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## 11 Influenza in animals and human health implications

### 11.1 Introduction

Avian influenza (AI) has become a disease of great importance for animal and human health. The number of outbreaks of AI in poultry has increased sharply over the past five years compared to the number reported for the previous 40 years. Between 1999 and 2005 more than 200 million birds have been involved in outbreaks.<sup>(1)</sup> These outbreaks have led to major consequences for the poultry industry in affected countries. There is also growing concern about the pandemic threat posed by AI. This risk posed to human health and the epidemiological features of confirmed human cases have been discussed in Chapter 3 (section 3.5).

This chapter describes AI, surveillance activities, agriculture contingency plans for dealing with an outbreak, as well as the public health management of an avian outbreak. It provides guidance on surveillance and management of human cases and their contacts. Finally it also provides information on influenza in other animals.

### 11.2 Avian Influenza in birds

AI can occur in most, if not all species of birds. Waterfowl (wild and domesticated) are the major natural reservoir of influenza viruses. All available evidence suggests that primary introduction of influenza viruses into an area is a result of waterfowl activity. Wild waterfowl are usually asymptomatic, may excrete virus for long periods, may be infected with more than one type, and often do not develop a detectable antibody response.

Commercial ducks have frequently been shown to be infected with influenza viruses, but this has rarely been associated with disease in the ducks because of the marked resistance these birds show, even to strains that are highly virulent for chickens and turkeys (e.g. Ireland influenza outbreak in 1983).

Influenza A viruses that infect poultry can be divided into two groups, according to the severity of the disease that they cause. These groups are Highly Pathogenic Avian Influenza (HPAI) and Low Pathogenic Avian Influenza (LPAI). HPAI viruses cause high mortality (>75%) in poultry, whereas LPAI cause only mild symptoms. HPAI viruses so far have been restricted to A/H5 and A/H7 A subtypes, although not all A/H5 and A/H7 are highly pathogenic. While HPAI is lethal in domestic birds (chickens and turkeys) it has a variable clinical effect in domestic waterfowl and wild birds. HPAI has only been associated with mortalities in wild birds in the case of A/H5N3 in common terns (South Africa, 1961) and in various species but particularly waterfowl and some scavenging birds during the current A/H5N1 panzootic (Asia, Africa and Europe, 2004-2007). LPAI viruses exist in nature and wild bird populations, particularly waterfowl. They can be of any subtype A/H1-16. They cause a localised infection that results in sub-clinical or mild disease, primarily respiratory disease, depression, and egg production problems. However, some low pathogenic strains of A/H5 and A/H7 have mutated to become HPAI following circulation among domestic poultry.

### ***11.3 Surveillance of AI: international and national prevalence data***

Comprehensive surveillance of AI is necessary not only for animal health, but also to provide early warning of new strains in animals, which might pose a threat to human health. Internationally and nationally, much work is underway to strengthen animal surveillance.

#### ***11.3.1 Worldwide surveillance***

The World Organisation for Animal Health (OIE) collects analyses and disseminates information on animal diseases from 169 countries worldwide, with the aim of increasing transparency globally. Up until 2006, only HPAI outbreaks were notifiable to the OIE. In 2006 the OIE Code was amended to make LPAI H5 and H7 outbreaks notifiable.

**Table 11.1** below lists the outbreaks of HPAI in poultry that are known to have occurred from 1959 to date (October 2007). Of all the HPAI outbreaks recorded worldwide, the most recent HPAI H5N1 panzootic is unprecedented

in terms of severity of disease in birds, range of bird and other animal species affected and geographical extent of disease. Sixty countries on three continents (Asia, Europe and Africa) have been affected by the disease.

