McMaster University | HEALTH FORUM

Rapid Evidence Profile

Identifying features and impacts of public health strategies that can be used to prevent, reduce and/or mitigate avian influenza spillover to humans

12 January 2024

[MHF product code: REP 64]

Context

- Avian influenza is commonly found in birds, but it can also infect non-human mammals (e.g., cats, foxes, bears), and humans.
- Human infections typically occur after exposure through close contact with infected birds or in highly contaminated environments like poultry farms and live bird markets.
- The risk of human infection with avian influenza A is low for the general public but may be higher for certain populations.
- As an emerging infectious disease with pandemic potential, it is important to identify effective upstream and downstream public health strategies (particularly those that adopt a One Health approach) to prevent, reduce, and/or mitigate the risk of avian spillover into humans.
- This rapid evidence profile was requested to inform initial deliberations about such public health strategies and therefore focused on identifying existing evidence syntheses where evidence from single studies was identified and synthesized.

Questions

- What are the features and impacts of public health strategies, particularly those that adopt a One Health approach, that can contribute to preventing, reducing and/or mitigating the risk of avian influenza spillover into humans?

High-level summary of key findings

- We identified 11 evidence syntheses related to public health strategies to prevent, reduce and/or mitigate avian influenza spillover to humans, seven of which we considered highly relevant.
- Only two evidence syntheses briefly mentioned One Health.
- Infection training for healthcare workers was identified as significantly reducing risk of infection from respiratory viruses among healthcare workers involved in endotracheal intubations.
- Enhanced sharing of production and trade data within commercial poultry networks was also identified as an informational strategy important for supporting mitigation strategies for the global spread of avian influenza.
- Several non-pharmaceutical measures were found to be effective at preventing infection with avian influenza, including using personal protective equipment, physical distancing in schools, and live poultry market interventions (e.g., quarantine access systems, physically separating poultry from different sources, disinfection and decontamination, daily cleaning, rest days, live poultry market closures).
- Vaccinations in humans was identified as the primary pharmaceutical measure used as part of public health strategies, with a favourable safety profile and immunogenicity of H5N1 and H7N9 vaccines.
- H5N1 and H5N2 vaccines appear to be efficacious in protecting chickens from morbidity and mortality.
- Additional research is needed to address several gaps in the literature, including strategies related to non-pharmaceutical measures to control the spread of infections, surveillance and reporting.

Framework to organize what we looked for

- Public health strategies
  - Information and education provision
  - Non-pharmaceutical measures to prevent infection
    - Avoiding sources of exposure (e.g., reducing contact with infectious birds, animals or environments)
    - Using personal protective equipment (e.g., masks, gloves)
    - Washing hands
    - Physical distancing
    - Following safe food handling procedures
    - Farm and market biosecurity measures
  - Non-pharmaceutical measures to control the spread of infections
    - Case and contact management
    - Isolation and quarantine
    - Border-control measures
  - Pharmaceutical measures used as part of public health strategies
    - Vaccinations (in animals)
    - Vaccinations (in humans)
    - Antiviral medications
  - Surveillance and reporting
- Priority populations
  - Groups at higher risk of exposure
    - Working on a commercial poultry farm (e.g., producers, processing plant worker, poultry culler)
    - Working with non-commercial or backyard flocks
    - Breeding and handling birds (e.g., dealer, breeder of exotics, falconry, racing pigeons)
    - Hunting and trapping wild birds and mammals (e.g., Indigenous harvesters)
    - Working with live or recently killed poultry (e.g., butcher)
    - Working with wild birds and/or mammals for healthcare, research and conservation (e.g., veterinarians, laboratory workers, researchers, biologists, wildlife rehabilitators, persons permitted to perform bird branding, capturing, sampling, removal, restoration)
    - Working with non-human mammals that commonly eat wild birds

Box 1: Approach and supporting materials

At the beginning of each rapid evidence profile and throughout its development, we engage a subject matter expert who helps us to scope the question and ensures relevant context is taken into account in the summary of the evidence.

We identified evidence addressing the question by searching ACCESSSS, Health Systems Evidence, Health Evidence and PubMed for full evidence syntheses (or synthesis-derived products such as overviews of evidence syntheses) and protocols for evidence syntheses. These searches were last conducted on 18 December 2023, which were not limited by publication date except in PubMed, which was limited to literature published from the last five years (2019 onwards). We also included evidence identified from internal searches provided by the Public Health Agency of Canada (PHAC) that were conducted for literature published since October 2022 with the last search conducted on 13 December 2023. The search strategies used are included in Appendix 1. In contrast to synthesis methods that provide an in-depth understanding of the evidence, this profile focuses on providing an overview and key insights from relevant documents. Note that while environmental contamination and biodiversity were considered as out of scope for this REP, they may be considered for future evidence synthesis products developed based on the findings presented here.

We appraised the methodological quality of evidence syntheses that were deemed to be highly relevant using AMSTAR. AMSTAR rates overall quality on a scale of 0 to 11, where 11/11 represents a review of the highest quality. The AMSTAR tool was developed to assess reviews focused on clinical interventions, so not all criteria apply to evidence syntheses pertaining to delivery, financial or governance arrangements within health systems or to broader social systems.

A separate appendix document includes:
1) methodological details (Appendix 1)
2) key findings from identified evidence documents (Appendix 2)
3) detailed findings from identified evidence documents (Appendix 3)
4) documents that were excluded in the final stages of review (Appendix 4).

