



Playing Chicken with Big Agriculture: Advocating  
Regionally Sensitive Food Sovereignty to Address  
Pandemic Influenza

Task Force 2014

University of Washington

Henry M. Jackson School of International Studies

The University of Washington  
The Henry M. Jackson School of International Studies

**Playing Chicken with Big Ag: Advocating Regionally Sensitive Food Sovereignty to  
Address Pandemic Influenza**

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## Acknowledgements

The authors of this Task Force would like to express our sincere gratitude to the many individuals and organizations that generously provided their time, expertise, and understanding to make this Task Force possible. We would like to express our deepest thanks to Dr. Robert Wallace. We appreciate the opportunity to share this with a prominent academic in the field and to learn from his advice and critiques. This Task Force would not have been possible without the guidance and direction from Professor Celia Lowe. Her valuable and critical feedback challenged this group to produce what is now the final product of this report.

We would also like to show our appreciation to Dr. Suraya Afiff, Anthropological Research Institute, University of Indonesia, and University of Washington Professor of Geography and International Studies, Matthew Sparke, for meeting with this group to engage us in discussion and provide us with valuable knowledge and insight. Finally, we would like to recognize and thank the Jackson School of International Studies for facilitating this program: Lauren Dobrovolny, Task Force Coordinator, Dr. Sara Curran, Chair of the International Studies Program, Wolfram Latsch, Director of Student Services, JSIS, and finally, Amanda Hornby, Undergraduate Instruction Coordinator, UW Libraries.

## Preface

The authors of this report are undergraduate students at the Henry M. Jackson School of International Studies at the University of Washington. Many International Studies students will pursue careers in policy making for both the private and public sector. Through Task Force they are able to examine problems with the intent of producing realistic and relevant policy recommendations to address current international issues. Over the course of one academic quarter, students collaborate to produce a 200-300 page report on a subject selected by Jackson School faculty. Once finished the report is then evaluated by an expert in the field.

This Task Force was given the title of, “Avian Influenza in Southeast Asia: Creating a Regionally Sensitive One Health Approach”. This title informed our initial research, leading this Task Force to adjust our aim toward engaging with not only the biological factors facilitating the disease, but also the socio-economic factors, addressing broader issues of food policymaking and sovereignty. The end goal of this report is to produce recommendations that would both deal with the risk of a pandemic threat now, and also create policy that would prevent its threat for the future. Thus, we address our report to the peasant advocacy group La Via Campesina.

Our report presents seven chapters that are grouped according to topic and theme, followed by a series of policy recommendations. Each chapter begins with background discussion and analysis before offering various policy recommendations available to La Va Campesina. The Task Force concluded that risky methods of industrialized farming are in abolishment and that a long-term plan is needed to further prevent the spread of H5N1. This includes advocating for more evolutionary research, reorienting technical

response programs away from large agribusinesses, inclusion of small actors and regional interdisciplinary discourse in response programs, and applying principles of food sovereignty to poultry production.

The chapters are Avian InFLUENZA (H5N1): A Product of a Globalized World; Discovering Fowl Play: A Case by Case Analysis; Biology of H5N1; On Hens and Needles: Improving Technical Responses through Vaccination and Culling; They're No Yolk: Health Response Programs for H5N1; Placing all the eggs in one basket: The compartmentalization of poultry production and pandemic response; and Food Sovereignty Combats the Threat of Avian Influenza. This Task Force's evaluation recognizes that problems particular to H5N1 can prevent the goal of stopping a global pandemic. It is also our hope that the chapters represent what we believe is the most important issues to addressing H5N1 and mitigating the disease.

## Terms and Abbreviations

AHW-----	Animal Health Worker
AI-----	Avian Influenza
AIPED-----	Vietnam Integrated National Operational Program on Avian Influenza, Pandemic Preparedness and Emerging Infectious Diseases
ASEAN-----	Association of Southeast Asian Nations
CAFO-----	Confined Animal Feeding Operation
CDC-----	Centers for Disease Control and Prevention
CPM-----	Commission on Phylsanitary Methods
DAH-----	Department of Animal Health
DCVMN-----	Developing Country Vaccine Manufacturers Network
DFIF-----	Department for International Development
DFS-----	Diversified Farming System
DIVA-----	Differentiation of Infected from Vaccinated Animals
DLD-----	Department of Livestock Development
DVS-----	District Veterinary Station
EID-----	Emerging Infectious Disease
EMIT-----	Emergency Medical Institute of Thailand
EMPRES-----	Emergency Prevention System
EVM-----	European Vaccine Manufacturers
FAO-----	Food and Agriculture Organization
GISN-----	Global Influenza Surveillance Network
GISRS-----	Global Influenza Surveillance and Response System
HPAI-----	Highly Pathogenic Avian Influenza
HSRI-----	Health System Research Institute
ICESCR-----	International Covenant on Economic, Social, and Cultural Rights
IHR-----	International Health Regulations
IMF-----	International Monetary Fund
KMP-API-----	Knowledge Management and Policy Dialogue through the Partnership on Avian and Pandemic Influenza
KOMNAS FBPI----	National Committee for Avian Influenza Control and Pandemic Influenza Preparedness
LBM-----	Live Bird Market
LDC-----	Less Developed Country
LDCC-----	Local Disease Control Center
LPAI-----	Lowly Pathogenic Avian Influenza
LVC-----	La Via Campesina
MARD-----	Ministry of Agriculture and Rural Development
MOET-----	Ministry of Education and Training
MOH-----	Ministry of Health
MOPH-----	Ministry of Public Health
MNC-----	Multinational Corporation
MRD-----	Mekong River Delta
NAFTA-----	North American Free Trade Agreement

NCAIAP-----National Committee for Avian Influenza Disease Control and  
 Prevention  
 NCVD-----National Centre for Veterinary Diagnostics  
 NGO-----Non-Governmental Organization  
 NHCO-----National Health Commission Office  
 NIH-----National Institutes of Health  
 NSCAI-----National Committee for Avian Influenza Disease Control and  
 Prevention  
 NSCHP-----National Steering Committee for Human Influenza Pandemic  
 Prevention and Control  
 OECD-----Organization for Economic Cooperation and Development  
 OH-----One Health  
 OIE-----World Organization for Animal Health  
 OPI-----Operational Program for Avian and Human Influenza  
 PAHI-----Partnership on Avian and Human Influenza  
 PDSR-----Participatory Disease Surveillance and Response  
 PPE-----Personal Protective Equipment  
 RRD-----Red River Delta  
 SARS-----Severe Acute Respiratory Syndrome  
 SIKHNAS-----National Information System for Animal Health  
 STEPS-----Social, Technological and Environmental Pathways to Sustainability  
 STMA-----Standard Material Transfer Agreement  
 TBT-----Technical Barriers to Trade  
 TRIPS-----Trade-Related Aspects of Intellectual Property Rights  
 TWN-----Third World Network  
 UN-----United Nations  
 UNDP-----United Nations Development Programme  
 USAID-----United States Agency for International Development  
 USDA-----United States Department of Agriculture  
 WHO-----World Health Organization  
 WTO-----World Trade Organization

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# Executive Summary

*Katherine Schroeder*

## Rationale

While a focus on pandemic preparedness is important, it does not address long term solutions to outbreak. In our highly globalized world, massive inequalities shape an environment in which preparedness benefits those of the first world, while ignoring the majority of disease victims. This strategy may have regionally contained outbreaks thus far, however avian influenza has the potential to spread across the world. Thus, it is important to move beyond basic awareness methods when seeking to control the spread of diseases. By viewing disease outbreak as a symptom of a greater world problem, we come closer to addressing the causes of outbreak. Thus, we have outlined the following recommendations for La Via Campesina:

**Recommendation 1:** To address the root causes of HPAI, advocate for abolishment of industrial poultry production's riskiest and unnatural practices, including but not limited to: overcrowding and high flock density, problematic waste management, mainstream use of antibiotics, and selective breeding for genetic homogeneity.

**Recommendation 2:** In order to increase our understanding of H5N1, advocate for research on the social, structural, and evolutionary mechanisms that facilitate the creation of a HPAI virus within large-scale poultry production.

**Recommendation 3:** To increase the effectiveness of technical responses, they need to be reoriented away from commercial, pharmaceutical, and agribusiness interests and instead towards local populations.

**Recommendation 4:** Advocate for the inclusion of small actors and regional interdisciplinary discourse in the creation of response measures and industry regulations that take into account human, animal and ecosystem health.

**Recommendation 5:** In order to combat the structural factors that create the threat of HPAI, apply principles of food sovereignty to poultry production.

## INTRODUCTION

# Poultry or Pandemic? An Exploration of Viral Origins

*Katherine Schroeder*

*“Food sovereignty prioritizes local food production and consumption. It gives a country the right to protect its local producers from cheap imports and to control production. It ensures that the rights to use and manage lands, territories, water, seeds, livestock and biodiversity are in the hands of those who produce food and not of the corporate sector.” – La Via Campesina Mission Statement*

Throughout history, human populations have been devastated by pandemics. During the dark ages, the Black Death swept through Europe and Asia, ousting the Mongol empire from power and permanently shifting trade routes. Pandemics are often characterized by their ability to effect the world’s most vulnerable populations. After the Spanish and Portuguese invaded the Americas, they hoped to use their military strength and technology to overtake the Americas. However, the biological army the Europeans brought with them was powerful enough. As the Aztecs did not possess immunity to European diseases, the pathogens were able to wipe out an estimated ninety percent of the population. This proves that given an opportune environment, a disease has the potential to create mass destruction.

Perhaps because of these vivid historical reminders, the fear surrounding avian influenza has been high since its emergence in 2001. While avian influenza (AI), or H5N1, has yet to reach pandemic proportions, it is characterized by relative uncertainty. Like many other outbreaks, it originated when a virus crossed the animal-human barrier. However, we have little experience and knowledge of the virus’s origins, structure, and potential for destruction. H5N1 has existed for centuries, yet its spread in our modernized society has called certain practices into question. One such practice is the intensified

methods of industrialized farming, better known as concentrated/confined animal feeding operations. Such operations decrease genetic diversity found in free range birds, and are often characterized by poor feeding and living conditions for birds. As we will argue in this report, conditions found in these farms allow for hastened and extreme spread of H5N1, and have increased the risk of zoonosis. These conditions, along with increased trade, globalization, and global agribusiness have created an ideal environment for viral recombination.

Given the globalized nature of our world as well as the universal human susceptibility to disease, an outbreak in Indonesia or Thailand poses a concern for the rest of the world, and H5N1 is thus a global problem. Despite our global need for a solution, current blame narratives have centered heavily on the developing world, particularly Southeast Asia. Once outbreaks were discovered in Asia at the start of the 2000s, pandemic preparedness centered on the needs of the West. News publications in the United States portrayed viral outbreaks a product of the ‘dirty’ wet markets of the Global South, and promoted isolation measures to prevent Americans from becoming victims of influenza. The vaccines that were created targeted developed countries, as few drug companies were willing to work with Indonesia and Thailand due to lower profit potential.

Yet simple pandemic preparedness and vaccines do not address the cause of outbreaks. For much of history, avian influenza has existed in birds and has not been infectious to humans. However, the virus has begun to emerge in humans in a series of outbreaks. Not only do we have little experience with the virus, we are also unable to predict when the next outbreak will appear. Above all, how has the virulence of H5N1

shifted to become infectious to humans? What element in our world has shifted to allow this change? While they may temporarily mitigate disease spread by informing the population, culling, and encouraging measures such as hand washing, such steps do not address the fundamental question of why outbreaks occur.

Because of the potential for destruction that avian influenza carries, this policy document outlines the underlying or structural causes of avian influenza. Our recommendations focus on regional solutions, and consider national and local actors. This is of extreme importance, given the tendencies of large international organizations to ignore the needs and desires of the global south. As those in countries such as Thailand, Indonesia, and Vietnam have been most affected by the virus, their interests should be most heavily considered when implementing policy decisions. With this framework in mind, we seek to question why the avian influenza virus is mutating to be infectious to humans, and what can change so that future outbreaks are avoided. Given the potential for destruction that a pandemic carries, such knowledge and strategy is vital.

From this analysis, it becomes apparent that food sovereignty is the most crucial issue in preventing future outbreaks. By increasing levels of food sovereignty, harmful practices of large agriculture will decrease. Not only are large agricultural plants partially responsible for food inequality and distribution, they also play a role in the spread of pandemics. To produce enough meat, larger plants often quickly cycle through birds, increasing the chance of viral mutation. In addition, cramped conditions for poultry and poor feeding practices have created an environment where viral mutation is common. This in turn increases the likelihood of avian flu shifting from a disease of birds to one of humans.

We have chosen to address our report to La Via Campesina (LVC). This non-governmental organization is a peasant advocacy group with headquarters recently relocated in Indonesia. LVC seeks to achieve food sovereignty for all, and works to minimize negative consequences of large agriculture. LVC focuses on investing in individual farmers and addresses the continual lack of food for many of the world's population, despite adequate overall resources. Through the following chapters, we provide recommendations for LVC based on the characteristics and history behind H5N1.

Chapter One details the ways in which H5N1 has the potential to become a global pandemic. While industrialization may have originally been a way to increase food production, it brings a risk of increased influenza virulence. If an Avian Influenza pandemic is to be avoided, farming, economic, and biosecurity practices must be redesigned. This should take the form of regulations that are of a regionally sensitive nature.

In Chapter Two, we provide a timeline for the path of H5N1 in Vietnam, Thailand, and Indonesia. This include statistics on human and poultry outbreak, as well as a description and analysis of country response. The chapter also attempts to contextualize H5N1 by including a description of past outbreaks, such as the pandemic of 1918, popularly known as the “Spanish Flu”, and the possibility of future avian flu mutations. This timeline and case study format will help the reader further understand the framework behind pandemic narratives that exist.

Chapter Three describes H5N1 from a biological perspective. This chapter illuminates sites along the virus's DNA path which may mutate and become dangerous to

humans, and what environments encourage mutation. This basic biological understand is critical to pandemic preparedness programs and outbreak mitigation. However most importantly, a biological background serves as a framework for understanding recommendations described in future chapters.

Chapter Four explores inequalities that exist in mass culling and pandemic preparedness. Over 400 million poultry have been culled since 2003, in efforts to stop the virus from being introduced as an endemic. However, there exist large economic consequences caused by culling, as well as changes in viral mutation. While farmers often lose their livelihoods as a result of the practice, compensation methods are difficult to execute and often create even more problems. Thus, we argue that a nuanced and sensitive forms of vaccination and culling must be used.

In Chapter Five, we analyze the existing and past responses by international and national health agencies in respect to H5N1 outbreaks. Beginning from the global scale, we analyze the role of these agencies and their standard health interventions in Thailand, Vietnam and Indonesia. Drawing from case studies dedicated to each country this report illuminates how international standardized response systems struggle from a lack of collaboration between multiple existing H5N1 mitigation efforts and demonstrates the urgent need for consideration of the local and cultural contexts of each nation's experience of H5N1.

Chapter Six explores One Health (OH) approaches to animal health, human health, and environmental health through prevention and control strategies. The unequal consideration between the three human, animal and environmental health components of the OH approach has been a huge factor prohibiting OH from success. Developing efforts

and pathways to better incorporate animal health, especially environmental health narratives, will help balance the approach to controlling H5N1. The lack of success in implementing OH practice worldwide is largely due to the conceptual origins of OH. It is a product and imposition of the Global North. Pandemic simulation models and biosecurity methods have the power to prevent and eradicate epidemics through identifying gaps in risk management, but unless properly implemented, they may have unintended and limited outcomes.

Finally, Chapter Seven contextualizes food sovereignty in relation to One Health and the normative regimen of food security. It also examines the popular discourses of the food security regime as well as food sovereignty. This chapter connects the issue of zoonotic disease, specifically highly pathogenic avian influenza, to issues of food. By recognizing the history and platform of LVC in relation to food sovereignty, this chapter provides an investigation into the role of LVC in ending the propagation of avian influenza. We contrast the practices of conventional poultry production with organic poultry production. The practice of organic poultry production instigates the proper use of biosecure methods curbing the pandemic threat of avian influenza. Organic poultry production complements the goals of the 2012 Indonesian Food Law, making it a regionally sensitive approach to address avian influenza.

Through this report and our recommendations to LVC, we hope to convey a specific set of strategies that will help mitigate future pandemics. Above all, we show LVC that considering outbreaks in advocacy is crucial in the fight for food sovereignty.

## CHAPTER 1

# Avian InFLEWenza (H5N1): A Product of a Globalized World

*Michelle Auster and Marina Fitzpatrick*

## **Abstract**

*The industrialization of livestock production as a way to meet the increasing food demands of the growing human population has increased the risk for the emergence of new, more virulent, and more resistant strains of influenza. Recent outbreaks of virulent strains of influenza, specifically H5N1, have found their niche in poultry raised in close proximity, and have arisen there from their original reservoir: migratory waterfowl. High concentrations of animals in Confined Animal Feeding Operations (CAFOs), intensifies the risk of zoonoses (diseases transmissible from animals to humans). Thus, the concentration of poultry in industrial settings effectively increases the opportunities and rates of viral recombination and spread between the birds in the same way that the concentration of people in close proximity to poultry farms increases the likelihood of human-to-human transfer. The industrialized environments artificially constructed by globalization now almost seem to encourage disease transmission and pandemic. Combined with the addition of an increasingly globalized world in which trade is constant and flowing, suitable and ideal environments for viral mutations exist in all parts of the world. Globalization has also forced more and more farmers out of traditional land practices and into the world of agribusiness, exacerbating the potential harm of an outbreak. Concern about the risk of an influenza pandemic leads us to recommend that regulations including but not limited to: flock density, waste management, use of antibiotics, and selective breeding be promoted in order to end the riskiest practices of industrial farming and further regulate biosecurity measures on trade. These regulations need to be created from the perspective of people inhabiting countries in the Global South, and operate on systems that would benefit their business and trade potential.*

**Keywords:** *industrial farming, CAFOs, globalization, trade networks, monoculture, industrialization, factory farms, H5N1, pandemic, poultry, influenza, emerging infectious diseases, zoonosis*

### *Industrial Agriculture in relation to Emerging Infectious Diseases*

In the history of human interaction and ingenuity, globalization has helped produce a strikingly different and modern world. The industrialization of the late 18th and early 19th century catapulted our world into modernity and with it came hastened and intensified communication, transportation, and technology. The Industrial Revolution provided countries with mechanisms to expand trade, proliferate the use of a dominant, universal language, draw national borders (and in doing so generate nationalism), and shift farmers from subsistence to monoculture. The birth of capitalism followed shortly after the Industrial Revolution, as it seemed almost a natural shift from previous village-centric, or town-centered lifestyles, into a future of business transactions and power relations. “Modernism claims that nations and nationalism have appeared as consequences of the processes that mark the modern period of social development. Nations and nationalism are epiphenomena, or even unintended consequences of processes of modernism and industrialization” (Breuilly, 2005, p. 9). Centuries ago influential economists and philosophers like Adam Smith and David Ricardo touted capitalistic methods of expansion, such as free trade and comparative advantage. Many countries that have embraced such methods have grown into world powers today. New developments in economic policy that allow for the expansion of globalization have made necessary alternative forms of living practices. Among these are the stark differences in modern land tenure and treatment, farming, eating, and work.

The overall narrative of the historical progress of globalization provides a useful framework for understanding the origins of Highly Pathogenic Avian Influenza Virus (HPAI) H5N1, commonly known as bird flu. As J. Otte et al. (2007, p. 2) point out, “Because of human and livestock population growth, changes in livestock production, the emergence of worldwide agro-food networks, wild animal trade, and significant changes in personal mobility, human populations increasingly share a global commons of disease risk, among themselves and with

other animals.” Thus making, H5N1 especially well positioned to become an emergent pandemic in our globalized society.

Specifically, the global phenomenon of factory farming is the primary driver of our increased global risk of an H5N1 pandemic. Large-scale factory farming techniques have become increasingly prominent in developing countries in recent decades, due to the saturation of capitalist industrial production techniques introduced by developed countries. Large, profit-driven corporations, such as Tyson Foods Inc., have essentially forced local agricultural business to scale up in order to remain competitive in the market and on par with today’s globalized world’s demands (Greger, 2006). Other neoliberal tenets of globalization like the freeing of trade, reduction of trade barriers, and the encouragement of land privatization, have been instrumental in shifting this process from small-scale family farming to large-scale factory farms in a matter of decades. Smallholder “backyard” farms still remain important in developing countries as a poverty reduction technique (FAO, 2009), but their prevalence is shrinking as the expansion of globalization manifests deeper into every corner of the world. Perversely, these smaller farms are often the first to be blamed for disease outbreaks. Although attacks on smallholder farms are popular techniques during HPAI disease outbreaks, there is more and more evidence suggesting that they are not the major perpetrators:

The lower probability of infection of backyard/hobby flocks compared to that of industrial flocks in the Dutch and Canadian epidemics, in which samples were collected from backyard/hobby flocks in the vicinity of infected industrial flocks, is consistent with findings from the HPAI epidemic in Thailand in 2004 and the 2002 outbreak of Newcastle disease in Denmark and suggests that commercial transactions are an important route for disease transmission between industrial farms (Otte et al., 2007, p. 12).

Another aspect of the increase in factory farm proliferation includes the self-reinforcing economic stability of multinational corporations (MNCs). Capitalistic and neoliberal globalization

essentially encourages monopolization of companies and products. Mike Davis describes the influence that global agri-business has on agricultural practices around the world:

The world icon of industrialized poultry and livestock production is giant Tyson Foods, which, like Wal-Mart, grew up in the hardscrabble Arkansas. Tyson, which kills 2.2 billion chickens annually, has become globally synonymous with scaled-up, vertically coordinated production; exploitation of contract growers; visceral anti-unionism; rampant industrial injury; downstream environmental dumping; and political corruption. The global dominance of behemoths like Tyson has forced local farmers to either integrate with large-scale chicken – and pork – processing firms or perish (2005, p. 83).

These operations own every ingredient down the line, from eggs to broilers, and from plants to feed (Davis, 2005). Large corporations such as Tyson Foods monopolize a cyclical program to control every aspect of poultry farming to maximize efficiency and profits, and have incorporated virtually every smaller company beneath it into its grasp. “A small number of globally operating companies form the apex of the breeding pyramid” (Otte, et al., 2007, p. 4). This vertical model has forced former smallholder and local farms to integrate into large-scale farming practices, eliminating previously held economic advantages like household food and financial security. For example, farmers might be unable to source local feed, or be unable to slaughter their chickens in simple facilities because they do not meet standards for commercial sale (Pollan, 2006).

Corporate monopolization of agriculture, supported through neoliberal policies generated by Western institutions, such as the World Bank and the International Monetary Fund (IMF), have forced less developed countries (LDCs) to increase development and expand their agricultural production in an impractical manner. Globalization, urbanization, and industrialized agriculture are all examples of these sorts of shifts towards increased exposure between people and vectors that threaten to provide the step H5N1 needs to become transmissible between people. The “shrinking” of our world through the development of high volume trade networks effectively exposes entire populations of both humans and animals to one another from origins that may be separated by thousands of miles. As an illustration of the interconnectedness of

global industrial poultry production, foreign transnational corporations buy out local small producers in less developed countries when such small producers have no way of competing with the kind of scale and specialization manifested in industrial agriculture (Greger, 2006). It is a frequently repeated trope of the effects of Structural Adjustment and globalization. These operations are proving more and more every day to be unsustainable through increasing evidence of their negative environmental and animal health impact, and as we've witnessed with the emergence of HPAI H5N1, are also quite dangerous and threatening to global public health. According to the spokesperson for the World Health Organization, "The bottom line is that humans have to think about how they treat their animals, how they farm them, and how they market them--basically the whole relationship between the animal kingdom and the human kingdom is coming under stress" (Torrey, 2005, p. 112).

Part and parcel of global agribusiness is the suppression of prices for consumers, making poorer countries unable to compete in the global market and produces abnormally low cost (and low quality) meat. The extreme mechanization of factory farming coupled with the freeing of tariffs on international trade allows for the production of cheaper broiler meat, which is predicted to only become cheaper over time. In the United States specifically, chicken consumption and demand has increased steadily for nearly a century. The world has witnessed an increase in global poultry meat production from 13 million tons to 62 million in the late 1960s and 1990s respectively (Wallace, 2009, p. 926). Currently, chicken consumption per capita is an estimated 90 pounds per year (National Chicken Council, 2005). In addition, chicken used to be more expensive than steak and lobster in the United States; poultry may now be cheaper than potatoes (Greger, 2006). It is a modern phenomenon that meat can be purchased and consumed for less money in total than vegetables. Poultry meats, especially chicken, are no longer luxurious foods. Chicken has become so accessible that it no longer factors as an additive in diets of the

industrialized world, but rather a staple. In former Tyson Foods CEO Don Tyson's words, corporations "control the center of the plate for the American people" (Duetsch, 2002, p. 80).

An essential component of what has allowed for the supply of broiler meats to match the demand in recent years is the homogenization of chicken morphology and DNA, and reduction in the variation of species. This process begins with skilled farmers selectively breeding chickens for their most desirable physical qualities according to consumers and popular demand. Over time, this artificial process produces the factory farm-induced reality of globalization: the shrinking of livestock genotype. Broilers today are prized for the fat to meat ratio, plumpness, and quick growth rate. The faster the birds grow to optimum consumption size, the faster they can be processed down the line and end up in grocery stores' aisles around the world. As soon as one batch leaves, another is ready to take its place. This process demands the same pace for all birds to ensure smooth business and economical turnover. Therefore, no variation in chicken growth or body meat content can be allowed, limiting the genetic diversity. When whole populations of animals have similar immune systems there is little natural deterrence to newly introduced pathogens and disease spreads at rates that would likely not occur in nature, as each animal is susceptible in the same exact way, and thus has no natural opportunity for developing immunity. As we will later discuss in Chapter Three, this loss of natural immunity is a direct result of human intervention, forcing animals into more artificial environments and existences. By altering the ways animals live, we are altering the ways viruses are bred; HPAI only evolves from LPAI within human constructed environments. It is the same homogenous process that has been done with lab rats, certain types of beef, and even bananas. This is the reason the term "heritage bird" exists today (denoting a bird which is not genetically parallel to broilers or layers). However, chickens were not genetically (nearly) identical to each other for all of history. Unsurprisingly, this human interference in genetic variation has serious implications for opportunistic infection

and virulence, which is one of the reasons why we have arrived today at Avian Influenza pandemics.

In its natural state, the influenza virus has existed for millions of years as an innocuous, intestinal, waterborne infection of aquatic birds such as ducks. If the true home of the influenza viruses is the gut of wild waterfowl, the human lung is a long way from home. How does waterfowl's intestinal bug end up in a human cough? Free ranging flocks and wild birds, have been blamed, but people have kept their chickens in their backyards for thousands of years, and birds have been migrating for millions. What exactly has caused this dramatic shift? The answer, we believe, lies in the unnatural and artificial practices of large-scale factory farms. These mechanized institutions rely on efficiency at the expense of any factor that inhibits progress and profit. As a consequence, healthier practices, for the poultry as well as the farmers, are ignored and biosecurity is compromised. With the onset of modern globalization, farming practices have radically shifted across the increasingly industrialized world.

Up until the late 1800's, the contact structure and small size of extensive and semi-intensive chicken flocks meant that emerging diseases could not spread easily (Swayne and Halvorson, 2003) and would therefore burn themselves out in a localized fashion (Alders, et al., 2013, p.1). After this time period, industrialization kicked into high gear for (then) developed and developing nations. Farm sizes grew and grew, yet other things that should have increased along with it for health reasons suffered from dollar-driven narrow-mindedness. The space for chickens and chicken flocks shrank, as well as their lifespan, while their bodies grew plump from selective breeding. Their quality of life was reduced to the point of breathing in stale air in a steel cage. These kinds of modern institutional conditions are some of what allowed for Highly Pathogenic Avian Influenza to emerge in its most virulent form, up to date. Swayne and Halvorson (2003) identified five distinct man-made ecosystems that have impacted avian influenza (AI) virus ecology: (1) integrated indoor commercial poultry, (2) range-raised commercial poultry, (3) live

poultry markets (LPMs), (4) backyard hobby flocks, and (5) bird collection and trading systems (Alders et al., 2013, p.1).

Also outlined in this article are the specific conditions within modern poultry production systems, such as factory farms, as they relate to the emergence of Newcastle disease virus (a virus which faced similar conditions as HPAI). As listed in Alders et al. (2013). The first condition necessary for HPAI to reach its highest virulence is having a host with genetic homogeneity. In the same way that selectively breeding laboratory mice to produce subjects that are for all relevant purposes genetically the same increases efficiency, chickens have been bred for the most desirable qualities to the consumers. Chicken husbandry practices are what have artificially created genetic homogeneity and two ‘breeds’ of chickens: broilers and layers. Independently, these practices have their own implications. Combine them, however, with high density rearing (the second condition for high virulence), and the situation is exacerbated. Heavy flock density makes viral transmission swift and easy, and lowers the immune system of the birds. Also potentially detrimental to the immune system are intensive vaccination programs that are designed to provide selective immune pressures. If proper infrastructure and organization is lacking in a country where vaccination programs are recommended, then execution may be handled poorly and the target flocks could suffer the consequences. All of these conditions combined form a circumstance under which a virus will thrive. With nearly infinite and genetically identical hosts, almost no physical space between one host and the next, and compromised immune systems, a virus will cleverly take advantage of this paradise to increase virulence and spread. It is important to remember that none of these conditions are natural.

The WHO, OIE, and FAO, respectively the world’s leading medical, veterinary, and agricultural authorities, all correlate industrial poultry production with the increasing trend of emerging infectious diseases. In general, the WHO blames the current crisis on the “industrialization of the animal production sector,” and more specifically the emergence of H5N1

on “intensive poultry production” (Greger, 2006, p. 181). The OIE, the World Organization for Animal Health, blames in part the shorter production cycles and greater animal densities of modern poultry production, which result in a “greater number of susceptible animals reared per given unit of time” (Greger, 2006, p. 181). These same sentiments were echoed by a Senior Food and Agriculture Organization official, “Intensive industrial farming of livestock is now an opportunity for emerging diseases” (Vidal, 2006). Other experts lay blame on the “so-called factory farming” “intensive agriculture production systems” or “intensive confinement” (Greger, 2006, p. 182). The FAO has stated, “...we are wasting valuable time pointing fingers at wild birds, when we should be focusing on dealing with the root causes of the epidemic spread which ... [include] farming methods which crowd huge numbers of animals into small spaces” (Greger, 2006, p. 182).

In October 2005, the UN issued a press release on bird flu, specifically calling on governments to fight what they call “factory farming”: “Governments, local authorities and international agencies need to take a greatly increased role in combating the role of factory-farming, commerce, and wildlife markets which provide ideal conditions for the virus to spread and mutate into a more dangerous form ...” (UN, 2005).

Emeritus professor Kennedy Shortridge was awarded the highly prestigious Prince Mahidol Award in Public Health, considered the “Nobel Prize of Asia,” (Greger, 2006, p. 182) for his pioneering work on H5N1. From 1977 to 2002, he advised the World Health Organization on the ecology of influenza viruses. He describes how modern poultry operations have created the greatest risk scenario in history. “The industrialization is the nub of the problem,” he said “We have unnaturally brought to our doorstep pandemic-capable viruses. We have given them the opportunity to infect and destroy huge numbers of birds and... jump into the human race” (“Seed Magazine”, 2006). The director of the Consortium for Conservation Medicine agrees, saying,

“The global poultry industry is clearly linked to avian influenza [H5N1],” and “it would not have happened without it” (Greger, 2006, p. 182).

In the wild if a bird (or host) gets too sick, too fast, the virus will not have the chance to infect other birds. “Influenza is ‘transmitted so effectively,’ reads one virology textbook, ‘that it exhausts the supply of susceptible hosts’” (Greger, 2006, p. 9). However, stick a sick chicken in a broiler shed beak-to-beak with another “20,000 to 30,000 day-old chickens” and the uninfected can no longer escape their sick companion (Greger, 2006, p. 177). Evolutionary biologist Paul Ewald argues, the key to the evolution of virulence may be the packing together of the infected with the uninfected:

We will continue to get severe influenza epidemics in chicken farms so long as the conditions in chicken farms, like the conditions at the Western Front, allow transmission from immobile chickens. This prediction has been confirmed by the lethal outbreaks of H5N1 in Asia and H5N2 in Mexico. Anyone who dismisses this analysis, as speculation does not understand how the scientific process works or what scientific theory actually is, at least with regard to evolutionary biology. (Rennie, 2005)

Conversely, Carol Byerly (2005) emphasizes the uniqueness of the conditions that led to the 1918 influenza pandemic. “The 1918 flu pandemic most likely will not happen again,” she said, “because we won’t construct the Western Front again” (Orent, 2005). But what Byerly fails to consider is that “the same stresses, filth, and crowding of trench warfare exists in nearly every industrial egg farm and chicken facility in the world” (Greger, 2006, p. 178). Even Ewald, though convinced that the overcrowding of intensive poultry production made H5N1 into the mass killer it is today, seemingly fails to recognize the newfound genetic similarities between chickens and humans that make viral evolution in the egg farm and the broiler house a sobering global concern (Ewald, 1996): “The idiosyncratic likeness between the viral binding capacity to both chicken and human respiratory linings may allow chickens to stand in as our surrogates for the evolution of human transmissibility. And, though millions fought along the Western Front, we keep birds in the trenches by the billions” (Greger, 2006, p. 178).

These high-functioning farms have essentially become independent, freely operating cells of production. Factory farms have taken care of themselves in such a way that the farmer no longer has the traditional responsibilities of a farmer, replaced now by the virus as the flock's shepherd. Viruses "think" in such a way to maximize their influence over the carrier, and H5N1 is no exception to this. It cannot kill the host too quickly, or it will not be able to spread to the next victim. Conversely, it cannot slowly invade, or it will also not make it anywhere further. Factory farms have the ideal conditions for H5N1 to evolve, and even pass on to the next farm. Stagnant and choking air quality in combination with birds nested together in the closest proximity possible with no means for movement or escape is like a "perfect storm" (Greger, 2006) for H5N1. These environments, home to birds of nearly no genetic variety, have created situations in which there is no capacity to accumulate pathogenic resistance and immunity to viruses. This failure is the window of opportunity for startlingly rapid increases in virulence. Yet these environments are built into our modernized, industrial system. The rabid dedication to expansion and efficiency of globalized agribusiness did not take into account how the artificial structure of Confined Animal Feeding Operations (CAFOs) reworked every level of natural, biological organization, and would ultimately foster disease.

In today's globalized society, "if the virus triggers a human pandemic, it will not [only] be peasant farmers in Vietnam dying after handling dead birds or raw poultry," which is a tragedy itself, "it will [also] be New Yorkers, Parisians, Londoners, and people in every city, township, and village in the world dying after shaking someone's hand, touching a doorknob, or simple inhaling in the wrong place at the wrong time" (Greger, 2006, p. xvi). Greger's speculations and predictions are entirely plausible with modern transportation. The global economy is fast-paced and intensely connected, and the trade networks of poultry include one product that reaches far corners of the Earth. Modern globalization has the capacity to spread disease from ground zero to the opposite side of the world, and everywhere in between, in a matter of days. Popular television

shows or modern films tend to dramatically depict pandemics as apocalyptic and unavoidable. A virus leaks from one vector to one, innocent human that unknowingly transmits it to the next, and so world chaos ensues. However, while an outbreak of H5N1 will indeed infect people around the world, it will not likely emulate a Hollywood film. This blockbuster, doom-like inevitability does not have to be the case when it comes to H5N1. If advancements in biosecurity, pandemic preparedness, and a reconfiguration of Agribusiness are taken into account, and implemented effectively in the necessary capacities (such as shipping and farming practices), then a worldwide panic need not ensue. As Alders, et. al. explains, “Biosecurity measures have been studied in detail in commercial poultry because it is an essential component of the intensive production system where the high density of genetically uniform birds greatly increases risks of disease outbreaks” (2013, p. 3).

Previously, bird flu viruses only directly infected people in rare laboratory accidents; now this occurs with frightening and increasing regularity. “There was an almost 80-year lag between the time when a wholly avian flu virus seemed to grow fatal in 1918 and when a bird flu virus acquired enough virulence to kill again in Hong Kong in 1997” (Greger, 2006). Although industrial poultry production was invented in the 1950s, only within the last few decades has intensive production truly gone global. “The intensification of the poultry industry worldwide seems to be a key element in causing influenza viruses of aquatic origin to undergo ‘more rapid’ adaptation to land-based poultry...”(Greger, 2006, p. 273).

By adapting to chickens, bird flu viruses hit an evolutionary jackpot. And by adapting to chickens, the viruses may be adapting to the human race. With unprecedented numbers of chickens intensively confined at record density, we are seeing bird flu viruses adapt to humans in ways we’ve never seen before:

The reason the 1918 virus killed fewer than 5% of its victims may have been because it was essentially restricted to the lungs. The spitting of blood and blackening of limbs was a result of the slow motion drowning the virus triggered by choking the lungs with fluid.

For H5N1, “It’s worse than that,” says Osterholm. “[I]t also goes in and begins to shut down all your vital organs. It’s a domino effect. Your kidneys go down, then your liver goes down, you have all this destruction through necrosis of your lungs and your internal organs. Everything goes.” Never before has a bird flu virus learned to activate itself throughout the human body until H5N1 (Greger, 2006, p. 338).

But the increasing demand for chicken is unnecessary. We don’t need to keep restocking broiler and layer sheds. However, no one is naive enough to think that humans will stop eating poultry or eggs in the near future. In fact, the One Health Initiative Task Force (2008) predicts chicken consumption will increase 50% by 2020. Therefore, ending chicken consumption may be little more than a hypothetical, but ending the riskiest practices, the most intensive forms of industrial poultry production, seems an attainable goal.

We all have the responsibility, even an ethical obligation, to know where our food comes from, and what impact its production has on the environment and public health, before we take it home and fry it up in a pan. The way to truly beat viruses like H5N1 is to eradicate the conditions that foster a virus’s rise from benign to lethal. As Mike Davis elaborates, these conditions do not begin nor end in the factory farm (2005). All levels of human-designed artificial environments must be taken into account.

Human-induced environmental shocks - overseas tourism, wetland destruction, a corporate ‘Livestock Revolution’, and a Third World urbanization with the attendant growth of mega slums - are responsible for turning influenza’s extraordinary Darwinian mutability into one of the most dangerous biological forces on our besieged planet (Davis, 2005, p. 8).

Although factory farms are one of the major instigators and sources of H5N1, they may also be part of the solution, and it would be wise to begin with addressing their systems to eradicate the threat of an influenza pandemic. Indeed, a massive reconfiguration of agribusiness systems would be required, but it should be apparent at this point that these environments are not sustainable, both environmentally and as it pertains to global health. Agribusiness’ focus would

benefit all if it shifted from profit-driven relentless progression to a larger concern for human, animal, and ecological health. A shift in perspective on modern farming practices is a crucial first step, and working to make these institutions more human-centered, and even operating from the perspective of the Global South, would be an essential component. It is wholly possible to learn from past pandemics in creating a new regionally-sensitive health policy for the future. “In the end H1N1 therefore showed that the concerns originally raised by Indonesia with regard to H5N1 samples and benefits remained justified: that poor countries with no domestic production capacity were effectively reduced to being pandemic canaries in the cloudy mineshafts of global influenza surveillance” (Sparke, 2012, p. 732). The poultry industry’s change is inevitable and vital if the global threat of H5N1 is to lessen. Developing countries cannot be made to continue to bear the heaviest burden of this global health issue. Animal factories affect us all, one way or another. But the impact on some is far greater than the impact on most. Without an increase in bio-containment and biosecurity measures, and with allowing Agribusiness to function virtually unsupervised, CAFOs remain a global public health risk.

## Policy Recommendations

We have identified industrial poultry production as the biggest contributor to the threat of Avian Influenza pandemic and thus, suggest alternative methods of poultry production combined with transmission control as the most effective way to empower local food regimes in a culturally sensitive way.

- **Create more rigorous standards:** The standards used throughout industrialized agriculture and/or factory farming lack specific quantifications of measurable criteria, such as flock density, which concurrently affects waste management and thus water contamination levels, among other things. Standards for which no international law currently exists require the development and/or revision of regulation(s) to incorporate that specification. Further research (expanded upon in Chapter 3) is necessary to identify specific standards warranting revision and what such revision should entail. Standards should specifically address: *overcrowding (flock density), waste management, use of antibiotics, surveillance*

- **Impact Assessments:** La Via Campesina should advocate for an independent party accredited by the FAO to conduct an environmental and social impact assessment (EIA) annually, which will quantifiably determine the impact industrial farming is having on international and local communities. An emphasis should be placed on local communities and small-farmers.
- **Taxation/Tax exemption:** La Via Campesina should lobby for the implementation of progressive tax determined by flock density. Firms that encourage overcrowding should be heavily taxed and tax exemptions should be given to corporations that meet the international standards outlined above.
- **Oversight:** We have identified potentially serious oversight problems in industrial farming standards and recommend that Via Campesina advocate for enhanced policing of the behavior of industrial agriculture production.

## CHAPTER 2

## Discovering Fowl Play: A Case by Case Analysis

*Katherine Schroeder and Linda Phan*

**Abstract:** *The following chapter provides a timeline of the H5N1 outbreaks in Vietnam, Thailand and Indonesia. The case studies first examine the famous outbreak of Spanish influenza in 1918, which serves as a reminder of the potential for devastation that influenza carries. Next we provide a timeline of outbreaks in Vietnam, Thailand, and Indonesia from 2003 to 2012 based upon international media from the time, interviews with scholars, as well as WHO reports and academic journals. These three countries experienced the highest rates H5N1 deaths of both humans and commercial poultry. While all three countries experienced a similar path of outbreak, each government faced unique challenges. In Vietnam and Indonesia, the decentralized poultry industry made it difficult to exert much control over the path of disease. The spread of disease was also exacerbated by a lack of funding and media misinformation. In Thailand the presence of large industrial poultry plants helped centralize outbreak response. However, strong political actors in the commercial poultry sector as well as the role of bird fighting in Thai culture complicated preventive governmental actions. Finally, we conclude with a description of the future of avian influenza, particularly the threat of H7N9, a strain of avian influenza that is emerging in Southeast Asia in 2014. This outbreak indicates that avian flu will continue to be an issue of national and global importance until the causes of outbreak is examined.*

**Keywords:** *Indonesia, Vietnam, Thailand, Culling, Backyard Poultry, H5N1, Globalization, Pandemic Preparedness*

### ***Introduction- Influenza of 1918***

We can learn a great deal about the recent H5N1 outbreak by looking at pandemics of the past, most notably the Spanish Influenza outbreak of 1918. The pandemic exploded in nearly every corner of the world, and is now remembered as a greater killer than World War I itself. Furthermore, “according to one academic reviewer, this ‘single, brief epidemic generated more fatalities, more suffering, and more demographic change in the United States than all the wars of the Twentieth Century’” (Greger, 2005, p. 6). It is remarkable how something so microscopic, completely removed and unbiased from humanity’s war and conflicts, produced unfathomable casualties. “In 1918, the average life expectancy in the United States dropped precipitously to only 37 years” (Greger, 2006, pg. 6). While we have not seen an outbreak on the same scale as this since 1918, the potential for an H5N1 global pandemic is still very real. Although Avian Influenza does not have the same proficiency for human-to-human transmission as the Spanish Flu did, its mortality rate is incredibly high. Because of the risk that Avian Influenza carries, it is of utmost importance that LVC consider steps towards reducing a future outbreak.

