Considerations for emergency vaccination of wild birds against high pathogenicity avian influenza in specific situations

World Organisation for Animal Health
Paris, December 2023

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Purpose

This document provides guidance on considerations for emergency vaccination[1] of wild birds[2] against high pathogenicity avian influenza (HPAI) in immediate response to an outbreak or increased risk of introduction of HPAI.

Background

Impacts of the current H5N1 panzootic on wild birds

The HPAI H5 lineage 2.3.4.4b, which emerged in 2021, is now the dominant subtype globally and has spread to all continents except Oceania (including Australia and New Zealand) and the Antarctic mainland. This subtype has infected and killed a far greater species diversity of wild birds than previous variants, with deaths and detections confirmed in well over 400 bird species (FAO 2023), including those in areas remote from both humans and poultry production. Important breeding colonies on oceanic islands (FAO 2023) and species that are listed as endangered, threatened or of conservation concern have been affected, posing threats to populations already under multiple anthropogenic pressures.

Management of outbreaks in affected countries has proved increasingly challenging due to the increased diversity, frequency, magnitude and duration of wild bird outbreaks. This sparks growing concern about the threat for the health of domestic and wild animals, biodiversity, and potentially for public health (WOAH 2023b).

Avian influenza control in wild birds

Compared with poultry and other captive birds, there are fewer options for mitigating the impact of HPAI in wild birds, with success often dependent on the local context. Risk mitigation for wild bird populations generally focuses on reducing risk of virus spread through restriction of access and interactions of people and poultry with wild birds, appropriate use of personal protective equipment (PPE) and disinfection when visiting wild bird habitat and restricting (or suspending) species-specific management activities (e.g. captive breeding, translocation of birds, hunting, etc). Carcass removal to control HPAI transmission at a site should be considered only with careful risk assessment (OFFLU 2023). There is no benefit to be gained in attempting to control the virus in wild birds and mammals through culling, disturbing populations so they move on ('hazing'), or habitat disinfection or destruction. Instead, measures should be taken to improve monitoring, surveillance, and biosecurity (WOAH 2022; FAO 2023).

While avian influenza (AI) vaccination has been used and can be a part of broader AI control strategies for captive wild birds, wide-scale AI vaccination of free-ranging wild bird populations is typically considered impractical with currently available vaccination strategies (OFFLU 2023). Emergency vaccination, as an adjunct to biosecurity or other control measures, could be considered under specific situations, for certain species, such as those of high conservation value. Like other options for control of HPAI in wild birds, the vaccination of wild birds should be considered within the local context, using a risk-based approach, and drawing on input and ongoing engagement with relevant stakeholders. The only example of such an approach to date is the 2023 emergency use authorization by the United States Department of Agriculture (USDA) and vaccination trial by U.S. Fish and Wildlife Service for the

[1] Emergency vaccination is a vaccination program applied in immediate response to an outbreak or increased risk of introduction or emergence of a disease, as per the WOAH Terrestrial Animal Health Code.

[2] Wild Bird means a bird (*Aves*) that has a phenotype unaffected by human selection and lives independently (e.g. free-ranging) without requiring human supervision or control as per the WOAH Terrestrial Animal Health Code.

protection of the critically endangered California condor (*Gymnogyps californianus*) (USDA 2023) (see Case Study, below).

Case Study:

After the HPAI deaths of 14 critically endangered California condors (*Gymnogyps californianus*), the USDA's Animal and Plant Health Inspection Service (APHIS) approved the emergency use of HPAI vaccine in an attempt to prevent additional losses to this species in May 2023 (USDA 2023). APHIS granted approval for use in California condors because the birds are critically endangered, closely monitored, and their population is very small which allows close monitoring of the vaccine to ensure it is administered only to the approved population (USDA 2023).

Additional conservation strategies follow decades of conservation efforts and are under strict oversight from the U.S. Fish and Wildlife Service (USFWS). Activities include a vaccination trial for safety and efficacy in a surrogate species (black vultures) and California condors in managed care (USFWS 2023). Additional strategies already in place include field monitoring and adaptation of current management practices (USFWS 2023). At the time of writing, six vaccinated condors have been released across the range (USFWS 2023). Additional releases are planned but no decision has yet been made about expanding the vaccination program to free-flying birds (USFWS 2023).

