

Avian Influenza Economic Modeling

DHS Priority Areas Addressed	<input type="checkbox"/> Prevention <input type="checkbox"/> Detection <input type="checkbox"/> Response <input checked="" type="checkbox"/> Recovery <input type="checkbox"/> Education/Risk Communication				
Proposal Section Addressed	Sections: NA				
Investigators	TAMU: Bruce McCarl and Yanhong Jin				
Objectives	Deliverables	Progress Toward Deliverables	Percent Complete		
Develop an economic/epidemiologic decision support system that assists policy formulation to efficiently detect and respond to incursions of pathogenic avian influenza virus strains and carry out a case study.	Economic model linked to geographic automata model of avian influenza spread within ecosystems, including multiple avian and mammalian species.	No geographic automata model has been made available yet to link economic analysis to.	0%		
	Decision-support system that allows investigation of surveillance options to detect incursions of avian influenza viruses, and investigation of mitigation strategies.	A study is under way to investigate the relationship between early detection and contact control options for latent and symptomatic flocks.	10%		
	Case Study level cost/benefit analysis.	A case study has been conducted in the context of backyard flocks. Cost minimization approach is used to investigate the benefits of decreasing latency and symptomatic periods versus decreasing the rates of inter flock contacts for latent and symptomatic flocks.	30%		

Highlight for Research Briefs

This investigation has been augmented with funding from USDA PRESIM (Program for Research of the Economics of Invasive Species Management). The model is an integrated epidemiologic-economic model for analysis of AI mitigation options within poultry sector. The long run goal is to develop a model for heterogeneous commercial flocks. As the first step a model was developed for homogeneous flocks and applied to analysis of backyard flocks. The model is performing well and will be expanded to heterogeneous flocks upon data availability. Next step is to collect commercial poultry farm level data to reflect direct and indirect contacts within commercial poultry farms.

Interpretive Summary

This investigation presents an integrated, economic-epidemiologic framework for analyzing the mitigation strategies against the spread of infectious animal diseases across backyard poultry farms. The framework is used to study the roles of reducing inter flock contact rates and reducing the lengths of symptomatic and latent periods under a cost-minimization scheme. Control of inter flock contact rates is considered for symptomatic as well as latent flocks. Another parallel study is to investigate the impacts of avian influenza events on stock prices of meat and egg producers. A time series analysis is

applied on the daily stock price. In particular, the following questions are addressed: Do avian influenza events affect the stock price of related publicly traded firms in the poultry industry? If yes, to what extent and how long is the duration? Does the impacts on the firms are interrelated?

The results of this work suggest that efforts to reduce the lengths of latent and symptomatic periods and efforts to control inter flock contact rates generally function as substitutes. This implies that under limited resource availability for AI control efforts, the mitigation strategy (e.g. quarantine, early detection) needs to be formed in a manner which takes into account substitutability of efforts to reduce inter flock contact rates during latent and symptomatic periods and efforts to reduce lengths of symptomatic and latent periods.

The results of this study indicate that this framework could be usefully applied in the context of the spread of AI across heterogeneous poultry farm categories.

Results and Interpretations

- Total number of infected flocks is lowest with the least expensive mitigation scenario and highest with the most expensive mitigation scenario.
- While the least expensive mitigation scenario corresponds to the least costly outbreak with the fewest infected flocks, the duration of the outbreak is the longest. May need to include length of disease presence as a significant component of costs associated with infectious livestock disease outbreaks.
- The cost minimizing combination of efforts to decrease the length of latent and symptomatic periods are 0.9 and 0, respectively, and corresponds to reducing the latent period from 5 to 0.5 days and leaving the symptomatic period at 10 days. This condition demonstrates the importance establishing mechanisms for early detection of AI in latent poultry flocks (Figure 1).
- The optimal level of effort to decrease inter flock contact rates for latent flocks, which correspond to the cost minimizing point is zero. The inter flock contact rate during the latent period remains at 0.3. However, effort to reduce the length of latent periods is 0.9, which reduces that the total number of inter flock latent contacts (Figure 2).
- The optimal level of efforts to reduce symptomatic flock contact rates corresponding to cost-minimizing point from figure 4 is 0.19. The contact rate of symptomatic flocks is reduced from 0.15 to 0.12 contacts per day (Figure 3).
- Efforts to reduce the lengths of latent and symptomatic periods and efforts to control inter flock contact rates generally function as substitutes
- The results also show that as efforts to cut the length of the latent period increase, the control of inter flock contact rates is more concentrated on symptomatic flocks rather than latent flocks. On the other hand, as efforts to cut the length of the symptomatic period increase, the control of inter flock contact rate is more concentrated on latent flocks rather than symptomatic flocks.

