| Project Details | |
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| Project Code | MRCPHS26Br Thomas |
| Title | Modelling and Communicating Avian Influenza Spillover at the Human–Wild Bird Interface: A One Health Approach |
| Research Theme | PHS |
| Project Type | Dry and wet lab, including field work. This is an interdisciplinary project. Predominantly the student will be dry lab to conduct modelling and co-production aspects. The student can participate in data collection in the field, for example, Bluetooth tagging and biological sampling of gulls. |
| Summary | Novel influenza A viruses that cross species barriers pose a persistent threat to global health. This interdisciplinary project will explore the risk of zoonotic transmission from wild birds, focusing on how human immune history and bird–human interactions shape that risk. This project offers a unique opportunity to gain interdisciplinary One Health training in infectious disease research, including mathematical modelling, lab work and field work to reconstruct infection histories, map contact networks, and co-develop communication strategies with stakeholders. |
| Description | **Background**<br>Novel influenza A viruses that cross species barriers pose a persistent threat to global human health. The 2021–2022 outbreak of highly pathogenic avian influenza virus (HPAIV) in Europe was the largest recorded epizootic. Rapid intercontinental spread of clade 2.3.4.4b H5N1 has continued among wild birds, with spillover into marine mammals, wildlife, and for the first time, dairy cattle—constituting a panzootic. This unprecedented epidemiology has intensified global concern and pandemic preparedness efforts, yet the role of wild birds in emergence and re-emergence is poorly characterised.<br>The risk of a global influenza pandemic caused by a novel avian influenza strain depends critically on the immune landscape in humans. Immune history—shaped by prior influenza exposures—affects susceptibility and vaccine effectiveness. Understanding how demographic factors and immune profiles interact is crucial for risk assessment (1). At the human–wild bird interface, contact patterns influence transmission. Social seabirds like gulls have experienced mass mortality due to H5N1 and play a key role in AIV transmission to other wild and domestic birds, highlighting the need to understand spillover potential (2). However, public health efforts will only succeed if protective behaviours are adopted by those at risk. Clear guidance and communication are essential.<br>**Overall Aim**<br>To develop an interdisciplinary One Health framework for assessing and communicating spillover risk of avian influenza from wild birds.<br>**Key Research Question**<br>What is the role of wild birds in spillover risk of avian influenza?<br>Objective 1: Reconstruct Human Influenza Infection Histories to Assess Zoonotic Risk<br>The student will analyse antibody profiles from a longitudinal, age-stratified cohort (ALSPAC) in southwest England using a novel bead-based multiplex assay. These profiles will be used to infer past infection |

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| | histories with seasonal influenza and cross-reaction to avian influenza strains. The student will apply serocatalytic, demographic and transmission models to identify population groups with varying levels of susceptibility or protection.<br>Student ownership: The student will be supported to develop and refine mathematical models and, if interested, engage in laboratory work to gain hands-on experience in serology. Public involvement activities will inform model development and interpretation.<br>Objective 2: Capture AIV transmission and spillover to humans given bird-to-bird and bird-to-human contact networks<br>The student will develop a multi-species transmission model capturing AIV transmission between wild birds, domestic birds and mammals (including humans). Model data will come from multiple sources, including social contact surveys, the Avian Contact Study and proximity data from our novel Bluetooth tracking system (3).<br>Using gulls as a proof-of-principle wild bird population, the student will quantify proximity-based interactions between gulls, and gulls to wild bird species, poultry and humans using the Bluetooth system. Factors associated with contact patterns, such as seasonality will be integrated into the model to estimate the direct and indirect contribution of wild birds to AIV risk in humans (4).<br>Student ownership: The student will be embedded within Project C-Gull at the University of Exeter (Penryn) and participate in fieldwork, including deploying tracking devices to gulls, quantifying heterospecific avian assemblages and association networks, collecting biological samples, managing data streams, and collecting questionnaire data. They will lead the integration of these datasets into the modelling framework. Public involvement will inform the design (research questions, modelling framework) and interpretation of results.<br>Objective 3: Communicating Zoonotic Influenza Risk<br>The student will co-produce public health communications for the public about wild birds, based on theories of behaviour (including the Protection Motivation Theory) (5) and the wider literature on uptake of protective behaviours. Communications will be optimised and tailored for different at-risk demographics (identified in objectives 1 and 2) or occupations at higher risk of AIV exposure through consultations and workshops with target groups. Stakeholder involvement will be embedded throughout.<br>Student ownership: The student will lead on design and co-production activities. Different media will be explored, such as written and/or a short film, with stakeholders (including the UK Health Security Agency) and public contributors shaping outputs. Outputs will contribute to official public health guidance.<br>**Outputs**<br>1) Publish research articles and open access code<br>2) Develop serocatalytic, demographic and multi-species AIV transmission models<br>3) Generate and publish open access novel datasets<br>4) Produce multi-modal media communicating health-protective behaviours for those at AIV risk; contributing to official public health guidance. |

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| | **Training Environment and Support**<br>The student will join a vibrant interdisciplinary network, including experts in ornithology, virology, immunology, infectious disease modelling, behavioural science, and public health. Key collaborators include the UK Health Security Agency (UKHSA), Animal and Plant Health Agency (APHA) and Institut Pasteur. They will benefit from integration into the Health Protection Research Unit in Evaluation and Behavioural Science (NIHR HPRU EBS). The project will provide interdisciplinary training in infectious disease research and contribute meaningfully to public health preparedness for avian influenza outbreaks.<br>1) Gostic et al, 2016.doi:10.1126/science.aag1322<br>2) Hill et al, 2022.doi:10.1371/journal.ppat<br>3) Farine et al, 2024.doi:10.1111/2041-210X.14433<br>4) Brooks-Pollock et al, 2015.doi:10.1098/rspb.2015.0374<br>5) Prentice-Dunn et al 1986.doi:10.1093/her/1.3.153 |
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