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THE RISK OF AVIAN INFLUENZA IN BIRDS IN AUSTRALIA

George Arzey
Elizabeth Macarthur Agricultural Institute
NSW Department of Primary Industries

ABSTRACT

Avian influenza viruses may cause mild or severe disease in birds. There have been five recorded outbreaks of highly pathogenic avian influenza in birds in Australia, all of which were caused by the H7 subtype. These were quickly controlled and similar coordinated responses are expected for possible future outbreaks of avian influenza. Migratory birds are not regarded as the source of these outbreaks, and the prevalence of avian influenza viruses in wild birds in Australia is very low. Avian influenza H5N1, which emerged in birds in China in 1996, has spread to bird flocks in Asia, Europe and Africa. The main carriers of avian influenza, ducks, do not migrate to Australia, and currently the risk of H5N1 occurring in Australian birds appears to be low. Nevertheless, surveillance and response plans for outbreaks of highly pathogenic avian influenza have recently been upgraded across Australia.

Avian influenza is a viral disease that primarily infects birds. This article describes avian influenza and provides information about outbreaks of avian influenza that have occurred in bird flocks in Australia. It also examines the risk of avian influenza H5N1 (hereafter also referred to as H5N1) occurring in birds in Australia.

Avian influenza viruses are classified into two groups based on their ability to cause disease in birds: the highly pathogenic strains that multiply in a wide variety of organs in the bird and can cause severe disease; and the low pathogenic strains that multiply in the intestines and respiratory tract only, and cause either no or mild disease, and low mortality.[1] Avian influenza viruses are also classified by the combination of two groups of proteins: hemagglutinin proteins (H) and neuraminidase proteins (N).

Influenza viruses have been reported in more than 90 species of birds. Ducks and other waterfowl (see Box 1 for definitions of the types of birds referred to in this article) are the recognised reservoir of avian influenza viruses and harbour all known subtypes of the influenza A virus. The low pathogenic viruses, including some H7 and H5 subtypes (which are the subtypes that most often turn into the highly pathogenic strains), rarely cause clinical signs in waterfowl, unlike the highly pathogenic H5N1, which can cause disease in these birds. Other wild waterbirds, like shorebirds, carry the low pathogenic avian influenza viruses, but at a much lower frequency than waterfowl. [1]

The introduction of low pathogenic viruses into susceptible poultry populations occasionally results in a mutational shift in the virus to produce highly pathogenic strains associated with severe disease. [2] Clinical signs of infected poultry include: reluctance to move, eat or drink; droopy appearance; severe respiratory distress; inability to walk or stand; unusual head and neck posture; and escalating flock mortality. Poultry can become infected with avian influenza through direct contact with an infected bird or infected material such as faeces, or through the consumption of food or water that is contaminated with the virus (which has the ability to survive several days in medium temperatures in areas not exposed to direct sunlight).[3]

Large scale outbreaks of highly pathogenic H5 and H7 avian influenza lasting for many years have occurred in poultry on many occasions in different regions of the world.[4] However,

BOX 1

GLOSSARY OF TERMS DESCRIBING THE TYPES OF BIRDS REFERRED TO IN THIS ARTICLE

Waterbird	Any bird whose natural habitat is water.
Waterfowl	A specific category of waterbird that includes ducks and geese.
Shorebirds	A waterbird that lives on the shores of beaches and lakes, such as seagulls, sandpipers and terns.
Poultry	Chickens, turkeys, domestic ducks and geese, partridge, guinea fowl, quails and pheasants.
Wild birds	Any type of non-captive bird.
Aviary birds	Any bird that lives in a cage or aviary– this usually refers to parrots, finches and canaries.
Migratory birds	Any bird that migrates. In Australia this is mostly shorebirds, as the majority of waterfowl are non-migratory.

