# LIVING WITH THE RISK OF BIRD FLU

April 2023

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# Preface

**Bird Flu, or Avian Influenza (AI), continues to pose a significant threat to bird health and welfare and sustainable poultry production in the UK and globally. The UK poultry industry is worth c£3.6 billion at the farm gate level. Total consumption of poultry meat is close to the total for beef, lamb and pork combined.**

UK poultry systems are highly efficient converters of feed inputs to nutritious protein for human consumption that is affordable for most consumers. In addition, egg production provides another highly nutritious food and eggs are a key ingredient for many readymade food items. Consequently poultry has a key role in UK food production, providing an important source of protein in human diets.

Disease outbreaks and health challenges are critically important to control, to maintain good animal welfare and to run profitable businesses. Bird Flu poses a considerable threat to this important food sector. It is highly contagious with a very high rate of mortality. Evidence of this is apparent from reports of unusually high death rates in wild bird populations. That in turn raises the level of risk to farmed poultry from wild birds.

Where policy has been containment and elimination of the disease, the most effective control measures require slaughter of whole flocks to prevent spread of infection. This can be devastating for both large-scale producers and backyard flock owners. Prevention measures for large-scale producers require rigorous biosecurity procedures, something that is not easily applied to flocks with access to the open air or smallholder flocks where wild birds can pass on the disease.

One viewpoint is that Bird Flu is now here to stay. Where previously we had outbreaks in the winter, with a respite in the summer as weather conditions warmed and slowed transmission, that is now not happening. Outbreaks are occurring throughout the year, in more places, more often. So how do we farm poultry in a way that does not compromise animal welfare unduly while farming in more sustainable ways?

CIEL commissioned this report to address this question. To this end, we have worked with a leading UK expert in this area. Professor Lisa Boden of the University of Edinburgh and her colleagues have provided a summary based on evidence from scientific studies and information collected in the UK and overseas on the monitoring and control of Bird Flu. This information has informed recommendations on how the industry can move forward against a backdrop where containing and eliminating this disease is becoming more of a challenge.

This report is intended to inform debate about continuing to produce poultry food products in the face of the risk from Bird Flu.

We need to tackle Bird Flu if we are to continue producing poultry food products. Effective policies that support sustainable poultry production are also required. Bird Flu has implications for food security and the affordability of high-quality protein in our diets. With evidence of transmission to other species, we also need to be aware of the implications for animal and human health.

**Dr Mark Young**
**Head of Innovation, CIEL**

# Executive summary

This report has been developed to help commercial poultry and game bird producers, small-scale poultry keepers and other bird owners achieve a better understanding of:

- The likely impact on poultry production of Avian Influenza (AI) in terms of productivity, product quality, efficiency and carbon footprint
- Ways to minimise the effects of AI on UK poultry production systems with reference to preventing and controlling outbreaks and mitigating impacts
- Mitigation strategies for fully housed production systems versus free-range systems
- Actions the sector could take to reduce the impact of AI

The report identifies a number of critical challenges associated with AI and the UK's outbreak response activities. These include:

- The severe negative impacts of the disease on animal health and welfare, poultry producers' wellbeing (including livelihoods), international trade and the environment
- The potentially serious threat to human health if AI became able to infect people more easily and spread from person to person
- The formal outbreak response may not be well known to all involved and the activities to prevent and control the disease (including culling) are stringent and onerous for poultry keepers
- All involved may not be aware of all available and accessible resources on AI, making it potentially challenging and time consuming for them to make a critical appraisal of the evidence and prevent spread of misinformation
- There are numerous uncertainties linked to risk management structures e.g., variability in biosecurity implementation between farms, awareness of industry, government guidance and regulations among small-scale poultry keepers, and the differential impacts of regulations on different parts of the poultry sector
- Although vaccination may prove to be an important aspect of strategies for sustainable control of Highly Pathogenic Avian Influenza (HPAI) in the future, it is not currently available in the UK due to technical and trade barriers
- While the commercial poultry sector has opportunities to influence government decision making, the same opportunities for engagement may not be available to small-scale or backyard poultry keepers

Potential strategies to respond to these challenges are proposed for further exploration with stakeholders to encourage and ensure good practice and innovative transdisciplinary solutions for long-term resilience and adaptation:

1. Strengthen existing science-policy-industry networks to include stakeholders and local knowledge in outbreak decision making processes
2. Improve data collection on location and biosecurity practices for bird keepers with fewer than 50 birds
3. Work collaboratively with producers to optimise biosecurity recommendations to improve resilience to increased and sustained infection pressure from infected wild birds
4. Coordinate risk communication strategies to improve engagement and understanding of risks across backyard and commercial sectors

The report concludes by proposing a number of core principles to improve ways of working together:

- Inclusive participatory approaches to facilitate collaboration with all stakeholders and integration of local knowledge into decision making pathways
- Development of locally appropriate and acceptable interventions
- Trust-building exercises
- Active and empathetic listening to diverse voices and opinions
- Ethical (and therefore equitable) approaches to risk communication and management across all stakeholders within the poultry sector

## Disclaimer

The information in this report refers to the 2022 HPAI outbreak in the UK and is therefore based on information available as of February 2023. The outbreak situation in the UK is rapidly changing and some of the data included may become outdated. For current up-to-date information about AI or other infectious disease threats affecting the poultry sector, we recommend visiting the Scottish Government, Department for Environment, Food and Rural Affairs (Defra), Department of Agriculture, Environment and Rural Affairs (DAERA) or the Animal and Plant Health Agency (APHA) websites for further information.

# Significance of an Avian Influenza outbreak

## What is Avian Influenza?

AI is an infectious disease that primarily affects birds, but can occasionally cross species barriers and infect mammals, including humans.[1]

AI is caused by an Influenza A virus that can be classified by its surface proteins, Hemagglutinin (H) and Neuraminidase (N).

There are 16 known subtypes of H proteins and 9 subtypes of N proteins that infect birds and these can combine to form numerous viral strains, such as the H5N1 subtype[2] causing the current outbreak in Europe. Some subtypes such as H5 and H7 are notifiable, which means there is a legal obligation to report suspicion of disease to the authorities. As with influenza viruses which infect humans, influenza viruses infecting birds evolve over time, with the potential to change the severity of the disease or infect new species.