*Table 11.1. Known outbreaks of HPAI in poultry 1959-2007 (adapted from WHO)*

<b>Year</b>	<b>Area</b>	<b>Affected</b>	<b>Strain</b>
1959	Scotland	chicken	H5N1
1963	England	turkey	H7N3
1966	Ontario (Canada)	turkey	H5N9
1976	Victoria (Australia)	chicken	H7N7
1979	Germany	chicken	H7N7
1979	England	turkey	H7N7
1983	Pennsylvania (USA)*	chicken, turkey	H5N2
1983	Ireland	turkey	H5N8
1985	Victoria (Australia)	chicken	H7N7
1991	England	turkey	H5N1
1992	Victoria (Australia)	chicken	H7N3
1994	Queensland (Australia)	chicken	H7N3
1994	Mexico*	chicken	H5N2
1994	Pakistan*	chicken	H7N3
1997	New South Wales (Australia)	chicken	H7N4
1997	Hong Kong (China)*	chicken	H5N1
1997	Italy	chicken	H5N2
1999	Italy*	turkey	H7N1
2002	Hong Kong (China)	chicken	H5N1
2002	Chile	chicken	H7N3
2003	Netherlands*	chicken	H7N7
2003 (ongoing)	Asia, Europe, Africa*	multiple species	H5N1
2004	British Columbia (Canada) Pakistan	chicken	H7N3
2006	South Africa	ostrich	H5N2
2007	Saskatchewan (Canada)	Chicken	H7N3
2008	England	Chicken	H7N7

*\*Outbreaks with significant spread to numerous farms, resulting in great economic losses. Most other outbreaks involved little or no spread from the initially infected farms.*

Table 11.2 below shows the number of outbreaks of HPAI H5N1 that have been detected in poultry and wild birds in EU Member States since the virus it was first introduced in February 2006.

*Table 11.2 Outbreaks of HPAI H5N1 detected in poultry and wild birds in the EU during 2006 and 2007*

	<b>HPAI H5N1 in poultry 2006</b>	<b>HPAI H5N1 in poultry 2007</b>	<b>HPAI H5N1 in wild birds 2006</b>	<b>HPAI H5N1 in wild birds 2007</b>
Austria			117	
Belgium				
Bulgaria				
Cyprus				
Czech Republic		4	14	1
Denmark	1		43	
Estonia				
Finland				
France	1		62	3
Germany	1	6	331	227
Greece			32	
Hungary	29	2	16	
Ireland				
Italy			16	
Latvia				
Lithuania				
Luxembourg				
Malta				
Netherlands				
Poland		9	64	1
Portugal				
Romania	172			
Slovakia			2	
Slovenia			28	
Spain			1	
Sweden	1		21	
UK		3	1	
	<b>205</b>	<b>24</b>	<b>748</b>	<b>233</b>

The Food and Agriculture Organisation (FAO) provides policy advice, strategy design, technical information and guidelines, contingency planning and technical assistance, training, equipment and supplies such as laboratory equipment, vaccines, agency and donor coordination and public advocacy in relation to AI. It works hand in hand with the OIE and, because of the threat to human health, the WHO. FAO has carried out many missions to HPAI H5N1 affected countries and produces regular bulletins on the situation worldwide.

### *11.3.2 EU surveillance*

The EU introduced active surveillance for AI in poultry in 2003, with the initial aim of determining the prevalence of LPAI A/H5 and A/H7 subtypes. Surveillance in wild birds was initially voluntary, but became compulsory in September 2005, when HPAI H5N1 spread from Asia into Eastern Europe. In September 2005 the EU surveillance programme was extended to include healthy wild birds and a list of target species - in which HPAI H5N1 had been detected, was created - with the additional objective of having an early warning system for the introduction of H5N1 into poultry.

The results of the EU surveillance programmes may be found on the website of DG SANCO at the following address:

[http://ec.europa.eu/food/animal/diseases/controlmeasures/avian/eu\\_resp\\_surveillance\\_en.htm](http://ec.europa.eu/food/animal/diseases/controlmeasures/avian/eu_resp_surveillance_en.htm)

### *11.3.3 Surveillance in Ireland*

The Department of Agriculture Fisheries and Food (DAFF) has had a serological monitoring programme for avian influenza in place since 1995. The programme is part of the Poultry Health Programme, and monitors commercial breeding poultry just before they come into lay, and when they move between sites. In addition all blood samples from clinically affected poultry are sent for serological testing. Approximately 20,000 samples are tested each year. Since 2003, DAFF has also taken part in the annual EU survey for avian influenza in poultry and wild birds. The survey in poultry includes turkeys and ducks reared for meat, free-range broilers, commercial

egg layers and breeding flocks. The wild bird survey includes birds found dead and birds that have been shot. The results of the surveys from 2003 to 2007 are shown in **Tables 11.3** and **11.4** below.

