AI poses to it.

The American egg market is largely focused around the caged production system, and their focus is on preventing and managing SE. In the USA, ST is not an issue.

American Regulatory environment

Federal

The regulation surrounding egg producing, packaging and processing in the USA is focused around prevention of SE. The regulatory system is complex and even those employed in the industry of regulating egg production seem to be confused. Attending the National Egg Regulatory Officials (NERO) meeting in San Antonia, Texas in early 2017, it was made evident that there is much uncertainty about the regulation of egg production throughout the USA.

At the federal level, there is The Egg Rule, which gets its legislative authority from 21 Code of Federal Regulations (CFA) part 118, which is administered and overseen by the US Food and Drug Administration (FDA).

The Egg Rule applies to any producer with 3,000 or more birds and places strict requirements on them in order to prevent SE. Any producer with more than 3,000 birds at one farm must be registered with the FDA within 30 days of becoming and egg producer (United States Food and Drug Administration, 2016).

The Egg Rule sets out several requirements the most important of which are below:

Pullets

- All pullets must be raised under SE-monitored conditions.
    - An environmental test must be conducted when the pullets are between 14 and 16 weeks old.

- If the test returns a negative result no additional testing is required until the birds are in lay and at 40-45 weeks of age.
- If the test returns a positive result, egg testing (see below) must be done within two weeks of the start of lay, and the pullet environment must be cleaned down and disinfected once they have moved onto their laying environment.

Biosecurity

- Steps must be taken to ensure that there is no introduction or transfer of SE into or amongst the hen houses. As a minimum, this must include:
  - Limiting visitors to the farm and into the sheds.
  - Preventing stray poultry, wild birds, cats or other animals from entering the sheds.
  - Employees must not keep birds at home.

Pest Control

- Steps must be taken to ensure that rodents, flies and other pests are kept at bay:
  - Use appropriate measures to control rodents and other pests.
  - Remove any debris or rubbish that may provide cover for rodents to live.

Cleaning and disinfection

- The sheds must be cleaned and disinfected wherever there has been a positive SE test at any point of the flock's life.
- If there hasn't been any positive tests, cleaning and disinfection is not required.

Refrigeration

- A cold chain must be established within 36 hours of lay.
- Any egg destined for the table market must be refrigerated at 7.2^{o}C (45F) or below, this includes during transport and in store when available for sale to the consumer.

Environmental Testing

- When the hens are between 40 and 45 weeks old a suitable sampling plan must be enacted, this depends on the type of housing in the sheds.
  - If the test results are negative, and your hens never undergo a moult then you do not need to perform any further testing on that flock.
  - If the results are positive then:

- The SE prevention plan must be reviewed and adjusted to ensure that all measures are being properly implemented.
- Egg testing must begin. (see below).

- 4-6 weeks after each and every induced moult, environmental sampling must take place.
  - The same steps take place for a negative or a positive test as described above.

Figure 3 is a good visual description of the sampling requirements under the Egg Rule.