The virus can be detected in samples taken from animals or the environment and can be quickly identified through tests that either identify the specific immune response to the virus, specific particles of the virus or the virus itself.

AI can also be characterised by the type of clinical signs it causes in birds. Low Pathogenicity AI (LPAI) is accompanied by minimal, if any, signs in infected birds while High Pathogenicity AI (HPAI) often results in severe clinical signs and potentially high mortality rates.[1] While HPAI is considered to be of greatest concern, LPAI with the H5 and H7 subtypes is still notifiable as the virus can mutate in infected birds and other animals, converting to HPAI.[3] The switch from LPAI to HPAI has been confirmed in chickens, turkeys and ostriches. The age of the bird, the size of the farm, and the farm type (e.g., free-range or backyard) has not been found to play a role in the emergence of HPAI.[3]

## How does the virus spread?

Global spread of AI is primarily through wild bird migration and movement of undetected infected poultry, other susceptible birds, poultry products/by-products or people. Typically, the initial incursion of the virus into the UK is through direct or indirect contact with wild birds. Waterbirds belonging to the order Anseriformes (mainly ducks, geese, swans) and Charadriiformes (gulls, terns, shorebirds) are often not severely affected by the virus and therefore those species play an epidemiological role as reservoirs for the disease.

AI outbreaks can occur at any time in the year, but a seasonal increase in Europe has been observed historically, coinciding with southwest/westward autumn migration and large local waterbird aggregations during wintering,[4] and with lower temperatures increasing the survival of the virus in the environment. Despite this seasonal pattern of infection, migratory wild birds are not the only source of infection for poultry. Infected migratory wild birds can infect resident wild bird species, domestic poultry, or other captive birds, resulting in local transmission.[5,6] H5N1 infections have also been recorded in mammals such as red foxes, Eurasian otters and seals.[7]

## Why is maintaining disease freedom important?

Infection with HPAI viruses is included in the World Organisation of Animal Health (WOAH) list of notifiable diseases[8] due to its severe consequences for animal (and potentially human) health and the potential for international spread. As for all notifiable diseases, all WOAH member states must comply with international regulations on reporting of AI and health standards for international trade in poultry and poultry products. The severe and wide ranging impacts of AI are listed in **Table 1**.

**Table 1.** Impacts of AI

| Potential impact (Depending on subtype) | Evidence and uncertainty |
|---|---|
| Productivity | HPAI impacts poultry production resulting in up to 100% mortality due to disease[9] and culling for disease control. Reduced production may lead to shortages of poultry products and price increases for consumers,[10] with HPAI outbreaks as a contributing factor to egg shortages reported in the UK in 2022.[11] The Department for Environment, Food and Rural Affairs (Defra) relaxed the rules on the sale of previously frozen seasonal poultry products in late 2022 to allow farmers breeding turkeys, geese, ducks or capons for their meat to slaughter the birds early and freeze the meat for sale during December when demand is high.[12] |
| Market access and risks to the supply chain | Due to the potential for AI spread through cross-border movement, detection of AI can result in a temporary halt to international trade and significant economic loss.[1] The UK seeks to maintain disease-free status to ensure that international trade can continue unimpeded.[13] In the event of an outbreak, compartmentalisation, which separates commercial birds from all other wild birds and poultry through high levels of biosecurity, is another way for trade to continue.[14,15] Consumer confidence in the safety of poultry products can also be impacted negatively by HPAI outbreaks, affecting both domestic and international markets.[16,17] |
| Zoonotic risk | People can become infected with AI viruses, potentially resulting in severe disease or even death. Human infection is rare and usually occurs in people who have been in close contact with infected birds or contaminated environments.[18] Suitable Personal Protective Equipment (PPE) is required by the UK Health and Safety Executive (HSE) and should be worn at all times by workers in a potentially infected environment.[19] In the UK, public health teams provide support in outbreaks of HPAI and will contact poultry workers who may have been exposed for follow up and provide antiviral treatment if necessary. The risk of infection from handling or eating properly cooked and stored poultry meat or eggs is very low.[20,21] |
| Pandemic potential | Person-to-person spread of AI has not been reported at present, but there is concern that AI, if introduced into the human population from birds or via pigs, could recombine with human or swine influenza virus to create a new, and potentially pandemic, human flu strain,[22,23] as in the case of the 1918 pandemic.[24] Transmission from mammal to mammal has been reported in mink, raising concerns about potential public health implications.[25] |
| Product quality | AI is unlikely to impact product quality directly as products from infected birds are not suitable for human consumption. |
| Environmental impact | Culling of poultry infected with AI results in protein wastage.[1] Carcass management may result in environmental contamination if not properly managed.[26,27]<br><br>The link between animal disease and increased greenhouse gas (GHG) emissions has been established in other livestock sectors.[28] Despite the current lack of evidence for a similar association between health and carbon footprint in the poultry sector, a similar association may exist. |

## What happens in the event of an outbreak?

The steps which occur in the event of an outbreak are outlined in **Figure 1**.