*Table 11.3. Results of AI survey in commercial poultry in Ireland (2003-2007)*

	<b>No. poultry holdings sampled</b>	<b>No. poultry holdings positive for A/H5 or A/H7</b>
2003	248	0
2004	321	0
2005	305	0
2006	306	0
2007	302	0

*Table 11.4. Results of AI survey in wild birds in Ireland (2003-2007)*

	<b>No. wild birds sampled</b>	<b>No. samples positive</b>
2003	449	1 pool (H10)
2004	360	H6, H10, H11
2005	757	12 (not H5 or H7)
2006	1070	2(H11) 1 (H5)
2007	728	3 (H5), 1 (not H5 or H7)

The last outbreak of HPAI occurred in 1983. Since 1987, there have been several outbreaks of LPAI in poultry in Ireland. A number of LPAI isolates of have also been detected in wild birds as a result of the EU survey. To date none of these has been an A/H7 subtype. A/H5 subtypes have been detected in two wild shot teal submitted as part of the active survey in hunted birds during the winters of 2006/2007 and 2007/2008. The list of isolates is set out in **Table 11.5** below:

*Table 11.5: Avian Influenza Isolates Detected in Ireland (1983 to June 2007)*

Year	Subtype	Pathogenicity	Isolated from
1983	H5N8	HPAI	2 commercial turkey flocks 1 broiler flock 1 breeding/commercial duck flock
1987	H9N2	LPAI	1 turkey breeder flock
1989	H7N7	LPAI	1 broiler breeder flock 1 commercial turkey flock
1991	H6N2	LPAI	1 broiler breeder flock
1993	H3N8 H9N3	LPAI LPAI	1 imported mallard duck consignment in quarantine
1995	H7N7	LPAI	2 commercial turkey flocks
1997	H9N2	LPAI	1 breeding pheasant flock
1998	H7N7	LPAI	28 commercial turkey flocks 1 broiler breeder flock
2003*	H10N5	LPAI	wild mallards
2004	H6N6 H10N7 H11N9	LPAI LPAI LPAI	wild widgeon wild mallards wild mallards
2005	Not H5 or H7	LPAI	
2006	H11 H5	LPAI LPAI	exotic duck in private collection wild teal
2007	H5	LPAI	wild teal

\*first year of survey in wild birds

#### **11.4 Laboratory testing of avian and mammalian influenza viruses**

The Central Veterinary Research Laboratory (CVRL), Backweston, Co. Kildare maintains a capability for virus isolation and identification of avian and mammalian influenza viruses. It also has the capacity and expertise for serological identification of antibodies to these viruses in the different species. Virus isolates from avians are submitted to the EU reference laboratory (Weybridge) in accordance with Directive requirements for further biotyping. Isolates from pigs are submitted to specialist laboratories for additional typing. Thus effectively a monitoring programme for all animal viruses is in operation from the CVRL. This allows for accurate diagnosis and the implementation of appropriate control measures.

The CVRL is the EU National Reference Laboratory for Avian influenza and at an international level participates in proficiency tests organized by the European (EU) Reference Laboratory for Avian Influenza.

### **11.5 Veterinary Control Measures for AI in birds**

EU legislation exists for the control of avian influenza in birds. The specific control measures that must be applied will depend on whether the virus is confirmed in poultry/captive birds or in wild birds, whether the virus is a highly pathogenic or low pathogenic strain, and whether or not the subtype involved is H5N1.

