

**One Flu East, One Flu West, One Flu Over the Cuckoo's Nest:
A Cross-Cultural Investigation of Pandemic Influenza Paradoxes in
Epidemiology**

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ABSTRACT

This comparative case study examining epidemiological practices in Vietnam and the US revealed three pandemic influenza paradoxes: The paradox of attribution which asserts that pandemic influenza comes exclusively from Asia even though historical evidence points to the contrary; the paradox of prevention which encourages industrial methods (i.e., factory farming) for combating influenza even though there is conflicting evidence for any superiority of this method in terms of means of production or disease prevention; and the paradox of action where epidemiologists act in ways not consistent with prevailing epidemiological recommendations. The existence of these paradoxes may, in fact, impede efforts at stopping and preventing pandemic influenza. In order to find the root causes of these paradoxes, this study examined indigenous media and historical and contemporary research reports on pandemic influenza. This archival information was juxtaposed to viewpoints garnered from ethnographic interviews with epidemiologists who have worked in Vietnam, the United States, or in both countries. This study found that these paradoxes endure because of the dual nature of science – the known and the unknown elements of current knowledge – and assumptions made between the two. The dual nature of science describes both the information that has been codified and information that has not been codified and the implications between the two. In other words, in between the spaces of known information, there are attempts to fill in the gaps in knowledge, which results in paradoxes. Of particular

importance in this gap-filling process are the three “C’s” of collaboration, conflict, and competition. Collaboration is integral to the successful prevention of influenza pandemics; however, it is this same collaboration wherein which epidemiologists are trained to be so highly specialized that they often depend on unvetted external expert information. Conflict and competition occur from the geopolitical level all the way down to the level of the individual epidemiologist and are influenced by the political and scientific economy along with social and cultural factors.

DEDICATION

This work is dedicated to Mrs. Lua Thi Vu, Mr. Phuc Cong Vu, Mrs. Tim, and Mr. W.H. with love. They actually do not enjoy reading non-fiction, so unless someone tells them about this heartfelt dedication, they will never know.

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List of Abbreviations

AIPED	The Vietnam Integrated National Operational Program on Avian Influenza, Pandemic Preparedness and Emerging Infectious Diseases
AMA	American Medical Association
ARTEI	Administration Agency for Radio, Television, and Electronics Information
CBIC	Certification Board of Infection Control and Epidemiology
CDC	Centers for Disease Control and Prevention
FDA	Food and Drug Administration
H	Hemagglutinin
HCMC	Ho Chi Minh City
HPAI	Highly Pathogenic Avian Influenza
HTD	Hospital for Tropical Diseases
LPAI	Low Pathogenic Avian Influenza
MM	Modern Medicine
N	Neuraminidase
NGO	Non-governmental organization
NIH	National Institutes of Health
OPI	Operational Program for Avian and Human Influenza
OUCRU	Oxford University Clinical Research Unit
PSA	Public Service Announcement
S&T	Science & Technology
SSK	Sociology of Scientific Knowledge
STS	Science and Technology Studies
TM	Traditional Medicine
UN	United Nations
US	United States
USAID	United States Agency for International Development
WHO	World Health Organization

CHAPTER 1 – INTRODUCTION – A TITLE DECONSTRUCTED

*Vintery, mintery, cutery, corn,
Apple seed and apple thorn;
Wire briar, limber lock,
Three geese in a flock.
One flew east, one flew west,
One flew over the cuckoo's nest.*

- Nursery Rhyme

As many experts in English literature have noted, this nursery rhyme is contradictory at best, and that is exactly the point. Firstly, by definition, geese united in a flock should not fly in separate directions. Moreover, ornithologists will quickly point out that cuckoo birds don't even make their own nests. Cuckoos are brood parasites who trick other birds into raising their young by depositing cuckoo eggs into an unsuspecting host bird's nest. As with the contrivances within this nursery rhyme, the STS field percolates with examples of these contradictions. For example, Robert Merton pointed out the norms of science, whereas Ian Mitroff later found the counter-norms in science.

In perhaps one of the most notable examples of these contradictions, Thomas Kuhn identified the subtle accommodations that occur in the science of astronomy. In **The Structure of Scientific Revolutions** Kuhn identified how discrepancies accumulated in what one views as "normal science." When the "normal science" can no longer account for these discrepancies, a "revolution" occurs and a new "paradigm" of science forms. In order to contrast "normal" science from "revolutionary science," Kuhn described the heliocentric model of the universe and the emergence of the geocentric model. To this day, these smidgens of contradictory truths are prevalent throughout science. This is true especially of the contradictions in the physical sciences. For

instance, in physics, there are many theories to account for discrepancies, such as the theory of special relativity and theories in quantum mechanics.

In the previous example, and as other studies in STS have shown, change in science can occur through a variety of mechanisms. In an overly simplistic interpretation, one type of change in science may occur because the science does not “function,” meaning it does not produce expected results or provide the expected explanations.¹ Presumptively, there will be a period of time where this science remains “nonfunctional.” Thus, these inconsistencies, or what I, in this dissertation, will call “paradoxes,” may be one of the underlying explanations as to why the science does not “function.”

Paradox – A statement or proposition that, despite sound (or apparently sound) reasoning from acceptable premises, leads to a conclusion that seems senseless, logically unacceptable, or self-contradictory.

– From Oxford Dictionaries

Looking through some sort of “whig history” or “scientific determinism” lens, one would assume that scientists, researchers in the field, or relevant social groups would naturally identify these “self-contradictions,” or paradoxes in a relatively short period of time.² Ergo they would also naturally act upon these findings and make the science “better,” and thus resolve any inconsistencies that arose along the way.³

¹ I realize that there are many other arguments in the philosophy of STS in terms of falsification and the meaning of what exactly is science, social construction, etc. but for the sake of this dissertation, I will focus on this facet.

² “Relevant social groups” – form the Social Construction of Technology (SCOT) from Bijker *et al.*

³ “Better” is, of course, a subjective claim, but used for illustrative purposes that are in line with the “whig history” argument.

One wonders whether there are procedures in the scientific community to explore these paradoxes. In one vein, the scientific community itself is about clarifying these inconsistencies. For the most part, this argument is true as in the aforementioned example in physics shows. Arguably, the institution of science aspires to be functional. Specifically, engineers of complex systems even have support from entire cadres of interdisciplinary engineers, called systems engineers, who holistically identify systemic issues to increase the efficiency and effectiveness of systems approaches. Thus, although not specifically charged to do so, they are able to potentially identify paradoxes in engineering systems.

Nonetheless, this self-introspection, or self-identification of internal paradoxes, does not always take place. For instance, in the 1990s researchers and aerospace engineers (who commonly work with, or are trained as, systems engineers) were baffled by the increased incidence of airline crashes in Korea. Most relegated the disproportionately high number of accidents to the realm of technical issues or poor training. However, Korean pilots had first-class training with first-class equipment. Surprisingly, it was not an engineer who proposed a potential explanation for these accidents – it was a journalist and author. In his book **Outliers: The Story of Success**, Malcolm Gladwell theorized that cultural issues prevented Korean co-pilots from questioning their superior officers. He suspected that due to cultural norms, Korean co-pilots would refrain from questioning more senior pilots. He found that Korean co-pilots continued to stay silent during potentially dangerous situations leading to proportionally more crashes than any other country. In this example, the answer fell outside the engineer's realm of study. Engineers did not have the information they needed – the

cultural context – to explain the problem. After the issues were identified, and a “cultural reorientation” was put into place, the number of plane accidents in Korea greatly decreased.⁴ Through integrating Gladwell’s findings through training and a “cultural reorientation,” Korean airlines vastly improved its safety record.⁵ This case is a perfect example of how scientists and engineers can augment their expertise by working with experts outside of their field.

One may argue that the example of conflicting theories in physics or unanticipated outcomes on Korean airliners were just isolated incidents. However, it may be that contemporary Science and Technology (S&T) may be rife with paradoxes.

PURPOSE – PARADOXES AND STS IN PRACTICE

In this dissertation I will investigate whether paradoxes do indeed exist in other fields. If these paradoxes exist, I will attempt to explain the reasons for these scientific contradictions. Finally, I will provide insights on whether these paradoxes need attention, and, if so, provide recommendations on how they might be mitigated.

As we shall, see paradoxes in science are neglected for a variety of reasons. Currently, for most sciences, there are no set methods of introspection to identify internal paradoxes. If paradoxes are somehow identified, for instance, with systems engineers, they might identify systemic issues with a large technological system; the paradoxes may be neglected since they may not totally impede the functionality of the system. These paradoxes may also be recognized but left unaddressed if scientists do not have the time,

⁴ Howard, Brian Clark. "Could Malcolm Gladwell's Theory of Cockpit Culture Apply to Asiana Crash?" National Geographic News 7/11/2013 2013: 1.

⁵ Howard, "Could Malcolm Gladwell's Theory of Cockpit Culture Apply to Asiana Crash,"1.

resources, tools, or information needed at their disposal for effective explanations or solutions. It may be that these paradoxes are caused by conflict and competition, but in a doubly paradoxical twist, these paradoxes may be caused by collaboration.

In this dissertation I will show how STS can be applied in contemporary practice to understand and explain scientific paradoxes. This is not a novel concept as other STS scholars apply STS research to advocate for changes in policy and politics. However, by using a contemporary case study, I will show how STS can be applied in two ways. First, research in STS can serve to identify paradoxes in complex systems and networks. Second, by identifying these paradoxes, STS approaches and analysis can provide viable explanations that may augment scientific practice. Thus, in this work I will highlight how it will be possible for STS to establish an active, multi-disciplinary partnership with the vast majority of other scientific disciplines. This study will also show, in particular, how STS can play an active role in the realm of health sciences much as the field of systems engineering plays an active role for engineering.

DEFINING THE PROBLEM: INFLUENZA PARADOXES

Recent news coverage initially sparked my interest in pandemic influenza. In particular, the avian influenza outbreak of 2003 and the Swine Flu pandemic of 2009 were the first pandemics in recent history to have a direct impact on my life, and the lives of many other Americans. Although this impact ranged from mundane recommendations for hand washing to the obstructive travel restrictions, in the case of the 2009 pandemic, many Americans, including me, actually became ill with some variant of the flu. The news from these two pandemics also brought out repeated themes that, with my

background in the biomedical sciences and knowledge of STS concepts, helped me form my initial research questions. Mainly, the news appeared to focus on where the pandemics emerged with a focus on the animal host and the geographic. For instance, the media seemed focused on whether pandemics emerge from chickens or pigs, Asia or North America, and so forth. These reports commonly had no explanation as to why it was necessary to find these origins. Moreover, many news reports relied on expert testimony, and more often than not, the experts disagreed. One might assume that given how technologically advanced the health sciences are, that there would be standard pandemic responses. But it appeared that the experts disagreed on how to deal with the current pandemic at hand and how to prevent future pandemics.

It is a happy coincidence, then, that “flu” is a homophone for “flew,” since in(flu)enza is the topic that sparked my initial interest in these scientific paradoxes. Influenza, as its Italian moniker suggests, affects most people either directly or indirectly.⁶ Almost everyone contracts the flu at some point in his or her lifetime or knows someone who has had the flu. Influenza can range from being a minor inconvenience to being potentially fatal for the very young, elderly, or immunocompromised. However, a large-scale influenza outbreak is a topic of grave concern – especially in light of the fact that it may trigger a pandemic.

The World Bank estimates that an influenza pandemic similar to the devastating pandemic of 1918 may cause approximately 800 billion dollars worth of damage to the world economy.⁷ According to the U.S. Department of Health and Human Services, a pandemic such as that of 1918 could result in 1.9 million deaths in the U.S. It is clear

⁶ Harper, D. (2016). Online Etymology Dictionary, “influenza.”

⁷ Brahmhatt, M. Avian and Human Pandemic Influenza – Economic and Social Impacts, World Bank.

that from the potential human and economic impact that pandemic influenza is a critical topic in the medical and public health community.

As with complex systems in engineering, fighting pandemic influenza involves a myriad of specialized scientists, epidemiologists, public health professionals, politicians, interested social groups, industry, countries, and international organizations. One of the complexities surrounds the fact that these groups are not distinct – politicians may also be medical doctors; those working for the poultry industry may also be epidemiologists; public health professionals may work for animal rights groups; and scientists can belong to a specific country, but network internationally.

As its name suggests, pandemic influenza cannot be contained within sovereign boundaries. Pandemic influenza is an international issue that affects individuals, groups, countries, and multi-national organizations. The political economy of pandemic influenza can be a highly contested social and political issue. Moreover, pandemic influenza spreads between animals such as poultry, swine, and other mammals (including humans), which, in turn, can impact animal husbandry and affect the international food supply chain. Thus, pandemic influenza can have great economic and resource ramifications.

The complex interplay between actors, groups, international organizations and economic impacts motivated me to examine leading-edge scientific and technical information on pandemic influenza, to attend public presentations, and to attend scientific conferences. Even with the most up-to-date material, I found many instances of conflicting claims, actions, and recommendations that could not be easily reconciled.

Using information from the STS and medical literature relevant to pandemic influenza, I identified an initial set of possible paradoxes.

Three pandemic influenza paradoxes stood out in particular: the paradox of attribution, the paradox of prevention, and the paradox of action. The paradox of attribution centers on the tendency to assign origins to pandemic influenza whether it be a location or a group of people, even though these origins cannot be verified or are commonly mistaken. The next two paradoxes delve into the illusion of standardization in the sciences. The paradox of prevention focuses on the belief that pandemic influenza can be mitigated through the widespread use of industrial practices; even though there is emerging evidence that these same practices may, in fact, encourage the development and spread of pandemic influenza. Finally, the paradox of action describes initiatives taken by health officials to curb disease, even though these actions are in direct contrast to internationally-recognized epidemiological recommendations.

CASE STUDY: A CROSS-CULTURAL INVESTIGATION OF PANDEMIC INFLUENZA

In order to study pandemic influenza, we must first study how it is currently controlled, and who the key players are in these efforts. While medical doctors are responsible for the individual care, it is epidemiologists who study pandemics on a population-scale. Epidemiologists are the key players who have firsthand knowledge of the different measures used to treat pandemic influenza and the reasoning behind the use of these techniques. Hence, this dissertation focused on epidemiological viewpoints in order to examine why these paradoxes occur and why they endure.

Nevertheless, it is difficult to ascertain worldwide differences in attribution and scientific practices from only one cadre of epidemiologists who have worked exclusively in one country. Potentially, there may be different epistemic communities wherein which epidemiologists from one country may only subscribe to one attribution type or one method of scientific practice. With that said, the science of epidemiology may differ from one country to the next and this may shape the formation of these pandemic influenza paradoxes. As the Sociology of Scientific Knowledge (SSK) puts forth, there may be differences in cultural, social, and political frameworks that are contributing to these pandemic influenza paradoxes. Moreover, the title of this dissertation suggests a presupposition. Mainly, that perhaps by examining science from differing perspectives – the “east” versus the “west” – it will be possible to gain traction in understanding these inconsistencies. Following on David Turnbull’s work in **Masons, Tricksters, and Cartographers: Comparative Studies in the Sociology of Scientific and Indigenous Knowledge**, it is hypothesized that these differences may be a result of the local constructions of knowledge.

In order to clarify these potential differences, this study uses a comparative case study that examines pandemic influenza through the viewpoints of epidemiologists who have worked in the United States, Vietnam, or in both countries. Although it is possible to examine pandemic influenza in other countries, the United States and Vietnam will be used as focal countries since they have dissimilar cultural, social, and political frameworks. Moreover, both countries have had a long and recent history of dealing with pandemic influenza.