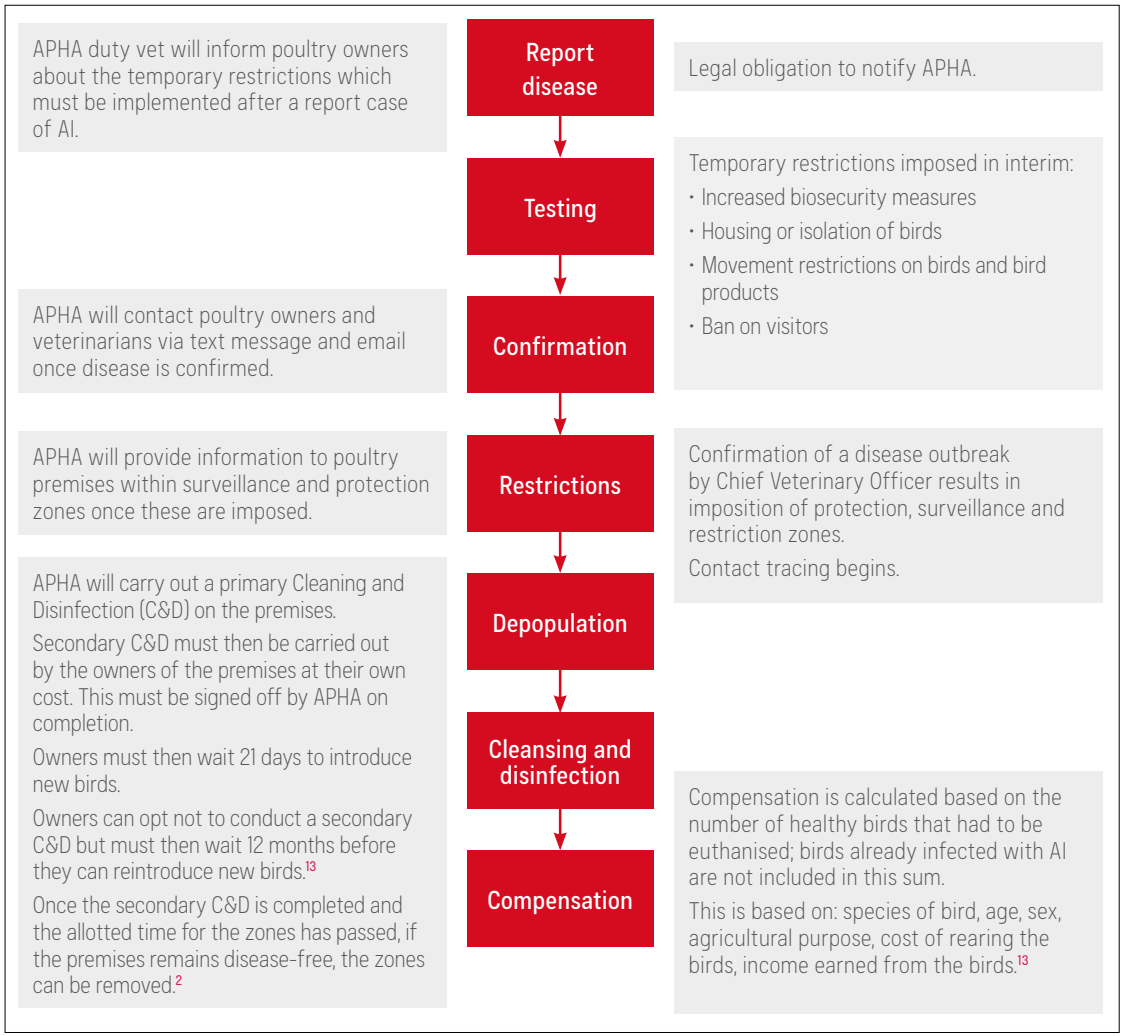



**Figure 1.** What happens in the event of an AI outbreak (summarised from the Notifiable Avian Disease Control Strategy for Great Britain)[2]

Both commercial and backyard poultry flocks can be affected by HPAI outbreaks. Strict biosecurity is essential on all types of holdings to prevent disease. However, the financial impact of an outbreak is greater for commercial holdings due to losses resulting not only from the disease, but also resultant trade and market impacts for the industry as a whole. This has resulted in tensions between commercial and backyard poultry sectors. There is a perception that the likelihood of infection is higher in backyard flocks due to lower biosecurity standards.[29,30]

However, a higher proportion of infected flocks are in commercial settings compared to backyard settings (60% commercial and 40% non-commercial).[31]

### Key challenges

- AI has severe, negative impacts on animal health and welfare, human health, poultry production, international trade and the environment
- The formal outbreak response may not be well known to all stakeholders
- Stringent disease prevention and control measures are required to help prevent the disease and its impacts

# Situation update

The UK and other European countries have been experiencing a major AI outbreak since 2021 with highly pathogenic subtype H5 viruses. In Europe, the outbreak has been classified as the worst ever in the region. Until the severe outbreak in the 2021/22 season, AI had occurred sporadically in Great Britain (GB) with the arrival of migratory birds in autumn and winter and cases on poultry holdings. In the summer of 2022, infection persisted in resident wild birds, including breeding seabirds, with large-scale wild bird mortality observed. HPAI, H5N1 subtype, is the predominant subtype isolated from the UK during the current season to date.[32] Analysis has demonstrated that HPAI virus is constantly mutating and evolving, and that, so far, the HPAI strains detected in the UK have likely originated from migratory wild birds arriving from Europe.[33] Both the frequency and severity of HPAI outbreaks have increased, justifying planning for living with an elevated AI risk.

Between 1 October 2022 and 27 February 2023, GB reported 174 confirmed outbreaks in poultry and other captive birds (England: 147; Scotland: 21; Wales: 5; Northern Ireland: 1). The most up-to-date numbers of confirmed cases are provided by the Animal and Plant Health Agency (APHA). APHA also reports confirmed cases in wild birds.

Recommendations to enhance stringent biosecurity measures have been made by Defra and a housing order has also been imposed on poultry premises in England and Wales. As of February 2023, there is no requirement to house birds in Scotland; however, this is being kept under constant review. The UK Government is taking action to update the compensation scheme for farmers and explore further avenues of eradicating this virus, such as the development and use of vaccines.[12]

# Promoting awareness

EFSA (European Food Safety Authority) concluded on 30 June 2022 that "the observed persistence of HPAI (H5) virus in wild birds since the 2020 – 2021 epidemic waves suggests that the virus may have become endemic in wild bird populations in Europe".[34] The UK Government and devolved administrations are actively investigating whether HPAI will continue to circulate in the wild bird population beyond the traditional 'season' and the impact this may have on the likelihood of new incursions onto commercial and backyard flocks.

After prevention through biosecurity, vigilance and early detection are also cornerstones of disease control because the faster we detect it the better the chances of halting it from spreading further.

Early detection is a shared responsibility across all poultry producers, irrespective of holding size or production system. Research indicates that some backyard producers may not be fully aware of the risk that wild birds pose to backyard and commercial flocks[29] and their legal responsibilities with respect to early detection, and safe disposal procedures of dead poultry to minimise risk of secondary AI spread.[35] Effective cooperation between commercial holdings and government in reporting and responding to outbreaks is essential, and compliance is high.


*"When there's an outbreak, you're dealing with relatively few people and there's a company structure there so you've got points of contact. The compliance is pretty high once there is an infected premises and government steps in."*

Researcher and industry consultant

## How to detect and report AI?

Government web pages provide useful guidance about early detection of AI (and summarised below in **Table 2**).

