Avian influenza in wild birds in Australia

Fact sheet

November 2023

Key points

- Avian influenza (AI) is an infectious disease of birds caused by strains of Influenza A virus.
- Avian influenza strains are classified as 'low pathogenicity' (LPAI) and 'high pathogenicity' (HPAI) based on their clinical effect on poultry.
- Past outbreaks of HPAI in Australia have affected poultry but not wild birds.
- Since 2021, new strains of HPAI (known as HPAI 2.3.4.4b) have resulted in severe and widespread HPAI outbreaks in poultry, wild birds, farmed mammals and wild mammals globally, but have **not** yet reached Oceania (Australia and New Zealand) or the Antarctic mainland.
- Low pathogenicity avian influenza viruses are considered part of the natural viral community in wild birds in Australia.
- Infection with Influenza A viruses in birds is a **nationally notifiable disease** (see *Surveillance and management*); you must notify animal health authorities if you suspect an animal has an infection with Influenza A viruses.

Aetiology

Influenza A viruses are RNA viruses belonging to the family *Orthomyxoviridae*. Influenza A viruses are classified according to the serological subtypes of their surface glycoproteins, haemagglutinin (HA) and neuraminidase (NA) [1]. To date, 16 HA and 9 NA subtypes are recognised in birds and are found in different combinations [2].

Influenza A viruses are further designated as high pathogenicity avian influenza (HPAI) or low pathogenicity avian influenza (LPAI), based on the ability to cause disease in poultry. AIV subtypes H5 and H7 have the capacity to mutate from LPAI into HPAI forms when introduced into poultry [3, 4].

Avian influenza viruses constantly evolve, resulting in the ongoing emergence of new lineages and strains that are classified based on sequence analysis and distribution of the viruses in hosts, geographic locations and time. The dominant strain currently circulating globally is H5 2.3.4.4b, with more than one NA subtype identified.

One Health implications

Wildlife and the environment: HPAI can cause mass mortalities in many species of wild birds as well as other non-avian wildlife species and may represent a population level threat to some wildlife hosts, impacting biodiversity.

Low pathogenicity AI strains are unlikely to cause disease in wild birds or other wildlife species but are important due to the potential of H5 and H7 subtypes to mutate into HPAI forms when introduced to poultry.

Domestic animals: a range of domestic species are susceptible to AIVs including poultry, swine, horses, dogs and cats. Domestic animals should not be allowed access to sick birds or bird carcasses.

Humans: AIVs do not normally infect humans, however some subtypes (of both low and high pathogenicity strains) have been associated with disease in humans, ranging from mild illness to severe respiratory disease and death, with 458 reported human deaths worldwide due to HPAI H5N1 (at 3 Oct 2023) [5].

Some humans have become infected with LPAI. Most illness and deaths associated with AIV in humans occur after **close contact with infected poultry** or with objects contaminated by their faeces. Deaths have also been attributed to close contact with infected wild swans [6]. A summary of confirmed H5N1 human cases can be accessed at www.who.int/teams/global-influenza-programme/avian-influenza. See also 'Avian influenza in humans CDNA National guidelines for public health units' www.health.gov.au/resources/publications/avian-influenza-in-humans-cdna-national-guidelines-for-public-health-units.

Natural and other hosts

Anseriformes (waterfowl: ducks, swans, geese) and Charadriiformes (gulls, terns and shorebirds) are considered the main natural reservoirs for all avian influenza A viruses [7]. There is a need for more detailed understanding of the natural history of AIVs, including wild reservoirs and host species worldwide. Studies indicate that host species and population ecology are important in AIV maintenance, transmission, and possibly, long-distance movement [8].

Influenza A viruses (including the current circulating strains of HPAI H5) can infect a variety of animals, including wild and domestic birds and mammals. The FAO website (www.fao.org/animal-health/situation-updates/global-aiv-with-zoonotic-potential/en) reports species affected in recent H5 outbreaks [9]. A referenced list of species in which H5N1 has been reported (to 2010) can be accessed via the USGS website www.usgs.gov/media/files/list-species-affected-h5n1-avian-influenza [10]. While previous outbreaks of HPAI overseas have resulted in deaths and mass mortality events in numerous avian species, the **recent global circulation** of HPAI 2.3.4.4b **poses unprecedented risks to wildlife.** In **birds**, infection and illness or death has been reported in most major bird orders, with over 250 species newly affected since 2021. Infection, illness and (in some cases) death have been reported in humans and at least 35 **mammal** species (see the FAO website for a comprehensive list https://www.fao.org/animal-health/situation-updates/global-aiv-with-zoonotic-potential/bird-species-affected-by-h5nx-hpai/en). Affected mammals are mostly species that predate or scavenge on infected birds (e.g. lions, foxes, bears) or live in close proximity to infected birds (e.g. marine mammals) [1, 9, 11, 12].

