

YEAR ONE REPORT

Avian Influenza Risk Predictions in Southeast Asia And Early Warning of Pandemic Influenza

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Accomplishments

- We participated in an Interagency Avian Influenza Working Group Meeting held in Jakarta in October 2008. The working group is composed of representatives from USAID, USDA, NAMRU2, CDC, and Department of State, and serves as a coordination body among the agencies for activities concerning avian and seasonal influenza in Indonesia. Each agency offered advice on how to work on the avian influenza problems and the potential political issues. Very useful information was obtained from the working group.
- We held meetings with researchers from foreign and international organizations in Indonesia, including WHO Indonesia, FAO Indonesia, Wetlands International Indonesia Program (WIIP), Institut Pertanian Bogor (IPB), Cobb Indonesia, Development Alternatives Inc., Indonesian Ornithologists Union, and International Livestock Research Institute. Possibility for sharing both remotely sensed and epidemiological data was discussed among other things. It was only possible to develop working relationship with some of these organizations because of political, competitive, or other issues.
- NAMRU2, our initial partner for the AIPI Project, currently operates without a formal MOU with the Indonesian government, because the MOU between NAMRU2 and the Indonesian Ministry of Health has expired. As in this situation it is less convenient to have NAMRU2 as our link with other organizations, we approached and developed working relationship with USDA Animal and Plant Health Inspection Service. We now have good rapport with its Indonesia office and the scientists at its laboratory in Maryland.
- We established working relationship with Wetlands International Indonesia Program. Wetlands International is an NGO based in Holland. Aside from avian influenza, WIIP is interested in biodiversity, climate effects on wetlands, and carbon cycles, etc. WIIP will provide us with wetlands data and bird data for various wetlands.
- We established working relationship with IPB's Veterinary School. Some of the scientists are interested in our modeling approach. From IPB, we will

obtain some transmission characteristics of AI virus and information on how the disease is manifested in poultry populations. It is already known that ducks are asymptomatic. An important issue is whether chickens infected with AI can be asymptomatic or not.

- We established working relationship with Cobb Indonesia, which is a subsidiary of Cobb International (with headquarters in Arkansas) and distributes approximately half of all the breeders in Indonesia. Cobb has already provided us with the standard operation parameters for its poultry productions and data for its farms in Indonesia. Our models may help Cobb to reduce on-farm and off-farm spread of AI virus.
- Based on the information from Cobb Indonesia and USDA APHIS, we developed an input-output flow diagram illustrating how H5N1 may circulate among all poultry sectors, from the mega-scale industrial farms down to the most ordinary backyard farms. This flow diagram is the basis for developing a compartmental-queuing model. Once developed and validated, our models will be made available to our US partners in Indonesia that have a need for modeling such risks.
- We are gearing up our work in pandemic influenza early warning, which is an important aspect of our AIPI project. Prevention or early warning of pandemic influenza in humans is the ultimate goal of the project. Because pandemic influenza is human influenza, we have started to gather human seasonal influenza data. We have made some contacts with the CDC Influenza Division and the Air Force Institute for Operational Health (AFIOH). AFIOH is the organization responsible for compiling influenza data in the military for CDC and DoD GEIS.
- We have analyzed human influenza data from warm climate, including Hong Kong and Arizona's Maricopa County. Despite its annual occurrence, influenza seasonality remains poorly understood. Prevailing theories on the seasonality vary from social contact behavior (school closing, air travel, etc.) to environmental factors. In temperate regions, influenza peaking in winter can be explained by the low temperature and humidity that can increase transmission by – among others – enhancing virus survivability outside the body, and promoting indoor crowding tendency. By contrast in some regions with warmer climate, influenza can peak twice a year. The role of environmental factors is arguable, due to the geographic variation of associated factors, and the elusive mechanism to increase transmission. The results will be presented in the ASTMH meeting in November 2009. We are also examining the suitability of human influenza data from some cities in Texas and Florida.

- We continued gathering human influenza data from cities and regions toward the northern parts of US, including New York City, Philadelphia, Cleveland, and Toronto.
- Through the connection from an invited symposium in the 2010 International Congress on Infectious Diseases, we tentatively will work with some scientists from MITRE's Biosecurity Program and Oxford University's Institute for Emerging Infection on some AI problems.

Milestones

- We have continued collecting information and data concerning avian influenza outbreaks, human cases, and related socioeconomic conditions from open sources. In June 2008, the Indonesian Ministry of Public Health decided not to timely announce avian influenza human cases, and only to release such information periodically. Judging from our experience of working with Indonesia's malaria data, it is reasonable to assume that the reliability of avian influenza related data in Indonesia may be lower than what we hope for.
- After an extensive wait, we finally obtained Indonesia human influenza data from hospitals in 18 cities through NAMRU2. The data covers both Type A and Type B influenza. Type A normally has seasonal variation, while Type B normally persists throughout the year. The data, however, is rather sparse, possibly due to the limited funding available to the various organizations that conducted these studies. Our goal is to compare the Indonesia influenza characteristics with those of some other warm regions in the world, like Hong Kong and Arizona's Maricopa County.
- We have been developing software to analyze the spatial risk patterns associate with avian influenza outbreaks in the Greater Jakarta, which has been the worst affected region in Indonesia. Locations of wet markets, poultry distribution centers, major transportation routes, waterways, and water bodies have been digitized and used as input. The data suggests that human cases are clearly related to poultry cases. Rainfall, holidays and festivals may be the contributing factors. We will continue the analyses.
- We acquired the needed ASTER imagery data for the NAMRU2 wild bird surveillance sites. Wetlands relatively close to these surveillance sites were identified. Bird species data at these wetlands were obtained. Some farmland distribution data in Indonesia was also obtained. We are in the process of identifying the migratory bird species that are prevalent at these wetlands.

Presentations and Publications

- **Avian influenza risk prediction and pandemic influenza early warning workplan**, presented to US Interagency Avian Influenza Working Group, US Embassy in Jakarta, October 21, 2008
- **Avian influenza risk prediction and pandemic influenza early warning project updates**, presented as part of a NASA Symposium within the ASTMH Annual Meeting, New Orleans, December 7-11, 2008.
- **Roles of remote sensing and GIS in avian and pandemic influenza surveillance and risk prediction**, accepted for oral presentation in the “GIS Applications: Risk Identification, Prediction and Disease Surveillance” session in the American Public Health Association Annual Meeting, Philadelphia, November 7-11, 2009.
- **Roles of remote sensing and GIS in avian and pandemic influenza surveillance and risk prediction**, accepted for oral presentation as part of the NASA Symposium within the ASTMH Annual Meeting, Washington, DC, November 18-22, 2009.
- **Examining environmental effects on influenza transmission in warm climate using neural network**, in ASTMH Annual Meeting, Washington, DC, November 18-22, 2009.
- **Remote sensing based modeling of avian influenza transmission in Indonesia**, in an invited avian influenza symposium in the 14th International Congress on Infectious Diseases, Miami, March 9-12, 2010.