**Table 2.** Signs of AI in birds

| Checklist: Signs of disease (summarised from Defra guidelines) | |
|---|---|
| **LPAI** | **HPAI** |
| · Often no signs | · Sudden death with mortality rising rapidly up to 100% in some species |
| | · Diarrhoea |
| Occasionally: | · Regurgitation |
| · Mild respiratory signs | · Respiratory difficulties, including mouth breathing, nasal snicking, sneezing, gurgling or rattling |
| · Diarrhoea | · Discharge from the mouth, nose, ears, or vent |
| · Loss of appetite | · Open sores |
| · Reduction in egg production | · Swelling and purpling discolouration of the wattle and comb |
| | · Behavioural or locomotive abnormalities |
| | · Eating less than usual |
| | · Sudden increase/decrease in water consumption |
| | · Shaking of the head or body |
| | · Stop or reduction in egg production |

## Where can you find other sources of information about the outbreak?

Reliable information about AI can be obtained from the sources listed in **Table 3.** This is not a comprehensive list of all resources available, but the sources listed provide useful information about the current AI situation in the UK and internationally.

**Table 3.** Useful sources of information on AI

| Purpose | Type of information | Source |
|---|---|---|
| General information | Information on AI, prevention, and biosecurity | Animal and Plant Health Agency (APHA) |
| | | Scottish Government |
| | | Welsh Government |
| | | Department of Agriculture, Environment and Rural Affairs (DAERA) |
| Current disease situation | Interactive map of AI prevention zones and high risk areas | Animal and Plant Health Agency (APHA) |
| | International HPAI situation | World Organisation for Animal Health (WOAH) |
| Human health | Advice on how AI spreads and how to detect it in humans | NHS |
| | Information regarding AI in humans | UK Health Security Agency (UKHSA) |
| | Resources for what to do if exposed to AI | Health and Safety Executive (HSE) |
| Management | UK response plan for AI | GOV.UK |
| | Updates on AI as it pertains to poultry meat industry | British Poultry Council (BPC) |
| | Updates on AI as it pertains to egg industry | British Egg Industry Council (BEIC) |
| Compensation | Resources for compensation due to animal diseases | Animal and Plant Health Agency (APHA) |

**Table 4.** Sources of support for farmers affected by AI

| AI can affect bird keepers in different ways. The organisations listed below can provide emotional, practical and financial support for current or former agricultural workers: | |
|---|---|
| **England and Wales** | Royal Agricultural Benevolent Institution (RABI)<br>Free helpline: 0808 1234 555 |
| **Scotland** | Royal Scottish Agricultural Benevolent Institution (RSABI)<br>Free helpline: 0800 188 4444 |
| **Northern Ireland** | Rural Support<br>Free helpline: 0800 138 1678 |

**Key challenge**

– Ensuring that all poultry keepers are aware of where to access relevant and reliable information. A list of reliable sources of information is provided to ensure that all poultry keepers and other stakeholders are able to access the most current, evidence-based information about AI

# Assessing risk

## Perceiving risk

There are differences in risk perceptions within the UK poultry sector, which may result in differences in risk-based behaviours, farming practices and uptake of advice and relevant interventions. For example, backyard producers may underestimate the risk of AI outbreaks that arise due to contact between wild birds, other species such as rodents which may carry the virus, and their birds/flocks, and/or they may not fully appreciate the impacts on commercial producers if their backyard flocks are infected with HPAI.[29]

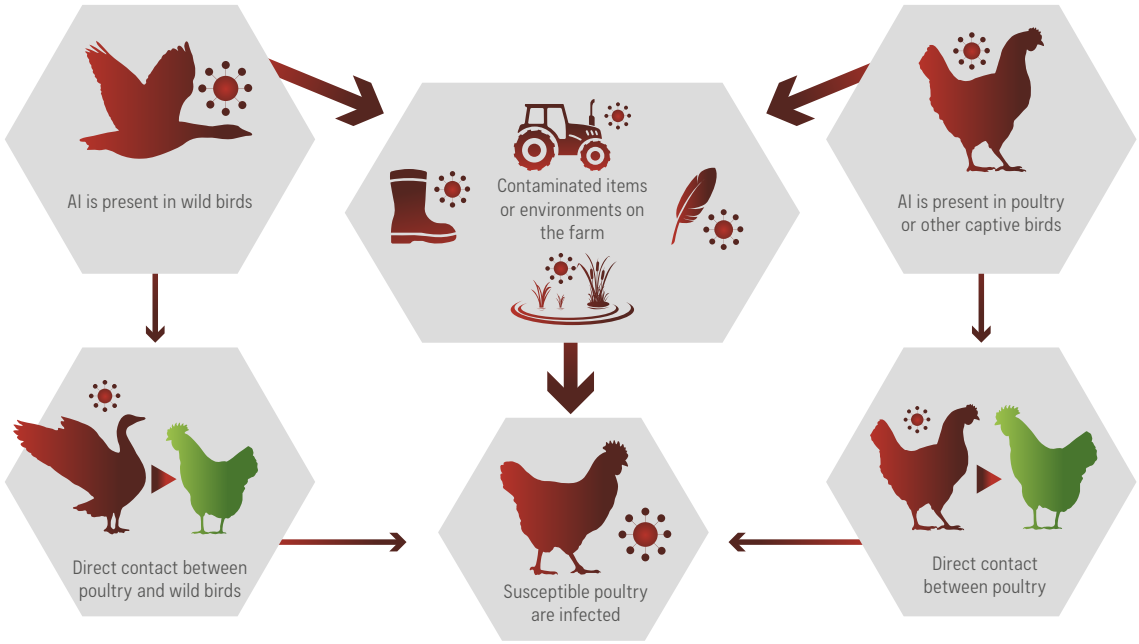
The differences in risk perceptions, attitudes and motivations of different segments of the UK poultry sector and between individual producers, combined with resource constraints and other challenges (e.g., increased fuel prices and market pressures) may also lead to selective or suboptimal application of recommended biosecurity measures.[35]

Different farms face different risks, and producers should seek expert input, from their vet and other advisers, about how best to assess and mitigate risks of AI incursion on their own premises.[36]

*Different farms face different risks, and producers should seek expert input, from their vet and other advisers, about how best to assess and mitigate risks of AI incursion on their own premises.*

## Understanding risk of disease incursion and transmission

**Figure 2.** Transmission pathways for AI




Understanding the risk of AI incursion and onward transmission within a poultry premises is an important prerequisite for risk mitigation strategies. The risk of AI introduction onto poultry farms is variable and dependent on differences in production systems, husbandry, weather conditions and geographical location of the farm.[4] For example, the risk increases with proximity to wild bird habitats and to poultry holdings[37] if the virus is present in those settings due to the increased likelihood of direct or indirect contact with infected birds.