RESEARCH QUESTIONS

This study will be the first of its kind to examine the field of epidemiology through an STS lens. Although epidemiologists commonly use the social sciences to help control disease – for instance, social epidemiologists identify socio-economic conditions that could help clarify disease rates in certain populations – the reverse is not true. There are few studies that examine the social structure of epidemiology and what impact that has not only on epidemiologists themselves, but also on the science that they create and employ.

This work is not meant serve as a generalization for all areas of science and technology, but it is designed to specifically examine a case study of import. This research is not meant to be a clichéd “demystification of science” study, but rather, borrowing from Bruno Latour’s work, it is meant to open up the “black box” of a contemporary field that most would believe has already been closed. Moreover, it is one of the first to explicitly apply STS to the field of epidemiology. In other words, based on the results from the interviews, themes emerge that could inform epidemiologists from these following research questions:

- Are there social and cultural factors that may influence a pandemic investigation?
- Are there differences in how “textbook investigations” are performed as opposed to field-based investigations?
- Are these paradoxes explainable?
- Do these paradoxes serve a purpose?

From these research questions I found that these paradoxes endure because of the dual nature of science – the known and the unknown elements of current knowledge –

and assumptions made between the two. The dual nature of science describes both the information that has been codified and information gaps. In other words, in between the spaces of known information, there are attempts to fill in the gaps in knowledge, which results in paradoxes. Of particular importance in this gap filling process are the three “C’s” of collaboration, conflict, and competition. Collaboration is integral to the successful prevention of influenza pandemics; however, it is this same collaboration wherein which epidemiologists are trained to be so highly specialized that they often depend on unvetted external expert information. Conflict and competition occur from the geopolitical level all the way down to the level of the individual epidemiologist and are influenced by the political and scientific economy along with social and cultural factors.

CHAPTER SUMMARY

In order to provide context for these influenza paradoxes, this dissertation will be organized in the following manner. Chapter 2 will examine the historical context of influenza in the United States and in Vietnam and the social and cultural similarities and differences that may impact the origin and perpetuation of influenza paradoxes. Chapter 3 describes the study methodology and data collection process. Following this, the study findings are organized by paradox. Chapter 4 delves into the paradox of attribution and the reasons why epidemiologists make such attributions and the dangers of misattribution. Next, in Chapter 5, the paradoxes of prevention and action, such as how different industrial practices are touted as potential ways to circumvent disease spread, are explored. Here we examine why epidemiologists may, in fact, be using different solutions to curb pandemic influenza, even though totemic science would lead us to

believe in a one-solution approach. The concluding Chapter 6 provides a detailed discussion on the research findings and suggests that paradoxes arise from the “dual nature of science” in the form of collaboration, conflict, and competition. In addition, the findings of this study are summarized as well as what impact these findings will have on the epidemiological community, and the potential of using applied STS to augment different fields of science. The appendices will also provide reference materials such as a template consent documents and interview materials.

CHAPTER 2 – THE DEVELOPMENT OF CONTEMPORARY MEDICINE AND INFLUENZA PRACTICES

As the foundation for this study and to facilitate assessment of the research findings, it is important to examine the historical milieus through which these paradoxes developed in both the United States and in Vietnam. The exploration of these two histories provides us then with some clues as to how and why these paradoxes developed. In addition, the comparison between these two countries shows that these paradoxes are not a uniquely American phenomenon. These paradoxes occur across cultures.

It is important to first explore the obvious – perhaps the scientific paradoxes are a result of a fundamentally different understanding of the science and technology of influenza prevention. One may initially conjecture that, as a part of the third world, Vietnam would not have the scientific wherewithal to combat pandemic influenza.⁸ Although the exact details of historical events may differ, we will find that the US and Vietnam generally share the same recent timeline of biomedical revelations. Both countries were in no way isolated from the international scientific community, and thus both have benefitted from global biomedical developments. The overall understanding of biomedicine is similar in both countries and, thus, would not be the distinguishing factor for these paradoxes.

We explore whether other factors – the social structures, cultural preferences, and the political economy of pandemic influenza – play a role in determining why certain

⁸ This comment is meant facetiously. In fact, technically, Vietnam is not even a part of the “third world.” The term is a loaded one with sometimes the meaning of a “developing country.” With that said, Vietnam isn’t even considered a “non-developed” country. According to the Human Development Index of 2014, Vietnam is “medium” “developed” country. Human Development Report 2014. New York: United Nations Development Programme (UNDP), 2014. Print.

practices are favored. As we will see here, there are differences in all three of these areas. In terms of social structures, both the government and healthcare systems in these two countries are drastically different. In terms of culture, cultural practices are quite distinct, but at other times, come into confluence. On one hand, the US narrative focuses on individualistic achievements whereas the Vietnamese narrative focuses primarily on communalistic efforts. Finally, pandemic politics may be one of the main drivers of these paradoxes. Filtered through the media, there is a large discrepancy between what people say and what people do. It is within this political system that epidemiologists, government leaders, policymakers, and farmers clash for limited monetary resources, political clout, and scientific credit. Nonetheless, before delving into these contemporary issues, one must lay the historical health sciences foundation of pandemic influenza in the US and in Vietnam.

HISTORY OF MEDICINE AND THE DISCOVERY OF THE INFLUENZA VACCINE IN THE UNITED STATES

The history of medicine in America was fraught with just as much uncertainty as any other country. In the nineteenth century American medicine was referred to as the “withered arm of science.”⁹ Medicine in the United States still lagged far behind Europe, owing, largely, to the fact that most medical schools were faculty-owned.¹⁰ Thus, there was a profitable incentive for faculty to have high enrollment, regardless of

⁹ Barry, John M. *The Great Influenza: The Story of the Deadliest Pandemic in History*. London: Penguin Books Ltd, 2005: 25.

¹⁰ Barry, *The Great Influenza*, 32.

qualifications or ability of the students.¹¹ Medicine in America was described as “primitive.”¹² Doctors, who may have had eight months or less of “medical school” training, used the standard practice of bleeding, or phlebotomy.¹³ They often prescribed medications that were habit forming and ineffective or even, as in the case of arsenic, poisonous.¹⁴ The state of medicine in the United States, in combination with poor nutrition and diet, and lack of sanitation and hygiene, resulted in an average life expectancy of about 40 years.¹⁵

Gradually, the field of medicine in the U.S. began to incorporate theories and techniques from the fields of chemistry, mathematics, physics and physiology. To find quantitative measurements, scientists began using the stethoscope in 1816 and the thermometer in the 1820s.¹⁶ In the 1830s, researchers even began using the microscope with novel achromatic lenses to view bacteria.¹⁷

The new notion of “evidence-based medicine” was just coming into light, and the germ theory, which states that small organisms cause disease and that a particular organism causes a particular disease, was just beginning to gain acceptance.¹⁸ The end of the nineteenth century culminated with Koch’s Postulates, which provided criteria for determining whether a particular microorganism produces a specific disease.¹⁹ Koch’s

¹¹ Ibid.

¹² Thomas A. Bailey, David M. Kennedy, and Lizabeth Cohen. *The American Pageant: A History of the Republic* (Boston: Houghton Mifflin Company, 2001): 342.

¹³ Barry, *The Great Influenza*, 22, 30, 32. Although this could be helpful in some instances, in historical hindsight, it may not have been warranted for most instances.

¹⁴ Bailey, *The American Pageant*, 685.

¹⁵ Barry, *The Great Influenza*, 22. This figure may not account for the high infant mortality at the time.

¹⁶ Barry, *The Great Influenza*, 25.

¹⁷ Barry, *The Great Influenza*, 28.

¹⁸ Barry, *The Great Influenza*, 27, 49.

¹⁹ Barry, *The Great Influenza*, 51.

Postulates asserted that first, a microorganism had to be identified. Then, it had to be isolated. Third, if used to infect an animal, the animal had to contract the disease. Finally, the same microorganism had to be identified in the infected animal.²⁰ Hence, this novel understanding of science gradually replaced antiquated “miasmatic” theories of disease.

The recommendations from Abraham Flexner’s *Medical Education in the United States and Canada*, colloquially called the Flexner Report (1910), revolutionized American medicine.²¹ In this report Flexner successfully argued for the elimination of many of the commercial medical schools. As a result of his recommendations, and increased regulation the number of medical schools in the US decreased from 155 to 31.²² Flexner used the Johns Hopkins School of Medicine model to successfully advocate for the following: increase the entrance requirements to at least two years of college, train physicians on the scientific method, and support original research at medical institutions.²³ These reforms boosted the qualifications of medical candidates, greatly toughened medical licensure, and elevated medicine past the anecdotal to an empirical endeavor.

The twentieth century also brought about much additional change. As Cowan notes in *More Work for Mother*, “in the years before widespread vaccinations and the availability of antibiotics, children were frequently sick and required care for long periods...[W]ithout the care of physicians and without medication, even the mildest

²⁰ Barry, *The Great Influenza*, 68-70.

²¹ Ludmerer, Kenneth M. “Commentary: Understanding the Flexner Report.” *Academic Medicine* 85, 2 (2010): 193-196.

²² Ludmerer, “Commentary: Understanding the Flexner Report,” 195.

²³ Ludmerer, “Commentary: Understanding the Flexner Report,” 193.

illness could become life threatening...”²⁴ In addition, hygiene and health considerably improved with the gradual integration of indoor plumbing.²⁵

INFLUENZA IN THE UNITED STATES

The trend of health-care related improvements was sorely tested in 1918, in what later would be called the “Spanish flu.” By most accounts, signs of this pandemic first appeared in the American Mid-west.²⁶ By the spring of 1918, it was reported in China.²⁷ By April, it had reached epidemic proportions in Europe and in France.²⁸ By July, even isolated areas such as New Zealand, the Philippines, and Hawaii had reported cases.²⁹ In an era without commercial air transportation, the virus managed to travel the world in a mere five months.³⁰ “Conservative estimate(s)” indicate that pandemic influenza killed more than the “deadliest wars” and that a fifth of the world’s population exhibited visible symptoms of disease with an unknown number of subclinical cases.³¹

At that time, there was no cure or treatment for influenza, but scientists believed that they would be able to find a cure.³² They had, after all, had recently tamed many bacterial diseases, such as tetanus, and had developed an array of experimental techniques to study bacteria. They could detect bacteria by staining, isolate bacteria with

²⁴ Ruth Schwartz Cowan, *More Work for Mother* (USA: Basic Books, 1983), 168.

²⁵ Cowan, *More Work for Mother*, 88.

²⁶ Edwin Kilbourne, “Influenza Pandemics of the 20th Century,” *Emerging Infectious Diseases* 12, no. 1(2006): 9.

²⁷ Ibid.

²⁸ June E. Osborn, ed., *History, Science, and Politics: Influenza in America, 1918-1976* (New York: Prodist, 1977): 7.

²⁹ Ibid.

³⁰ Ibid.

³¹ Osborn, *History, Science, and Politics: Influenza in America*, 5.

³² To this day, there is still no cure for influenza, only vastly improved treatment regimens such as the use of antivirals, or preventative measures such as the use of vaccines.

porcelain Chamberland filters, grow bacteria in nutrient broths or formulations, and kill bacteria using newly developed vaccines. Nevertheless, scientists made one faulty assumption. They assumed that bacteria caused influenza.³³ The causative agent was, instead, a virus.

The influenza virus was drastically different from what researchers had encountered in the past. The influenza virus is much smaller than the bacteria scientists studied and was invisible using the microscopes of the time. Attempts to isolate the organisms causing influenza with Chamberland filters also failed since the smaller viruses traveled freely through these filters that were designed to segregate larger bacteria.³⁴ Adding to these difficulties, scientists did not know that viruses could not reproduce their genetic material without the aid of a host. Despite valiant attempts, researchers could not grow the virus in culture.³⁵

In 1918, Richard Pfeiffer, the director of Germany's Institute for Infectious Disease and student of Koch's, believed he had found the causative bacterium. Pfeiffer used the same Koch's postulates that garnered him much success in developing a typhoid vaccine, and reported that *Bacillus influenzae* (current nomenclature is *Hemophilus influenzae*) caused influenza.³⁶ In reality, what Pfeiffer discovered was a, sometimes, coconspirator in influenza's lethal progression. Influenza may weaken the immune system to the point that it becomes susceptible to secondary infection, especially from that of the bacterium, *Hemophilus Influenzae*. Perhaps this is a good example of Thomas

³³ Since 1898, scientists knew that a pathogen smaller than bacteria could cause disease, in particular, the tobacco mosaic virus, but they had not yet assigned influenza as having viral origins.

³⁴ Osborn, *History, Science, and Politics: Influenza in America*, 15.

³⁵ Osborn, *History, Science, and Politics: Influenza in America*, 16.

³⁶ Barry, *The Great Influenza*, 69.

Kuhn's "paradigm."³⁷ It is arguable that this "prevailing paradigm tends to freeze progress, indirectly by creating a mental obstacle to creative ideas and directly...if they conflict with the paradigm."³⁸ As studies of Pfeiffer's and derivative vaccines showed inconclusive results, researchers focused on limiting the secondary infections by producing "witches brews of pneumococci, streptococci, staphylococci, Pfeiffer's bacillus, and sometimes unknown microbes isolated in the death house."³⁹ Rather than solving the root of the problem by finding innovative solutions, the researchers focused solely on what they knew best, namely, bacteria. This approach provided only temporary or ineffective solutions. It seemed as if Kuhn's notion of "truth" arresting progress was correct in that a vaccine would not truly become available for another two decades.

Contemporaneously, the field of virology was just beginning to emerge and little was known about viruses. Felix d'Herrelle theorized that there was an agent that infected bacteria. What he actually found was a virus that infected bacteria, which we now refer to as a "bacteriophage." Scientists were left speculating about a virus they could not see. Until 1930, the influenza virus was commonly isolated from ferret hosts and kept "viable" in mice.⁴⁰ In Stoke's first study of influenza, he had to use 11,000 mice to maintain the virus.⁴¹ The Mouse Protection Test was one of the first tests used to measure antibody titre.⁴² However, this test required a significant amount of time to perform.

³⁷ Wiebe E. Bijker, Thomas P. Hughes, and Trevor Pinch, eds., *The Social Construction of Technological Systems* (Cambridge, Massachusetts: The MIT Press, 1989): 108.

³⁸ Barry, *The Great Influenza*, 15.

³⁹ Eyler, "De Kruij's Boast," 411.

⁴⁰ Eyler, "De Kruij's Boast," 413-415.

⁴¹ Eyler, "De Kruij's Boast," 416.

⁴² *Ibid.*

After 1930, it was discovered that the virus could be cultivated in chicken eggs.⁴³ Thus, viral antibodies could be more easily produced in chicken eggs for testing.

The results from these studies helped clarify the different influenza “types.” In October of 1940, using the results from these studies, scientists at the United States’ International Health Division (IHD) of the Rockefeller Foundation and the United Kingdom’s National Institute for Medical Research designated that titers reactive to these isolated antibodies would be called “Influenza A.” Cases with similar symptoms to that of Influenza A, but without reactive antibodies would be called “clinical influenza.”⁴⁴ This also paved the way for potential “Influenza “B,” “Influenza C’s,” and so forth.