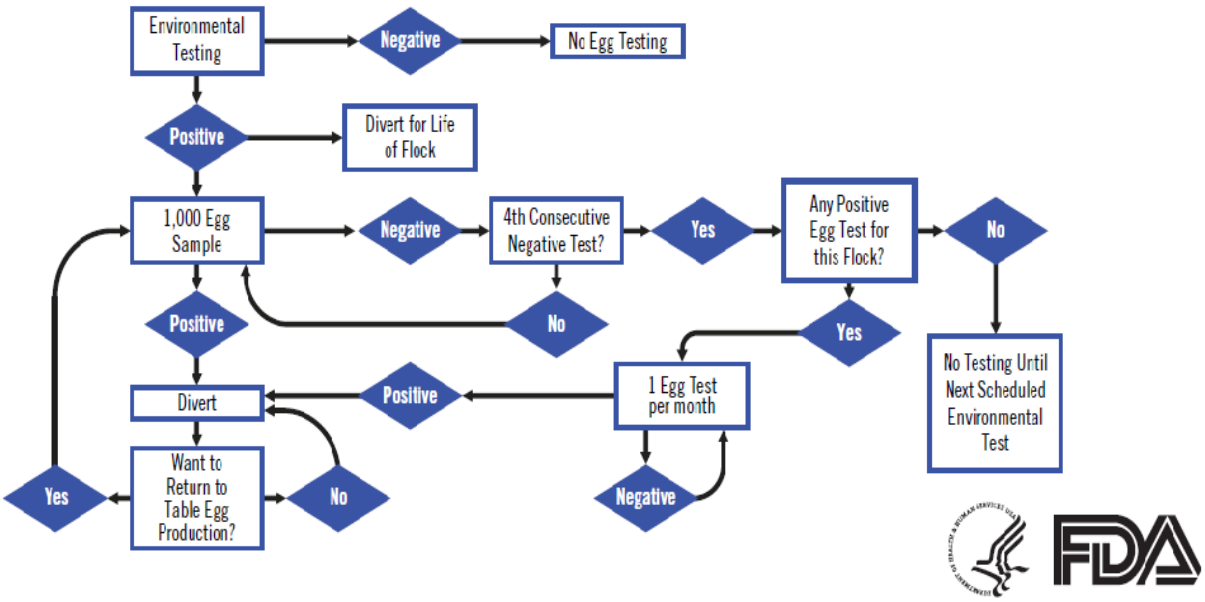

Figure 3: Requirements of the Egg Rule under the FDA. Source Code of Federal Regulations Title 21; Part 118 Production, Storage and transportation of Shell Eggs (The Egg Rule).

Egg Testing

Where an environmental test comes back positive egg testing must begin. Similarly, where a positive environmental test comes back positive eggs from the flock must be diverted to treatment for the life of that flock or otherwise begin egg testing.

Egg testing details:

If environmental samples come back positive:

- Eggs must be diverted to treatment for the life of the flock, or
- A minimum of 1,000 intact eggs that are representative of a day's production must be tested four times at two-week intervals, a total of 4,000 eggs; if all four tests are

negative no further egg testing is required and the eggs can return to the table egg market.

- If there is a positive egg test within these tests the eggs must be diverted to treatment for the life of the flock, if later there are four negative egg tests in a row eggs may return to the table egg but an egg test must be conducted monthly for the remainder of that flock's production life.
- There are strict requirements around labelling pallets, eggs, or casing that are being used to carry eggs that are diverted for treatment.

Record Keeping

- A written SE prevention plan must be in place.
- Documentation detailing that pullets were raised under SE monitored conditions.
- Detailed documents outlining all activities to do with SE prevention that takes place on the farm including but not limited to:
    - Biosecurity measures that are in place.
    - Rodent and pest control measures.
    - Cleaning and disinfection procedures performed if cleaning was required.
    - Records of refrigeration details.
    - Any details to do with environmental and egg sampling.

Californian Egg Law

States are at liberty to enact their own legislation that requires more stringent standards than the Egg Rule. The Egg Rule is the minimum requirements for egg producers that have 3,000 or more chickens. California, as the largest egg consumption state, has decided to enact stricter and more rigid requirements on any egg producer within the State. Similarly, these requirements are placed on to any producers wishing to sell eggs within California.

The Egg Safety and Quality Management (ESQM) Program which is part of the Meat Poultry and Egg Safety Branch of the Californian Department of Food and Agriculture, is the regulatory body for shell eggs and egg products produced, shipped or sold in California. The purpose of the ESQM is to ensure that eggs sold in California are not only safe but also of known origin and quality. Any eggs to be sold or produced in California must be produced by hens that have at least 748cm2, enough room to for each bird to be able to stand up, lie

down, turn around, and fully extend their wings without touching another hen or the edge of a cage. Vaccination is also mandatory. Birds must be vaccinated twice, once with a live vaccine and once with a killed vaccine

Analysis

SE is of major concern to the American egg industry, as is avian influenza. With this in mind it is very interesting to note that cleaning down of houses is only required when there is a positive SE test, nor is any vaccination required of the birds. The FDA has published material indicating that the effectiveness of vaccines has not yet been sufficiently proven to negate any of the other requirements under the Egg Rule (US Food & Drug Administration, 2010). The FDA believe that vaccination is one part of an effective SE prevention plan when all other elements of the Egg Rule are also in place. The FDA believes that if producers have identified that vaccination is an appropriate measure for their particular farm, then they encourage the use of the program [vaccination program] as an additional SE prevention measure (US Food & Drug Administration, 2010).

Case Study: Nero

In San Antonio, Texas, from February 26 – March 1, 2017, the National Egg Regulatory Officials conference was held. After three days with the USA's leading egg regulators, producers and researchers it was made clear that the American egg industry is quite different to Australia.