Challenges for field deployment are significant and lessons learned from this experience will be informative for future application of emergency vaccination of wild birds against HPAI.

The Vaccination of wild birds against HPAI section, below, outlines a risk-based process for considering the use of emergency vaccination as a control tool for HPAI in wild bird populations.

Vaccination of non-poultry species against AI - current knowledge

Most information on vaccination in birds other than turkeys and chickens comes from zoo vaccination programs and consists primarily of serological data (Koch et al. 2009). Vaccination is generally considered safe and efficacious under zoo conditions in most zoo species studied (Philippa et al. 2005; Philippa et al. 2007; Koch et al. 2009).

In studies where experimental challenge was conducted in captive birds other than chickens and turkeys, vaccination using inactivated vaccines protected them against disease and mortality, provided the vaccine was sufficiently equivalent with the challenge virus (Koch et al. 2009). In most species studied, inactivated AI vaccines induced good antibody titres when applied twice and when body weight is taken into account (Koch et al. 2009). However, a significant species variation in serological response has been reported, including between species within the same order (Bertelsen et al. 2007; Vergara-Alert et al. 2011).

Vaccination with successive heterologous vaccines may represent the best alternative to widely protect valuable or endangered bird species against HPAI virus infection (Vergara-Alert et al. 2011).

Vaccination of wild birds against HPAI

International standards

General

Any plan for an AI vaccination program for wild birds should comply with the standards described in the WOAH Terrestrial Animal Health Code (Terrestrial Code) and the Manual of Diagnostic Tests and Vaccines for Terrestrial Animals (Terrestrial Manual).

Article 4.18 of the Terrestrial Code provides general guidance on vaccination, including vaccination strategies, vaccine choice, logistics, evaluation, and other critical elements of vaccination program. Article 10.4 of the Terrestrial Code provides information specific to HPAI, including general provisions, surveillance and monitoring. It recognises that vaccination can be used as an effective complementary control tool as part of a disease control program for avian influenza under specific conditions.

The standards on the requirements for vaccines are available in the Terrestrial Manual and specific information for avian influenza vaccines for birds, including production and regulatory requirements, surveillance diagnostics and vaccine choice is available in Article 3.3.4.

Wild birds

Article 10.4.1 of the Terrestrial Code notes that a **notification of infection of birds other than poultry, including wild birds,** with influenza A viruses of high pathogenicity, or of infection of domestic or captive wild birds with low pathogenicity avian influenza viruses **does not affect the high pathogenicity avian influenza status of the country or zone.** A Member should not impose bans on the international trade of poultry commodities in response to such notifications, or to other information on the presence of any non-notifiable influenza A virus in birds.

Vaccination of wild birds will not affect the AI status of a free country or zone (Article 10.4.1 (point 6) of the Terrestrial Code), if surveillance supports the absence of infection, in accordance with 10.4.28. of the Terrestrial Code, in particular point 2 (WOAH 2023c).

In accordance with Article 4.18.11 of the Terrestrial Code, free countries or zones applying systematic or emergency vaccination in response to an increased risk of introduction of a disease should inform trading partners and WOAH of their vaccination programme, as appropriate. Unless otherwise specified in the relevant listed disease-specific chapter, in the absence of cases, demonstrated by adequate surveillance, vaccination of animals **does not** affect the status of the country or zone and should not disrupt trade.

Authorisation and planning

A decision to vaccinate wild birds should be made by the relevant Veterinary Authority[3] in consultation with other relevant authorities (e.g. wildlife management authority) on the basis of the global and local situation, with consideration of the risks as outlined in this guidance document. The suitability of a vaccination program should be considered as an adjunct to other disease control measures.

[3] Veterinary Authority means the Governmental Authority of a Member Country having the primary responsibility in the whole territory for coordinating the implementation of the standards of the WOAH Terrestrial Animal Health Code.

Planning for an AI vaccination program in wild birds should be preceded by an evidence-based risk assessment and a cost-benefit analysis of a vaccination program (see Considerations, below).