By November of 1940, Thomas Francis, Jr., a former member of IHD and by that time associated with the University of Michigan, isolated a virus that met all of the criteria previously established as being Influenza A. However, this virus did not react with influenza A antibodies nor did it afford protection against influenza A. Thus, Francis named this new virus “Influenza B.”⁴⁵

Although there were already vaccines for other viral diseases, there still was no vaccine for influenza. During this time, vaccine trials were being performed from 1936-1938 by Stokes in New Jersey, from 1936-1941 by Morris Siegel and Ralph Muckenfuss in New York, and from 1940-1941 by Frank Horsfall in California.⁴⁶ All results were deemed “inconclusive.”⁴⁷

⁴³ Osborn, *History, Science, and Politics: Influenza in America*, 17.

⁴⁴ Eyler, “De Kruij’s Boast,” 417.

⁴⁵ Ibid.

⁴⁶ Eyler, “De Kruij’s Boast,” 417-419.

⁴⁷ Eyler, “De Kruij’s Boast,” 420.

Surprisingly, even by that time no one had ever visually confirmed the existence of a virus. It was not until 1941 that tobacco mosaic virus, a plant pathogen, was viewed through X-ray crystallography diffraction imaging. By using that technique in 1955, Rosalind Franklin (of DNA fame) was the first to detail the structure of tobacco mosaic virus.

The 1940s brought about many technological advances. The need to better quantify the virus led to the development of indirect tests, which measured vaccine amounts by observing hemagglutination, or clumping of red blood cells.⁴⁸ Fortunately, the proteins that produced the agglutination were antigens. Thus, if antibodies were added before the addition of red blood cells, these relative amounts could be quantified.⁴⁹ This simplified method reduced the amount of time to measure antibodies from days to hours.⁵⁰ George Hirst developed this hemagglutination-inhibition test, which was improved upon by Jonas Salk, the future inventor of the polio vaccine, and who was also co-credited with the development of the first influenza vaccine.⁵¹ The technique of centrifugation also came into use, allowing for the production of highly concentrated vaccines.⁵²

With war a looming threat, in early 1941, the Army Epidemiological Board (or the AEB, which later was more broadly applied and renamed the “Armed Forces Epidemiological Board” (AEB) was established.⁵³ The AEB founded the Commission on

⁴⁸ Osborn, 17.

⁴⁹ Osborn, 17.

⁵⁰ Eyler, John M. "De Kruij's Boast: Vaccine Trials and the Construction of a Virus." *Bulletin of the History of Medicine* 80 (2006): 409-38. Print: 422.

⁵¹ Eyler, "De Kruij's Boast," 421.

⁵² Eyler, "De Kruij's Boast," 424.

⁵³ Winkelstein, Warren, and Elizabeth Barrett-Connor. *The Development of Epidemiology: The United States of America*. Oxford University Press, 2009. Print: 375.

Influenza headed by Thomas Francis, Jr. which tested the latest polyvalent vaccine.⁵⁴ In this polyvalent vaccine, Francis hypothesized that if he used antibodies to *many* influenza strains, he would be able to elicit a hyperimmune response to protect against *all* influenza strains. Thomas worked with Salk to create an influenza vaccine containing antibodies to influenza A and influenza B virus.⁵⁵ Perhaps fortunately for the populace, but unfortunately for the researchers, there was no natural outbreak during the trial period for the vaccine and the test was aborted.

Undeterred, Francis and Salk tried to perform another vaccine trial in 1942. The trial was expanded to eight academic institutions with 12,500 study participants.⁵⁶ This trial represented another scientific leap. Historian of medicine and public health, John Eyler, emphasized that “the trial was innovative in design: the vaccinated and the controls were randomized by serial number; the trial was placebo controlled, and it was double blind.”⁵⁷ Revolutionary for its time, these techniques are now deemed by most physicians as the norm. By 1943, it was clear that the trials were a success. The rate of natural infection in those who received the placebo was 7.1% compared to the infection rate of 2.2% in those who actually received the vaccine. Tests in 1945 further confirmed this finding with decreased rates of infection. In tests at the University of Michigan, the rates of infection fell from 9.9% to 1.1%, and at Yale University, fell from 12.5% to 0.5%.⁵⁸ The cumulative results of these studies marked the development of the first safe, and effective, influenza vaccine.

⁵⁴ Eyler, “De Kruij’s Boast,” 425.

⁵⁵ Ibid.

⁵⁶ Eyler, “De Kruij’s Boast,” 426.

⁵⁷ Ibid.

⁵⁸ Eyler, “De Kruij’s Boast,” 427.

However, Francis' and Salk's vaccine failed to prevent the epidemic of 1946-1947.⁵⁹ Researchers were once again baffled. They initially believed that the vaccine was ineffective because it was stored before use. Nevertheless, tests indicated that the vaccine was still potent.⁶⁰ Scientists later discovered that the antibodies isolated in this outbreak did not react to the strains covered by the vaccine. In other words, the polyvalent vaccine did not create a hyperimmune response to all influenza strains. The vaccine would only be effective against the influenza strain for which it had antibodies.⁶¹ Scientists found that it was impossible to craft a vaccine that contained antibodies to all strains of influenza (since it is impossible to know all of these strains). Moreover, even if scientists knew all of the influenza strains, it would be impossible to safely administer such a concoction to a patient.

Scientists also found other peculiarities with influenza viruses. Namely, in the virus grown in eggs, there was little variation; but in animals that was a whole different matter. For instance, in 1947, George Hirst noted there was little variation in the virus he grew in eggs since 1941. However, in the viruses used in mouse models, there were antigenic changes. This work revealed one of influenza's unique characteristics. While other viruses have "immutable antigenic characteristics," the influenza virus changes its antigenic locations.⁶² Therefore if someone was immune to chickenpox, they would remain so. But if someone was immune to one type of influenza virus, it is not necessarily true that they would be protected against the next type. In the 1946-1947 pandemic, the vaccine did not prevent disease because the vaccine was produced with an

⁵⁹ Eyler, "De Kruij's Boast," 428

⁶⁰ Ibid.

⁶¹ Eyler, "De Kruij's Boast," 429.

⁶² Osborn, *History, Science, and Politics: Influenza in America*, 17.

antigenic specificity different from that of the circulating influenza. Scientists realized that their notion of using many strains to induce hyperimmunity needed to be modified. They needed to identify the most likely strains of influenza that would occur in a year and specifically create vaccines against them.

The pandemic of 1957 was a valuable learning experience for the United States.⁶³ Although the virus was identified in February 1957 in China, a vaccine formulation was not approved until July. Since it typically takes six months to produce the vaccine, along with the additional time for the human body to acquire immunity, the vaccine proved too late.⁶⁴ It was a “dismal failure” with 70,000 casualties, “and a large store of unutilized vaccine which had been produced too late to be of use.”⁶⁵ During this pandemic, the United States had the ability to act swiftly, but did not do so. Many would agree with Eyler’s account that “there is much more to medical technology than science: Economics, nonscientific traditions of thought, and social and political factors (not to mention fraud, shortsightedness, and other human imperfections) all help shape its evolution.”⁶⁶ In this instance, the technology of the vaccine was no longer in question; it was the use of the technology.

Once again, influenza was not proving to be easily “tamed.” Scientists had already identified approximately 24 strains of the virus. Certain countries preferred to test and use certain strains, WS strain in the UK, PR8 strain in the US, and Mel (for Melbourne) strain in Australia.⁶⁷

⁶³ Osborn, *History, Science, and Politics: Influenza in America*, 22.

⁶⁴ *Ibid.*

⁶⁵ *Ibid.*

⁶⁶ Bijker, *The Social Construction of Technological Systems*, 245.

⁶⁷ Eyler, “De Kruij’s Boast,” 429.

Despite the failure of the 1957 vaccine, later annual vaccine formulations did prevent disease and decrease total related expenditures. The total cost of the 1968 epidemic was 3 billion dollars whereas the 1918 epidemic cost over 100 billion dollars.⁶⁸ The combined mortality rate of both the 1957 and 1968 epidemics combined paled in comparison to the 500,000 deaths in the United States alone from the 1918 “Spanish flu.”⁶⁹

Eyler reminds us that “influenza cannot be conquered with a vaccine” and that the influenza puzzle still remains to be solved.⁷⁰ As soon as scientists and researchers believe they have “found the missing piece,” with a technological solution, in the case of Pfeiffer, Mother Nature appears to tell them that they were solving the wrong jigsaw puzzle. As soon as scientists believe they are close to solving this new puzzle, Mother Nature reappears to add more pieces and complicate matters.

HEALTHCARE IN THE US

Socioeconomic and strategic planning issues aside, being citizens of the richest nation in the world, many Americans do not have to worry about the availability of medications or resources when a medical situation arises. According to the US Census Bureau, as of 2014, 90% of Americans had some form of health insurance coverage.⁷¹ Moreover, many Americans do not have to worry about finding a hospital or a health care provider.

⁶⁸ In adjusted to 1968 currency. Osborn, *History, Science, and Politics: Influenza in America*, 23.

⁶⁹ Osborn, *History, Science, and Politics: Influenza in America*, 24.

⁷⁰ Eyler, “De Kruif’s Boast,” 437.

⁷¹ Smith, Jessica C., and Carla Medalia. “Health Insurance Coverage in the United States: 2014.” 2015. Print.

In the US, many hospital and health centers are privately owned and operated, but highly regulated. The McCarran-Ferguson Act (through US V. South-Eastern Underwriters Association ruling) allows for extensive federal oversight of insurance companies. The US Food and Drug Administration (FDA), as its namesake suggests, closely approves and monitors food and pharmaceuticals. Besides state and local legislation, the US Department of Health and Human Services manages health care. Other institutions include the Centers for Disease Control and Prevention (“the CDC”) and National Institutes of Health (NIH) which work toward disease prevention and research. This situation of having access and available health care, health care facilities, and resources stands in stark contrast to many countries throughout the world.

HISTORY OF MEDICINE AND OF INFLUENZA IN VIETNAM

Vietnam and Vietnamese medicine have a long history dating back more than 4,000 years.⁷² The same historical, political, and social forces that led to the creation of Vietnam as a contemporary nation-state heavily influenced the development of Vietnamese medicine and science. These forces include periods of war and peace, conquests and subjugation, and internal and external strife.

The etymological changes in Vietnam’s history mark major influences on Vietnamese medicine. Vietnam has been inhabited since the Paleolithic Age. During the Bronze age, Vietnam regarded itself as Đông Sơn (“East Mountain”) and thrived with advances in science and technology such as the exportation of bronze to China (bronze

⁷² Chu, Lan Tuyet. *An Introduction to the History of Traditional Medicine and Pharmaceutics in Vietnam*. Historical Perspectives on East Asian Science, Technology and Medicine: World Scientific, 2002. Print: 228

casting having appeared in Vietnam before China), the cultivation of rice, and the domestication of animals. Vietnam came under Chinese occupation for roughly one millennium (179 AD – 938 AD). During that time Vietnam was known as “Nam Việt” or “Southern Viet” which is a direct translation of the Chinese (“*yue nan*,” 南越).⁷³ Unsurprisingly, during this time, many aspects of Chinese traditional medicine were infused into Vietnamese medicine. After gaining independence from China, the Vietnamese gradually expanded southward – much like the United States expanded Westward with its belief in Manifest Destiny – in what the Vietnamese term *Nam Tiến*, or the (Southern progression). During French occupation, from the mid-19th century, Vietnam was known as *An Nam*, a colonial part of French Indochina. It was during this time, that many so-called “Western” concepts were introduced and integrated into Vietnamese medicine. After 1954, the French were dismissed from the country following the battle of Dien Bien Phu and Vietnam became divided into North Vietnam and South Vietnam. After the Vietnam War with the United States ended in 1975, Vietnam was “reunified” and is now officially known as the Socialist Republic of Vietnam or *Cộng hòa xã hội chủ nghĩa Việt Nam*.

The country of Vietnam, roughly a little smaller than the state of California, is currently inhabited by about 90 million people, most of whom are ethnically Vietnamese. However, there are many other groups in Vietnam whom the Vietnamese refer to as the “indigenous peoples” throughout the country and highlands like the Muong, the Yao, and Degar (who the French called the Montagnards) along with over 50 other ethnic groups.⁷⁴

⁷³ Chu, *An Introduction*, 264.

⁷⁴ Chu, *An Introduction*, 228.

Vietnamese medicine encompasses all of the different influences that contributed to its namesake and development as a nation-state. For the sake of simplicity, this research divides Vietnamese contemporary medicine into two distinct tracts – “Vietnamese traditional medicine,” and “Modern/Western medicine.”⁷⁵

Vietnamese traditional medicine is difficult to describe since as many authors noted, “there is no official definition of traditional [Vietnamese] medicine.”⁷⁶ In general, there is a focus on homeopathic, individualized treatment of the patient.⁷⁷ In addition, there is a focus on self-regulation and self-repair of the body.⁷⁸ Moreover, Vietnamese traditional medicine commonly focuses on “natural ingredients” to treat illness or maintain health.⁷⁹ Vietnamese traditional medicine can be further divided into two categories - *Thuốc Bắc* or “Northern Medicine,” in reference to Chinese traditions and not surprisingly, *Thuốc Nam* or “Southern Medicine,” which encompasses folk and indigenous knowledge from Vietnam.⁸⁰ In both cases, the general Vietnamese population

⁷⁵ The use of the term “modern” and “Western” are understandably loaded terms. Although I would rather describe “modern” or “Western” medicine as “Allopathic” medicine to encapsulate what is commonly defined as medicine based on biochemical paradigms; historically, researchers in the development of Vietnamese medical history have used the terms “modern” and “Western” and thus it may be confusing to the reader to continually cite the same concept with different terms. NCI Dictionary of Cancer Terms. (2014). Web.

⁷⁶ Do, Tat Loi, and D.X. Nguyen. 1991. “Native drugs of Vietnam: which traditional and scientific approaches?” *Journal of Ethnopharmacology*: 32, 52.

⁷⁷ Wahlberg, A. 2006. “Bio-politics and the promotion of traditional herbal medicine in Vietnam.” *Health: An Interdisciplinary Journal for the Social Study of Health, Illness and Medicine* 10 (2): 126.

⁷⁸ Chu, Q.T. 2008. “The model of integration of traditional medicine with modern medicine in hospitals of traditional medicine in Vietnam: present status and prospective plan.” *Chinese Journal of Integrative Medicine* 14 (3): 228. This individualization may be warranted since Variations in drug metabolism have been found in similar genetic Asian groups. In particular, the metabolization of “propranolol on blood pressure and heart rate.”

⁷⁹ Chu, Q.T. “The Model of Integration of Traditional Medicine,” 228.

⁸⁰ Jenkins, Christopher N.H., Thao Le, Stephen J. McPhee, Susan Stewart, and Ngoc The Ha. 1996. “Health care access and preventive care among Vietnamese immigrants: Do traditional beliefs and practices pose barriers?” *Social Science & Medicine* 43 (7): 1050.

understands the overall concepts of “traditional” medicine and applies these concepts to their everyday life.