Council Directive 2005/94/EC lays down the rules for the control of HPAI and LPAI in poultry or captive birds.

**Avian influenza is defined as “an infection of poultry or other captive birds caused by any influenza A virus of the subtypes H5 or H7, or with an intravenous pathogenicity index (IVPI) in six-week old chickens greater than 1.2”.**

**HPAI is defined as an infection caused by “avian influenza viruses of the subtypes H5 or H7 with genome sequences codifying for multiple basic amino acids at the cleavage site of the haemagglutinin molecule similar to that observed for other HPAI viruses, indicating that the haemagglutinin molecule can be cleaved by a host ubiquitous protease or avian influenza viruses with an intravenous pathogenicity index in six-week old chickens greater than 1.2”.**

**LPAI is defined as an infection caused by “avian influenza viruses of subtypes H5 or H7 that do not come within the definition of HPAI”.**

#### *11.5.1 Controls when HPAI is confirmed*

When HPAI is confirmed in poultry or other captive birds, the Directive requires that certain measures are applied on the infected premises and

additional measures are applied in a *protection zone* and *surveillance zone* in the area immediately surrounding the infected premises:

### **Infected premises**

- Killing and disposal of all poultry/captive birds
- Cleaning and disinfection of the premises
- Destruction or treatment of manure, slurry and bedding
- Tracing and destruction of poultry meat and eggs produced during risk period
- Epidemiological investigation and tracing of high-risk contacts
- Prohibition on birds entering or leaving
- Controls on people, vehicles and other things entering or leaving
- Controls on re-stocking

### **Protection zone** (minimum of 3 km radius from the infected premises)

- Identification of all poultry/captive bird holdings
- Clinical examination and testing of all commercial holdings
- Clinical examination of all non-commercial holdings
- Confinement of all poultry indoors
- Prohibition on bird fairs, markets, shows or other gatherings
- Prohibition on the release of game birds
- Controls on the movement of live poultry and eggs
- Controls on poultry meat originating from birds in the zone
- Biosecurity measures to be taken when people or vehicles are in contact with poultry, poultry carcasses and eggs

### **Surveillance zone** (minimum of 10 km radius from the infected premises)

- Identification of all poultry holdings
- Prohibition on bird fairs, markets, shows or other gatherings
- Prohibition on the release of game birds
- Controls on the movement of live poultry and hatching eggs
- Biosecurity measures to be taken when people or vehicles are in contact with poultry, poultry carcasses and eggs

Controls must be kept in place for at least 30 days. Where movements are controlled, specific derogations are allowed, but only after a risk assessment and if appropriate biosecurity precautions are taken.

Additional measures such as a standstill on movements of poultry, preventive culling and vaccination in high-risk areas or in high-risk compartments (e.g. categories such as free-range birds, integrated companies) are also allowed for.

#### *11.5.2 Controls when LPAI is confirmed*

If LPAI is confirmed in poultry or captive birds, the Directive requires that some or all of the following measures are applied on the infected premises (as determined by a risk assessment), and measures are applied within a *restricted zone* around the infected premises:

#### **LPAI infected premises**

- Killing and disposal, or slaughter following testing, of all poultry
- Killing and disposal captive birds
- Cleaning and disinfection of the premises
- Destruction or treatment of manure, slurry and bedding
- Epidemiological investigation and tracing of high-risk contacts
- Tracing of hatching eggs produced during risk period, and official supervision of birds hatched from these
- Prohibition on birds entering and controls on birds leaving
- Controls on people, vehicles, table eggs and other things entering or leaving

#### **Restricted zone** (minimum of 1 km radius from the infected premises)

- Identification of all commercial poultry/captive bird holdings
- Clinical examination and testing of all commercial poultry holdings
- Prohibition on bird fairs, markets, shows or other gatherings
- Prohibition on the release of game birds

- Controls on the movement of live poultry and eggs
- Biosecurity measures to be taken when people or vehicles are in contact with poultry, poultry carcasses and eggs

The controls apply for at least 21 days where the birds are killed and testing has been completed and no further risk exists, and 42 days if the birds are not killed.