Firstly, their production systems are largely focused around conventional cage systems. This, however, is changing. Led by the over 150 large retailers, such as McDonald's and Walmart, the USA is looking like it will need to be cage free by 2025 in its egg production. This is going to cost the industry somewhere in the realm of US $ 5-8 billion. Not only this, but currently the industry is not in a good position to move to a cage free system.

The level of understanding about bird health and behaviour outside of cages is very limited. It was very surprising to learn that the lead regulator for the Federal government of the USA did not know what dust bath holes were. The regulator was anecdotally telling a story about a visit to a 'cage free' farm, in an attempt to understand what might be required to start the planning of this enormous shift in the industry, and a photo was placed on the projector of a hole that had been created by the chickens for dust bathing. People in the room – which was filled with more than 100 of the country's leading producers, researchers and regulators –

were asked if anyone knew what it was – no one did. There were answers about nutrition deficiency, predators digging them, and there was genuine shock when they were informed – as part of the author's presentation – that these holes are dug by the chickens to engage in the natural behaviour of dust bathing. This lack of general understanding of flock behaviour outside the cage is an indication of just how much the industry has to learn if a move to cage free is really around the corner.

Secondly, and relatedly, the American poultry industry is highly concerned about SE and it is also highly susceptible to avian influenza. However, they do not seem to have any major issues with ST. There was some discussion during the conference about this and Oscar Garrison, Vice President of Food Safety Affairs for United Egg Producers, said that the reason that ST is not an issue is because SE is an issue. That is that if they combated SE, they could face issues of ST coming in to take its place. There was also chatter about whether a move to cage free will see an increase in outbreaks of ST.

The conference was highly informative, and some meaningful connections were made with very interesting and educated people, including fascinating producers.

Case study: Karyn Kreher's Farm Fresh Eggs, Clarence, NY

Figure 4: Karyn Kreher of Farm Fresh Eggs, and her family. Source: Karen Kreher.

Kreher's Farm Fresh Eggs is a family farm, run by 17 family members. They have been in egg farming since 1924 and are committed to producing and marketing safe, premium quality eggs within New York State. Karen is the Director of Food Safety and Quality Assurance and is responsible for making sure that the brand stays true to its core values. The Kreher family

have many contract farms that produce eggs for them and Karen really enjoys her role in the family business. Karen studied poultry science at University and is well educated in the world of chickens and egg production.

Figure 5: Farm Fresh Eggs aerial view. Source: Karen Kreher

As part of their food safety assurance, Kreher Farm Fresh Eggs employs a USDA grader/inspector at each of their packing facilities. This ensures that they are compliant to the highest level with quality assurance and food safety regulations.

Case study: Kaliko Orian, Kaliko Farms, California

Kaliko Orian is a small egg producer based in California, not far from Los Angeles. Kaliko owns and operates Kaliko Farms, where she and her team produce free range eggs, and is unregulated under the FDA as she has 1,000 hens. Kaliko hand collects all her eggs, and by self-admission is a backyard flockster who is doing her best to learn all she can to build not only her business but the industry as a whole.

Avian influenza is a real risk to the American poultry industry and whilst in attendance at the NERO conference, there was a real sense that people like Kaliko are in danger of putting the whole industry at risk to things like AI. Kaliko presented at the conference and indicated a real desire to learn from the industry, and she asked those in attendance to please consider providing educational opportunities for small producers like herself.

Figure 6: Kaliko Orian of Kaliko Farms at her farmers market. Source: Kaliko Orian

Figure 7: Eggs from Kaliko Farm. Source: Kaliko Orian

Kaliko was a fascinating businesswoman, telling stories about spending hundreds of dollars on vet bills for one hen and raising eyebrows when she explained she sells her eggs for $12 a dozen. Her eggs are multi-coloured and produced by a variety of breeds. Her hens are fed a non-genetically modified, corn free, soy free, are free to roam on pastured paddocks. She sells her eggs to local grocery stores and at farmers markets. Her hens only produce about 50% of the time, with her average layer laying only 180 eggs a year.

One story she recalled involved a 3,200-kilometer round car trip, with a two-day old chick in her pocket. The chick was injured and she had to take it to a vet in Eugene, Oregon. These

are the kinds of efforts this small producer has to go to in order to protect her small flock. The chick did survive and is now producing eggs for her.

The concerning part about this case study is that Karen was relatively uneducated about the food safety risks associated with egg production, not to mention other general production concerns. Although she was extremely willing and hopeful of learning how to better improve her business, and her customers experiences with her product, she is effectively an egg producer, producing and selling eggs for a premium, with very little food safety measures in place.