Owing to its long history and geographic proximity with China “Northern Medicine” corresponds to many familiar Chinese concepts and techniques. These concepts include the belief in the balance between *âm* (*yin*) “cool” / “female” and *đương* (*yang*) “hot” / “male forces” and the techniques include the use of acupuncture and moxibustion.⁸¹ It is important to note that the transfer of medical knowledge between China and Vietnam was not one way. Many Chinese texts such as “the Chinese Medical Dictionary” (*zhongguo yaoxue da dianci* 中國藥學大詞典) record Vietnamese indigenous medicines, where and how they were produced, and the experiences in the local use of the medicines.⁸²

One of the primary differences between “Northern” and “Southern” medicines is that “Southern medicine” focuses on using indigenous natural resources such as plants and animals found only in Vietnam. “Southern” medicine is influenced by the indigenous peoples and beliefs to include those of Vietnamese ethnic minorities. “Southern medicine” is also distinguished by its focus on *phong* (confusingly enough, from Chinese word “feng” 風) or wind.⁸³ For instance, when someone catches a cold, it can be referred to as *trúng gió* or “being hit by the wind.” A common treatment for catching a cold, flu, sore throat, and other similar ailments is *cạo gió* or “scraping the wind.”⁸⁴ This technique more or less involves the application of a menthol solution (like trade names

⁸¹ Purnell, L.D. 2008. "Traditional Vietnamese Health And Healing." *Urologic Nursing*: 44, 66.

⁸² Chu, *An Introduction*, 264.

⁸³ Purnell, “Traditional Vietnamese Health And Healing,” 66.

⁸⁴ *Ibid.*

“VapoRub[™]” or “Tiger balm”) over a large patch of skin and then taking a coin to scrape off the solution. The result is a very large, and very red, patch of skin. The redness on the skin comes from the increased circulation caused by the solution and the skin (much as one would have after scratching a mosquito bite) returns to normal after a few days. In theory, the combination of menthol and scraping increases blood circulation, thereby helping the body to quickly mobilize its self-defense mechanism. Due to the vivid coloration of the skin post- *chào gió*, there have been many cases where the practice has been mistaken for child abuse. However, studies have shown that (American) “health care providers need to be encouraged to develop cultural sensitivity so that *chào gió* is not construed as an act of child abuse within health care delivery situations.” There are distinct texts that describe different facets of general traditional Vietnamese medical treatments such as *Nam Duoc Than Gieu* (The Miraculous Efficacy of Vietnamese Medicines) from the 17th century that “describes [ing] 580 indigenous drugs in 3,873 prescriptions for 10 clinical specialists” and *Hong Nghia Giac Thu* (Medical book from the Village Hong Nghia), describing 630 other medications.⁸⁵

“Western” medicine has been a large influence in Vietnam ever since French colonization. In fact, due to opposition from the local elite, the French created a new class of elite, trained in allopathic methods in order to maintain colonial power.⁸⁶ During this time, French medicine was primarily limited to the Vietnamese elite and people who lived in the cities.⁸⁷ As many citizens in the city were economically more well off, in

⁸⁵ Do, “Native drugs of Vietnam,” 51.

⁸⁶ 1867, when most of the Vietnamese scholar-officials who had ruled the area previously, withdrew and refused to cooperate with the Europeans. The French had no choice but to create an elite of their own and begin to educate it in French ways.” Smith, “Health Insurance,” 459.

⁸⁷ Chu, *An Introduction*. 268.

1964, 79% of the Vietnamese surveyed in the capital city of Saigon “preferred Western Medicine.” During this period of colonization, traditional medicine was “neglected and rejected.”⁸⁸ An additional “Western” influence arrived during the Vietnam War. Both the American Medical Association (AMA) and the United States Agency for International Development (USAID) had operations in Vietnam as early as 1966.⁸⁹ Perhaps in retaliation, in the context of Vietnamese traditional medicine, “Western” medicine was considered as “too strong” or “hot.”⁹⁰ Perhaps this initial apprehension of “Western” medicine was also due to increased nationalist pressures during that time.

Even before the end of the Vietnam War and “reunification” of the country, President Ho Chi Minh of North Vietnam wanted a symbolic unification between traditional and modern medicines emphasizing, “we should attach special importance to studying the integration of traditional medicine and modern medicine” and “TM [Traditional Medicine] practitioners should study MM [Modern Medicine] while MM doctors should study TM. People’s health care carried by both TM practitioners and MM doctors is the same as a person working with two hands. Two hands collaborating well in work will bring a good outcome.”⁹¹

Moreover, Ho Chi Minh’s rhetoric accepted “modern medicine” yet rejected “Western medicine,” and emphasized this unification would be “Vietnamese” stating: “We must build our own medicine... Our ancestors had rich experience in the treatment of diseases using local medications and those of the north [China]. To enlarge the sphere

⁸⁸ Chu, “The model of integration of Traditional Medicine,” 228.

⁸⁹ Marley, “Medical Help for Viet Nam,” 160.

⁹⁰ Jenkins et al, “Health care access,” 1050.

⁹¹ Chu, “The model of integration of Traditional Medicine,” 228. Vietnamese texts have a propensity towards using acronyms, even if they are not commonly used.

of action of medicine, it is necessary to study means of uniting the effects of oriental remedies with those of Europe”⁹²

In order to “modernize, standardize and repopularize Vietnamese traditional medicine” Ho Chi Minh created networks and associations such as the National Institute of Traditional medicine in 1957 under the purview of the Ministry of Health.⁹³

Ho Chi Minh’s communist system of purportedly “modern” medicine created a free public health care system that was questionable at best. This statement should be qualified since many other scholars have found that “data about the situation in Vietnam prior to 1989 are hard to obtain.”⁹⁴ In fact, health care officials “described how during meetings official data are changed at will.”⁹⁵ Although the communal plan of allocating doctors, healthcare staff, and services seemed great on paper (even the World Health Organization (WHO) “produced laudatory articles based on the official information of the Vietnamese government”), healthcare staff was grossly underpaid.⁹⁶ This lack of resources led many health professionals to seek second jobs, resulted in medical thievery, and encouraged sales of black market medicines.⁹⁷ Although there was healthcare, researchers noted “this sounds impressive, but availability does not mean that the Vietnamese health-care system was effective and that the quality was sufficient.”⁹⁸ In fact, there were many medical shortages. Medicine was commonly in short supply, counterfeiting of medicines rampant, and medicines also had to come from overseas,

⁹² Wahlberg, “Bio-politics,”130.

⁹³ Wahlberg, “Bio-politics,”131.

⁹⁴ Wolffers, I. 1995. " The role of pharmaceuticals in the privatization process in Vietnam's health-care system." *Social Science & Medicine* 41 (9): 1327.

⁹⁵ Wolffers, “The role of pharmaceuticals,”1326.

⁹⁶ Ibid.

⁹⁷ Ibid.

⁹⁸ Ibid.

most commonly from family members living in the United States.⁹⁹ In order to cope with the lack of medicines, Vietnamese researchers prudently recommended that traditional methods should be used for acute diseases if “modern drugs are expensive so that poor people can’t buy” or when there is only positive and no negative effects.¹⁰⁰ Furthermore, “as a way to overcome this shortage, the Vietnamese government launched a ‘revolutionary movement to bring traditional medicine back to the grassroots level.’”¹⁰¹ It is clear that the use of traditional medicines that are more readily available was a result of necessity as opposed to efficacy or individual preference. An important point here is that although the Vietnamese would have preferred allopathic methods, in cases where resources were limited, they would fill “modern” medical gaps with “traditional methods.”

In 1989, Vietnam underwent economic reform with *đổi mới*, or the “new life.” Healthcare was privatized in the hope that healthcare and medicines would become more widely available and mirror the economic progress being made. Nevertheless, even to this day, healthcare is limited to what resources are available, not to how well physicians understand the medical sciences. Due to these resource constraints, there are modern facilities located in Vietnamese cities where injections of vitamin B are commonly used as opposed to antibiotics or other common methods used in the United States.¹⁰²

This is in stark contrast to the American health care system where most facilities are privately owned and managed enterprises. Moreover, in the US, most facilities have

⁹⁹ Wolffers, “The role of pharmaceuticals,” 1330.

¹⁰⁰ Do, “Native drugs of Vietnam,” 51, 55.

¹⁰¹ Wahlberg, “Bio-politics,” 138.

¹⁰² Wolffers, “The role of pharmaceuticals,” 1330.

ample amounts of resources and supplies, funding from health insurance (mandated in some form or another) in addition to governmental Medicare and Medicaid.

Currently, Vietnamese medicine consists of both “traditional” and “modern” medicine. There is a strong affinity for traditional methods since, like most of the population, “the Vietnamese government has advocated this approach since almost all the previous and present leaders of Vietnam were cured with traditional medicine.”¹⁰³ Moreover, traditional methods are recommended for “chronic diseases but not in the diagnosis and treatment of acute diseases and surgical diseases which must be diagnosed and treated accurately and promptly.”¹⁰⁴ Traditional medicine is also recommended when “Western medicine is ineffective.”¹⁰⁵

At first glance, strangely enough, other than availability, there does not appear to be conflict between “traditional” and “modern” medicine. In many respects, this may be because Vietnamese medicine has already dealt with medical knowledge transfer, especially with regard to Chinese medicine. Two studies support how ethnically Vietnamese are affected by these two different integrated systems. Although the Vietnamese populations living in the US have different medical beliefs, studies have shown that “their beliefs are very similar to many American’s beliefs about “natural” and dietary supplement products. Traditional Vietnamese medicine is used more as a supplement and for prevention of disease rather than a replacement for Western treatment.”¹⁰⁶ Another US study shows “clearly that many Vietnamese possess traditional

¹⁰³ Do, “Native drugs of Vietnam,” 54.

¹⁰⁴ Chu, “The model of integration of Traditional Medicine,” 229.

¹⁰⁵ Do, “Native drugs of Vietnam,” 51, 55.

¹⁰⁶ Nguyen, Sammie, Donald Richard Miller, and Molly J. Dingel. 2010. “Traditional Medicine Use in a Vietnamese-American Community.” *The Annals of Pharmacotherapy* 44: 769.

health beliefs and practices which differ from those of the general U.S. population. Yet, the data do not support the hypothesis that these traditional beliefs and practices act as barriers to accessing to Western medical care or to utilizing preventive services.”¹⁰⁷

It is easy enough to describe Vietnam as a “developing nation,” but in reality it has been developing in parallel with “Western Medicine” all along and is actually not considered a “developing nation” at all.¹⁰⁸ Although there is a cultural emphasis on higher education in science, technology, engineering, math, and law, the lack of resources available to medicine and public health continue to be a major obstacle for research, training, and education.¹⁰⁹ In 2013, Vietnam’s GDP was approximately 171 billion US dollars and had a little over a quarter of the US population, whereas the US GDP was 16.7 trillion US dollars which is approximately 100 times more economic output than Vietnam.

A large part of this parallel acceptance of “modern science” stems from the French colonization of Vietnam as French Indochina (1887-1954). Initially French occupation became a conduit for scientific information exchanges between Vietnam and the West. What might be surprising to some is that less than four years after its founding branch in Paris, a Saigon Branch of the Pasteur Institute was founded in 1891.¹¹⁰ This was followed in relatively quick succession by an associated Pasteur Institute of Nha Trang in 1895 and the National Institute of Hygiene and Epidemiology of Hanoi in 1923.¹¹¹

¹⁰⁷ Jenkins et al, “Health care access,” 1049.

¹⁰⁸ With that said, Vietnam isn’t even considered a “non-developed” country. According to the Human Development Index of 2014, Vietnam is “medium” “developed” country. Human Development Report 2014. New York: United Nations Development Programme (UNDP).

¹⁰⁹Runckel, Christopher. 2011. The Education System in Vietnam Business-in-Asia.com.

¹¹⁰ Pasteur, Institut. 2010. The Institut Pasteur In The World.

¹¹¹ Ibid.

Interestingly enough, Alexandre Yersin (of *Yersinia Pestis* / plague fame) actually set up the Medical School of Ha Noi in 1902 and he founded the Nha Trang laboratory that was to be later incorporated into the Pasteur Institutes. Both Pasteur and Yersin are affectionately remembered in Vietnam where amidst political unrest, the streets that bear their names are still the only ones unaffected by social and political change.¹¹²

Owing to these prior scientific exchanges, Vietnam as a whole has known and understood “modern” medicine since its inception. As Pasteur would put it, “in science, there is no concept of different countries because knowledge is the property of humanity and the light to guide the entire world.”¹¹³ Indeed, even though Vietnam has its own understandings of “traditional medicine,” the concepts of bacteria, viruses, and disease transmission are not at all alien.

Thus, contemporary Vietnamese medicine is a conceptual mix of both “traditional” and “modern” medicines. To explain the development of medicine in Vietnam without the players involved is only providing a partially accurate description. Vietnamese medicine developed from historical influences from the ethnically Vietnamese, the indigenous peoples of Vietnam, the Chinese, French, and Americans. The preferred use of “traditional” versus “modern” medicines is greatly impacted by politics, class struggles, physical availability, and economics.

Currently, as it was before, Vietnam is a beneficiary and contributor to the international research community. In urban areas, Vietnam has many world-class hospitals and research institutes, many of which partner with international organizations.

¹¹² VNS. 2011. "Streets of Saigon: Pasteur." *Saigon Today*.

¹¹³ VNS

For instance, the Ho Chi Minh City (HCMC) Hospital for Tropical Diseases (HTD) partners with the Oxford University Clinical Research Unit (OUCRU). Under the Ministry of Health, the aforementioned Pasteur Institute is still in full operation in collaboration with the National Institute for Hygiene and Epidemiology in Hanoi, Vietnam and the Pasteur Institute in Nha Trang. Like most countries, Vietnamese researchers and scientists travel abroad for education, teaching, research, and return to Vietnam to continue their research. Even though Vietnam is a smaller country than the US, it currently has 12 medical schools, which also contribute to research. It is not merely a beneficiary of international research. Vietnam works as an equal partner with researchers from the US and around the world in order to combat pandemic influenza flu.

AVIAN INFLUENZA IN VIETNAM

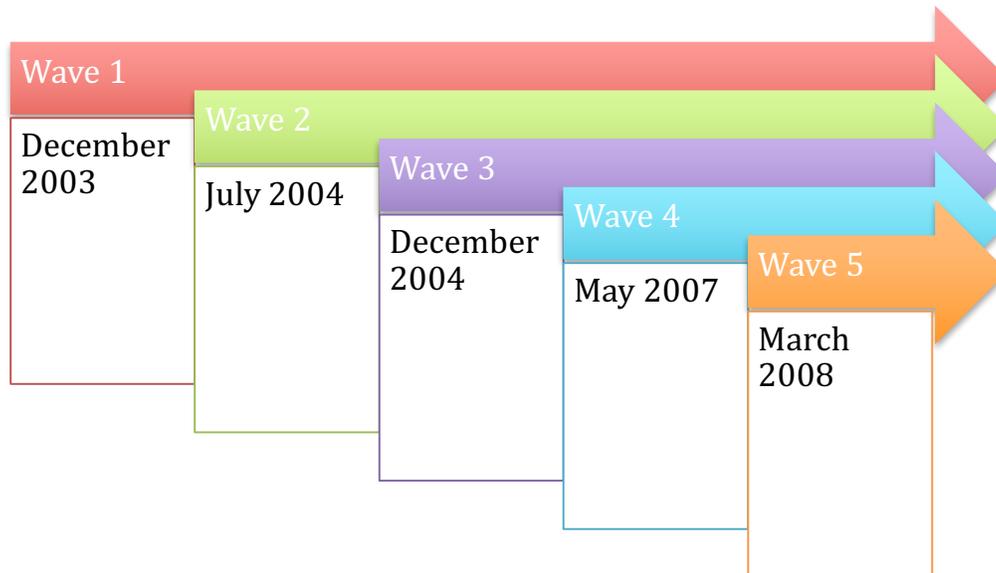
Recent epidemics in Vietnam provide clues as to why pandemic paradoxes may linger.¹¹⁴ One of the most recent outbreaks in Vietnam centered on avian influenza, which, as its name suggests, starts in birds. Scientists consider avian influenza strains as those with this highest likelihood of instigating pandemics. From December 2003 – March 2008, the influenza outbreak in Vietnam was actually an extended event consisting of five “waves” affecting both humans and animals.¹¹⁵ (See Figure 1 below) Based on the information from Nguyen Tran Hien’s (from the World Organization for Animal Health’s) timeline, these waves lasted from (1) December 2003 – March 2004;

¹¹⁴ As a global disease, influenza has also had a long history in Vietnam. However, due to poor record keeping, conflict, destruction of records, and relevance to this study, the details of these previous events will not be discussed. It is important to note here that avian influenza, or more commonly known, “bird flu,” does not necessarily become a pandemic, but could become pandemic.

