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## SHORT REPORT

# No evidence of transmission of H5N1 highly pathogenic avian influenza to humans after unprotected contact with infected wild swans

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(Accepted 18 August 2009; first published online 18 September 2009)

## SUMMARY

Highly pathogenic avian influenza (HPAI) subtype H5N1 remains a public health threat as long as it circulates in wild and domestic birds. Information on the transmissibility of H5N1 HPAI from wild birds is needed for evidence-based public health advice. We investigated if transmission of H5N1 HPAI had taken place in people that had unprotected contact with infected wild mute swans during an incident at the Abbotsbury Swannery in Dorset, England. Thirteen people who had been exposed to infected swans were contacted and actively followed up for symptoms. Serology was taken after 30 days. We did not find evidence of transmission of H5N1 HPAI to humans during the incident. The incident provided a rare opportunity to study the transmissibility of the virus from wild birds to humans.

**Key words:** Avian flu, influenza A, transmission, zoonoses.

Wild birds, mainly ducks, swans and geese are known to be the reservoir for many different low pathogenic subtypes and strains of influenza A virus [1]. Under certain circumstances highly pathogenic strains may develop. Highly pathogenic avian influenza (HPAI) subtype H5N1 was first detected in South East Asia in 1997 and has been causing sporadic outbreaks in domestic and wild birds in Europe since 2005 [2]. Transmission to other animals including humans has been recorded on numerous occasions. Infection in humans mainly causes pneumonia and is often fatal

[3]. Infection of humans has occurred following close contact with infected domestic birds. To our knowledge, there is only one report of an incident where transmission may have occurred after contact with wild birds. This report mentions a cluster of seven cases in Azerbaijan where at least the index case may have acquired the disease after de-feathering a sick swan for consumption [4]. Due to the severity of the disease and perhaps partly because of the high media attention it has received, there has been a high demand for public health advice on the risk of transmission from wild birds to humans. However, it has not been possible to base such advice on direct evidence since there are so few records of incidents that may shed light on the actual risk of transmission between wild birds and humans.

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On 10 January 2008, the carcasses of three wild mute swans (*Cygnus olor*) submitted to the ongoing surveillance programme for avian influenza in wild birds at the Veterinary Laboratories Agency (VLA) tested positive for H5N1 HPAI. The submitted birds were in poor condition and a necrotic state at the time of testing, but brain lesions consistent with avian influenza were observed (encephalitis with cuffs) with neuronal labelling. The swans had been found by wardens at the Abbotsbury Swannery, a wild swan sanctuary and tourist attraction in Dorset, South West England. At the Swannery, wild swans are fed regularly and tourists are encouraged to get close to the swans during the open season. In winter, about 250 mute swans come to the Swannery to feed each day along with other wild birds mainly mallard (*Anas platyrhynchos*), common coot (*Fulica atra*), tufted duck (*Aythya fuligula*) and common pochard (*Aythya farina*). The total population of mute swans in the area at this time of the year is about 750. This figure includes both swans that breed in the area and swans that only spend the winter months there [5]. The Swannery is closed for visitors during the winter. The first swan, found on 27 December, had a leg injury, a second swan found on 29 December, was emaciated. Both were euthanized, put in plastic bags and stored for collection. A third mute swan was found dead on 4 January. Due to the holiday season, and lack of H5N1 HPAI infection in Western Europe at the time, the carcasses were not submitted for immediate analysis until 8 January, leading to a time lag between the collection of the carcasses and the availability of test results. For this reason the wardens and members of the public were unaware of the potential risk and continued to have unprotected contact with the swans. Following confirmation of H5N1 HPAI infection in the swans, full protective equipment including boots, protective suits, goggles, and FFP3 respirator or mask was generally used.

Veterinary authorities mounted an outbreak response according to EU regulations [6] by setting up monitoring and control zones and carrying out active surveillance for infection in domestic and wild birds. Eleven infected birds, ten mute swans and one Canada goose (*Branta canadensis*) were found in the time period (27 December to 29 February). Surveillance of wild and domestic birds did not find evidence of more widespread infection. The haemagglutinin gene of the virus strains isolated from the swan carcasses were 99.8% identical at the nucleotide level. The highest similarity with other strains was with

H5N1 HPAI strains of clade 2.2 isolated from wild birds in Czech Republic, Romania and Poland in mid- to late 2007 [5].

The Health Protection Agency (HPA) carried out follow-up surveillance of all humans exposed to H5N1 HPAI and assessed their need for prophylactic oseltamivir medication and vaccination against seasonal influenza to prevent the potential mixing of avian and seasonal human influenza viruses.