The Spanish Flu was traumatizing and horrifying for the people during the 1910s, including survivors. The impact that an outbreak of H5N1 would cause on an equitable scale is nearly unimaginable. We predict that avian influenza will not stay contained within Southeast Asia, as it was in the early 2000’s. There is no doubt that modern medicine has improved exponentially since the tragedy of 1918, and science and public health professionals today can handle much more than what was once possible. However, the makeup and consistency of our current world has shifted toward a more intensely

connected, densely populated, and globalized one in little under a century. If these trends continue in an irresponsible and regionally insensitive manner, it is not a farfetched idea to expect severe consequences. An increase in virulence and human-to-human transmission capacity, combined with modern trade networks, movement and transportation, and the multitudes of existing ideal environments for viral habitation and mutation all around the world may indeed spark a pandemic. Thus, this report will serve as an account and a warning for the potential future of H5N1, as well as how LVC can create positive change.

From reviewing the Spanish Flu of 1918 we will now begin our overview of the emergence and spread of H5N1 in modern times. H5N1 first emerged in China in the mid-1990s. While the disease stayed within poultry for several years, it soon crossed the human species barrier causing small strings of human casualties (Lowe, 2010). Given the deadly nature of the disease and the potential for a massive pandemic, levels of fear and uncertainty were high, particularly in Southeast Asia. Vietnam, Thailand, and Indonesia were at the heart of the outbreak, in part because of their massive poultry industries and location near Southeast China. While the three countries faced the same outbreak, policies and reactions varied widely.

Beyond examining the particular narratives that emerged it is also vital to delve into the political and economic histories of each country. This knowledge helps explain how and why the outbreak happened as it did, as well as the motivations behind each country's reaction to H5N1. We will introduce each case study with an overview of the country and poultry sector. Finally, we will provide a description of the H5N1 outbreak in each location and the governmental and media response. Each country case study and

analysis will serve as a vital background for recommendations suggested later in the report.

### *Vietnam Case Study*

Vietnam, along with Egypt and Indonesia, has had the highest rate of human H5N1 cases ("Evolution of Highly," 2012). The first poultry outbreak of avian influenza struck Vietnam in 2001. After moving through commercial birds, the first human cases occurred in late 2003 and early 2004 (Pfeiffer, Minh, Martin, Epprecht, & Otte, 2007). The epidemic first appeared in the capital city of Hanoi located in Northern Vietnam, where fourteen patients were confirmed to have H5N1 after being admitted for a respiratory illness. ("Avian influenza," 2004). While the cases represented a cluster of infections, there remains no evidence that human-to-human transmission occurred. Since the first epidemic hit in 2004, there has been a reoccurrence of poultry and human outbreaks resulting in 59 reported deaths between January 2003 and September 2011 and over 100 reported cases (Nguyen et al., 2012). The Government of Vietnam initially tried to conceal the outbreaks due to the fear of scaring off tourists. In spite of this, once news of the outbreak became public, Vietnam received full attention from foreign donors and international organizations including the World Health Organization (WHO) and the Food and Agriculture Organization (FAO) (Scoones, 2010). In part because of their openness and cooperation, Vietnam received large amounts of foreign aid and support to contain the outbreak, making the country one of the largest recipients of aid targeted towards H5N1 (Scoones, 2010).

The outbreak of H5N1 also disrupted the market in Vietnam. A year after the first outbreak, a 2005 report from the FAO revealed that: "In Vietnam 17.7% of households

earn less than one US dollar per capita a day, and 63.7% of the households [earned] less than two USD per capita per day.” Such statistics show that the country is particularly vulnerable to economic instability. With the country being home to 220 million domestic poultry in 40 percent of households (Verdick, Craddock, & Gunn, 2010) many households earn low income through backyard poultry farms. During the H5N1 scare, 57 percent of farmers were forced to cull their birds; however compensation was only 18% of value per bird. This removed a major source of income for the country’s poorest members, as the modest amount was not sustainable (FAO, 2005). Thus in Vietnam, the emergence of H5N1 not only affected the national economy, it deeply disrupted the livelihoods of individual farmers.

### ***Socio-economic poultry in Vietnam***

Poultry production is an important system and way of life for many Vietnamese people, and is ranked second after pork when it comes to productive value and importance (Nguyen & Long, 2008). The most common poultry production system in Vietnam is the practice of the non-intensive system. Duc and Long reported that in 2005, about 7.3 million (92%) households in Vietnam raised poultry and local and private companies practiced only two percent (Nguyen & Long, 2008). The practice of semi-commercial poultry production (200-2000 birds) in Vietnam is a fairly new practice that only began in the early 90s. Therefore, farmers' experience in the commercial production of poultry has been limited (Phan, Vu, Duquesne & Lebailly, 2013).

Human infections concentrated mostly in the Red River Delta (RRD) provinces in the north and the Mekong River Delta region (MRD) in the south, the two regions with the largest poultry production in the country. Before the flu hit Vietnam in 2003, the

national poultry population was over 250 million, with approximately 58 million in the Red River Delta and 36 million in the Mekong River (Nguyen & Long , 2008). By 2004, poultry production had decreased by about 14%. According to the 2008 FAO report done by Duc and Long from the National Institute of Animal Husbandry in Vietnam, in 2004, 46% of poultry was raised in the Mekong River Delta and Red River Delta combined, accounting almost half of the country's poultry production (Nguyen & Long , 2008).

In terms of the control measures in the two regions, it has generally followed the national guidelines implemented by the Vietnamese government and their collaboration with foreign agencies who have invested a large sum of money to control the human and agricultural effects of the H5N1 epidemic ("Policy analysis of," 2011). The outbreak in Vietnam during the first epidemic waves in 2003-2004 in the Northern and Southern regions of Vietnam required the government to implement different control measures to prevent the epidemic from spreading and re-occurring. In a 2005 report from the FAO, the Vietnamese government took several measures that consisted of modified flock eradication, movement control, limited compensation, import ban, quarantine, disinfection and screening. Since the outbreak, methods in preventing and controlling the virus have been implemented in a top-down decision-making process that begins from the central to local level, with close collaboration from the Department of Animal Health, National Committee for Avian Influenza Disease Control and Prevention (NCAICP), and the National Steering Committee on Avian Influenza (NSCAI). Large donors, such as ones mentioned above, have larger control on decision at the central level, whereas Provincial People Committees play key roles at the local level ("Policy analysis of," 2011). The NCAICP was established as Vietnam's national coordination program,

chaired by the Minister of Agriculture and Rural Development (MARD). The Committees used this platform to bring together the different national and international agencies to discuss disease control measures and report it back to the government. The established National SARS Steering Committee in 2003 also plays an important role in preventative and control policies. In 2005, The NSCAI adopted an AI national preparedness plan following WHO's guidelines that was approved by the Prime Minister ("Policy analysis of," 2011).

### ***Timeline of H5N1 Outbreaks***

Examining the timeline of H5N1 human and poultry outbreaks in Vietnam will offer a better understanding of the roles government action, policies and international players played in the reaction to a potential human pandemic response (which will be further explored in Chapter Five). Looking at the timeline will also illustrate Vietnam's consistent concern with strict public health policies such as vaccination, culling, and stamping out responses in poultry and human H5N1 outbreaks. Hence, retracing the events may point out any mistakes and necessary changes during past outbreaks to prevent future ones. This section will first examine the chronological timeline of six H5N1 outbreaks in Vietnam that began in late 2003 to late 2008, and the current outbreak in 2014.

### ***First Wave: Late 2003- March 2004***

The first wave of Avian Influenza H5N1 in poultry occurred in late 2003 to early 2004. As previously mentioned, the Ministry of Agriculture and Rural Development (MARD) leaders initially tried to keep it a secret, for fear of damaging tourism. However,

once the virus was known publicly, the prime minister quickly emphasized their readiness to fight the flu by declaring that they would try to eradicate the virus by February and would cooperate with the international community (Scoones, 2010). During this first wave, two inter-ministerial national coordination committees were established to respond to the H5N1 virus. In January 2004, chaired by MARD, The National Committee for Avian Influenza Disease Control and Prevention (NSCAI) was created, followed by, The National Steering Committee for Human Influenza Pandemic Prevention and Control (NSCHP), chaired by the Minister of Health (MoH) (Payne & Do, 2013). In this period, 45 million birds were culled, and 27 human cases were reported, of which 16 were fatal. In early 2004, 24% of Vietnam communes and 60% of towns were affected in 57 of 64 provinces in Vietnam, resulting in 17% of Vietnam's poultry being dead or culled. Continued outbreaks were reported from July-September 2004, and four more reports of fatal human cases were reported during these months.

### ***Second and Third Wave: July-November 2004 and Dec 2004-April 2005***

The second wave of H5N1 outbreak was short and also a let down to the central officials' goal of eradicating the virus by February. Due to its reoccurrence, Vietnamese central officials realized that the virus could potentially be endemic. The growing pressure to mitigate the disease during this wave was therefore a high priority for the Government of Vietnam. With the guidance and collaboration with foreign donors (and their funding), the national response to poultry outbreaks concentrated on stamping out, disinfection and movement controls. (Payne & Do, 2013). Throughout the second wave, continued sporadic cases of both human and poultry were reported. The third wave, from late 2004 to early 2005, was a period of close cooperation between international donors

and the Government of Vietnam in developing a poultry vaccination policy. With the help of increased foreign aid, a nationwide vaccination campaign was being implemented for the fall of that year. However, implementation problems in pilot provinces were present but were not highlighted by the media. Continued poultry outbreaks were reported in December 2004, and a total of 6 human outbreaks confirmed and reported in January 2005.

***Fourth Wave: October 2005-Dec 2005***

During the fourth wave in 2005, cooperation between the Government of Vietnam and foreign donors was still strong. Vietnam received increased aid from donors and continued to take technical advice from international agencies. In a matter of two months, Vietnam made a national plan for a pandemic as requested by WHO. Due to increased international concern for a global human pandemic, in January 2006 in collaboration with the European Commission and the World Bank, a global conference was co-sponsored for donor pledging in Beijing hosted by the Government of China. “Official Donor Agreement pledged USD 1.9 billion for the global API response” (Payne & Do, 2013).

With the close partnership between the Ministry of Agriculture and Rural Development (MARD) and the Ministry of Health (MOH) and assistance from the World Bank and the United Nation system, the Government of Vietnam developed a comprehensive plan, the Vietnam’s National Integrated Operational Program for Avian and Human Influenza (OPI), for the period of 2006-2010. This was also known as “the Green Book,” with the goals of controlling and reducing H5N1 health risk to human and “controlling the disease at source in domestic poultry, by detecting and responding promptly to human cases, and by preparing for the medical consequences of a human

pandemic (Payne & Do, 2013). In November 2006, the Partnership on Avian and Human Influenza (PAHI) was created to support the organization of national and international resources for the operation of the OPI. The new PAHI plan included 26 national and international partners, which included the Government of Vietnam that was “represented by the MARD Minister as Chair of the NSCAI, and international organizations such as the UN World Bank, NGOs, international donors and other sponsors (Payne & Do, 2013). MoH gave MARD the task of leading the vaccination campaign (Scoones, 2010). By late 2005, the Government of Vietnam announced a national campaign for a mass poultry vaccination program and some significant decreases in outbreaks but sporadic poultry and human outbreaks still occurred (Payne & Do, 2013).

***Fifth and Sixth Wave: Dec 2006-Nov 2007 and Dec 2007-late 2008***

The fifth wave highlighted the failure of the entire vaccination campaign due to the poor results and recurrence of poultry outbreaks. According to Vu, this was mostly due to the implementation process that faced issues such as corruption, false reports, and finger pointing among officials. The initial two-year plan for vaccination was also ending in 2007 yet there was no strategy of how the campaign would end. Hence, the vaccination campaign was beginning to receive doubts about its effectiveness to control the virus from foreign donors, stakeholders and government officials. Media highlights from newspapers during the time also reported farmer’s refusal to vaccinate, causing concern for the donors and policy-makers who realized that farmers would most likely not pay for the vaccines after the end of the campaign (Scoones, 2010). In spite of the private doubts from some international and national stakeholders on the results of the vaccination

program, the donor and government relationship remained intact and further funding continued.

In the sixth wave, sporadic poultry outbreaks further led national and international doubts about the vaccination program. Despite the lack of direction, the vaccination program was extended for another year through 2009. The Government of Vietnam and foreign donors also began planning for implanting a proper strategy program for avian influenza that focused on restructuring the livestock sector. In 2008, many outbreaks in poultry were reported throughout Vietnam, with the worst in July where 15 outbreaks in poultry occurred in nine different provinces in VM. In September, there were 915 outbreaks in poultry found in six different provinces ("Avian influenza in").

### ***Current outbreak***

In early January 2014, two human cases of H5N1 deaths were reported in Vietnam (Yang, 2014). On February 15th 2014, MARD announced H5N1 poultry outbreaks in eight provinces throughout the northern and southern regions. Since the end at Lunar New Year, at least 30,000 infected poultries have been culled (Yang, 2014). The Government of Vietnam has responded by sending inspection teams to check poultry trade in high risk areas susceptible to the virus, and urged agencies in the country to take samples of poultry in markets to find early detection (Yang, 2014).

Poultry and human outbreaks have decreased over the years but are still sporadic in Vietnam today. This indicates that past H5N1 response policies have been instrumental to the decline, but is not enough to prevent the disease from spreading. In later chapters of this report, the roles of big agriculture, biosecurity measures and technical and health

response programs in H5N1 eradication will be explored to provide a better understanding why the disease continues to persist today.

### ***Why the timeline is important***

The timeline reveals that the Vietnamese government saw H5N1 as a national security threat and responded to the possible pandemic with a set of public health policies that did not consider the livelihoods of small scale farmers. (Herington, 2010). In 2004, the government adopted a policy where area-wide culling was implemented and poultry trading within Vietnamese borders and across the Chinese border was heavily restricted. It was estimated that over 38 million birds were killed in order to prevent the virus from spreading (Herington, 2010). Due to the high losses, Vietnamese farmers suffered from the culling, a less erratic policy was adopted later on. This reform allowed for uninfected birds living more than three kilometers away from infection areas to avoid culling (Vernick et al., 2010). With support and guidance from the WHO and the MARD, the area-wide culling was followed by a 2005 nationwide vaccination campaign for all commercial birds to prevent a future epidemic (Herington, 2010). Initially, a two-year plan, the campaign was extended until 2011 when new vaccine-resistant strains of H5N1 were detected among the birds (Desvaux et al., 2013).

While this new plan was a nationwide effort over several years, it received limited support by most in Vietnam. It is unlikely that the vaccination policy was approved by Vietnamese farmers and international agencies, in part because of high costs and low success rate of vaccines. Other intervention programs were implemented since the epidemic, including a surveillance program through the Vietnamese Department of Animal Health (DAH) with the help of National Centre for Veterinary Diagnostics

(NCVD) to monitor outbreak in domestic poultry. This program gathered more than 2,500 H5N1 positive samples, many of which have been characterized by virus culture, full genome sequence, and antigenic testing (Nguyen et al., 2012). However, the usefulness of the collected information has yet to be determined. In short, with the high numbers of confirmed human reports shared with widespread poultry outbreaks of H5N1, concerns over the likely beginning of a human pandemic strain made avian influenza in Vietnam a focus of both national and international concern. Vietnam's response towards the H5N1 epidemic was met with a strict attitude by enforcing poultry vaccination, culling infected poultry and disinfecting poultry farms in high-risk areas (Velasco, Dieleman, Supakankunti & Phuong, 2008), as well as close collaboration with foreign donors' support to prevent a human pandemic. As seen with the current outbreak in 2014, these strict policies have not changed.

According to *Vietnam News*, when the first wave of H5N1 occurred in 2004 the Vietnamese government reported the epidemic had lowered the national GDP by 0.5 percent, with much of the loss attributed to poultry culling. Aside from being accused of housing birds responsible for viral outbreaks, rural farmers were unable to sell their poultry to wary consumers. Aware of farmers' discontent, prime minister Phan Van Khai initiated a program in 2005 offering compensation to farmers and livestock breeding centers of 15,000 VND for every H5N1 infected bird culled and an additional 3,000 VND per bird to cover culling costs. Many Vietnamese farmers fought widespread culling and vaccination programs out of governmental suspicion. Compensation was much too low, and was viewed as an act of charity towards farmers, not reimbursement.

Compensation was also distributed unfairly, often targeted towards larger poultry

farms while ignoring small-scale farmers (Scoones, 2010). During the first and second wave of the epidemic in 2005-2006, the local governments targeted some small-scale farmers as the source of outbreak. Backyard farmers were forced to stop poultry farming, and were either denied compensation or veterinary health care as an overall government plan to cut down small poultry producers (Scoones, 2010). As a consequence of such treatment, many small farmers continued to sell and trade sick birds against governmental regulations, and many even disposed of vaccinations. As in other Southeast Asian countries, small-scale farmers were not acknowledged by the government or provided adequate financial backing. Since reports of newer outbreaks this year, Vietnam has continued to respond with similarly harsh policies from past waves, such as vaccination and widespread culling. Thus, small scale farmers continue to be the marginalized group affected in this epidemic. As an international voice for peasant farmers La Via Campesina can promote a stronger relationship between farmers and the government and advocate for the rights of Vietnamese farmers in the H5N1 epidemic.

### ***Thailand Case Study***

The outbreak of H5N1 came at a time of both political and economic change in Thailand. In the late 1990s the country quickly shuffled between Prime Ministers and was faced with a major recession in 1997 as the stock market in all of Southeast Asia crashed (“Thailand Profile”, 2013). The crash was caused in part by the sharp decline in commodity prices of exports from the area. To combat the crisis, Thailand began to rely on short-term international currency borrowing, which further increased financial instability. To reconstruct the financial sector, the IMF, World Bank, and the Asian Development Bank created a debt consolidation, or structural adjustment plan, for

Thailand worth 17.2 billion dollars. While the plan was well intended, and more successful than programs implemented in most countries, the market in Thailand did not recover as quickly as expected by IMF and World Bank experts (Lane, 1999).

One way that Thailand was able to move out of this recession was by developing a booming poultry industry, particularly since 2002. While levels of profit briefly decreased in 2004 as a consequence of the H5N1 outbreak, production has increased by a total of six percent from 2002 to 2011. The industry is expected to keep growing as demand for chicken meat increases in the United States and Europe (Preechajarn, 2013). Currently, Thailand is home to nearly 250,000 million commercial birds, which produce a million tons of meat a year (Greger, 2006). While exports comprise 40 percent of the demand for poultry, internal demand for chicken meat is high as well (Scoones, 2010).

Less than ideal economic conditions have motivated a slew of backyard birds in Thailand. As popular source of supplemental income, 80 percent of Thai households keep chickens. Backyard ducks are also popular, as well as birds used for fighting (Greger, 2006). Birds are usually kept on an informal basis, and are used mainly for home consumption or sale at the local markets. Generally owners let birds run free, and do not use expensive technology or specialized breeding that is common in larger facilities. However despite the influence of backyard birds, the vast majority of poultry production takes place in large commercial plants with over 1,000 chickens. This is due in part to the largely urban nature of the Thai population, as well as the market monopoly held by several large poultry production companies (Scoones, 2010). During the 2000s, this focus on commercialization meant that large amounts of money was invested in processor plants and breeding programs. Many Thai officials viewed this investment as money well

spent, given the profit potential in domestic and international markets (Giles, 2012). However, criticism of large poultry facilities is common, and plants are rumored to be hotbeds for corruption. Dhanin Chearvanont, a key owner of major Thai poultry plants, was able to transform his family business into a nationally-known corporation in the late 1980s. However, this transition was marked by a series of illegal donations to politicians in the United States, as well as media cover-ups (Greger, 2006).

### ***Outbreak***

Thailand's powerful poultry industry may support the country economically, but it also was blamed for a string of H5N1 outbreaks. In 2003 the first wave of H5N1 in poultry emerged in Thailand. Most poultry owners were unaware of the disease or how to stop it, and the outbreak quickly moved through poultry in 42 of Thailand's 76 provinces (Chunsuttiwat, 2008). Originally the disease went unaddressed, as many farmers attributed chicken deaths to chicken cholera, a disease that is non-transmittable to humans. Despite pressure from international organizations, little was done to test birds, and chicken deaths were dismissed as anomalies (Greger, 2006).

However, this disinterest changed once H5N1 moved outside of poultry. The first reported human infection was in January, 2004 when two young boys in the Suphanburi province and another in the Kanchanaburi province tested positive for H5N1. The children were treated for respiratory problems and pneumonia, and all three survived. Given the minimal infection rate of humans in Thailand and high survival rate, public fear surrounding the disease was low at the start of 2004 ("Investigation of Avian Influenza (H5N1) Outbreak in Humans", 2004).

Despite minimal public interest, the government feared the virus would hurt chicken sales. After several cross departmental meetings, the Thai government developed a strategy to combat the outbreak. This strategy included steps to protect the poultry industry in the form of public awareness campaigns touting the safeness of chicken (Scoones, 2010). Celebrities were shown eating chicken, and free Kentucky Fried Chicken giveaways were held across the country. The government also hoped to limit the spread of the outbreak by mass culling birds that might have been exposed to H5N1. Approximately 62 million birds, mostly chickens being raised by small and medium-sized backyard producers were killed during the government's campaign (Greger, 2006). The operation cost nearly 135 million USD and employed animal disease experts, public health volunteers, and members of the military (Scoones, 2010).

However, culling efforts were not met with universal success. Based on estimates performed by the Thai government, close to 90 percent of all cases of avian influenza were found in commercial birds, not free range birds of backyard farmers. This caused resentment among smaller farmers, who blamed the commercial poultry industry for the outbreak. The commercial poultry industry was able to escape the majority of culling because of their political and economic power. Commercial meat was quickly packaged and sold once culling mandates were issued, mitigating losses. This meant that while nearly 130,000 birds were killed per day in Thailand during 2004, the total was made up almost entirely of backyard birds (Greger, 2006).

Another hindrance to mass culling was the presence of fighting birds in Thailand. Bird fighting is a major source of entertainment in the country, and has even been compared to baseball in the United States (Greger, 2006). Bird owners often have close

relationships with their birds, both physically and mentally (Lowe, 2010). During culling, bird owners hid fighting birds away from their regular market chickens. Beyond emotional attachments, owners were unwilling to give up their top fighting birds because of cost. The government offered slightly over a dollar per bird; a reasonable sum for a chicken sold on the wet market. However, fighting birds can cost up to 1,000 USD, creating a disincentive for owners to report illness or relinquish birds (Greger, 2006).

While some bird owners may have been unwilling to work with the government, the majority of the public was eager to participate in public health measures. Such programs were also motivated by the government's desire to maintain its strong poultry export market. To combat H5N1 the Thai MoH devised a list of response strategies framed from existing health surveillance created during earlier SARS outbreaks. This consisted of increased disease surveillance, sanitation in hospitals, public communication and education, vaccine stockpiling, and increases in viral medications (Chunsuttiwat, 2008). This public health campaign closely followed guidelines from the MoH, the CDC, and the WHO. The campaign aimed to prevent animal-to-human and human-to-human transmission through pandemic preparedness. This included stockpiling Tamiflu, as well as working with local hospitals to quarantine patients with H5N1 symptoms. The MoH campaign also aimed to use the media to educate poultry production workers to use protective gear and avoid infected birds. Consumers and retailers were advised to not sell infected or raw poultry, instructed in safe food-handling practices, and were taught to report symptoms of the virus to health-care providers in a timely manner ("Investigation of Avian Influenza (H5N1) Outbreak in Humans", 2004).

### ***Late Outbreaks***

At the start of 2004, a lull in H5N1 outbreaks took place. During this time, no poultry or human infections were reported; however government and media interest remained high. By the middle of 2004, several poultry infections emerged. Perhaps because of strong programs in existence, H5N1 disappeared in Thailand until 2008.

Unlike the previous two outbreaks, the third appearance of H5N1 emerged mainly in humans, not poultry. The string of cases began in the Uthai Thani province, and resulted in 25 confirmed human cases of H5N1. Of these cases, mortality rates were high, with 17 total deaths. However, nearly all infected were children, whose weaker immune systems and greater interaction with poultry made them more susceptible (Scoones, 2010). The Thai government continued to maintain high levels of disease surveillance during the 2008 outbreaks. Everyone who was hospitalized with respiratory illness was tested for H5N1, and all swabs were submitted to the Thai National Institute of Health. The government also invested money in maintaining statistics on the population. This effort included research on human vaccines. However, vaccine development was made difficult by a lack of funding and economic conditions in Thailand. Since the outbreak of 2008, H5N1 has not been recorded in Thailand. However, surveillance for H5N1 and other strains of avian influenza remains high (Gregor, 2006).

### ***Indonesian Case Study***

Of the 489 worldwide cases of H5N1, 80 percent have occurred in Indonesia prior to 2010 (Lowe, 2010). While a warm climate and proximity to the original source of outbreak played a role in this high prevalence of disease, Indonesia's large poultry population also facilitated the outbreaks. As the country faces large amounts of poverty,

many citizens need alternative sources of income through backyard poultry (Scoones, 2010). Across the country, 60 percent of all households are home to nearly 300 million chickens. The birds serve as an important source of protein, as well as a medium of trade for other merchandise (Lowe, 2010). Poor farmers are often very attached to their chickens, both from a perspective of nostalgia and economic self-preservation (Lowe, 2010). Beyond backyard birds, large commercial poultry is a major industry that employs a million people in Indonesia (Scoones, 2011). According to the USDA, Indonesia's commercial poultry sector is expected to double in the next ten years as a result of the rising middle class ("USDA International Egg," 2013). Indonesia is an important source of chicken meat for the United States, and was the 8th largest producer of eggs and the 10th largest producer of chicken meat worldwide in 2011 ("H5N1 Avian Influenza," 2011).

### ***Outbreak***

This powerful industry was hurt in 2003, when birds began to die from H5N1. Between 2003 and 2004, 600,000 chickens died in 17 of Java's 35 residences from H5N1 (Scoones, 2010). To address the outbreak, Indonesia first proposed mass avian vaccinations, however there was a distinct lack of qualified medical and veterinary personnel (Scoones, 2010). Hoping to prevent human transmission, the government poured money into H5N1 specialists for hospitals across the country, as well as a containment strategy. This pandemic plan eventually was labeled the "Disease Surveillance and Response Project" by the Indonesian government, and was established to localize H5N1 (Scoones, 2010). The project was known in Indonesia as the most sincere domestic effort to combat current and future outbreaks (Scoones, 2010). The goal

was to expand both animal disease surveillance measures, as well as raise public awareness about disease prevention. Rapid testing kits were suggested, which were able to diagnose H5N1 in birds within a matter of hours (Sedyaningsih, 2007).

The first sign of an H5N1 outbreak among humans was in Pekalongan, a district in Central Java. According to WHO reports, the case was officially confirmed in July of 2005, although deaths are suspected as far back as 2003. Although a young man is considered to be the ‘patient zero,’ it is suspected that his two young children were disease victims as well (Scoones, 2011). By the end of 2005, 20 total cases of H5N1 were reported. In 2006, the largest cluster case was reported, which spanned seven cases over four households. This cluster took place in the Karo district of Indonesia, and remains the largest linked outbreak to date (Aditama, 2012).

The outbreaks from 2003 onwards were characterized by high fatality rates, with almost two thirds of all reported cases resulting in mortality. Among those with serious cases of H5N1, high mortality rates have been blamed on lack of awareness and timely treatment (Scoones 2011). Poor economic conditions might also have increased mortality rates, as medical care for those infected was often difficult to access or too expensive (Sedyaningsih, 2007). Reported mortality rates are likely higher than reality, as mild or asymptomatic cases may have gone unnoticed and unrecorded. Patterns of close contact transmission were common, and those who came within one meter of an infected person were more likely to contract the disease. However, zoonotic transmission between fowl and humans was believed to be the source of disease, not human-to-human transmission (“H5N1 Avian Influenza,” 2011).

As the outbreak continued from 2007 to 2008, the government expanded efforts to

control the disease. This took the shape of a plan to reconstruct the poultry industry to prevent viral mutation and disease spread. However, this proved to be much more difficult than vaccination programs and public awareness. The Indonesian poultry industry is fragmented in nature as a result of the multitude of backyard birds, meaning that mass culling is difficult and expensive (Lowe, 2010). Public support was low, and steps to kill the chickens were met with strong opposition. In early 2007 the Indonesian government initiated a program to offer financial compensation to any backyard farmer if a chicken was killed. While the plan was well intended, the level of compensation was too low for the majority of farmers to agree to such a measure (Chanlett-Avery, 2011).

Perhaps the largest conflict that took place in internal Indonesian politics was between the Indonesian MoH and physician and governmental actor Siti Fadilah Supari in 2007. By 2007, the Indonesian MoH declared that human-to-human transmission of H5N1 had taken place, and released their findings to the Indonesian media and CNN. In her book Time for the World to Change, Supari claims that this information was both incorrect and used to isolate Indonesia from other countries (Supari, 2008). As Thailand and Vietnam had not experienced human-to-human transmission of H5N1, Indonesia would be uniquely burdened by decreases in tourism and lower international standing. Ultimately, Supari claimed that the presence of H5N1 was a method for the United States government to control populations, and further expand the gap between rich and poor countries (Supari, 2008). While the validity of her statements remains unclear, it indicates underlying tensions.

In order to explain Supari's response to the outbreak, we must examine the history of Indonesia's foreign relations with the United States. As the foreign interests of the

United States are often mirrored in policies of organizations such as the WHO, it is crucial to understand underlying tensions. In the 1940s, Indonesia gained independence from the Netherlands (Suraya, 2014). Violence erupted until the 1960s, as rebellious groups in Indonesia attempted to topple the president. During this time, the United States supported Indonesian President Sukarno, despite the violent policies of his regime. Consequently, many Indonesians were imprisoned without trial and accused of harboring communist sympathies. Such events increased tensions between the United States and Indonesia, and the terrorist attacks of September 2001 still furthered the rift between the two countries (Suraya, 2014). As Indonesia's population has the highest percentage of Muslims in the world, the United States raised suspicion and pressure on the government of Indonesia ("BBC Country Profiles: Indonesia" 2014)

Beyond such tensions, internal media in Indonesia also played a role in disease outbreak reactions. Regardless of the mortality rates of H5N1 or actual risk, media perceptions and public views varied greatly between 2003 and present time. At the start of the outbreak in 2003, the media took to sensationalizing the nature of the disease with the goal of raising public fear and media sales. However, as time passed and dire predictions failed to come to light, this fear began to subside among the population (Suraya, 2014). In 2007 there was little urgency and fear of H5N1. Author and anthropologist Celia Lowe describes in her article titled *Viral Clouds: Becoming H5N1 in Indonesia* that during her research in Indonesia, the public was generally skeptical of any actual risk associated with H5N1. While farmers often avoided purchasing sick chickens, they remained unconcerned about the majority of interactions with their backyard birds (Lowe, 2010).

### ***Recent Cases***

Since 2012 no cases of H5N1 in humans were recorded in Indonesia, and media in the country has begun to abandon previously adopted fear narratives (Sagita, 2013). Recent articles by *The Jakarta Globe* on avian influenza have taken a relatively neutral stance, describing Indonesian efforts to prevent the disease, as well as potential risk factors associated with China and Hong Kong (Sagita, 2013). While the media's attempt to raise fear of a nationwide pandemic is no longer a priority, traces of old narratives continue to be used. For instance, a recent article also describes reports of H7N9, a mutation of H5N1. While the piece was relatively objective, the author mentioned the similarities between the outbreak and the destruction of the Spanish flu in 1918 (Sagita, 2013). However, regardless of the intentions behind the comment, media in Indonesia has become comparatively more neutral towards avian influenza as time goes on.

### ***Conclusions***

All three countries experienced a similar path of disease outbreak and thus a shared burden. Vietnam, Thailand, and Indonesia were all forced to cull large amounts of poultry. This along with decreases in tourism and narratives of fear had the ability to significantly lower the economic productivity of all three countries. It has become clear as well through the analysis of these case studies that mass culling as a primary response to outbreaks is not effective in the long-term, and not guaranteed to be effective in the short-term as well. Culling can even put humans at risk for exposure, and thus have the opposite effect of what was intended (Greger, 2006). Essentially irresponsible and rash decisions place significant economic burden on the already underserved, and are not sensitive to extremely variable situations across time and geography. These kinds of

responses need not be implemented for future outbreaks. To this day increased security and trade regulations exist, and both the WHO and the United States State Department list warnings to partners and travelers to the Southeast Asia region. Small poultry farmers in the region universally received less support than large-scale poultry plants, regardless of the actual location of sick birds.

However despite a similar outbreak pattern, reactions to H5N1 varied greatly across Southeast Asia. While all three countries complied with international organizations and actors, regional responses were less than ideal. In Indonesia and Vietnam, the interests of small farmers were not considered, perhaps because of previous government regimens. In Thailand however, all farmers received equal compensation, which promoted compliance with culling and vaccination plans. Thus, to understand stories of outbreak, historical frameworks are vital. The accounts of these three countries during their experiences with and responses to H5N1 will thus hopefully serve as an informational and useful toolkit for understanding the scope of Avian Influenza in the world today, and its potential impact in the future. The future of H5N1 may look very different from past outbreaks as the virus continues to mutate and precautions are ignored. “Within a single individual, the virus is evolving, adapting, learning. It hits dead ends and tries something new, slowly notching up mutations that may lock into place the ability to effectively survive in, and transmit between, people. Every single person who gets infected presents a risk of spawning *the* pandemic virus” (Greger, 2006). H5N1 is not the only type of influenza the world has seen, or will see. By all realistic measures, it is only a matter of time before the next “big” virus hits. Yet, if we take hindsight-based knowledge from these case studies of the 1918 Spanish Flu, and Thailand, Indonesia, and

Vietnam's responses to the H5N1 outbreaks, then the next big virus may not reach the same levels. Medical professionals do not need to be focused as heavily on the production of vaccines and drugs knowing that the virus will mutate. These drugs, complicated enough on their own just to make, may become obsolete faster than desired. If the focus is placed more heavily on pandemic prevention, learning from past outbreaks, then influenza may hopefully be a less threatening virus. We hope this introduction has laid the groundwork for exploring the full report and our coming recommendations.

## Policy Recommendations

Given the diverse nature of Southeast Asia, it is vital to develop a strategy for LVC that embraces the differences of individual countries.

- **Promote poultry transparency:** Thailand's poultry industry is unique in Southeast Asia for its intensely centralized corporate focus. However, such an industry is also infamous for a lack of transparency and corruption, which produces inappropriate poultry handling. LVC should campaign for increased transparency in large poultry industry by releasing purchasing information, as well as records of imports and exports.
- **Accurate media reporting:** In Indonesia, treatment and control of the H5N1 outbreak was hindered by inaccuracies in the media. This produced attitudes of fear throughout the country, as well as indifference when dire predictions failed to come true. Thus, it is of vital importance to ensure that media reporting is accurate. LVC should advocate for accurate media policies so that outbreaks are reported correctly and in a timely fashion.

## CHAPTER 3

# Biology of H5N1

*Natsuki Yoshioka and William Young*

**Abstract:** *This chapter introduces the H5N1 influenza virus from a biological perspective, and how the virus evolves through random assortment. The first section, “Creation of a Monster”, begins by covering the basics of the virus and how the environment selects for mutations, increasing the fitness of the virus over time. There will be an emphasis on the emergence of the high pathogenic version of H5N1 out of large poultry populations. The second section, “Movement within the Human Sphere”, begins by analyzing Live Bird Markets and poultry populations as human constructed reservoirs in which H5N1 can persist. For the purpose of this paper the human sphere is defined as any environment that is continuously frequented by humans, this can include the agricultural sector, zoos, cities, markets, homes or recreational bodies of water. The focus then shifts to elucidating how the virus moves within the human sphere including transmission within poultry and transmission within humans. The next subsection, “Movement throughout the Ecosystem” details niches within the environment that contribute to the persistence of the H5N1 virus and expands on the last section by exploring how the virus moves outside of the human sphere. It includes an exploration of waterfowl and bodies of water as environments that allow the virus to persist and evolve. The next focus is waterfowl migration patterns and how those interact with certain environmental factors contributing to the spread of H5N1. Following this are details on species separate from waterfowl that can contract and spread H5N1 with a particular emphasis on spread into the human sphere. This subsection finishes by detailing ways that H5N1 can be detected. Everything from understanding the disease to controlling an outbreak requires detection of the virus. Within this section there is an exploration of ways to detect the virus within the environment and within organisms, this includes symptoms’ as well a specifically testing for the presence of H5N1. Overall, this chapter provides La Via Campesina the basic biological epidemiology to fully comprehend the intentions behind each recommendation provided by latter chapters of this report.*

**Keywords:** *H5N1, Influenza, HPAI, LPAI, Transmission, environment, waterfowl, infection, outbreaks*

## ***Introduction***

This chapter covers the biological and ecological information that helps La Via Campesina understand the basic scientific fundamentals relevant to our policy recommendations. The introduction of LPAI H5N1 into poultry productions within the industrial farming complex intensifies the evolutionary processes of the HPAI version of the virus. Hence, understanding mechanisms of antigenic shift helps us to focus on the “Creation of a Monster”. The introduction of LPAI H5N1 into poultry populations within the Industrial farming complex facilitates the evolution of the HPAI version of the virus. Furthermore, the avian influenza virus has become installed within the human population, creating the potential for a pandemic. Therefore, understanding the aspects of transmission within poultry and humans, as well as the diverse reservoirs of H5N1 is relevant to fully comprehending human risk. Moreover, we advocate that information on the virus’s behavior within the ecosystem supports disease surveillance and education programs to control the movement of the virus.

### ***Creation of a Monster: Influenza Fundamentals***

Like many of the common influenza viruses, H5N1 is part of the *Orthomyxovirus* family. The genetic material is in the form of single-stranded helical RNA. Avian influenza is a disease specific to birds caused by Influenza type A. There are three major types of influenza that infect humans, classified into three groups: influenza A, B and C. Influenza A and B can both cause serious infections, and are the cause of what we call the flu. Influenza C viruses differ from influenza A and B, and only cause a mild infection. Unlike the A and B, the C virus is physically and genetically different and is a low

concern to becoming a global pandemic. Most pandemics, including the H5N1, are type A viruses, meaning they have the potential to infect both humans and animals. (Goering, 2012).

The structure of the influenza virus includes a lipid bilayer made from the plasma membrane of a host cell. Influenza A and B viruses have two proteins called the Hemagglutinin (HA) and the Neuraminidase (NA). The role of the HA protein is to attach on to the host cell that it is intending to infect, while the role of the NA is to release the virus particles made in the host cell. Underneath the outer surface is the nucleoprotein, where the genomic information is stored. The genetic information of influenza is comprised of eight single-stranded RNA pieces that are packaged into a helical shape (Davidson, 2005).

Viruses are unique because they carry genetic information in the DNA or RNA but lack the synthetic machinery for this information to be processed into new viral material. Therefore, they can only transcribe their genetic material after infecting a host-cell and using the host to regenerate genetic information. The following describes this process of replication:

- 1.) Attachment and penetration: Attachment of virus haemagglutinin to Sialic acid receptor in the respiratory tract to gain entry into the host cell.
- 2.) Un-coating: Virus particles shed its genetic information in the host cell.
- 3.) Replication: Viruses produce messenger RNA (mRNA), which is then translated in the host cell to produce viral proteins. Influenza viruses are negative-

sense and single-stranded viruses, which means they produce the mRNA by first transcribing into a positive-sense strand using the viral polymerase. This extra step converting a negative-sense strand into a positive-sense strand before peptide formation makes the virus susceptible to more mutational changes. Viral mRNA is translated in the host cell to generate viral proteins.

4.) Assembly: Forming capsid around the nucleic acid and the outer glycoproteins

5.) Releasing new virus particles by budding through the host cell membrane.

The outcome of an influenza infection is the destruction of the host cell. This is called lysis, because the virus breaks open the host cell to produce lethality. Both NA and HA are proteins that determine the type of influenza, namely the *antigenicity* of the influenza virus. Mutations, or slight changes, in the antigenic structure of the influenza virus produce new subtypes and strains of the virus. There are known to be sixteen major types of HA and nine of NA (Goering, 2012). The combinations of H and N are responsible for determining the pathogenicity and severity of such disease. Naturally produced virulent strains have been subtypes H5 or H7. However, according to the recent *Manual of diagnostic tests and vaccines for terrestrial animals: (mammals, birds and bees)* produced by the OIE, amongst these H5 or H7 isolates have been of low virulence are those that lack a HA0 cleavage site amino acid sequence (Goering, 2012).

Influenza viruses display host specificity, which means only a limited array of host species can be infected by the type of influenza. Absorption, or the initial process of

specificity, determines the ability of the virus to be able to attach to the host cell. An influenza virus can attach by its Haemagglutinin (HA) to the glycoprotein found on the cells of the outer membranes and on red blood cells. Attachment to the receptor is followed by entry into the host cell. For influenza viruses, the receptor molecules called the Sialic acid, are located along the respiratory tract and the lungs. “Expression of type 2 Sialic acid core in both chickens and humans has been hypothesized to promote human infection with chicken origin H5N1 viruses” (Kaplan & Webby, 2013, p. 6).

Transmission Basics: The basic reproduction number ( $R_0$ ) is the amount of organisms an infected organism will infect during its infectious period. In order to control an epidemic this number needs to be less than one (in some cases it can be just slightly over). This means that each victim infects at maximum only one other susceptible host. Reduction of  $R_0$  is achieved in two ways, by reducing contact rate between animals (or humans) by isolation or separation, and by reducing infectiousness of animals (or humans) by treatment or vaccination.