¹¹⁵ Nguyen, Tran Hien. 2008. "Avian Influenza In Vietnam: Situation And Lessons Learned."

(2) July 2004 – August 2004; (3) December 2004 – November 2005; (4) May 2007 – December 2007; and (5) January 2008 – March 2008. During all five waves, the number of confirmed cases in humans ranged from 4-66 and the number of deaths ranged from 4-22. During the first wave, 43.9 million animals were reportedly culled, while successively this number declined with each wave. More or less, the epidemic continued despite efforts from the Vietnamese health officials and international organizations to control the disease. Since the 2003-2008 outbreak, there have been additional outbreaks in Vietnam, but interestingly, they have not taken on the same level of urgency, tone, and scrutiny of the 2003-2008 outbreak.

FIGURE 1: AVIAN INFLUENZA TIMELINE IN VIETNAM



PANDEMIC POLITICS

The “politics” of influenza are highly complex. It involves a collision of many actors including citizenry, local, national, international, non-governmental organizations

(NGOs), and multi-national organizations. “Politics” in this context refers to both governance and policy decisions, and also to the mediated discourse these actors use as persuasion. What we find is three different media narratives: 1) The Vietnamese media which blames the populace for disease spread, 2) Communications from multinational organizations which are very optimistic and generally supportive of the Vietnamese government’s response, and 3) Foreign media which had a more critical response to Vietnam’s pandemic mitigation efforts.

The political economy of influenza may play a major role in the development of pandemic paradoxes. “Economy” in this context will be used to denote both monetary resources and other forms of currency such as “scientific currency.” Although this section will focus on the monetary implications of pandemic influenza, Chapter 5 will detail issues of scientific “credit.”

VIETNAMESE MEDIA

According to the Vietnamese media, the problem with the avian influenza epidemic was that the people did not understand the implications of their actions in fueling the disease progression. For the most part, the Vietnamese media focused on official government statements and supported educational outreach as a form of disease prevention. Tran Duc Long, deputy director of Legal Services, from the Department of Health who was in charge of the flu information dissemination, wanted information to be directed to each citizen. He noted that he is afraid that they “do not know fear.” (Hai Ha)¹¹⁶ Even in foreign press media, other officials also reiterated this opinion. Bui Quang

¹¹⁶ This Vietnamese linguistic set phrase term is very condescending. It implies that the person making the statement knows much more. It’s along the lines of standing next to someone looking at a

Anh, head of the Department for Animal Health noted, “‘It’s difficult to change their [the people’s] habit but we need to educate them,’ ‘Once they understand and follow all the instructions, we can prevent the virus from spreading.’”¹¹⁷ Other government organizations also supported the educational efforts to include the “Ministry of Culture and Information and localities in coordination with the Ministries of Agriculture and Rural Development and Health, the Central Committee of the Vietnam Fatherland.”¹¹⁸

According to the logic of the Vietnamese media, the continuation of the epidemic stems from this “lack of education” of the public. This lack of education then leads to the public’s refusal to stop raising poultry in close proximity to human habitats. One Mr. Giang, said “the two biggest problems of HN (avian influenza) prevention: Many residents refused to register their household poultry and that is why 100% of the poultry can’t be vaccinated against; many non-infected poultry from other provinces flock to the source of viruses that now exist Hanoi.”¹¹⁹

In addition, as a state-run enterprise, the Vietnamese media extolled successes and outreach efforts from official, organized groups. In an October 2005 article, Vietnamese media reiterated the slogan “Vietnam does not have bird flu because of joint effort.”¹²⁰ Moreover, state-sponsored organizations like the Vietnam’s Communist Youth League

child next to the stairs and telling someone a child “does not know danger.” Please note that the information from this citation was later edited online and the statement has been subsequently removed from the source. It could be a reflection of the addition of “online ads” which are predominant in online Vietnamese news media.

¹¹⁷ Tran, VM. 2005. “Official Urges Farmers to Curb Bird Flu.” *Associated Press Newswires*.

¹¹⁸ 2005. “Vietnam issues six urgent bird flu preventive measures.” *Thai News Service*.

¹¹⁹ Đức Kế. Ông Giang cho biết 2 khó khăn lớn nhất hiện nay của HN trong công tác phòng chống dịch: Nhiều người dân không chịu đăng ký gia cầm nuôi trong nhà nên không thể tiêm phòng 100%; ngoài nguy cơ virus trên các đàn gia cầm từ các tỉnh đổ về thì nguồn virus tồn tại sẵn ngay tại địa bàn Hà Nội cũng rất lớn.

¹²⁰ “Chung sức vì một Việt Nam không cúm gia cầm.” Le, Ha. 2007. “Media Campaign against bird flu (Chiến dịch truyền thông phòng chống cúm gia cầm).” *Viet Bao (Vietnam News)*.

tasked younger people to help disseminate information, help cull, stop trade, and look at poultry production processes to figure out better control strategies.¹²¹

It also appears that the Vietnamese media focused more on influenza antiviral (Tamiflu) or vaccine testing, supplies of antivirals, and foreign government donations of antivirals. There were seldom articles on actual drug distribution, vaccine distribution, and actual treatment of cases.

COMMUNICATIONS FROM MULTINATIONAL ORGANIZATIONS

Large / multinational organizations such as nongovernmental organizations (NGOs), the WHO, United Nations (UN), and even the United States CDC had more or less optimistic and supportive responses to Vietnamese government attempts to stop the epidemic after 2004. Information from large and multinational organizations also addressed international efforts like how the WHO and the United States provided funds to help with equipment and training.

These organizations partnered with the Vietnamese media. For instance, the United States Agency for International Development (USAID) partnered with the Vietnamese media to create public service announcements (PSAs). These PSAs included one that encouraged Vietnamese backyard flock owners to quarantine newly bought chickens for two weeks (or else their neighbors would not invite them to future parties) and one that encouraged keeping chickens enclosed.¹²²

¹²¹ Bui, Minh long. 2004. "Roundup - Vietnam takes bolder measures to curb bird flu spread." *Xinhua News Agency*.

¹²² USAIDVietnam. 2011. Avian Influenza: Vietnam Public Service Announcement 1. YouTube.
USAIDVietnam. 2011. Avian Influenza: Vietnam Public Service Announcement 2. YouTube.

Information from these large organizations also touted the Vietnamese government's actions and their action plans. These large organizations had a tendency to make the epidemiological efforts seem much more robust than they actually were. For example, IRIN, a the UN Office for the Coordination of Humanitarian Affairs news and analysis service, reported "Vietnam now has 15 sentinel surveillance sites that test sputum samples of patients suspected of having the flu, allowing health officials to detect and track the disease."^{123,124} Moreover, Nguyen Tran Hien from the World Organization for Animal Health's "Avian influenza In Vietnam: Situation And Lessons Learned" summary presentation noted quite an impressive surveillance network in Vietnam. Unfortunately, at the time of publication, that surveillance system was not as sophisticated as originally touted.

Nguyen Tran Hien's presentation also showed the Vietnamese government's handling of the epidemic in a favorable light noting in the "Lessons Learned" slide that "1. Highest political commitment: Strong leadership of the Government. 2. Establishment of multi-sectorial Steering Committees for control and prevention of avian and human influenza at all levels, from central to communal level. 3. Good collaboration between MARD, MOH, other ministries and mass organizations to develop and implement 'Integrated Operational Program for Avian and Human Influenza (OPI),' and so forth. Like the Vietnamese government officials, most of the blame was focused on the Vietnamese citizenry. In his "Challenges" slide, Nguyen notes "3. Poultry raising system is not appropriate: back-yards in household, small farms; 4. Poor recognition and

¹²³ 2009. IRIN. According to its website.

¹²⁴ IRIN. 2010. "Lessons Learned From SARS, Bird Flu, H1N1." Eurasia Review: News and Analysis.

reporting of suspected HPAI in poultry. Human case identifications mostly occurred before reports of disease in poultry. 5. Low awareness and high risk behaviors of handling and eating sick poultry/their products.” However, in contradiction to his other slides, he briefly mentions the “challenge” of a “lack of capacity and resources for active surveillance and research.”

For the most part, these grand characterizations made by these large organizations are later refuted by the foreign press reports.

FOREIGN MEDIA

The crux of the influenza epidemic situation in Vietnam could be garnered from analyzing the foreign media (news outside of Vietnam) reporting in conjunction with making some assumptions and “filling in the gaps” of Vietnamese media reporting. The foreign press was quick to note the difficulties of the Vietnamese citizenry, not due to any lack of scientific understanding, but more to economic and governmental trust issues. It was made very clear that the Vietnamese people knew that a virus caused avian influenza and may or may not be transmittable via human-to-human contact and / or bird-to-human contact.

Foreign media elucidated government claims. The foreign press showed that the surveillance network was not as robust as the government claimed noting, ““In many places, the epidemic surveillance network is non-existent,’ vice-minister of health Tran Chi Liem told an official newspaper recently.”¹²⁵

¹²⁵ York, G. 2005. "Vietnamese farmers worsen bird-flu threat by ignoring ban; Death toll mounts as some bribe officials, smuggle ducks, pullets past checkpoints in Communist country." *The Globe and Mail*.

It is important to note that the information from the Vietnamese government has been one sided. Many commentaries agree that “Vietnam’s leaders say the government is ‘of the people, for the people, and by the people’... the country’s political system has only one political party, the Communist Party. Elections typically have only candidates approved by that party.”¹²⁶ Thus, there are biases in what one can find in the open literature.

Moreover, Vietnamese officials have not always been forthright with information. Reporters without Borders accused the Vietnamese government of restriction of the press. Nevertheless, Vietnamese radio refutes the clam as “Brazen slander against press freedom in Vietnam.”¹²⁷

Telecommunications have also been reportedly restricted. Even though Vietnam has had a flourishing internet development rate, recently, “the US House of Representatives passed Resolution 672 stating that the establishment of the Administration Agency for Radio, Television, and Electronics Information [ARTEI] in Vietnam has limited internet freedom and has censored personal blogs.”^{128, 129} In a press interview the Vietnamese Information Minister denied the charge stating, “In Vietnam, the internet made its appearance 12 years ago on 19 November 1997. During this period, the Internet grew rapidly in Vietnam with the state’s support and promotion...” Further, he discussed the growth of Internet cafes and how they are crowded, implying a sense of

¹²⁶ J., Benedict, and Tria Kerkvliet. 2001. "An Approach for Analysing State-Society Relations in Vietnam." *SOJOURN: Journal of Social Issues in SE Asia* 16 (2), 1.

¹²⁷ "Vietnamese radio denounces press freedom report." 2009. "Vietnam: Information minister denies US charge, says no control on Internet." *BBC Monitoring Media*.

¹²⁸ "According to the International Telecommunications Union, Vietnam is one of the top 10 countries in the world that has the highest internet development rate during the 2002-2007 period" (Vietnam: Information minister denies US charge, says no control on internet").

¹²⁹ "Vietnam: Information minister denies US charge, says no control on Internet."

public access to the Internet. He then emphasized, "That is why one cannot say that Vietnam has restricted the use of the Internet. If we had done that, there would not have been this development."¹³⁰ The logical fallacy in his statement was that although access was possibly increased, that does not mean that the actual information itself was not limited. In a quick analogy, even though one can allow more readers into a book store that does not equate to the number of books being limited. Other officials have partially commented on this issue such as "communication ministry officials believe that new legislation on blogging will help create a healthier online environment."¹³¹

Foreign press reports showed that Vietnamese authorities attempted to hide the first cases of avian influenza in the country. In fact, Vietnamese authorities later admitted that they knew about the virus' appearance long before the "official" start date of December 2003. As other researchers including Nicholas Thomas have found, "soon after Vietnamese authorities called for international assistance, they confirmed that an earlier outbreak had been detected in July 2003. However, for political and economic reasons (Vietnam was preparing to stage the 22nd Southeast Asian Games) the authorities elected not to publicize the matter. That outbreak, in Northern Vietnam, lasted from July to September 2003. In this case, Vietnam demonstrated a notably different procedure for dealing with infectious diseases than was the case with SARS [Severe Acute Respiratory Syndrome]."¹³²

¹³⁰ Ibid.

¹³¹ "Than Nien" (Vietnamese Youth newspaper), "Vietnamese web users doubt effectiveness of planned blog regulations" and 2008. "Vietnamese web users doubt effectiveness of planned blog regulations." BBC Monitoring Media.

¹³² Thomas, N. "The Regionalization of Avian influenza in East Asia: Responding to the Next Pandemic(?)." *Asian Survey* 46 (6): 926.

THE POLITICAL ECONOMY OF INFLUENZA

International politics played a large role in the actual continuation of the disease. This has been thoroughly documented in Ian Scoones' compendium *Avian Influenza: Science, Policy and Politics*. In it, Scoones compiles the works of political scientists, psychologists, and physicians and provides an historical summary of the international response to avian influenza. He and Paul Forster create an actor network diagram of the many actants involved such as "Big Pharma," "Ministries of Health," "Big Chicken," "WHO," and "World Bank," just to name a few.¹³³ This actor network diagram not only showed the three different international narratives and responses, but it also revealed potential areas of economic competition – that between large organizations, countries, farmers, and animal producers. Scoones' point will be echoed throughout this research as he notes, "we find again and again that standard technical and policy solutions do not work as planned, and context really does matter. The economic structure of production, alongside political contexts, is critically important."¹³⁴

SARS was unlike avian influenza because the disease progression of SARS played a significant role in combating the disease itself. The main difference was that SARS was not linked to the poultry industry in Vietnam. In a country where 70% of the economically disadvantaged produce chickens, any disease affecting poultry would greatly affect their livelihood and subsequent reactions.¹³⁵

The confluence of pandemic influenza, food commodities, and culture cannot be overlooked. In Stacy Lockerbie's "Global Panic, Local Repercussions: Exploring the

¹³³ Scoones, Ian. 2010. *Avian Influenza: Science, Policy and Politics*. London: Earthscan: 22.

¹³⁴ Scoones, *Avian Influenza*, 224.

¹³⁵ York, "Vietnamese farmers," A3.

Impact of Avian Influenza in Vietnam,” she details both the nutritional and economic importance of poultry as a food source in Vietnam. Moreover, she details its consumption as a status symbol.