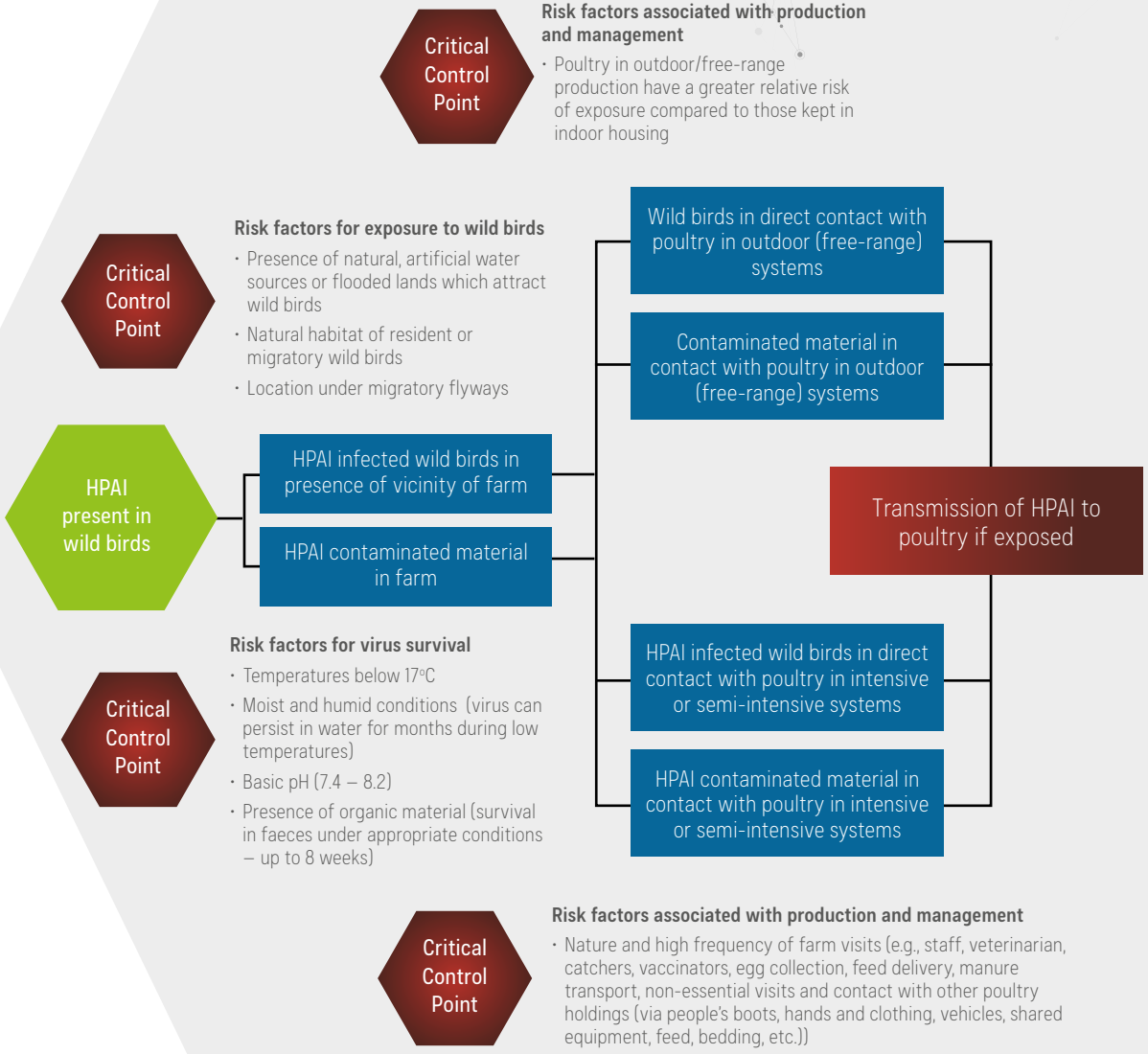
Birds may become infected with HPAI when coming into contact with the virus (**Figures 2 and 3**). This may occur through direct exposure where poultry come into contact with an infected wild or domesticated bird. Infected birds shed virus into the environment through respiratory secretions and faeces. Infection can occur indirectly if poultry come into contact with the virus in the environment (including feed and water) or on fomites (e.g., on clothing, footwear, wheels of vehicle, machinery). Mammals including wildlife such as foxes and rodents on farms can spread through physical contact or become infected with HPAI and act as a reservoir of infection for poultry, via direct or indirect transmission.[38] Windborne spread of AI between farms has also been recorded[39] although this is highly dependent on proximity.

Virus survival is influenced by environmental conditions. HPAI viruses are most stable at slightly basic pH, temperatures below 17°C, and fresh to brackish salinities in water.[40] HPAI can survive for prolonged periods in water,[41] chicken faeces and soil, and on glass and galvanized metal, but survival on wood and concrete is more limited.[42] HPAI viruses persist longer than LPAI viruses in poultry bedding material.[4] The H5N1 virus subtype, which is causing the current outbreak, appears to be more stable and resistant to ethanol than other subtypes,[43] potentially reducing the effectiveness of some disinfectants. It is important to choose a disinfectant that has been tested and approved by government and use it according to the instructions. Defra supply a list of disinfectants approved for use in England, Scotland and Wales. In a study from the Netherlands detailing access of wild birds and mammals to a free-range farm in a high risk area for AI virus, no direct contact was observed between wild birds and poultry,[44] suggesting that indirect contact with areas contaminated by wild birds is an important route of exposure for poultry.

# Managing risk

The most important measure to prevent introduction of HPAI from wild birds into poultry holdings is strict biosecurity. Poultry producers need to be able to identify Critical Control Points (CCPs) in their production systems where interventions can be introduced to reduce the risk of spread. The risk pathways and potential CCPs to prevent AI incursion onto poultry farms are described in **Figure 3**. Sources of information on relevant interventions, recommendations and guidelines are presented in **Table 5** seen on the next page.