Conclusion

The Australian egg industry is one filled with passionate farmers, world class researchers, and consumers who love our product. That being said, the industry also has a reputation as being connected with many food poisoning outbreaks. Simply put, eggs often get a bad rap when things go wrong in commercial kitchens.

Currently, regulation of egg production in Australia is minimal. There are varying local and state level requirements but no federal legislation that is applied consistently or on a mandatory basis throughout the country. All the countries studied for this report do have minimum regulatory standards that apply to commercial egg producers and all countries have further schemes that go above and beyond the minimum.

In Australia, there is a voluntary accreditation scheme, run by Australian Eggs, that provides requirements and adherence to best practice standards across a variety of different aspects of production, including hen welfare, food safety, the environment and egg grading. These are, however, completely voluntary and may not provide a meaningful advantage to being accredited with the system.

As is seen from countries such as the UK, the USA and the Netherlands, a minimum standard of production is vital to ensuring the security of the egg industry as a whole. What is needed in Australia is a consistent, detailed and mandatory set of minimum requirements for anyone wishing to produce eggs for a commercial outcome, regardless of the scale of the operation.

The industry needs to better coordinate with regulators and develop a set of requirements that are applied equally throughout the country. In doing so, commercial advantage can be gained by those producers exceeding minimum requirements and adopting best practice, while consumers can be assured that no matter who or where they buy eggs from, they are purchasing a safe product.

Recommendations

The following opportunities are identified for consideration by the Australian egg industry and the Australian food service industry to drive industry-wide best practice for the production and handling of eggs:

- Consistent mandatory minimum standards should be considered for all producers wishing to sell eggs to anyone, whether that be through Australian Eggs accreditation or some other regulatory system. This way, all egg producers must have a basic understanding of producing a safe food product, and in turn the industry as a whole is protected.
- Support and education of regulators across the country should to continue in a manner that is uniform and robust. Regulators and health officials need to understand that currently, the existence of salmonella on-farm in and of itself is not an issue and that best practice cannot necessarily eliminate salmonella on farm. The issue for food poisoning outbreaks occurs when eggs are mishandled by either food service providers or egg farmers failing to maintain appropriate minimum standards.
- Food safety training should be provided to restauranteurs, chefs and anyone preparing or selling food to the public with particular attention paid to the use of raw egg products and the cross-contamination risks associated with doing so.
- Producers that provide a safe and fit for purpose product should not be held liable for an end user mishandling the product.
- In the event of food poisoning outbreaks, thorough investigation of both on-farm practices and in-house food handling procedures should to occur. If it is evident that the egg farm is complying with best practice, which would be evident through accreditation, or compliance with regulations, the farm should not receive any negative outcomes.
- The industry should further educate the end user. The consumer needs to understand that eggs in and of themselves are almost always an extremely safe product. They need to be able to easily and distinctively recognise those producers that are adhering to best practice, and what purchasing a product that is not compliant with best practice means. This could be done through educating the end user on the importance of buying an accredited product.

References

American Egg Board, Industry Overview (2017) http://www.aeb.org/farmers-and-marketers/industry-overview

Anon (2016) Industry Vet. Conversations with Australian leading poultry vet, whilst conducting research for this paper. He wished to remain unnamed.

Australian Consumer Law (2017). Australian Consumer Law (Free Range Egg Labelling) Information Standard 2017.

Australian Egg Corporation Limited, (2016) Annual Report https://www.aecl.org/assets/About-us/Annual-Report-2016.pdf

Australia New Zealand Food Standards Code - Standard 3.2.1 - Food Safety Programs

Avined, translated using web-based translator, Types of Sampling https://www.avined.nl/basic-page/typen-monstername

Campbell, K. (July 2016) Glenrath Farms, Scotland.

Centers for Disease Control and Prevention, *Salmonella* Atlas. https://www.cdc.gov/salmonella/reportspubs/salmonella-atlas/serotyping-importance.html

Clements, M (2013). What lies behind the success of Dutch poultry and egg production? https://www.wattagnet.com/articles/21900-what-lies-behind-the-success-of-dutch-poultry-and-egg-production?v=preview

Code of Federal Regulations Title 21; Part 118 Production, Storage and transportation of Shell Eggs (The Egg Rule) (came into effect 2009.)