The key to figuring out why avian influenza was such a persistent epidemic in Vietnam can be traced back not only to the difficulty of “modern medicine” to treat the disease, but also to how the Vietnamese viewed the disease. As Scoones succinctly notes, “socio-cultural constructions of risk, threat and the role of poultry in local livelihoods define perception and response.”¹³⁶ It seems that the Vietnamese people are more or less concerned with diseases that actually kill or permanently debilitate. They are accustomed to a less than perfect health system that does not lend itself to treating most serious diseases. Thus, they are only concerned if something kills them. Since it appeared that the number of deaths was relatively low, the people were relatively unconcerned about keeping their poultry.

Through the five waves of the epidemic, there were also a decreasing number of culled animals. Potentially, there could have been fewer poultry to cull. However, another explanation related to corruption might be more plausible. On one hand, Vietnamese officials advocated culling; however, there were suspicions that that officials were paid off by poultry farmers to ignore culling. In one instance, the people suspected that the inspector was bribed to ignore a pond full of ducks.¹³⁷ In other cases, the inspectors started to identify with the concerns of the farmers and one woman was allowed to keep her poultry after insisting that her chickens were disease free.¹³⁸

¹³⁶ Scoones, *Avian Influenza*, 225.

¹³⁷ York, “Vietnamese farmers,” A3.

¹³⁸ Ibid.

The Vietnamese people also developed strategies to circumvent culling or make culling as profitable as possible. According to Nguyen Duy Long, the person in charge at Long An Veterinary Department, per chicken, each resident would receive 10,000 dong (about 60 cents US) and 400 dong for eggs.¹³⁹ This was dependent on the region in the country. Farmers would actually move their poultry where they would get more compensation for culling.¹⁴⁰ Moreover, they would move their poultry to other regions not mandated to cull “stubbornly believing there is nothing wrong with their birds as long as they can still flap their wings.”¹⁴¹ Because the compensation for culling was much less than market values, the farmers would also quickly sell their chickens at a discount.¹⁴²

The economic concerns were so real that poultry farmers resorted to insuring any possible deaths that came about due to eating their product. One farmer advertised that if a person dies, he would give \$6,400 US to the family and pay for all medical expenses.¹⁴³ That is a substantial amount in a country where in 2004 the annual income was only about \$1,000 US.¹⁴⁴

PANDEMIC RESPONSE FRAMEWORKS

In response to the avian influenza outbreak that started in 2003, both countries developed differing pandemic response frameworks. The US created a National Strategy

¹³⁹ TMH. 2005. "Compensation concerns hamper Vietnamese efforts to contain bird flu." *Agence France Presse*, 1/19/2005.

¹⁴⁰ Patha, Don. 2004. "Bird-flu politics hits poor hardest." *The Nation*, Hanoi, 2/20/2004.

¹⁴¹ Ibid.

¹⁴² TMH, "Compensation concerns hamper Vietnamese efforts to contain bird flu"

¹⁴³ AP. 2004. "**Vietnamese farmer insures chickens, vows to pay relatives of anyone who dies from bird flu after eating his poultry.**" *AP Worldstream*, 3/18/2004. <https://www.highbeam.com/doc/1P1-92265471.html>.

¹⁴⁴ 2004. Vietnamese poultry farmers forge ahead under shadow of bird flu. In *eFeedLink*.

for Pandemic Influenza, while Vietnam cooperates with the One Health approach through the Vietnam Integrated National Operational Program on Avian Influenza, Pandemic Preparedness and Emerging Infectious Diseases.¹⁴⁵ Both provide a response framework based on considerations of what could happen in a response rather than a formulaic response based on set assumptions. In other words, the responses are contingent on what could happen rather than what will happen.

The US National Strategy emphasizes three tenants for an influenza pandemic response: (1) preparedness and communication, (2) surveillance and detection, and (3) response and containment.¹⁴⁶ In it, the National Strategy emphasizes a coordinated response with federal, state, and local partners to ensure public safety. A critical component is the use of communications with NGOs and the public.

The Vietnam's AIPED emphasizes enhanced coordination, control in the agricultural sector, and preparedness. Although similar to the US's national strategy, it is different in that control is vested upon the Vietnamese Prime Minister. Moreover, although coordination occurs between the national government and the provinces (akin to the US federal government and states) and international organizations, there is an emphasis on cooperation with "donor" organizations."¹⁴⁷ Another critical difference involves the "One Health" approach, which emphasizes the interplay between animals, humans, and disease. Although it is an area that the US CDC recognizes, it is one the

¹⁴⁵ "National Strategy for Pandemic Influenza: Implementation Plan One Year Summary." edited by Homeland Security Council, 2007 and Health, Ministry of Agriculture and Rural Development and Ministry of. "The Vietnam Integrated National Operational Program on Avian Influenza, Pandemic Preparedness and Emerging Infectious Diseases (AIPED), 2011-2015." 2011.

¹⁴⁶ "National Strategy for Pandemic Influenza," 1.

¹⁴⁷ AIPED, 1. These "donors" remain unnamed, but are assumed to be organizations such as the WHO.

Vietnamese MOH follows. In other words, although the US recognizes it as a good approach, there was no mention of it for pandemic purposes, but it is a concept that the AIPED abides by. One final difference between the US and Vietnamese response framework involves public agency. In the US response, the public is informed, but in the Vietnamese response, there is an emphasis on “behavioral change.”¹⁴⁸

Thus, in both the US and in Vietnam, there is no formulaic response for pandemic influenza. Historically, although it may seem like Vietnam had some missteps, this was because the US did not experience an avian influenza outbreak. The US was able to form lessons based on Vietnamese experiences. As we will soon see, epidemiologists in Vietnam did not have historical hindsight to aid with their decisionmaking. Nevertheless, a detailed analysis for these two response frameworks would be a great area for future study.

SUMMARY

From this historical look we see that although the United States and Vietnam have different medical traditions, they do not have isolated histories. Both the US and Vietnam gained from, and contributed to, international research and perspectives. With the benefit of hindsight, both countries went from not knowing much about influenza and viruses to what we now refer to as biomedicine. Although access and resources greatly vary, in contemporary times, researchers in both countries have an equally sophisticated understanding of medicine.

¹⁴⁸ AIPED, viii.

If the different ways in which influenza is attributed, prevented, and acted on are not due to a difference in the understanding of science and technology, they may be due to the differences in social structures, cultural practices, and availability of resources. Vietnam's healthcare system is undergoing a privatization process. Despite knowledge that some techniques may be more viable, there is really no access to the resources needed. Thus, when resources are in short supply, the Vietnamese population steers towards more commonly available traditional medicines to breach the gap in healthcare. This is drastically different from the US healthcare system where those with insurance generally have access to the gamut of treatments and preventative measures. These histories then provide us with the expository information and clues we will need to examine the paradoxes.

We will soon see cultural nuances, societal structures, and the availability of resources are driving forces behind the paradoxes of attribution, prevention, and action. In a cyclical influenza season, the intrinsic location of Vietnam situates it in a macro "Southern Influenza Season". The focus on communalism encourages certain treatment practices but this is a tug and pull relationship between the availability of resources at hand.

Nevertheless, pandemic influenza paradoxes should not be oversimplified and reduced to national cultures. There may be other cultural factors at play. Thus, although an historical look is informative, an ethnographic study of epidemiologists can seek out and identify such factors.

CHAPTER 3 – RESEARCH METHODOLOGY AND POPULATION

I sought a methodology that could potentially identify, describe, and explain three influenza paradoxes for this research. I pursued two phases of data collection. In the first, I identified and examined archival materials. In particular, since the scientific field most concerned with pandemic responses is that of epidemiology, I reviewed the relevant literature. In the second phase, I performed ethnographic interviews. These interviews were conducted with the main stakeholders in pandemic prevention, mainly, epidemiologists, to allow them to draw on their subject-matter expertise to verify and help explain these pandemic paradoxes. Each of these phases will be described in greater detail below.

RESEARCH PHASE ONE

The first phase of research, my research efforts were focused on finding epidemiological practices associated with combating pandemic influenza. Here I explored a broad swath of publically available information, including the historical environment in which the field of epidemiology emerged. This work included performing archival research at the U.S. National Archives in Washington, D.C. to examine primary sources such as correspondence, letters, legislation, and so forth; and reading books and journal articles on the history of epidemiology. For the most part, this archival research clarified the history of epidemiology in the US. To learn more about contemporary epidemiological practices, I consulted journal articles and conference proceedings. These were supplemented with attendance at pandemic-influenza

conferences. I also mined official pandemic response guidance to include institutional public health, hospital, and research institution recommendations. In addition, I explored media, including internet media such as news and television programming for relevant information.

During this investigation it became clear that these paradoxes could not be explained without a comparison to another epidemiological paradigm. In other words, concentrating only on the US would be inadequate to explain these paradoxes. Since these paradoxes are part of an “international phenomenon,” it was important to study an epidemiological counterpart in order to better understand and explain them.

I chose Vietnam as a comparative nation due to its history with pandemic influenza and potential dissimilarity with the US. First and foremost, it provides an alternate perspective. In STS scholar David Hess’ *Science Studies: An Advanced Introduction*, one of “the key methodological issues in discussions of values is a comparative perspective.”¹⁴⁹ Hess notes, “in the case of primatology as studied by Haraway (1989), several of the most profound alternatives emerged when previously excluded social categories – South Asians, Japanese, and Western women – entered the field. They were able to see what the Western men could not see, to go (sometimes boldly) where no white man had gone before. What appeared previously as pure representation now was revealed to be only partial representation that was grounded in cultural values.”¹⁵⁰ With that analytic premise, information from Vietnam could provide a richer analysis of the research questions at hand. Thus, in many respects I wanted to apply *standpoint theory*, in what Sismondo details as “the recognition of the social

¹⁴⁹ Hess, David. *Science Studies: An Advanced Introduction*. New York: NYU Press, 1997. Print: 146.

¹⁵⁰ Ibid.

character of knowledge, show[ing] that to increase objectivity, communities of research and inquiry should be diverse, representative, and democratic.”¹⁵¹ Vietnam was also a prime candidate for a “comparative perspective “since it has many similarities and differences to the US. Vietnam is similar to the US in that it has have extensive recent experience with pandemic influenza. Second, Vietnam is dissimilar to the US in that it has markedly different social, cultural, and political frameworks. The US is a western, capitalist country as opposed to Vietnam, which is an eastern, communist country. These similarities and differences could deepen and enrich understanding of these paradoxes. Thirdly, the existence of paradoxes in both the US and Vietnam would lend credence to the fact that paradoxes are not a uniquely American phenomenon, but ones that the epidemiological community would need to address.

A few difficulties arose during the process of exploring open source information: The STS literature on pandemic influenza was sparse, at best. Thus, STS research on *related* disciplines such as medicine and health, and specific disease topics was employed to strengthen the analysis.

The same rigor was applied to the collection of epidemiological information in Vietnam. However, as mentioned in Chapter 2, regardless of topic matter, official reporting and Internet posting is subject to a high level of government control in Vietnam. Thus, an additional way to obtain unmodified opinions about influenza paradoxes was needed. In order to alleviate this problem, a second phase of research was employed.

¹⁵¹ Sismondo, Sergio. *An Introduction to Science and Technology Studies*. West Sussex, United Kingdom: John Wiley & Sons Ltd, 2010. Print: 77.

RESEARCH PHASE TWO

In the second phase of research, I interviewed epidemiologists who have worked in the United States, Vietnam, or in both countries. Although a convenience sample was used, the interviewees were contacted via targeted searches for public health experts or epidemiologists who have published on pandemic influenza, members of epidemiological associations associated with, or identified as critical epidemiological leaders in, pandemic influenza. I also found interviewees through recommendations from prior interviewees who strongly recommended experts in the field. Participants were promised confidentiality except for general documentation on demographic matters such as occupation, age, years of experience, education level, and gender. This promise to protect confidentiality was intended as a means to strengthen participant's level of comfort with the interview process and to allow them to be as candid as possible. Additionally, participants were protected through the use of non-attributable codes. For instance, a participant would be given a unique, non-attributable identifier such as participant "Q." Although, there was IRB approval and associated translations of documentation to perform interviews in either English or Vietnamese, all of the respondents chose to respond in English. The interviews took place either in-person, or via telecommunications (such as by telephone, Skype, etc.), according to the interview respondents preferences over the span of a 16 months. These interviews were conducted in more than seven different time zones over four continents.¹⁵²

The interviews were usually thirty to forty five minutes in length (although some lasted over 90 minutes) at times convenient for the participants. Participants were also

¹⁵² See the Appendix for Institutional Review Board materials and approvals.

very generally helpful in sending additional e-mail documentation and citations to subjects discussed. There were no reports of any adverse reactions to the interviews. For the most part, interviewees were interested in the outcome of the study and often recommended additional interview candidates for outreach. Most of the interviews were digitally recorded. Whether or not the interviews were recorded depended on the participant's individual preferences. The notes from these interviews were generally transcribed through the use of Nuance® Dragon NaturallySpeaking dictation software. Relevant portions of interviews were manually transcribed for additional accuracy.

While the process of interviewing epidemiologists was taking place, I started the analysis process by finding repeated themes. Interview questions were updated to examine whether epidemiologists in subsequent interviews agreed or disagreed with these emergent themes. For the most part, participants generally agreed with prior statements, but provided additional nuances, details, and information to consider for subsequent analysis.

A qualitative process was then used to analyze further the content of the interviews. Relevant ideas and comments were organized into topical areas. For instance, the organization of the field of epidemiology was an emergent theme. A specific topic that arose involved the sub specialization of epidemiologists. As the interviews unfolded, I would continue to add to these topical areas and explore potential explanations for these influenza paradoxes.

In total, 15 epidemiologists were interviewed. Roughly half had public health experience in Vietnam. This includes interviewees who have worked in both the US and Vietnam. Only two had exclusive public health experience in the United States.

Although I did not pose the question, some respondents chose to provide their years of experience in the field which ranged from having five to 27 years of experience working as epidemiologists. These epidemiologists have experience, past and present, working at the CDC, MOH, NIH, Wellcome Trust, and so forth. Eight participants had Ph.D.s in public health and four had M.Ds. They have academic backgrounds (as a students or professor) at Harvard, Columbia, Oxford, and so forth. From a brief look at their publications, they had a combined total of over 400 books and articles. Respondents confirmed a wide range of subspecialties including pediatric epidemiology, injury epidemiology, reproductive health epidemiology, molecular epidemiology, and veterinary epidemiology. Table 1 below provides a roll-up summary of the number of interviewees' gender, educational background, and types of work experience.

TABLE 1: SUMMARY OF INTERVIEWEES

Gender	MDs	Degree in Epidemiology / Public Health	Self-Described Epidemiologist	Veterinarian	Working in Public Health or Associated Field	Total number of Interviewees
Women	2	6	9	0	9	9
Men	2	5	5	1	6	6
Total						15

*One female respondent did not have a degree in epidemiology, public health, or medicine. She had degrees in Math, Ecology and Evolution; specifically, the ecology of infectious diseases.

CHAPTER 4 – THE PARADOX OF ATTRIBUTION

PANDEMIC INFLUENZA CAN COME FROM ANYWHERE, BUT PANDEMIC INFLUENZA COMES FROM ASIA

The paradox of attribution questions why researchers try to assign origins to pandemic influenza, even though most experts agree that these origins are oftentimes difficult to identify, and more often than not, difficult to confirm. In particular, the paradox of attribution questions why researchers often point to Asia as being the sole source of influenza pandemics.

Accusations of origin have critically important ramifications. For one, attributing incorrect geographic origins may misdirect crucial resources. Furthermore, incorrect attribution may lead to delayed epidemiological response times, resulting in increased incidence of disease, and increased mortality. Additionally, misattribution may have significant economic impacts on relevant domestic poultry and swine industries, international trade, and tourism.