Mass mortality events in wildlife due to HPAI 2.3.4.4b have occurred worldwide [13-15]. Examples include:

- 2020, Germany: 3000 red knots

- 2021-22, Israel: 8000 Eurasian cranes
- 2022, Peru: over 100,000 wild birds
- 2022, Chile: over 4,000 sea lions

For more information on the current global outbreak of HPAI, see the FAO website and also the WHA HPAI technical issues update https://wildlifehealthaustralia.com.au/Portals/0/Incidents/HPAI_Technical_Issues_Update_V3Sept23.pdf and other resources at https://wildlifehealthaustralia.com.au/Incidents/Incident-Information/high-pathogenicity-avian-influenza-information.

World distribution

Avian influenza viruses have a global distribution and have been isolated from all continents, including Antarctica [2, 10, 16-18]. The current global outbreak of HPAI has spread through Asia, Africa, Europe, North and South America and into the Antarctic islands. Only Oceania (which includes Australia and New Zealand) remain unaffected.

Since 2020, there has been an increase in frequency and geographic spread of HPAI outbreaks in poultry and wild birds, associated with HPAI 2.3.4.4b strains. For a global map of AI viruses with zoonotic potential, see www.fao.org/animal-health/situation-updates/global-aiv-with-zoonotic-potential/en.

Occurrences in Australia

High pathogenicity AI H5 viruses (including H5N1) have <u>not</u> been detected in Australia.

In Australian poultry enterprises, eight outbreaks of HPAI H7 strains occurred between 1976 and 2020 [19-22]. HPAI has never been detected in Australian wild birds, other than one detection of HPAI H7 in a feral Eurasian starling (*Sterna vulgaris*) trapped inside an affected poultry shed during a 1985 HPAI outbreak [23-26].

Low pathogenicity AIVs have been detected in wild birds in Australia, however mortality due to AIVs has not been reported in wild birds (either native or feral) in Australia [24, 27, 28].

Almost all LPAI subtypes (H1-16, excluding H14) have been detected in Australian wild birds. LPAI viruses have been identified in Australian Gruiformes, Pelecaniformes, Procellariiformes, Anseriformes and Charadriiformes [23, 29-35].

Previous research assessed the biological pathways of risk for HPAI H5 entry into Australia from migratory birds and estimated the risk of infection in the wild birds of northern Australia to be negligible to very low [36, 37]. However, with the emergence of the new strain of HPAI virus, the likelihood of introduction to Australia via migratory birds has increased compared to previous years [38].

Epidemiology

The incubation period for AI varies with bird species, virus subtype and virulence [39]. High pathogenicity AI incubation in wild birds can range from a few hours to 7 days.

In wild ducks, viral replication occurs primarily in the gastrointestinal tract with high loads of virus being shed in faeces [40]. Faecal-oral transmission is thought to be the main means of AIV spread in wild bird populations. Recent isolates of HPAI H5N1 have also been found in tracheal samples, suggesting the method of transmission may be species dependent, and airborne transmission may be important in some species, when in close contact [39].

The duration of virus shedding appears to vary with host species. Virus can be shed in poultry and wild bird faeces for 30 days or longer [41]. Virus survival outside the host is affected by environmental conditions. Avian influenza viruses can persist for extended periods in water and faeces, depending on ambient temperatures, pH and salinity [39].

The epidemiology of AIVs is likely to be different in Australia compared to other regions of the world. As much of the current understanding of AIV ecology, molecular phylogenetics and spread is derived from studies in Asia, Europe or North America, it may not be relevant to the Australian situation [23, 42]. Recent studies support the hypothesis that within the Australian context, the drivers for emergence of AIV are likely to be different to those in the northern hemisphere. Both long- and medium-term rainfall patterns, as well as variation in population size within wild duck species, have been linked to AIV prevalence in wild duck species in south-east Australia. In the Australian context, rainfall events strongly influence breeding opportunities in wild duck species, which can in turn determine age-structures and percentage of immunologically naïve individuals within the flock [43]. Furthermore, **Anseriformes species found in Australia are not migratory** (they do not travel to the northern hemisphere), although they are nomadic within the Australo-Papuan region [44, 45].

