Consortium on Law and Values in Health, Environment & the Life Sciences

2010-11 Student Proposal Cover Page

Applicant Information

Applicant Name:	**Amanda Beaudoin**			Email:	beau0209@umn.edu
Project Title:	**Let Them Graze Ducks!:** Using agent-based modeling of the village poultry sector in Thailand to identify measures that control influenza transmission while mitigating negative socioeconomic impacts				
Department:	Veterinary Population Medicine	College:	College of Veterinary Medicine		
Home address:	2124 Como Avenue #204	City & State:	**Saint Paul, MN**	Zip:	55108
Faculty advisor name:	Jeff Bender, Randall Singer	Email:	bende002@umn.edu, singe024@umn.edu	☐ Not applicable	
Dept. Head's name:	Thomas Molitor	Dept. Head's email:	molit001@tc.umn.edu		
Dean's name:	Trevor Ames	Dean's email:	amesx001@umn.edu		

How did you hear about this funding opportunity? Email from Audrey Boyle

Funding

Total amount of funding requested:	**$9,018**	Is funding available within your center or dept for this project? **Preliminary data was gathered with funding from the CDC. That funding will expire in May, 2011, and an award such as this is needed for project completion.**

Executive summary (maximum 200 words)

My research involves avian influenza transmission in free-grazing duck populations in Thailand. In this management system, duck farmers move their duck flocks among post-harvest rice fields, where they feed on residual rice, insects and snails. Spatial analysis has shown that free-grazing ducks are associated with outbreaks of highly pathogenic avian influenza H5N1, though little is known about the transmission events that occur among these flocks. During the 2004-05 outbreaks, bans on duck movement caused a loss of livelihood for many flock owners. Understanding this population's role in influenza transmission will promote the creation of informed policy, thus ensuring socioeconomic security and minimizing risk of transmission of bird flu from poultry to humans. Through my dissertation work, it has become clear that many duck flock movements and contacts take place at the village level, including daily movement from barn to field, weekly egg collection, and poultry sales by second-party traders. *I will use the requested funds to develop an agent-based model of poultry owners, traders and markets for use in characterizing the contacts made at the village level and identifying opportunities for reducing the risk of transmission. Funds will be used for travel, poultry owner interviews and stipend during model development.*

Approvals

Check all appropriate approvals required for your proposal. Approvals must be obtained prior to receipt of funding. If you have applied for approval but have not yet received it, indicate that below.

IRB	☒ Yes ☐ No	☒ Application pending	IRB Study number 0701M01041- change request pending
IACUC	☐ Yes ☐ No	☐ Application pending	
Other	☐ Yes ☐ No	☐ Application pending	

Checklist

☒ The proposal is 1000 words or less excluding budget, biographies, references and citations.

Let Them Graze Ducks!:
Using agent-based modeling of the village poultry sector in Thailand to identify measures that control influenza transmission while mitigating negative socioeconomic impacts

Project Description

Background

Highly pathogenic avian influenza (HPAI) virus H5N1 infection of domestic poultry was first identified in Hong Kong in 1997. In the years since, HPAI H5N1 emerged in multiple Asian countries as well as Europe and Africa.[1] Global avian mortality is estimated to be hundreds of millions of birds. In addition to being fatal for many avian species, HPAI H5N1 can cause severe disease in humans. Between 2003 and February of 2011, there have been 519 human cases of H5N1 with 306 deaths (59% case fatality).[2]

Thailand confirmed its first outbreaks of HPAI H5N1 in early 2004. The country utilizes four types of poultry production systems: closed houses, open houses, field grazing and backyard flocks.[3] At the start of 2004, 10-11 million ducks were raised in the field-grazing system, where ducks are transported among post-harvest rice fields to feed freely on residual rice, insects and snails.[3,4,5] This transport has traditionally extended beyond villages, and even hundreds of kilometers between provinces.

Studies conducted in Suphanburi Province in central Thailand using spatial statistics have found a strong association between HPAI outbreaks and the density of field-grazing ducks.[4] Since the first emergence of H5N1 in Thailand, the Thai Department of Livestock Development has imposed various regulations on the management of field-grazing ducks. These regulations have ranged from country-wide registration and pre-movement influenza testing, to the establishment of region-specific policies, to nation-wide prohibition. By June of 2005, the number of field-grazing ducks being raised in Thailand had decreased to 5 million. Some of this decrease in grazing duck numbers was due to farmers switching to closed housing systems. However, many lost their flocks because the owners simply could not afford an alternative production system. Though farmers have protested multiple times throughout the years, subsequent adjustments to the bans, such as establishing zones of movement, have not withstood, and prohibition was repeatedly reinstated during times of known H5N1 virus circulation. While there has been an apparent decrease of HPAI H5N1 virus transmission with these restrictions, government regulations have a significant effect on the socioeconomic status of those raising field-grazing ducks. I believe that improved characterization of virus transmission among field-grazing duck flocks, as well as between duck flocks and other domestic poultry, is essential to the development of effective and sustainable government regulation.