the recent outbreaks of H5N1 in poultry flocks across the world are unprecedented in their spread, and have resulted in large numbers of poultry deaths. Theoretically, such outbreaks could provide opportunities for exchange of viral segments (reassortment) with human influenza virus, which could result in a new strain of human influenza. There is no evidence, however, that any of the avian viral components involved in the 1957 and 1968 human pandemics, or any human epidemic, originated from domestic poultry. In addition, the avian viruses involved in the 1957 and 1968 pandemics were not highly pathogenic viruses, unlike the currently circulating H5N1 virus. The 1918 influenza pandemic virus, although a descendent from an avian virus, was not acquired directly from its avian donor[5,6] and is genetically unlike any other avian or mammalian influenza virus examined over the past 88 years.[7]

OUTBREAKS OF AVIAN INFLUENZA IN AUSTRALIA

Despite the presence of poultry in Australia since 1788 and regular movements of very large numbers of migratory birds to Australia each year, the first avian influenza outbreak was recorded in Australia in 1976. Australia has had five outbreaks of avian influenza in birds, all caused by the highly pathogenic H7 subtype, and all in chickens in cages or barn type housing. Three outbreaks occurred in Victoria (1976, 1985, 1992), one in Queensland (1994) and one in NSW in 1997.[8,9] The outbreaks were controlled quickly by the slaughter of all the birds on the infected farms; disinfection; movement controls; and surveillance in the area to detect new foci of infection.[8]

In four of the five outbreaks, while there was a presumptive association with wild waterbirds, there is little evidence to support this.[8] The most likely 'ancestor' of the first Australian avian influenza outbreak in 1976 was H7 virus from a domestic duck.[10] Emus have been considered as a possible source in the 1997 outbreak in NSW.[9] Genetic analysis of the isolates from the 1976 to 1994 Australian outbreaks is also not consistent with introduction by migratory birds.[11] The H7 subtypes involved in the Australian outbreaks have never been detected in wild waterbirds in Australia, either before, during or after the poultry outbreaks.[12]

Infection with other low pathogenic avian influenza viruses among wild waterbirds in Australia has been found to be infrequent and extremely low[13] compared with a 19 per cent infection rate in Europe[14] and up to 34 per cent infection among ducks in North America.[15]

THE SPREAD OF AVIAN INFLUENZA H5N1

Avian influenza H5N1 was first reported in China in 1996 as a cause of disease in geese. The virus was a reassortment of avian influenza viruses from goose, quail and possibly teal.[16] Initially the H5N1 outbreaks were only reported in poultry in South East Asia. Subsequently, H5N1 outbreaks were also reported in wild birds in zoological parks in South East Asia[17], and in wild birds in China, Mongolia, Kazakhstan, and Western Siberia, with subsequent spread to Europe, Africa and the Middle East (Table 1). From 2003 to July 2006, the total number of poultry outbreaks due to H5N1 in South East Asia exceeded 3100.[18] The number of dead and culled birds is estimated to exceed 220 million and the economic impact in this region alone is estimated in excess of $10 billion.[19]

Avian influenza H5N1 spread from its source in Southern China to other countries through the transportation of poultry and poultry products, and through bird migration.[20] Between 1996 and 2003 several consignments of live ducks, live geese and duck meat from China were found to be infected with H5N1 on arrival in Hong Kong, Vietnam, South Korea and Japan.[18] Genetic analysis suggests that there was further spread from China to Vietnam through poultry trade in 2005.[20] Transmission within poultry is recognised as the major mechanism for sustaining the virus within the Asian region.[20]

Some of the birds that were found to be infected with H5N1 in West-Siberia in October 2005, seasonally migrate to Africa, Europe, India and South East Asia, but not to Australia.[21]

Wild waterfowl[22] and movements of poultry and poultry products appear to have played a role in the European spread.[23] In Africa, infection with H5N1 was reported initially in Nigeria[24], a country with extensive trade in poultry with China and Turkey, where H5N1 outbreaks had been reported earlier. None of the main wild bird species wintering over in the African countries has been found with infection in Europe, nor has H5N1 been found in wild birds in Nigeria, Niger or Cameroon. The current outbreaks of H5N1 in eight African countries appears to be related to trade in poultry for human consumption, including illegal trade.[25]

RISK OF AVIAN INFLUENZA H5N1 IN BIRDS IN AUSTRALIA

The four main potential routes of avian influenza H5N1 into a country are the movements of: infected poultry (and poultry products); aviary birds; contaminated materials; and migratory wild birds.

