

# Bird Flu



The H5N1 virus has been given a lot more attention than previous outbreaks of flu in birds. Scientists and science reporters are interested in it because, although other flu subtypes (H1, H7) have transmitted from birds to people, this is the first time that H5 has done so, and with a high mortality rate. In the future, H5N1 may or may not produce a strain that is transmissible *between* humans, but its study is likely to be significant in vaccine and virus research.

The discussion about H5N1 in the UK has also become part of wider concern about risk and disaster planning, and subject to an intense media scrutiny of the Government's preparations for different kinds of emergencies. This has caused some confusion between the risks associated with bird flu and those of a possible future strain transmissible between people. It also seems to have created the misleading impression, reinforced by inaccurate circulars being sent out to staff by some employers, that there are preventative measures that the general public should be taking against a flu pandemic: this is not the case.

## H5N1 is a bird disease

There are many types of flu virus. H5N1 is a subtype of influenza A (see box) that is found in birds. A new strain of H5N1 that poses a serious threat to poultry, and that has been contracted from poultry by a small number of people, was first identified among wild geese in China in 1996. Over the last decade it has spread rapidly among wild birds.

## How the virus spreads

### Wild birds to poultry

Some water birds carry H5N1 in their intestines without becoming ill. Migrating water birds may be responsible for carrying the H5N1 virus from Southeast Asia to Europe and Africa. They shed the virus in nasal secretions, saliva and faeces, which might infect farmed birds.

### Poultry to poultry

Farmed birds don't carry natural resistance to H5N1. If a chicken becomes infected the virus can spread to and kill a whole flock in a few days. In the UK flu vaccines are not used for poultry because they can mask the prevalence of the virus thus making the birds effective carriers.

### Poultry to humans

It is very difficult for humans to become infected because the virus does not bind to cell receptors in the upper airway like ordinary human flu strains. It binds to receptors much deeper in the lungs, making it harder to contract.<sup>1,2</sup> Flu viruses are relatively fragile: H5N1 cannot survive for more than a few days

## Another way of saying...

**Pathogenic** – disease causing. (From the Greek *pathos* meaning *disease* and *genesis* meaning *bringing into being*.)

**Endemic** – always present in a population. Chicken pox is endemic in the UK, but malaria is not. It is also used for non-human animals, e.g., "bird flu is endemic in southeast Asia" (enzootic would be the scientifically correct term). (From the Greek *en* meaning *in* and *demos* meaning *people*.)

**Epidemic** – a sudden outbreak in a population, e.g., seasonal flu. (From the Greek *epi* meaning *upon* and *demos* meaning *people*.)

**Pandemic** – an epidemic that spreads worldwide. (From the Greek *pan* meaning *all* and *demos* meaning *people*.)

## It is called 'H5N1' because...

Viruses are tiny pieces of genetic material (DNA or RNA) surrounded by a protective coat. Influenza A is covered in spikes made by two types of protein: haemagglutinin (H) and neuraminidase (N). There are 16 different types of H and 9 types of N. H5N1 simply features type-5 H and type-1 N.

## Influenza A, B & C

Influenza's RNA is always linked to a nucleoprotein that exists in three different forms, labelled A, B and C.

**Influenza A** infects many animals including humans, dogs, cats, horses, pigs and birds; it is responsible for regular and sometimes major outbreaks of flu.

**Influenza B** circulates widely only in humans and causes sporadic outbreaks.

**Influenza C** also circulates widely only in humans, but seldom causes severe symptoms.

outside its host and is destroyed by heat, so cooked poultry and eggs are safe to eat. The only people who have contracted the virus are those who live and work among infected birds, but even then infection is very rare: around 200 people have caught the virus in 10 years (of those, more than 50% have died, because H5N1 is highly pathogenic).<sup>3</sup>

### Human to human

It doesn't.<sup>4</sup>

## A human disease is unlikely

There have been more than 20 outbreaks of highly pathogenic bird flu in poultry since 1959, six of which were major outbreaks affecting many farms and causing large economic losses.<sup>5</sup> Although a few people became infected with various bird flu viruses, none of these infections resulted in a disease that was transmissible between people, i.e., a human disease.

The three human flu pandemics of the last century share a genetic lineage that began with a genetic mutation in 1918.

**1918-19 (H1N1):** 'Spanish flu' was caused by a bird flu virus that mutated in such a way that it could pass from person to person.<sup>6</sup> It killed an estimated 50 million people and is the worst flu pandemic in history. H1N1 evolved into milder strains that still circulate today.