Methods

My dissertation work to date has included the completion of over 200 surveys of field grazing duck owners. These surveys indicate that the majority of duck flock movements and contacts take place within and between villages, as opposed to between districts or provinces. This includes daily movement from barn to field and weekly egg collection by second-party traders, who often collect eggs from multiple flocks in one day. On a less frequent basis, ducks are bought and sold by second-party traders. Ducks have been identified as a potential biologic "bridging species" for influenza virus transmission between wild waterfowl and gallinaceous

poultry (e.g. chickens). Field-grazing ducks are likely to have direct and indirect interactions with wild birds due to the shared rice field habitat, presenting opportunities for the exchange of viruses. In addition, the frequent movement of duck flocks within and between villages could provide daily opportunities for transmission of influenza virus from grazing ducks to other poultry such as backyard chickens and ducks. With the aid of a native Thai assistant, *I plan to conduct in-depth interviews with field-grazing duck owners, backyard poultry owners, poultry traders, slaughterhouse workers, live bird market salespeople and livestock officers in two villages of Suphanburi Province, Thailand.* The interviews will focus on the frequency and character of poultry-related contacts, including the transport, sale and purchase of both birds and eggs. *Global positioning system (GPS) data of flock locations will also be collected.*

I will use this data to develop an agent-based model of the village-level poultry network. Agent-based models provide a means for combining theory and computation to produce a computerized artificial society.[6] The model will be made up of agents that represent each of the important roles in the village poultry sector, with the action of each agent informed by the information obtain through in-depth interviews. The agents will interact on a spatially explicit backdrop of the village, developed using geographic information system (GIS) map data and the GPS location data collected on-site. As the agents interact, I will be able to determine which members of the poultry community are the most connected, thereby identifying potential opportunities for surveillance and intervention. *Through this modeling process, I plan to hypothesize which interventions at the village-level would result in a decrease of between-flock avian influenza virus transmission risk.* By evaluating the impact of movement and trade regulations within the model, I hope to identify policies that will have a large impact on the risk of transmission while minimizing the negative socioeconomic implications for flock owners. Such policy outcomes may include a limit on the number of egg collection transactions per day or redirection of the routes utilized by duck flock owners to get from barn to rice field, in order to minimize contact with village poultry.

Overall Significance

This work will highlight recommendations to improve the efficacy and minimize the negative socioeconomic impact of policies that are made regarding field-grazing duck flocks during H5N1 outbreaks in central Thailand. In addition, good policy and compliance with given regulations can be expected to lead to improved animal and human health. The use of agent-based models in the study of infectious diseases is a nascent trend, and it is an attractive option for examining disease transmission in heterogeneous societies. It has been utilized with success in the fields of artificial intelligence, ecology, economics and the social sciences. In addition to providing policy recommendations for this specific village-level system, I hope that the completion of this project will demonstrate the utility of such methods in the field of veterinary infectious disease epidemiology.

Timeline for Use of the Award

July, 2011: Travel to Thailand for three weeks of data collection.

July- December, 2011: Develop the agent-based model and interpret the output.

Biography

Amanda Beaudoin, DVM is a PhD candidate in the Veterinary Medicine graduate program at the University of Minnesota's College of Veterinary Medicine. Her research interests include global infectious disease epidemiology, emerging diseases of animals and humans, and the health of humans living in close contact with animals. Dr. Beaudoin was born in central Massachusetts and lived there through her undergraduate training. She graduated with highest distinction from Worcester Polytechnic Institute, obtaining a Bachelor of Science degree in Biotechnology, with a minor in International Studies. She earned a Doctor of Veterinary Medicine degree from Cornell University in 2006 and has since gained experience in both equine and small animal practice. Dr. Beaudoin's career goal is to facilitate the connection of field surveillance, scientific research and policy for the control of infectious diseases affecting animals and humans. She has a special interest in international work and hopes to someday be employed by a federal or intergovernmental agency such as the Centers for Disease Control and Prevention, the Food and Agriculture Organization or the World Organization for Animal Health. Dr. Beaudoin plans to complete her doctoral degree in early 2012.

Selected References

1. World Health Organization. H5N1 avian influenza: Timeline of major events. http://www.who.int/csr/disease/avian_influenza/en/index.html. Accessed 11/14/2007, 2007.

2. WHO | Cumulative Number of Confirmed Human Cases of Avian Influenza A/(H5N1) Reported to WHO http://www.who.int/csr/disease/avian_influenza/country/cases_table_2011_02_02/en/index.html. Accessed 2/3/2011, 2011.

3. Songserm T, Jam-on R, Sae-Heng N, et al. Domestic ducks and H5N1 influenza epidemic, Thailand. *Emerg Infect Dis*. 2006;12(4):575-581.