#### 11.5.3 Controls when HPAI H5N1 is confirmed

If H5N1 is confirmed in **poultry**, Commission Decision 2006/415/EC requires that a *protection zone and surveillance zone* are declared as for HPAI. These zones become *Area "A"*. In addition a buffer zone must be declared between area "A" and the disease-free area of the country. This buffer zone is called *Area "B"*. Movements of poultry, other captive birds, wild game birds, wild feathered game meat, poultry by-products and hatching eggs between and from these areas are controlled.

If H5N1 is confirmed in **wild birds**, Commission Decision 2006/563/EC requires that initially a *control area* (minimum 3 km radius) and *monitoring area* (minimum 10 km) are declared. The limits of the areas must then be re-assessed when the species of bird, its normal habitat, range etc. and the local environmental conditions are known. The size may then be decreased or increased accordingly.

#### 11.5.4 Contingency Plan for AI in birds

In order to carry out the control measures as quickly as possible, a Contingency Plan has been prepared by DAF. The plan includes an operation manual, which contains chapters on the following:

- Suspect avian influenza
- Confirmed avian influenza
- Public health aspects
- Slaughter
- Disposal

- Cleaning and disinfection
- Slaughter plants
- Forms
- Advice leaflets
- Restriction notices
- Protocols for sampling
- Licensing

### ***11.6 Public Health Management of AI outbreaks in birds***

With progression of AI in wild birds into the EU, and occasional poultry outbreaks, considerable effort has gone into agreeing combined veterinary and public health working protocols for the public health management of an outbreak of avian influenza in Ireland. In Supplement 11, Guidance on Public Health Actions to be taken on Notification of Avian Influenza in Animals in Ireland is provided. This guidance is based on international guidance from WHO, ECDC, CDC and Canada. The guidance includes the agreed notification procedure between Agriculture and Public Health, management of contacts; guidance for those involved in avian influenza outbreak control activities, surveillance protocols, and public health advice leaflets for those affected and for the general public. These protocols have been tested in multi-agency exercises throughout Ireland, and are subject to ongoing review.

**The Expert Group advises that close collaboration between veterinary and public health authorities at all levels, and joint working, protocol development etc. continue on an ongoing basis.**

#### *11.6.1 Prevention and clinical management*

The possibility of A/H5N1 should be considered in all patients with severe acute respiratory illness. This includes travellers and visitors to AI affected countries as well as those with close contact with sick poultry or wild birds. An algorithm for assessment, referral and laboratory investigation has been prepared and is available in Supplement 11. Patients with suspected or proven A/H5N1 should be hospitalised in isolation for clinical monitoring,

appropriate diagnostic testing and antiviral therapy. Supportive care with provision of supplemental oxygen and ventilatory support is the foundation of management.

WHO recently produced rapid advice guidelines on pharmacological management of humans infected with A/H5N1.<sup>(2)</sup> The evidence was assessed according to the methodology described by GRADE, a methodological guideline process, which included evaluation of existing systematic reviews, literature searches and expert consultation. The quality of evidence was classified as high, moderate, low or very low based on the methodological characteristics of the available evidence. In addition recommendations were graded as strong or weak, where strong recommendations mean that most individuals should receive the intervention and weak evidence means that most would want the intervention, but many would not. These recommendations are:

- In patients with confirmed or strongly suspected H5N1 infection, clinicians should administer oseltamivir treatment as soon as possible (strong recommendation, very low quality evidence)
- In patients with confirmed or strongly suspected H5N1 infection, clinicians might administer zanamivir (weak recommendation, very low quality evidence)
- In patients with confirmed or strongly suspected H5N1 infection, who do not need mechanical ventilation and have no other indication for antibiotics, clinicians should not administer prophylactic antibiotics (strong recommendation, no quality grading provided)
- In patients with confirmed or strongly suspected H5N1 infection, who need mechanical ventilation, clinicians should follow clinical practice guidelines for the prevention or treatment of ventilator associated or hospital acquired pneumonia (strong recommendation, no quality grading provided)
- In pregnant patients with confirmed or strongly suspected infection with avian influenza A (H5N1) virus, clinicians should not administer