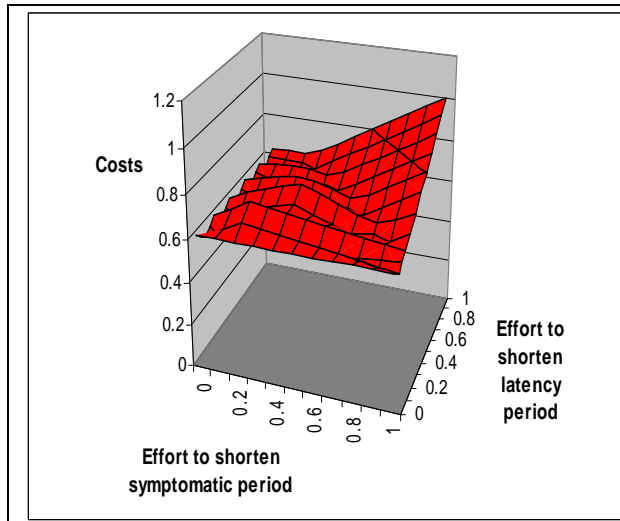


Figure 1

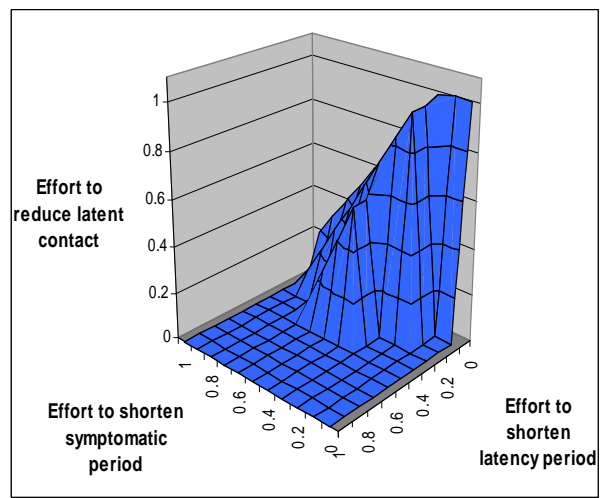


Figure 2

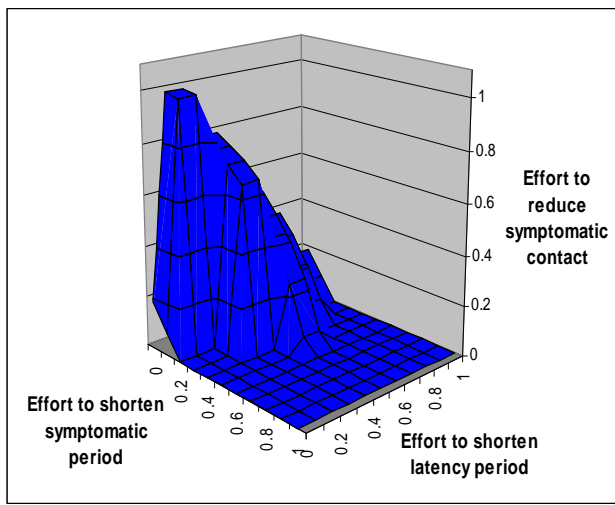


Figure 3

Technology Transition

A poster has been presented at the annual meeting of American Agricultural Economics Association in Portland in July 2008 entitled “CRITICAL COMPONENTS OF PREPAREDNESS AND RESPONSE FOR AVIAN INFLUENZA MITIGATION WITHIN THE POULTRY SECTOR “ by Levan Elbakidze and Aklesso Egbendewe-Mondzozo.

A poster has been presented at the DHS Research and Education Summit in May 2007 entitled “The Impacts of Avian Influenza Events on US Stock Prices of Meat and Egg Producers” by Huang, W., D. Bessler, Y.H. Jin, and B. McCarl.

Manuscript

Elbakidze, L., “Modeling of Avian Influenza Mitigation Policies within the Poultry Sector” Under Review at the Journal of Agricultural and Resource Economics.

Status of Funding

Funding for one more year is available.