

Unmasking Avian Influenza



(nekofumi, <http://www.phoenix-c.or.jp>)

By Tom Allen

From the news and movies to politicians, everyone has heard of the imminent threat of the “bird flu,” or avian influenza. But what is it that makes this disease scarier than the influenza that goes around every year? Why have so many people touted this disease as the one that will take over America?

Influenza in General

Flu in the Past

When people speak of a pandemic disease outbreak, most people’s thoughts will go to the 1918 Spanish Influenza outbreak. Stories were widely reported of soldiers returning from World War I collapsing and dying within days of looking healthy. The entire world was affected as over 20 million people died (Webster, 1999). The strain of influenza that caused that pandemic is an example of how quickly a virus can mutate from being near harmless to

Quick Facts about the Spanish Flu:

- Was the worst influenza pandemic in modern history
- 20% of the world population was infected with the disease
- An estimated 25 to 100 million people died across the globe
- People would go from feeling fine to unable to walk in hours

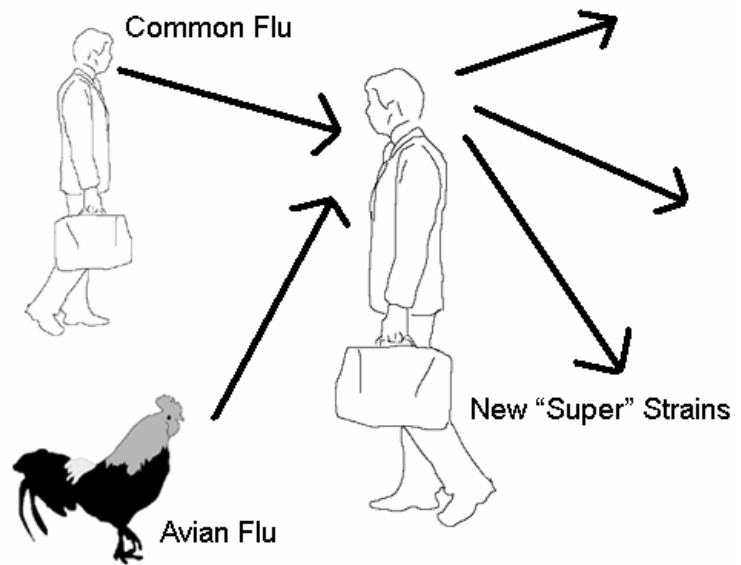
devastating a population. A popular theory of the origin of Spanish Influenza strain is that it was originally localized in birds, when it infected a human and mutated into the Spanish Flu.

Flu Right Now

The current cases of avian influenza have been localized in Asia and Eastern Europe, causing scares across that entire half of the world. The strain that has caused the most alarm is H5N1 and at this point can only be transmitted from bird to bird and from bird to human. If the current virus fails to mutate, the danger to the human population is minimal. What has made this virus news-worthy is that when humans get infected, half of them die. In order to understand how to prepare for a possible pandemic, it is important to know how the virus can mutate and become a lethal killer.

How the Flu Spreads

Influenza strains can be categorized by how they infect new hosts. The average flu that spreads through the human population every year is capable of human-to-human infection. The strain of avian flu that is spreading through Asia and Europe is only capable of bird-to-bird and bird-to-human infection. This means that someone that is infected with bird flu cannot infect anyone else. Each strain can also be divided into groups based on the method of each of those forms of infection. For example, the H5N1 strain can only infect new hosts through the transmission of fecal matter and water. The people that have been infected with the bird flu so far have mostly been infected by their water supplies. The modern human influenza, on the other hand, can spread through the air by staying alive in saliva. Since all influenzas primarily infect the lungs, this method of transmission suits it perfectly, as the host coughs, sending saliva into the air and infecting all near him.



An example of how antigenic shift occurs (Artist: author)

radically different from either original “parent,” it is usually much more lethal than through antigenic drift (Anonymous, 2006).

