

# BIRD FLU 2003-2004: DOE SPECIAL MEDICAL UPDATE

## Friday, February 13, 2004

### What is the present situation?

Avian influenza is an infectious disease of birds caused by type A strains of the influenza virus. The disease, which was first identified in Italy more than 100 years ago, occurs worldwide. All birds are thought to be susceptible to infection with avian influenza, though some species are more resistant to infection than others. Since mid-December 2003, a growing number of Asian countries have reported outbreaks of highly pathogenic avian influenza in chickens and ducks. Infections in several species of wild birds and in pigs have also been reported. The rapid spread of highly pathogenic avian influenza, with outbreaks occurring at the same time in several countries, is historically unprecedented and of great concern for human health as well as for agriculture [<http://www.fao.org/>]. Particularly alarming, in terms of risks for human health, is the detection of a highly pathogenic strain, known as "H5N1", as the cause of most of these outbreaks. H5N1 has jumped the species barrier, causing severe disease in humans on two occasions in the recent past, and is now doing so again, in gradually growing numbers. Fortunately, the H7 strain presently infecting Delaware chickens has never been known to cause human infection ...

[http://www.who.int/csr/don/2004\\_01\\_15/en/](http://www.who.int/csr/don/2004_01_15/en/).

**In birds:** Outbreaks of avian influenza A (H5N1) have been confirmed among poultry in Cambodia, China, Hong Kong (in a single peregrine falcon), Indonesia, Japan, Laos, South Korea, Thailand, and Vietnam. The infection is spread as infected birds shed virus in saliva, nasal secretions, and feces. Avian influenza viruses spread among susceptible birds when they have contact with contaminated excretions. It is believed that most cases of H5N1 infection in humans have resulted from contact with infected poultry or contaminated surfaces ... <http://www.cdc.gov/flu/avian/index.htm>.

**In people:** While there has been no human to human transmission, the outbreak of bird flu has resulted in human cases of H5N1 infection in Vietnam and Thailand. Deaths have been reported. At this time it is believed that these cases resulted from contact with infected birds or surfaces contaminated with excretions from infected birds. Human infection has occurred rarely, with the first documented human infections with the H5N1 avian strain occurring in Hong Kong in 1997. Symptoms from human infection are limited to studies of the 1997 Hong Kong outbreak. Symptoms included fever, sore throat, cough and, in several of the fatal cases, severe respiratory distress secondary to viral pneumonia. In that first outbreak, 18 persons were hospitalized and 6 of them died. The source of infection in all cases was traced to contact with diseased birds. The mortality in this small group was 33%. In comparison, SARS overall mortality was about 10%. **The H5N1 strain can be deadly!**

### Why so much concern about the current outbreaks?

Public health officials are alarmed by the unprecedented outbreaks in poultry for several reasons:

- Most of the major outbreaks recently reported in Asia have been caused by the H5N1 strain. There is mounting evidence that this strain has a unique capacity to jump the species barrier and cause severe disease, with high mortality in humans as was noted above.
- **An even greater concern is the possibility that the present situation could give rise to another influenza pandemic in humans.** Scientists know that avian and human influenza viruses can exchange genes when a person is simultaneously infected with viruses from both species. This process of gene swapping inside the human body can give rise to a completely new subtype of the influenza virus to which few, if any, humans would have natural immunity.
- Existing vaccines, which are developed each year to match presently circulating strains and protect humans during seasonal epidemics, would not be effective against a completely new influenza virus.
- If the new virus contains sufficient human genes, transmission directly from one person to another (instead of from birds to humans only) can occur. When this happens, the conditions for the start of a new influenza pandemic will have been met. Most alarming would be a situation in which person-to-person transmission resulted in successive generations of severe disease with high mortality.

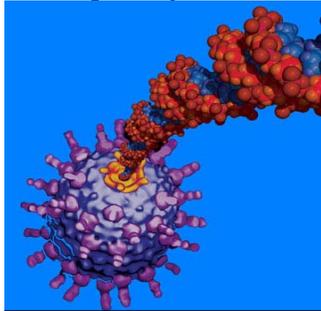
This was the situation during the great influenza pandemic of 1918–1919, when a completely new influenza virus subtype emerged and spread around the globe, in around 4 to 6 months. Several waves of infection occurred over 2 years, killing an estimated 40–50 million persons ... [http://www.who.int/csr/don/2004\\_01\\_15/en/](http://www.who.int/csr/don/2004_01_15/en/).

## Travel Advice

WHO does not at present recommend any restrictions on travel to any country currently experiencing outbreaks of H5N1 avian infection in poultry flocks, including countries which have also reported cases in humans. Travelers to countries in Asia with documented H5N1 outbreaks should avoid poultry farms, contact with animals in live food markets, and any surfaces that appear to be contaminated with feces or fluids from poultry or other animals. Also note that influenza viruses are destroyed by heat, and as a precaution, consumers should ensure that all foods from poultry, including eggs, have been thoroughly cooked ... [http://www.who.int/csr/don/2004\\_01\\_26/en/](http://www.who.int/csr/don/2004_01_26/en/).

## Understanding how viruses infect cells

Although they are not themselves alive, a virus can reproduce by hijacking the machinery of a living cell.



A virus biomolecular portal motor (yellow) compresses coiled lengths of DNA into the viral shell to 6,000 times its normal volume, creating pressures ten times as powerful as those inside a champagne bottle ... <http://www.lbl.gov/Science-Articles/Archive/infectCells.html>.