Compassion Foods, 2012, Egg Production in the EU: https://www.compassioninfoodbusiness.com/media/5789260/laying-hens-egg-production-in-the-eu.pdf

Department of Agriculture and Water Resources, Australia

Egg Info UK, Industry Data https://www.egginfo.co.uk/egg-facts-and-figures/industry-information/data

Egg Info UK, British Egg Industry Council https://www.egginfo.co.uk/british-lion-eggs/british-egg-industry-council

Encyclopaedia Britannica, Egg https://www.britannica.com/topic/egg-food

Garrison, O. (February 2017) Vice President of Food Safety Affairs, United Egg Producers, USA.

Havinga T, van Warden F and Casey D, (2015) *The Changing Landscape of Food Governance: Private and Public Encounters.*

Hewson K A and Chia R (2016). Australian Egg Corporation Limited, *Through Chain Salmonella Risk Identification*.

Inall, D. (January 2017). Senior Vice President, United Egg Producers, the USA.

Intermedia Group, (2017) Respondent Summary, Eating out in Australia Report.Intermedia Group Pty Ltd http://www.the-drop.com.au/wp-content/uploads/2016/11/EatingOutinAustralia_2017_Respondent-Summary.compressed.pdf

Kreher, K. (February 2017) Farm Fresh Eggs, Clarence, New York.

O'Keefe, T (2012). Cage ban shrinks the German egg industry http://www.wattagnet.com/articles/11805-cage-ban-shrinks-the-german-egg-industry

Orian, K. (February 2017) Kaliko Farms, California.

National Agricultural Statistics Service (NASS), (2017). Agricultural Statistics Board, United States Department of Agriculture (USDA)2017. *Chickens and Eggs* http://usda.mannlib.cornell.edu/usda/current/ChicEggs/ChicEggs-08-22-2017.pdf

Spitzer H, (2015), *An Analysis of Bacterial Contamination of Chicken Eggs and Antimicrobial Resistance* http://digitalcommons.csbsju.edu/cgi/viewcontent.cgi?article=1076&context=elce_cscday

The British Egg Industry Council; British Lion Code of Practice (came into effect 1998), https://www.egginfo.co.uk/british-lion-code-practice

The Top Five of Anything https://top5ofanything.com/list/70aa0666/Countries-that-Consume-the-Most-Eggs

Tomeson, R. (July 2016) Tomesen Pluimveehoud, Doetinchem, Netherlands

United States Food & Drug Administration, Guidance for Industry: Questions and Answers Regarding the Final Rule, Prevention of Salmonella Enteritidis in Shell Eggs During Production, Storage, and Transportation (2015). https://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/Eggs/ucm313728.htm#Intro

Wanstall, D. (July 2016) Bank Farm Poultry, England.

Windhorst, H W (2016). The Netherlands – the leading country in European egg and poultry meat exports http://zootecnicainternational.com/focus-on/netherlands-leading-country-european-egg-poultry-meat-exports/

Plain English Compendium Summary

Project Title:	Food safety, whose responsibility is it? Egg safety, should the farmer be solely responsible?
Nuffield Australia Project No.:	1601
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Objectives	• Understand the current egg climate in Australia; the rules and regulations around egg production, and the use of eggs in the food service industry. • Identify countries that are leading the way in egg regulation and research as to food safety • Identify and understand how those countries practices may or may not work in the Australian context • Identify opportunities for consideration by the Australian Egg industry, and the Australian food service industry as to best practices for the production and handling of eggs.
Background	Green Eggs was implicated in a food poisoning outbreak in 2014, when a burger restaurant that it supplied, provided contaminated mayonnaise to its customers. This sparked a desire to research and better understand Australia's food safety and egg production regulation.
Research	The author travelled to the United Kingdom, the United States of America and the Netherlands to undertake the study, alongside field research.
Outcomes	There are some ways that the Australian egg industry could further protect itself going forward in to the future. Research gathered from this study indicates that the Australian egg industry could better coordinate with regulators and develop a set of requirements that are applied consistently throughout the country as well as being appropriately monitored and enforced. Similarly, much work is needed to educate regulators and food service providers in the nature and risks associated with mishandling eggs and cross- contamination from other food products. Currently, regulation of egg production in Australia is fragmented. There are varying local and state level requirements but no federal legislation that is applied equally or mandatorily throughout the country.
Implications	Consistent mandatory minimum standards should be considered for all egg producers wishing to sell eggs with compliance demonstrated through either a quality assurance scheme or monitoring and enforcement. If action is not taken the Australian Egg industry continues to face huge economic reputational damage if and when food poisoning outbreaks occur.
Publications	Verbal presentation, 2017 Nuffield National Conference, Darwin, NT