**Figure 3.** Risk pathways for transmission of HPAI (provided by EPIC Scotland, 2023). Identification of risk factors is an important prerequisite for identifying CCPs (and effective interventions) to mitigate virus incursion onto a farm or backyard premises



Producers take decisions about mitigating risks in the context of the operation of the farm as a whole. For instance, they may want to keep their poultry within a free-range supply chain, meaning they do not want to move towards an indoor production system. Decisions and biosecurity also have implications for society as a whole: consumer demand for free-range produce because of a perception of higher welfare may be seen to conflict with recommendations that housing poultry is preferable from a purely risk reduction perspective. Living with AI will mean considering biosecurity within the context of different farmer, industry and societal values around poultry production,[36] perhaps requiring more participatory research to understand practices on all farms and support compliance with regulations.

**Table 5.** Key interventions, recommendations, and guidelines by stakeholders and for stakeholders managing AI risk in the UK

| Stakeholder | Recommendations/guidelines |
|---|---|
| Farm | • Implementation of appropriate biosecurity measures at all times and by all types of poultry holdings and sizes, regardless of being an indoor or outdoor/free-range unit<br>• It has been estimated that applying the highest standards of biosecurity (i.e., housing, no access to open water and strict biosecurity) can result in a 264-fold reduction in the likelihood of HPAI incursion compared to no biosecurity measures[36]<br>• The UK Poultry Health and Welfare Group (PHWG) has partnered with the UK Government to produce a photo gallery that highlights good examples of biosecurity practice for farmers<br>• Compliance with government and industry disease control policies |
| Industry | • Company-specific guidance e.g., Aviagen Best Practice for Biosecurity<br>• Quality assurance standards e.g., Red Tractor, RSPCA Farm Assured |
| Government | • Policies for prevention and control of AI e.g., housing orders, implementation of disease control zones in the event of an HPAI outbreak[41]<br>**Biosecurity guidance for:**<br>• England<br>• Scotland<br>• Wales<br>• Northern Ireland |

**Key challenge**

– There are numerous uncertainties linked to risk management structures e.g., variability in biosecurity implementation between farms, awareness of industry and government guidance and regulations among backyard poultry keepers, and the differential impacts of regulations on different parts of the poultry sector

## Other approaches for disease control

While biosecurity is the best method of reducing the likelihood of an AI incursion, the risk of AI transmission is still present due to the number of ways it can be spread.[46] Vaccination has been explored as another means to minimise the spread of the disease.[47] Although some vaccines have been developed, vaccination of poultry and most captive birds is not currently legal in the UK (with very few exceptions for some zoo birds) and is unlikely to be feasible in the near future.[48,49] A full list of the disadvantages of vaccination are available from APHA and Defra[49] and include:

- A concern with the use of vaccination surrounds the numerous combinations the viral strain can take, isolating the virus in each region and vaccinating for that specific strain may be unrealistic
- Many vaccines require more than one administration within the bird's lifespan, sometimes with several weeks needed between doses, which is not feasible in wild birds and commercial flocks comprised of thousands of birds, particularly broiler flocks with a short production cycle
- Vaccines may be able to reduce mortality rates due to AI, but there is another concern that vaccinated birds would still be able to carry and transmit the virus without displaying symptoms. This would make it more difficult to trace the virus and could lead to further spread among birds

Currently, UK legislation restricts the vaccination of poultry and most captive birds.[49] Biosecurity is still considered the best method of reducing the likelihood of an AI incursion on poultry premises, but with the increasing infection pressure of AI, vaccines could help reduce vulnerability to the virus. This is a potential future avenue of risk mitigation that could be beneficial in combination with good biosecurity measures, but the concerns regarding its implementation first need further research and discussion.

Until vaccination is available, other innovative uses of technology have been applied to help understand and control HPAI. Genomic sequencing has been used extensively for outbreak surveillance to identify the strain of the virus that is present and to track the spread and evolution of the virus. This has the potential to be used alongside vaccination in the future to ensure that the vaccine is effective against circulating strains and to identify when vaccine updates would be required, as has happened in China.[51] Mathematical modelling, using multiple big data sources, can be used for prediction of HPAI outbreaks.[52] Rapid detection of outbreaks is also essential and new technology is being developed for detection of disease, such as biosensors, image analysis and robot vehicle surveillance.[53]

### AI vaccine case study: China

AI vaccine is widely available and administered to poultry in China. A number of challenges remain, even when vaccination is carried out, including reaching backyard poultry for vaccination, practical challenges of implementing full vaccine courses in species with a short lifespan due to the production cycle, and virus spread due to inadequate biosecurity and mixing of birds at markets in a partially vaccinated population. This emphasises that vaccination is only one aspect of successful elimination of HPAI.[50,51] Mass vaccination strategies in China have been found to show satisfactory effects in reducing outbreaks in poultry, but potential shortcomings have been identified, such as the risk of silent AI infections in poultry or accelerating viral mutation.[51] A more detailed exploration of the Chinese experience may be of value to inform future decisions about vaccination in the UK.

**Key challenges**

- Vaccination is the most promising approach for sustainable control of HPAI but is not currently available due to technical and trade barriers
- Until there is an international decision or agreement about vaccine availability, distribution and use, and the impact of this on member country access to international markets, deployment of a vaccine campaign may be hindered

# Communication

As the current HPAI situation is both unprecedented and constantly changing, disease control policies must be responsive and able to adapt as new scientific evidence becomes available.

Trusted links between scientists, industry leaders and policy makers should be established outside these disease emergencies as an important mechanism to ensure that information is disseminated across all bodies to improve the speed of decision making and subsequent actions. Successful communication of risk relies on good communication links between all organisations and individuals involved.

**Figure 4**, devised by the Scottish Government's Centre of Expertise for Animal Disease Outbreaks (EPIC),[55] provides a useful model for provision of evidence to underpin policy making.


**Figure 4.** Proposed architecture for an equitable expert information ecosystem for HPAI knowledge sharing (adapted from Boden et al. 2019[56])

## Communication pathways

Industry involvement and support is the cornerstone of a successful communication pathway between policy makers and farmers. For example, the poultry sector has achieved substantial reduction in the use of antibiotics in recent years,[57] through proactive, collaborative working among stakeholders to take action to safeguard poultry and human health.[58] A more detailed review of stakeholder communication and roles in this process could help to identify valuable lessons which could be applied to efforts to combat HPAI.