**1957-58 (H2N2):** 'Asian flu' was born of genetic mixing between an H1N1 human virus and an H2N2 bird virus. It was less virulent than the Spanish flu and the world was better prepared, but more than two million people died.

**1968-69 (H3N2):** 'Hong Kong flu' was born of genetic mixing between an H2N2 human virus and an H3N2 bird virus. Only slightly more pathogenic than regular human flu, one million people died in this pandemic.

To become a significant threat to humans, H5N1 will either need to change through mutations in its genetic material (which arise from mistakes in copying itself when it reproduces) or mix with a human virus. Such a change is impossible to predict and may not occur at all. To become a human disease the virus would also have to change into something that infects the nose and throat (rather than the lungs). This would help the virus to spread more easily but it might compromise its ability to cause harm, as a lung infection is typically more damaging than a nose and throat infection.

Based on the possible range of changes in H5N1, there is a greater chance of it first becoming a human disease that does not spread easily than one that does (which a pandemic strain would have to be). In this case, we would see some restricted transmission within communities and be able to set up the isolation measures that have been used for other diseases, such as severe acute respiratory syndrome (SARS).

Social conditions have a very strong bearing on the spread of harmful viruses. In 1918 basic medical facilities were overwhelmed with casualties from war and many people were already weak. The conditions of the war meant that uninfected people mixed much more with those who were very sick with flu or who

had died, particularly in the cramped conditions of trenches, barracks and hospitals.

## What can be done?

The main concern with H5N1 is to protect bird stocks in the poultry industry by minimising contact between farm birds and infected wild birds. Significant outbreaks in farms would kill many thousands of birds and damage the industry. It is also necessary to minimise circulation of the virus near human populations, to protect people and restrict the chances of H5N1 changing into a human disease. This is largely an issue for those countries where people live among infected birds.

There are some actions being taken to address these concerns:

- Government**
- monitoring birds for signs of flu
  - banning imports of live birds
  - sealing off regions surrounding an outbreak
- Farmers**
- restricting interaction between their stock and wild birds
  - reporting suspected incidences of flu in their poultry flocks
- Scientists**
- researching how H5N1 spreads and affects the human body
  - developing anti-viral drugs to slow the progress of flu
  - developing technologies to accelerate the production of vaccines

### The general public

- nothing  
(other than report unusual incidents of dead birds to Defra<sup>7</sup>)

There is no reason to buy face masks or anti-viral drugs or to avoid eating eggs and poultry. People who are not in very close contact with infected birds have no reason to worry or to modify their behaviour because H5N1 is currently a disease of birds and there is not a human strain of this disease.

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### Further information

The Department for Environment, Food and Rural Affairs (Defra: [www.defra.gov.uk](http://www.defra.gov.uk)) provides information on bird flu issues related to farming. Although bird flu is not a significant food issue, the Food Standards Agency ([www.food.gov.uk](http://www.food.gov.uk)) provides some information. More generally, the Department of Health and Human Services (USA) hosts an excellent website with lots of clear and up-to-date information ([www.cdc.gov/flu/avian](http://www.cdc.gov/flu/avian)).

To see how the bird flu story is being played out in the UK national press, go to the Society of General Microbiology's website ([www.sgm.ac.uk/news](http://www.sgm.ac.uk/news)).

This note has been collated by Chris Tyler, with kind assistance from Sense About Science advisers. Additional research and monitoring by Aurélie Catteau and Timothy Wogan.

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<sup>1</sup> Shinya K *et al.* 2006 *Nature* Mar 23, 440(7083):435-6

<sup>2</sup> D van Riel *et al.* 2006 *Science* Published online, March 23, 10.1126/science.1125548

<sup>3</sup> [http://www.who.int/csr/disease/avian\\_influenza/country/en](http://www.who.int/csr/disease/avian_influenza/country/en)

<sup>4</sup> Some of the 200+ cases of bird to human infection have been clustered in households, leading to suspicion of human to human transmission. However, family members share the same environment, living alongside infected birds, so the route of infection is often hard to determine. There have been no instances of spread from person to person outside the immediate family.

<sup>5</sup> [http://www.who.int/csr/don/2004\\_03\\_02/en/#outbreak](http://www.who.int/csr/don/2004_03_02/en/#outbreak)

<sup>6</sup> Taubenberger JK *et al.* 2005 *Nature* Oct 6, 437(7060):889-93

<sup>7</sup> <http://www.defra.gov.uk/animalh/diseases/notifiable/disease/ai/wildbirds/index.htm>