The virus particle contains a strand of DNA or RNA, which can be packed under enormous pressure within the viral shell (see drawing, left), and can be extremely small --a thousand times smaller than a bacterium. The jacket normally is studded with chemical "feelers" that can bond to the outside of a cell. Once docked, the viral DNA (or RNA, depending on the virus) is injected into the cell, leaving the jacket outside. In the simplest virus, the DNA or RNA strand is now floating freely inside a cell, and uses the cellular apparatus to make copies of itself. Eventually the cell is so full of new viral particles that the cell bursts, freeing the virus particles to attack new cells. Using this system, the

speed at which a virus can reproduce and infect other cells is amazing. The article [How Viruses Work](http://science.howstuffworks.com/virus-human.htm) by [Craig C. Freudenrich, Ph.D.](http://science.howstuffworks.com/virus-human.htm), describes this process in detail ...

<http://science.howstuffworks.com/virus-human.htm>.

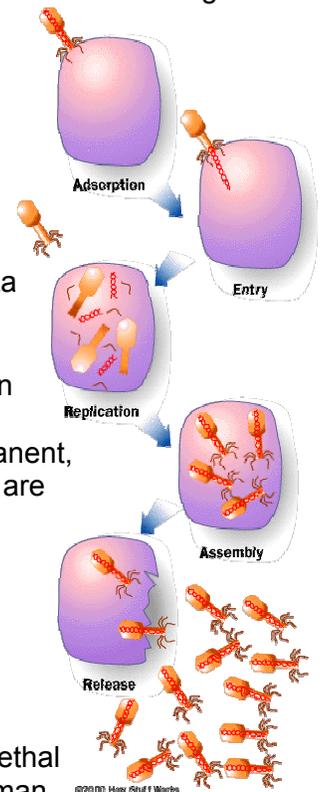
### A constantly mutating virus with two consequences: "drift" and "shift"

All type A influenza viruses, including those that regularly cause seasonal epidemics of influenza in

humans, are genetically labile and well adapted to elude host defenses. Influenza viruses lack mechanisms for the "proofreading" and repair of errors that occur during replication.

- **Antigenic "drift":** As a result of uncorrected errors, the genetic composition of the viruses changes as they replicate in humans and animals, and the existing strain is replaced with a new antigenic variant. These constant, permanent, and usually small changes in the antigenic composition of influenza A viruses are known as **antigenic "drift"**.
- **Antigenic "shift":** Influenza viruses have a second characteristic of great public health concern: influenza A viruses, including subtypes from different species, **can swap or "reassort" genetic materials and merge**. This reassortment process, known as **antigenic "shift"**, results in a novel subtype different from both parent viruses.

As populations will have no immunity to the new subtype, and as no existing vaccines can confer protection, antigenic shift has historically resulted in highly lethal pandemics. For this to happen, the novel subtype needs to have genes from human influenza viruses that make it readily transmissible from person to person for a sustainable period. The H5N1 strain has been shown to mutate rapidly and has a documented propensity to exchange genes with influenza viruses from other species.



From: ["How Viruses Work"](http://science.howstuffworks.com/virus-human.htm)  
by [Craig C. Freudenrich, Ph.D.](http://science.howstuffworks.com/virus-human.htm)

## Can a pandemic be averted?

No one knows for sure. As we saw above, influenza viruses are highly unstable and their behaviour defies prediction. However, if the right actions are taken quickly, an influenza pandemic can be averted. The first priority, and the major line of defense, is to reduce opportunities for human exposure to the largest reservoir of the virus: infected poultry. This is achieved through:

- The rapid detection of poultry outbreaks
- The emergency introduction of control measures, including the destruction all infected or exposed poultry stock, and
- The proper disposal of carcasses.

All available evidence points to an increased risk of transmission to humans when outbreaks of highly pathogenic avian H5N1 influenza are widespread in poultry. As the number of human infections grows, the risk increases that a new virus subtype could emerge, triggering an influenza pandemic.

This link between widespread infection in poultry and increased risk of human infection is being demonstrated right now in Asia. WHO stresses the urgency of the situation and the need for rapid action in the animal and agricultural sectors.

## Are presently available 'human' flu vaccines useful in averting an influenza pandemic?

Yes, but in a precisely targeted way. **Annual vaccines are produced for routine use in protecting humans during seasonal epidemics of influenza. They offer no protection against infection with the H5N1 avian virus.** For these reasons, WHO has issued guidelines for vaccination with current trivalent influenza vaccine [<http://www.who.int/csr/disease/influenza/vaccinerecommendations/en/>], of groups considered at high risk of exposure in countries experiencing outbreaks of highly pathogenic H5N1 avian influenza in poultry. Current 'human' flu vaccines, when administered to high-risk groups, such as poultry cullers, protect against circulating human strains and thus reduce the risk that humans at high risk of exposure to the bird virus might become infected with human and avian viruses at the same time. As noted above, dual infections give the avian and human viruses an opportunity to exchange genes, possibly resulting in a new influenza virus subtype with pandemic potential ... [http://www.who.int/csr/disease/avian\\_influenza/avian\\_faqs/en/#pandemic](http://www.who.int/csr/disease/avian_influenza/avian_faqs/en/#pandemic).

## How are workers protected?

Workers involved in the culling of poultry flocks must be protected against infection by proper clothing and equipment. These workers should also receive antiviral drugs as a prophylactic measure. For the reasons noted above, they should also receive the current trivalent influenza vaccine.

The information presented in this Update is consistent with that found at the Centers for Disease Control and Prevention [<http://www.cdc.gov/flu/avian/index.htm>], the World Health Organization [[http://www.who.int/csr/disease/avian\\_influenza/en/](http://www.who.int/csr/disease/avian_influenza/en/)], and other reputable sites. The material provided is for informational purposes only and any recommendations are not intended to replace the advice of your physician. You are encouraged to seek advice from a competent medical professional regarding the applicability of any recommendations with regard to your symptoms or condition. Please direct questions, comments or suggestions to:

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