Understanding transmission of avian influenza to farmed poultry: Roles of biosecurity measures, wildlife interaction and ecological factors.

Introduction

The risk of transmission of avian influenza (AI) from wild bird populations to farmed poultry in Ireland is a topical issue (1). Ireland's position as a key wintering site for migrant birds makes it particularly vulnerable to disease outbreaks (2). These outbreaks pose an economic threat to poultry production and a public health risk due to their potential for transmission to humans (3). Prevalence of AI in Ireland is passively monitored in wild birds by reports of dead or sick waterbirds and actively monitored in farmed poultry. Biosecurity measures were recently imposed on free range poultry farms to mitigate the risks of disease outbreaks (4). However, the importance of ecological factors in AI transmission remains uncertain (5). Furthermore, the adoption of biosecurity measures and their perceived utility are also uncertain. These deficiencies diminish our ability to effectively mitigate the risks of AI outbreaks.

The objectives of this project are to:

1. Investigate the uptake of recent biosecurity measures and their perceived utility;
2. Investigate the extent of interactions between wild and farmed birds;
3. Identify the wild birds with the highest interaction rates with farmed poultry; and,
4. Identify the regions and farming practices at most risk of AI outbreaks.

Methodology

1) Online survey of poultry farms

Poultry farmers nationwide will be invited to participate in an online survey (designed and distributed in consultation with members of the Irish Farmer's Association (IFA) Poultry Committee). The survey will investigate poultry farmers' uptake and perceptions of recently imposed biosecurity measures. Responses will be analysed using qualitative and quantitative methods (e.g. for ranked and frequency data respectively).

Migratory wild birds interact with resident wild birds (e.g. migrating whooper swans and resident mute swans), implicating resident birds as potential AI reservoirs. National Parks and Wildlife Service data and the Birdwatch Ireland Irish Wetland Bird Survey data will be used to provide context on the role of migratory bird species as vectors for AI. Wild bird species (grouped by colour/size) will be included in the survey for farmers to identify the wild birds that interact most with farmed birds. Sighting frequencies will be related to farm locations and proximity to habitat features using correlation analyses. This will elucidate key geographical and ecological risks of AI outbreaks.

2) On-farm investigation

Should COVID restrictions be relaxed during the project, participating poultry farms will be visited to further evaluate explanatory variables such as habitat type and/or proximity to watercourses. Combined with online survey data on-farm observations will elaborate investigation of variables influencing AI transmission and therefore enhance the reliability of the project findings.

Project schedule

	Preparation	W1	W2	W3	W4	W5	W6	Post-project
Ethics Approval								
Develop survey								
Recruit survey participants								
Deliver survey								
Assemble survey results								
Analyse uptake & perceptions of biosecurity measures								
Identify wild birds interacting most with farm birds								
Relate findings to migratory routes								
Map & study habitats of farms participating in the online survey								
Combine findings with survey data								
Prepare project report								
Communicate findings								

Possible Difficulties

Risk	**Mitigation**
COVID restrictions inhibit travel	• Results will be primarily obtained from an online survey, enabling the project's progression under the highest COVID restrictions. Integration of online survey results with migration pattern datasets will in itself produce impactful results. • Relaxed COVID restrictions will enable travel to participating farms to map and survey farm ecology. This ancillary work will enhance capacity to answer secondary questions regarding ecological factors responsible for AI transmission.
Poor survey uptake	• To ensure participation of poultry farmers, invitations to participate in the survey will be developed in consultation with the IFA Poultry Committee.
Complexity of AI vector interactions	• Migratory birds pass AI to resident birds; hence, there are many interacting wild bird species. This project will simplify this diversity by selecting birds most known as vectors for AI.

My role and development opportunities

I will be responsible for design, dissemination, and analysis of the survey, with guidance from Prof. Holland. Statistical analyses will be undertaken in R, developing my analytical skills. Stakeholder collaboration will develop my leadership and communication skills. This leadership experience will position me to successfully complete my 'Leadership in Action' experience.

Dissemination

Findings will be communicated to participating poultry farmers and submitted to the IFA and Birdwatch Ireland. Collaboration with the Department of Agriculture, Freshwater and Marine (DAFM) will also be sought to disseminate my findings to stakeholders.

Interdisciplinary and international focus

The project investigates key ecological variables associated with AI transmission. Hence, it will involve interdisciplinary collaboration with experts in behavioural interactions, migratory behaviour, and parasitology (e.g.: Prof. Nicola Marples, Drs Andrew Jackson and Pepijn Luijckx respectively).

Overwintering migratory birds potentially transmit AI to wild birds resident at wintering and stopover sites. Hence, this project has a significant international dimension. AI researchers in countries sharing migratory birds with Ireland (e.g. Iceland (6) or Greenland (7)) will be consulted to understand the prevalence of AI in stopover or breeding sites. This will enhance my knowledge of the migratory birds most likely carrying AI.

Research supervisor and Collaborators

Professor Holland has great expertise and experience in the design and analysis of surveys. My project has been designed to utilise this research expertise. The project outcomes will position me to conduct subsequent research on behavioural interactions between wild and farmed birds with collaborators such as Professor Marples and Dr Jackson.

Outcomes

The project will make an original and timely contribution on a topical issue of critical ecological, economic, and social importance. The findings will help to:

- Identify effective and feasible biosecurity measures;
- Determine geographical factors contributing to possible AI outbreaks; and,
- Establish the wild bird species of greatest risk to poultry farmers.

This knowledge will aid the implementation of future biosecurity measures. It will also help to focus future research on key knowledge gaps in AI transmission to farmed birds.

Pre-clearance requirements

Professor Holland and I will seek School of Natural Sciences Ethics Committee approval before undertaking the survey. The survey will be GDPR compliant, i.e.: voluntary, anonymised, confidential, and conducted with informed consent.

References

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