### ***Evolution of the virus***

The replication process of the avian influenza virus is prone to genetic mutations and diversity because of the high error rates of the RNA polymerase used during the replication process (Fordyce, *et al.*, 2013). Influenza viruses undergo genetic changes over time, which increases its virulence. Ultimately, this is a public health concern because of the potential for H5N1 to evolve and become transmissible to humans.

Antigenic shift and drift: Influenza A and B viruses emerge to develop new strains through slow prolonging processes of mutations, called antigenic drift. This mutation takes place on the gene that codes for the antibody binding sites. Most mutations are deleterious and may render the virus ineffective, while some will not change the fitness of the virus at all. An even smaller number of mutations may result in a fitness increase that will produce a different viral strain. Through this process, the virus surpasses the body's immune system, which is unable to distinguish and express immunity to the new influenza strain. Influenza A viruses can also mutate through antigenic shift, which produces a new subtype of the virus. Unlike antigenic drift -a slow and gradual process- antigenic shift is an unexpected and immediate change in antigenicity. Antigenic shift occurs when a cell becomes "simultaneously infected by two different strains of type A influenza" and develops a new recombinant genome (Davidson, 2005). This process is more frequent in influenza A because there is a greater range of hosts than influenza B viruses. Thus, antigenic shift cannot occur between type A and B viruses. The formation of a new recombinant strain, such as the HPAI H5N1 is predominantly due to antigenic shift and can infect birds, pigs, and humans. Development of a new subtype of the virus could cause a global pandemic very rapidly given a lack of human immunity.

Virulence increases when LPAI evolves into a HPAI virus. This evolutionary process takes place as selective pressures between natural and artificial ecosystems change in the intensive poultry production. Influenza viruses that have subtypes H5 and H7 are categorized into Highly pathogenic (HPAI) and Lowly pathogenic (LPAI) Avian Influenzas based on degree of virulence and mortality rates. HPAI is defined as efficient transmission and 100% mortality rates

within 48 hours (Scoones, 2010, p.8). The LPAI produces mild respiratory symptoms in birds, while the HPAI infects organs as well as the respiratory tract. The LPAI virus is capable of transforming into HPAI after a series of mutations over time. Therefore, it is possible that wild waterfowl are capable of passing the LPAI virus to poultry flocks while migratory birds carry the HPAI virus to new uninfected areas. (Scoones, 2010). Figure 3.1 highlights the clinical differences between HPAI and LPAI viruses in poultry. HPAI has greater mortality rates, infectious periods, and sites of infection when compared to the LPAI virus. Infectious period indicates the timeframe of capability to expose others to the virus (CDC, 2011). HPAI viruses are more persistent than LPAI viruses during the infectious period (Goot, 2009). Moreover, the virulence of the HPAI is reduced in populations that have experienced LPAI infections. The LPAI virus serves as a primary infection that defends the host when having a HPAI secondary infection.

**Figure 3.1: Differences between HPAI and LPAI**

	<b>HPAI</b>	<b>LPAI</b>
<b>Mortality Rates</b>	High	Low
<b>Infectious Periods</b>	Longer (~6.8 days)	Shorter (~4.8 days)
<b>Site of infection</b>	Trachea and Cloaca	Trachea only

The ecological differences in which HPAI and LPAI viruses prosper are also a crucial aspect of understanding viral emergence. LPAI viruses infect wild water-birds while HPAI infect poultry (Lebarbenchon *et al.*, 2010, p 1057). It is rare that HPAI viruses infect wild birds because HPAI does not naturally emerge and cannot persist in natural ecosystems. Therefore, an increase in virulence takes place when the LPAI virus enters the domestic bird population and evolves into

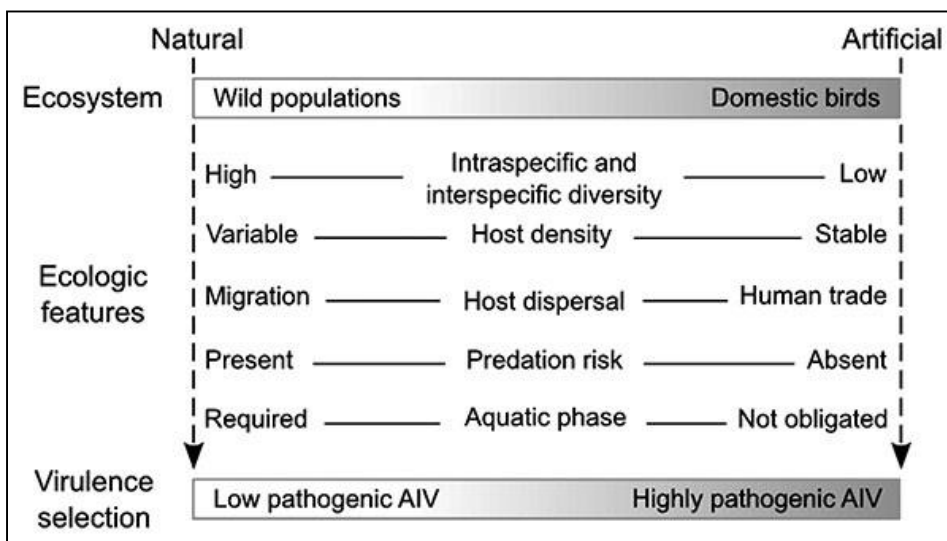
an HPAI virus. Artificial ecosystems are man-made environments that do not exist in the wild, and include poultry farming, free-grazing duck production, and live bird markets (Lebarbenchon *et al.*, 2010, p 1058). In comparison with natural ecosystems, the range of host species available for infection is much lower in environments of domestic birds. There is a greater risk for the HPAI virus to infect artificial environments because host density is large and age-structure is more uniform in industrial poultry farms than in the wild. Moreover, there are more occasions during the industrial poultry production process for viral transmission among birds. These include, but are not limited to the physical transport of “feces, feathers, and meat, [and movement of] cages, packaging, farm workers and their clothes, and vehicles used on farms and over long distances” (Lebarbenchon *et al.*, 2010, p 1058). Through principles of natural selection, viruses that are able to adapt and endure in these diverse environments reproduce to generate offspring that have these favorable traits. After a series of reproductive generations, the majority of the viruses will have these traits that allowed survival. At this point, the two ecosystems exert different selective pressures on the influenza virus population. The artificial conditions of industrial agribusiness have caused the maladaptation of HPAI influenza strains to their natural ecosystems and hosts that allowed increasing virulence. Unlike LPAI, the HPAI viruses require “high and sustained host contact rates that are rare under natural conditions” (Lebarbenchon *et al.*, 2010, p 1058). Example of these conditions in the natural sphere include harsh weather conditions or defined life cycles that make the artificial environments more favorable for the virus. HPAI viruses in wild birds, including migratory birds, can introduce the virus to uninfected areas due to their high virulence and inability to severely harm waterfowl.

### ***Movement within the Human Sphere***

The H5N1 virus has become embedded in the human sphere, and its persistence within this environment maintains its status as an imposing threat that must be dealt with before it becomes a pandemic. The virus has been shown to sweep through poultry populations and infect

humans that come in contact with the high pathogenic version that is produced within large poultry farms. Humans have unknowingly constructed reservoirs that enable the virus to persist within the human sphere ensuring that it won't be eradicated. All these factors have created a situation that demands immediate action and requires pandemic preparedness plans be in place in the case of an outbreak.

**Figure 3.2 Nature and Artificial Virulence (Lebarbenchon, 2010, p. 1058)**



### *Constructed Reservoirs*

**Live Bird Markets:** Live Bird markets (LBM) are reminiscent of industrial poultry farming complexes in that they house large numbers of live poultry in close proximity, yet also introduce new birds, making LBMs hotspots for diseases. The major danger of LBMs is that most birds incorporated into this environment are quickly slaughtered and eaten. If a bird is infected while at the market, it often is not viewed as a risk. The frequency at which the LBM is inhabited plays a large role in the LBMs spread and persistence of the H5N1 virus. Rest days allow the market to be “disinfected so that the infectious reservoir, if present, is assumed to be removed” (Fournie et al., 2010, p.1084). However, if the market is used multiple days in a row, the virus may survive within the infect birds brought in the next day, further

contributing to viral spread.

The type and practices of poultry merchants that frequent the live bird market play a role in the LMB's ability to act as a reservoir. Some merchants bring only a portion of their birds to the market and quite frequently a vendor will not sell all of their birds. This means that the unsold birds (that are potentially infected) are taken back to the poultry farm, allowing the virus to spread to other birds. Some merchants don't limit themselves to one LBM, and if their stock has become infected a vendor will spread the virus to all other LBMs that they visit.

Poultry: Under specific population and spatial relationships poultry can act a reservoir for the virus. Poultry is the major means by which a virus moves into human populations, and persistence of the virus within poultry population poses a significant threat to human health. One study conducted by Hosseini et al. (2013) analyzed how different poultry demographics affected the movement and persistence of the H5N1 virus within poultry populations. The study analyzed each farm based on the spatial relationships between the farms. Their key finding was "persistence of A/H5N1 is highly dependent on farm size" (Hosseini et al., 2013, p. 3). Within small farms the  $R_0$  is significantly less than one (indicating that some infected poultry don't infect other birds) meaning the virus fails to spread. This is due to the low number of poultry within each farm and the genetic variation that exists within poultry. Even if the virus is able to travel between small farms, it is likely to die before spreading far. However, it should be noted that if small farms are close enough that poultry from different farms interact frequently, patterns begin to behave similar to larger farms. Large farms have a  $R_0$  significantly higher than one and "the epidemic rapidly burns through the population, and as long as

the network is sufficiently connected that all patches become infected, they all experience a full epidemic” (Hosseini et al., 2013, p. 3). This is very different from viral persistence, and when analyzing farm size based on persistence large farms allow proper actions to be taken. Despite this advantage, large farms have the greatest potential to start a pandemic. A pandemic will result if the large farm has any connection to outside farms. Moderate farms face the most problems with persistence. The  $R_0$  of these patches is between 1 and 6, allowing these patches to experience “local mini-epidemics”, which can prolong an outbreak. In some cases the virus doesn’t infect a large portion of the poultry population, “...and if pathogenicity is low, may not cause noticeable outbreaks.” (Hosseini et al., 2013, p. 3) A network of moderately sized farms will allow the outbreaks to “smolder” contributing to the persistence of H5N1. Though the results of this study show that moderately sized farms are best for persistence, it is important to realize that lack of surveillance is what produced these results. Eliminating persistence within this environment simply requires more rigorous surveillance techniques that would not allow these outbreaks to go unnoticed.

### ***Transmission within Poultry***

Outbreaks of H5N1 within poultry are a major factor contributing to infection of humans with H5N1 and understanding the way H5N1 transmits within poultry will minimize human infection. It is also within large poultry populations that the virus evolves from a LPAI virus to a HPAI virus. Tiensin et al. (2007) used the 2004 outbreak in Thailand to study H5N1 dynamics of transmission within poultry. They treated “...flocks of backyard chickens, broilers, fighting cocks, or laying hens” (p. 1680) as different types of populations and as such were able to find differences in the

transmission properties within these populations. The average  $R_0$  of all populations varied between 2.26-2.64, and increased throughout the 4 day infectious period (Tiensin et al., 2007). More specifically the  $R_0$  of backyard chickens and fighting cocks varied from 2.18-2.40, while the  $R_0$  of broiler chickens and laying hens varied from 2.31-3.17. While this difference was not statistically significant, it does "...reflect the effect that contact-structure differences have on transmission" (Tiensin et al., 2007, p. 1682). One would expect that broiler chickens and laying hens are kept in close contact with each other while backyard chickens and fighting cocks are granted more mobility.

It should also be noted that this "study was conducted under the implicit assumptions that (1) the chickens had no immunity to H5N1 virus at the time of its introduction, (2) all susceptible chickens were equally susceptible, (3) all infected chickens were equally infectious and spread the virus throughout the flock, and (4) all H5N1-infected chickens eventually died from the disease" (Tiensin et al., 2007, p. 1680). Since laying hens and broiler chickens generally come from single breeders and traits are selected, these assumptions closely replicate reality. In backyard chickens and fighting cocks one would expect more genetic variation offering greater chance of immunity or decreased susceptibility, lowering the  $R_0$  of these groups even further and possibly making the difference of  $R_0$  between the two groups significant. The same study noted a lack of accuracy about the exact number of poultry deaths within each farm, stating "data such as the total number of animals and the number of deaths per day really should be recorded per house, to facilitate epidemiologic analysis" (Tiensin et al., 2007, p. 1683). Thus, a greater understanding of flock transmission may help in "(1) determination of the time of introduction of the virus into a flock, (2) estimation of the proportion of animals

requiring vaccination, and (3) assessment of the effect of intervention strategies” (Tiensin et al., 2007, p. 168).

### ***Transmission within Humans***

Transmission between humans requires close contact with infected humans or their immediate environment. H5 antibodies have been detected in health care workers that worked closely with infected patients, suggesting that transmission of H5N1 to healthcare workers took place (Van Kerkhove et al., 2011). Cases have also developed within family members living in close proximity (Kandun et al., 2006). One case documented infection upon living in a home previously inhabited by an infected individual (Kandun et al., 2006). Still other cases have suggested contact with fertilizer harboring H5N1 viruses (Kandun et al., 2006). Feces from infected poultry had been used in the fertilizer, which would have been avoided had proper waste management taken place. A study conducted by Ron Fouchier discovered that H5N1 could evolve in mammals to gain airborne transmissibility with just a few mutations. This would greatly increase transmission among humans, posing numerous problems.

### ***Movement throughout the Ecosystem***

The virus is a product of nature, and along with everything else that exists in a nature, it has a role to play in a healthy functioning ecosystem. Understanding the virus’s niche within the ecosystem will allow us to pinpoint the vectors through which the virus expands, particularly within the human sphere. The knowledge that we have now is more than sufficient to understand and pinpoint these vectors, allowing for control of the virus’s spread through surveillance and educational measures.

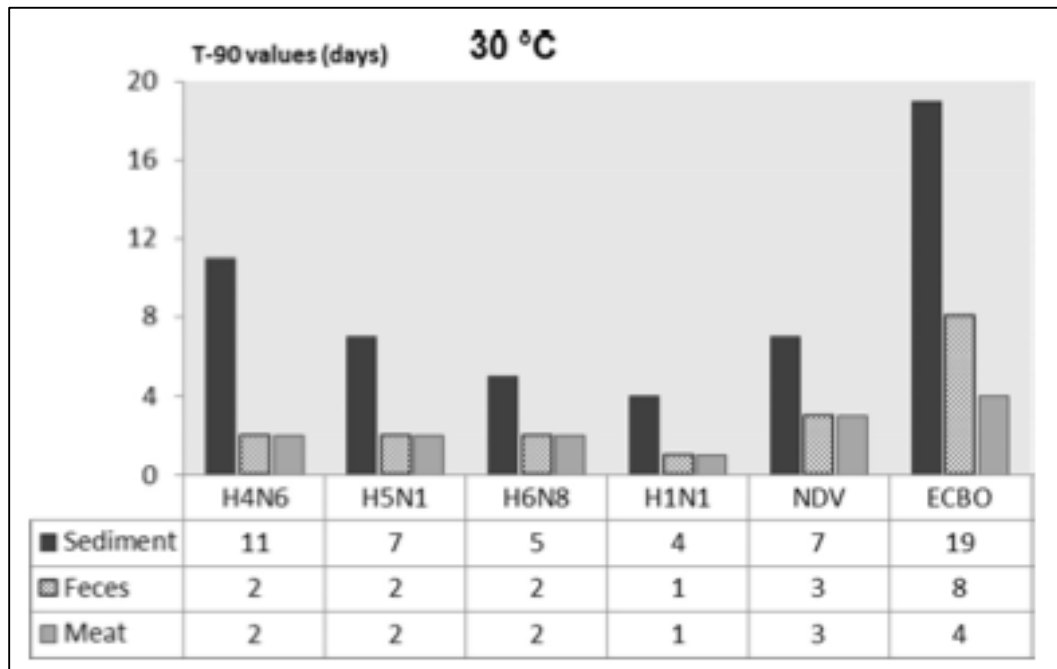
## Natural Reservoirs

Waterfowl: Waterfowl have been coined the “Trojan horses” of H5N1 spread. They are relatively asymptomatic when infected by the H5N1 virus, allowing them to go undetected by human surveillance and continue with their daily activities and migrations without hindrance. Though they are the main carriers of the H5N1 virus they generally carry a low pathogenic version of the virus which is of little threat to human health. The high pathogenic version of the virus can be found in waterfowl at much lower rates. The virus subsists within the intestines of waterfowl and is released when the bird defecates, resulting in viruses existing in particles of feces within the water. The particles will either remain suspended in the surface water or settle into the sediment where they have the potential to be picked up by waterfowl. This creates a system in which the virus can easily infect multiple waterfowl, and as more birds become infected the viral concentration in the water increases. This, in turn, increases the chances that an uninfected bird will become infected, ensuring the virus’s persistence within multiple species of waterfowl. H5N1 has been found in 36 species of ducks and four species of geese. (Kaplan & Webby, 2013) The virus also has the ability to persist within waterfowl meat after death, which puts predators and scavengers at risk of infection. A study done by Nazir et al. (2010) showed that the virus can persist in duck meat for two days at temperatures between 20-30 degrees Celsius. When the temperature is dropped to freezing the virus can survive for 54 days, particularly troubling when we consider that meat is generally transported frozen.

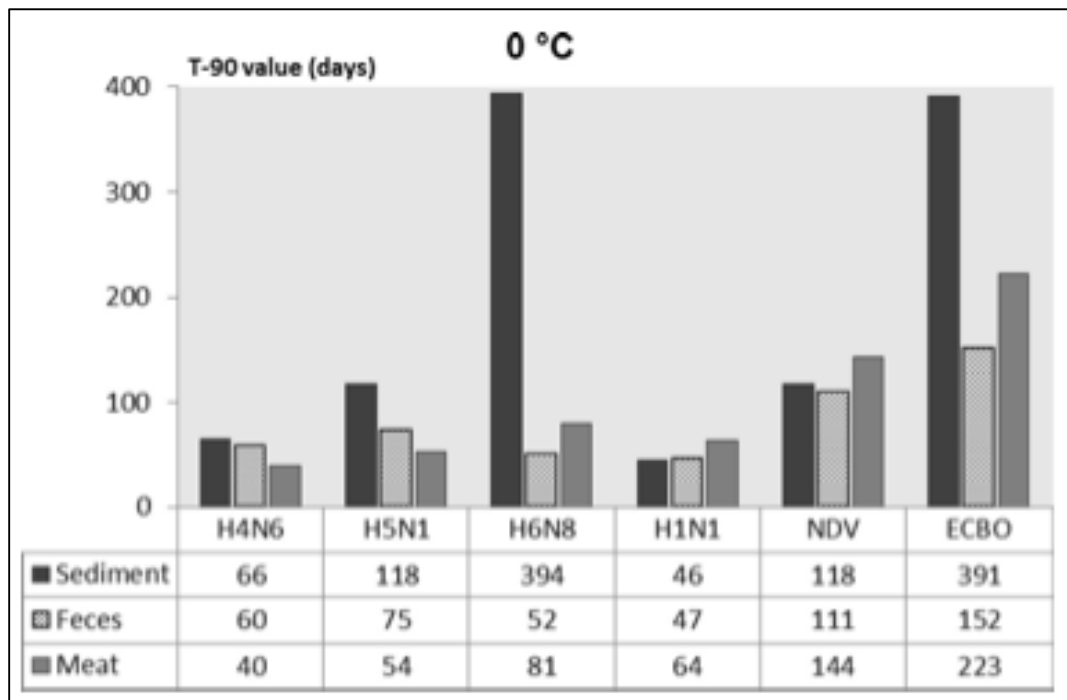
Water: As a product of evolution viruses have gained the ability to survive outside of a host organism for variable amounts of time. This trait allows the virus to more

effectively transmit between organisms, as it can remain active within the environment until it can infect another organism. Different environments support a virus for variable amounts of time; this plays a large role in the virus's ability to persist within a given environment. H5N1 is primarily found in waterfowl and as a result is continuously secreted into aquatic environments. The virus accumulates in surface water and sediment, allowing both environments to act as a reservoir in which the virus may survive to infect more waterfowl as they forage for food in sediment and surface waters. A 2011 study done by Nazir, Haumacher, Ike, and Marschang specifically examined the ability of viruses (influenza LPAI H4N6, H5N1, and H6N8) to survive within lake sediment and duck feces. The study also varied temperature, which has been shown to affect the virus's ability to survive. This showed that "the infectivity of various AIV subtypes can be preserved for extended periods of time at low temperatures" (Nazir et al., 2010, p. 4983). This is troubling when we consider waterfowl migration patterns and find that some species spend their summer in northern regions where winter temperatures drop below freezing. Within sediment held at a temperature of 0 degrees Celsius the H5N1 virus has the ability to survive for 118 days in sediment and 75 days in feces (Nazir et al., 2010). This number drops significantly as temperatures go up to 30 degrees Celsius, which is much closer to the average temperature in Southeast Asia. At this temperature, H5N1 can survive for seven days in sediment and two days in feces. While these numbers are less intimidating, they provide enough time for the virus to infect uninfected organisms that ingest water.

**Figure 3.3 Part 1: Persistence of viruses within sediment, feces, and meat at 0 and 30 degrees Celsius (Nazir et al., 2010, p. 4983)**



**Figure 3.3 Part 2: Persistence of viruses within sediment, feces, and meat at 0 and 30 degrees Celsius (Nazir et al., 2010, p. 4983)**



Another study conducted by Lang et. al (2008) found that “The diversity of

sequences in these samples [lake sediment] was extremely high and included four different HA subtypes” (p. 510). This suggests that sediment may allow multiple forms of the influenza virus to mix and infect a single organism, allowing genetic material from different strains to mix with the potential to produce a novel strain.

The ability of the virus to persist in an aquatic environment makes these environments hot spots for infection. Humans are no exception to this, as simply swimming in infected waters creates a risk of infection. Domestic ducks and chickens are also at risk and must be kept away from infectious waters, and poultry farmers must be conscious of the water source for their birds.

### **Vectors of Transmission**

**Waterfowl Migrations:** Since waterfowl are generally asymptomatic carriers, the virus doesn't inhibit them from migrating along their regular patterns. A study done by Gilbert et al. (2010) found “...that satellite tracked birds (Ruddy Shelduck and two Bar-headed Geese) reveal a direct spatio-temporal link between the HPAI H5N1 hot-spots identified in India and Bangladesh” (p. 448), suggesting that migration routes play a role in the pattern of outbreaks and hence the spread of H5N1. Waterfowl tend to be loyal to their migration routes and use the same bodies of water as resting points along their route (Gilbert et al.). Detailing these routes will provide a means to pinpoint areas that are at greatest risk of outbreak. By understanding when these birds migrate certain measures can be put in place to limit their interaction with poultry and other susceptible animals. In this way the spread of H5N1 would be reduced and contained within its natural environment.

Unfortunately, habitats continue to be destroyed forcing the birds to alter their migration patterns making their stop off points harder to predict. This may also contribute to the mixing of different viral strains as species that generally don't inhabit the same migration routes are forced to mix. Another study by Fang et. al (2008) found that a low rate of precipitation correlated with a higher risk of outbreak. This is because low precipitation decreases the area of wetlands and lakes that waterfowl can inhabit. As a result the birds are crammed into smaller environments. This in turn creates bodies of water in which the virus is concentrated and has a greater ability to infect other organisms. These factors need to be monitored so that plans intending to limit the spread of H5N1 can be designed accordingly (Fang et al., 2008, p.2).

Host Range outside of Waterfowl: H5N1 is generally understood as a virus that infects waterfowl, chickens, and humans. Other species are not always considered when analyzing the spread of the disease, yet they play a vital role. Passerines including Sparrows, Finches, and Starlings can very effectively move the virus from the wilderness into an urban settings, where it can creating a network of infection sites in cities far away from waterfowl populations (Siembieda et al., 2008). Pheasants and quail also pose a threat because they are commonly hunted for food or sport, and can infected hunters as they clean birds (Siembieda et al., 2008).

While waterfowl are the primary carriers of LPAI H5N1 they are not the only species that are susceptible to infection. Other birds, rodents, and mammals can both contract and spread H5N1. The migratory paths of waterfowl often interlink with the migratory paths of other birds. Bird deaths across many species increase near outbreaks of H5N1, suggesting that other birds are in fact susceptible. This has been confirmed

experimentally in species including “brown-headed gulls, great black-headed gulls, and great cormorants” (Kaplan & Webby, 2013, p. 5). While this poses a threat to humans who may interact with birds, non-waterfowl birds generally show symptoms of the disease and can be avoided. Passerines are also susceptible to infection by H5N1 viruses. Experimental infection has shown that these birds possess replicating viruses in their respiratory and gastrointestinal tract for 4-7 days and infection is often lethal. Transmission is relatively low in these birds, “suggesting that they may be incidental hosts and not maintenance reservoir hosts” (Kaplan & Webby, 2013, p. 5). Seeing as these birds are generally wild and peri-domestic they have the ability to introduce the virus into the human sphere making surveillance of these birds a priority. Raptors are also susceptible to infection. It is hypothesized that these birds obtain the virus from feeding on infected poultry or wild waterfowl. This was deduced by testing the strain isolated from infected raptors and finding that it very closely resembled the virus present in poultry within the area. Raptors have been experimentally shown to be highly susceptible to H5N1 and die relatively quickly. (Hall et al., 2009) This combined with the fact that they are carnivores and rarely interact with other animals aside from killing them suggests that they have minimal contributions to the spread of H5N1. Gallinaceous birds, the group that includes chickens, are highly susceptible to the infection and contribute to its increase in virulence. This group also includes pheasants, quail and guinea fowl, which exhibit similar symptoms to chickens. However, wild gallinaceous birds are not primary spreaders because they die 3 days post infection (Kaplan & Webby, 2013).

Mammals are also susceptible to infection by H5N1 but, “surveillance [has shown] that most mammalian cases of H5N1 occur simultaneously with outbreaks in

domestic poultry, indicating contact with poultry as the primary route of interspecies HPAI H5N1 transmission” (Kaplan & Webby, 2013, p. 7) There is also a lack of interspecies transmission within mammals because the primary route of influenza transmission is through respiratory droplets and H5N1 is currently unable to transmit via respiratory droplets. Nonetheless mammals may be infected by direct contact with infected animals. Swine are typically infected with H1 or H3 type viruses, but experiments have shown that they can be infected with H5N1. The disease does little to pigs and they generally do not suffer any symptoms. Several studies show that isolated viruses from pigs and chickens within the same farm indicate the H5N1 virus can move from pigs to chickens.

Within pigs, mutations occur within the virus that “highly attenuate the virus in mice, suggesting multiple passages in swine reduced the virulence of the chicken H5N1 strain” (Kaplan & Webby, 2013, p. 8). This phenomenon, though not greatly explored, could be used to lower the virulence of H5N1 strains. Members of the order Carnivora (cats) have also been shown to be highly susceptible to H5N1. During outbreaks “captive tigers and leopards succumbed to H5N1 infection at zoos in Thailand following an outbreak of H5N1 influenza in wild-birds in 2003 and 2004” and “a 2009 H5N1 outbreak occurring in the Phnom Tamao Wildlife Rescue Centre in Cambodia caused 100% mortality in lions, Asiatic golden cats, and clouded leopard” (Kaplan & Webby, 2013, p. 8). Domestic house cats are also highly susceptible to infection by H5N1. Findings have indicated that cats can spread and contract the disease through nasal secretion and feces. This poses a great risk to humans with house cats. Findings have also isolated the virus from carcasses of domestic dogs, which presumably contracted the disease from eating

infected bird carcasses. The virus has also been isolated in nasal swabs of donkeys and, “a wild stone marten and Owston’s civets have tested positive for H5N1 infection” (Kaplan & Webby, 2013, p. 9).

The ability of H5N1 to infect multiple species of mammals opens up many new vectors through which the virus may move into the human sphere. The symptoms of an H5N1 infection are not always obvious, and as a result the animal will most likely receive general treatment from a veterinarian. This will put the veterinarian as well as zookeepers at risk of infection and if the disease is not confirmed to be H5N1 they will not be aware that they were exposed. The same is true of domestic cats but to a greater extent. Cats frequently rub their faces on humans to transfer their scent, but along with that they may deposit nasal secretions harboring the H5N1 virus.

### *Detection of H5N1*

Within the Environment: The major accumulation of H5N1 within the environment takes place in bodies of water. An accurate way of detecting the virus within water will offer effective ways to limit infection. However, as the virus is dilute in surface water it must be filtered and concentrated for the virus to be protected. A study by Deboosere et. al (2011) found that “the optimal protocol corresponded to a continuous filtration at 30 liters/h through glass wool, followed by a contact time of 10 min with 300 ml of 1.5% beef extract buffer (pH 9.5) containing 0.05 M glycine and a viral elution step at 30 liters/h, and then a PEG concentration with a precipitation step for 2 h and a centrifugation time of 1 h at 4°C.” (p. 3905) after which RT-PCR was best for detection of H5N1 within the concentrated solution. As water is a major reservoir for the virus,

early detection could severely limit the spread of the virus because infected bodies of water could be closed off or put under surveillance

**Simple Detection:** Simple detection involves recognizing symptoms of infected animals. Though this can be effective, symptoms of H5N1 can be similar to those caused by seasonal influenza or other disease, making more complex detection methods necessary. Recognizing symptoms is the cheapest and easiest way to monitor H5N1 and they can be easily taught to people as a way to limit viral spread. Thus, we have included details of common symptoms experienced by specific species when infected with H5N1. In raptors the virus attacks the central nervous system and symptoms include feather fluffing, ataxia, anorexia, tremors, and weight loss. In cats the symptoms include increased body temperature, weight loss, and decreased activity. Swine exhibit very few symptoms upon infection with H5N1. The only noticeable one is weight loss (5-15% of initial body weight) during the 4 days following infection, but the weight loss is generally recovered. (Kaplan & Webby, 2013) In gallinaceous birds the symptoms of infection are “depression, anorexia, and respiratory congestion in addition to edematous comb and wattles, and hemorrhage of the conjunctiva and bursa of Fabricius” (Kaplan & Webby, 2013, p. 6). In humans the symptoms include high fever with a temperature usually higher than 38 degrees Celsius, diarrhea, vomiting, abdominal pain, chest pain, bleeding from the nose and gums.

**Complex Detection:** Complex detection is required to confirm the presence of the H5N1 virus. At the moment there are two techniques best suited to detect the virus, one is a reverse transcription-polymerase chain reaction (RT-PCR)-based nucleic acid detection assay and the other is enzyme-linked immunosorbent assay (ELISA). RT-PCR allows us

to sequence the genomic information from a sample; this information can then be compared against known sequences obtained from virus samples to analyze the presence or absence of the virus. A major drawback is that RT-PCR "...cannot diagnose patients more than 2 to 3 weeks post-H5N1 infection, as RNA is not detectable after the clearance of [the] virus." (Khurana et al., 2011, p. 12445) ELISA uses an enzyme that is congregated to an antibody that will seek out the antigen that it is specifically designed for and when bound will cause a detectable reaction, often a color change. Production of an antibody requires genomic knowledge of the virus and can be specialized to unique areas of the virus so as to not detect unwanted material. Both of these methods require a laboratory setting but there has been investigation into developing a rapid field test using ELISA. A study by Khurana et al. (2011) developed an "ELISA and rapid test platforms of H5N1-SeroDetect [that] demonstrated a high degree of specificity, discriminating between H5N1 virus-infected individuals... and uninfected individuals..."(p. 12460). The rapid test is a strip that is "...immersed in a 50-fold dilution of a serum/plasma sample..." with a positive test indicated by a color change on one of three lines on the strip. Each line corresponds to H5N1 specific "peptides PB1-F2 (2-75), M2e (2-24), and HA2 (488-516)" (Khurana et al., 2011, p. 12456). The methods of detection are effective and continued use of these methods will ensure accurate data is gathered on H5N1.

### ***Conclusion***

H5N1 continues to be a public health concern because of its increasing virulence and ability to move to human populations. Understanding the biological mechanisms behind H5N1 an essential basis to our policy report. This chapter has explained the science of H5N1 Highly Pathogenic Avian Influenza evolution and highlighted its ability to developed higher virulence.

The biology behind the influenza virus entailed details of structure, replication and transmission. This sets the groundwork for understanding how and why viruses evolve over time. The next section of this chapter explained evolutionary mechanisms of the virus, consisting of how viruses interact and are shaped by their environment, given that HPAI evolves from LPAI within human constructed environments. The following section reinforced the threat that HPAI poses to humans, while also providing knowledge critical to setting up pandemic preparedness programs and dealing with possible outbreaks in the most efficient way. Furthermore, it highlights the potential effectiveness of surveillance programs through a technical perspective. The next section highlighted how natural reservoirs and viral movement throughout the environment are critical to pinpointing where and how the virus moves into the human sphere. Information from this section support surveillance measures and outbreak prevention plans explained in chapters five and six of the report. The biological framework validates the claim that AI increases its virulence through industrial poultry production.

## Policy Recommendation

Based on this biological examination, we have designed recommendations given the concept that information and proper surveillance measures are beneficial to addressing H5N1.

- **Risk Reduction:** Emphasize the importance of dismantling the industrial farming complex and constructed reservoirs as a means to reduce the risk of HPAI H5N1.
- **Monitoring:** Emphasize the importance of strategic surveillance and education systems in limiting the spread of H5N1. Proper surveillance will provide information that can pinpoint areas that are at greatest risk of an outbreak while also providing an early warning system. Educating people on the common routes of transmission will help reduce risky behavior.
- **In depth data gathering requirements surrounding H5N1:** If it can be confirmed that the patient is infected with H5N1 then an investigation should take place to discover how the virus was obtained. This involves an interview with the patient along with testing those who they came in contact with, or the environments that they frequented. Tests should be done more often in spring and

fall (migratory seasons) and should concentrate on bodies of water are heavily used by humans and waterfowl.

- **Increase H5N1 Research:** Advocate for continuing research on H5N1. There have been reports that influenza virus have achieved a lowered virulence in poultry populations if the virus moves through swine. Continued research in this area may reveal natural mechanisms that may help lower the virulence of the virus. The exact mechanism by which the LPAI evolves into the HPAI within a large poultry population is not fully understood. Continued research in this area could elucidate ways of stopping this transformation.

## CHAPTER 4

## On Hens and Needles: Improving Technical Responses through Vaccination and Culling

*Erin Larsen and Jennifer Charoni*

**Abstract:** *The following chapter provides a critique of the technical responses previously implemented following H5N1 outbreaks in Southeast Asia. The most basic, immediate interventions historically used to combat a burgeoning pandemic are culling and vaccination. Culling, at its simplest level, is the systematic destruction of avian hosts of the disease to prevent its spread. Vaccination is the injection of antigens (a weakened version of the virus) into human or avian organisms that have not yet contracted the disease but are at risk from it. This process hopes to grant organisms future immunity by prompting the creation of antibodies equipped to respond to H5N1. Through the analysis of the implementation of these two strategies it is clear that there is a disconnect between what needs to happen for effective, immediate responses to a possible pandemic and what has occurred in the past. We point out ways that past responses have failed in providing support to those who need it most and have instead catered to global corporate agendas. Finally, we provide recommendations for bettering technical responses in the event of future outbreaks.*

**Keywords:** *culling, human vaccination, poultry vaccination, viral sovereignty, H5N1, poultry, pandemic, influenza, Thailand, Vietnam, Indonesia.*

### ***Introducing Technical Responses through a Political, Social, and Economic Lens***

The technical responses implemented in the past upon the occurrence of an H5N1 outbreak will not be effective when addressing the possibility of a future large-scale avian influenza pandemic. Those likely to receive the brunt of ill effects of the disease will not receive access to necessary medicines, adequate prevention techniques or any sort of stability without a change in the implementation of strategies. Respectively, both culling and vaccination programs have catered towards large scale agribusiness and the pharmaceutical industry as a whole. This has meant ignoring the economic impact to farmers who have, under instruction from organizations like the WHO, culled their entire chicken coups and simultaneously extinguished their livelihoods, or not ensuring access to vaccinations to those in the midst of a pandemic. Technical responses must be better tailored to provide effective treatment to those most affected by influenza and less based on the broader goals of commercial poultry farmers, large pharmaceutical conglomerates and the wealthy nations that control them.

What follows is an in-depth examination of culling and vaccination. In an effort to take into account past issues and inequalities, the political atmosphere under which vaccines are created was a large portion of our critique of past strategies. For this reason, a section devoted to the dissection of viral sovereignty, its past and possible future effects on the vaccination process, was necessary and investigated via the 2007 Indonesia/WHO vaccine sharing controversy. Other inequalities such as pharmaceutical patents, worldwide genetic data sharing policy and patent law are important for their hindrance to vaccine accessibility for developing nations.

Following this, a more technical, detailed look at the effect pharmaceutical companies have on vaccination development for humans seeks to specify new technologies and ways to assure vaccination to those in closest proximity to a possible outbreak. These more minute strategies connect to bigger picture ideas about the agency of pharmaceutical companies in the world and their priorities.

Additionally, the implementation of poultry vaccination has been a topic considered by many nations in which H5N1 has been pandemic within poultry populations. While little is known about the effectiveness of this strategy as part of a larger control plan, many endemically infected countries have turned to poultry vaccination as part of an emergency response plan. As a control strategy, poultry vaccination is both costly and time consuming, so it is imperative that more research be done in order to accurately measure its effectiveness.

Just as the pharmaceutical companies have had clear ulterior motives with the production and distribution of vaccinations, the agribusiness economy has received unfair advantages in regards to culling and the destruction of infected materials as well. The culling section focuses on case studies from previous H5N1 outbreaks in Thailand and Vietnam and current protocol. The economic effects to states, commercial farms, and small-holder farms are examined. It is revealed that most major culling programs have disproportionately affected small-holder farms. Additionally, negative effects on the transformation of the virus itself, and short term and long-term goals are discussed throughout the analysis.

Technical responses must be based on the most effective means to quell a pandemic. The hierarchical structure of the globalized world creates an environment in

which agribusiness pharmaceutical profits are placed above the health of developing countries. This system increases the likelihood that a country like Indonesia, without the necessary wealth to produce its own vaccines or effectively manage its economy in the event of needing to curb its poultry industry, will incur devastating losses. Past technical responses increased the likelihood that the disease would thrive long enough and at a large enough scale to affect even the wealthiest of countries.

### ***Viral Sovereignty***

The idea of viral sovereignty stems from the unevenness experienced by states, including Indonesia that encounter the most harm from a disease and the least benefit from its medical solutions. This in turn raises several issues. First, there exists the basic idea that people in developing countries under the current pharmaceutical system are unlikely to receive access to vaccines in the event of an international emergency like a pandemic because they are: 1) too expensive, and 2) under current production capacities, the world will only be able to produce enough vaccines for wealthy countries which own and operate their own pharmaceutical companies and hold more global power. Secondly, there is the idea that developing countries often provide genetic information necessary for the creation of these vaccines (because diseases needing vaccinations to combat them occur most often in developing countries) and are unable to afford them.

In 2008, the term viral sovereignty came into the public sphere when Laurie Garrett and Richard Holbrooke used it to describe the protest of Indonesian government officials unable to vaccinate their people against bird flu. The government of Indonesia, specifically acting through its minister of health Siti Fadilah Supari, refused to provide viral samples of H5N1 to the World Health Organization. This mechanism had been

relied upon for updating vaccines with the quick mutation of influenza and other recurring viruses for the previous fifty years without challenge (Lakoff, 2010). The reactions of intergovernmental actors such as the WHO and Western media sources were panicked: this “outlandish” action led by Supari was seen as a global health threat, one that could stop worldwide vaccine creation and defense against a possible pandemic (Garrett and Holbrooke, 2008). However, the samples were providing data for vaccines Indonesians would likely never see.

When H5N1 emerged for the first time on a large scale in 2003, the WHO set up a sample sharing network called GISN (Global Influenza Surveillance Network), stemming from an organization which had existed since 1952, to handle information about the disease. Samples were provided by countries experiencing flu and used to look at the evolution of influenza and how best to target it with vaccines; samples were then transferred to industry leaders (usually large pharmaceutical companies) (Smith, 2012). The World Health Assembly, the governing body of the WHO, has claimed that this protest by Indonesia is putting “the public health security of the whole world at risk” (Caplan, 2007), an ideal echoed in the above mentioned Garrett article, which sparked further outrage from international organizations and Western nations on the subject.

However, other Third World Nations (including the Indian Minister of Health) backed Supari’s sentiment. China refused to send samples to the GISN, Iran supported Indonesia in order to oppose the United States, and support from the Non-Aligned movement (a vestige from the Cold War) and countries like Brazil also lent credibility to the cause (Smith, 2012). Holbrooke and Garrett saw this as a movement “fueled by self-destructive, anti-Western sentiments” (Garrett & Holbrooke, 2008). It is important to note

at this point that Supari simultaneously accused organizations and the United States of profiteering off of the vaccine information Indonesia provided, and even starting biological warfare. The biological warfare accusation allowed all of her statements to be termed “outlandish” by Holbrooke et al, and led to a call for absolute “transparency” meaning the sharing of influenza data with absolutely no compensation (Garrett & Holbrooke, 2008).

Other Western journalists were sympathetic to the Indonesian plight, including an article in Time magazine, an editorial in Lancet (Lankoff, 2010), and the Vancouver Examiner admitting, “a vaccine would be another financial windfall for the western pharmaceutical companies at the expense of Indonesia” (Crowe, 2009). The BBC said that no country had been “harder hit by the H5N1 bird flu virus than” Indonesia (British Broadcasting Corporation [BBC], 2007) and so did The Straits Times of Singapore (Asmarani, 2007). However, many articles originating from the United States overlooked the much greater risk of contracting fatal bird flu in Indonesia and inaccessibility of vaccines versus the more abstract threat to global public health posed by their refusing to provide viral data.

Smith (2012) suggests that there was a difference in the perception of what sample sharing was meant to do between developed and developing nations. Vaccines and viral data were seen in wealthy states as a public good, while to those exposed to the disease regularly they were treated as a luxury good. “Indonesia appeared to place a higher priority on drugs than surveillance, while wealthy states demanded surveillance because they already had the other resources required to put this relative luxury to use” (Smith, 2012). The United States and pharmaceutical companies sought to de-link the

two aspects presented: sample sharing and the ability to provide vaccines to those in need were both important issues, but should not be connected in a legal framework. The opposing side saw the link between the shared samples and their eventual product as definite, and enforceable.

