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H5N1: A THREAT IN MISSISSIPPI?

BY
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H5N1 is a highly pathogenic avian influenza strain which has cost the poultry industry millions of dollars globally.

AN INFLUENZA PRIMER

In order to understand H5N1 as a threat in Mississippi, we must understand influenza. Influenza is a virus. Some strains are highly pathogenic; others are not. The public has come to confuse influenza with avian influenza, H5N1 and pandemic. These are not synonymous terms. For our purposes, flu is essentially **seasonal flu** – the flu that strikes humans each year during "flu season" (the rough opposite of hurricane season – flu season runs from November through April). It is a respiratory illness which can be transmitted from person to person. Most humans have some degree of built-in immunity to seasonal flu, and available influenza vaccines are fairly effective. Seasonal influenza is the 6th leading cause of death in the United States. During an average season, as much as 20% of the US population may become infected; 36,000 may die; more than 200,000 may require hospital admissions.

Avian influenza, or bird flu, is caused by flu viruses that naturally occur among wild birds. Avian flu was first identified in Italy over a hundred years ago. So far, avian flu has mutated into at least 16 varieties, of which H5N1 is but one. Former Health and Human Services Secretary Tommy Thompson has called the potential for an epidemic of avian influenza "one of the greatest dangers facing the United States."

H5N1 is a highly pathogenic strain of avian flu. Dr. Robert Webster, who holds the Chair in Virology at St. Jude's Children's Research Hospital in Memphis calls it "the worst flu virus I have ever seen or worked with or read about….[it] is a very promiscuous and efficient killer." It is deadly to domestic birds, and under certain circumstances H5N1 can be transmitted from birds to

humans. Neither domestic bird flocks nor humans appear to have any degree of built-in immunity to H5N1. Currently no vaccine is available. Humans have been infected as a result of exposure to contaminated feces, nasal secretions or saliva of infected birds.

H5N1 surfaced in Asia around 1997 and has spread constantly. Beginning in 2006, the virus appeared in a number of European countries and subsequently in Africa. To date, H5N1 remains an avian influenza which is not presently optimized for infecting humans. On the rare occasion that it does so, it does so lethally. As of early December 2006, the World Health Organization (WHO) reports 258 cases of infection with 154 deaths. This reflects a Case Fatality Rate (CFR) of ~ 59%. In other words, of those individuals infected, approximately 60% die. At present, 258 cases out of the hundreds of millions of individuals who may have been exposed to the virus means that human infection is a low probability event. However, the sloppy reproduction habits of flu viruses, which lead to a high rate of virus mutation, concern medical researchers. Since its identification in 1997, H5N1 has mutated into two clades or strains. Clade 2, in turn, has mutated into 3 sub-clades. Clade 2-1, which emerged in 2004 in Indonesia, is associated with a CFR of ~77%.

Pandemic flu is a virulent human flu that causes global outbreak. It is the viral equivalent of the perfect storm, according to Michael Specter. Pandemics emerge from animal viral reservoirs, they have the capacity to make *people* sick, and they are able to spread efficiently – through a sneeze, a handshake, or a cough. H5N1 has met the first two elements of the perfect storm – it's new, so humans have no antibodies, and it's deadly and without a vaccine. Will it mutate to spread efficiently human-to-human?

A pandemic occurs when a virulent human flu develops rapidly, so that no vaccine is available. WHO predicts that influenza pandemics can be anticipated three to four times a century. The Spanish flu of the early 20th century killed 40-50 million people worldwide and approximately 600,000 individuals in the United States, and is considered the US's most recent serious influenza pandemic. Researchers estimate the CFR of Spanish flu to be ~ 2.5 to 5%, *significantly* less than the CFR of H5N1.

Typically, influenza epidemics arrive in "waves" of infection which last roughly 12-15 weeks with a peak of infection around 5-6 weeks into the wave. WHO anticipates several waves of varying severity with perhaps 30% of a population being infected in a wave. Obviously, there will be local variations in the percentage of population infected, dependent in part on pandemic preparedness plans which are implemented in those areas.

MISSISSIPPI'S "SPECIAL INTEREST"– OUR POULTRY INDUSTY.