Any logistical constraints should be identified and addressed as a first step in the adequate planning of field interventions, such as vaccine source and supply or individual bird identification (see Considerations, below). Relevant permits will be required to be issued by regulatory agencies before a vaccination plan can proceed (see Legal and regulatory framework, below).

In addition to the technical aspects of vaccination, a biosecurity strategy, an awareness program, and communication plan should be implemented.

Considerations

Vaccination is intended to prevent and control the occurrence of disease and mortality, and to reduce the transmission of the pathogenic agent. Ideally, vaccines should induce immunity that prevents infection. However, some vaccines may only prevent clinical signs, or reduce multiplication and shedding of the pathogenic agent (WOAH 2023c).

The general considerations for deciding whether to initiate a vaccination program, as outlined in the Terrestrial Code Chapter 4.18, are addressed below in the context of vaccination of wild birds against avian influenza. Additional considerations for the local context may also be required by Veterinary Authorities and Wildlife Authorities.

Outbreak Epidemiology

- What is known of the circulating HPAI strain(s) of concern, including virulence and transmissibility?
- What is the likelihood of introduction of a pathogenic agent or emergence of a disease (if not already present)?
- Where are the potential or actual points of entry of infection of the population at risk?
- What is the incidence and prevalence of disease (if present)?
- Is it likely that the disease can be rapidly contained without vaccination?
- Is vaccination a suitable adjunct to other disease control measures?
- What is the risk to public health from the disease in this wild bird population? Consider, for example, indigenous populations, visitors, managers, researchers and hunters.
- What is the value of unvaccinated wild populations as indicators (‘sentinels’) of disease occurrence? Long-term circulation of AI virus in vaccinated wild bird populations may result in both antigenic and genetic changes to the virus (WOAH 2023a). Continued virus circulation in vaccinated populations with limited disease signs may reduce the value of vaccinated wild populations as indicators of disease occurrence (EFSA 2007; WOAH 2023c), and may contribute to endemicity, continued virus evolution (Lee et al. 2004), and spillover risk.

Target population(s)

- What is the significance of the species / population to be vaccinated? Consider, for example, if animals are of high conservation value or rare[4], epidemiological role, research value, public interest value.
- What is the likely susceptibility of the species to disease and mortality due to HPAI?
- What is the density of the species / population?
- What is the health status of the population? Concurrent infections, illness or immunodeficiency might adversely affect the ability to develop immunity in response to vaccination or increase adverse effects.
- What is known of the HPAI status of the population? Is there already a level of natural population immunity? Ability to distinguish vaccinated birds from those infected with HPAI is important (see vaccine and vaccination below).
- Can vaccinated individuals be reliably and effectively identified?
- What are the animal welfare and logistic implications of capture and handling that would be required to deliver an emergency vaccination program? This will require input of information on the vaccine and vaccination, below. Considerations should include pre- and post-vaccination monitoring, required animal identification systems and the recommended vaccination schedule which may include multiple doses.
- What is the risk of exposure to HPAI? Consideration of species / population ecology and behaviour which may affect this risk should be included, for example, if the species migrate to/from known HPAI areas, congregate together or with other species, or consume carrion.
- Is there any species / population ecology and behaviour that may influence the effective and timely delivery of vaccination? Consider, for example, accessibility for capture and handling, nesting and breeding behaviour, the likelihood that vaccinated birds could move outside established ranges and cross borders or other response zone boundaries.
- Is there any likelihood that vaccinated individuals may enter the human food chain (e.g. via hunting or wild harvesting)? Vaccinated birds may not show any clinical signs if infected with HPAI and may present a public health risk.

If multiple species or populations are under consideration for emergency vaccination, the above evaluation of the target populations may also be used to prioritise them.

Vaccine and vaccination

The standards on the requirements for vaccines are available in the Terrestrial Manual. General information for diagnostic tests and vaccines is available in Parts 1 and 2. Specific information for diagnostic tests and vaccines for avian influenza in birds is available in Chapter 3.3.4.

[4] In the context of wild birds, animals of **high conservation value** or which are **rare** may include: those listed by the Convention on International Trade in Endangered Species (CITES); species on the International Union for the Conservation of Nature Red List of Threatened Species; species listed under regional, national, or local legislation as of conservation concern or in peril; species or individuals considered genetically, iconically, or otherwise valuable. The loss of these animals through disease or culling would be considered to have negative impacts on conservation efforts.