Why Avian Flu is Worse

Ease of Mutation for H5N1

The H5N1 subtype of avian influenza is particularly dangerous due to its ability to change more rapidly than other strains. This characteristic is due to its capability of easily infecting other animals besides birds. When the virus infects other animals, they could be carrying other viruses that would not be present in birds. One of the animals that can pass influenza easily to humans is pigs. After the initial outbreak of the Spanish Flu in 1918, the virus infected the pig population and now the versions of the flu that infect pigs can be easily transmitted to humans. Since modern pig flu viruses can easily infect humans, a pig infected with two strains could create a strain capable of conducting human-to-human infection. (Anonymous, 2006)

How the Flu Mutates

Influenza can mutate through two ways: antigenic drift and antigenic shift. Antigenic drift is where the virus mutates due to the introduction of antibodies that attempt to kill the virus within the host. Usually these mutations are small, but constant; in this way the virus “drifts” through mutations. These mutations are one of the reasons why the flu spreads so efficiently every year. The World Health Organization keeps track of these mutations throughout the year, making sure they know if a strain is becoming more lethal. The second method of mutation is through antigenic shift, which is where a host is infected with multiple strains of the flu at the same time. Each influenza virus contains eight gene segments. When the two variants of the flu mix, they can combine to form an entirely new strain that takes bits from each. Since this new virus is so

Lethality of H5N1

One of the reasons that H5N1 should cause alarm is its pure lethality after infection. As of May 23, 2006, there have been 218 cases of H5N1 infection and 124 deaths. This equals a 57% mortality rate, which is very high for a virus that can spread as easily as the flu. If the virus were to mutate to a form that could easily pass from human to human while retaining its current lethality, millions could die before a vaccine could be developed (WHO, 2006).

The Ubiquity of Birds

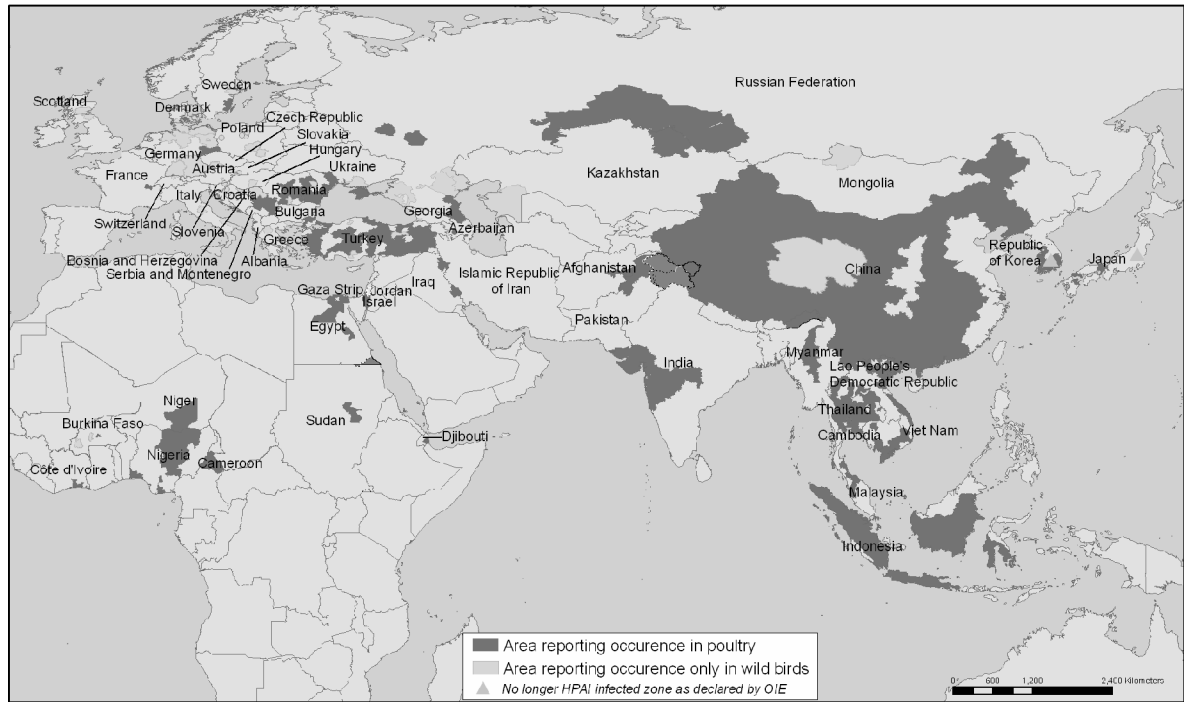
One of the unique characteristics of the H5N1 strain of avian influenza is that many migratory birds do not become ill upon infection of the virus. They can contract the flu, then migrate across the world and take the virus with them, infecting other birds along the way. This gives the virus especially hard to quarantine, as birds can fly past any roadblock or body of water in their way.