### **11.7 Infection control**

Guidance for AI is based on that recommended by WHO, which should be consulted for detailed information.<sup>(3)</sup> A summary of some of the aspects is given below:

1. *All healthcare facilities should take standard infection control precautions, which include:*
  - Hand hygiene
  - PPE based on risk assessment and to avoid contact with blood, body fluids, excretions and secretions
  - Appropriate handling of patient care equipment and soiled linen
  - Prevention of needlestick/sharp injuries
  - Appropriate environmental cleaning and spills management
  - Appropriate handling of waste
2. *All healthcare facilities should implement respiratory hygiene*
  - Persons with respiratory infection should be educated to:
    - Cover their mouth and nose with a tissue when coughing and dispose of used tissue in waste containers
    - Use a mask if coughing, when a mask can be tolerated
    - Perform hand hygiene after contact with respiratory secretions
    - Sit or stand at least 1 metre (3 feet) from other persons if possible
  - Healthcare facilities should promote respiratory hygiene by:
    - Educating HCWs, patients, family members and visitors on the importance of containing respiratory aerosols and secretions to help prevent the transmission of influenza and other respiratory viruses
    - Posting signs requesting that patients and family members with acute febrile respiratory illness use respiratory hygiene

- Posting signs requesting that persons with acute febrile respiratory illness refrain from visiting the healthcare facility
- Considering making tissues and masks available so that source control measures can be used in common areas and areas used for the evaluation of patients with acute febrile respiratory illness. Areas where people gather such as waiting rooms should be prioritised
- Providing resources for hand hygiene in common areas. Areas where people gather such as waiting rooms should be prioritised.

### 3. *Early recognition, isolation and reporting of possible AI cases*

- Healthcare facilities should
  - Make it a priority to establish methods to ensure early recognition and investigation of possible AI cases (Algorithm, Supplement 11)
  - Initiate IC precautions promptly when AI is suspected
  - Report all possible cases immediately to the Medical Officer of Health, and provide all essential available information requested
- In Ireland, currently **without** known AI infections in animals or humans:
  - **Query** patients with severe acute febrile respiratory illness about travel to AI affected countries within the 2 weeks prior to symptom onset
  - **Consider** the diagnosis of AI in patients with severe acute febrile respiratory illness who have travelled to an AI affected country within the 2 weeks prior to symptom onset **and** who have had exposure to birds, to known or suspected AI infected patients, or to other severely ill people while in an AI affected country.

- If symptoms, travel and exposure history support the possibility of AI infection, such patients should be put under isolation precautions immediately

4. *Isolation precautions for suspected or confirmed AI-infected patients*  
(See WHO guidance for detailed description)<sup>(4)</sup>

- Patient placement
  - Place the patient in an adequately ventilated ( $\geq 12$  air changes per hour) room (airborne infection isolation room) if available
  - If a single room is not available, suspected and confirmed AI patients may be cohorted separately in designated multi-bed rooms or wards
- Cohorting
  - If single rooms are not available, patients infected with the same organisms can be cohorted. These rooms should be in a well-defined area that is clearly segregated from other patient-care areas used for uninfected patients. Suspected and confirmed cases should be housed separately
  - The distance between beds should be at least one metre.
  - HCWs assigned to cohorted patient care units should be experienced, and should not be assigned to other non-infected areas.
  - The number of persons entering the cohorted area should be limited to the minimum number necessary for patient care and support
  - HCWS should be aware that cohorted patients may be concurrently infected or colonised with other pathogens and should use standard and pathogen specific transmission based precautions where applicable
- Barrier precautions for the care of patients with respiratory illness or suspected or confirmed AI

- In addition to standard precautions, all HCWs providing care for patients with acute febrile respiratory illness or suspected or confirmed AI should use PPE as per **Table 11.6**

#### 5. *Duration of infection control precautions*

- For adolescents > 12 years of age, and adults, implement precautions at the time of admission and continue for 7 days after resolution of fever.
- For infants and adolescents ≤12 years of age, implement precautions at time of admission and continue for 21 days after symptom onset.