Mississippi has a poultry industry of which we are justifiably proud. Mississippi ranks 4th in the nation in boiler production and 16th in the nation in egg production. The Mississippi Department of Agriculture and Commerce's (MDAC) estimates approximately 827,000,000 broilers and 1,600,000,000 eggs were produced in Mississippi in 2005, resulting in poultry agriculture income for the state exceeding $1.98 billion.

Counties leading Mississippi's poultry production are located in central Mississippi: Scott, Smith, Leake, Simpson, Jones and Neshoba. In addition to poultry production, the majority of poultry raised in Mississippi is also processed in Mississippi. MDAC publications reflect 17 broiler slaughter facilities in the state, with most broilers undergoing further processing in the State as well. The State is also home to at least two plants which are designated as "spent hen" facilities – facilities which utilize female chickens to lay eggs either for production of broilers or for table eggs.

Mississippi's wild and domestic birds are at risk for H5N1 and other strains of avian flu. Not only is the bird population at risk, but traditional methods of dealing with the waste from the poultry industry and its collection point – wood shavings -- and their afterlife as pasture fertilizer, bring associated risks.

Researchers have developed the transmission protocol for locales with a large poultry industry. Migrating birds are carriers. As they migrate, their infected feces, saliva or secretions are spread and domesticated birds become infected, and usually die. Areas which have live birds as a part of their economic markets – like Mississippi's broiler industry, where birds are kept in very close quarters – may anticipate a rapidly spreading virus. In addition to bird-to-bird or, on occasion, bird-to-human infection, H5N1 has demonstrated an interest in all invitations and opportunities to mutate.

It does not take a rocket scientist to envision a worst case scenario with poultry and poultry waste – particularly when one considers that an infected bird who survives can continue to expel viral remnants up to 10 days after successfully combating the infection.

MISSISSIPPI'S PANDEMIC PREPARATION.

The Trust for America's Health, a non-profit, non-partisan organization with a goal of making disease prevention a national priority, released its 4th annual report: "Ready or Not? Protecting the Public's Health from Disease, Disasters, and Bioterrorism" on December 12, 2006. After analyzing the progress of 50 states and the District of Columbia by studying 10 key indicators

of health emergency preparedness, it gave Mississippi a score of 6 out of 10. Half of all states scored 6 or less on the scale of 10 indicators. Mississippi's preparedness weaknesses include a nursing shortage, few adults over 65 obtaining pneumonia vaccination, no state effort compatible with the Center for Disease Control's (CDC) National Electronic Disease Surveillance System, and a low level for funding for public health services.

Mississippi has a Pandemic Influenza Preparedness Plan which has been in place since 2004. Currently the Department of Health's (DOH) prevention strategy includes educational measures to control disease transmission (health hygiene) and vaccine delivery. However, currently there is no vaccine for H5N1. Thus, a pandemic would require antiviral agents (such as oseltamivir phosphate – the U.S. has stockpiled enough to treat 2.3 million people – the price is $60 per course of treatment), supportive and symptomatic treatment, recommended isolation and quarantine, if necessary. DOH has authority over epidemics occurring within the state, including enforced isolation, quarantine and physical control of property as required for the protection of public health. *See* Mississippi Code §41-23-5.

The Department of Health estimates that an influenza pandemic would result in over 2,500 deaths in Mississippi, over 10,000 hospitalizations, over a half-million interactions with physicians resulting from out-patient care, requiring over 650,000 doses of vaccine (if available for the virus), and over 32,000 hours of health care provider time needed for treatment of the infected population.

The Mississippi Department of Wildlife, Fisheries and Parks has developed a plan to monitor any type of high pathogenic avian influenza outbreak in Mississippi's wildlife.

CONSIDERATIONS FOR H5N1.

H5N1 has the potential to mutate from avian influenza to a pandemic strain which would infect humans. This is due to its virulence, the fact that there is no vaccine, and its demonstrated ability to morph easily. In the last decade, H5N1 outbreaks occurred in Hong Kong, Korea, Vietnam, Cambodia, Thailand, China (including Tibet), Indonesia, Turkey, Iraq, Romania, Ukraine, Azerbaijan and the Greek isle of Oinousses. While no H5N1 strain has been tracked to North America, Canada has detected two less virulent strains of the virus: subtype H7N3 in British Columbia, and the subtype H5N3 in Quebec. Mexico has detected H5N2 within its poultry industry near Mexico City.