H5N1 is dangerous in Asia because there is a large poultry industry there, where many workers are in direct contact with chickens that could contract the virus from migratory birds.

Avian Flu in the Future

What Makes a Pandemic?

The World Health Organization requires three conditions in order for an outbreak to be called a pandemic: the disease must be new to its host population, it must be able to infect humans and cause serious harm to their health, and it must spread easily between humans. So far, H5N1 has met the first two conditions of a pandemic; the third could be met if the virus were to mutate to be human-to-human and be airborne. The fastest way this could happen would be through antigenic shifting using a “mixing” host.



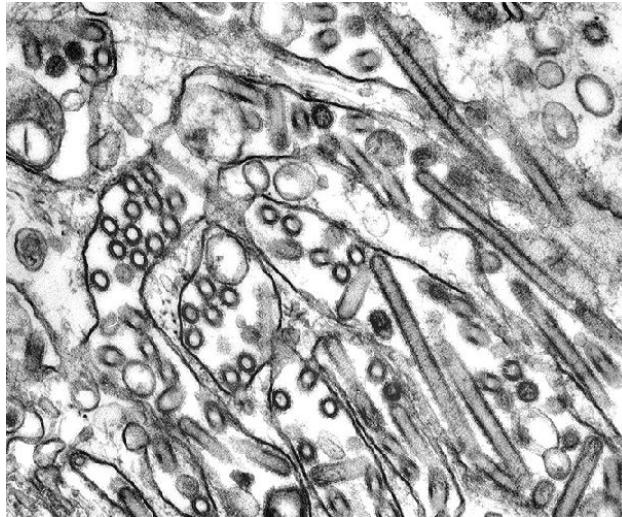
A map detailing the detected cases of Avian Influenza in wild birds and poultry since 2003 (WHO, <http://gamapservr.who.int>)

This host could either be a human who gets infected with two strains of the flu at the same time or it could be a mammal like a pig that already has the capability of passing influenza to humans. If during an antigenic shift, it kept one of the eight segments that allowed its lethality while taking a segment that allows it to pass easily between humans from a different virus, a potential disaster could happen.

Possible Immune Strains

The main drug used to fight infections of the avian flu is Tamiflu, an antiviral medication that was used extensively in Asia. There are fears, however, that the increased use of Tamiflu could lead to resistant strains. Due to antigenic drift, if the virus is exposed to the antibodies that Tamiflu helps create, then the virus has a chance to change its genetic structure so that the drug's effect is lessened.

In Vietnam, a patient was diagnosed with a new strain of H5N1 that was immune to the effects of Tamiflu. In this case, a second drug similar to Tamiflu worked in treating the virus, but this could mean bad news if the virus can adapt to new drugs this fast. (Kaye, 2005)



(San Francisco Department of Health, <http://www.sfdcp.org/>)

Possible Scenarios

If an avian influenza pandemic were to occur, analysis would need to be conducted on the particular strain to see if current antiviral medicine could be used to treat it. In the time before a vaccine for that individual strain could be developed, existing antiviral drugs would need to be prescribed. If the strain were resistant to antivirals, however, this delay between initial phases of the pandemic and production of a tailored vaccine could mean the deaths of a large portion of the world's population. It is therefore important to closely watch the mutations of the current strains, while continuing research on new antiviral medications to combat new strains. A future pandemic cannot be stopped by simply coming up with a cure beforehand, due to the changing nature of the virus. Only physical measures and a world ready to create vaccines on demand can

be effective against a deadly strain of Avian Influenza.

Summary

Influenza has caused at least one large outbreak in the past that left the world crippled. Influenza in general mutates either slowly due to the presence of new antibodies in its host or quickly through mixing of different strains in a host. Avian Influenza is important because it can

kill half the people it infects. If the Avian

Influenza becomes easily transmittable between humans, a pandemic will occur. If this strain were to be resistant to antiviral medications, millions could die before a treatment is developed.

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