4. Gilbert M, Chaitaweesub P, Parakamawongsa T, et al. Free-grazing ducks and highly pathogenic avian influenza, Thailand. *Emerg Infect Dis*. 2006;12(2):227-234.

5. Gilbert M, Xiao X, Chaitaweesub P, et al. Avian influenza, domestic ducks and rice agriculture in Thailand. *Agric Ecosyst Environ*. 2007;119:409-415.

6. Gilbert N. *Agent-based Models.* 1st ed. Los Angeles: Sage Publications; 2008.

Consortium on Law and Values in Health, Environment the Life Sciences

Budget for Student Proposals

Project Title:

Let Them Graze Ducks!: Using agent-based modeling of the village poultry sector in Thailand to identify measures that control influenza transmission while mitigating negative socioeconomic impacts

Instructions provided below.

			Requested funding	Matching/other funding	
	Personnel costs	**Description & justification** **Salary = __hrs x ____ hrly wage**	**Amount**	**Amount**	**Source**
1	**Salary (stipend):** I am employed under a 50% graduate student appointment. I am requesting funding for 18 weeks (10 hours/ week) with 0.8534 fringe, September-December, 2011. Please see below for justification of budget.	Salary $3,893 = 180 hrs x $21.63 Fringe $3,322 = $3,893 * (0.8534) Total $7,215	$4,600	2,615	To be determined. It is likely that advisor or departmental funds will cover the balance.
2	**Research Assistant:** Student from the College of Public Health at Chulalongkorn University. Please see below for justification.	Salary $400= 80 hours x $5/hr	$400		
3	Other personnel				
4	Other personnel				
5	**Personnel Subtotal**		$5,000.00	$2,615.00	
6	Speaker Honoraria				I will also be applying for a UMN Graduate School Thesis Research Grant, with maximum award of $5,000 to be used for project costs. The application submission deadline is March 1, 2011, and decisions are known by May 14, 2011. No stipend is covered by that award.
7	**Supplies & Services:** Please see below for justification.	**Transport** to field sites for interviews at 3,000 Thai bhat, or $100 per trip (4 trips- **$400**); **Compensation** of 40 interview participants at 300THB, or $10 each (**$400**); **Compensation** of livestock officer participants, 2 at 500THB, or $16/trip (**$128**).	$928		
8	Equipment				
9	**Travel** to Bangkok, Thailand for 3 weeks in July, 2011. Please see below for justification.	**Airfare** to Bangkok, Thailand (**$1,900**, at most); **Lodging** in Chulalongkorn University housing for 3 weeks, at 500THB, or $16/day (**$350**); **Meals and incidentals** at $40/day (federal per diem is $72/day) (**$840**)	$3,090		
10	**Subtotal research supplies, equipment, travel, other**		$4,018.00	$2,615.00	

Consortium on Law and Values in Health, Environment the Life Sciences

Budget for Student Proposals

11	**TOTAL BUDGET**		**$9,018.00**		

1. Stipend justification. I will be working on the data analysis and model building during the summer and during the Fall 2011 semester. I have stipend funding secured through the end of August, and though work for this project will begin in July, I am only requesting funding for September through December. I anticipate that the balance of my stipend for that time will be supported by my advisor or the department. I will also be applying for the Doctoral Dissertation Fellowship for 2011-2012.

2. Research assistant payment justification. The research assistant will likely be a student from the College of Public Health at Chulalongkorn University. Over the 3 weeks, as well as during preparation time before my trip, it is expected that the assistant will work for approximately 80 hours, making phone calls to arrange field visits, conducting interviews in the field and translating and discussing interview transcripts. The compensation of $5/ hour is consistent with compensation of research assistants on previous projects in Thailand.

7. Supplies and services. Previous data collection trips to Suphanburi Province from the home-base of Chulalongkorn University in Bangkok has informed these expense estimates. The compensation amounts listed here are consistent with previous studies with poultry owners in Suphanburi.

9. Travel to Bangkok, Thailand for 21 days in July, 2011. Airfare is based upon a Travelocity search for July, 2011. I will use this time to conduct interviews and collect GPS location data for use in the development of an agent-based model of avian influenza spread in rural Thai villages. I am aware that this trip is shorter than the desired 6 weeks indicated on the RFP, but I believe that three weeks is long enough to collect the necessary data, and a significant amount of time will be spent on data organization and analysis upon my return from Thailand. I am confident that three weeks will allow time for sufficient data collection, as the specific methodology of the trip will be developed before leaving and will be informed by a period of preliminary data collection that will occur in March of 2011 (during completion of laboratory research activities supported by my current funding source, which expires in May, 2011). In addition, a collaborative relationship has been formed with the livestock officers in Suphanburi Province, and this will facilitate the data collection.