Indonesia was using the legal framework from the Convention on Biological Diversity to form a basis for its protest, which called for sovereign rights of states over their “genetic resources” and “sharing in a fair and equitable way the results of research and development and the benefits arising from the commercial and other utilization of genetic resources” (Convention on Biological Diversity [CBD], 2010). Indonesia had seen their viral data as a resource, and believed they should receive vaccine access in exchange for samples (Caplan, 2007). At the time, an Australian company had created a vaccine for the disease, which was both unaffordable and too scarce to reach Indonesians (the limit of production was estimated at 500 million, which meant that it was likely not going to reach developing countries at all) (Lakoff, 2010). The company was using data from Indonesia without the government’s consent, or knowledge (Smith, 2012). However, this wasn’t the only time Indonesia was placed below developed nations and their priorities: for example, in 2005 the Indonesian government wasn’t able to procure Tamiflu (an antiviral meant to treat its first H5N1 cases) because what little existed of the drug was being stockpiled in wealthy uninfected countries that still had zero exposure to the influenza it was meant to combat (Supari, 2008).

Extensive negotiations between the onset of the protest in 2006 and an eventual agreement changed little. GISN became GISRS (Global Influenza Surveillance and Response System), and the process of benefit sharing was rearranged. A new Pandemic

Influenza Preparedness (PIP) Network allowed for Standard Material Transfer Agreements (SMTAs) to track viral contributions by countries to the WHO and was meant to provide benefits in response. However, the effectiveness of this legislation is questionable. Supari herself may have broken the IHR (International Health Regulations) by refusing to share viral samples, but the formal legislation supposedly created to promote benefit sharing is just as easily broken. Standard Material Transfer Agreements (STMTAs) are now the vehicle for moving benefits throughout the chain of vaccine creation (Smith, 2012). These methods are based on the original use of legal statutes like the Convention on Biodiversity and the International Seed Treaty (argued by Indonesia to apply to viral data, but argued by the United States to not apply to “an invasive pathogen rather than an indigenous organism”) (Smith, 2012), which are notoriously vague and have historical difficulties in enforcement.

The Convention on Biodiversity rests on three principles: (1) biodiversity conservation, (2) sustainable use, and (3) just benefit-sharing (Mullis, 2009). Equitable use of genetic resources is the cornerstone of the Indonesian argument for vaccine-related benefit sharing. Another piece of applicable legislation is the International Covenant on Economic, Social and Cultural Rights (ICESCR), which details a state’s right to the highest possible attainment of health. However, by withholding samples Indonesia may be violating this ICESCR legislation standard by making the health of other countries less guaranteed (Muller, 2009). In the end, the vagueness of legislation such as this, as well as the propensity of actors to choose certain points from statutes and ignore others creates a cyclical argument.

In 2007, WHO officials met with health officials from Asian countries in Jakarta,

and later with vaccine company representatives, which led to the WHA meeting discussions a month later. The WHO led an \$18 million fund to set up vaccine production in six developing countries, and also proposed setting up expert groups for global stockpile. However, this stockpile was originally meant to contain 40-60 million doses, and Indonesia alone would need 22 million (Fedson & Dunhill, 2007). The vaccination of people in the face of the pandemic is a problem yet to be solved.

### ***Human Vaccination***

The vaccination of humans against influenza has been a historically difficult process for several reasons: the mutation of the virus is quick and difficult to account for and predict; and regional and global politics often hamper a process that is already expensive and time-consuming. The following section includes a range of more specific information about the effectiveness and processes for human vaccination against influenza, and larger, big-picture concerns about the idea of vaccinating large numbers of people in developing nations.

Currently, avian influenza is in a state of limbo labeled by the WHO as “Pandemic Alert”, wherein a small amount of human-to-human transmissions of the disease have occurred, but no human to human to human transmission has been recorded (Brilliant, 2013). Most experts predict a pandemic will occur in the next three years, and 90 percent of expert flu experts interviewed by Dr. Larry Brilliant predicted that an avian bird flu pandemic would occur within the next two generations. An estimated one billion people will be infected if the disease mutates to support human transmission, and of these 165 million are estimated to die. Given this potential for tragedy, it is important to rely on vaccinations to help build immunity among the population.

Vaccinations traditionally consist of injecting a weakened or incomplete version of a virus into the body. The body then develops antibodies able to combat a full-force version of the virus if later infected, accomplishing immunity (Berkley, 2013). Antigens are weakened versions of the viruses injected, which must be grown in a living organism ‘host’ (Dugdale, 2012). Antigens can be completely dead upon injection, and are then referred to as ‘inactivated’. This version of vaccination is safe, in that there is no chance of virulent infection, and it can be transported in most cases without refrigeration (an asset when navigating developing nations) (National Institutes of Health [NIH], 2012). Unfortunately, however, this type of vaccination is less effective at developing immunity in people, and requires two to three doses (NIH, 2012). The ability to vaccinate the inhabitants of third-world countries multiple times is both unlikely to occur in a state of emergency and very expensive. The amount of antigen necessary for multiple injections is difficult to justify due to its low and high demand. To combat this, there is the option of including adjuvants in the productions of vaccines – these are additives that increase immune response to antigens, heightening immunity development. Adjuvants have been in use since the 1930s and are licensed in the US only in the form of aluminum salts or gels (Center for Disease Control [CDC], 2010). “We are confident that a vaccine is feasible even if it is not fully matched to the pandemic strain, as long as there is a strong adjuvant,” said Giuseppe del Giudice of Chiron (an American biotech company) ((Mackenzie, Debora, and Choo, Kristin, 2005). Pandemic influenza requires more doses of vaccine in order to attain immunity than its seasonal version, and this means, again, more antigen use. US officials have until recently been critical of H5N1 vaccination with adjuvants, and they are not traditionally used in the development of seasonal influenza

vaccines. Large amounts of clinical trials were required for their use, which vaccination companies were unwilling to pay for. This set back research in this area until a lifting of these requirements was accomplished. The US made vaccines without adjuvants have performed unimpressively in trials, something the now liberated use of adjuvants (which are and have been used in traditional vaccination for diseases such as Hepatitis B and HPV) will hopefully fix (CDC, 2010; Fedson, 2007). Live, attenuated vaccines are another option for antigen sparing. In these, the virus is still living but has been weakened. Live, attenuated vaccines create better immunity in patients but require that the patient is strong and healthy, which excludes the very old or very young, and this excludes those most likely to be greatly harmed by influenza. This type of vaccination requires consistent refrigeration, which is also difficult to attain in an emergency and to maintain consistently throughout transportation (NIH, 2013). Vaccines like this are also able to create antibodies that are reactive to a wider range of flu strains ((Hessel and The European Vaccine Manufacturers (EVM) Influenza Working Group, p. 165, 2009).

Antigen-sparing techniques are important because of the difficulty that comes with growing quickly mutating flu viruses. Beginning in the 1940s, viruses for vaccination were grown in living chicken eggs. Most strains of influenza are able to be produced with a ratio of 1 or 2 doses of vaccine per egg, but it is unknown how well a strain will grow within an egg until this is tried for the first time. The possibility of combating an avian influenza pandemic with this method would require, then, an inordinate amount of eggs (hundreds of millions), which may or may not work well with the particular strain isolated from the outbreak. The idea of somehow accumulating hundreds of millions of chicken eggs to grow a virus-combating vaccine designed to

protect humans from a disease which causes chickens to drop dead is also an irony that must be recognized. The recent swine flu outbreak in North America demonstrates how badly this process can go: the particular swine flu strain grew terribly in eggs. With each egg only producing 0.6 doses, the possibility of mass vaccination was nonexistent. The growth of viruses in eggs also takes at least 6 months- and with simple errors, this huge amount of time and expenditure is easily wasted: in 2004, influenza vaccination production was cut in half when one of the two factories producing it was contaminated (Berkley, 2013).

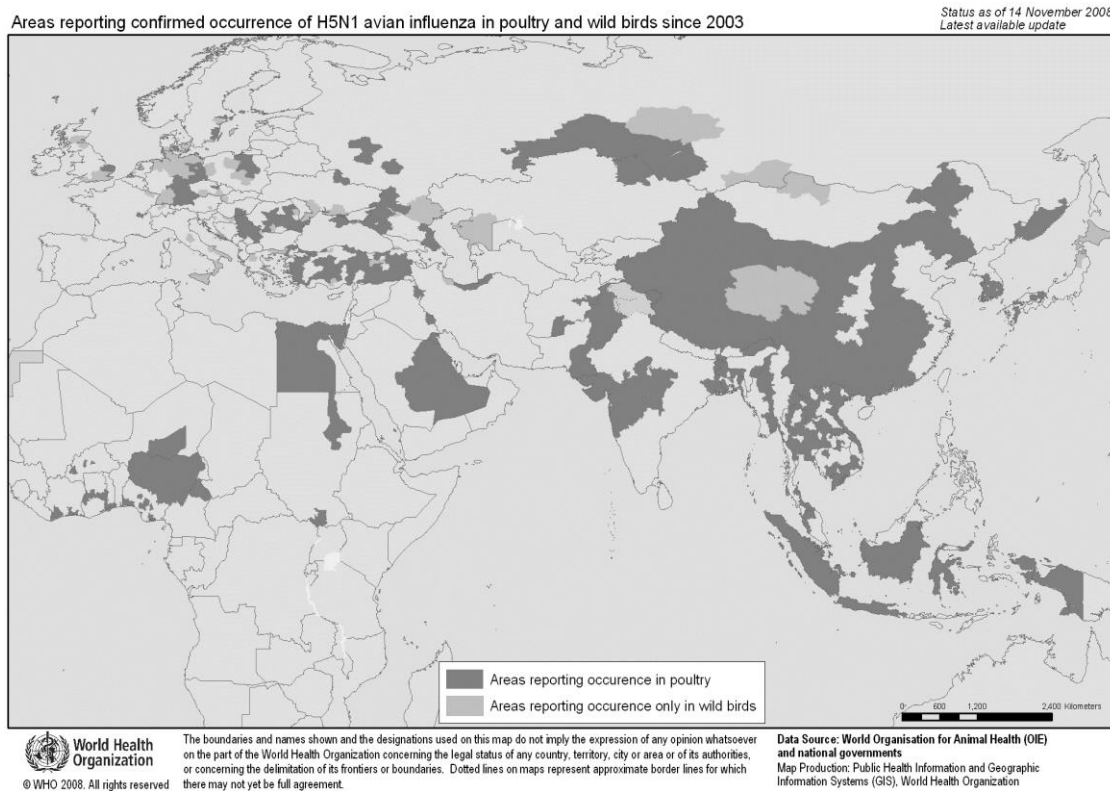
The use of eggs is therefore outdated and must be replaced with the support of new, more efficient technologies. There are several feasible options for these that have legitimate research behind them. Growing viruses for antigens in bacteria is one way to decrease the vaccination preparation time period. Where egg-based methods take 6-8 months in general, growing viruses in e. coli can reduce this time to a few weeks and decrease costs significantly (Berkley, 2013). The process for vaccine modification to account for mutation and new strains has also improved from original methods. While original vaccination creation consisted of trial and error (the injection of a modified pathogen into the body and then an observation of the resulting immunity achieved), the type of quick mutation, which influenza is characterized by and which makes it so dangerous, needs a quicker and more thoughtful method of vaccine formulation. Even if a person has been immunized against influenza before, a second infection could prove detrimental because mutation can be so extreme that the new version of the flu is unrecognizable to the body. For seasonal flu, scientists choose three strains to predict the flu variety of the coming year, which allows them to create effective vaccinations.

Broadly neutralizing antibodies are a new idea that could assist with combating quick mutations of flu: they would be trained by a vaccination to latch on and disable multiple variations of the flu by recognizing the areas of the virus that do not mutate (Berkley, 2013). This idea turns vaccinology on its head and instead begins from the desired antibody and determines how to create this type of antibody from an antigen. The process determines which parts of a virus antibodies are able to latch onto, and then uses this knowledge to rationally design a more universal vaccine. Using areas of the virus that do not mutate allows antibodies to recognize the general type of virus that is present in an infected body. Vaccines like this are not able to provide complete protection from disease but have the possibility of preventing death (Berkley). Technology like this is able to “multiply production many times over” and could “make the concept of pre-pandemic immunization a reality” (Hessel & EVM, 2009). The idea of a broad-based ‘priming dose’ is that can and should be administered now, and followed up with a more specific strain in the event of a pandemic (Mackenzie & Choo, 2005).

These strategies are by all means not comprehensive but serve to demonstrate current medical possibilities, and the fact that combating an influenza pandemic could be possible with the use of new technologies. However, one of the most convoluted and difficult parts of an immediate technical response to influenza has been the distribution of vaccines to those in clear threat of contracting the disease. “Most developing countries will have no access to a vaccine during the first wave of a pandemic and perhaps through its duration”, admits the WHO (World Health Organization [WHO], 2013). Ironically, this is where the vaccines are most needed, as evident from the WHO map above, showing five years of outbreaks and their locations (WHO, 2008). With heavy coverage

in Southeast Asia, and the exclusion of all western nations, the distribution of outbreaks and those countries producing vaccines for influenza are oddly opposing.

**Figure 4.1: Areas reporting confirmed occurrence of H5N1 avian influenza in poultry and wild birds since 2003**



Those living in Indonesia are the most likely of all nationalities to contract avian influenza, with 162 recorded cases in Indonesia versus an average number of 21 cases in the other 14 countries with infections between 2003 and 2009 (WHO, 2013).

Pharmaceutical companies that manufacture avian influenza vaccines are located in Australia, Canada, China, France, Germany, Italy, Japan, the Netherlands, the UK, and the United States. In six months, all of these facilities combined operating perfectly with their current technologies would be able to vaccinate 700 million people. The population of these producer countries combined is over 750 million (Fedson, 2007). According to

the United Nations System Coordinator for Avian and Human Influenza nearly 100 countries will purchase influenza vaccines in the event of a pandemic. The fatality rate for bird flu in Indonesia was 80% in 2007, but bird flu vaccines were unlikely to reach the country in time to respond to pandemic-level needs because of their high cost and demand by larger, more influential countries (Caplan, 2007). “Pre-pandemic vaccines”, which are brand new vaccines in the process of being tested and developed are sent by contract to a list of certain countries first, none of which are developing nations.

Further difficulty in acquiring vaccines has stemmed from patent laws regarding the use of the intellectual property, including pharmaceutical products. The TRIPS (Trade-Related Aspects of Intellectual Property Rights) Agreement) took effect in January 2005 and is a product of the World Trade Organization. In order to encourage invention and development of medicine, it awards pharmaceutical companies handsomely for new medicines with exclusive patents. “Patents provide the patent owner with the legal means to prevent others from making, using, or selling the new invention for a limited period of time, subject to a number of exceptions,” writes the WTO (WTO, 2014). What these patents have effectively done, however, is provide companies monopolies on medicines which make them incredibly expensive. It is clear also where all of this money is going: the United States will receive \$19 billion a year from TRIPs-related patents, and TRIPs mirrors strict US patent laws (Multinational, 2003).

There is an exception to TRIPS called ‘compulsory licensing’. This is the idea that governments can override patents of producers within their country. This means that they can force production of needed medicines but the patent holders still must be paid. The 2001 Doha Ministerial Conference allowed this to extend to production outside of the country to

include developing countries incapable of domestic production. In August 2003, waiving a further provision allowed generic copies of medicines made under compulsory licenses to be exported to developing countries that “lack production capacity” (WHO, 2014). Many national laws, in order to be in compliance with past TRIPS negotiations, still prevent this however. And “the supplying country would have to issue a compulsory license to export a generic copy of a medicine that is patented in that country” (WHO, 2014), meaning that obtaining vaccines in the event of a pandemic would place the developing countries most likely to need them at the mercy of the wealthiest nations of the world.

This dilemma would be the case unless, somehow, developing nations were able to produce their own vaccines in-country. Here, it is useful to look at the success of one such company: Shantha Biotechnics, which emerged in India in 1993. By 2009, Shantha was operating out of India and producing vaccines to the tune of \$90 million in revenues which provided 120 million doses of Hepatitis B vaccine to many developing countries (Chakma, Masum, Perampaladas, Hays, and Singer, 2011). “The idea that the poor are a sustainable and ideal initial market has been a common thread in previous studies describing successful Southern innovators, especially vaccine manufacturers including Indian Immunologicals and the Serum Institute” (Chakma et al, pg. 2, 2011). In-country labor, scientists, and resources were cheaper than production costs in richer countries, and funding was procured from multiple investors for in-country production. Local support came in free lab space provided by local universities. In 2003 Shantha helped form the Developing Country Vaccine Manufacturers Network (DCVMN), and they along with other manufacturers supply over half of UNICEF’s vaccines (Chakma et al,

2011). Shantha invested quickly in extensive research and development, allowing them to pass WHO quality standards. Granted, investments from wealthy countries and some development in those countries was initially necessary, but in country production meant that vaccines were sold at 23 cents a dose, and were finally affordable for those that needed them.

Support for research and development like this should be a priority for government. Federal officials in countries like the United States and Canada support medicine quality and innovation. Letting privatized businesses make decisions involving medication has led to very small, inaccurate trial sizes. Companies, riding the turbulent waters of international demand, don't strive to work on the production of drugs for a future pandemic that might happen. They have no incentive to improve vaccination creation strategies for ten years from now (Fedson & Dunhill, 2007). Private vaccine manufacturers in Europe are further inhibited in that they are unable to find the least antigen necessary to produce sufficient immunity: fearful of receiving a 'fail' on any one vaccination, they refuse to lower antigen amounts and conserve said substance in case a smaller amount is slightly too little to pass immunity tests. Without any government involvement in the development of formula, countries are essentially stockpiling substances for which they have little research background.

### ***Poultry Vaccination***

The persistence with which the H5N1 virus has repeatedly reoccurred in various Southeast Asian countries has led some countries to look into the possibility of adding poultry vaccination to their various strategies used to combat the disease. First used on a large scale in Hong Kong in 2002, widespread poultry vaccination has been considered

and implemented by numerous countries in attempts to help eradicate the disease (Sims & Dung, 2009). Poultry vaccines are more broad and long-term than their counterpart human vaccines and while there are still many problems and weaknesses associated with poultry vaccination, its success in various countries urges further investigation (Swayne, 2006). In a 2004 position paper, the FAO states, “The main objectives of [poultry] vaccination are to reduce the production losses caused by the disease, to reduce the spread of AI virus to animals and humans by reducing the shedding of viruses in the environment, to create (by way of vaccine induced immunity) barriers between infected and free areas/compartments and to help in the control and eradication of the disease” (Food and Agriculture Organization [FAO], 2004, p. 45). There is no one individual vaccine which immunizes for all avian influenza forms, and there are currently two technologies which have been licensed to use in the field. The first form, an inactive vaccine, can provide protection against multiple species of birds whereas the second, a recombinant fowlpox-H5-A1, can only be used in chickens and is applied at one day old in the hatchery. Currently, the inactive vaccine is most widely used because of its ability to protect various species of birds. Vaccine strains must be evaluated every two to three years to ensure their effectiveness. In the US inactivated vaccines cost \$.05 per dose plus an additional \$.05-\$.07 to administer (Swayne, 2006). Because of the direct and indirect costs associated with vaccination programs they have primarily only been implemented in areas of extreme risk and in emergency response situations.

Poultry vaccination has been implemented in four of the six endemically infected countries, and if carried out properly, vaccination programs increase the resistance of poultry to infection as well as reduce excretion of the virus (FAO, 2011). It is important

to note that the success of a vaccination program is wholly dependent on the program's design with varying factors including but not limited to, financial resources available, structure of poultry sector, and veterinary/animal science capacity of host country. There have been instances where large-scale campaigns have failed in providing increased immunity to the disease (Sims, 2013). Additionally, mass vaccination campaigns will never be able to achieve immunity across an entire country at a high enough level to completely eradicate the disease. However, they may be effective in creating a large number of individually protected flocks and in reducing the total number of fully susceptible poultry (FAO, 2011). The FAO currently has a substantial set of guidelines regarding vaccination strategies, an excerpt from their 2004 position paper reads as follows:

“It is difficult to prescribe a set of rules for vaccination of poultry against HPAI that cover all situations. However, FAO recommends that the following fundamental principles (which should be adapted to suit national or regional objectives) be considered in developing a vaccination strategy:

- Vaccination cannot be used as a panacea or in isolation from other measures that must be applied in the face of ongoing outbreaks (e.g. stamping out, biosecurity, disinfection).
- Flocks of birds that are infected must not be vaccinated.
- The vaccination strategy should be developed in consultation with all stakeholders, including the private sector.
- The types of poultry and production sectors to be vaccinated must be determined and clearly documented.
- Sufficient quantities of appropriate vaccines must be available for the planned duration of the vaccination program
- Countries may develop their own vaccines and reagents but these should be subject to appropriate QA/QC measures as specified by the OIE.
- Countries or regions may consider ‘banking’ of vaccine and appropriate diagnostic tests and reagents.
- A surveillance strategy must be developed that includes the capacity to identify a

- monitor both field exposure to HPAI and the use of vaccine.
- Logistic arrangements must be in place for delivery and administration of vaccine.
- The effectiveness of a vaccine strategy should be reviewed within an appropriate timeframe. It is suggested that initially 12 months of vaccination should be completed before this assessment is done to allow for the influence of seasonal factors.
- An exit strategy (after which the vaccine would no longer be used) should be identified.
- OIE recommendations should be followed, including in relation to the implementation of a DIVA [differentiation of infected from vaccinated animal] strategy” (FAO, 2004, p. 46).

In accordance with the aforementioned recommendations, the FAO will support the implementation of a vaccination program in response to an outbreak, in response to a defined trigger (such as the detection of H5N1 in dead wild waterfowl), or as a baseline precaution in highly vulnerable poultry populations. The differentiation of infected from vaccinated animal strategy (DIVA) refers to either diagnostic testing among vaccinated populations or the use of sentinel birds, which are non-vaccinated animals kept in vaccinated flocks to be used as a models of comparison (FAO, 2004). Both Vietnam and Indonesia have used poultry vaccination programs as an emergency response and as a part of wider control strategies. Poultry vaccination is currently banned in Thailand. This is due to countries such as Japan, Thailand’s largest poultry importer, banning imports of vaccinated poultry as it makes the disease harder to track (FAO, 2005a). Indonesia chose to vaccinate farms located in infected and high-risk areas following the severe drop in poultry exports, which was a result of the first major outbreak. Indonesia encountered many problems with their vaccination program, including the wide distribution of village birds which are not held in captivity, skepticism from farmers regarding the free vaccinations and who will be held responsible if complications arise, farmers’ ignorance of the symptoms of H5N1, and a lack of veterinary field staff and

laboratory facilities (FAO, 2005b). Because the program was underdeveloped and because of the lack of cooperation from local farmers, the implementation of the program may have actually helped contribute to the spread of the virus via improperly handled vaccination tools (FAO, 2011).

The most widespread vaccination programs have occurred in China and Vietnam. Between 2004 and 2005 there were a reported 42 people who died as a result of the H5N1 virus in Vietnam, making it the record holder for human deaths in any given country to date. As an attempt to curb any further human contraction of the disease by reducing the level of infection in poultry, the Vietnamese government embarked on an unprecedented vaccination program to the entire poultry population. With funding from both the FAO Technical Cooperation Program and the US Agency for International Development, Vietnam was able to secure 280 million doses of the vaccine in order to vaccinate 87 million chickens and 40 million ducks in the first round of the vaccination program between October and December of 2005 (FAO, 2006). The Vietnamese government chose to use vaccines produced in China because they were significantly cheaper than their counterpart vaccines produced elsewhere and experimental data showed they were just as, if not more, effective at generating an immune response in vaccinated poultry. Because most human cases had been associated with small-scale poultry production there was a conscious decision by the Vietnamese government to not only include small scale farmers in the vaccination program but to subsidize the costs as well. This was not a decision which was taken lightly as this sector of poultry production is widely distributed in millions of small flocks throughout the country and would require the mobilization of a large number of animal health workers down to the communal level

(Sims & Dung, 2009). The vaccines were free to farmers with flocks of fewer than 2,000, and were administered at central vaccination points in the North and via door to door visits by animal health workers in the South (Sims & Dung, 2009; FAO, 2006). Larger commercial flocks with over 2,000 heads of poultry were required to purchase their own vaccines, and were free to vaccinate whenever their poultry reached the recommended age, whereas small-scale farms were regulated by the large-scale vaccination campaigns. After this first massive vaccination campaign was implemented there were no human cases reported for over twelve months. However, because this campaign was an emergency measure it is impossible to tell if the reduction in human cases was coincidence, a result of other control measures implemented, or solely a direct result of the vaccination campaign, as there was no time to implement a control trial in which certain provinces were vaccinated and others were not (Sims & Dung, 2009).

When implementing a mass vaccination campaign it is not possible to achieve a 100 percent immunization in all flocks, but luckily that is not necessary in order to reduce the number of susceptible poultry and decrease the prevalence of infection. In fact, during Vietnam's three rounds of its vaccination campaign, the achievement level of total immunized poultry stayed near 50 percent. While some view the vaccination strategy as the campaign which saved Vietnam, the program had multiple, substantial drawbacks. Not only was the overall cost of such a widespread vaccination campaign estimated to have been at ten million US dollars per round, of which there were three, but there were numerous disadvantages and complications which arose as well. Among these are the risks posed by vaccinators as spreaders of disease, the likelihood of product degradation (vaccines need to be stored at 4 degrees Celsius in order to be 100 percent effective), and

the risk of harming or even killing birds if the vaccines are not administered correctly. Additionally, many farmers showed great resistance to receiving the government enforced vaccines. This was particularly true for duck farmers who had never experienced outbreaks of the virus and felt that the vaccines were irrelevant and unnecessary as well as chicken farmers who, following the first round of vaccination, experienced a temporary reduction in egg output or had animals killed or injured because of the incorrect administration of vaccines and were wary to submit their livelihood to such losses again (Sims & Dung, 2009).

Poultry vaccination is by no means considered to be a primary strategy when combating avian influenza, but rather seen by many as one to complement the numerous other control methods already in use. Poultry vaccination, if used correctly, has the ability to greatly diminish the probability of human contraction of the disease by reducing the prevalence of the disease within poultry populations of high risk. However, there is still very little empirical data on the effectiveness of this method as part of a larger control strategy as there have been no control groups of non-vaccinated birds for comparison when poultry vaccination has been implemented and proved to be 'successful'. It is therefore necessary that further testing is done on behalf of national governments or international bodies in order to conduct a cost/benefit analysis of this expensive endeavor.

### ***Culling***

Since 2003, HPAI H5N1 has killed or led to the culling of over 400 million domestic poultry worldwide (FAO, 2012). The practice of culling has been implemented in most countries wherein the disease has been identified, in an attempt to prevent further

spread and infection. Current FAO guidelines stress the importance of the destruction of infected flocks, in a paper detailing the recommended approach strategies to controlling, preventing, and eliminating the virus, the organization states, “The standard first line of approach to HPAI involves detecting cases early, destroying any known infected flocks after introducing movement controls to prevent onward transmission, and tracing both forward and backward to identify dangerous contact premises” (FAO, 2011, p. 18). The preferred method of culling is asphyxiation via the use of carbon dioxide. This method is extremely effective for chickens but highly unreliable in ducks and geese. Physical methods are the methods of choice for waterfowl, primarily cervical dislocation using cattle castration forceps (FAO, 2004). Whichever methods are implemented, FAO guidelines reiterate that culling procedures must be carried out as humanely as possible. Countries may either choose to implement a mass culling campaign, or a ‘stamping out’ program, destroying all birds within the known infected farm, region, or in extreme cases, the entire country. The opposite of mass culling is selective culling in which only the infected birds are exterminated. Various countries have used both strategies, successfully and not successfully, in efforts to eliminate the spread of the virus.

The most successful case of a mass culling campaign to date is the efforts taken by the Chinese government following the initial outbreak of the virus in the Guangdong Province in 1996. While the government did not consider this outbreak a large enough threat to warrant the implementation of a country wide culling program, once the virus was discovered the following year in Hong Kong the Chinese government participated in a drastic effort to eliminate the disease. The city was able to completely eradicate the disease by culling all commercial chickens and shutting down the poultry market for

seven weeks. During the seven week period, all farms and markets were cleaned, disinfected, and given new equipment. The immediate actions taken by the Chinese government, including the culling of over 1.5 million commercial poultry, is what is believed to have eliminated the possibility of a widespread human pandemic (FAO, 2011). Stamping out programs have shown to be effective in most cases for the elimination of the H5N1 virus. Successful case studies include mass culling campaigns in Canada, the Netherlands, Mexico, Japan, Malaysia, and South Korea (Sims, 2013; FAO 2011).

While mass culling has shown in some cases to be extremely effective at completely eliminating the virus from the host country, there are many disadvantages to this practice, which influence governmental decisions. Widespread area culling is extremely costly for all parties involved: the economic effect of the 1997 culling of all commercial poultry in Hong Kong exceeded 22 billion dollars (Shim & Galani, 2009). This colossal cost is precisely the reason that many countries which initiate mass culling campaigns either stop halfway or are never implemented at all (FAO, 2011). Subsequently, any stamping out programs will not be successful in areas of high poultry density if there are weaknesses in disease reporting, tracing, and surveillance systems, which is true for most countries where H5N1 is endemic in poultry (Sims, 2013). These surveillance issues can include the failure of farmers to report disease when it occurs, the lack of a relationship between poultry owners and community animal health workers, a lack of clinical signs of disease in infected poultry, insufficient field and laboratory equipment used to detect disease, and complex market chains making tracing of the disease extremely difficult (Sim & Dung, 2009). Both Egypt and Vietnam attempted a

stamping out program which proved to be unsuccessful due to structural weaknesses in their surveillance systems made it impossible to find and destroy all infected poultry (FAO, 2011).

Additionally, in cases of wide area culling, governments run the risk of alienating local farmers if healthy birds are killed or if inadequate compensation or none at all is given (FAO, 2011). Because of this, in cases where area wide culling is enforced many farmers will resist by either moving or selling their remaining poultry instead of carrying out with the culling operations (Sims, 2013). The effectiveness of any stamping out program depends wholly on early detection and the farmers' willingness to comply with government requests (FAO, 2011). Furthermore, many question the morality surrounding animal welfare issues when widespread culling is done in a remote location or county with little to no veterinary expertise (Sims, 2013). Because of the extreme costs, multiple disadvantages, and the relatively low chances of nationwide eradication when all factors are taken into account, area wide culling is now only recommended as an option if the stamping out campaign has a high probability of eliminating the virus (FAO, 2011).

Limited culling has been successful in viral elimination in programs implemented in Thailand and China (Sims, 2013). The destruction of only clinically affected poultry and those located within epidemiologically linked locations is much less distressful on affected communities, lessens the risk of the disease spreading to neighboring areas via cross contamination in culling facilities, and is the method of choice when dealing with broiler farms where farmers are likely to quickly sell off their remaining birds to salvage their investment (FAO, 2011). Selective culling is currently the method of choice for

countries which have H5N1 pandemic within their poultry population. While mass culling proves to be more effective at controlling the spread of disease in the correct circumstances, selective culling is always more effective at reducing disease per chicken culled (which lessens the risk of farmer alienation as they feel their economic losses are warranted) (Shim & Galani, 2009).

Whether the program of choice is limited culling or area wide culling, both scenarios have severe impacts on infected countries. First, and probably the least publicized, are the impacts culling has on the transformation of the virus itself. Despite mass culling efforts since 1997, the H5N1 virus continues to re-emerge in the bird population, in part because of the detrimental effects of culling to long-term immunity. (Shim & Galani, 2009). The structure of the global poultry market only increases these effects. With the average commercial bird having a lifespan of two months and all commercial poultry having a near identical genetic makeup, by destroying all infected birds it effectively eliminates the possibility for the species to naturally evolve to create a resistance to the virus. Culling not only stunts evolutionary resistance but promotes a heightened virulence of the disease, as the virus now has less time to kill the bird before said bird is strategically destroyed (Shim & Galani, 2009). Thus, while culling has undeniable benefits, it comes with long-term consequences.

Culling, on any scale, has direct and indirect costs ranging from the country's GDP to the individual backyard farmer's livelihood. Before Thailand's initial outbreak in 2004, it was ranked fourth among the world's poultry exporters and produced approximately one billion chickens per year (Tiensin et al. 2004). With a human population of 62.2 million and between 60 and 80 percent of all rural households keeping

poultry, the Thai poultry market provided a large portion of income for many citizens (FAO, 2005b; FAO, 2005a). During the first week of the epidemic in January of 2004, there were a reported 149 outbreaks in 32 out of Thailand's 76 provinces. Immediately following the outbreak, all products, including feed, bedding, waste, and manure from infected flocks, were destroyed. Selective culling was chosen to be implemented and all infected birds were destroyed one to two days after the virus was confirmed, with confirmation taking two to eight days by the nearest capable laboratory. Concurrently, a restriction on the movement of poultry and all poultry products was implemented within a five-kilometer radius of any infected flock. If the poultry death in any particular farm due to the virus was greater than ten percent in a single day, all birds, products, and other potentially hazardous materials were destroyed (Tiensin et al. 2004). Because 90 percent of all poultry keepers in Thailand fall into the backyard poultry category, small-scale farmers were disproportionately affected by the disease outbreak. However, the Animal Epidemic Act of Thailand lists HPAI as a highly contagious disease and subsequently, the Thai Department of Livestock is required to compensate farmers at 75 percent of the birds' market value. The Thai government allocated a budget of 132.5 million US dollars to direct compensation to farmers. After the initial outbreak, 407,338 farmers were compensated for 60,634,000 birds (FAO, 2005b). Farmers received 100 percent compensation during phase one of the outbreak, January-May of 2004, and 75 percent compensation during phase two, July-December of 2004 (Tiensin et al. 2004). While the government of Thailand offers more adequate compensation than many countries with poultry endemic with the H5N1 virus, compensation could only cover so much of what became a drastic loss of economic activities.

Vietnam and Indonesia were much less fortunate due to their governments' inability to compensate farmers for culled poultry. Following the official recognition of the respective outbreaks in these two countries, the Indonesian government ordered the culling of all birds within a one kilometer radius and the Vietnamese government ordered the immediate culling of all birds within a three kilometer radius of the initial outbreak location (FAO, 2005a). These emergency measures were never wholly affective because in both cases birds were left on several farms and trade continued in all affected areas. In Vietnam, where 58 out of 64 provinces were affected, the outbreak resulted in the immediate culling of 17 percent, or 44 million, of the total poultry population. The national direct loss because of this was the equivalent of 200 million US dollars (FAO, 2005a). Pre-outbreak, poultry production was the main economic activity for approximately 68 percent of all male led households. As a result of the outbreak, the average losses for the typical small-scale farmer were the economic equivalent of 2.3 months of work, and as such, many farms had to switch to other economic activities, mainly pig and rice production, in order to compensate for these losses (FAO, 2005a). Although small-scale farms made up 57 percent of all the farms which were forced to cull, they received no compensation at all. Economic compensation was disproportionately given out to large-scale producers (FAO, 2005). Large farms received compensation comparable to 18 percent of the market value of each bird killed. The Vietnamese government, along with the State Bank of Vietnam, did decide on special conditions for loans in order to bolster economic activity by recently affected farms. Short-term loans were to be rescheduled to 12 months and long term loans to be extended by a period comparable to half of their term. The amount of loans accessible without

collateral increased dramatically as well. Again, however, these loans were disproportionately given out to large-scale farms with backyard farmers being repeatedly ignored (FAO, 2005a). Indonesia's poultry economy was devastated by the outbreak and subsequent culling as well. With two million birds having died as a result of the virus or from culling after the first immediate outbreak, the total direct loss to Indonesia was approximately 170 million US dollars. After adding indirect losses to farmers and all parties involved, the total estimated losses near 387 million US dollars (FAO, 2005a). Compensation was given to smallholder farms under a set of strict guidelines regarding who was eligible but even then farmers received only ten to twenty percent of the market value of each bird (FAO, 2005a). Additionally, the dramatic drop in poultry prices on the market made this economic downfall hit all producers, regardless of whether or not their particular birds were affected.

Furthermore, not only does the culling of poultry create economic losses due to an initial loss of poultry sales, but the period of time directly following culling in which the farmers are unable to resume production create large indirect losses as well. Current FAO Guiding Principles state that the restocking of farms should not take place until a minimum of three weeks has passed since the destruction of all poultry and poultry related materials (FAO, 2005a). In Indonesia, it took commercial farms an average of one to three months to restock their facilities post culling procedures, and a shocking 42 percent of commercial farms without ties to larger farms did not restock at all, because they were not able to recover economically from the losses suffered. Approximately 59 percent of broiler farms and 92 percent of layer farms were forced to draw on their savings, expand and create different areas of trade, and in some cases sell assets in order

to stay afloat (FAO, 2005a). In Vietnam, much like Indonesia, the majority of farms were restocked between one and three months. For small scale production facilities in both countries the restocking process is much more time consuming as it relies on the eggs produced by remaining hens rather than through the acquisition of day old chicks due to monetary constraints (FAO, 2005a). Both Indonesian and Vietnamese small scale farmers were extremely affected by these economic losses.

The undeniable benefits associated with culling, the primary being the prevention of a widespread pandemic, are far too great to consider halting this preventative method altogether. As detailed above, culling has directly prevented an outbreak from becoming a widespread pandemic in at least once instance (Hong Kong) and has been highly successful in multiple other instances in containing the disease. As such, it is almost guaranteed that in the event of any and all future outbreaks national governments will implement culling on some scale. However, there are several aspects to this necessary evil which must be addressed in order to help alleviate the burden culling creates. The main problem with the destruction of all infected materials is the economic impact on the individual farmer. While culling affects all farms regardless of size, it has proven to be disproportionately detrimental to small-holder farms which have no ties to large agribusiness entities. Because of this, it is prudent that national governments guarantee some form of compensation or incentives to farms before any culling procedures take place. This will both ensure that poultry production will return to normal levels after the outbreak takes place as well as promote farmer cooperation. If farmers believe that culling campaigns are pointless or will rob them of their livelihoods they will not comply and in many cases sell off their remaining birds or move them. Farmer noncompliance

almost always guarantees failure and so governments must show that the decision to cull is not one taken lightly.

### *Conclusion*

The technical responses which have been implemented in the face of widespread pandemics have been a necessary component in keeping avian influenza at bay and will continue to be valuable strategies in further attempts to eradicate the virus. Vaccination, in both humans and poultry, and culling are not only some of the first actions taken in response to an outbreak but are instrumental in containing and limiting the spread of the disease should an outbreak occur. While implementations of these responses are unquestionably crucial they are currently insufficient and need a drastic change in procedural protocol. As discussed, experts agree that it is not a question of if but rather when a large scale pandemic will occur, and when it does, with the implementation of current technical response practices those in the most need will be the least taken care of. Whether it is those most vulnerable to infection not receiving vaccines or individual farmers incurring a complete loss of their livelihoods the protocol surrounding technical responses are not currently tailored to those who need them most. It is urgent that reforms are made which benefit the most vulnerable populations and those who will undoubtedly receive the brunt of the virus's ill effects. Along with our specific recommendations it is undeniably crucial that organizations in positions of power work to give those countries most affected by the disease the ability to fully equip themselves with the tools needed in order to eliminate the virus. As detailed throughout the chapter these tools include internal vaccine development strategies, vaccination sample sharing incentives, the ability to compensate farmers for economic losses, knowledge

surrounding the development and effectiveness of both human and poultry vaccination, and international support.

## Policy Recommendations

- **Promote in-country vaccine production:** Lobby for funding from organizations like the WHO to be used to set up infrastructure in country to create cheaper vaccination options that will allow the country needing the vaccines control over vaccination.
- **Equal vaccine distribution:** Lobby for a clause providing a reasonable number of samples of vaccines developed by other nations to be sent as payment to the country of samples' origin, in clear, direct legislation from the WHO. This provision of samples to those in need should be the cost of receiving free viral samples from WHO. (This also allows rich countries to maintain their own stockpiles as long as they provide a certain percentage of the total number of vaccines produced to an emergency stockpile for those in immediate need).
- **Promote provisions for a fairer global stockpile:** All countries must contribute funding to a stockpile of medication if they wish to be involved, based on what they can afford (contributions can take the form of viral data, vaccinations themselves or funding). Production of the stockpile should be monitored by WHO or another intergovernmental organization (to provide funding and structure for accurate trials of vaccines and health standards which are usually lacking where vaccine production is based only in private organizations). The WHO or other body should work with private companies to use the infrastructure they've already established.
- **Stockpiling:** Advocate for TRIPS clause for emergency patent override means that the WHO stockpile can/should begin to produce this stockpile without worrying about patents. Incentives should be provided for countries producing vaccines for an emergency situation and allowing patent overrides in their country.
- **Funding incentives:** Vaccines produced for emergency use should take advantage of new technology for effectiveness and quick production. Vaccines should use antigen-sparing techniques. Modern retroactive vaccinology, recombinant vaccines and bacteria-based antigens should be perfected for avian influenza. Egg-based virus-growing methods should be used only as a backup method. Funding incentives should be given to companies that experiment with these new, more efficient technologies from organizations like the WHO.
- **Broad based vaccines:** Advocate for broad-based flu vaccines that are administered regularly should be advocated for (where knowledge of specific pandemic strain is unavailable). Broad-spectrum, multi-strain influenza antigens should be included in regular vaccinations for people in nations at high risk of avian influenza infection (Southeast Asia).

- **Restocking as compensation:** Ensure guaranteed compensation, in the form of restocking, to farmers by national governments before any emergency culling procedures take place. Restocking, as per FAO guidelines, should take place between three and four weeks after the destruction of all infected materials. National governments should fund the restocking process with taxation revenues from large commercial farms, as discussed in chapter seven.