One aim of the HPA investigation was to identify any transmission of H5N1 HPAI to those exposed to infected birds. We considered a person to have been exposed if they had been within 1 m of an infected bird without wearing protective equipment. If an exposed person had manually handled an infected bird they were defined as having had close contact, whilst if they had only been within 1 m without touching the bird they were defined as having had close proximity contact. In order to identify those exposed, we contacted and interviewed people that had reported wild birds confirmed to have been infected with H5N1 HPAI. We asked them questions regarding exposure, symptoms of disease and to name others potentially exposed. Those named were also contacted and asked the same questions and assessed for the need of chemoprophylaxis or vaccination. Thirteen people were identified who fitted the definition for having been exposed. Seven had made close contact while euthanizing sick birds, de-ringing and bagging carcasses and six had close proximity contact. All were contacted and those who were still within the incubation period for H5N1 HPAI were contacted daily and asked about symptoms. None developed symptoms compatible with an influenza infection and all had made contact with mute swans. All seven with close contact and four out of six with close proximity contact agreed to have blood samples taken for serology. Blood samples were taken 30 days after exposure and analysed at the Respiratory Virus Unit of the Health Protection Agency (Centre for Infections, Colindale, UK) by micro neutralization (MN) and haemagglutinin inhibition (HI) using horse red blood cells using standard protocols [7–9]. The antigen used in the assays was NIBRG23, reverse genetic (RG) derivative of A/turkey/Turkey/1/2005 (H5N1) and genetically the most closely related available RG strain to the isolate from the incident [A/mute swan/England/26/2008 (H5N1)]. For MN the starting dilution was 1:20 and in HI the starting dilution was 1:8. All samples tested negative for antibodies to H5N1 HPAI in both assays. The assessments and the results are summarized in Table 1.

Table 1. Information on individuals included in the study regarding classification into exposure category, clinical illness, oseltamivir medication and the results of serological testing

Exposed number	Type of exposure	Within incubation period at time of assessment	Symptoms compatible with influenza within incubation period	Oseltamivir	Serology
1	Close contact	Yes	No	Yes	Negative
2	Close contact	No	No	No	Negative
3	Close contact	Yes	No	Yes	Negative
4	Close proximity contact	Yes	No	No	Negative
5	Close proximity contact	Yes	No	No	Negative
6	Close contact	Yes	No	Yes	Negative
7	Close contact	No	No	No	Negative
8	Close proximity contact	No	No	No	Negative
9	Close contact	Yes	No	Yes	Negative
10	Close proximity contact	Yes	No	Yes	Negative
11	Close proximity contact	Yes	No	Yes	No sample
12	Close proximity contact	Yes	No	Yes	No sample
13	Close contact	Yes	No	Yes	Negative

The investigation did not find any clinical or serological evidence of transmission of H5N1 HPAI to people that had been exposed to infected swans. This information must be interpreted with caution due to the small numbers of participants in the study and the difficulties in estimating the extent of the actual exposure, as we do not know how infectious each bird was at the time of the contact. However, the necropsies showed that they suffered neurological damage indicative of systemic infection. Mute swans infected in controlled experiments where influenza virus could be detected in the brain have been shown to shed high levels of virus in both trachea and cloacae for up to 10 days [10, 11]. The excreted amount depended to some degree on the infective dose given but average peak levels of virus in tracheal swabs as high as  $10^{4.3}$  egg infectious dose<sub>50</sub>/ml were recorded [11]. We can not be sure that we identified everyone potentially exposed to H5N1 HPAI during the incident as the incident involved free-living wild birds. However, we believe that we identified the majority as the Swannery was closed to the public during the winter months and as it is likely that people who had close contact with sick or dead birds would have contacted the health services due to the high media attention both nationally and locally.

In conclusion, the findings represent unique and rare evidence on the risk of transmission of H5N1 HPAI from wild swans to humans. Although the study only involves contact with mute swans, we

argue that the risks of transmission from close contact with swans can be used as estimation for the maximum risks involved in similar contact with other wild bird species given that swans are large birds that excrete relatively large quantities of virus [10]. The evidence obtained from this study may by itself not be enough to change current public health advice or recommendations regarding the need for protective measures when handling wild birds due to the low number of study participants. We therefore suggest that similar studies should be undertaken in future outbreaks of H5N1 HPAI in wild birds so that the combined results of several studies, perhaps analysed in a meta-analysis, may provide enough evidence to justify changes if needed. H5N1 HPAI remains a serious public health threat in parallel with the current pandemic outbreak of influenza A H1N1v as long as it keeps circulating in wild and domestic bird populations due to its ability to cause serious disease and its pandemic potential.

#### ACKNOWLEDGEMENTS

We thank the following people at the Health Protection Agency for their assistance in the investigation: Maria Zambon and Nick Phin at the Centre for Infections, Colindale. Nick Gent at the Centre for Emergency Preparedness and Response, Porton Down. Kalyanaraman Kumaran, Paul Bolton, Sue Appleby and Karen Walls at the Dorset Health

Protection Team, Ferndown. Ruth Hall at the South West Regional Office, Stonehouse.

## DECLARATION OF INTEREST

None.

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