Initially, I conjectured that these attributions could be due to four factors:

- 1) The Index Case – Finding the index case, or the first instance of a disease, is a successful strategy that epidemiologists have used in the past. Nineteenth century epidemiologist, John Snow, is considered by most historians as the father of modern epidemiology.¹⁵³ During a time when most doctors espoused the miasma theory, believing that disease was caused by “bad air,” Dr. Snow was able to pinpoint the cause of a cholera outbreak in London to a specific, contaminated water pump. In his seminal work (and subsequent publications), *On the Mode of Communication of Cholera*, he was able to systemically connect the origin of contaminated water and link it to actual cases of cholera. Though

¹⁵³ Vachon, David. “Part One: Doctor John Snow Blames Water Pollution for Cholera Epidemic.” Old News. 16.8 (2005) May & June: 8-10. 21 July 2015.
<<http://www.ph.ucla.edu/epi/snow/fatherofepidemiology.html>>.

appropriate for cholera, this strategy may not be appropriate for influenza because of its shorter incubation time.

- 2) Disease Naming Conventions – Historically different strains of influenza are identified using geographic locations. This may be misleading as there is a significant amount of confusion as to which geographic location the strain of influenza is named for – the geographic origin of the disease (which is oftentimes difficult or impossible to ascertain) or the location of the lab in which the strain is discovered.
- 3) Blame Metaphors (Blakely) – Historically groups of people, especially disadvantaged groups (or countries) are unfairly implicated for causing disease. This tendency to assign fault to other groups may be at play.¹⁵⁴
- 4) Invalidated information – The quest of science itself rests on the desire to find knowledge, but in that quest scientists must also present and communicate the knowledge they have found. This can be done in a variety of methods such as journal articles and electronic media (including television and the internet). In emergency situations, and pandemic influenza certainly fits that mold, inaccurate information may creep into genuine attempts to provide the public with information.

The archival research materials and, as we will discuss this in greater detail later, interview analysis supported all of these four factors.

After the interview analysis, I found that there are additional factors contribute to strengthen the paradox of attribution:

- 5) Seasonal versus Pandemic Influenza Definitions – Although one would think that there are distinct differences between seasonal influenza and pandemic influenza, at times

¹⁵⁴ From Debra E. Blakely's "Social Construction of Three Influenza Pandemics in the New York Times." 884-902, 2003.

these terms can converge and diverge. Since these terms can have points of intersection, characteristics of seasonal influenza can often be confused with pandemic influenza. This waxing and waning of terms may encourage misattributions. In other words, although there are textbook definitions for these terms, epidemiologists sometimes use them interchangeably, leading to potential areas of confusion. Moreover, these terms can serve as malleable semiotic boundary objects (as in Star and Griesemer).

- 6) Situated Knowledges – As Haraway noted, science may appear as if comes “from no where.” Even so, where the science being performed is situated greatly impacts the way in which science is communicated. For one, locations of dominant research institutions inaccurately portray locations of influenza “hotspots.” Moreover, there is a “Northern” seasonal influenza and a “Southern” seasonal influenza. This type of geographical situatedness may lead to assigning incorrect origins to a cyclically global disease.

DOES PANDEMIC INFLUENZA COME FROM ASIA?

In order to better understand the paradox of attribution, we must examine whether pandemic influenza does indeed come from Asia. Surprisingly, the answer is both yes and no. Historically, there have been some pandemics that have emerged from Asia, but not all of them have. There have been five pandemics in the last century. As shown in the Table 2 below, all of these were named with places or animals of origin.

TABLE 2: HISTORICAL INFLUENZA PANDEMICS

Approximate Duration	Pandemic
1918-1920	“Spanish” flu
1957-1958	“Asian” flu
1968-1969	“Hong Kong” flu
1977-1978	“Russian” flu
2009-2010	“Swine” flu

Research in the medical literature shows that although epidemiologists agree that the 1918, 1968 and 1977 pandemics did not emerge from Spain, Hong Kong, and Russia, respectively, these attributions persist. In the case of the 1918 “Spanish Flu,” epidemiologists now generally believe that the flu began in the United States in Haskell County, KS where World War I troops were stationed.¹⁵⁵ The 1957 and 1968 pandemics are thought to have originated in China. Nevertheless, the 1957 pandemic were labeled a more general “Asian” flu. During the 1968 pandemic, much to the chagrin of Hong Kong Health Officials, the media converged on the usage of the term “Hong Kong flu.”¹⁵⁶ The 1977 Russian Flu (also called the “red influenza” or “red flu”) appears to have started in Northeastern China. Although there is still some debate, the 2009 “Swine” flu pandemic arguably started in animals in California but was reported in human cases in Mexico.¹⁵⁷

As shown in Table 3, of these five pandemics, three of these appellations are arguably misattributed with regard to places of origin. Based on historical events alone, we find that although some pandemic influenzas emerge from Asia, not all of them do. In fact, although this

¹⁵⁵ Barry, *The Great Influenza*.

¹⁵⁶ At the time, Hong Kong was not a part of Mainland China. Blakely, 893.

¹⁵⁷ Zhang H, Chen L (August 2009). “Possible origin of current influenza A H1N1 viruses.” *The Lancet* 9 (8): 456-7.

study did not pursue this finding, all of the last five pandemics have possibly originated from the US or China.

TABLE 3: HISTORICAL INFLUENZA PANDEMICS WITH POSSIBLE ORIGINS

Approximate Duration	Pandemic	Possible Origin
1918-1920	“Spanish” flu	USA
1957-1958	“Asian” flu	China
1968-1969	“Hong Kong” flu	China
1977-1978	“Russian” flu	China
2009-2010	“Swine” flu	USA/Mexico

Recently, there have been many influenza outbreaks in both North America and Asia. From January to March of 2015, there was an H2N2 outbreak in Arkansas linked to a commercial turkey flock.¹⁵⁸ Highly Pathogenic Avian Influenza (HPAI) was found in Montana and California.¹⁵⁹ Singapore reported an equine flu epidemic from horses exported from New Zealand in July of 2015.¹⁶⁰ Throughout 2015, India had a large outbreak of influenza.¹⁶¹

To examine what the cohort of epidemiologists who were interviewed thought about how pandemics start origins, we can reference the broadly scoped question: “In your viewpoint, what is the origin of pandemic influenza?”¹⁶² As shown in Table 4, out of the 15 interviews, nine

¹⁵⁸ Gee, Kelsey. “Avian Flu Found on Turkey Farms Supplying Butterball,” *Wall Street Journal*. 11 March 2015. 1 April 2015. <http://www.wsj.com/articles/bird-flu-strain-found-in-arkansas-same-as-virus-in-missouri-1426094184>

¹⁵⁹ “More avian flu in US birds; Asian H9N2 found in Alaska.” *Center for Infectious Disease Research and Policy (CIDRAP) News*. 1 April 2014. 6 April 2015.

¹⁶⁰ “Equine flu outbreak is over, say Malaysian officials.” 23 October 2015. 1 November 2015. *Horsetalk*. <http://horsetalk.co.nz/2015/10/23/equine-flu-outbreak-over-malaysia/#axzz3wbAXIqJJ>

¹⁶¹ Paliwal, Ankur. “Tracking India’s Deadly Flu Outbreak in Real Time. *NOVANEXT*. 28 October 2015. 1 November 2015. <http://www.pbs.org/wgbh/nova/next/body/kumbh-mela-flu/>

¹⁶² Please see Appendix for a full list of Interview Questions

provided a “genetic response.” In other words, they described the interplay of genetics between species that bring about disease.¹⁶³ Of the six interviews that provided a location, four pinpointed Asia, while the rest noted that pandemic influenza can arise from “anywhere.” Interestingly enough, two of these four had experience working in Vietnam.

TABLE 4: PANDEMIC ORIGIN RESPONSES

Response Category	Number of Responses
“Genetic”	9
“Anywhere”	2
“Asia”	4

Of the respondents who noted “Asiatic” origins of pandemic influenza, they had varying reasons for this belief. For instance, an injury epidemiologist (Participant Z) believed that pandemic influenza arose from “probably the Asian continent” (Participant Z) “mainly from studying it and from information I received and from knowing about this vaccine development where it develops from our knowledge from vaccine development initiatives from the flu that we track in the Asian continent” (Participant Z). Nevertheless, participant Z also noted, “why we do it is to provide some sort of geographic understanding, of where flu comes from but it can be misdirected or miscategorized. It does, or could possibly lead to some biases and missed interpretation by people. How you attribute and what caused it has some risk of using location.” (Participant Z) Participant’s Z’s statement was extremely interesting for the following reasons: a) Participant Z noted that one of the reasons pandemic influenza emerges from Asia is because of

¹⁶³ We will discuss the details of this “genetic response” in the following chapter.

influenza tracking and vaccine development in Asia itself; b) Participant Z assumes that it is important to find the origin of pandemic influenza; and c) Participant Z noted the dangers of potentially misattributing the disease.

Two of the four “Asia” respondents had experience working in Vietnam. One noted, “There certainly isn’t one right answer to this.” (Participant X) The same respondent described the amalgam of factors that statistically would lead to pandemic influenza. In particular, the fact that Asia has the largest percent of the world’s population, the largest percent of animal life, the largest percent of land along with the estimate that 40% of Vietnam’s population owns poultry. (Participant X) The participant offers “I really do think that these viruses originate or are created genetically in Asia and then wind up spreading at a low level, let’s say in pigs or silently among ducks in Northern Vietnam.” (Participant X) This leads one to believe that the past work experiences of the epidemiologists do not necessarily impact their thoughts on pandemic influenza origins. In other words, their experience working in Vietnam does not preclude them from believing that pandemics come from Asia.

Nevertheless, I asked those respondents who provided “genetic” responses for their thoughts on Asiatic origins, and the responses converged on the belief that pandemic influenza could start in Asia, but as interviewee E noted, “But H1N1, didn’t come from Asia, right? It started potentially in Mexico.” (Participant E) Moreover, “I wouldn’t necessarily place all your chips in one basket on an area that it would come from.” (Participant E) Respondent U also noted, “If we go back to the H1N1 pandemic, this took everyone very, very, very much by surprise. Because everyone was expecting an H5N1 emerging in Asia and there was an H1N1 emerging in Mexico” (Participant U)

We now see that about a quarter of the respondents (4 out of 15) offered “Asiatic” origins of pandemic influenza citing other “expert opinions,” statistical chances, and from reports on vaccine development. The lack of other geographic mentions is also telling. Other than Asia, none of the interviewees provided an alternative geographic location for pandemic influenza.

DO WE NEED TO FIND PANDEMIC INFLUENZA ORIGINS?

As noted, modern epidemiology was built upon finding the reasons for disease and exploring ways in which these diseases can be prevented in populations. As the *Handbook of Epidemiology* describes, “the description of disease patterns includes analysis of demographic, geographic, social, seasonal and other risk factors.”¹⁶⁴ Thus, one of the most important constructs of epidemiology involves finding all of the information available on disease. In fact, most scholars define epidemiology as being:

Concerned with the distribution and determinants of health and diseases, morbidity, injuries, disability, and mortality in populations. Epidemiologic studies are applied to the control of health problems in populations. The key aspects of this definition are determinants, distribution, population, and health phenomena.¹⁶⁵

In fact, “prevention of disease by breaking the chain of transmission has traditionally been the main purpose of infectious disease epidemiology.”¹⁶⁶ In many epidemiological texts, one method commonly described involves disease mapping. As described in the *Handbook of Epidemiology*, “plotting diseases on a map is one of the very basic methods epidemiologists do

¹⁶⁴ Wolfgang, Ahrens. "Handbook of Epidemiology: Introduction." Berlin: Springer, 2005. Print: 1335.

¹⁶⁵ Friis, Robert H., and Thomas A. Sellers. *Epidemiology for Public Health Practice*. Sudbury, Massachusetts: Jones and Bartlett Publishers, 2009. Print: 7.

¹⁶⁶ Wolfgang, Ahrens. "Handbook of Epidemiology: Introduction." Ed. Ahrens, Wolfgang. Berlin: Springer, 2005. Print. 1329.

routinely. Nonetheless, the same *Handbook* warns, “these tools should be used with caution. They can be useful to generate hypotheses and identify possible associations between risk of disease and environmental exposures. Because of potential bias, mapping should never be considered as more than an initial step in the investigation of an association. ‘The bright color palettes tend to silence a statistical conscience about fortuitous differences in the raw data’ (Boelaert et al. 1998).”¹⁶⁷ Moreover, the *Handbook* further cautions, “geographic distribution is important to describe diseases linked to environmental conditions but may not be so useful for other diseases.”¹⁶⁸

One must wonder if it is even necessary to find the geographic origin of pandemic influenza. Without a doubt, the strategy of finding geographic origin works very well for some diseases as it does with Ebola. Nevertheless, finding information about or finding the cause of disease does not necessarily equate to finding the geographic origin of the disease.

THE INDEX CASE

As seen with Ebola virus and cholera, finding the first, or index case, of a disease is important in stopping the further spread of disease. It would also, then, appear that finding the index case would also be valuable in combating influenza pandemics. We can roughly compare pandemic influenza to Ebola and cholera.

Recent events have highlighted the critical role of epidemiology in combating the 2014-2015 outbreak of Ebola in West Africa. Although the outbreak caused over 11,000 deaths,

¹⁶⁷ Ibid.

¹⁶⁸ Ibid.

epidemiological intervention has since quelled the outbreak.¹⁶⁹ To most epidemiologists, Ebola has three critically important characteristics:

- 1) Ebola has a natural animal reservoir, meaning there are animals who carry Ebola virus and can transmit it to humans;
- 2) Ebola has a relatively long incubation time of two to 21 days; and
- 3) Ebola can only be spread through contact with bodily fluids.

With rapid detection, if epidemiologists can quickly find the index case, in theory, they would have better chances of finding the animal reservoir and could intervene to stop animal-to-human transmission. With contact tracing, they could also monitor and quarantine possibly infected individuals and prevent further cases of disease. In the case of the 2014-2015 outbreak, the animal reservoir has not yet been found, but researchers were able to find the index case of the disease, a two-year-old child from Guinea, to trace the chain of infection.¹⁷⁰ Finding the index case was also important since it allowed epidemiologists to identify the Ebola strain and the geographic progression of the disease through molecular tracing. Also, finding information about the index case could lead to the potential development of a vaccine.

As shown in Table 5, pandemic influenza shares some similarities with Ebola and cholera. For one, pandemic influenza is caused by a virus just as is Ebola and it shares a similar incubation time with cholera. Nevertheless, as a whole, pandemic influenza is not similar to Ebola or to cholera, and as we shall soon see, it should not be treated in the same way as Ebola or cholera.

¹⁶⁹ (2016). "Latest Ebola outbreak over in Liberia; West Africa is at zero, but new flare-ups are likely to occur." [World Health Organization Media Centre](#).

¹⁷⁰ Currie, Janet, Bryan Grenfell, and Jeremy Farrar. "Beyond Ebola." *Science* 351.815 (2016): 815-16. Print.

TABLE 5: PANDEMIC INFLUENZA COMPARISON TO OTHER COMMUNICABLE DISEASES

	Infective Agent	Incubation time	Mode of Transmission
Pandemic Influenza	Virus	1 – 4 days	Respiratory droplet
Ebola	Virus	2-21 days	Bodily fluid
Cholera	Bacteria	2 hours - 5 days	Oral fecal

Align this contrasting information about influenza to Ebola and cholera to autonomous technology and Langdon Winner’s critique of it.