The detailed guidance also covers recommendations regarding visits by family member/visitors, pre-hospital care and transport, waste disposal, environmental cleaning and disinfection, patient care equipment occupational health recommendations for HCWs, and care of the deceased.

### **11.8 Public health management of human cases of avian influenza A/H5N1 and their contacts**

Guidance for the public health management of human cases of avian influenza A/H5N1 and their contacts has been prepared and are detailed in Supplement 11. This guidance includes case definitions of AI, the notification procedures to be followed when a case is suspected, establishment of outbreak control teams, media management, provision of information to the public and others, case surveillance requirements, and contact tracing.

Table 11.6. Barrier precautions for persons providing care for patients with acute febrile respiratory illness (AFRI, including patients with suspected or confirmed AI infection

Barrier precautions	Application of barrier precautions depending on type of patient contact			
	Close contact (<1 m/3ft) with patients with AFRI with no known AI risk factors*	Entry to AI isolation room/area, but no anticipated patient contact	Close contact (<1 m/3ft) with AI infected patient in or out of isolation room/area	Performance of aerosol generating procedure on AI patient <sup>a, b</sup>
<b>Hand Hygiene <sup>c</sup></b>	Yes	Yes	Yes	Yes
<b>Gloves</b>	Not routinely <sup>d</sup>	Risk assessment	Yes	Yes
<b>Apron</b>	Not routinely	Risk assessment <sup>e</sup>	Not routinely <sup>e</sup>	Not routinely <sup>f</sup>
<b>Gown</b>	Not routinely	Risk assessment <sup>e</sup>	Yes <sup>f</sup>	Yes <sup>f</sup>
<b>Hair cover</b>	Not routinely	Not routinely	Not routinely	Optional
<b>Surgical mask (on HCW)</b>	Yes	Not routinely	Yes	Not routinely
<b>Surgical mask (on patient)</b>	Not routinely <sup>i</sup>	No	Not routinely <sup>j</sup>	No
<b>Particulate respirator (min FFP2 or FFP3)</b>	Not routinely	No	No	Yes <sup>g</sup>
<b>Eye protection</b>	Risk assessment	Risk assessment <sup>h</sup>	Yes	Yes

\* Bird exposure in regions with AI infections in animals or exposure to AI-infected patients

- a. Aerosol generating procedures create aerosols of different sizes (large and small-particle aerosols) Examples of aerosol-generating procedures include endotracheal intubation, aerosolised or nebulised medication administration, diagnostic sputum induction, bronchoscopy, airway suctioning, tracheostomy care, chest physiotherapy, nasopharyngeal aspiration, positive pressure ventilation via face mask (BiPAP, CPAP), high frequency oscillatory ventilation, post-mortem excision of lung tissue.
- b. Where possible aerosol-generating procedures should be performed in adequately ventilated ( $\geq 12$  exchanges per hour) rooms, side rooms or other closed single-patient areas with minimal staff present. PPE should cover the torso, arms and hands as well as the eyes nose and mouth
- c. Standard precautions are the minimum level of precautions indicated for all persons at all times
- d. Gloves should be worn in accordance with standard precautions.
- e. Gloves and gown or apron should be worn during cleaning procedures
- f. If splashing with blood or other bodily fluids is anticipated, and gowns that are not fluid resistant are used, a waterproof apron should be worn over the gown.
- g. If particulate respirator is not available, avoid aerosol-generating procedures as much as possible.
- h. Use eye protection if close contact ( $<1$  metre) with patient is possible
- i. Provide surgical mask for patient (if tolerated) when patient is outside the isolation room/area.