## CHAPTER 5

## They're No Yolk: Health Response Programs for H5N1

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**Abstract:** *The following chapter provides an analysis of how mitigation and prevention responses to the pandemic threat of H5N1 have unfolded within the national contexts of Thailand, Viet Nam, and Indonesia. This analysis first introduces the importance of cultural sensitivity in enacting any type of global prevention program. Acknowledging the necessity of local involvement and participation in disease surveillance and national health systems, this analysis then highlights the current gaps in national health programming that prevents systematic sustainability in the long-term. We argue that these gaps, maintained and exacerbated by the responses of international health agencies, highlight the importance and value of mitigation capital within the context of H5N1 prevention. We define mitigation capital as the resources, funding, expertise, programming, and global recognition utilized in combating the risk of H5N1 in a variety of contexts. Using the situational examples of the three countries, we demonstrate how mitigation capital controls the discourse and interactions between organizations on global, national, and local scales.*

**Keywords:** *local context, regional sensitivity, mitigation capital, international health agencies, national health systems, international aid, H5N1, pandemic, poultry, influenza*

### *Introducing the Role of National and International Health Agencies*

This chapter analyzes the outcomes of how mitigation responses to H5N1 have unfolded at the local scale within Thailand, Vietnam and Indonesia. These responses often stem from international health agency involvement through the use of academic and health expertise, designing and implementing response programs, and the allocation of funds. We define these responses as forms of mitigation capital, or resources utilized by actors and agencies around the world. The initial and standard responses of mitigation capital are reconstructed and newly shaped by the interactions between global, national and local scales. Not only does the important component of cultural sensitivity get lost within these transactions between scales, the consequence of not addressing the local context actually impedes overall H5N1 mitigation and eradication efforts. In this context the ‘traffic between scales’ refers to the activities, transactions, discussions, and engagements between all actors, health agency networks, and their initiatives. This traffic is important as it influences policy and produces both actions and results. Cultural sensitivity needs to be consciously incorporated through local discourses to more appropriately address current H5N1 mitigation interventions and to effectively reconstruct new efforts aimed at eradication. We define local and cultural sensitivity as active acknowledgement and encouragement of national, regional, and local health actors in combating H5N1. This involvement may take many forms, from programming of national surveillance systems to combating the risk of outbreak to the inclusion of backyard farmers in educating local populations about the risk of H5N1. With such acknowledgement also comes the continual reassessment of international aid and

international health agencies' role in promoting certain types of programming within specific national contexts.

Looking to the future, there is ample room and opportunity to create sustainable health networks led by national and local health initiatives. Historically, the involvement of international health agencies, while directed to provide for the greatest good, has not necessarily provided efficient funding or expertise within specific national contexts. As we work towards controlling H5N1, we argue that national health systems should work to maximize international health support within specific national and local contexts. We demonstrate this argument by defining attributes of current national health systems, and identifying the gaps we find. We conclude that there is room for continued partnership with international agencies, but within a new framework that rethinks the partnership between scales. A continual collaborative relationship between all actors and agencies involved will be essential in attaining the greatest chance of success in quelling the pandemic risk of H5N1 within an increasingly globalized world.

The following outline provides a clear framework, defined scales and regional case studies to present a thorough analysis of how various types of health responses have played out within Thailand, Vietnam and Indonesia. The first subsection of this chapter, *Products of International Health Agencies*, will further explore the characteristics and forms that mitigation capital takes and identify the main global agencies involved in Avian Influenza interventions. This begins the discussion on the influence international health agencies have over health response programs. Next, the regional context currently shaping national programs is introduced to provide a foundational understanding for three case studies. Thailand provides an example of mitigation capital's influence in providing

medical and structural expertise to developing nations. Such a relationship between international health agencies, foreign aid, and national health systems is currently imbalanced by the tremendous influence that mitigation capital holds. This section is rooted in an analysis of national health programs within the Thai context, juxtaposed with examples of international academic/expertise intervention in the context of H5N1 prevention. Vietnam provides an example of how the outcomes of mitigation capital in international/national health response programs affected the lack of knowledge, behaviors and compliance from small backyard farmers in H5N1 mitigation efforts. This section will first examine how the international and national partnership on H5N1 response programs had little consideration for local organizations and key stakeholders in their implementation process. The following section will then discuss the local-scale gaps in these respective programs by looking at the marginalization of farmers as well as the women farmers' narrative in H5N1 prevention. In the context of the Indonesian case study, mitigation capital takes the form of funding and resources as forms of capital that play huge roles in action and outcome. Equitable resource allocation in Indonesia is challenged by the decentralized political climate that weighs on the archipelago. Though many national disease surveillance systems have become highly developed since initial H5N1 outbreaks, resource allocation between Indonesian districts and municipalities is highly inequitable. The geography and political climate heavily contribute to the current decentralized state of Indonesia's national health system, making preparation for H5N1 outbreaks between districts extremely varied. If considered, local and cultural sensitivities can provide knowledge about which areas and populations exhibit the

highest demand for resources. Thus, we argue control interventions can better address Indonesia's inequitable resource distribution.

We believe that the issue of incorporating local and cultural sensitivity into mitigation efforts is vital to La Via Campesina (LVC). In order to defend small-scale agriculture and promote social justice and dignity, the opinions and livelihoods of the people and communities of Thailand, Vietnam, and Indonesia must be taken into account. Understanding how farmers and the larger population experience H5N1 outbreaks and responses is crucial to reconfiguring and improving control and prevention efforts. As LVC defines its vitality and legitimacy through the existence of organizations on local and national scales, the issue of cultural sensitivity is key in determining the role of international agencies in long-term systemic solutions.

### ***The Products of International Health Agencies***

There are a great number of international agencies involved in the control of H5N1 Avian Influenza (AI) in Southeast Asia. The World Health Organization (WHO), the Food and Agriculture Organization of the United Nations (FAO), the World Organization for Animal Health (OIE), the Association of Southeast Asian Nations (ASEAN), the World Bank, the U.S. Agency for International Development (USAID), the US Centers for Disease Control and Prevention (CDC), and the United Nations System Influenza Coordination (UNSIC) have all contributed to Southeast Asian H5N1 response programs in a variety of ways (See Appendix for more information on these organizations and their programs and guidelines related to H5N1). Because large international actors have the authority, capability, and funds to address the threat of H5N1 on a global and regional scale, they produce what we have termed 'mitigation

capital,' aimed at the realization of this goal. Mitigation capital is the money, personnel, research, guidelines, and programs that arrive at the national level to tackle the AI menace within each country. Recognizing the interactions between international health agencies and national health response programs, we will specifically address the provision of three different types of mitigation capital in our case studies: sanctioned health and academic expertise in Thailand, response program guidelines in Vietnam, and funds in Indonesia.

Large international organizations are able to provide mitigation capital to countries in the form of sanctioned health and academic expertise because they possess the necessary funds and trained personnel to produce high-quality research, to design and direct response programs, and to practice skilled health care. This was exemplified in the WHO document titled *Clinical management of human infection with avian influenza A (H5N1) virus*, released in 2007 to replace the *WHO interim guidelines on clinical management of humans infected by influenza A(H5N1)*. The report explains the importance of creating standardized care steps, outlines which treatments, or “modalities” should be used and which should be avoided, and elaborates on seven different considerations of “case management” (WHO, 2007a).<sup>1</sup> In addition, the WHO published a protocol titled *Collecting, preserving and shipping specimens for the diagnosis of avian influenza A(H5N1) virus infection* which describes procedures for everything from safety during sample collection to how to ship the specimens (2006).

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<sup>1</sup> The seven considerations of “Case management”: “1. Diagnosis,” “2. Site of care,” “3. Antiviral Treatment,” “4. Other pharmacological interventions,” “5. Supportive therapy for critically ill patients,” “6. Special considerations,” and “7. Infection control considerations/ Isolation facilities” (WHO, 2007).

Response program guidelines, another form of mitigation capital, are also often provided by international organizations for use at the national level. One example is the FAO's 2011 report titled *Approaches to controlling, preventing and eliminating H5N1 Highly Pathogenic Avian Influenza in endemic countries*. This text discusses the useful control measures of "Stamping out," "Vaccination" (of poultry), "Monitoring and surveillance," and even "Understanding and modifying the poultry sector" (2011a, 18). Such recommendations are intended to be incorporated into countries' existing measures for improvement.

Lastly, funds are a major component of mitigation capital often provided by large international agencies for use by national governments and other actors at the national and local level. The United States government claims to give the most money to Indonesia's struggle against HPAI H5N1, and as of February 2013 USAID stated they had "provided \$120 million to support Avian and Pandemic Influenza (API) control and prevention in Indonesia" (USAID, 2013). USAID works with and provides financial resources to the Indonesian government through a variety of channels. One important program that receives financial support from USAID is the Participatory Disease Surveillance and Response (PDSR) system, "which provides district level veterinarians with skills to rapidly detection [sic] and respond to AI outbreaks" (USAID, 2013). This surveillance program is run by the Indonesian Government with assistance from the FAO.

Although international agencies such as the WHO, FAO, and USAID are in the position to provide mitigation capital to national governments and programs, inefficiencies can arise between the provision at the global scale and implementation at

the local scale. Consequently, once target populations are reached, local interests may cease to be addressed. We will explore this problem of local and cultural suitability in the following case studies looking at the national H5N1 response programs in Thailand, Vietnam and Indonesia.

### ***Introducing National Programs and Regional Context***

Disease surveillance programs are an integral part of any preventative health system. Within the H5N1 HPAI context, surveillance programs are used mainly as a method of early detection and quarantine within poultry populations. Current surveillance methods are led by national and international actors, but are reliant on the input and support of local communities and farmers. The following analyses will provide an overview of current national health surveillance systems within Thailand, Vietnam, and Indonesia on a local and regional level.

Prior to the recognized H5N1 outbreak in Southeast Asia, national surveillance systems were largely undefined in terms of scope and application. Surveillance measures were in the form of passive programming, collecting data on outbreaks, and infections from existing records post-event rather than actively engaging individual health workers and local populations in creating a more active and sustainable surveillance structure. Such passive surveillance measures lacked direct engagement with local communities and farmers and also lacked productive engagement with large industrial production facilities. As limited surveillance lead to the underreporting of disease, the 2004 outbreak highlighted the need for defined, structured, and readily applied reporting structures (Sims, Domenech, Benigno). Without a proper understanding of the disease's scope and impact, it is impossible to forge an effective response and long-term solution. Initially,

such efforts were enacted by national governments and agencies with the support of international actors. We suggest a more targeted approach in engaging these structures on a regional and local level to ensure the longevity and viability of long-term surveillance programs.

The following analysis provides such an approach in engaging national programs on a contextual local level. To respect regional differences, this analysis is conducted on a country-by-country basis. First, we analyze Thailand's national health response programs on a structural level. Then, we provide local feedback on how these programs work and the gaps that they do not provide for. We will then conduct similar analyses for Viet Nam and Indonesia. Ultimately, we seek to highlight national programming while understanding local and regional involvement and feedback. Such an approach differs from the typical top-down programming of international agencies.

### ***National Programs and Regional Context: Thailand***

The standardized response programs and approaches enacted by international health agencies to control H5N1, while viable from an aggregate point of view, are insufficient within the Thai context to combat outbreak in the long-term. While foreign aid has sought to create structures that involve local authorities and populations, we should be critical of the role that continual foreign aid plays in deciding health policies on a national level within Thailand.

Similar to the situation elsewhere in Southeast Asia, the initial outbreak of H5N1 in Thailand was met with initial widespread culling and removal of infected poultry populations. Surveillance measures within Thailand have since been formed largely

through the Thai Department of Livestock Development (DLD) and the Ministry of Public Health (MOPH). Since 2004, there has been particular renewed focus on the “X-Ray” surveying initiative and amendments to the Animal Epidemic Act.

The Ministry of Public Health (MOPH) leads the charge on setting national health policy and oversees much of the facilities involved in the country’s universal healthcare system. The Thai Department of Livestock Development (DLD) acts as a national agency with the capability to reach local populations on the village level. Following the 2004 outbreak and initial culling effort, the DLD, in cooperation with other national agencies like the Ministries of Agriculture and Public Health, assumed a “stamp out” approach to combating the H5N1 strain. Other national entities involved in program-setting agenda include the Health System Research Institute (HSRI), the Thai Health Promotion Foundation (“ThaiHealth”), the National Health Commission Office (NHCO), and the Emergency Medical Institute of Thailand (EMIT).

This approach, compared to a response-based initiative, focuses on a nationwide surveillance program. Dubbed “x-ray surveys,” the program created a system by which national agencies would enter a local village and collect swabbed samples from random flocks of poultry. National agencies including the Ministry of Agriculture and Cooperatives and the Ministry of Public Health worked with provincial governors, volunteer public health workers and livestock workers. Though this appeared to be an attempt to engage the local community in surveillance measures, some analysts suggest that this system acted as more of a manipulation of mitigation capital imposition of national agencies (with international funding) on local populations. One article noted that, “Through [this] surveillance program, farmers were also persuaded to report sick or

dead poultry in their flocks to authorities” (“Avian Influenza,” 1669). Whether farmers willingly participated in this program is unclear. In effect, such a program – while feasible on a macro level in developing a surveillance program to screen for pathogenic H5N1 – did little to promote local engagement of farmers and consumers in the long run. Rather, this “x-ray” campaign to screen backyard poultry production allowed national agencies with international funding to intervene in daily social and economic processes of Thai citizens.

While seemingly disregarding regional sensitivities, this program also highlighted the problem of contingency-based foreign aid. Another report released from Chulalongkorn University in Bangkok analyzed this study as a form of active surveillance that allowed national health authorities to better understand the risk posed by the poultry economy. Though poultry farming is especially important to backyard farmers who operate on a small scale, the role of larger industrial-level poultry facilities (often with international corporate ties) within Thailand is often overlooked. A Thai-authored report takes care to note that all samples were “from backyard animals or local meat birds” and that no samples were taken from “birds with standard farming systems with high biosecurity.” The promulgated concept of biosecure facilities as a safer means of production is a falsity supported by agribusiness entities with foreign stakes and influence (“Live Bird Markets”). The report later concludes that most diseased animals in the markets came from backyard farms, despite acknowledged sample bias in only inspecting non-biosecure carcasses. Therefore, this report implies that H5N1 HPAI derives from backyard poultry farming production without the biosecure qualities of large agricultural production facilities.

The Animal Epidemic Act is another way in which national health organizations sought to improve standing structures following the outbreak of 2004. In this act, the Thai national government moved forward in classifying not only which types of animals were to be watched, but also took steps towards breaking down and classifying the economic process of handling animal goods within a standardized context (“Animal Epidemics”). On a national level, this act in its amended form proved to be a tremendous step forward, outlining the correct processes from reporting a potentially diseased animal to guidelines for the removal of diseased animals or carcasses. There is special care to note the power of regional authorities to proclaim an epidemic, and for the need to collaboratively work with local veterinarians in assessing a potential risk hazard.

Despite legislative efforts to promote lasting change within Thai health structures, much of the current academic literature focused on H5N1 within Thailand is authored by Western experts and agencies. Therefore, not only is health system funding within Thailand at risk, but also the discussion and feedback surrounding such funding. For example, Thailand’s recent clinical trial to test an H5N1 influenza vaccine was labeled a “result of international collaboration with health agencies around the world,” including the U.S. Department of Health and Human Services’ BARDA division (“H5N1 Avian Flu”). In such a case, intellectual agency is assumed by U.S. donors in taking control of the project from Thai authorities. This pattern of behavior undermines the Thai national health system and prevents sustainable growth apart from international aid. For both donors and recipients alike, this pattern is unacceptable in achieving greater standards of global health.

Another publication, Thailand's "Country Cooperation Strategy" pamphlet authored by the WHO, goes further in propagandizing the country (with international funding) as a harbinger of faith against the struggle of H5N1 ("Country Cooperation"). Lauding Thailand's "long, successful history of health development," the report lists the country as an "emerging development partner and active participant in a number of international initiatives" ("Country Cooperation"). The report stresses that Thailand collaborates with a "number of development partners" to "strengthen national capacity in the health sector and to facilitate its international engagements" ("Country Cooperation"). A comprehensive list of such development partners mentions at least thirty western health organizations or non-profits, including a slew of United Nations agencies as well as "a few bilateral donors (EU)" ("Country Cooperation"). The few Thai agencies that are recognized are those that derive some measure of support from foreign aid. Such a pamphlet, taken as a means of information and of intellectual jurisdiction, is yet another example of how foreign entities assume agency over health concerns presenting pandemic risk like H5N1.

Ultimately, these programs and partnerships involving the Thai national government illustrate the complex nature of funding and systems development in a globalizing world. Though many of these systems are successful in establishing better methods of standardizing responses and preparations to pathogenic threats, there is still the untapped resource of local understandings and initiatives that could provide a more sustainable future for Thailand's health system.

***National Programs and Regional Context: Vietnam***

Though faced with a similar situation as Thailand, Vietnam as a state faces different challenges in establishing a sustainable national disease surveillance system. Initial disease information and surveillance systems were enacted in the 1960s, but remained largely stagnant and passive in terms of surveillance programming. The 2003-2004 outbreak of H5N1 HPAI therefore led to a more structural response system, based on local farmers, poultry sellers, and health workers, as well as district veterinary stations.

Vietnamese surveillance and response efforts to the outbreak of H5N1 were largely passive due to the high cost of establishing active surveillance systems. The initial response to the 2004 outbreak included the widespread culling of poultry, destroying 44 million birds (Minh, 22). Such efforts suggest that the Vietnamese government was initially focused on controlling, rather than eliminating, the disease. Beyond culling, initial control efforts also included movement management (controlling the transportation of wild waterfowl and poultry) and vaccination against the strain. These passive surveillance efforts provided a solid foundation for more active measures to be installed by international governments and agencies.

Vietnamese surveillance structures are built under the framework of the Department of Animal Health, which coordinates national disease control policies, and Regional Animal Health Offices, which manage programs within their given regions. While animal census data (taken once per year with the annual census) is compiled on the provincial level, specific outbreak data begins its collection process on the individual level. The focus of Vietnamese surveillance structures is based in a system of monitoring viruses through the collection of poultry samples at hundreds of live bird markets. One

statement suggested that such efforts will “improve biosecurity in poultry production,” though it is unclear whether industrial production facilities are also included in these surveillance efforts.

Based on the structure of the FAO-provided Transboundary Animal Disease Information System, surveillance data on H5N1 outbreak is collected on the village level. Typically, outbreak data is recorded through a reporting system: first, to the village Animal Health Worker, who then reports to the District Veterinary Station (DVS). The DVS is responsible for alerting the respective national agencies and for conducting an initial investigation into the outbreak sample. Recent international funding has expanded the capabilities of Vietnamese laboratories, which are now capable of testing poultry samples for the H5N1 strain. In general, such new funding from the USAID and FAO is expected to help the Ministry of Agriculture and Rural Development’s Departments of Animal Health and Livestock Production to “develop and apply policies and legislation to improve bird flu and other animal disease control nationwide” (US Embassy, 2013).

Since 2004, Vietnam has served as a model country for other H5N1 endemic countries by their international collaborators in its efforts to control H5N1 from becoming a possible human pandemic, and their willingness to cooperate with foreign donors. The close relationship between the two led foreign donors to become deeply involved in all steps in H5N1 policy process. This includes agenda setting, strategy formulation, implementation and policy evaluation, as well as assistance in short term and long term reforms (by funding and technical support) (Scoones, 2010, 108). In relation to foreign collaboration, the Government of Vietnam particularly had relationships with the Food and Agriculture Organization of the United Nations (FAO),

the World Organization for Animal Health (OIE), the World Health Organization (WHO), and the Minister of Agriculture and Rural Development (MARD). For the past decade, the two key national emergency response coordination of H5N1 have been, The National Committee for Avian Influenza Disease Control and Prevention (NSCAI) and The National Steering Committee for Human Influenza Pandemic Prevention and Control (NSCHP). In 2004, NSCAI was established by Vietnam's prime minister, Phan Van Khai, and chaired by the MARD Minister, with vice ministers of both MARD and MoH appointed as vice chairs (Payne & Do, 2013). The NSCHP evolved from an earlier committee establishment to respond to the SARS scare, chaired by MoH ministers and other members from related sectors.

With the two committees working closely together and with international donors, response programs such as the Vietnam's National Integrated Operational Programme for Avian and Human Influenza 2006-2010 (OPI), The Partnership Framework for the Partnership on Avian and Human Pandemic Influenza (PAHI) and the Vietnam Integrated National Operational Program on Avian Influenza, Pandemic Preparedness and Emerging Infectious Diseases (AIPED) were established to further prepare for H5N1 and emerging infectious diseases. As a form of mitigation capital, these health response programs illustrate the absence of cultural and regional sensitivity significant to H5N1 prevention efforts and crucial to curtailing the disease in Vietnam. For this reason, this section will consider the culture gaps in international and national policy decision-making and incorporate the farmer and gender perspectives to support this argument.

In the 2013 PAHI report on *Enhancing Coordination on Emerging Infectious Diseases in Vietnam*, governmental and international response programs were advised to

work together to address the national avian influenza pandemic and emerging infectious diseases (EID) coordination in Vietnam. The report consisted of interviews taken from the Support to Knowledge Management and Policy Dialogue through the Partnership on Avian and Pandemic Influenza (KMP-API) that was partially funded by USAID and the United Nations Development Program (Payne & Do, 2013). International and national stakeholders interviewed from the report insisted that “effective ongoing coordination on surveillance, preparedness and long term disease prevention is more challenging for Vietnam than actual emergency response activities once a threat is identified” (Payne & Do, 2013). Despite lower reported occurrences of human and poultry infections since the first epidemic wave, sporadic poultry and human outbreaks have continued to persist. Many national and international interviewees of the API coordination also suggested that “sub-committees or a separate national community on human and animal health disease led by MoH and MARD respectively, would be required” (Payne & Do, 2013). For example, giving more focus on zoonotic emerging diseases and non-zoonotic diseases in humans and animals. Another proposal from the support recognized that further attention and inclusion could be given to the participation of “relevant parts of ministries that are currently not included” (Payne & Do, 2013). In particular, collaboration could include the serious non-health impacts of pandemics, such as the impact of wildlife and university curricula (particularly the Ministry of Education and Training (MOET)). In addition to include various health sectors, the PAHI report recognizes that the international coordination has focused too much on technical mechanisms:

[However], some stakeholders noted that, in practice, the NSCAI and NSCHP have tended to focus on monitoring of the immediate situation and emergency response activities, rather than long-term strategic efforts including cross-sectoral

coordination of difficult and costly prevention and eradication activities, as well as wider preparedness (Payne & Do, 2013).

Since the H5N1 epidemic, the national and international response has been reliant on short-term emergency response. Therefore, shifting towards a longer-term goal may better increase cooperation and success in mitigating the disease for the future.

In Ian Scoones, *“Avian Influenza: Science, Policy and Politics”* Vu also identified the same problem:

The technical narrative focused on issues such as risk evaluation, disease prevention, control strategies, vaccine tests, disaster planning and the restructuring of livestock production to meet biosecurity requirements. Topics such as poultry trade, poultry production and farmers’ beliefs and risk perceptions appeared only occasionally in the narrative. The epidemic was treated as a technical problem, not as a power struggle, a political challenge, a measure of national greatness or a change to speak up for poorer people (2010).

Participants of the technical narrative are experts and researchers from various fields, such as animal health, epidemiology, human health, communication and agronomy.

However, it appears from past policy decision-makings and response programs that it was the animal health experts who dominated the technical narratives. This was partly due to the weaker role of WHO-MoH compared to FAO-MARD and for Vietnam’s decision for implementing a vaccination campaign, which grabbed the most attention and resources, minimizing other issues (Scoones, 2010). Another crucial aspect to the technical narrative is the poor collaboration between the foreign donors, the Government of Vietnam, and the stakeholders of avian influenza. Farmers, businesses, and ordinary consumers were hardly invited to meetings and workshops that were hosted by the Government of Vietnam and international donors. Although the representatives from the Women’s Union and Farmer’s Union were invited they often “thought and behaved like bureaucrats”

(Scoones, 2010). This further indicates that multispectral collaboration—especially a community-based collaboration—is needed to represent all parties that are directly affected by H5N1 virus.

As mentioned briefly above, there also seemed to be different levels of collaboration between the international key players and the Government of Vietnam. The World Bank who donated large funds and investments to Vietnam, and the FAO were the main contributors to the AI control policies. They were also closer to MARD and the NSCAI, whereas WHO although, participated in the Red Book, Green Book and the National Strategy on Preventative Medicine to 2010, did not have as close of a relationship with the Vietnamese government (Scoones, 2010). Strengthening the coordination between national organizations thus, is also an important factor in H5N1 mitigation efforts.

Furthermore, the consequences of effective national and international response programs toward avian influenza also lie in the policymaking and political system of Vietnam. First, the fragmentation of the government structure from central to local levels is unequal and ineffective (Scoones, 2010, 99). Vu explained, “Central policy has become a channel to distribute patronage and provincial governments have emerged as major players in politics” (Scoones, 2010, 99). Therefore, the decentralization system of the Vietnamese government leads to a greater gap between the local and central policies and how policy intention and policy results will actually turn out. For example, competition for power and resources can be controversial when implementing international foreign aid or investment. In the case for avian influenza, the problem “suggests an overall lack of policy effectiveness and a high rate of leakage as funds travel down administrative

levels” (Scoones, 2010, 99). The second characteristic is the marginalization of farmers in the Vietnamese political system. Due to farmers making up approximately 70 percent of the Vietnamese population, the disregard for farmers’ wellbeing suggests that there are “wide gaps between policy statements” and avian influenza. This leads to lack of compliance from farmers unless they are pressured to do otherwise (Scoones, 2010, 99). In short, during the avian influenza pandemic central officials and international donors held the power in policy decision-making whereas local governments played the important roles of implementing the central policies (but did not have a say) in the procedure. At a more local level, smallholder farmers had little role in the policy plans and sought to not comply with central policies and “avoided their interventions if they could” (Scoones, 2010, 125).

### ***Marginalization of Farmers***

The particular marginalization of farmers and the undermining of their existence in national and international response programs at the local level calls for structuring a stronger relationship to consider the cultural context in response programs. In addition to poor knowledge and lack of avian influenza awareness, the absence of the local and ordinary citizen’s perspectives in government policy making resulted in urban residents continuing to eat poultry blood pudding, as well as attempting to hide their pet birds from culling teams. In some cases, traders were also involved in bribing the police to sneak in unvaccinated poultry into the big cities while some farmers were reported to even throw out half unused vaccination doses (Scoones, 2010 117). As a consequence, the act of noncompliance from the farmers and consumers has most likely (indirectly) allowed the virus to spread. Although the local and cultural perspectives were rarely included in

mainstream media, it wasn't completely shunned from researchers' work (funded by international donors) to include the underrepresented groups. In 2008 during the conference on international AI research in Hanoi, there were presentations on poultry farmers' and traders' knowledge, risk perception and farming practices and behavior towards H5N1 threat. However, the extent in which this translates into policies is limited (Scoones, 2010, 117).

The mistrust and resistance from farmers is illustrated by a 2008 USAID funded survey on duck farmers. The survey revealed that farmers and veterinary officials in Vietnam lacked communication with one another and only communicated when ducks were in need of vaccination. In addition to the poor relationship, there was also a lack of mutual understanding between farmers and veterinary officials. Farmers often did not immediately report the death of ducks, and only did so when the deaths occurred in large groups (Scoones, 2010, 117). One farmer from the survey reported:

I don't want to pay for veterinarians as they do not have real experience like me. There is no need to inform anyone." Another said: "If the authorities compensate, I will inform them. Otherwise, I will throw into the river or bury them... why should I tell anyone? To let them laugh at me? (2010).

Farmers and ordinary citizens' defiance toward national health response programs, such as vaccination has also been unsuccessful. For example, farmers refused to vaccinate their poultry in many places because they did not want their birds to be touched since birds' layers often "became stressed after vaccination and because they did not trust government officials" (Scoones, 2010, 117). The distrust and suspicious attitudes from farmers reveal that national programs (with guidance from foreign agencies) are not as effective at the local level and more gaps need to be filled in order to provide efficient

outbreak prevention. One possibility is for the national and local governments to provide better educational programs and information that can be easily understood by local farmers.

In a 2008 European Commission gender study report, a Vietnamese farmer that was interviewed had suggested the desire for district and commune authorities to send their staffs to each farm or village to give guidance to poultry raisers, as well as a more strengthened communication campaign, so that every person can understand AI better and would be encouraged to report as early as possible (Velasco, Dieleman, Supakankunti & Phuong, 2008). More specifically:

Farmers thought that the government should implement a more in depth communication campaign, which is easy to understand, and government should enforce regulations if poultry raisers do not follow guidelines. Further they should encourage the farmers to detect and report as early as possible to the local authorities if they detect abnormal levels of sick or dead birds. More-over, they suggest that animal health staff should carry out disinfection campaigns more frequently, both at farms and in the village as a whole, and further to provide vaccine on a month basis, because bird cycles are short. Government should inform as soon as possible about outbreaks in nearby villages (Velasco, Dieleman, Supakankunti & Phuong, 2008).

Policies involving AI control and prevention were not properly explained to ordinary Vietnamese citizens and farmers. “Government officials often did not go into specifics in their public comments or writings. Most reporters did not have sufficient technical training to ask technical questions or to explain scientific issues to readers” (Scoones, 2010, 110). For future implementation process, the media and educational campaigns should seriously consider presenting straightforward information to farmers and villagers who may not understand technical or scientific data.

### ***Women’s Perspective***

According to the 2008 European Commission (EC) gender study report, Vietnamese women are deeply involved in small poultry production, poultry marketing, and have an active role in “management, feeding watering, disease detection, purchase of feed supplements and veterinary care” (Velasco, Dieleman, Supakankunti & Phuong, 2008). Yet, incorporating the women’s narrative in AI policies, response programs and trainings have been finite. As an underrepresented group, central and local officials and international agencies should adopt the consideration for women farmers into these programs in order to increase their knowledge and behaviors of H5N1. Since men are traditionally considered the head of the household and are the majority of animal health employees, they are typically invited to poultry production and management training courses for AI prevention and control (Velasco, Dieleman, Supakankunti & Phuong, 2008). As the EC reported, men who attended the trainings would share the information to their wives and neighbors, but women have not been included in the AI campaigns or trainings:

National plans and programmes on AI prevention, control and pandemic preparedness, which set out the framework for coordinated actions for reducing risks and improving emergency response preparedness, do not include a gender perspective. Guidelines hardly, if at all, mention gender as a strategic concept and tool in AI responses (Velasco, Dieleman, Supakankunti & Phuong, 2008).

Thus, in order to increase H5N1 awareness and prevention, local, national and international agencies should adopt the women’s narrative into their AI coordination, policies, response programs, and trainings. Among the men and women poultry farmers who were interviewed, all indicated that they had basic knowledge of avian influenza. This included basic hygienic guidelines: not touching infected poultry without gloves,

consuming infected poultry, washing hands after handling poultry, and reporting to authorities if they suspected any of their chicken were sick (Velasco, Dieleman, Supakankunti & Phuong, 2008). Male farmers were also aware of detecting symptoms among birds and fowl, and what to do if there was a sudden outbreak among the birds. Men also claimed that they were able to protect their families against AI. Television news, public information programs, and campaigns, as well as, community broadcasts, farmers' training courses and handbooks (distributed by AI campaigns) contributed to most of their knowledge. Again, "women's awareness on disease prevention and control remained limited" (Velasco, Dieleman, Supakankunti & Phuong, 2008). To ensure appropriate H5N1 knowledge and behaviors to female (and male) farmers, guidelines should go beyond basic hygienic care and focus more on interactive trainings that involve participation.

Although prevention and response programs were organized for farmers by the Farmers' Association, Vietnamese Women's Union, and/ or the District Veterinary Station, both male and female farmers interviewed noted that some did not attend training courses due to "no awareness, no time, and the timing of the trainings were not suitable to their own schedules." (Velasco, Dieleman, Supakankunti & Phuong, 2008). Therefore, the respondents of this report suggested, "timings of trainings should [also] be adapted to farmers' time, and should be short and easy to understand. They also suggested that more AI and animal disease control trainings and information campaigns should be conducted"(Velasco, Dieleman, Supakankunti & Phuong, 2008). The farmers' suggestions address the importance of how health response programs have shown lack of consideration for the opinions and input of stakeholders directly affected from AI, and

further suggesting that programs should be strengthened to tailor their needs. In behalf of La Via Campesina's (LVC) active role in peasant organizations for small-scale producers and rural women across the Global North and the Global South, LVC should advocate for equal male and female participation in H5N1 policy makings, health response programs and sustainable agricultural practices. This includes finding effective ways for Vietnamese farmers to have an incentive to attend the training and to recognize the emergency of a potential avian influenza outbreak. Programs should also acknowledge that behavioral changes within a local and cultural context are harder to change, but should not impede them from continuing to create better understanding (Velasco, Dieleman, Supakankunti & Phuong, 2008).

To conclude, the national health response programs in Vietnam have created useful response programs in its efforts to increase small-scale farmers' awareness on the dangers of the H5N1 virus. Nonetheless, as this case study demonstrates, there is still room for improvement. To create mutual understanding and coordination between central officials and small-scale farmers, international and national health response programs should include the opinions and voices of all stakeholders affected by avian influenza, especially the women's narrative in H5N1 discourse.

### ***Indonesia: An Archipelago of Uneven Distribution***

A common critique of global health interventions is that whilst resource and funding donations are necessary, the ways in which they are implemented or distributed often don't take into account the political and economic climate of the country in question, nor do they always strengthen national ministries. As argued previously, the traffic between scales influences policy and produces action and effect. Funding and

resources for H5N1 intervention are inequitably allocated and distributed due to the traffic and transactions of mitigation capital between the scales of the global, national and local. National disease surveillance systems have become highly developed since initial H5N1 outbreaks, however, the allocation and distribution of other forms of mitigation capital between Indonesian districts and municipalities is highly inequitable. Preparation between districts and municipalities varies due to the country's geography, national political climate, and the current decentralized state of Indonesia's national health system. Funds and resources for H5N1 control and preparation have not been allocated appropriately. To increase preparation national, local, and cultural sensitivities that give insight to the country's geography, political climate, and decentralized health system need to be incorporated into response programs to better address this inequitable distribution of mitigation capital. Providing knowledge on where and who exhibit the highest demands for what resources are questions to inform appropriate control intervention can both strengthen ministries of health and encourage health sector collaboration between districts and municipalities. Mitigation capital in the form of funds and resources overshadows alternative local needs. Marginalized voices from local health care workers and field-level actors involved in control efforts present alternative needs and demands that have to be incorporated into response programs. Firstly this case study provides both a description of the past and current AI response programs in place. It then provides an analysis of these programs in the context of the current Indonesian health care system. We have seen Indonesia and Cambodia become major hot spots for health agency H5N1 disease intervention and a huge influx of international health agency funds.

### *Programs in Place*

Though this analyses focuses on preparation inequity and marginalized local health insights it is important to describe the current control measures in place. International standardized response programs have had small successes in H5N1 mitigation within the reporting and information systems that also function at the district and municipal levels within case referral networks. Within these districts and municipalities the CDC has guided the construction of “command posts” to help unify a reporting information system. These command posts attempt to ensure that any confirmed or suspected cases, and even rumors get reported to the national system, where the information can be tracked by international agencies concerned with pandemic preparedness. From here the information is also used for decision making around dispatching investigation teams, completing weekly and monthly routine data sets as well as event based human and animal case reports (Pongcharoensuk et al., 2012) Komite Nasional Pengendalian Flu Burung dan Kesiapsiagaan Menghadapi Pandemi Influenza (KOMNAS FBPI) is the ministerial level national coordinating body that oversees the implementation of the National Strategic Plan. It helps coordinate and direct numerous activities including human health and anti-viral drug stockpiling. Surveillance information systems however are directed under the combined effort of Indonesia’s Ministry of Agriculture, the FAO, the government of Japan, USAID, and the Australian Agency for International Development (AusAID). Indonesia provides a good model for comparison, as the country has sought to improve surveillance measures since the initial outbreak of H5N1 within the country in 2004. The programs that have been established are the Participatory Disease Surveillance (PDS) & Participatory Disease Surveillance

and Response (PDS), the National Information System for Animal Health (SIKHNAS) and the HPAI Information System

On a national level, PDS & PDSR were taken as an initial response to the growing H5N1 HPAI threat of 2004. Modeled after the PDS system developed for pest eradication in Africa and Pakistan, the Indonesian PDS system sought to establish initial surveillance techniques on the ground while compiling data for aggregate analysis. Built-in feedback systems allowed for the initial PDS system to evolve to include a response component, thereby labeling the program PDSR. This program focuses on strengthening disease prevention and control on varied levels: management, technical analysis, political, etc. The PDSR has been evaluated to be an effective tool for dynamic recruiting, training, and managing capabilities across Indonesia by the international community. “By mid 2008, 2112 officers, including 353 qualified veterinarians and 495 people with no official animal health qualifications, were operating in 27 of 33 provinces across 331 of Indonesia 448 districts” (Scoones et al, 2010, p. 148). These numbers compared to the Integrated Surveillance for Avian Influenza (ISAI) Project, which aimed to incorporate human and animal surveillance, only established 170 District Surveillance Officers in 9 provinces (Scoones et al, 2010). Disease information is reported to the Local Disease Control Center (LDCC), which delivers the information to a central database for government knowledge. Proponents of the PDSR model now argue for a narrowed focus on village-level activities in engaging individual households and farmers in surveillance practices. Such practices include educating the population on H5N1 causes and symptoms, encouraging safe poultry rearing and culling when necessary, and promoting the sharing of information regarding diseased poultry. The ongoing evolution of the

PDSR program aims to establish a sustainable community-based program within existing social structures that will also aid in the prevention of other zoonotic diseases.

Such efforts are aided by the continual development of technical analysis procedures including data collection processes. SIKHNAS and the HPAI Information System are two such examples of programs that focus on data collection and analysis. While SIKHNAS focuses on mapping technologies to create a geographic understanding of disease, the HPAI Information System provides a centralized source of information for Indonesians within varied sectors of society. Initially developed as part of the PDSR program, the HPAI Information System has evolved to include both backyard and commercial poultry surveillance components. The HPAI Information System defines its role as a means of providing disease information, monitoring and evaluation to decision-makers, and guidance to field activities conducted by local governments. Since its inception, over 10,000 HPAI outbreaks have been reported by this program. As the foundation for surveillance systems are now in place, the greatest need is in increasing efficiency and communication between varying surveillance systems. Due to the difficult nature of transferring and sharing information, the current priority is to develop new methods for “enhanced data integration” that will serve to protect farmers and laymen alike.

### *Indonesia Case Study Analysis*

Many of these response systems have been modeled from international health agency guidelines and have even had partial success in mitigating transmission and spread through highly developed disease reporting and surveillance systems. Using research from the local level, from scales of rural to urban, this section compares how

varying areas within Indonesia have dealt with H5N1 in combination with their collaboration with international health agencies. This section draws from academic research and reports from multiple resources such as the AsiaFluCap Project from within the London School of Hygiene and Tropical Medicine under the Communicable Diseases Policy Research Group in Bangkok from authors such as Piya Hanvoravongchai, the STEPS center from University Sussex and also the work of multiple authors such as Wiku Adisasmito and who are producing work from within the University of Indonesia. Scoones et al (2010) also provide this case study with significant local level material and analysis of the effectiveness of H5N1 control measures in the region of Southeast Asia.

Of all our nation state case studies, Indonesia has suffered from the highest number of H5N1 outbreaks and has also received the most funding to fight this strain of HPAI that is now considered endemic. The districts and municipalities of Java, Sumatra, Bali and Sulawesi have experienced the most severe outbreaks and sporadic cases continue to arise throughout other islands (Forster, 2008). Firstly, it is worth noting as Indonesia is an archipelago of many islands that response programs and their implementation have varied and been challenged due to the highly contextual dynamics of this geographical space. Indonesia's government declared the outbreak of H5N1 to the OIE in January 2004, the same year the country had its first, free presidential election (Scoones et al, 2010). The Indonesian health system, and inherently its varying HPAI response programs, both function at the district level. This means provincial authorities hold policy making control and are responsible for directing pandemic preparedness programs. Though a collaborative health system is challenged by the country's archipelago geography, multiple authors argue collaboration is challenged more due to

“the country’s transitioning democracy and the complex relationship between the state and its bureaucracy – a vast decentralized network of local governments and administrations” (Scoones et al, p. 130). From the 456 autonomous districts and municipalities within Indonesia this case study will focus on reports, understandings, perspectives and health system data centered on Jakarta, West Java, and Bali.

Secondly, it is crucial to describe the context of Indonesia’s human health responses based on the country’s recent political restructuring and decentralization and its inherent effect on health system capabilities. Due to the enormous size of Indonesia, the country is culturally, religiously and ethnically diverse, resulting in varied efforts to tackle the H5N1 epidemic sprawled across the islands. Current control measures attempt to take into account only certain actors involved in the Avian Influenza epidemic in Indonesia by tackling backyard farmers, consumers and also, with little success, commercial producers. Indonesia’s 1999 decentralization legislation was a radical change from authoritarian ruler Suharto’s ‘New Order’ regime that affected the country’s health system dramatically. District level-governments have only been recently empowered through a direct electoral system change in 2004 to hold policy making authority (Scoones et al, 2010, p. 137). This transition has resulted in highly concentrated power within districts and municipalities instead of larger provinces. Controlling the disease from a national or provincial standpoint has made both allocation of funds and collaboration between human health projects and animal health projects the most prominent challenges throughout the country. Consequently, “in January 2007, Indonesia comprised 33 provinces and 456 autonomous local governments of which 363 were districts (regencies) and 93 municipalities (cities)” (McLeod, R.H., 2008, p. 201). The

local officials of these 456 autonomous governments have the choice whether to implement Ministry of Health and Ministry of Agriculture response plans. The pace and scale of decentralization has produced such varied results within districts that factors other than ethnicity or language such as income, education, health systems, administrative cultures, allocated HPAI funding, to poultry consumption and production, both in respect to backyard farming and industrial production, all combine into complex networks that make implementing a comprehensive nationwide response extremely difficult.

During a STEPS reflection workshop on pandemic flu controversies at the University of Sussex, Elbe, Leach, and Scoones (2013, p. 3) argue:

As policy communities have reflected on the failings of earlier responses, a new or revived – One Health narrative has been suggested, arguing for closer integration of human, animal and ecosystem health concerns. This has gained purchase in some quarters, but, as we discussed in the H5N1 case, the wider ecological, social and economic issues were downplayed in favor of a drug and vaccine response. We heard how alternative narratives based on local understanding, rooted in particular contexts, get short shrift, often seen as too specific and particular to be relevant to a global response. The international policy machinery is poorly geared to context-specific responses, seeing this as the responsibility of local health authorities. Yet, as we heard, in resource poor and low capacity settings, global framings and interventions dominate, often to the detriment of effective and efficient responses.