Dr. Margaret Chen, former Director of Health of Hong Kong and now the chief officer of the WHO, is credited with averting a pandemic in 1997 by her handling of the H5N1 outbreak in Hong Kong. (One and a half million birds were put to death in less than 3 days under her skillful leadership. There were only 6 human fatalities.) Dr. Chen is concerned with the ability of H5N1 to initiate direct infection in humans. She sees this occurrence as a reality in Asia, particularly if humans who are infected with seasonal flu are exposed to avian influenza strains at the same time. Dr. Chen describes the infected individual as a "mixing vessel" for a mutated strand of avian influenza virus that spreads easily from person to person This event, she says, will marks the start of the next global flu pandemic.

H5N1 is demonstrating its ability to mutate in non-traditional hosts. It has now infected pigs, tigers and other large cats, mice, domestic cats, along with various species of wild birds normally immune to avian flu (pheasants, swans, turtledoves, eagles, etc.) Leading virologist Dr. Todd Hatchette notes H5N1's viability in a large number of hosts is evidence that it is refining its genes in order to make the leap to become the next pandemic virus. The character-specifics making H5N1 pandemic-focused, according to Hachette, include demonstrations of (1) rapid mutation; (2) ability to infect and live in diverse hosts; and (3) lethality in humans who have been infected.

The Pan American Health Organization (PAHO), the world's oldest public health organization, is concerned that although the Americas do not host the most heavily-trafficked worldwide flyways, there is a flyway link from Asia to Alaska. Thus H5N1 can enter the Americas via bird migration. PAHO's executive director, Carissa Etienne, believes the greater risk to the Americas will occur after H5N1 has morphed as Dr. Chen predicts – human-to-human in Asia. She, like Chen, is certain that event will occur. With international travel, H5N1 as pandemic will enter the Americas through a human rather than a flyway.

Bird pandemics, called epizootics, can result in economic devastation of the institutional bird flocks, like Mississippi's poultry industry, and can also threaten food supplies. But a pandemic which might result from a mutation of H5N1 to a human-to-human strain would cause the deaths of millions worldwide, serious economic disruptions and a breach of the social fabric.

If H5N1 does morph to the human population as a pandemic, it will be the first time the world has been able to anticipate an influenza epidemic, due to a study of viral genetics at the CDC and elsewhere. But will we be prepared?

PREPAREDNESS THOUGHTS.

What about flu shots? The annual flu shot that you receive is a "highly educated" bet on the strain of flu that will most likely infect you. It stimulates antibodies that should provide protection from the viral strain that epidemiologist think might occur during the upcoming flu season. But flu viruses make "antigenic drifts". If H5N1 morphs to the human population, such an antigenic drift would probably make the flu shot useless as protection. The antigenic drift must occur for a vaccine to be specifically targeted.

Avian Flu. The staff of the John C. Stennis Institute of Government has made a review of literature and the State's emergency legislation, emergency preparedness standards and other issues of concern in event of an avian flu outbreak in Mississippi's wildlife or poultry industry. Mississippi's poultry industry risks an economic disaster if massive flock slaughter is required. Because H5N1 has demonstrated the ability to spread from bird to humans by direct contact, the poultry industry's labor force is at risk. These laborers could also become the "mixing vessel" to allow H5N1 to morph to pandemic. Either scenario could result in a stress on our medical facilities and health caregivers.

Vaccines for chickens exist, but there are no effective guidelines on use and implementation. China and Indonesia, neither of which exports poultry, vaccinate their flocks. Other Asian countries do not. Health ministries in some Asian and European countries are considering the use of biothermal RFID chips to telegraph temperature spikes in a representative bird population, an early indication of infection. Warning from a temperature spike could expedite disease identification, which currently occurs by observing discoloration of beak, sneezing, diarrhea and sudden death in the flock.