## **11.9 H5N1 in other animals**

### *11.9.1 A/H5N1 in cats*

A number of papers have reported on avian influenza in cats. Keawcharon et al demonstrated that H5N1 caused severe pneumonia in tigers and leopards that fed on infected poultry carcasses.<sup>(5)</sup> Kuiken et al experimentally inoculated cats with H5N1 virus intrathecally and fed them virus-infected chickens.<sup>(6)</sup> The cats developed severe diffuse alveolar damage and transmitted the virus to sentinel cats. Rimmelzwaan et al reported that domestic cats can be infected by eating infected birds, and that infected cats can spread infection to other cats, most likely through faeces, urine and other secretions from the respiratory tract.<sup>(7)</sup>

However, cats probably have little or no contribution to the spread of the disease because the number of infected poultry is much higher than the number of infected cats; poultry shed much more virus than other animals. During an H5N1 outbreak it is recommended that domestic animals should be monitored for infection.

### *11.9.2 Equine Influenza*

This disease is caused by two subtypes of virus H7N7 also known as A/equine 1 (prototype Prague/56), which is a H7N7 and A/equine 2 (Prototype Miami/63), which is a H3N8. The former does not appear to be prevalent currently and has not been isolated, since about 1979 although antibodies to this type have been detected in non-vaccinated horses born since that year. The H3N8 appears to have arisen from recombination from avian strains.

Equine influenza is endemic in most countries with significant equine populations, except Australia. Vaccination is widely practiced, using the H3N8 strains of virus in the vaccines. Antigenic shift continues and major epidemics occur, despite vaccination and the incorporation of recent isolates into vaccines.

Equine influenza is considered a production disease i.e. occurrences of the disease are not notifiable and there are **no official** measures specifically designed to control this disease in Ireland. Specific control measures, in the event of an outbreak are the responsibility of attending private veterinary practitioners.

Mandatory industry rules apply regarding vaccination and revaccination for competition horses in the thoroughbred industry. Vaccination in the presence of maternal antibodies appears not only to inhibit the serological response but also inhibits the response to future vaccinations. Vaccination reduces clinical disease due to the virus but does not prevent circulation of the virus or disease occurrence in the non-responders.

Major epidemics of equine influenza occur at periodic intervals e.g. Eastern Europe 1956; USA 1963; North America and Europe 1978-81, South Africa 1986, India 1987; China 1989 and 1993/94. The epidemic in China in 1989 involved an avian influenza virus A/Equine/Jilin/1/89 (H3N8), which had lost its ability to replicate in birds when it became infective for horses. Equine influenza has never been known to infect man.

### 11.9.3 Swine Influenza

This disease is a scheduled and notifiable disease in Ireland (Class B). Two subtypes generally affect pigs - namely H1N1 and H3N2. Two main types of swine viruses are currently in circulation in Europe - the avian like H1N1 and a human/avian like H3N2. More recently a H1N2 has been detected in pigs in the UK, France, Italy and the Netherlands. These latter isolates contain a haemagglutinin, which is closely related to a human type of the early 80's. H1N7 has also been isolated from pigs in the UK associated with clinical disease.

Two types of virus have been isolated in Ireland - a H1N1 was isolated for the first time in November 1991, and H3N2 was isolated for the first time in June 1993. The H1N1 isolated in Ireland, is different from the strains circulating in Europe and elsewhere, and probably represents a separate introduction of an avian strain into Irish pigs. It is serologically related to Weybridge 79 and OMS/2899/82. The H3N2 virus isolated is serologically related to OMS/3633/84.

No evidence for the existence of H1N2 in Irish pigs has so far been detected.

### 11.9.4 Other Mammals

Other mammals can and do respond clinically to influenza infections notably mink, which have been affected with H10N4 in Sweden. H5N1 infection was confirmed in a Stone Marten that was found in the Rugen area of Germany where three cats were previously confirmed as having H5N1.

A mink infected with an H5 virus was found in late March 2006 in the Blekinge region of Southern Sweden, where several infected birds had also been found. It was thought to have contracted the virus by consuming infected wild birds, the suspected mode of transmission to felines as well.

### 11.10 References

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