No significant poultry trade exists between Australia and other countries, and uncooked poultry products are not allowed into Australia. The risk from smuggled live birds or their products always exists. The risk of humans visiting infected regions and on return introducing infection through contaminated materials is also a possibility.

The recognised reservoir of the avian influenza virus—ducks and other waterfowl from infected regions of the globe—do not migrate to Australia, and Australian ducks are predominantly non migratory with only a few species occasionally reaching the Torres Straits and New Guinea. [26]

A significant group of birds that migrate across the infected South East Asian region is the shorebirds. Their migration starts in the Arctic Circle (Northern Siberia and Alaska) and most species take several weeks to reach Australia. In the regions infected with H5N1, this virus has not been found in the species of shorebirds that migrate to Australia. Approximately 3 million shorebirds reach Australia each year. [27] Since 1996 approximately 27 million shorebirds have visited the Australian continent and despite the presence of H5N1 in the South East Asian region, as well as other subtypes like H6N2 and H9N2[28,29], no disease has been reported in the wild bird population or domestic poultry in Australia.

The other significant migration occurs when muttonbirds (shearwaters) arrive in Australia. The flyway of these species is mostly over the sea and despite their huge numbers their flyway is not across areas currently infected with H5N1. Thus the risk posed by this group of birds is low.

A number of Australian bird species migrate to Torres Strait and New Guinea, where H5N1 has not been reported. Some migration range extends to Indonesia.[25] This is regarded by some as imposing a significant risk; however, other avian infectious diseases present in Indonesia have not spread to Australia. One example is Newcastle disease, which was reported in Indonesia as early as 1926[30]—despite the ability of the virus to infect as many avian species as the avian influenza virus, it has not spread to Australia.

The risk from migratory birds, such as shorebirds or muttonbirds, depends on a variety of circumstances including: the H5N1 status in the Arctic Circle during breeding or pre migration staging; the migration time; the infective status of the birds on arrival in Australia; and the H5N1 status of other countries en-route. No cases of avian influenza H5N1 have been found in countries traversed by migrant birds en route to Australia (the Philippines, Taiwan, New Guinea, East Timor and New Zealand). Blood samples of migratory birds from Northern and Western Australia,

TABLE 1

COUNTRIES AND AUTONOMOUS REGIONS WITH H5N1 INFECTION IN POULTRY OR WILD BIRDS (JULY 2006)

Asia	Year*	Europe	Year	Near/Middle East and Africa	Year
China	1996	Russia	2005	Iran	2006**
Hong Kong	1997	Romania	2005	Iraq	2006
S Korea	2003	Turkey	2005	Cyprus	2006
Indonesia	2003	Azerbaijan	2005	Nigeria	2006
Japan	2004	Ukraine	2005	Egypt	2006
Vietnam	2004	Bulgaria**	2006	Niger	2006
Thailand	2004	Hungary**	2006	Cameroon	2006
Malaysia	2004	France	2006	Jordan	2006
Tibet	2004	Slovakia**	2006	Gaza	2006
Cambodia	2004	Slovenia**	2006	Israel	2006
Lao PDR	2004	Bosnia**	2006	Burkina Faso	2006
Mongolia**	2005	Albania**	2006	Ivory Coast	2006
Kazakhstan	2005	Italy**	2006	Sudan	2006
India	2006	Poland **	2006	Djibouti	2006
Myanmar	2006	Germany	2006		
N Korea	2006	Austria**	2006		
Afghanistan	2006	Greece**	2006		
Pakistan	2006	Croatia**	2006		
		Scotland**	2006		
		Denmark**	2006		
		Sweden **	2006		
		Spain **	2006		