Although shorebirds are exposed to HPAI viruses along the migratory route between Asia and Australia, there is no evidence that migratory birds have carried infectious HPAI H5 clade 2.3.4.4 into Australia in samples collected up to and including the 2022 migratory season [27, 46, 47]. National AIV wild bird surveillance data (see *Surveillance and management* below) indicates that migratory shorebirds do not commonly carry AIVs into Australia from other regions of the world [35, 48] and analysis of AIVs present in Australia demonstrates limited evidence of viral introductions to date [46, 49-51].

Clinical signs

Wild birds infected with **LPAI** viruses usually show no clinical signs however, reduced foraging and altered migration have been reported in infected swans in one overseas study [52].

High pathogenicity AI viruses, including HPAI H5 virus strains, can result in up to 100% mortality in chickens [53]. High pathogenicity AI H5 virus strains (including 2.3.4.4b strains) have caused significant mortality events in a variety of wild bird species and wild mammal species overseas (see *Natural and other hosts*) [9, 10, 54].

Infected **wild birds** may have neurological signs (ataxia, paralysis, seizures, tremors, abnormal posture), respiratory signs (conjunctivitis, increased nasal secretions, oedema of the head, dyspnoea), gastrointestinal signs (diarrhoea) or sudden death without prior signs [2], similar to the signs seen in infected poultry. **Wild mammals** may show neurological or respiratory signs (as above) or die suddenly without signs.

Diagnosis

A diagnosis of AIV infection must be confirmed by PCR and/or virus isolation. In Australia, samples are tested for influenza A using PCR. All Influenza A positive samples are then tested using a specific PCR for influenza A subtypes H5 and H7. Positive H5 and H7 samples are sent to the CSIRO Australian Centre for Disease Preparedness, Geelong, for viral culture and sequencing to determine pathogenicity. Serum can be tested for antibodies to the influenza A virus using ELISA. This test has shown to be valid in a number of Australian wild bird species [55, 56].

Laboratory diagnostic specimens and procedures

Both live and dead birds (or other species) may be sampled. Swabs (cloacal, oropharyngeal) and environmental (faecal) samples are collected for viral testing and serum is collected to test for evidence of exposure to AIVs. Collection procedures are in accordance with the 'Sick and Dead Bird Health Surveillance: sample collection protocol' [57]. In dead birds, samples should include alimentary tract tissues (proventriculus, pancreas, intestine, caecal tonsils), respiratory tract tissues (trachea, lung) and brain. Samples from live birds should include oropharyngeal and cloacal swabs and/or fresh faeces, and serum for antibody studies [41].

Clinical pathology and pathology

There is little reported information on clinical pathology of wild birds infected with AIVs. Changes in domestic ducks included anaemia, reduced plasma protein and increase in a range of biochemical parameters in serum [58].

There are no pathognomonic lesions for avian influenza in birds [2]. Severity and distribution of lesions are dependent on the pathogenicity of the virus and host factors (e.g. species, age, immunity). In LPAI virus infections, there may be no pathological changes, or mild to moderate respiratory lesions may be present. Similarly in HPAI infections, there may be no visible pathology or severe multi-organ involvement with necrosis, inflammation and haemorrhage [2].

Differential diagnoses

Differential diagnoses may include any cause of sudden death or acute onset of illness (e.g. acute poisoning, misadventure such as heat stress or dehydration, chlamydiosis, avian paramyxovirus or acute infections such as *E. coli*) [41].

Treatment, prevention and control

There is **no treatment** available for LPAI or HPAI AI in wild birds (or poultry).

Although prevention and control of AIV in wild birds (and mammals) may be challenging, various steps have been recommended, including:

- practicing good baseline biosecurity in all situations involving wild animals, to minimise risks to wild birds and mammals from people and other sources (see *National Wildlife Biosecurity Guidelines* https://wildlifehealthaustralia.com.au/Portals/0/ResourceCentre/BiosecurityMgmt/National_Wildlife_Biosecurity_Guidelines.pdf)

- good surveillance and data collection including reporting and investigation of all unusual and mass sickness and deaths in domestic and wild birds, and wild mammals (see also WHA "*HPAI advice for veterinarians and wildlife health professionals*" https://wildlifehealthaustralia.com.au/Portals/0/Incidents/HPAI_Advice_for_veterinarians_and_animal_health_professionals.pdf).
- use of a cross-sectoral One Health approach for communication and coordination of preparedness and response to AIV outbreaks.
- practicing intensified surveillance and biosecurity measures in high risk situations [14].
- removal of wild animal carcasses during an outbreak will reduce environmental sources of the virus but also introduces new risks and challenges such as animal disturbance, contributing to disease spread and exposure of humans to infection [59] The advice from joint CMS and FAO's Scientific Task Force on Avian Influenza and Wild Birds is that decisions around the removal of carcasses should be determined based on a risk assessment [14].