- Is a vaccine with the appropriate antigenic properties available?
- What information is available on the most appropriate vaccination regime for the species of concern? Consider, for example, the method of administration, dosage, and frequency of administration which will be required for the relevant age groups, and if this is logistically feasible for the population.
- Is the vaccine available in sufficient quantities, and with sufficient continuity, to enable a full course of emergency vaccination to be administered the population of concern?
- Can the regulatory requirements for access to vaccines be met? Consider, for examples, legal approvals, movement controls or quarantine; see Legal and regulatory framework, below.
- Can the monitoring requirements in vaccinated birds be met? As for any emergency vaccination regime, the discrimination between infected and vaccinated birds and flocks is fundamental for progressive disease control and eventual eradication (WOAH 2013). The implementation of measures to determine virus circulation in vaccinated animals (a DIVA[5] strategy) are necessary for the early detection of any HPAI infected animals. Animals should also be monitored for adverse effects or vaccine failure.
- What is the likely effectiveness and duration of immunity for the species of concern in response to AI vaccination? Species, animal age and recommended vaccination regime should be included in considerations.
- Is the vaccine safe and what are the consequences for individual welfare and population viability if adverse vaccination effects are seen?
- Has this proposed vaccination been used in this species before, or is there any capacity to conduct a trial vaccination program? It should be noted that a significant species variation in serological response, including between species within the same order, has been recorded in zoo species vaccination programs (Bertelsen et al. 2007; Vergara-Alert et al. 2011).

Diagnostic capacity

- Have the relevant diagnostic laboratories confirmed their willingness and capacity to undertake the additional testing necessary to implement pre- and post-vaccination AI monitoring and surveillance?

Work health & safety

- What are the physical and mental risks relating to the repeated capture and handling of wild birds for diagnostic testing, vaccination, and post-vaccination monitoring?

[5] Differentiating Infected from Vaccinated Animals (DIVA). For example, vaccines would be chosen to provide protection from the HPAI H5N1 by selecting vaccines using inactivated H5N2 or H5N9 strains. Using heterologous N vaccines allowed some immunity to develop to H5, but when testing for serologic activity after vaccination, the antibodies in the vaccinated bird would be to either N2 or N9, not the circulating pathogenic N1. Thus, animal health officials could determine whether the titre had developed from an infection with H5N1, or via vaccination using the inactive vaccine with N2 or N9. The DIVA principle should be considered when selecting a vaccine, but this technique may not be validated for non-poultry bird species.

- Is there any risk of zoonotic transmission from infected birds relating to repeated capture and handling of wild birds for diagnostic testing, vaccination, and post-vaccination monitoring?

Legal and regulatory framework

- What regional, national and/or jurisdictional permits are required for the use of vaccines in wild birds?
- Is licensing for the off-label use of the vaccine in wild birds required?
- What quarantine, movement, research and animal welfare permits are required capture, handling, identifying, sampling and vaccinating wild birds?
- What research and animal welfare permits are required for vaccine trials?
- Are there any reporting requirements for adverse effects or vaccine failure, and what is this pathway?
- Are special permits required for species of conservation concern?
- Are there any requirements for pre- and post-vaccination monitoring of or surveillance in vaccinated wild birds?
- Is there a risk that individuals could move outside established ranges and cross borders or other response zone boundaries? Does this pose any risks for the broader response, trade or commercial operations?
- Does a vaccination program align with the values of indigenous stakeholders? Consider if consultation with and co-governance decision making by indigenous stakeholders is required.

Resources

- Has a responsible agency for resourcing the program been identified (which may span several years)? Considerations should include coverage for the in-field program, training and any regulatory or strategic oversight.
- Are the resources available to support the entire vaccination effort, including coverage for the in-field program, training, diagnostic testing and any regulatory or strategic oversight? Considerations should include financial, material and human resources.
- Can effective tracing and record keeping resourced? Note that this involves identification and tracing of individual vaccinated wild birds until the end of their life or until the emergency response (including surveillance for proof of freedom) is complete.
- Is effective collection and storage of relevant scientific data appropriately resourced? Considerations should include financial, material and human resources to maximise program learnings.

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