* Only initial outbreak in any species is listed **Outbreaks only in wild birds

Sources: [18] and FAOAIDS news. Update on the Avian Influenza situation Issue No 39 at www.fao.org/ag/againfo/subjects/documents/ai/AVI-bull039.pdf

H5N1 outbreaks summaries www.birdlife.org/action/science/species/avian_flu/pdfs/hn51_outbreak_weeks.pdf -
The table covers the period until July 2006

where migratory birds are first likely to encounter the Australian mainland, have shown no evidence of exposure to H5N1.[31]

Once infected, provided they remain healthy, migratory birds could carry H5N1 to Australia. Examining 13,115 wild birds in Asia between 2003 and 2005, Chen et al[20] found only a very small proportion (0.046 per cent) carried the H5N1 virus. Following infection, waterfowl excrete the virus for three to seven- days.[20] If the excretion period in shorebirds is similar, the opportunity for avian influenza H5N1 to be carried to Australia via migratory birds that travel 12,000 km (a journey that may take several weeks) could be limited.

The lack of an association between previous Australian outbreaks and migratory birds, and the lack of spread of other avian diseases from Asia to Australia, could indicate a low risk for the introduction of H5N1 by migratory birds into Australia. Indeed, the risk from migratory birds has been recognised as low.[32] Even so, continuous evaluation and monitoring of birds is planned, especially around the peak migration period.

SURVEILLANCE AND RESPONSE PLANS

A national surveillance program for influenza viruses in wild birds, targeting between 60 to 300 young ducks and shore birds in at least two locations in each state, is currently being planned to coincide with the peak migration period (October to November). Swabs will be taken from live or freshly dead birds. A national zoo-based program is also being planned to examine wild birds in zoos.

Investigations of mortality among wild birds and/or domestic and commercial poultry are routinely undertaken when reported by the public or bird keepers. A recent survey of commercial poultry across Australia has confirmed freedom from highly pathogenic avian influenza viruses.

In response to the outbreaks of avian influenza H5N1 in poultry flocks around the world, strategies to reduce the risk of introduction of disease agents into poultry farms (biosecurity) have been upgraded. Plans have been developed to minimise the impact of an outbreak through early detection and effective response. National exercises have been held around Australia to refine the capacity of government and the poultry industry to respond to an outbreak (for example, Exercise Eleusis, held in 2005). In addition, NSW has initiated training of personnel to enhance the capacity for early detection.

In the event of an outbreak of avian influenza in poultry in Australia or the appearance of a highly pathogenic avian influenza virus among wild waterfowl, the national disease strategy for Avian Influenza (AUSVETPLAN), will be implemented. Action will include the destruction of all poultry on infected premises; possible pre-emptive culling on other premises; cleaning and disinfection of infected premises; tracing and surveillance; upgrading of biosecurity on poultry farms; increased public awareness; and vaccination of poultry, especially in high density poultry areas or if there is evidence of rapid spread.

The slaughter of wild birds is not part of the plan.[3] However, in the event that wild birds are found with H5N1 in Australia, public and industry awareness will be raised and surveillance on farms within the immediate detection zone will be implemented. The AUSVETPLAN website is: www.animalhealthaustralia.com.au/programs/eadp/ausvetplan.

CONCLUSION

Avian influenza H5N1 has not been detected in Australia. Although five outbreaks of avian influenza in poultry have occurred in Australia, all involving H7 subtypes, it is unlikely that they originated from migratory birds. There is no evidence to suggest that either low pathogenic or highly pathogenic influenza A viruses of poultry origin have been involved in any human influenza pandemic or epidemic. The risk of introduction of H5N1 to Australia appears to be low, although scientific uncertainties about the virus and its epidemiology make any prediction unwise. To accommodate this threat and uncertainty, preparedness and biosecurity on poultry farms have been upgraded.

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