The practices of **culling, containing or dispersing** wild animals and the destruction or modification of habitat (e.g. use of disinfectants) have been deemed as ineffective measures for AIV control by global advisory organisations [41, 60] and should be strongly discouraged.

Vaccination of valuable captive birds (e.g. in zoos and breeding centres) and threatened species of wild birds may be considered in the event of a HPAI outbreak in Australia, and has been included in national AUSVETPLAN guidance documents [61]. See https://animalhealthaustralia.com.au/ausvetplan.

Prevention of infection in farmed birds relies on appropriate biosecurity. See AUSVETPLAN and National Farm Biosecurity Manual for Poultry Production https://www.agriculture.gov.au/sites/default/files/sitecollectiondocuments/animal-plant/pests-diseases/biosecurity/poultry-bio-manual/poultry-biosecurity-manual.pdf.

Research

There are a broad range of endemic AIV subtypes in wild birds in Australia. Key research recommendations for the Australian situation include:

- more detailed understanding of the natural history of AIVs, including wild reservoirs and host species across the globe
- further analyses to explore environmental and species-specific variables
- future analyses to explore spatial and temporal trends, and climatic and rainfall zone
- further analysis of AIV phylogeny and gene flow of subtypes, ecology and epidemiology
- further analysis of the pathogenicity, for poultry, of AIV subtypes found in wild birds, in particular, H5 and H7 subtypes. This includes the ability of LPAI H5 and H7 subtypes to mutate to HPAI
- further analysis of the susceptibility, pathogenicity and transmission dynamics of LPAI and HPAI viruses in Australian wild bird species.

WHA analysis supports continued use of faecal environmental samples for wild bird surveillance due to the relative low cost and logistical ease of collecting these compared to other samples [23].

Surveillance and management

The National Avian Influenza Wild Bird Surveillance Program coordinates information to inform the national picture on AIV. The Program includes surveillance for AIV via sampling of healthy, live and hunter-shot wild birds; and investigation of significant, unexplained morbidity and mortality events in wild birds [23]. During the 18 years of the Program, thousands of Australian wild bird samples have been screened, with no HPAI viruses detected [28].

Two summaries of surveillance results have been published (July 2005 to June 2007)[34], (July 2007 to June 2012)[23]. Another study used AIV wild bird sequences generated through the Program [46]. Further information can be found on the WHA website: https://wildlifehealthaustralia.com.au/Our-Work/Surveillance/Wild-Bird-Surveillance.

Passive surveillance in wild bird mortality events excluded AI as the cause of death in over 2,500 wild bird mortality events since 2005 [62] [eWHIS data, contact admin@wildlifehealthaustralia.com.au].

AI outbreaks in Australia (including wild birds) are managed under the 'Disease Strategy: Avian influenza (version 5.2), AUSVETPLAN 2023' [41]. Infection with Influenza A viruses in birds is a **nationally notifiable disease** (see www.agriculture.gov.au/biosecurity-trade/pests-diseases-weeds/animal/notifiable). By law you **must** notify animal health authorities in your jurisdiction if you know or suspect that an animal has a notifiable pest or disease. Refer to advice in your jurisdiction (https://www.agriculture.gov.au/biosecurity-trade/pests-diseases-weeds/animal/state-notifiable) and on outbreak.gov.au on how to report.

Wildlife Health Australia administers Australia's general wildlife health surveillance system, in partnership with government and non-government agencies. Wildlife health data is collected into a national database, the electronic Wildlife Health Information System (eWHIS). Information is reported by a variety of sources including government agencies, zoo based wildlife hospitals, sentinel veterinary clinics, universities, wildlife rehabilitators, and a range of other organisations and individuals. Targeted surveillance data is also collected by WHA. See the WHA website for more information https://wildlifehealthaustralia.com.au/Our-Work/Surveillance and https://wildlifehealthaustralia.com.au/Our-Work/Surveillance/eWHIS-Wildlife-Health-Information-System.

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Wildlife Health Australia welcomes your feedback on fact sheets. Please email admin@wildlifehealthaustralia.com.au. We would also like to hear from you if you have a particular area of expertise and are interested in creating or updating a WHA fact sheet. A small amount of funding is available to facilitate this.

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