This rapid evidence profile was prepared in the equivalent of three days of a 'full-court press' by all involved staff.

        - Working or visiting live bird or mammal markets
        - Working with or caretaking of animals that regularly interact with wild birds (e.g., caretakers, pets, guardian dogs, hunting dogs, mink farmer)
        - Working in healthcare settings and other contacts of cases (if human-to-human transmission starts)
    - Other equity considerations
- Outcomes
    - Zoonotic infections
    - Human-to-human infections
    - Health-related outcomes for individuals infected

What we found

We identified 11 evidence syntheses related to public health strategies to prevent, reduce and/or mitigate avian influenza spillover to humans. While we did not identify any strategies related to non-pharmaceutical measures to control the spread of infections or in relation to surveillance and reporting, we were able to identify some public health strategies related to information and education provision, non-pharmaceutical measures to prevent infection, and pharmaceutical measures from the included evidence syntheses. Due to the limited number of highly relevant evidence syntheses included (seven of 11 evidence syntheses), we incorporated findings from medium and low relevance syntheses in the summary below.

Information and education provision

In terms of information and education-related public health strategies, a medium-quality evidence synthesis (low relevance) that focused on front-line healthcare workers found that infection training for those who are involved in endotracheal intubations can significantly reduce their risk of infection from respiratory viruses.(1) Using a systems-level approach, another medium-quality evidence synthesis (medium relevance) highlighted the need for sharing of production and trade data between private and public sectors within commercial poultry networks to facilitate data access and inform policies that can support mitigation strategies for the global spread of avian influenza.(2)

Non-pharmaceutical measures to prevent infection

Several non-pharmaceutical measures to prevent infection with avian influenza were identified, including using personal protective equipment, physical distancing, and farm and market biosecurity measures. Personal protective measures (e.g., gloves, gowns, surgical masks, N95 respirators) for front-line healthcare workers were found to be effective, and school closures were identified as a strategy to prevent the spread of H5N1 in Australia (from low relevance evidence syntheses).(1; 3; 4) One medium-quality evidence synthesis identified live poultry market interventions including quarantine access systems, physically separating poultry from different sources, disinfection and decontamination, daily cleaning, rest days and live poultry market closures. These interventions supported a decrease in incidence of avian influenza viruses at live poultry market settings.(5)

Pharmaceutical measures used as part of public health strategies

Vaccination in humans was identified as a pharmaceutical measure used as part of public health strategies. An Andalusian Agency for Health Technology Assessment reported in a medium-quality evidence synthesis that an inactivated split-virion formulation of the pre-pandemic H5N1 influenza vaccine, which includes a low antigen dose and an oil-in-water emulsion-based adjuvant, had a favourable safety profile and immunogenicity.(6) This finding was supported by another medium-quality evidence synthesis that reported that two doses of 7.5µg of oil-in-water emulsion-adjuvanted H5N1 vaccine induced a robust antibody response and was well-tolerated among older adults.(7) We identified a low-quality evidence synthesis that found reduced responses to H5N1 influenza vaccination in individuals who had received the seasonal influenza vaccine.(8) Additional research is needed to

better understand the reduced immune responses. Lastly, we identified one medium-quality evidence synthesis that concluded that adjuvanted H7N9 vaccines for humans were immunogenic and safe in healthy individuals.(9)

Vaccinations in chickens were identified in two medium-quality evidence syntheses. One evidence synthesis described that both inactivated and recombinant fowlpox virus expressing H5 vaccines (for H5N1 and H5N2) were efficacious in protecting chickens from morbidity and mortality.(10) The other evidence synthesis indicated that recombinant herpesvirus of turkeys (rHVT) and inactivated replicating viral-vectored vaccines offered advantages to induce broader immunity as they were more tolerant of the variation in the hemagglutinin 1 domain.(11)

Next steps

Several gaps exist in the existing evidence syntheses about public health strategies to prevent, reduce and/or mitigate avian influenza spillover to humans that could be the focus of future evidence syntheses. These include:

- One Health approaches that focus on human, animal and environmental health (we only identified two evidence syntheses that briefly mentioned One Health in passing) (4;5)
- Non-pharmaceutical measures used globally to control the spread of avian influenza infections in humans and animals
- Public health strategies focused on surveillance and reporting of avian influenza infections in humans and animals
- Public health measures that are specifically tailored to priority populations that are at higher risk of exposure to avian influenza (e.g., commercial farm workers)
- Variations in immune response in humans and animals because of influenza vaccinations.

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Bain T, Bhuiya A, Demaio P, Wilson MG. Rapid evidence profile #64: Identifying features and impacts of public health strategies that can be used to prevent, reduce and/or mitigate avian influenza spillover to humans. Hamilton: McMaster Health Forum, 12 January 2024.

This rapid evidence profile was funded by the Public Health Agency of Canada. The McMaster Health Forum receives both financial and in-kind support from McMaster University. The views expressed in the rapid evidence profile are the views of the authors and should not be taken to represent the views of the Public Health Agency of Canada or McMaster University. The authors wish to thank Nujud Al-Jabouri, Samantha Cheng, Yao Maclean, Kunika Singh, and Tresha Sivanesanathan for conducting the AMSTAR appraisals.