Defra and APHA provide updates to the poultry industry online and via social media (Table 3), but governments and their delivery partners will also actively meet with industry representatives, such as the British Poultry Council (BPC), to provide updates and consult on the implementation of policy frameworks, as well as collaborate with industry in delivering informative events. Nevertheless, industry members suggest that greater communication between government and industry needs to occur. This suggests that outbreak communication pathways may need to be strengthened, additional stakeholders may need to be included and/or greater awareness of existing communication structures may need to be generated.[47,59]

Backyard livestock keepers are not generally represented by any trade body, making access to updates on AI, legislation and best biosecurity measures highly variable between keepers.[60] Most backyard poultry keepers in a Scottish survey assessed themselves as having a medium to high level of knowledge of biosecurity, poultry health and legislation, although the majority were implementing a small number of biosecurity measures.[29] Small flock owners often rely on books, magazines, poultry clubs, and Facebook communities for information on AI despite information from these sources not always being accurate.[61]

It is important that all bird owners, regardless of flock size, know which sources they should go to for timely information on the current AI situation. Active outreach activities may be needed to improve knowledge transfer about the risks of AI, interventions, and best practices to prevent and control disease.

**Key challenge**

- While industry does feed into governance decision making, this relationship may not be well known by all poultry keepers and communication pathways need to be developed further to ensure that all poultry keepers have the opportunity to feed into policy, including backyard keepers

*It is important that all bird owners, regardless of flock size, know which sources they should go to for timely information on the current AI situation.*

# Working together

## Improving preparedness and response to disease threats

This report has identified critical internal (i.e., strengths, weaknesses within industry control) and external factors (i.e., opportunities and threats outside industry control), which may influence the effectiveness of AI outbreak preparedness and response activities. Internal and external factors were combined to investigate potential strategies which could be explored in the future with industry stakeholders (**Table 6**).

**Table 6.** Desk-based approach to strategy development: strengths, weaknesses, opportunities and threats to the long-term resilience of the poultry sector to HPAI. The strategies identified are exemplars only and should be explored formally after discussion with stakeholders

| | |
|---|---|
| **Strengths**<br>• Good industry awareness<br>• Well established government systems for outbreak response<br>• Effective implementation of disease control measures in the commercial poultry sector<br>• Communication pathways linking industry trade associations and government<br>• Track record of effective collaboration between stakeholders<br>• Compartmentalisation to maintain trade during an outbreak (also as demonstration of high biosecurity standards) | **Weaknesses**<br>• Uncertainty about the geographical distribution/number of birds for premises with fewer than 50 birds<br>• Differences in biosecurity practices between large- and small-scale premises, type of premises (intensive/indoor or outdoor/free-range) and premises with different species are not well known<br>• Lack of quantitative data on the relative benefits of housing compared to increased biosecurity<br>• Limitations to communication pathways between industry and policy makers<br>• Lack of connection and cooperation between commercial and backyard sectors to prevent disease incursion |
| **Opportunities**<br>• Revisions to disease control policy to reflect the changing disease landscape, nationally and internationally<br>• Updating of trade agreements to reflect changes in disease and vaccination status<br>• Ongoing scientific research leading to improved understanding of HPAI and innovative approaches to control<br>• Training/education to improve compliance with existing protocols<br>• Vaccines under development – vaccination likely to be available within next few years | **Threats**<br>• Increased infection levels in wild and captive birds<br>• Change in seasonal patterns of wild bird infections<br>• Delays in availability of vaccine<br>• New strains due to virus mutation/reassortment – potential for increased pathogenicity or reduced vaccine effectiveness<br>• Zoonotic threat – risk of human infections<br>• Loss of consumer confidence in poultry products due to HPAI outbreaks<br>• Limited veterinary capacity to respond to outbreaks |

**Opportunity – Strength strategies**
Strengthen existing science-policy-industry networks to include stakeholders and local knowledge in outbreak decision making processes.

**Threat – Strength strategies**
Harmonised biosecurity standards for producers to improve resilience to increased and sustained infection pressure from migratory wild birds.

**Opportunity – Weakness strategies**
Improved data collection on location and biosecurity practices for bird keepers with fewer than 50 birds.

**Threat – Weakness strategies**
Coordinated risk communication strategies to improve engagement and understanding of risks across backyard and commercial sectors.

# Conclusions and next steps

The current AI outbreak has highlighted the important interdependencies and interlinkages between the health of animals (i.e., poultry, wild birds, wildlife), people and their livelihoods, and the environment (i.e, One Health).[62] This report has identified important One Health impacts of the current AI outbreak and ways in which the risks may be better assessed, managed and communicated across the entire sector (accounting for important differences in the risk burden on housed versus free-range systems, and commercial versus backyard poultry keepers).

The One Health framework has evolved to respond to a global anxiety to improve preparedness and response to animal and zoonotic disease emergencies. In this context, it perhaps offers opportunities to garner political, institutional and economic commitment for joint science-policy-industry activities to strengthen information systems, improve training and capacity of expertise, research and innovation for improved AI outbreak response. An integrated One Health approach may also improve industry solidarity and inclusion of local knowledge and expertise in decision making pathways.

Work is currently being undertaken in the UK to improve preparedness and response to animal and zoonotic disease outbreaks, and, in particular, AI. The Ecology and Evolution of Infectious Diseases (EEID) and FluMap collaborative projects funded by UKRI-BBSRC explore measures to reduce risk of disease in birds, and subsequent risk of human exposure. The FluMap consortium is led by APHA and is comprised of scientific experts from eight British institutions working together to better understand the current strains of AI and their transmission among different birds and how this data can be best translated and communicated between scientists and decision makers.[63]

The future risks and impact associated with AI remain highly uncertain. Discussions between science, industry, society and policy will be necessary to encourage and ensure good practice and innovative cross-sector solutions for long-term resilience and adaptation. Living with AI will mean considering biosecurity within the context of different farmer, industry and societal values around poultry production. We propose that this should be underpinned by five core principles.