Internationally funded or resourced responses have not been substantially context-specific in respect to Indonesia. This lack of collaboration between the multiple responses organizations often results in either overlap or areas missed out during mitigation efforts. The control focus has placed most of its emphasis on acting through specific types of scientific expertise, mainly epidemiological and participatory surveillance control

measures. International standardized response programs do not apply well to the context of Indonesia's decentralized health system. Indonesia like many developing nations has a shortage of health care workers, especially physicians and nurses. Regional disparities exist in numbers of available avian human influenza trained health care workers, which are mostly condensed in highly populated areas. Depending on the region physicians, nurses and community health workers all have different levels of preparedness in respect to H5N1. Pongcharoensuk et al (2012) reports on details from CDC designed Pandemic Influenza 'socialization' educational symposiums for health care workers for avian influenza case management. These symposiums were of higher occurrence in his case studies of Bali and Jakarta. However conclusions from a mixed method multidisciplinary study taking in south Jakarta on the attitudes, concerns, perceived impact, personal and institutional preparedness and coping strategies of primary healthcare workers found that most were not prepared for Avian Influenza. The report stated there is an urgent need to build their primary healthcare capacity to protect them and contain this global health threat (Koh et al, 2009). Bali has more regular AHI meetings than Jakarta. Some authors claim this, in combination with Bali's 2008 pandemic simulation exercise leaves Bali more prepared than other areas of Indonesia such as Jakarta and West Java.

These case studies illuminate the hyper-focus of response programs to solely tackle H5N1 through technical disease control measures and such measures are constructed and maintained by global standard medical frameworks of epidemic or pandemic preparedness. Instead, turning toward local health care workers and gaining insight to resource deficiencies and funding demands would be a highly more effective way to construct context specific response programs.

Between each of the districts and municipalities that we discuss in our case studies, there are some more uniform models of human health care services that transcend these regions. The health care system responds to HPAI infections based on case referrals. These case referrals often begin at rural Posyandus which are informal health services available in rural zones then onwards to Puskesmas, community health centers in sub-districts and villages (Pongcharoensuk et al., 2012). Only able to diagnose and treat more common diseases, Puskesmas do not receive enough funding to handle H5N1 cases (Lowe, 2010). From Puskesmas patients and cases are referred to formal health clinics and onwards to district level hospitals. Each district or municipality has varied health care access and affordability for its population. Indonesia, like Viet Nam, has multiple health insurance schemes such as social security and government employee health insurance (Hanvoravongchai et al., 2012). The Indonesian capital of Jakarta has state-of-the-art medical diagnostic technologies available for wealthy expatriates and citizens—facilities comparable to those available in Singapore or the United States (Lowe, 2010). At the provincial and district levels these facilities and their donors, the MoH, WHO, USAID, AusAID and the government of Japan, provide anti-viral treatment, training for health care workers, services to build laboratory capacity, personal protection equipment for health care workers.

This study has found that Indonesia experiences most of its challenges for a unified H5N1 response and more in general a collaborative health sector due the lack of uniform action between districts and municipalities. The standard control focus that does exist at local levels has placed most of its emphasis on acting through specific types of scientific expertise, mainly epidemiological, biological and viral approaches to disease

management. However, these efforts are often misplaced and inappropriate to national and local realities in Indonesia that prevent smooth implementation. An example of this lack of consideration for the local and cultural context at the places of intervention can be taken from Indonesia's efforts to stockpile and its resource allocation methods. Stockpiles of the anti-viral oseltamivir, or its market name Tamiflu, and personal protective equipment (PPE) vary in size across West Java, Jakarta and Bali. The national stockpiles of oseltamivir throughout Indonesia cover around 1% of their population (Hanvoravongchai et al., 2012). In Indonesia the availability of health facilities is quite limited as seen in the density of hospital beds, which is at 1 per 1,000 or less. Generous funds exist for AI resources, especially in comparison to other diseases present in Indonesia, as the multiple agencies, especially the WHO, provides grants especially for H5N1 control. However, again, implementation and allocation of resources is disproportionate among districts and municipalities due to a lack of national level oversight. Examining the health sector in four districts (Central Java, Lombok, Kalimantan and Flores), Kristiansen and Santoso (2006, p. 254) found no figures available for the real district government expenditure and concluded that, "there is a total lack of financial transparency and accountability in all districts". When constructing pandemic preparedness guidelines or H5N1 response programs, issues such as these need to be taken into more consideration if responses are to be successful.

The international standardized response routine of surveillance, interventions and disease control is constantly challenged by the diversity of culture, geography, ecology, politics and socio economics that span across Indonesia. Some local regions have proven dedication and political will for implementing eradication efforts however it is the lack of

collaboration between districts and municipalities in combination with a loose and decentralized national role overall that keeps Indonesia from mitigating H5N1 at its full potential. In time collective government support, as well as increased communication between MoH and MoA initiatives would increase collaborative efforts that look to all sources and causes of H5N1. Yet for now, response programs need to address the complex realities of Indonesia's current experience with H5N1 to best mitigate this disease. Mitigation capital in the form of funds and resources is not always appropriate to local needs. Marginalized voices from local health care workers and field-level actors involved in control efforts must be utilized within response programs to incorporate context specific, local and alternative demands.

***Concluding Remarks: The Utility of Mitigation Capital***

This chapter has analyzed how H5N1 mitigation responses have played out within the national contexts of Thailand, Vietnam, and Indonesia. Using the framework of mitigation capital, we have argued that there are inefficiencies between the efforts of international health agencies and the involvement of national and local populations. Within Thailand, we found that the monopolization of mitigation capital by international health agencies - inherited from a tradition of international aid and jurisdiction over pandemic risk prevention - continues to suppress the power and initiative available within local and regional communities to combat risks like H5N1. In Vietnam, we experienced how the role of international aid continues to promote structural inequalities and differences within citizen lives and local communities. Finally, in Indonesia we questioned the role of international funding in promoting aims that highlight the inability of standardized international programs to work within specific regional contexts. This

deficiency in cultural sensitivity is a concern that will continue to suppress H5N1 pandemic prevention efforts on scales of all dimensions.

Through this chapter, we have argued that the role of mitigation capital is crucial in determining the future of pandemic preparedness and prevention. In analyzing where mitigation capital comes from and who currently controls it, we have highlighted where gaps exist and where programming does not meet the needs of local or national communities. We therefore suggest that the global community needs to review the role of international aid within local contexts. Do the aims of international agencies meet the needs of national governments? Even further, how do international agencies seek to collaborate with national organizations in controlling and utilizing mitigation capital? The case studies presented here demonstrate that there is still much opportunity for such collaboration to take place. As we look to a more sustainable future, the most successful programs will be those that utilize mitigation capital efficiently and responsibly - not as a tool of international aid but as a tool that creates a narrative of cooperation and trust between actors on local, national, and global scales.

## Policy Recommendations

- **Regional Sensitivity:** Advocate for the incorporation of a regionally sensitive multidisciplinary approach that embodies LVC's mission through collaboration between international, national, regional, and local authorities. This collaboration should seek to streamline the 'traffic between scales' and efficiently utilize mitigation capital, especially with the goals of national health agencies in mind.
- **Transparency:** Encourage a reevaluation of mitigation capital to recognize the role of national actors and academic experts within the field of H5N1 prevention. This could include measures to promote transparency surrounding the terms and agreements of donor and foreign aid.
- **Mutual Cooperation:** Through such reevaluation, promote a serious consideration for local and cultural complexities in implementing successful H5N1 response programs and eradication efforts. This includes the consideration of the voices and opinions of all stakeholders (male and female farmers, traders, unions, consumers, etc.) to ensure mutual understanding and cooperation.

## CHAPTER 6

## Placing all the eggs in one basket: The compartmentalization of poultry production and pandemic response

*Colin Mackenzie, Libby Anderson, and Maeve Regan*

**Abstract:** *One Health approaches consider animal health, human health, and environmental health in outlining prevention and control strategies. Prevention has been emphasized through containment rhetoric and a subsequent shift towards compartmentalization of the three branches of One Health. This version of One World One Health follows the belief that isolating farm animal populations from environmental and human systems can prevent the intersection of biological reactants necessary for an international pandemic. While true on paper, in practice this logic does not consider gaps that are inherent to containment systems. Reducing the factors that create risk and recombining the three components of One Health may eliminate the potential for pandemic generation and lead to a better understanding of the mechanisms involved in relevant processes.*

**Keywords:** *One Health, Biosecurity, H5N1, Pandemic Simulation, Recombined One Health, Risk, Compartmentalization*

## ***Introduction***

The state of pandemic threat has been defined by a misplaced focus on disease containment and more assumption than certainty when it comes to evaluating risk. This attention is evident in the conceptual framing of H5N1 prevention strategies and is manifested by farming practices. The current production of risk of is a systemic issue that cannot be resolved exclusively through biological safeguards along lines of transmission. Modes of disease containment are valuable in limiting transmission but present their own complications that make them ill-suited to prevent all pandemic opportunities at the current magnitude and complexity of international poultry production and consumption. Furthermore the state and extent of pandemic risk at any given time is virtually unknowable which only further fuels containment rhetoric. In critiquing current pandemic containment strategies it will be useful to examine the role of One World One Health in influencing policy.

One World One Health is a way of framing public health policy by focusing on three aspects of any public health issue and their relationship with one another in the spread of disease. One Health approaches consider animal health, human health, and environmental health in outlining prevention and control strategies. One Health therefore employs an exchange between veterinary medicine, human medicine, and environmental science (One Health Initiative Task Force). A One Health approach can be highly useful in framing issues of public health that depend upon the confluence of all three factors to remain a hazard. Such public health concerns include vector borne disease where wild animal populations infect domestic animal stocks. The One Health Initiative Task Force (2008) claims that by 2020, demand for animal based protein will rise by 50%. This

coupled with mankind's continued expansion into the natural environment is expected to create an increase in zoonotic disease incidence and prevalence as a result of human interactions with and dependency on animals. While One Health approaches may be inherently useful, the results of this process can come to be defined by the world from which One Health originated, the Global North. Specifically, biosecurity is being used in the One World One Health model to compartmentalize each branch of animal, human, and environmental health. The following sections will illustrate how compartmentalization as expressed through One World One Health has come to define international response against the threat of an H5N1 Pandemic via international actors, simulation, biosecurity, and public promotion.

International agencies influence and shape the political forces that drive pandemic security practices through narratives of reterritorialized spaces of disease risk that override sovereignty and through the influences and pressures of donor's requirements inherent to funding networks. Pandemic simulation models and biosecurity methods have the power to prevent and eradicate epidemics through identifying gaps in risk management, but have inherently limited outcomes. Through the media and multiple international health agency networks geographies of blame and narratives of fear become a byproduct of poor risk management practice and their outcomes.

If a One Health perspective is to be adopted it must be reconstructed around the local knowledge and social structures already in place. This can be achieved by deconstructing the current compartmentalized system. LVC is in a favorable position to recognize the need for regional and case specificity within all sub-sectors of risk management, this line of thinking can be applied to the technical aspects of biosecurity

such as reducing flock density and utilizing findings from pandemic simulation models to better address risk management gaps. LVC can promote for a wider use of a Recombined One Health approach to inform, inspire and mobilize diverse publics. A Recombined One Health approach can be utilized and further developed by multiple actors such as farmers, laborers and peasant movements to scholars and public intellectuals, to NGOs and human rights activists from around the world for the promotion of future forms of biosafety and containment methods that incorporate diverse health perspectives to support organic farming production. We suggest that LVC advocate for a move in the direction of crafting a Recombined One Health approach that considers biosocial factors and can better promote the needs of small producers and protect them from industrialized agriculture while limiting pandemic risk.

### ***Segregated Health Narratives***

Very specific human health narratives and animal health narratives both represent how H5N1 is understood and shape the way preventative measures and various health responses unfold on an international scale and within each country. According to Roe (1991), 'narratives' have beginnings, which define the problem; middles, which outline the cause and effect explanations and assumptions; and ends, which define the solutions. Health disciplines and their narratives have been segregated and categorized as result of the scientific revolution that alienated forms of species health from one another (Wallace et al., 2013). This section provides an analysis of the outcomes of the segregated approach to H5N1 intervention in respect to global avian influenza control methods through focusing on human and animal health narratives. It also briefly draws from Chapter 2's analysis of ecosystem health to expose the environment as an uncontrollable

vector for disease transmission. While H5N1's natural reservoirs are waterfowl, contaminated water, and poultry, humans have constructed new reservoirs that facilitate LPAI's evolution into HPAI, enabling it to persist within the human sphere. The compartmentalized and confined species activities on CAFO's are artificial environments that motivate HPAI to evolve. These ecosystem health narratives do not receive substantial attention in response program efforts or pandemic preparedness plans. Instead human health discourses are most widely utilized by many in the public health sphere to influence action and policy against H5N1. Yet while animal health voices remain mostly within veterinary science sectors, animal health narratives and measures have also been able to gain some traction and attention in the battle against this zoonotic disease. Unfortunately these two different health sectors frame separate issues and propose dissimilar methods. While the animal health control measures that do exist are less developed than human public health narratives, it is ecosystem health narratives that are even most absent from the H5N1 conversation.

The majority of H5N1 problems and solutions are framed by epidemiological expertise and controlled through mechanisms of clinical pandemic preparedness. Combining material from the health sector preparation and mitigation efforts described in Chapter 5 in combination with research on attempted One Health implementation in H5N1 burdened regions, this section illuminates the fiscal determinants and politics behind infrastructural health expertise that construct H5N1 pandemic policy making and segregate human, animal and ecosystem health efforts. Public health authorities already allocate a huge portion of fiscal resources to influenzas every year across the developed world with consistent case monitoring, virus sampling and flu shots. A dedication of

resources by the international public health response to H5N1 AI specifically towards human health and pandemic preparedness has been no different. Human health measures such as surveillance systems and epidemiological response programs receive more funding. Rudge et al., (2012) write:

A recent paper on Financial and Technical Assistance from the 2010 International Ministerial Conference on Animal and Pandemic Influenza (IMC-API) reports that over 50% of total donor funding committed towards avian and human influenza worldwide between 2005 and 2009 was allocated towards “human health and pandemic preparedness” with other funds committed towards sectors such as animal health; monitoring, information, and internal coordination; and information, education and communication (p. 7).

The WHO is the most prominent actor within the public health sphere dedicated to H5N1 control. The organization’s human health narratives consist of scientific expertise such as epidemiological statistics, mathematical population data, clinical and biological discourses. Scoones et al (2008, p. 21) argues:

A main component of the overall ‘outbreak narrative’ (see Wald, 2008) surrounding H5N1 is “a human public health narrative which certainly dominated the media and political concerns: *‘human-human spread is the real risk, and could be catastrophic.’* Here a combination of drugs, vaccines and behavior change were seen to dominate the response, one very centered on the WHO, with UNICEF and a number of NGOs being important players too.

Global public health actors have shaped both how and through what mechanisms H5N1 is controlled. Human health pushes for pandemic preparedness response programs primarily focused on drug stockpiling, developing case reporting systems within human health surveillance networks, and clinical preparedness in various forms such as stocking personal protective equipment and implementing health care worker educational programs. Having conducted extensive research on the effectiveness of the H5N1 response in Southeast Asia Scoones et al (2008) argues that a more prophylactic,

preventative, primary care approach, utilizing non-pharmaceutical and community-based interventions are seen to be the most effective over typical technical, medical and technology-driven approaches such as drugs, vaccines and hospitals. The surveillance systems for human cases of H5N1 have become especially developed enterprises due to this human health focus. For example in Indonesia the PDSR has even been internationally acknowledged for its success (Scoones et al, 2008). Though the human public health mitigation efforts have taken center stage, the animal health sector has also taken many strides in influencing H5N1 containment policy. Again, instead of combining response efforts with interdisciplinary approaches to H5N1 containment, these sectors continue to function more or less separately.

H5N1 is essentially an avian disease, reserving the necessary expertise of veterinarians who largely represent the OIE and the FAO. The OIE is more orientated towards animal health and veterinary services yet the FAO also contains an Animal Production and Health Division. When Avian Influenza started hitting the headlines in the late 2000's these divisions were finally given more influence and funding (Scoones et al, 2008). Just as surveillance systems for human cases of H5N1 have become developed enterprises, surveillance systems to monitor both the wild migratory bird populations and some backyard poultry farms have received significant attention by veterinarians. That being said, animal health-centered biosecurity regulations have been poorly implemented within commercial-scale poultry production facilities and their surveillance systems remain equally underdeveloped. Evidence of surveillance reports and outbreak data within these facilities is very difficult to come by in research due to corporate privacy. Instead, in regards to animal health risk management beyond biosecurity, efforts have

focused on regulating local wet market trade and hygiene practice. Extreme measures of culling have also been animal health focused species specific epidemiological responses to address routes of transmission between birds.

Scoones et al (2008, p. 26) states:

The veterinary narrative essentially argues that the standard veterinary response – using a combination of culling, movement control and vaccination – to eliminate the disease is all that is required. This is enshrined in the OIE guidelines which specify ‘eradication pathways’ for different listed diseases. The OIE Performance Vision Strategy is the tool that defines what needs to be done and the next steps are investment in capacity (labs, personnel training, equipment, vaccines, ect.) which the FAO, WB and other agency projects would take on.

Such methods of response were dominated by international animal health agencies made up of the global North. The FAO’s contribution to animal health pathways of control consisted of biosecurity of poultry production units and wet markets. Perhaps more importantly, the standard veterinary response becomes limited when it needs to be applied to local, economic and cultural contexts in the places of intervention. Referring to animal health actors, Scoones et al (2008, p. 28) states “the construction of a particular view of the disease (one of poultry, mostly chickens) and how to deal with it (eradication/stamping-out) reinforced the power and influence of certain individuals and organizations to the exclusion of others.” The specialist instincts of scientific expertise deter hopes for collaboration. Because responses were led by compartmentalized yet powerful health sectors and agencies the field level socio-cultural realities for farmers and local vets were not taken into consideration. These diverse publics become the ‘excluded others.’ The political arguments about who was to blame had strong economic roots. Arguments were heightened during the years of the first outbreaks as cause and blame fell between unregulated commercial poultry facilities and ‘unhygienic’ backyard farmers. However discourses of modernity ensued and backyard farmers were deemed to

be in need of modernization thus causing animal health specialists to argue strongly for biosecurity regulations. Backyard poultry farmers' 'behavior' in combination with overall animal husbandry habits within Indonesia and Viet Nam have been especially targeted. Chapter 5 argues that internationally developed standardized response programs which seek to mitigate H5N1 often fail on the ground level due to their severe lack of consideration for the local and cultural context at the places of intervention. Targeting farmer's behavior and long rooted cultural habits of animal husbandry are one of the few and inadequate ways these response programs have sought to address H5N1 risk management at the local level. At times these responses have the ability to even "increase risk of spread as activities are forced underground" (Scoones et al, 2008, p. 5), and therefore become less regulated and more risky. Tidy and neat manuals, protocols and response programs designed at the international level do not touch the ground level realities that contribute to H5N1 growth and spread. To implement a real One Health approach these debates need to be not only centered on health sciences, but also power, money and position. One World, One Health in theory holds promise that movement away from simple categorizations of particular species health can ensue. Existing response programs fall short of addressing the dynamic intersections of H5N1 that Lowe (2010, p. 625) states as "clouds or clusters of genomes with unstable group boundaries."

The continued compartmentalization of health narratives consequentially inhibits successful mitigation efforts. Though international health agencies have been eager to acknowledge One Health methods by making shifts to reintegrate health disciplines, the efforts have not been substantially reformative. Wallace et al (2013) draws from the ideas of Schwabe (1984) and Wilson et al (1994) to argue that "One Health appears the latest in

a series of efforts pushing back against the specialist instincts population health researchers bring to interdisciplinary practice” (p. 3). Only few could argue that the theory behind this integration of health disciplines is something detrimental to H5N1 mitigation methods or to overall zoonotic disease control efforts in general. Though there have been movements of disciplinary integration, One Health’s overall focus remains diverted on H5N1 ‘problems,’ instead of ‘solutions,’ continuously delaying more effective eradication efforts. The following analysis on topics of biosecurity and pandemic simulation models prove that when in practice, these current technical H5N1 containment strategies abide and maintain compartmentalized scientific approaches, generating their own failure.

### ***Risk Generation and Isolation***

In his article “Preparing for the Next Emergency”, Lakoff (2007) explains how the Global North and the United States in particular have inadvertently exposed populations to risks that are difficult to calculate if not incalculable entirely as a consequence of recent infrastructural developments. The global industrialized agricultural system was developed to increase what Lakoff (2007) has termed “population security”, or the wellbeing of a national population, by providing stable and affordable food sources. The original intention of mitigating risks surrounding food production supply and stability have been overshadowed by a novel set of biological hazards that are a product of recent structural developments.

Certain industrial agricultural systems have since moved beyond the scope of current risk assessment and management capabilities by either growing too technically complex, moving overseas or both. The case of avian influenza in Southeast Asia is an

exemplification of one such occurrence. Modernizations within the previous century have led to a gap between our ability to produce food in a manner that provides stability for certain populations and our ability to ascribe a quantifiable amount of risk to those production methods. This gap has expanded to the point where technologies that previously served to provide population security have themselves become risks to population security in a turn of events that Beck (2002) describes as “reflexive modernity”.

Modern efforts to create disease-free agriculture mark a division between the Global North and the Global South. The former is characterized by a movement towards bio-secure facilities that isolate poultry from the surrounding environment, while the latter has been vilified in many senses for both intra and interspecies contact. The general relationship between the two is domineering, where the Global North exerts its technological capabilities over the Global South to develop patchwork solution to problems created by western agricultural practices. The language itself used by One World One Health suggests that health and illness are universal and quantifiable qualities with disregard for cultural and anthropological context. Such ideology has emphasized “contamination over configuration” (Hinchliffe, 2013) and has been manifested within the industrial poultry industry by the compartmentalization and physical isolation of animals and animal health from the remaining branches of One World One Health. As it is currently utilized within the industry, One World One Health is product of Western health care practices, industrial farming, and human relationships with animals. One Health, as it has existed within the Global North, cannot merely be exported and put into practice in far reaching corners of the globe (Hinchliffe, 2013). A Recombined One

Health perspective must be constructed around the local knowledge and social structures already in place.

Much of the pandemic threat that H5N1 poses is contingent upon an idea that virologist Nathan Wolfe has come to call “viral chatter”. Wolfe (2011) explains that the continuous exchange between viruses, human populations, and animal population enabled by the current agricultural, urban, and world trade structures allows for an ongoing process of viral adaptation. Given ample opportunity for viral recombination a potent strain is more likely to result than if conditions limited such pathogenic dialogue. The current One World One Health approach towards industrialized poultry farming relies upon technological measures such as biosecurity to limit the threat of viral chatter created by transmission pathways between domestic birds, wild birds, and human populations.

Modern safeguards against pandemics originating in agricultural production have been developed with focus on the control of transmission as the primary method of public protection. The purpose of these measures is to make a substantial difference in the suppression of viral threats, however they are incapable of filling all gaps in the current structure of food production. For example, within industrial poultry houses the birds must be moved from their individual cages to be transported for various reasons including to the slaughterhouse. This step illustrates a contact point between human and domestic bird populations that is built into the current production system (Hinchliffe, 2013). Not every poultry production facility employs all transmission control measure in an effective manner, but regardless of both the quality and quantity of transmission control measures, risks still exist. It follows that sections of the international poultry production network

that do not employ the latest transmission control measures would experience greater levels of risk.

One Health efforts carried out by members of the Global North are guided away from addressing the causative factors behind H5N1 by the urgency surrounding concerns of national security. These efforts are fueled by the fear generated by being unable to calculate the risks associated with institutionalized behavior. National security concerns and associated preparedness plans utilize language that assumes that catastrophic events are not to be avoided but rather moderated, diminished, and controlled. Approaches towards H5N1 preparedness have paralleled national security efforts to develop civil defense systems (Lakoff, 2007). It is from these notions that Global North responses to H5N1 have come to emphasize technological patchworks such as biosecurity. In the face of incalculable risk the rational response is to assume a worst-case scenario and build response efforts around that idea.

An example of this process can be found in a 2001 pandemic role-playing simulation under the Bush administration named “Dark Winter”. Both former and standing members of the United States National Security Council participated in the simulation over a 14-day time period that depicted a clandestine smallpox attack within the United States. In response to the simulation’s outcome, the United States began to stockpile vaccines throughout the country (Lakoff, 2007). Granted the causative factors are different in their institutionalized origins but it is possible to trace where the rationales behind pandemic preparedness measures are coming from.

Biological risks will exist in every corner of the natural world, organized agriculture being no exception. The One Health perspective on biological risk

management has represented an extension of Global North-centric processes that assume Western infrastructure and understanding without much consideration for local differences when implemented in other parts of the world, namely Southeast Asia. A One World One Health approach cannot exist without an acknowledgement of gaps between the compartmentalized design of pandemic preparedness approaches in the Global North and active efforts to include critical elements of the social and cultural terrain in their implementation in the Global South.

As international involvement through various global health agencies has previously been discussed, what remains is not only an analysis of pandemic ‘preparedness narratives’ as products of these health agencies, but also as products of political and economic networks. Andrew Lakoff discusses in his book Disaster and the Politics of Intervention the privatization of risk management, in particular the political influences behind global health crisis interventions; this section recognizes the politics of control that have become evident as these international agencies mold into global health bodies of justified authority to carve out disease response programs. The political factors influencing which agencies become responsible for pandemic security policy making are shaped by the dominance of scientific expertise, the political economy behind funding global health networks and various forms of biosecurity methods. As mentioned through chapter 5, H5N1 response programs, as a form of mitigation capital, emerge from international health agencies such as the WHO, FAO, UNICEF, and the OIE. UNISIC especially possesses a key coordinating role, particularly on financial and wider policy issues in H5N1 pandemic preparedness and the World Bank, is becoming ever more important on bridging and financing. These actors hold authorized, “sanctioned expertise

or, at the extreme, military-style force” (Scoones et al, 2008, p. 20). The political economy behind funding for health agencies is due just as equal consideration as an influential actor in policy outcomes as is science narratives. It is from within the friction of where these particular networks intersect that the response to Avian Influenza gains traction for implementation. These networks have produced different framings and proposed strategies that were pursued during the initial H5N1 outbreaks in the early 2000’s. However, it was only specific narratives that dominated across a range of actors. The major narrative of ‘pandemic preparedness and emergency response’ linked issues of social, political and economic risk management to overshadow all else.

Scoones et al (2008) defined a pandemic preparedness narrative as the following: A much wider network of business/industry players and consultants are concerned, linked to different branches of government, notably prime ministers’/presidents’ offices and finance ministries with concerns about the fallout of any pandemic. The humanitarian community – UN agencies, the Red Cross, development NGOs and others – are also important (p. 21).

Pandemic preparedness narratives emerge from professional, organizational, political or commercial interests. “Understanding how these ways of thinking, talking and presenting ideas in public, academic and policy discourse is essential in unraveling how particular policy processes in particular places emerge” (Scoones et al 2008, p. 20). Narratives are products of political and economic interests as they are compartmentalized health sectors. These narratives allude to their audience that international agencies and national governments have taken pandemic threats seriously, however many authors such as Greger (2006) and Scoones et al (2008) judge the global preparedness systems in place to be shockingly poor and underdeveloped. Greger (2006) states:

Despite repeated warnings over the years that a new pandemic is inevitable and repeated prods by the WHO for countries to draw up preparedness plans, only about 50 of more than 200 countries have done so. Some of these “plans” are as stunted as a single page and most, as described in the science journal *Nature*, are

“very sketchy.” The WHO calls for countries to “put life in these plans” by carrying out practice simulations. “One has to be very vigilant, honest and brave,” asserts Margaret Chan, now the WHO’s chief of pandemic preparedness. “Sometimes you need to make unpopular, difficult recommendations to political leaders which may have a short-term impact on the economy and on certain sectors” (p. 242).

The world doesn’t seem to be taking this pandemic potential seriously enough. Despite the non-existence of well-coordinated pandemic preparedness plans there has been a rapid influx of initiatives taking place in Southeast Asia that are often either overlapping or misplacing their efforts. “The world of crisis and emergencies is thus very different from the highly technical, often quite academic, cultures of the veterinary and public health responses discussed previously” (Scoones et al 2008, p. 28). As proven so far by the little success these numerous agencies have had, conventional policy approaches to risk management do not sufficiently apply to the nature of H5N1. All agencies, governmental or not, and all disciplines must collaborate to recognize uncontrollable factors and their inherent uncertainty by scientific standards. Greger (2006), while referencing the U.S. struggle to implement a pandemic preparedness plan states:

A pandemic would impact all agencies of government, but they don’t all have the same priorities. Senior policy analysts describe the Department of Agriculture and the Department of Health and Human Services, for example, as “not exactly good bedfellows.” The USDA’s traditional mission to defend the economic interests of the agricultural industry sets up a natural tension with agencies prioritizing broader concerns. Experts predict the economic impact on U.S. agriculture will be nothing compared to the havoc wreaked by the virus more generally (p. 244).

Collaboration is crucial to creating pandemic preparedness policy that can improve biosafety methods and simulation preparation models, and thereby overall mitigation, if not eradication, of H5N1. The environment must be acknowledged as an

uncontrollable component outside pandemic policy's reach. Further compartmentalized and concentrated human and animal activities in farming practice cannot continue while the environment encapsulates these activities, existing as an omnipresent vector that facilitates disease growth. This includes looking to the concentrated species operations within the industrial poultry sector as a significant cause of H5N1 mutability and increased risk. Specific efforts to restructure the poultry industry to incorporate organic production methods will be elaborated on further in Chapter 7. The evidence, agendas and arguments that fill the narratives of pandemic policy making are steeped in the context of the political economy that shapes global health governance. Though sufficient pandemic preparedness plans have yet to be properly developed, various forms of biosecurity have been one of the most consistent preparedness responses. Biosecurity often consists of a series of techniques designed to manage risk factors in food safety, animal life and health, and environmental life and health ("Biosecurity in Food", 2003). In the event of an influenza outbreak and in the precursory period before an outbreak, biosecurity techniques have the utility to play a large role in the eradication or amplification of an epidemic. The forms of biosecurity that currently exist will be discussed further below in the form of pandemic simulation models and in the context of implementation and outcomes in Thailand, Indonesia, and Viet Nam.

### ***Simulation***

It should be noted that the role of simulation models is not to precisely predict the paths that pandemic spread will take, but to identify the likely mechanisms. Simulation models present an opportunity for scientists to imagine possible outcomes of hypothetical conditions where full-scale experiments are impossible due to logistical or ethical

reasons. An important task that simulation models accomplish is the identification of gaps in any current preparedness plan (Krumkamp, Stein, & Chavez, 2011). Some simulation models contain their own suggestions for improvements of pandemic preparedness measures, however, many revolve around actions that deter pathogenic spread once an outbreak has already occurred. Slowing the spread of disease would undoubtedly prove critical were a pandemic to present itself, however, this section will attempt to employ the gaps identified by simulation models to suggest preparedness measure that would lessen the likelihood of an outbreak transpiring. Although simulation models are valuable in highlighting breaches in any preparedness plan, the solution to gaps has been to increase and further expand transmission control measures such as biosecurity. Simulation models represent a tool that has been utilized to further entrench efforts to compartmentalize the poultry industry rather than integrate it.

In Indonesia, 80% of the nation's 55 million households engage in backyard poultry farming practices at some level (Putro et al., 2008). While backyard farms are generally unassociated with conditions that facilitate the rapid recombination and spread of potent viruses, they are nonetheless susceptible to infection, should an outbreak occur, and therefore place human populations in the vicinity at risk. The Putro et al. agent-based simulation considers "virtual space density control" wherein contamination risk is evaluated based on agent density in any given space compounded with behavioral patterns and protective measures. "Spots" such as public transportation, offices, poultry stalls, and hospitals are assigned a high contact density that distinguishes spot contamination from person to person or agent contamination (Putro et al., 2008). Agents fall into five groups of people; babies age 0-5 years, schoolchildren age 6-12 years,

students age 13-18 years, young people age 19-34 years, middle age people 35-59 years, and old people with greater than 60 years.

The behavioral patterns factored into this simulation assume each agent group acts relatively uniformly yet different from the other agent groups. For example, on any given day, most young and middle aged agents travel between work and home via public transport and other young and middle aged agents travel to the markets while most school children travel back and forth between school and home. The model utilizes population and urban planning data from the city of Bandung, Indonesia as a basis for its projections.

By breaking agent movement down in relation to other agents and spots, contact exposure can be more accurately calculated. The study ultimately suggested methods heavily oriented towards transmission control. The study does go so far as to suggest population density management as a tool for pandemic preparedness but fails to include any kind of logistical plan. While this simulation model still represents a somewhat simplistic and general depiction of both human and virus behavior it is a step towards considering human behavior and relevant social factors as a means of altering community structures to dampen if not prevent the rapid and uncontained spread of disease.

### ***Biosecurity***

Biosecurity measures have an impact on the biological virulence of a disease and the transmission of a virus (both within farms, and to external bodies). The case of the H5N1 outbreak in South East Asia underscores how, in order to have a positive outcome and aid in the prevention of future epidemics, biosecurity must be modified to identify and fill the present gaps which allow for the amplification and transmission of disease. Biosecurity is currently being implemented in a way which attempts to compartmentalize

humans, animals, and the environment, ignoring the role of anything but direct biological intervention. When these ‘compartments’ inevitably meet through various pathways of transmission, the result is an increase in virulence and transmission of disease. In the last several decades, many highly pathogenic viruses have emerged, H5N1 being one of them. The spread and intensification of the H5N1 strain in Southeast Asia has been stimulated, in part, by the conditions of food animal farming.

Biosecurity, as a broad term, can be used in policy sense as well as a technical, agricultural sense; the two are inherently connected. However, for our purposes we will be examining the technical biosecurity measures, which play a direct role in the spread of H5N1 and exist as unintended risks to animal, human and ecological health. Biosecurity is, in its most basic working definition, “any practice or system that prevents the spread of infectious agents from infected to susceptible animals, or prevents the introduction of infected animals into a herd, region, or country in which the infection has not yet occurred” (Graham, 2008, p. 284). The measures vary by country, species, and production mode, but biosecurity tactics are promoted worldwide as a positive addition to food animal production and supported by governments, multilateral institutions, and non-governmental organizations (NGOs). These guidelines that are put in place to manage risk factors and prevent sickness have had varying effects and are often aimed in the wrong direction. To begin, the definition of biosecurity, its goals, and the forces behind implementation will be discussed. Next the focus will shift to the state of biosecurity and how biosecurity looks on both small and large poultry operations in Indonesia, Thailand, and Vietnam. In this light, the outcomes and consequences of biosecurity measures will be examined, and the critiques that develop from this review will be considered. By

looking at the processes, risks, and outcomes, the concept of biosecurity can be better understood as a compartmentalized, containment oriented method, supported by the One World One Health structure.

The Food and Agriculture Organization of the United Nations (FAO) has a more detailed definition than the working example stated above. They define biosecurity as “...a strategic and integrated approach that encompasses the policy and regulatory frameworks (including instruments and activities) that analyze and manage risks in the sectors of food safety, animal life and health, and plant life and health, including associated environmental risk.” The FAO considers this approach holistic (“Biosecurity in food”, 2003). This holistic nature is echoed in the One Health sentiment (“Mission Statement”, n.d.). In order to maintain this holistic approach, biosecurity techniques are implemented in a two-part process. Bioexclusion concerns the prevention of pathogen introduction, and is the first step. Biocontainment concerns post introduction actions, both within farms and external to the farms (Otte, 2007). Ideally, by working together, these two practices ultimately will help maintain human, animal and ecological health through safe agricultural practices. This holistic vision, however, has become a superficial form of risk management and is much less dynamic than possible and necessary, due precisely to the focuses on exclusion and containment which often ignores gaps (which inevitably emerge when humans, animals, and the environment interact). The dichotomy between the holistic, integrated One Health ideal and the exclusion and containment centric practices of biosecurity creates an ineffective framework to build upon when creating pandemic prevention and control.

Although the definition of biosecurity speaks to a broad audience, the actual

process of applied biosecurity is quite diluted. The practice of biosecurity remains rather vague, partly due to the fact that poultry production and husbandry differs greatly between countries and even between farms (“Biosecurity for Highly”, 2008). The research, policy recommendation, and enforcement for biosecurity interventions comes from many different organizations, including the FAO, World Organization for Animal Health (OIE), The Department for International Development (DFID), and local governmental departments. The standards in biosecurity are generally set by agencies like the OIE and the Commission on Phytosanitary Methods (CPM). The FAO for example lists the “fundamental principles” of biosecurity as “segregation, cleaning, [and] disinfecting (sic)” (“Biosecurity for Highly,” 2008, p. 1). The presence of international organizations and multilaterals guides the biosecurity discourse, and is responsible for the presence of biosecurity as an important concept in both political and scientific fields.

This variation of international standards makes it difficult to come to a fair and official consensus on how biosecurity is to be implemented, and who should be in charge of the implementation and regulation. Most international agencies like the DFID and FAO use national government agencies as “target audiences”, providing technical support and information, and it is the national agencies that often make final decisions on national and local policy enactment (“FAO Biosecurity Toolkit”, 2007, p. 5). Biosecurity is also a product of international laws and agreements (like the Technical Barriers to Trade ((TBT)) agreement), which are backed by a specific sector and have a vested interest in biosecurity practices (“FAO Biosecurity Toolkit”, 2007). The Technical Barriers to Trade act, for example is linked to the World Trade Organization and, along with other trade laws, used to protect international trade and business. This type of influence changes

what biosecurity looks like, both politically and technically. Acknowledging these influences is important in understanding exactly what is regulated, who regulations are imposed upon, and the consequences of biosecurity in both business and society. This political/technical nature of the current state of biosecurity is one that makes it difficult to both pinpoint theoretically and administer wholly, as we will see below.

According to the FAO the growth rates of both consumption and production of poultry are higher than any other type of livestock in Indonesia, and the presence of poultry in both the economy and society is highly visible and important. (“Indonesia” 2005, pg. 6-9). This fact holds true for Thailand and Vietnam as well (“Thailand”, 2005, p. 7, “Vietnam, 2005, p. 6-10). Poultry is pervasive in Southeast Asia, and the regulations around it vary, depending on location, size of operation, and institutional involvement. Since poultry is produced in many different contexts (even within specific countries), the regulation is currently highly complicated and disjointed. This leads to less than ideal security and health outcomes, affecting both small and large scale producers.

In 2004, the FAO introduced a classification system for defining different poultry sectors, using the scale of the production. Sector one consists of industrially integrated production. Sector two is commercial poultry production, where birds are sold through markets or slaughterhouses. These sectors generally have over 10,000 birds and are considered commercial operations (“Biosecurity for HPAI”, 2009). Sector three consists of smallholder commercial poultry. And sector four is the ‘backyard’ poultry that is consumed locally, and not often considered part of a large commercial operation (“Biosecurity for HPAI”, 2009). Biosecurity measures are highly affected by the sector or size of the farm. Large operations often have more enforceable standards and rules,

resulting in the premises being deemed biosecure and safe for workers and animals. Other modes of poultry production and distribution are more difficult to regulate, due to their small size and lack of standardization.

Small scale producers are often responsible for the biosecurity where poultry is raised, and for the biosecurity of the venues in which they are sold. Live bird markets, where many smaller poultry operations distribute birds, tend to have very little in the way of disinfection and practice less formal methods of biosecurity (Sumiarto & Arifin, 2008), which raises risks in the distribution phase of the poultry industry, if not in the growing methods. In a WHO case study of two markets in Indonesia, only two of ten “control measures” were actually enacted. These measures consist of practices such as sanitation regulation, zoning for different processes (slaughtering, cleaning, selling), and access to water and electricity, among other things (Samaan et al., 2011). FAO recommendations for these types of operations are community oriented, rely on cleaning, and will be less standardized than large-scale biosecurity recommendations (“Biosecurity for highly,” 2008). Sector four (that is, very small) operations that have mainly scavenging poultry can’t be managed in the same way commercial poultry can, because biosecurity measure like culling, disinfecting, and separate housing plans would be ineffectual. The ineffectuality isn’t necessarily due to the practices, but comes down to the difficulty of proper implementation. It’s difficult to regulate small batch poultry ownership in the same way one would manage a commercial farm. While smaller operations are more difficult to regulate, they also pose fewer risks for viral recombination. This creates a conundrum for many policymaking groups and biosecurity experts when trying to implement broad technical biosecurity measures in different

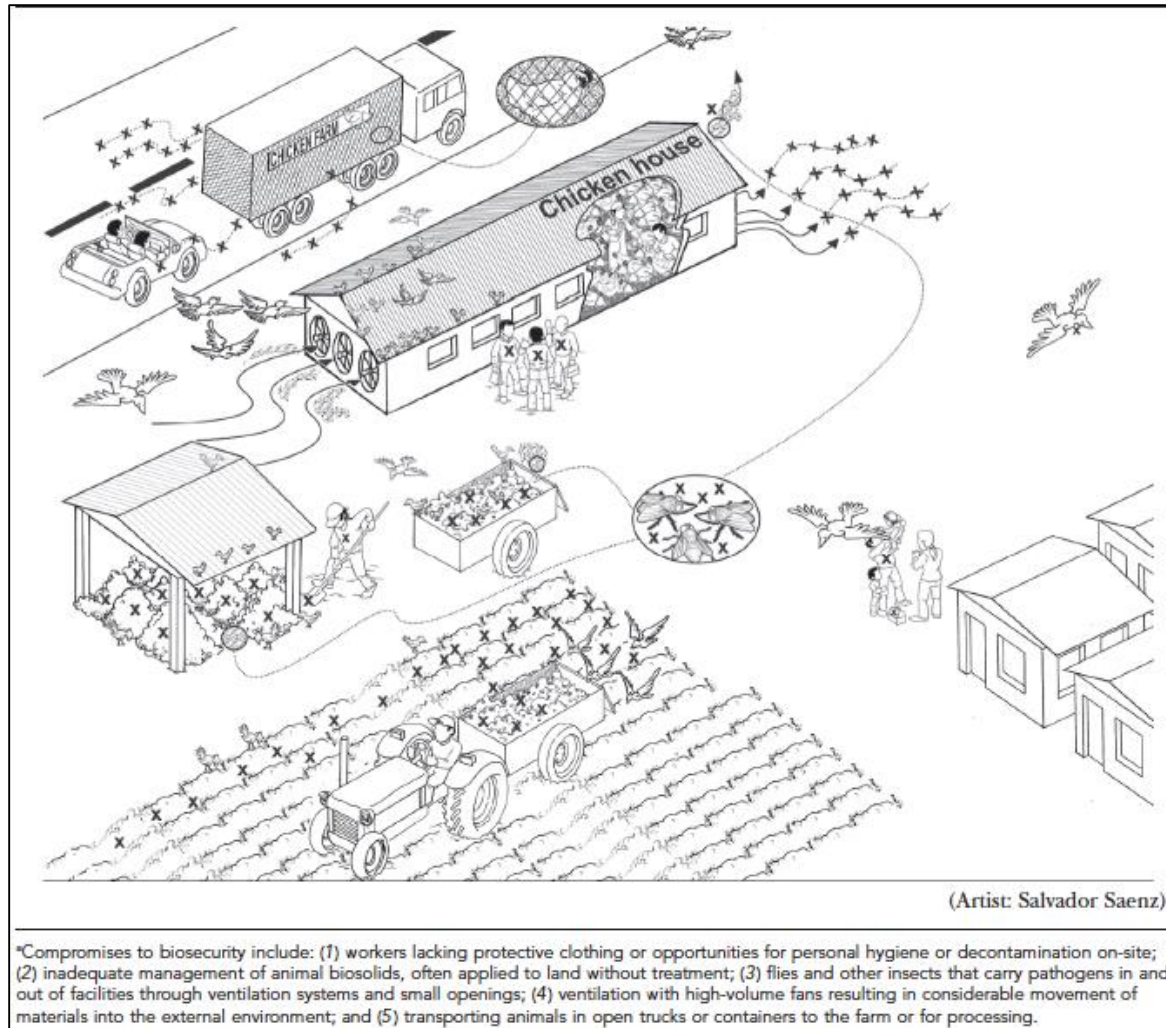
agricultural contexts.