Pandemics. The staff of the John C. Stennis Institute of Government has made a review of literature and the State's emergency legislation, emergency preparedness standards and other legislation of concern in a pandemic situation. The Institute makes recommendations for Legislative consideration.

1. Emergency preparedness statutes do not specifically contemplate pandemics. There is perhaps a need to amend the definition of a natural emergency to include a pandemic or health epidemic.
2. There is not a seamless way to provide emergency licensing status to medical professionals who might come to Mississippi to respond to a disaster.
3. There is a weakness in the drug stockpiling chain. The DOH preparedness plan is dependent on the Strategic National Stockpile (SNS) of vaccines and anti-viral medications.
4. There must be some way to effectively dispose of poultry industry waste and flocks with immediacy if required.

CONCLUSION.

A majority of public health experts continue to assess the risk of an H5N1 virus mutating to a human-to-human transfer system as quite significant. Mississippi, with the 4th largest commercial poultry industry in the nation, located around the state's most populous center, is a place where the mutation could occur. We must be prepared to make difficult economic choices quickly in the event necessary to save and secure not only various portions of Mississippi's commercial flocks but Mississippi's wildlife population and Mississippi's citizens.

In such an environment, there will be tension between those responsible for Mississippi's agriculture and commerce and those responsible for Mississippi's public health. It is to be expected. But the tension must be managed for the best outcome. That's what leaders do.

Preparation requires attention to two scenarios: (1) protection of our wildlife and poultry flocks from any avian flu strain and protection of our poultry industry workforce from bird to human transfer, particularly with the extremely high CFPs associated with the H5N1 strains; and (2) protection of our general population from a pandemic, whether as a result of an influenza outbreak or other cause.

The economic impacts of either or both scenarios are enormous to the State, and either will require our leaders to accomplish balancing acts in which public health and safety is weighed against economics, property rights, and restriction of personal liberties by isolation and quarantine. Additionally, the State will be required to creatively summon the strength of our health care system, still reeling from the demands placed upon it by Katrina and still suffering from losses of manpower, equipment and supplies which resulted. Due to large numbers of uninsured and low income citizens in the State, resources will be required to provide minimum care in the event of bird-to-human infection or pandemic exposure.

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Lydia Quarles is a Senior Policy Analyst at the John C. Stennis Institute of Government, Mississippi State University. She received her *Juris Doctorate* in 1975 from Cumberland School of Law, Samford University, and her MA and BA from Mississippi University for Women, in 1972 and 1971 respectively, in political science and communication. After over a dozen years in the private practice of law in Alabama and Mississippi, she joined the Mississippi Workers' Compensation Commission as an Administrative Judge in 1993. Eight years later, in 2001, she was appointed Commissioner of the agency. In 2006, she resigned to join the Stennis Institute.

Quarles remains active in bar work, and currently chairs the Women in the Profession Committee, a standing committee of the Mississippi Bar. She also serves as co-chair of the Mississippi Supreme Court's "Gender Fairness Implementation Study Committee" and acts as the Chief Operating Officer of the Workers' Compensation Section of the Mississippi Bar. She is a fellow of the Mississippi Bar Foundation, a recipient of the Mississippi Bar's Distinguished Service Award, a member of the Mississippi School for Math and Science Foundation Board and a member of the MUW Alumni Board. Quarles was recently honored by the American Bar Association's Administrative Law and Regulatory Practice Section, receiving the Mary C. Lawton Award for lasting contributions to the Mississippi Workers' Compensation Commission in the areas of alternative dispute resolution and access for Hispanic workers.

In 2004, Quarles was named one of Mississippi's 50 Leading Business Women by the Mississippi Business Journal; the Journal recognized her service to the State as a Commissioner as well as entrepreneurial skills developed in her property management business in Starkville, Spruill Property Management, LLC

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Elected to the United States Senate in 1947 with the promise to "plow a straight furrow to the end of the row," John C. Stennis recognized the need for an organization to assist governments with a wide range of issues and to better equip citizens to participate in the political process. In 1976, Senator Stennis set the mission parameters and ushered in the development of a policy research and assistance institute which was to bear his name as an acknowledgment of his service to the people of Mississippi.

Mississippi State University