## Five core principles to improve ways of working together

1. Inclusive participatory approaches to facilitate discussion with stakeholders and integration of local knowledge into decision making pathways
2. Development of locally appropriate and acceptable interventions
3. Trust-building exercises
4. Active and empathetic listening to diverse voices and opinions
5. Ethical (and therefore equitable) approaches to risk communication and management

# CIEL commentary

By Dr Mark Young and Dr Fiona Short, CIEL

**This report identifies some clear challenges the poultry industry faces in dealing with the ongoing risk of Bird Flu. Many of these are centred around knowledge and communication and there is an overall requirement for all stakeholders to work together to overcome these challenges.**

It is important not to single out producers; more should be done to harmonise the response across the sector as a whole. The advice provided should be unambiguous and prevent the spread of misinformation. Variation also exists in the handling of the disease across the industry and UK, adding to confusion and uncertainty.

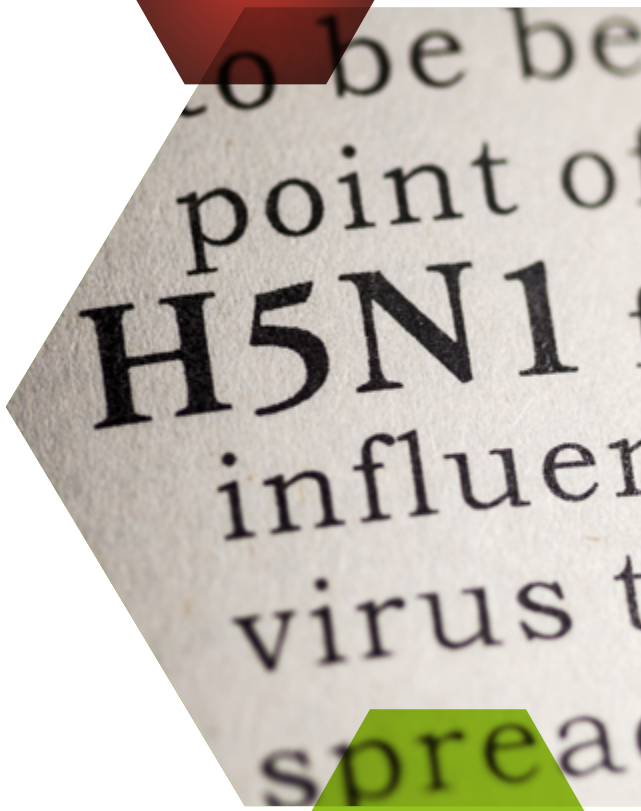
More complete data collection and aggregation is needed to inform monitoring and enable proportionate and timely responses to outbreaks. This process should include small-scale flock owners, not just commercial producers. Disease does not respect national borders and aggregated data should be accessible by all four Nations in the UK, and ideally also Ireland.

Data will additionally provide the evidence base to explore new ways to minimise impacts of the disease through management, improved biosecurity, vaccines, and genetic selection for greater resistance to the disease in poultry.

Key areas to develop common approaches include:

- Minimising risk from Bird Flu for all flock owners, for their own flocks and others
- The collection, aggregation and reporting on industry data
- Response processes and objectives
- Communications which are accessible to all, both in terms of access and understanding
- Close engagement with veterinary practices supporting poultry owners to ensure these key advisers are part of the process, from facilitating on-farm data collection through to advice on biosecurity and managing responses to outbreaks

Vaccination may be the answer in the long-term but there are difficulties to overcome. The virus can mutate resulting in the need to update vaccines regularly to maintain adequate coverage and their use may compromise future management of Bird Flu. The mode of administration needs to be considered, especially when large numbers of birds need to be vaccinated and taking into account the short life cycle in broiler production.



## Support

Producers cannot do this alone and specialist support is essential. There should be increased engagement with all producers, to include small-scale poultry keepers, to disseminate information and develop a common approach to managing Bird Flu. This would be aided by a register of all bird owners irrespective of flock size. Defra consultation on this is currently underway at the time of writing this report.

Of utmost importance is support for all those involved in handling a Bird Flu outbreak. Support should be freely available to help them cope with the practical and emotional implications of outbreaks. In addition, producers should be fully compensated for the financial impacts associated with a Bird Flu infected flock.

## Further research areas

One of the factors often overlooked is the interaction between production system and Bird Flu. Birds in free-range systems are perceived to have a higher welfare status but they are at greater risk of infection. Birds that are required to move indoors due to a housing order are at risk of stress as a result of the sudden change in environment. Future research could examine the effect of housing orders on free-range birds and focus on the opportunity to develop housing systems for such birds, which lowers the risk of Bird Flu and protects their welfare.

## Take home messages

- The risk of Bird Flu is here to stay
- Industry, government, and small-scale producers need to collaborate to ensure up-to-date and accurate information is disseminated to all those involved
- Government support will continue to be required and enhanced to ensure that all outbreaks are handled promptly and competently
- More research is needed to continue work which is underway on vaccine development, supported by international agreement on availability, distribution and use
- Research into production systems and Bird Flu risk is required

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It has benefited from the input of AI specialists at EPIC, the Scottish Government's Centre of Expertise on Animal Disease Outbreaks. The text has been thoroughly reviewed by EPIC scientists; with their input, we are confident that the report has captured the best understanding of the epidemiology and best current practice as of February 2023.

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Global Academy of Agriculture and Food Systems

# Glossary of abbreviations

| | |
|---|---|
| **AI** | Avian Influenza |
| **APHA** | Animal and Plant Health Agency |
| **BBSRC** | Biotechnology and Biological Sciences Research Council |
| **BEIC** | British Egg Industry Council |
| **BPC** | British Poultry Council |
| **Defra** | Department for Environment, Food and Rural Affairs |
| **EFSA** | European Food Safety Authority |
| **EPIC** | Epidemiology, Population health and Infectious disease Control |
| **FAO** | Food and Agriculture Organisation of the United Nations |
| **GB** | Great Britain |
| **HPAI** | High Pathogenicity Avian Influenza |
| **HSE** | Health and Safety Executive |
| **LPAI** | Low Pathogenicity Avian Influenza |
| **UK** | United Kingdom |
| **UKRI** | UK Research and Innovation |
| **WHO** | World Health Organisation |
| **WOAH** | World Organisation for Animal Health (formerly OIE) |

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