Sector one and two regulations are more standardized. For example, in Indonesia, commercial layer farms have biosecurity requirements that include disinfecting vehicles, workers, and work areas (Sumiarto & Arifin, 2008). Large swine and poultry houses are ventilated with fans and temperature systems, which control conditions and air quality inside the barn (Otte, 2007). This form of systematic biosecurity regulation and sanitation is typical of large-scale agriculture, because it serves a purpose (keeping the area they are responsible for sanitized) and is easily monitored. These processes physically separate the animals, humans, and environment as much as possible and contain the different environments. However, the outcomes from these standard biosecurity practices in large agriculture have had unintended consequences and commercial “biosecure” systems in Thailand are not necessarily associated with a reduction in risk of HPAI in farm or flock level, compared to backyard producers (Graham, 2008). The attempt to separate the human environment from the animal, and to compartmentalize the process of poultry production (even within farms) has left gaps in security that impact human, animal, and environmental health and doesn’t wholly acknowledge the overlaps that exist between the sectors and has led to unintended outcomes.

The commercial sector, where biosecurity is implemented in a more standardized fashion often escapes criticism about biosecurity practices, despite not being associated with the reduction of HPAI risk (Graham, 2008). Wallace claims, “Despite ‘biosecurity’s’ invocation of a prison hospital, no megalopolis of millions, grouping animals into super colonies for which they never evolved, is ever so lockdown spic-and-span” (Wallace, 2009a). The cleanliness inside a poultry facility doesn’t necessarily

equate with lowered viral transmission, due to the interaction that happens between humans, animals, and the environment. These interactions are where many of the gaps occur, and where transmission can take place. Facilities with many biosecurity procedures still miss pathways of transmission and aren't completely effective, due to the inevitable gaps in coverage and overlaps in pathways.

Graham outlines several missed pathogenic pathways often overlooked by standard exclusion and containment biosecurity practices. The first are 'occupational pathways', which concern human interaction with the animals. The provision of protective clothing and on-site decontamination and hygiene opportunities are not provided to many workers (Graham, 2008). Workers act as a 'bridging population' for influenza transmission (Saenz, 2006, p. 339), and excessive worker exposure, according to mathematical models, can act as amplifiers to influenza (Otte, 2009). While trying to contain populations, there is inevitable contact with humans. Biosecurity can also overlook workers, leaving gaps between the different secured sectors, and allowing for viral transmission to the human population.



**Figure 6.1: The animal-human interface and infectious disease in industrial food animal production: Rethinking biosecurity and biocontainment, (Graham, 2008)**

The second pathogenic pathway is environmental. Flock size, as mentioned before, increases the risk of disease transfer. The high ventilation systems that are used in these large flock production facilities also pose a risk. The ‘tunnel ventilation’ can move materials from inside the poultry facility to the outside environment (Graham, 2009, p. 287). It is here that the problem of biosecurity becomes very evident; the measures put in place to keep large barns with large flocks ventilated are effective at doing so, but have outcomes that impact the environment *outside* biosecure environments. The exposure of

the outside environment to the air (and materials in the air) from a large poultry facility is not necessarily included in a biosecurity plan but nonetheless goes unchecked, in part due to the compartmentalized nature of biosecurity practices. Another environmental pathway is through animal waste, which has no specific requirements for treatments. The FAO estimated that globally, 140 million metric tons of poultry litter was produced in 2003 (Graham, 2008). According to Otte et al., poultry house waste is commonly used in aquaculture and the artificial wetlands, thus re-exposing the waste to wild birds (2007). These pathways provide opportunity for transmission to humans, wild birds, and other nearby poultry farms. However well separated the poultry production processes is from the environment and humans, there will inevitably be pathways of contact, which raise risks. These risks are especially dangerous within densely populated, large scale poultry production facilities.

Thailand's agricultural data shows that the poultry industry is highly concentrated, both by region and by density within barns where poultry are housed. Most commercial poultry exists within the central and eastern regions (Graham, 2008), and as stated above, most of the poultry is commercial. According to Graham, 75% of poultry flocks are considered 'backyard poultry' and consist of about 30 birds per flock. However, while backyard poultry accounts for 75% of the flocks, they only account for 1/5<sup>th</sup> of the total poultry population in Thailand. This means, that although they may have more separate flocks, they have a far smaller number of birds (both per flock, and in absolute terms). Commercial poultry (with an average flock size of 3,500) accounts for only 2% of the flocks but 60% of the poultry population (Graham, 2008). This pattern of regional specificity within commercial poultry is also seen in Indonesia, Vietnam, and

much of the rest of the world. The tightly packed poultry, while often passing biosecurity inspections, are creating an environment that encourages progression of viruses like H5N1. As noted before, these commercial ‘biosecure’ systems in Thailand are not associated with a reduction in risk of HPAI in farm or flock level, compared to backyard producers (Graham, 2008). The “efficient, but crowded” (Saenz, Hethcote & Grey, 2006, p. 343) environment that has become so prevalent in the modern poultry industry, and the outcomes from biosecurity that have done little to prevent a viral epidemic.

Biosecurity is being implemented as a compartmentalized aspect of the One World One Health model. It is also compartmentalized within its own technical practices, attempting to separate humans, animals, and the environment. Because of the focus on exclusion and containment, the high flock densities, and unchecked pathways of transmission, biosecurity plays a role in both the amplification and prevention narratives of those H5N1 outbreaks that have occurred, and those that have yet to occur. A Recombined One Health model would reintegrate the human, animal, and environmental when looking at biosecurity and refocus on reducing risk through prevention rather than control measures.

### ***Media and Containment Narratives***

Media has a center-stage role in producing narratives and responses to outbreaks and pandemic contingency plans. For the purposes of this section media is defined as national popular press, TV radio, advertising agencies, specialist science journalism, and politicians. Public fear and geographies of blame are products and narratives of containment and risk management outcomes that are pushed forward by media. As noted by Scoones and Forster (2008, p.20), “public anxiety and fear infiltrate media debates,

constructing ‘the other’ – dangerous places and people where diseases come from.” Pandemic risk narratives can be framed in ‘potential mortalities,’ which media outlets are known to portray the highest estimates. Rudge et al (2012) argue that total donor funds committed to avian and human influenza broadly correspond to avoidable mortality rates estimated at country level. Clearly the connection between mortality rate discourses and funding are very real interactions. Media reports on pandemic consequences almost always pay particular attention to large scale potential economic devastation and the collapse of the interconnected globalized world that we live in today. Headlines matter and policies almost necessarily have to follow a “simple narrative storyline – beginning, middle, end; if this is the problem, then this is the solution” (Scoones and Forster 2008, Pg.21). Media raises the profiles around H5N1 issues, and therefore raises funding and resources too. Media is most significant because of the illusion of disconnect it has with policy making, yet the very real and pervasive effect it has on factors of public fear, geographies of blame, funding and resource allocation.

The politics of fear and blame go hand in hand. Sparke and Anguelov (2012) extract examples of the power of media from encounters during the H1N1 2009 swine flu pandemic scare to elaborate on both the production and consequences of geographies of blame. The following examples expose the inequalities in blame of outbreak narratives in media (Sparke & Anguelov, 2012). In the post 9/11 climate of tense surveillance, immigration, border control and heightened territoriality the swine flu pandemic severely affected changes in US – Mexican relations. These discourses flooding the media influenced policy making behind H1N1 U.S. biosecurity measures, Mexican meat trading networks, as well as a cultural and ethnic association between Mexican people and swine.

Wallace (2009), Sparke and Anguelov (2011) bring to the forefront the irony behind geographies of blame by labeling H1N1 the NAFTA flu instead of the swine flu. This reference is drawing on the real consequences of industrialized meat production and international trade networks to hopefully invite these globalized pathways into the conversation of who and what are really to blame for HPAI. Looking at NAFTA facilitated American CAFOs in Mexico, many believe the H1N1 strain perhaps even entered Mexico from the US. Scoones et al (2008) states the international response has been largely dominated by an overarching ‘outbreak narrative’ (see Wald, 2008). Features of public fear and assumptions that outbreaks emerge from primitive, primordial, backward, unregulated contexts have also contributed to constructions of geographies between nations that are modern. There is too much fear centered on narratives of security and immigration and not enough fear around real risk communications by policy makers to help citizens be informed.

Greger (2006, p. 247) states:

“Don’t be afraid to frighten people” is considered by WHO risk communication specialists to be a key principle in communicating risks such as H5N1 with integrity. The director of the Canadian Centre for Health Care Ethics wrote, “A concern that public discussion of a probable flu pandemic will cause alarm among the public is not sufficient justification for non-communication, just as concern for a patient’s anxiety would not justify not warning him of an impending stroke.” UN Secretary-General Kofi Annan has counseled, “If other pandemics have taught us anything, it is that silence is deadly.

National governments need to accelerate the process of developing pandemic preparedness plans instead of playing on fears centered geographies of blame. Silence around the real threats and true causes for fear don’t make headlines as well as ‘outbreak narratives’ such as these geographies of blame and fear. They maintain the categorization

of health narratives through focusing on human immigration patterns as human health threats and the trade of animal products between nations as both human and animal health threats. This significant amount of attention on ‘problems’ being blame and fear should be redirected towards ‘solutions’ aimed at factory farming reform.

### ***Alternatives and a Refocused One Health***

Despite the increase over the last decade in organizations such as One World, One Health (Zinsstag, 2009), further discussion is needed to determine how to begin implementing the core values and approaches of these initiatives in a context and fashion appropriate for states such as Thailand, Viet Nam, and Indonesia. This chapter provides ideas on how to better implement a sustainable system that addresses all the dynamics inherent to the complex H5N1 interspecies disease. Constructing a multidisciplinary response to H5N1 entails using various forms of knowledge, not limited to scientific expertise, to outline where the evolutionary genetics of this rapidly changing virus cross over with the population ecology of each space and locale it inhabits. Firstly, ecosystem health narratives must be more widely heard and further developed. Wallace et al (2013) acknowledges that placing a disease within the existing OH framework of shared functional ecologies of humans, livestock and wildlife is not sufficient in addressing ecosystem health. The ecosystem is an uncontrollable vector for H5N1 transmission. Preston et al (2013) states that “it is difficult to anticipate consequences of ecosystem encroachment since the dynamics are highly variable and outcomes unpredictable.” Refocused One Health will include ecosystem health narratives to begin addressing the riskiest practices in all forms of poultry production. The global policy response to Avian Influenza has also been focused on controlling the virus and its intermittent outbreaks without considering local, social, political and economic contexts of the places where H5N1 is endemic. Through looking to advocacy groups and small NGOs we see alternative, more appropriate approaches to the global pandemic policy response.

Scoones et al (2008, p. 23) states:

GRAIN and the Third World Network have been prominent NGOs that have been critical of the mainstream framing of the debates, around livelihood and development and implication for the poultry industry in the case of GRAIN and around intellectual property and virus-sharing in the case of the Third World Network. Unfortunately the narratives of small scale poultry producers who frame the H5N1 debate in different ways and offer alternative narrative to outbreak responses are often unheard.

The management and risk prevention of a global health crisis, especially the pandemic risk potential of a highly pathogenic influenza strain such as H5N1, should fall on all disciplines not solely health, as well as all scales, communities, and organizations. The STEPs pathways project, defined in chapter 5, is continuously developing a response to Influenza A that is concerned with justice, equity and a ‘pro-poor’ stance in pandemic policy. These alternative perspectives should include small-scale farmers and advocacy groups such as La Via Campesina, GRAIN and the Third World Network. Elbe, Leach and Scoones (2013, p. 4) report during a STEPs reflection workshop on Pandemic Flu Controversies that workshop participants recognized the importance of getting local insights into dynamic and uncertain process through participatory approaches, including ‘participatory epidemiology’ and sociological/anthropological research. But some argued that this was not just about getting better data and more effective parameterization, but also about ensuring perspectives were heard that were often obscured in policy debates.

Scoones et al (2008, p. 30) acknowledges:

No systematic studies, to our knowledge, have really delved into the understanding of people’s risk perceptions and how cultural practices might affect their responses. The practice of drinking duck’s blood, common in parts of Asia, was looked upon by some with revulsion and horror, rather than as something that had to be understood in embedded cultural terms. The people were seen as backward and in need of modernization, and their fatalism about death and disease could be overcome through education and propaganda.

These conditions exist and vary on scales from the local to the national, proving

that the implementation of ‘one-size-fits-all’ intervention responses do not apply to the complex and dynamic contexts of the Southeast Asian populations. Scoones (et al 2008) states that the assumption that a standardized response plan could be effective in such diverse contexts is absurd and “all the international frameworks, capacity building programs and so on were only meant to be guidelines of proposals – but with an urgency to act and substantial funds to spend, it never quite works out like that” (p. 14). Many sections throughout this report have displayed research and analysis from a comparative approach to best view H5N1 as a disease that transcends species and intertwined environments but also to include all scales from local perspective to global frameworks, between international players, regions, nations and rural districts. Forster asks important questions about the concept of an international response to H5N1 being a ‘global public good,’ as illustrated by slogans such as ‘One World, One Health.’ “What happens when the international community, proclaiming global public good objectives, arrives in a place like Indonesia, where notions of public goods are fragmented, contested and highly contingent, and where an international public good appears very distant?” (Forster, 2008, p. 44). Incorporating the alternative pathways of groups such as La Via Campesina, GRAIN and the Third World Network can challenge pandemic preparedness models to facilitate to the local scale and cultural contexts of where H5N1 exists.

From within Wallace’s et al (2013) article *The Dawn of Structural One Health* evidence proves HPAI shocked science into recombining health perspectives for more rounded disease interventions. As a result One Health now attempts to encapsulate multidisciplinary health perspectives of human, animal and ecosystem health, and has more recently included social science perspectives. Zinsstag et al (2012) notes in a series

of *Ecohealth* editorials that through intercultural work on the human-animal relationship the emotional and financial value assigned to animals by humans can be critically determined and used to influence OH through philosophical ramifications. We argue that more social science research such as this should be encouraged to achieve cross-cultural perspectives on the socio-economic context of animal husbandry practice and commercial poultry production.

One Health currently addresses necessary disease interventions, instead of the root causes of disease outbreak or in the case of H5N1, continued AI mutation and movement. Reintegration will mobilize biosecurity efforts to move away from technical segregated containment methods. Refocused One Health can be utilized as a tool to design pandemic security models and mitigation interventions that are well rounded and regionally sensitive. However instead of calling for solely a reintegration of health narratives and expertise with the addition of crucial social science work, we also call for an entirely Refocused One Health. Wallace et al (2013) states “emblematic of Gilles Deleuz’s (1968/2004) notion that the veracity of problems, not solutions, are to be judged first, this class of One Health aims at controlling diseases without changing the fate of the capital accumulation underlying them” (p. 6.) Refocused One Health will address necessary short term interventions while at the same time long term change by firstly acknowledging root causes of outbreak. Refocused One Health needs to be utilized as a tool that is not only cross disciplinary within health science but also multidisciplinary overall to address alternative local and cultural contexts and the economic and political determinants of human-animal interactions.

### ***A Move towards Recombination***

A step in the direction of crafting a truly Recombination One Health approach would include the increased use of social sciences such as medical anthropology as a lens for framing further policy efforts. International entities such as the World Health Organization have implicated social and cultural aspects of Southeast Asian daily life in the destructive potential of H5N1 with limited efforts to delineate the rationale behind those threats. Pandemic preparedness efforts have been directed towards the further development of technological fixes rather than an evaluation of various local poultry economies, the limits of local governments on initiating and regulating small poultry reform, and local understandings of safe poultry practices. Compartmentalization of One World One Health has not only encouraged physical barriers between animals, humans, and the environment, but has isolated any dialogue between those respective fields. As the Kleinman, Bloom, Saich, Mason, & Aulino (2008) article explains,

In the case of H5N1, biologists have identified a potentially dangerous virus, epidemiologists and ecologists have tracked its spread, and social scientists and journalists have probed ways in which people might suffer from it. Yet it is precisely the interactions among these factors that deserve more attention. (p. 2)

Since the initial outbreak of H5N1 more than a decade ago there have been some signs of efforts to change human relationships with birds in Hong Kong. The booming megacity hosts a bustling population with a high demand for live poultry. For consumers, purchasing live animals is an optimal method of ensuring both the quality and freshness of the product. It is not surprising then that the confluence of one of the world's largest cities with a massive and constant flow of live poultry together constitute the makings of a very real pandemic threat. The Cheung Sha Wan Central Market sees the arrival of around ten thousand new chickens on any given day from Hong Kong and the nearby

mainland (Keck, n.d.). Certain techniques that consumers have frequently used to inspect live birds for purchase are now considered inadvisable and reserved for biologists as a means of collecting samples due to the viral threat. Poultry consumers have also seen other increases in bird market regulation such as the emphasis on having the poultry merchant slaughter the animal rather than taking home live birds. The practice of taking home live animals however remains widespread, especially on the mainland (Keck, n.d.) (Liu, 2008).

Hong Kong is also a major destination for avid birdwatchers since it is a stop for over 500 bird species along the Eastern Australian flyway (Keck, n.d.). This region has a biodiversity reserve that experience closures when H5N1 is detected within a given radius of the city. The inclusion of wild birds into this setting further complicates patterns of biological chatter along with our understanding of viral risk by presenting further opportunities for viral segments to be introduced and recombined with those found within domestic populations. This setting exemplifies the utility that a Recombined One Health approach can have when used in context.

The Hong Kong bird watching society has been sub-contracted by the Hong Kong government to monitor bird populations through the collection and examination of bird feces for signs of the H5N1 virus (Keck, n.d.). In this way amateur scientists have formed a kind of disease surveillance network that is capable of altering some regional operations should H5N1 be detected. Although these efforts represent some initiative to adapt to the menace of avian flu through the inclusion of varying branches of study and observation, they are far from being extensive enough to constitute an adequate system of pandemic preparedness. Placing such issues within a Recombined One Health framework can be

useful if setting specific factors are taken into consideration. The inclusion of groups such as amateur scientists, poultry merchants, and birdwatchers diversifies the perspectives and narratives that are taken into consideration when forming pandemic preparedness policy. This further exemplifies how the One World One Health approach as it exists outside of Southeast Asia presents a domineering perspective unless it considers local knowledge and practices.

### *Conclusion*

The H5N1 outbreak in Southeast Asia is an epidemiological narrative consisting of more than sick birds and sick humans. In order to grasp the scope and of this narrative, it is important to approach it with a wider lens than provided by the One Health model. While the One World One Health framework submits to the structure of an interdisciplinary approach, the outcome has resulted in a focus on containment and compartmentalization rather than a dynamic approach to animal, human, and ecological health. The One Health structure is a product of Northern knowledge and inherently encourages segregation of health narratives, risk generation and isolation along with containment focused measures like pandemic simulations, biosecurity measures, and media narratives.

A Recombined One Health model encourages more focused multidisciplinary health approaches and collaboration between public health agencies from all scales to combine understandings that can identify the riskiest components of our current poultry production methods. Risk can be diminished by simplifying poultry systems and can be better managed by expanding the discussion of the means by which hazards are produced. A biosocial approach, an examination of the intersections between regulation, practice,

local knowledge and biology illuminates nuanced dynamics along the supply and demand chain where containment universally dismisses them. Through this Recombined One Health approach, biosecurity practices and pandemic simulation models become a facet of risk management, not an amplifier of risk or a containment measure. Incorporating a Recombined One Health framework when reconfiguring current industrial poultry practice will use combined species health understandings to encourage organic production methods. Recombined One Health knowledge can incentivize a reduction of confined and concentrated meat production methods through highlighting the health and transmission risks these methods pose. The environment needs to be considered as an uncontrollable vector for H5N1 disease transmission that current technical strategies of security containment cannot manage or regulate.

LVC is in the position to advocate for a more regionally sensitive approach to the existing One World One Health mode. This Recombined One Health model will encourage small scale farming by advocating for shifts away from riskier large poultry farming, acknowledging the importance of maintaining a poultry industry in Southeast Asia. Mike Davis calls for the creation of “a truly global public-health infrastructure” (2005, pg. 176), and the Recombining of the One Health model would be a move towards this goal through regional sensitivity and risk awareness and minimization, carried out by multiple disciplines. By promoting this Recombined One Health model risk for a global pandemic will be lowered, and the outcomes of interventions will be more positive for animals, humans, and the environment.

## Policy Recommendations

- **Recombined One Health approach:** Incorporate local and cultural understandings of H5N1 to better construct and apply pandemic prevention methods within the region of Southeast Asia. Health agencies should incorporate alternative approaches of H5N1 prevention strategies by including multidisciplinary approaches of medical anthropology and social science to encourage human, animal and ecosystem health sector collaboration from all scales to combine understandings that can better identify the riskiest methods of our current poultry production practice. LVC should advance the implementation of a Recombined One Health that draws from intercultural work on the human-animal relationship to better determine the emotional and financial value assigned to animals by humans within developed and developing nations.
- **Recombined One Health frameworks:** Advocate for a redevelopment of biosecurity practices and simulation models that more appropriately address the issues surrounding H5N1 from a prevention standpoint. The redevelopment includes, but is certainly not limited to, the following:
  - Operate poultry production and sales under conditions where risks are quantifiable, but are not imposed upon small producers
  - Biosecurity measures be dependent on flock size, region, and local and conditions
  - Push for legal regulations of flock densities (aiming for lower density and smaller flock size)
  - Improve waste management and ventilation regulations in large agricultural operations.

## CHAPTER 7

## Food Sovereignty Combats the Threat of Avian Influenza

*Peter Clinkenbeard and Megan Mayer*

**Abstract:** *This chapter examines the concepts of food security, food sovereignty, and One Health and provides an analysis regarding their effectiveness in combating avian influenza. Contextualizing food sovereignty in relation to food security, demonstrates the global setting in which these terms are used and defined. Illustrating the dual commitment of organizations to both food security and One Health, this chapter also examines the tensions existing in such a system, proposing Structural One Health as a response. The implementation of food security has created the threat of pandemic highly pathogenic avian influenza (HPAI) and as a result any global health response must address the problems created in the Food Security regime. Food sovereignty as a response that hands food production back to the peasants largely diminishes the threat of pandemic HPAI. The section exploring the history and political power of La Via Campesina (LVC) explains the role that it plays in combating HPAI. Using Diversified Farming Systems as an example, this chapter provides concrete policy recommendations about the implementation of food sovereignty on a regional and national scale. The Jakarta Call and the Indonesian Food Law of 2012 serve as case studies that stress the interconnectedness of food systems and global health.*

**Keywords:** *Structural One Health, Food Sovereignty, Organic Poultry Production, Organic Agricultural Production, Food Security, La Via Campesina, Highly Pathogenic Avian Influenza*

### ***What is Food Sovereignty?***

Food sovereignty is a concept best illuminated by the Declaration of Nyeleni in 2007, signed by more than 500 representatives from 80 different countries.

Food sovereignty is the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems. It puts those who produce, distribute and consume food at the heart of food systems and policies rather than the demands of markets and corporations. It defends the interests and inclusion of the next generation. It offers a strategy to resist and dismantle the current corporate trade and food regime, and directions for food, farming, pastoral and fisheries systems determined by local producers. Food sovereignty prioritizes local and national economies and markets and empowers peasant and family farmer-driven agriculture, artisanal fishing, pastoralist-led grazing, and food production, distribution and consumption based on environmental, social and economic sustainability. Food sovereignty promotes transparent trade that guarantees just income to all peoples and the rights of consumers to control their food and nutrition. It ensures that the rights to use and manage our lands, territories, waters, seeds, livestock and biodiversity are in the hands of those of us who produce food. Food sovereignty implies new social relations free of oppression and inequality between men and women, peoples, racial groups, social classes and generations. (“Declaration of Nyeleni” 2007).

The Nyeleni Declaration stresses the right of people to determine their own means of production, affirming the right of the peasant to their means and style of life as it has been practiced through the years. It denounces transnational organizations that do not recognize the importance that food has in respect to livelihood and culture. Food sovereignty has international implications by prioritizing local and national food systems. In the words of Dena Huff, the North American coordinator for LVC, “everything that food sovereignty encompasses is human rights, women's rights, and education; everything that makes a good life and protects the planet” (Ridbery, 2010).

Food sovereignty combats highly pathogenic avian influenza (HPAI) by changing the nature of food production. As mentioned in previous chapters, the role globalization plays in creating the risk of threats such as HPAI comes not only at the biological level,

but also at the social and economic levels. Were it not for the “innovations” of big agriculture, the conditions necessary for the creation of such a threat would be largely nonexistent (J. Otte, et al., 2007). The trade networks that cause the threat of a *pandemic* disease would not exist was it not for the current globalized food regime. Lastly, the production systems that turn poultry into a commodity to be maximized transform the nature of agriculture and the peasant lifestyle. The nature of globalized food networks means that the production of food is no longer a style of life, but rather a way of achieving profit. Thus, we see that avian influenza is inextricably linked to the principles of food sovereignty and the reality of the food production regime.

In order to provide greater context to food sovereignty, it is important to observe its ideological alternative: food security. Born from the commitment of international agencies to reduce hunger globally, food security is based on four guiding principles: first, food availability, which is determined by whether there to be enough food for everyone; second, food access, which is determined by whether people have enough resources to actually obtain the food produced; third, food use, which is determined by whether the food produced is actually being used to provide basic nutrition and care to everyone; lastly, food stability, which means people are not subject to hunger as a result of market abnormalities and natural disasters (“Food Security,” 2006). As mentioned previously, international institutions such as the WHO, FAO, WTO, the World Bank, etc., largely support food security. Food security actually shares many characteristics with food sovereignty on paper; the difference mostly lies in its implementation and focus. LVC however has been largely critical of food security for the way that it has come to embody western hegemony, below is a critique of the Food Security regime.

### *The Failures of Food Security*

Food security was coined at the World Food Summit in 1996. The summit, led by the FAO, endeavored to create a global food regime that was conducive to the eradication of poverty and hunger. With the principles of sustainable agriculture, fair and liberal trade, and gender equality, the Rome Declaration on Food Security (1996) sought to advocate for the global poor. Yet many peasant advocacy groups hold such a term in disdain. Why? This section will critically analyze food security alongside food sovereignty.

As mentioned in previous chapters, the relationship between HPAI and the global food regime is not as tenuous as it might seem. The quick mutation of the virus is a product of industrial poultry production, and the spread of the virus is hastened by inherently imperfect biosecurity mechanisms. These globalized networks have almost singlehandedly created the very problem this report is seeking to remedy. Ironically, these ardent supporters of the Food Security regime, which contributed to the creation of HPAI, are also the main parties in combatting HPAI's spread.

These organizations have approved a method of combatting HPAI known as One Health ("Contributing to One World One Health" 2008). This method of addressing this virus is meant to be an interdisciplinary response that stresses the interconnectedness of environmental, animal and human health. The policies of One Health have largely focused on biological measures (involving human, animal and ecological factors) to address the spread of HPAI, but have done little in the realm of socioeconomic adjustment. One Health has done nothing to adjust the systems that create disease, despite the admission in an FAO report that industrial systems of production contribute to the

virulence and danger of such a disease (J. Otte, et al. 2007). By studying food security in conjunction with One Health, we recognize the ties that food production has to the emergence of zoonotic diseases, and the ways that the globalized food regime reinforces these ties. All the while, the institutions reinforcing the globalized food regime are advocating for One Health as a response to the very problems which they have created, One Health, for the sake of maintaining the Food Security regime, has abandoned its mandate to provide a holistic approach to diseases. The result is a symptomatic One Health that deals only with the prevention of a pandemic, but not the prevention of the disease itself.

Structural One Health emerged as an ideology of response to combat the underlying tensions of a system that creates the disease which it seeks to treat. The Structural One Health approach understands pathogens it studies by integrating organism and environment, biological and social, and natural and social sciences. In creating a Structural One Health approach, scientists, both social and natural, are able to provide a cohesive holistic response to a multidisciplinary problem (Wallace et al. 2013). Thus, the study of food security will be held in contrast with the principles of Structural One Health, knowing that they are necessarily interconnected.

The role of these international organizations in creating the globalized food regime also cannot be overlooked. The WTO (while not expressly related to One Health) and the World Bank have acted as liberalizing forces in the creation of the global economy and food regime. Eliminating tariffs and subsidies in the name of creating free trade, both of these supranational organizations are instrumental in creating food security. While the FAO and the OIE play less direct roles in the creation of such a liberalized

market, their indirect role is made apparent in the way that they assign blame and create responses. The WHO, OIE, and World Bank stress the importance of biosecurity, assigning blame to backyard poultry farmers as they claim said farmers have the most “bio-insecure” food production systems.

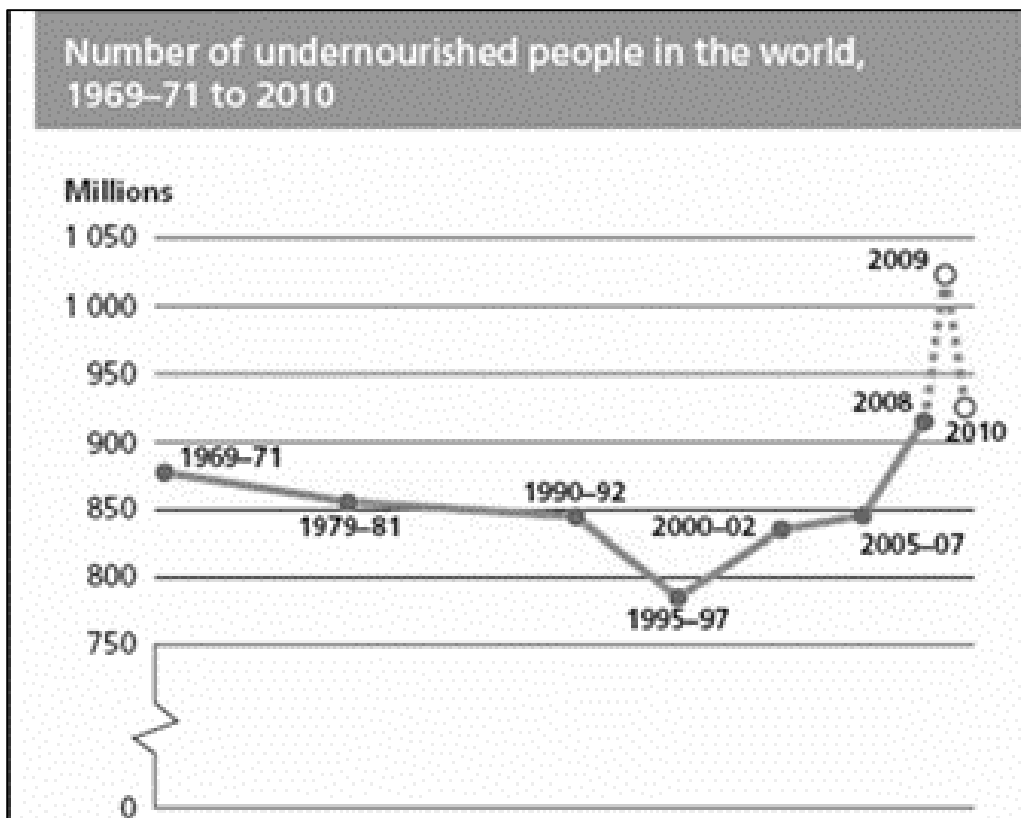
Rather than attempting to refute the assignment of blame as previous chapters have done, more energy will be put towards discussing the way that these international institutional powers have created a paradigm that contradicts the commitment to a Structural One Health. If food security is creating bio-insecurity, how did such a situation emerge? While the goals of food security are humanitarian and well-intended goals, they have become skewed.

One of the main critiques of food security is how it addresses the root causes of hunger and undernourishment. The implementation of food security focuses on the creation of calories, without focusing on food quality or distribution. When adjusted for population increase, caloric production world-wide has increased by 17 percent between 1970 and 2000. Plenty of calories are being produced; the issue is where these calories are going, and what kind of calories they are (M.S. Carolan 2013). It is not sufficient to say that the world is food secure if there is enough corn to feed the world, as no one would choose to nor be able subsist on such a diet. By maintaining the caloric standard, global institutions ignore the root issues involving its distribution and use. In a report from the International Fund for Agricultural Development one of the main policy recommendations is the investment in local agriculture (“IFAD Strategic Framework”, 2011). This is valuable because it stresses the productivity of local farmers in their

endeavors; however it does nothing to recognize the structural problems created by profit-seeking commoditization.

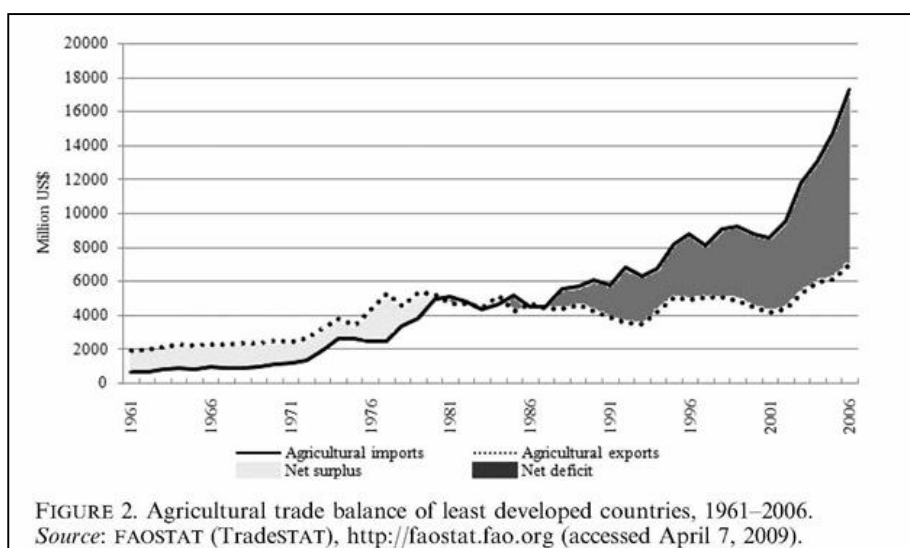
Another way in which food security contradicts structural One Health is through the supposition that liberalizing food markets or the trade of new goods will bring wealth and full stomachs to developing countries. While it is true that global poverty has been decreasing steadily over time, undernourishment has actually been increasing since 1995. The inverse relationship between poverty and undernourishment indicates a fundamental flaw in the global Food Security regime. The greater macroeconomic context of market liberalization has also led to increasing price volatility (Clapp, 2009). With the global poor spending a larger portion of their household budgets on food, this increasing price volatility can often determine the nourishment of these families.

**Figure 7.1: Number of undernourished people in the world (FAD strategic framework 2011-2015, 2011)**



Food security ultimately increases the dependency of developing countries on richer countries and increases malnutrition and hunger. Ultimately, it seems that the ones who should be legislating around food security and food policies are the ones for whom it would matter most, the Global South, and yet food security was a policy crafted by the global North.

**Figure 7.2: Agricultural trade balance of least developed countries (Source: *Food Price Volatility and Vulnerability in the Global South: considering the global economic context, 2009*)**



The Food Security regime seems to have been ineffective in its most essential element, decreasing global hunger, and for that reason it is clear that it cannot remain as it has been. Going back to the definition, we realize that the problem with food security is not its purpose, but how it has been enacted. At its heart, the Food Security regime ought to play a significant role in the One Health strategy set out to combat avian influenza; however in its action, the Food Security regime increases the danger of an avian influenza by creating complicated networks of trade, and by decreasing the health and infrastructure of indigenous food regimes.

***La Via Campesina (LVC)***

LVC was born out of the need for peasants to reclaim their lifestyle. The name translates to “The Peasant Way (or Road)”, a term that was meant to reclaim the peasant identity as an autonomous and time honored tradition of life. “There have always been campesinos.” said Marcelo Carreon Mundo, leader with the Ejidos Productores Forestales de la Zona Maya, “what did not exist before were investors, industrialists, political parties, etc.” (Desmarais, 2007, 138). Recognizing the need for peasants from countries around the world to bond together to lobby for their rights was the first stage of LVC’s development, as the impact of global policies was felt by several different peasant groups (Martinez-Torres, Rosset 2010). As globalization became a much more acute and recognizable force, the role of LVC grew, and has since become the premier advocacy organization for the rights of peasants around the world. Representing 164 different organizations in 79 different countries, LVC has become not only a regional force in the fight for food sovereignty, but an international one. Currently based in Jakarta, Indonesia, LVC is poised to make an enormous impact, regionally and internationally regarding the health and socio economic injustices caused by industrial poultry production.

LVC is a grassroots movement, which believes that the true power of a system lies in the people who work the system and not those who lead it. Their platform is focused on a grassroots approach to policymaking and advocates strongly against international organizations such as the WTO. It is valuable to understand this platform, because it stresses a regionalized approach, necessary when addressing the problems created by zoonotic disease. Avian influenza provides a unique opportunity for advocacy by providing tangible evidence of how industrial agriculture, particularly industrial

poultry production, has created a dangerous problem. This affirms the need of food sovereignty to regional governments, and even to some degree international institutions.

The fact that the United Nation's 1<sup>st</sup> millennium goal has to do with eradicating extreme poverty and hunger ("The millennium development goals report," 2013) indicates that there is some recognition among international organizations that problems exist in the global economy. This recognition is valuable; as such organizations are major players in policies regarding food security. Food Sovereignty, and the solutions that it claims to bring, addresses directly four of eight millennium development goals and indirectly addresses at least three of the remaining four, one being the combatting of disease in the developing world. Using avian influenza as a scientifically proven threat of industrial agriculture might help mobilize some international institutions to make the production of food more ecologically healthy. International institutions do have power, and though the one could never solely implement food sovereignty from the top down, such advocacy could be a means of leveling the playing field for peasants and smallholders.

In addition to lobbying and acknowledging the power of international institutions to make a difference, LVC address regional and national venues. In many countries in SE Asia, there is already a political will to make these reforms happen, and actions such as the 2012 Food Law in Indonesia serve as good examples. The Food Law is meant to establish food self-sufficiency as a means to achieve food sovereignty (Wibowo, 2012). Therefore by effectively lobbying regional groups such as ASEAN or nations such as Indonesia, Vietnam or Thailand, food sovereignty might become a physical model that can be improved upon and verified. In the midst of a broken model, the use of economic

incentives to restore equilibrium in the marketplace can be a means of empowering and establishing the peasant class. The issue at hand is that the true cost of industrial poultry production, one that includes the costs of biological insecurity and pandemic risk, is not actually reflected in the market price of the products produced under such conditions, which reflects poor economic practices. To account for bad economics the Indonesian Health Minister, in an address to the WHO in 1998, proposed that before any project was to undertaken, it must first undergo an evaluation of its environmental effect (Sujudi, 1998). Evaluating the health costs associated with economic projects is the first step towards internalizing such costs. By utilizing market mechanisms, LVC might be able to effectively gain traction and challenge industrial production.

Lastly we recognize and acknowledge the work that LVC already does in mobilizing the many peasant actors whose voices are infinitely important to the debate. To lobby these voices is perhaps most important of all. Using outbreaks as a means to mobilize and demonstrate support for policies around food sovereignty is an effective way to gain political momentum quickly. If it is demonstrated to peasants the true threat of industrial agriculture (threats to which they are likely acutely aware), mobilization of such voices ought to be easy. Enhancing the power of the peasant vote however is something entirely different. If the peasant bloc is to effectively recognize its own self-interest, it must create an efficient alternative or revision to food security, and it must do so at an international, regional, national and local level. LVC must play its part in both mobilizing the peasant voice around a coherent policy, and in the creation of such a policy, in order to achieve the goals of food sovereignty.

***What does food sovereignty actually look like?***

In promoting regionally sensitive food sovereignty movements, particularly in SE Asia, countries can achieve self-reliance and market success without relying on industrial poultry production. Its goal is to abolish market-dependency so that successful markets become a way to improve well-being, instead of an end in themselves. Food sovereignty promotes alternative means for the production of poultry and other food-based industries so that factory farming may no longer be seen as the most efficient means of production. LVC's rights-based claims over the last 20 years suggest that, "public policies for food sovereignty tend to promote agriculture as the motor for the economy and as a main contributor to economic growth; they seek to boost local and peasant-based food production for food security, often in the context of a self-sufficiency strategy" (Claeys, 2013, p. 5). By implementing organic and diversified farming systems in a general sense, as well as suggesting specific organic poultry production methods, SE Asia can boost food production and achieve self-sufficiency.

Food sovereignty and organic agricultural methods are often inextricably linked, agricultural cultivation and self-sufficiency (as opposed to importing foodstuff) is often the choice of small-scale farmers and peasants. Encouraging organic agricultural and poultry production promotes biodiversity that provides protection against disease virulence associated with poor genetic diversity, discussed in detail in the biology chapter of this report. Diversified Farming Systems (DFS) emerged as a means of promoting organic practices and biodiversity. The multifaceted production of DFS is illustrated in a quote by Kremen, Iles and Bacon:

Farming practices and landscapes that intentionally include functional biodiversity at multiple spatial and/or temporal scales in order to maintain ecosystem services that provide critical inputs to agriculture, such as soil fertility, pest and disease control, water use efficiency, and pollination (2012).

DFS blend social-ecological systems and manifest at the field-level in mixed cropping systems, rotation of crops or livestock over time. Kremen et al suggest that DFS results in agro-biodiversity in terms of heterogeneous landscapes that will promote arable land on which local people can make their own choices about agricultural cultivation. The impermanent nature of DFS and their flexibility makes these systems a feasible framework for a regionally sensitive food sovereignty movement: “A DFS is not only spatially heterogeneous, but is variable across time, due both to human actions (e.g., harvest, crop rotations, fallows, and other management practices or land use changes), and natural successional processes” (Kremen et al, 2012). Because agro-ecology is a set of sustainable farming practices, DFS acts as a framework, “that draws from agro-ecological, social, and conservation sciences to focus analytical and action-oriented attention toward farming systems in which cross-scale ecological diversification is a major mechanism for generating and regenerating ecosystem services and supplying critical inputs to farming” (Kremen et al, 2012).

Because industrialized farming systems simplify ecosystems to maximize the profitability of commodities, DFS provide a reasonable and direct solution to turn away from monocrop and monoculture production. Farmers are often trapped in industrial management practices because of contracts, economies moving toward specialization, and government subsidies among other things. Diversified Farming Systems provide an increase in arable land with which farmers are re-instilled with power of choice, to choose how they would like to define their own food systems. This must be addressed in conjunction with the political economy that created the need for the shift. Politics and power relations in SE Asia must be studied to establish the context in which DFS are to

be implemented. Thus, local and international organizations such as LVC and GRAIN, an organization with which LVC has worked before, play a role in promoting and diffusing these ideas.

With Diversified Farming Systems as a framework for implementing food sovereignty in SE Asia, we now discuss organic agricultural methods and the positive ways in which such practices can help to achieve food sovereignty. Some studies have shown that organic agriculture can contribute equally if not more to food supply than green-revolution methods such as fertilizers, curbing any claims that such practices are less efficient or productive (C. Badgley et al, 2007, p. 88). Just how much more efficient, quantitatively speaking, is not known precisely and would require support from research institutions for further investigation (C. Badgley et al, 2007). However, “overall, the compiled data suggest that organic agriculture is economically more profitable: net returns, taking total costs into account, most often proved to be higher in organic systems” (UNCTAD, 2013, p. 53). In order to promote DFS, natural nutrient cycling processes could be something of the following: cover crops, manures, compost, crop rotation, intercropping, and biological pest control (C. Badgley et al, 2007, p. 87). The aforementioned organic and sustainable practices can help improve soil quality and thus provide a means for indigenous people to regain control over production. Enabling farmers to choose how they use their land is a means for locals to have the flexibility and autonomy to turn away from a dependency on industrial farming practices. Creating markets for rotational organic crops maintains and augments the profitability of small-scale farming in developing countries (UNCTAD, 2013).

Because agro-ecology is the study of the environment system in tandem with animal and human systems, promoting a self-sufficient method of agricultural production acts as a support for promoting organic poultry production. According to the United Nations Conference on Trade and Development report, “one advantage of agro-ecology is its reliance on locally produced inputs... [relying on DFS to] produce their own fertilizers and pest control systems” (UNCTAD, 2013, p. 36). Organic poultry production calls for a more ‘natural’ method.. Examples of its implementation in places other than SE Asia have proven that it is one way that peasants can work to achieve food sovereignty in a productive and biosecure way. Here, agro-ecology is understood as the, “application of the science of ecology to agricultural systems, [that] can result in modes of production that are not only more resilient, but also both highly productive and sustainable, enabling them to contribute to the alleviation of rural poverty, and thus, to the realization of the right to food” (UNCTAD, 2013, p. 34). Thus, the concept of agro-ecology compliments the urge to practice organic methods, a term used in place of sustainable, to help “realize” this right and access to food. There is not much data regarding the productivity of organic poultry production in SE Asia specifically, however, movements are in place that suggest that there exists a demand in Indonesia for an organic market, and organic poultry specifically. Using a case study on organic poultry production from the Swedish University of Agriculture Sciences, we identify methods used that could be mimicked in SE Asia, remaining culturally sensitive to the needs and desires of those peoples.

Organic poultry is similar to organic agricultural practices mentioned previously in that it involves, “sustainable resource utilization without adding synthetic substances

such as chemical fertilizers and herbicides” (Berg, 2001, p. 37). Said practices call for free-range roaming areas that are only most productive when sustainability cultivated in the ways mentioned previously. In organic poultry production, farmers are not allowed to use antibiotics or chemotherapeutics, as used in conventional poultry husbandry, but “the rules for organic animal husbandry do allow routine vaccination, when ‘there is an obvious need and other methods of treatment can be regarded as less acceptable’” (Berg, 2001, p. 38). Thus, organic regulations do recognize and encourage biosecure practices when appropriate and necessary, while maintaining the integrity of an organic label. Such methods are gaining momentum as 19% of organic producers in 2007 are in Asia (Greenpeace, 2009, p. 45). It is true that free-ranging and organic birds can be infected with parasites, but frequently changing pasture grounds, i.e., using diversified cropping systems mechanisms, can help reduce this risk (Berg, 2001, p. 40). Also, similar to crop-rotation in organic agriculture cultivation, grazing areas need to be allowed to replenish without birds on them and can be replenished in the organic ways suggested herein (Berg, 2001).

Ultimately, what is most crucial for understanding the benefits of organic poultry production versus conventional poultry production is “a need for information about biosecurity, disease detection and disease prevention on organic poultry farms” (Berg, 2001, p. 43)- detailed information about biosecurity can be found in the preceding chapter of this report. Organic poultry production is meant to compliment backyard farming practices that exist already by promoting safe and biosecure methods to keep waterfowl away from free-range poultry, i.e., using self-feeder dispensers that do not attract waterfowl (Fanatico, 2008). In addition, maintaining sanitation between flocks via,

“downtime [between flocks] of two to three weeks will help control pathogens that need a host to survive” (Fanatico, 2008, p. 5). Even though current comparisons of organic agriculture to conventional practices have routinely been biased to conventional methods, there exists an, “urgent need to direct much more research and investment into extension of services to support organic agriculture and shift the bulk of public support from polluting activities to sustainable practices to give equal footing to organic farming systems” (Greenpeace, 2009, p. 53). This chapter outlines organic practices that could provide an alternative means to industrial poultry production and thus, subside the threat of avian influenza. Recordkeeping of the effectiveness of organic poultry production in SE Asia will also be helpful in evaluating its benefits.

### ***Food Sovereignty in Indonesia***

Food sovereignty in Indonesia emphasizes rice as a means to feed its people (Suraya Afiff, personal communication, January 30<sup>th</sup>, 2014). However, the market for rice in Indonesia is so tightly regulated by the government that domestic production for local consumption can be more expensive than importing it from elsewhere (Natawidjaja & Rum, 2013). Many skeptics are concerned that food sovereignty is, “a good advocacy term” (Suraya Afiff, personal communication, January 30<sup>th</sup>, 2014), but that it may not be feasible. Suraya Afiff, a professor at the University of Jakarta, for example, believes that food sovereignty in the country, defined as enough availability and access to rice for Indonesia, is not feasible due to “poor soil [quality], a scarcity of water or no good irrigation system[s] available” (Suraya Afiff, personal communication, January 30<sup>th</sup>, 2014). However, food sovereignty does not necessarily only mean rice cultivation in Indonesia. For example, in Indonesia specifically, 100% rice self-sufficiency has been

found to be one of the most expensive and least effective means of achieving food sovereignty (Natawidjaja & Rum, 2013). For Indonesia, a policy that promotes the goals of the Food Law 18/2012, that slows down conversion of productive agricultural land to non-agriculture may prove to be the most effective (Natawidjaja & Rum, 2013).

Food sovereignty, as defined by LVC, is about returning autonomy and decision making to the peasants of the country to define their own food and agricultural systems. In Indonesia, where the people are plagued with market competition from factory farming, and financial incentives to sell land to the government as opposed to cultivating on it, food sovereignty would be providing the resources and political economy necessary to give the people the freedom to choose what they would like to produce in an efficient, productive, and biosecure way. By providing alternative methods for safe and biosecure organic poultry production as well as providing specific examples of ways in which soil may be revived for agricultural production as an alternative way to meet SE Asian food demands, we provide incentives to end factory farming practices that perpetuate the threat of avian influenza.

### ***Food Sovereignty, an Ideology that is Catching On***

This ideology of a food sovereignty movement is exemplified in SE Asia by the Food Law 18/2012 passed in Indonesia. The Food Law promotes access to food, diversification, local food, safety, nutrition and “the ability to define own food preference (food sovereignty)” (Natawidjaja & Rum, 2013). Thus, the implementation of this law exemplifies the fact that policy makers in SE Asia, Indonesia in particular, are seeing the relevance and significance in promoting primarily domestic production, in line with food sovereignty. However, the corporate and global actors must be convinced of the

detrimental effects of their practices, in this case referring to the health threat that industrial poultry production poses to society. Therefore, just as food sovereignty promotes individual human rights, it also encourages a general “social control over the food system” (Southgate, 2011, p. 22). At the Jakarta Call in June of 2013, LVC addressed how a holistic understanding of the ways in which environmental, human, and animal systems work together is necessary to “reject confined animal production” (The Jakarta Call, 2013) that is repeatedly practiced in industrial farming and that has proven to be a serious contributor to the emergence of avian influenza.

### ***Concluding Remarks***

Food sovereignty is not to be confused with food security nor with the perceived notion that food sovereignty is simply one country producing what it does most efficiently and feeding an entire population based off of that commodity. Food sovereignty is different than food security because it encompasses choice and autonomy, whereas food security focuses too much on caloric needs and not enough on the political and social issues surrounding production. Furthermore, food sovereignty is about returning the autonomy to the local people in a specific area in a way that gives peasants the opportunity to achieve a means of production that is economically self-sufficient and self-reliant. As we have identified globalization and the innovations of big agriculture as the greatest influences and instigators of avian influenza, we denounce such practices, and believe food sovereignty is a shift away from these harmful methods. Food sovereignty is best achievable by ecologically sound and sustainable methods, exemplified in organic poultry practices and organic agricultural practices that provide further production methods beyond industrialized poultry production. Because LVC has

established itself as a peasant movement, returning the power of choice to the people, it is the best way to advocate for the points addressed in this report.

## Policy Recommendations

- **International:** Continue the advocacy work being done to remove the World Trade Organization from agricultural and food oriented policies.
  - Lobbying OECD countries to remove policies restores the power of the global South in policy-making around food.
  - Fighting for the integration of food sovereignty into global policymaking terminology.
- **Organic poultry production:** We recommend the practice of organic poultry production as an alternative to conventional industrial methods, which we believe significantly contribute to the increased virulence of avian influenza. Organic poultry practices allow safe and biosecure methods, alluded to in chapter six, for cultivating poultry at the local level.
- **Organic cultivation:** We encourage organic cultivation of agriculture as a mode to enable Southeast Asia and Indonesia the flexibility to choose how local people define their own food system. Organic agricultural practices replenish existing poor soil conditions and provide food and income alternatives for the local farmer.
- **Regional:** Enhance collaboration among peasant and advocacy groups in Southeast Asia. Organizations such as GRAIN have worked extensively in combatting the industrial food complex, and enhancing collaboration with them would strengthen advocacy agendas of both organizations.
- **Media attention:** Through cooperation with the media, bring attention to outbreaks of avian influenza, and the parties responsible for the outbreak.
- **National:** Advocate for a progressive tax based on flock size, to equalize market incentives and rewards for small scale farmers and large scale. Avian Influenza is an externality of the industrial poultry production system. A progressive tax that internalizes the health costs of large flock sizes restores market prices to equilibrium, restoring the political economy of the peasant. The taxes collected will be used to fund restocking measures and viral preparedness measures.

## CONCLUSION

## A Bird's Eye View

*Michelle Auster, Tessa Carter, Marina Fitzpatrick, and Colin Mackenzie*

While there are many positive effects of globalization, the most detrimental are continuing to reproduce themselves around the world today, with most of the blame falling on developing countries. Influenza, a virus that has existed for centuries, is now more of a threat than ever to human and animal health due to several factors. The negative effects of globalization, poor infrastructure, and hazardous farming practices have led to the threat of a global pandemic reminiscent of outbreaks and plagues of the past. Viral mutation has increased rapidly, raising the alarm for pandemic preparedness. An outbreak in Southeast Asia has the potential to spill over to the rest of the world. This policy report is centered on how we may preemptively curb the threat of Highly Pathogenic Avian Influenza. We seek to determine programs, policies, and changes in actions that are regionally and culturally sensitive. However, pandemic preparedness is not a long-term solution; it is one limited way to boost national infrastructure in order to combat pathogens. This is why a focus on eliminating the current, most risky practices of industrial agriculture fueled by the monopolistic tendencies of global capitalism is vital to sustainable population health.

Food sovereignty may have at first seemed like a distant and far-removed recommendation to address and combat pandemic influenza. However, we hope that through a detailed analyses of H5N1 and a critical dissection of harmful practices that exacerbated the outbreak, policy perspectives will shift towards responsible farming practices. Confined Animal Feeding Operations (CAFOs) have become an industrialized

standard, and the use of their most harmful and risky practices are widespread. These institutions will maintain their power over industry in the coming future until they can be regulated. They will continue to pose an imminent threat to One Health until changes are made.

With unprecedented numbers of chickens intensively confined at record densities, we are witnessing bird flu viruses adapt to humans in ways we have never seen before. This suggests that artificial environments motivate HPAI to evolve and increase in virulence. By examining the biological mechanisms behind HPAI, we have identified trends that prove that as industrial agriculture intensifies, so do outbreaks. Therefore, a comprehensive understanding of the virus's natural reservoirs, as well as how the virus moves throughout the environment is critical to determining where and how the virus penetrates the human sphere. Given that HPAI evolves most efficient and effectively from LPAI in human constructed environments we have determined that it is necessary to dismantle and end the riskiest practices of industrial agriculture before it is too late.

We have identified a variety of issues plaguing the implementation of culling and vaccination in response to avian influenza. While we recognize that both of these are essential measures, the current methods are insufficient and need to be amended immediately. Past responses to avian influenza outbreaks have been biased against the most endangered populations, and instead have catered to the desires of wealthier nations, pharmaceutical companies and poultry producers. In the case of human vaccination, it is clear that the system as it now stands will not be successful in delivering sufficient human vaccines to the developing countries of Southeast Asia that are at high risk of sustaining serious outbreaks. Poultry vaccination against H5N1 needs further exploration

in order to ensure that it constitutes money well spent, especially for countries with scant resources. Implementation of culling strategies and related compensation has favored large corporations over smaller farmers. This dynamic should be reconsidered, especially in light of evidence suggesting the extent of large-scale poultry producers' contribution to the heightened threat of avian influenza. Lastly, more research is vital in order to strengthen the current technical responses of vaccination and culling with the hope that we can ultimately mitigate H5N1's threat to the best of our abilities, and for all populations at risk.

We have also recognized that there are inefficiencies in the interactions between international, national and local scales in the creation and implementation of H5N1 response programs. International agencies are charged with providing mitigation capital, a term we developed to encompass the variety of resources offered to national governments in the fight against Avian Influenza. Mitigation capital takes a variety of forms and encompasses research, guidelines, personnel, funds and academic and health expertise. While we acknowledge that large international organizations involved in health have both the means and mandates to create and deliver mitigation capital, interactions between scales can generate inefficiencies that result in problems at the national and local levels. Specifically, we are concerned with a deficiency in cultural consideration in response program implementation. In our case studies within Thailand, Vietnam, and Indonesia we explore the influence of mitigation capital on national health systems and why the element of local and cultural consideration is so important. In order to bring this element into the discussion and better harness the power of mitigation capital, we

recommend the inclusion of individuals' and communities' experiences, understandings and ideas about H5N1 in the creation and implementation of response programs.

Technological developments have attempted to justify the riskiest practices through narratives of containment in terms of both production and pandemic response measures. While biosecurity and transmission control measures have been heavily developed in recent years, they cannot be relied upon exclusively in the prevention and inhibition of disease spread. Transmission control measures encourage isolation and compartmentalization of human, animal, and environmental health as a means of minimizing contact among various animal species and humans. However, among the economies of scale found in industrial agriculture, minimizing risks brought about by interspecies contact is simply insufficient. Interspecies contact is an unavoidable fact that is inherently built into the modern system of commercialized poultry and will continue to present risks to public health so long as biologically hazardous practices are pursued. A Recombined One Health model encourages bringing the fields of human, animal, and environmental health back into an exchange with one another through a multidisciplinary approach and collaboration between public health agencies from all scales. Including small actors such as local producers and distributors in the dialogue on industry regulation and restructuring will lead to the formation of industry standards that simultaneously mitigate immeasurable risk while protecting their livelihood. A biosocial approach, an examination of the intersections between regulation, practice, local knowledge and biology illuminates nuanced dynamics along the supply and demand chain where containment universally dismisses them.

A distinction must be recognized between food sovereignty and food security to emphasize the empowerment that food production grants small producers. Where food security concerns itself primarily with access to food as a means of meeting the caloric needs of a population, food sovereignty accentuates the choices, independence, and autonomy that are facilitated by an individual or community's ability to produce food for itself. Food sovereignty preserves the voice of the small producer in political and social discourses on the management of the agricultural industry and holds economic self-sufficiency and self-reliance as essential principles of the small farmer's living standards. As globalization and the innovations of big agriculture have been identified as the single most significant causative factors for avian influenza, we believe food sovereignty presents a beneficial shift away from biologically and socially hazardous practices. Organic poultry production presents the best pathway outside of industrial poultry production to provide for local populations in ecologically and biologically sustainable methods. As an established leader in the peasant movement LVC is in a favorable position to return the power of choice to small agricultural producers by advocating the recommendation found in this report.

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[http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&ved=0CCcQFjAA&url=http%3A%2F%2Fwww.k4health.org%2Fsites%2Fdefault%2Ffiles%2F2013\\_API%2520Program%2520FINAL.docx&ei=ZMcOU9-QIJKGogSJ4ILACQ&usg=AFQjCNGuwa8ThcigxatI74yViQ\\_IHtbSqw&sig2=RlOjb6sHleaVwhQa6\\_754A&bvm=bv.61965928,d.cGU](http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&ved=0CCcQFjAA&url=http%3A%2F%2Fwww.k4health.org%2Fsites%2Fdefault%2Ffiles%2F2013_API%2520Program%2520FINAL.docx&ei=ZMcOU9-QIJKGogSJ4ILACQ&usg=AFQjCNGuwa8ThcigxatI74yViQ_IHtbSqw&sig2=RlOjb6sHleaVwhQa6_754A&bvm=bv.61965928,d.cGU).
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## Appendices

### APPENDIX A: Chapter 3, Biology of H5N1

Figure 1: (Davidson, 2005)

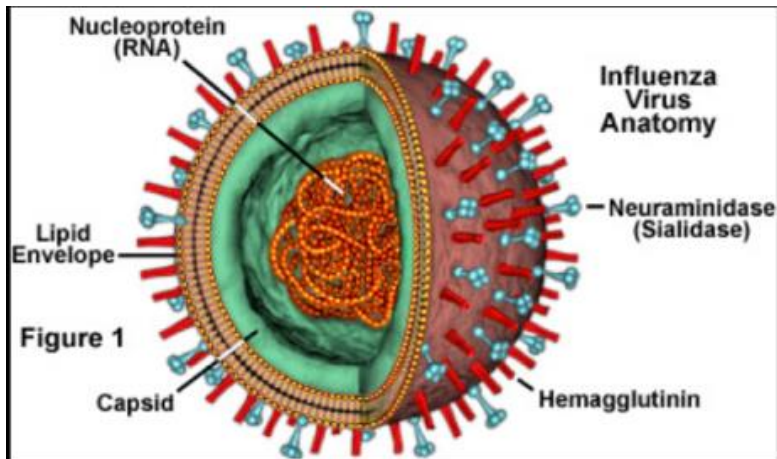
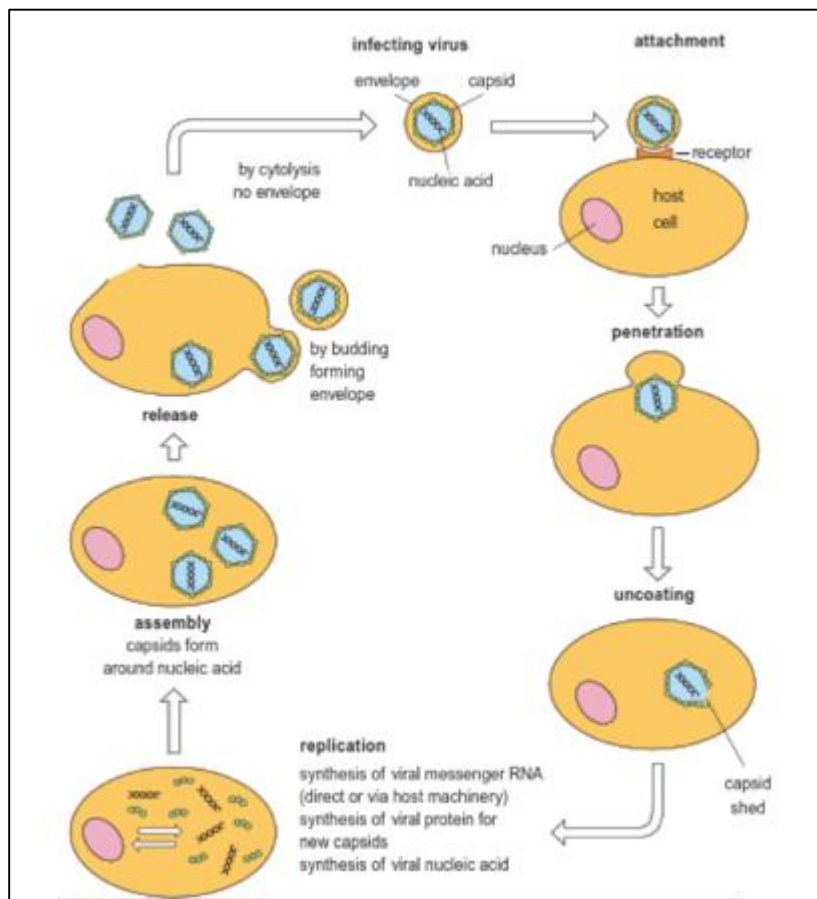
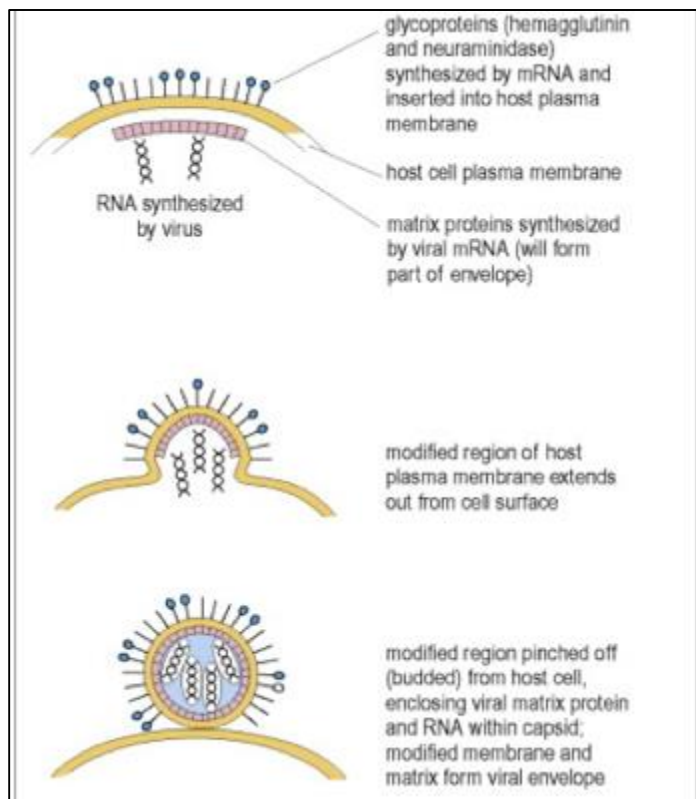


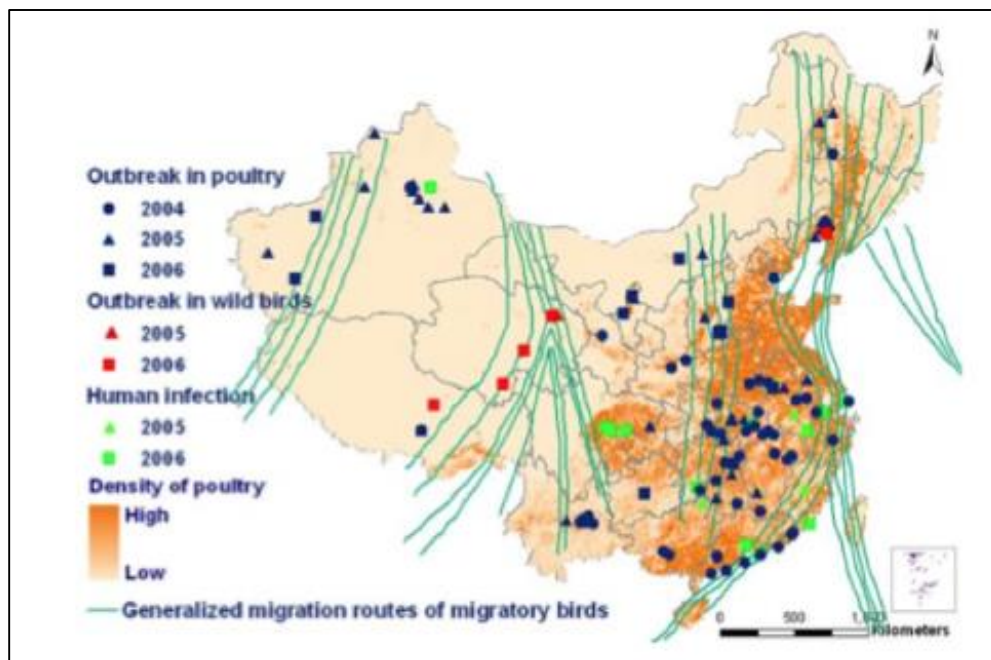
Figure 2: (Goering, 2012)



**Figure 3: (Goering, 2012)**

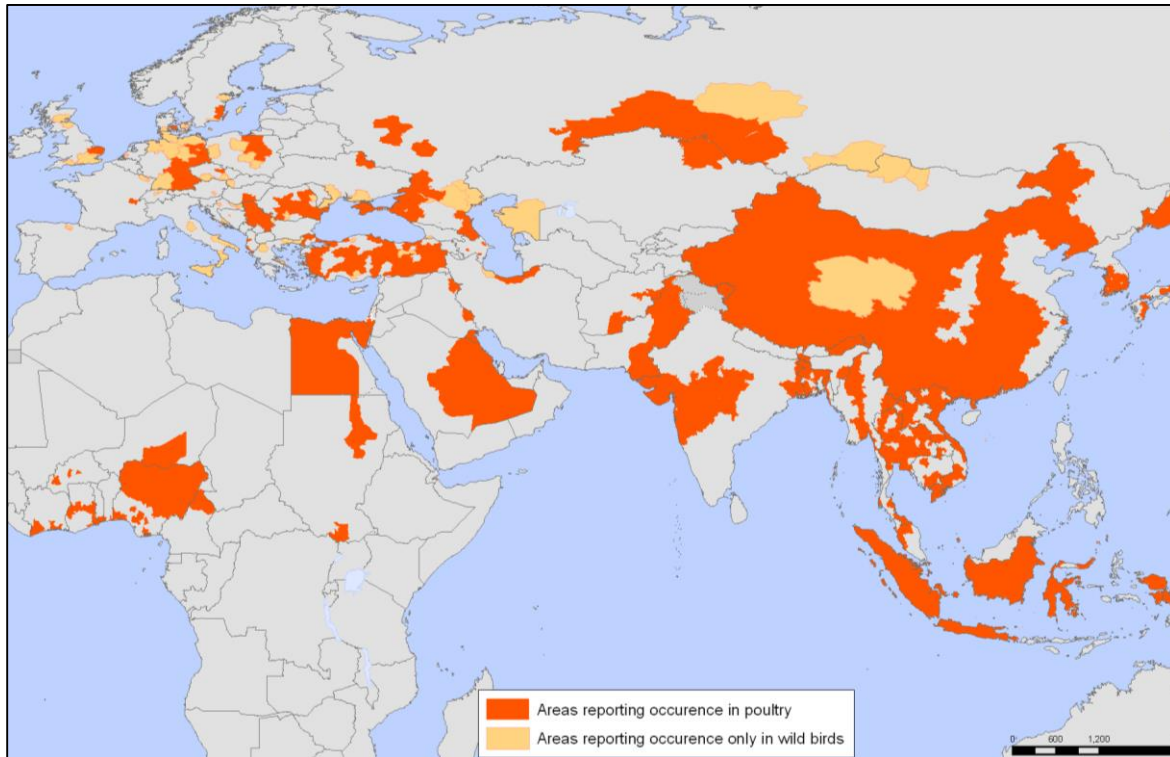


**Figure 4: Spatial distribution of HPAI H5N1 outbreaks in domestic poultry and wild birds and human cases in mainland China (Fang et al., 2008, p.2)**



## APPENDIX B: Chapter 4, Technical Responses

**Figure 1: Areas reporting confirmed occurrences of H5N1 avian influenza in poultry and wild birds since 2003 (World Health Organization, 2008)**



## APPENDIX C: Chapter 5, International organizations involved in H5N1 programs and related documents

*Tessa Carter*

### ***The United Nations System Influenza Coordination (UNSIC)***

The United Nations (UN) set up UNSIC and appointed a Coordinator in 2005 to work primarily on avian and human influenza (AHI), which continued operations through 2011 (UN Development Group). The main goal of this office was to facilitate collaboration between various organizations working on avian influenza (AI) response

such as the FAO, OIE and WHO. To this end, they published the *UN System and Partner's Consolidated Action Plan for Avian and Human Influenza (UNCAPAHI)* in 2006, last revised in 2011. This Plan encourages the development of advanced AI response programs at the national level, but with collaboration between countries on a global scale and especially on a regional scale. It also highlights the need for collaboration between the sectors of human and animal health, and outlines seven specific objectives (Nabarro, 2011).<sup>2</sup> A major funding source for this program was the UN Central Fund for Influenza Action. Additionally, UNSIC worked through the Towards a Safer World (TASW) initiative to promote “multi-sector and ‘Whole of Society’ approaches to pandemic preparedness,” stressing the need for communication on a number of levels (UNSIC, 2011, 2).

Keeping in line with UNSIC’s prioritization of AI response programs at the national level, in 2008 it published a document called *Avian and pandemic influenza coordination: A resource guide for UN Country Teams*. The text mainly focuses on the importance of coordination between sectors within countries, and gives recommendations and examples for how to implement it. Furthermore, the UN maintains a *Portal on Pandemic Influenza*, which provides up-to-date information anyone can access on AI and the pandemic threat it poses.

### ***The World Health Organization (WHO)***

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<sup>2</sup> The seven objectives: “Animal Health and Bio-security,” “Sustaining Livelihoods,” “Protecting Human Health,” “Coordination of National, Regional and International Stakeholders,” “Communication: Public Information and Supporting Behavior Change,” “Continuity under Pandemic Conditions,” and “Humanitarian Common Service Support” (Nabarro, 2011).

Much of the WHO's governance which affects H5N1 AI comes from broader influenza and pandemic work and guidelines. First of all, they have developed information outlining the different phases of pandemic alert. The cycle begins with the "Interpandemic phase" and from there moves into the "Alert phase," onwards towards the "Pandemic phase," then into the "Transition phase," and once again to the "Interpandemic phase," finishing where it began (WHO, 2014, *Current WHO global phase of pandemic alert*). Currently, the WHO classifies H5N1 AI as being in the "Alert phase" because the state of the disease has the potential to evolve into a pandemic, and so they advocate for careful surveillance and response measures at the national and local levels. The WHO also supports the Global Outbreak Alert and Response Network (GOARN), which "is a technical collaboration of existing institutions and networks who pool human and technical resources for the rapid identification, confirmation and response to outbreaks of international importance," under their broader vision of a sound Global Alert and Response (GAR) framework (WHO, n.d.c). One aspect of GOARN is the Guiding Principles for International Outbreak Alert and Response, which were created in 2000 to reflect a consensus on the standard approach (WHO, n.d.d).

In 2011 the WHO created the *Pandemic influenza preparedness (PIP) Framework: for the sharing of influenza viruses and access to vaccines and other benefits*. The document is primarily concerned with ensuring that countries share information about influenza viruses with pandemic potential with the WHO, and also that vaccine and antiviral stockpiles will be maintained to which developing countries will have access in the event of a pandemic as well as during the "inter-pandemic period"

(WHO, 2011). The WHO hopes to achieve these goals by “improving and strengthening the WHO global influenza surveillance and response system (‘WHO GISRS’)” (6).

With the creation of the PIP came the adoption of the WHO GISRS, which replaced the Global Influenza Surveillance Network (GISN). According to the WHO website, GISRS both “monitors the evolution of influenza viruses and provides recommendations in areas including laboratory diagnostics, vaccines, antiviral susceptibility and risk assessment,” and “serves as a global alert mechanism for the emergence of influenza viruses with pandemic potential” (WHO, n.d.b). GISRS is made up of an “international network of influenza laboratories, coordinated by WHO,” and “comprises National Influenza Centres, WHO Collaborating Centres on Influenza, WHO H5 Reference Laboratories and Essential Regulatory Laboratories” (WHO, 2011, 11). Additionally, the WHO maintains guidelines for confronting the threat of any pandemic influenza, and published the latest version in 2013 (replacing that of 2009) titled *Pandemic Influenza Risk Management: WHO Interim Guidance*. This document is intended for national public health professionals and delves into a broad number of topics from the pandemic phases to PIP, drawing on the H1N1 experience of 2009 (WHO, 2013).

Particular to H5N1, the WHO released specific *WHO guidelines for investigation of human cases of avian influenza A(H5N1)* in 2006, which they updated in 2007 (WHO, 2007b). This remains the most current version available. The document claims to “provide all levels of public health investigators with the essential information on how to conduct an investigation of human cases of A(H5N1),” and hopes that national, regional and local-level officials will follow the guidelines to develop the necessary programs, yet

still make sure that they tailor the systems to their own situation and needs (2007b, 2). Over the course of the document eleven steps of the investigation process are laid out.<sup>3</sup> The guidelines also encourage the use of a multi-disciplinary team charged with carrying out the investigation (4), and reminds the reader about the importance of complying with the International Health Regulations (IHR) of 2005.

The WHO published the second edition of the International Health Regulations in 2005. This document states that a case of “Human influenza caused by a new subtype,” if found by a national surveillance system, must be reported to WHO (2005, 43).

In addition to the *Guidelines for investigation of human cases of avian influenza A (H5N1)*, the WHO published a document titled *Clinical management of human infection with avian influenza A (H5N1) virus*. This was released in 2007 to replace the *WHO interim guidelines on clinical management of humans infected by influenza A(H5N1)* of 2004, reflecting changes in recommendations (WHO, 2007a). The report explains the importance of creating standardized care steps, and outlines which treatments, or “modalities” should be used and which should be avoided (WHO, 2007a). In addition, the WHO has even published a protocol for *Collecting, preserving and shipping specimens for the diagnosis of avian influenza A(H5N1) virus infection* which describes procedures for everything from safety during sample collection to how to ship the specimens (2006).

### ***The Food and Agriculture Organization of the United Nations (FAO)***

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<sup>3</sup> The eleven steps of the WHO “guidelines”: “1. Prepare for the investigation,” “2. Confirm the diagnosis, interview the case patient and visit the patient’s home,” “3. Define a case and actively search for cases and their contacts,” “4. Collect specimens,” “5. Visit hospitals and other sites of health care,” “6. Initiate enhanced surveillance,” “7. Undertake animal health and environmental investigations,” “8. Analyse data,” “9. Conduct complementary studies,” “10. Implement prevention and control measures,” and “11. Report and notify” (WHO, 2007).

While the WHO focuses on responses to AI in the human population, the FAO is primarily concerned with the disease as it infects animal populations. Although they do not believe that eradication of the disease from endemic countries will be possible within this decade, they do acknowledge the possibility as H5N1 has been in some cases eliminated from domestic poultry populations in previously endemic countries (FAO, 2011b). Furthermore they have published a paper titled *Approaches to controlling, preventing and eliminating H5N1 Highly Pathogenic Avian Influenza in endemic countries*, which discusses the useful control measures of “Stamping out,” “Vaccination” (of poultry), “Monitoring and surveillance,” and even “Understanding and modifying the poultry sector – production and market chain studies and value chain studies” (FAO, 2011a, 18). Later, the text introduces a section called “Innovative approaches to meeting goals,” and includes measures the FAO is working on to combat “the various institutional and structural problems that led to the disease becoming endemic in the first place” (33).

In order to support the flow of information about livestock diseases and prevent the spread of these diseases across borders, the FAO set up the Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES) in 1994 (FAO, n.d.). Today they maintain a website for EMPRES-i Global Animal Information System which provides veterinarians and other animal health workers with “up to date information on the global animal disease distribution and current threats at the national, regional and global level” (FAO, 2012). The application receives information about outbreaks from a broad array of sources and also maps the “disease events” (FAO, 2012). To support EMPRES and help respond to the HPAI threat, in 2004 the FAO created the

Emergency Center for Transboundary Animal Diseases (ECTAD), which includes a regional office for Asia in Bangkok (FAO, 2011b, Feb.).

The FAO is also involved in collaboration with and support for regional and national response programs. To support this partnership, they have developed the *FAO Regional Strategy: for Highly Pathogenic Avian Influenza and other Emerging Infectious Diseases of Animals in Asia and the Pacific 2010-2015*. This *strategy* involves programs that are already in place or are being planned in order to meet four broad “objectives” concerned with regional and national sensitivity (FAO, 2010, ix).<sup>4</sup>

#### ***The World Organisation for Animal Health (OIE)***

The OIE is instrumental in compiling and maintaining current disease and outbreak information on AI through their Avian Influenza Portal (OIE, 2014). This includes a webpage that posts specific updates from around the world about AI types H5 and H7 in animals. Similar to EMPRES-i, this page compiles information about outbreaks and maps it (OIE, 2014a). The AI Portal also offers that “the most effective strategy for dealing directly with avian influenza [is] early detection and early warning, rapid confirmation of suspects, rapid and transparent notification, [and] rapid response (including containment, management of poultry movement, zoning and compartmentalization, humane stamping out and vaccination where appropriate)” (OIE, 2014b). Lastly, the OIE has its own guidelines and standards for maintaining biosafety

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<sup>4</sup> “1. Provide technical options and advice for prevention and control of HPAI and other EIDs appropriate to the region. 2. Enhance capacity to implement and maintain national and regional approaches to animal disease prevention and control. 3. Coordinate regional activities including the further development of sustainable laboratory, epidemiology and socio-economic networks and information systems. 4. Advocate for commitment to prevention and control of EIDs within national governments, regional organizations and donors.” (FAO, 2010, ix)

and biosecurity in poultry populations, for AI surveillance in animals, and for “rapid confirmation of suspects and diagnosis of avian influenza” (OIE, 2014b).

### ***OIE/FAO***

Together, the OIE and FAO created the OIE/FAO Network of Expertise on Animal Influenza (OFFLU) in 2005. OFFLU claims to be “working to reduce the negative impacts of animal influenza viruses by promoting effective collaboration between animal health experts and with the human health sector” (OFFLU, 2014). When it comes to HPAI, OFFLU provides a large array of information and resources on H5N1. This includes guidelines for surveillance of H5N1 in both domestic poultry and wild birds, published in May 2013 in a report titled *OFFLU Strategy document for surveillance and monitoring of influenzas in animals*. The OIE and FAO have also jointly released documents providing information and, more importantly, broad recommendations for dealing with outbreaks of animal diseases such as H5N1 on the ground, for example *Ensuring Good Governance to Address Emerging and Re-emerging Animal Disease Threats* (2007).

### ***WHO/FAO/OIE***

These three large international organizations responsible for a great deal of the global governance on H5N1 also work in explicit collaboration with each other. In 2008 they released the most recent *Global Strategy for Prevention and Control of H5N1 Highly Pathogenic Avian Influenza*, replacing the original version from 2005.<sup>5</sup> The objective of the document at the global level is “to provide global leadership in

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<sup>5</sup> *FAO-OIE Global Strategy for the progressive Control of Highly Pathogenic Avian Influenza (HPAI)*

generating and providing sound technical and policy advice in coordinating and harmonizing national, regional and global plans, and in improving the effectiveness and efficiency of programming and implementation of disease prevention and control” (FAO, OIE & WHO, 2008, xiv). Additionally, the FAO, OIE and WHO are committed to working together to “address health risks at the human-animal-ecosystems interfaces,” including HPAI H5N1 (FAO, OIE & WHO, 2011). They established the Global Early Warning System (GLEWS), which draws on the tripartite partnership (between the FAO, OIE and WHO) to create an international surveillance system. It recognizes the need for communication and collaboration between each of the “sectors responsible for human health, animal health, wildlife, and food safety” (FAO-OIE-WHO, 2013).

#### ***Association of Southeast Asian Nations (ASEAN)***

ASEAN maintains a regional antiviral drug (Tamiflu) and Personal Protective Equipment (PPE) stockpile in Singapore. ASEAN is also important in coordinating communication between national governments. In 2010 the Association released *Crossing Borders and Traversing Bridges of Partnerships: Roadmap for an HPAI-free ASEAN Community by 2020*. This document underlines the need for collaboration between sectors and lays out seven extremely detailed “Strategic Goals” to complete as steps in the process of “prevention, control and eradication of HPAI and other HPEDs in the region” (ASEAN, 2010, 6).<sup>6</sup>

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<sup>6</sup> “Strategic Goals:” 1. “Strengthening veterinary services,” 2. “Progressive zoning and cross-border management,” 3. “Vaccines and vaccination strategy,” 4. “Stamping-out/Culling,” 5. “Surveillance and Monitoring,” 6. “Market-chain management,” and 7. “Enhanced Bio-security” (ASEAN, 2010, 13-30)



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Task Force 2014

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