‘Autonomous technology.’ This term describes the widely held belief that in advanced capitalist societies technological development had taken on a life of it’s own as if it were an out-of-control Frankenstein monster. Winner developed the alternative perspective that technology and technological design are the products of interested human decisions. His work suggest that citizens should awaken from their ‘technological somnambulism’ and explore, critique, and protest the uncritical embracing of new technologies.¹⁷¹

In this case, the unquestioning acceptance of epidemiological techniques that are appropriate for Ebola and cholera, but may not be for pandemic influenza. To that end, here are the interviewees’ comments on whether we should question this methodological “somnambulism.” Other scholars in STS, too have noted the “the natural tendency to keep with what has worked before.”¹⁷² In this example, the insistence of using a moth as a genetic model as opposed to the *Drosophila* model led to the demise of the “Liverpool school” in the field of genetics.

¹⁷¹ Hess, David. *Science Studies: An Advanced Introduction*. New York: NYU Press, 1997. Print: 124.

¹⁷²Zallen, Doris T. 2014. "The power of partnerships: the Liverpool school of butterfly and medical genetics." *The British Journal for the History of Science* 47 (4): 698.

Most interview respondents did not see the value of finding the index case for pandemic influenza. In following with the epidemiological quest for information, they espoused that finding out information, in general, about a potentially new pandemic strain would, in itself, be very valuable.

Their opinions on the index case were linked to the counterfactual interview question: Let's say an index case was not found during an influenza pandemic (such as Swine Flu), what would have been the different outcome?¹⁷³

Only three respondents saw value in finding information about a new strain. Participant A noted that researching the initial cases may help inform people not to travel to that location. (Participant A) Participant E noted, "I do think [finding the source] is important" (Participant E) For instance if found at a particular wet market, epidemiologists could then inform people to stay away. Participant H detailed, specific to influenza, it would be critically important to find out if the new disease is a new strain or is genetically capable of person-to-person transmission. (Participant H) With that said, when questioned about the swine pandemic, Participant H noted, "no, I don't think the outcome would be different." In essence, the participants found value in finding early information about the disease as a general preventative measure or for genetic analysis.

Epidemiological techniques, like technological artifacts, may also be in many respects considered "constructed." As Sismondo notes in *An Introduction to Science and Technology Studies*, "Knowledge and artifacts are human products, and marked by the circumstances of their

¹⁷³ The question was intentionally framed as a counterfactual in order to overcome any bias to a potentially controversial question. For instance, if one were to ask, "how do you feel about finding the index case? With the background of Ebola or cholera in mind, an epidemiologist may not think about the holistic differences between those two diseases and pandemic influenza. On the other hand, if we present a subjective conditional, the participant may be able to created alternative possibilities. Nicholas, Philip, Johnson-Laird, and Ruth M. J. Byrne. *Deduction: Essays in Cognitive Psychology*. 1991. Print.

production.”¹⁷⁴ Owing from its recent modern history, feminist [STS scholars] have shown how science reifies cultural values and categories by attributing to them a naturalness that in fact may not be there.”¹⁷⁵ In other words, it could be hypothesized that the three respondents above espoused a cultural norm of epidemiology, one whose first step is to find the first case of a disease.

As we see in Table 5, with pandemic influenza, the combination of its short incubation time and highly infective mode of transmission may outweigh attempts at finding an index case. In regard to finding the index case, Participant C responded, “No, I don’t think so... I think by the time we had figured out where it had tracked from it was so widespread...” (Participant C) In a similar vein, Participant X notes, “My feeling is that it would not be very helpful for influenza partially because the disease spreads too quickly and by the time you found the index case, the person would have been cured and they would have even forgotten that they had symptoms. Would probably take weeks to identify a backwards chain of transmission to an index case.” (Participant X) Participant Z had a similar thought, “For flu, you really want to be cautious about the value of finding the index case depending on what the disease is. Flu, I’m not sure the value of that. Spending the time to find the index case for the flu, because it spreads so quickly and rapidly, but knowing the clusters, could help us locate the disease location and spread.” (Participant Z) Here we see the paradoxical situation. Although epidemiologists find that identifying the source of pandemic influenza is helpful, and not a requirement, there appears to be an undue focus on finding the origin of the disease.

¹⁷⁴ Sismondo, Sergio. *An Introduction to Science and Technology Studies*. West Sussex, United Kingdom: John Wiley & Sons Ltd, 2010. Print: 11.

¹⁷⁵ Hess, David. *Science Studies: An Advanced Introduction*. New York: NYU Press, 1997. Print: 115.

As we see in Table 5, pandemic influenza is drastically different from Ebola and cholera. Concerning finding the index case, Participant V responded, “it seems like for something like the flu in particular, and if you’re talking about pandemics, it seems very inefficient. With such a short incubation time, by the time you would track, do the work to track somebody down, it would seem probably too late anyways. So if you are talking about having limited resources, and if you are talking about health care workers doing that, I don’t know if that is the best use of resources. So if you are talking about something like Ebola. It may make more sense to do it in that case, maybe not so much with flu... isolation is probably not as effective as in Ebola.” (Participant V) Thus, since finding the index case is extremely helpful in mitigating diseases like Ebola or cholera, these same methods may be applied to pandemic influenza with unknown, or perhaps limited efficacy.

BIOCHEMISTRY OF PANDEMIC INFLUENZA

A biochemistry of pandemic influenza is important for subsequent discussions of naming conventions. There are three types of flu, types A, B, and C. Historically, influenza type A is the only type that causes epidemics. Influenza type A is further categorized into subtypes by a various combinations of 16 hemagglutinin (H) and 9 neuraminidase (N) glycoproteins that cover the outer membrane of the virus particle. The hemagglutinin is responsible for viral entry, and, after replication, the neuraminidase is responsible for the viral progeny’s escape from a host cell. One commonly infective avian influenza virus is subtype H5N1, categorized as a biosafety level 3+ virus.¹⁷⁶ Influenza A subtypes are also categorized into different strains. In the case of avian

¹⁷⁶ With 3 being the highest level possible, requiring the highest bioprotection methods. Gregor, Michael. 2006. *Bird Flu: A Virus of Our Own Hatching*. New York: Lantern Books. Online version published with

influenza, strains are categorized as Low Pathogenic Avian Influenza (LPAI) or Highly Pathogenic Avian Influenza (HPAI).

Scientists believe that waterfowl are the natural reservoirs for all influenza type A viruses.¹⁷⁷ Hence, one could extrapolate that wild aquatic birds are the natural reservoirs for all epidemic influenzas.¹⁷⁸ The influenzas that appear in birds are termed “avian” influenza. One must keep in mind that influenza can affect many animals to such as pigs (swine), horses (equine), and so forth.

Nevertheless, the avian flu virus is usually innocuous in both birds and humans. Even though it has been endemic in aquatic birds for millennia, the fact remains that from an evolutionary standpoint, it is better for the virus to remain sub-lethal.¹⁷⁹ Some scientists use the adage “dead ducks don’t fly,” referring to the virus’ “preference” to have its host live on to propagate its viral progeny.¹⁸⁰

Unfortunately, avian influenza viruses are notorious for mutating within a host. When DNA replicates in the human body, it undergoes rigorous molecular quality control checks. When RNA viruses such as influenza replicates, they do not undergo these meticulous genetic checks. Thus, while human children generally resemble their parents, influenza’s viral progeny are typically different from the initial “parent” virus due to nothing more than “mistakes” during the replication process.¹⁸¹ As a result, it is common for minor changes in the hemagglutinin and

chapter headings. “Biosafety Level Zero.”

¹⁷⁷ “Influenza Viruses,” Centers for Disease Control and Prevention, 18 November 2005, <<http://www.cdc.gov/flu/avian/gen-info/flu-viruses.htm>> (1 December 2006).

¹⁷⁸ Gregor, “This is a detective story. Here was a mass murderer that was around 80 years ago and who’s never been brought to justice. And what we’re trying to do is find the murderer.”

¹⁷⁹ Jeffery K. Taubenberger and David M. Morens, “Influenza Revisited,” Emerging Infectious Diseases 12, no. 1 (2006): 2.

¹⁸⁰ Gregor, “Acute Life Strategy.”

¹⁸¹ Gregor, “There is nothing permanent except change.”

neuraminidase proteins to occur, a process called genetic drift.¹⁸² However, if, let's say, a migrating duck already infected with one avian influenza virus happenstance landed on a pig farm only to be infected with another influenza virus. These two different influenza viruses have the ability to exchange genetic information with each other leading to a sudden, major change called antigenic shift.

Most historians and researchers have pointed to three factors that would lead to an epidemic. First, the virus would need to mutate in an animal host and infect a human population with no prior natural immunity. Second, the virus has to be able to kill. Lastly, the virus would have to be highly contagious. This combination of happenstance occurrences would be the tinder for a new pandemic.¹⁸³

With an ever-changing virus, vaccines have been historically made based upon the Centers for Disease Control's (CDC's) educated recommendations to the Food and Drug Administration (FDA) as to which strains will probably be the most common in the coming year.¹⁸⁴ The likely strains are identified by surveillance information from over 100 countries. These countries send representative viruses to four WHO labs in Atlanta, Georgia, USA (Centers for Disease Control and Prevention, CDC), London, United Kingdom (The Francis Crick Institute), Melbourne, Australia (Victoria Infectious Diseases Reference Laboratory), Tokyo, Japan (National Institute for Infectious Diseases); and Beijing, China (National Institute for Viral Disease Control and Prevention).¹⁸⁵ The vaccine is then manufactured in chicken eggs, tested,

¹⁸² "Influenza Viruses."

¹⁸³ Gregor, "It was 'the perfect storm' – a tempest that may happen only once in a century – a nor'easter created by so rare a combination of factors that it could not possibly have been worse."

¹⁸⁴ "Influenza Vaccine: How It's Made," [Influenza.com](http://www.influenza.com), <http://www.influenza.com/Index.cfm?FA=Science_History_6> (1 December 2006).

¹⁸⁵ Centers for Disease Control and Prevention, National Center for Immunization and Respiratory Diseases (NCIRD). "Selecting Viruses for the Seasonal Influenza Vaccine." 2016.

and then disseminated to the public. Indeed, the process of production, from identifying likely strains to patients receiving the vaccine, can take about 10 months.¹⁸⁶ These vaccines are imprecise, since an influenza vaccine for H2N2 will not necessarily protect someone with H3N3.¹⁸⁷

To further complicate matters, there are actually two seasonal influenzas – a “Northern hemisphere” season that usually peaks during the winter and a “Southern hemisphere” season that usually peaks in the summer in those respective hemispheres. Even in one year, there may be significant differences between the “Northern hemisphere” strain and the “Southern hemisphere” strain” such that there are two different vaccines for these two seasons.

NAMING CONVENTION

Perhaps this tendency to assign Asiatic origins is related to epidemiological use of a long-established naming convention.¹⁸⁸ For instance, one isolate of influenza would be identified as “A/duck/Fujian/412/2006 (H3N2).” This nomenclature describes the virus type (A), the original host (duck), the place where the virus first known to have originated (Fujian), the strain number (412), the year it was first isolated (2006), and its subtype (H3N2).¹⁸⁹ This nomenclature is very useful to the scientific community. On one hand, this nomenclature allows for clear communication between researchers. By using this name, researchers can quickly identify the strain name that they are working with. On the other hand, this nomenclature is misleading, since it assumes that the location where the virus was isolated is the same as the location where

¹⁸⁶ “Influenza Vaccine: How It’s Made.”

¹⁸⁷ Taubenberger, 2.

¹⁸⁸ “A Revision of the System of Nomenclature for Influenza Viruses: A WHO Memorandum.” *Bulletin of the World Health Organization* 58.4 (1980): 585-91. Print.

¹⁸⁹ CDC (2011). Types of Influenza Viruses. <http://www.cdc.gov/flu/about/viruses/types.htm>

the virus originated. In other words, it is akin to finding a puppy in a kennel and assuming that was where the puppy was born.

Researchers themselves are confused by this naming convention. When the naming convention was revised in 1980, most components of the name – the virus type, the host, strain number, etc. were described in great detail.¹⁹⁰ For instance, concerning the second portion of the naming convention – “2. The host of origin. This is not indicated for strains isolated from human sources but is indicated for all strains isolated from non-human hosts, e.g., swine, horse (equine), chicken, turkey. For viruses from non-human species, both the Latin binomial...” and so forth.¹⁹¹ In cases where influenza arises from a non-human animal, the virus name will identify that animal. For example, a virus might be named “A/duck/Alberta/300/77(H4N3)” and the animal of first origin is a “duck.” However, in terms of the third portion of the naming convention the only detail provided is – “3. Geographic origin.”¹⁹² Even amongst the interviewees, there was a great amount of disparity as to what this meant. To some interviewees, this meant the geographic origin of the laboratory that isolated the strain. (V) To others, it meant the actual location of where the virus was first found. (H) To paraphrase, participant Y, “it always seemed more about who discovered it as opposed where it came from.”

Interestingly, this naming convention is a requirement to allow for standardization in the epidemiological community. As participant A explains, “The naming convention. It sort of codifies. Even though that’s not where it started, they found it and they reported it, like they are supposed to do according to international regulations.” (Participant A) We will see this as a

¹⁹⁰ "A Revision of the System of Nomenclature for Influenza Viruses: A Who Memorandum." Bulletin of the World Health Organization 58.4 (1980): 585-91. Print.

¹⁹¹ Ibid.

¹⁹² Ibid.

recurring theme as the desire to label, categorize, and contextualize amorphous knowledge can lead to misuse, misinterpretation, and misunderstanding of science.

There have been recent calls in the scientific literature to think cautiously about how to name these strains. In a recent BBC News article, “WHO issues disease-naming advice to avoid offence,” WHO assistant director general for health security, Dr. Keiji Fukuda noted, “This may seem like a trivial issue to some, but disease names really do matter to the people who are directly affected.”¹⁹³ In this article, Dr. Fukuda pointed out the implications to trade, “particular religious or ethnic communities,” travel, commerce, and the unnecessary culling of animals.¹⁹⁴

As Roos and Becker from The University of Minnesota’s Center for Infectious Disease Research & Policy (CIDRAP) note, it might be an “outdated” naming convention.¹⁹⁵ In their news article from 2004, they point out that even though avian flu H5N1 was found in Italian and Canadian birds and even though avian flu is typically associated with deadly pandemics, officials did not view this particular virus as “dangerous.”¹⁹⁶ They posed the logical question “If the virus has the same name as the one in Asia, why isn’t it just as dangerous?”¹⁹⁷ Although naming the H and N components is very useful, they note, “A flu virus also has six other genes and corresponding proteins. Thus a name like ‘H5N1’ is a very incomplete description for the virus.”¹⁹⁸

There were mixed thoughts as to whether the preponderance of qualified laboratories promoted naming convention biases. In other words, some epidemiologists thought that

¹⁹³ “Who Issues Disease-Naming Advice to Avoid Offence.” *BBC News* 2015. Print.

¹⁹⁴ *Ibid.*

¹⁹⁵ Robert, Roos, and Amy L. Becker. “H5n1 Avian Flu Viruses: What's in a Name?” *CIDRAP (Center for Infectious Disease Research & Policy)* 12/30/2005 2005. Print: 1.

¹⁹⁶ *Ibid.*

¹⁹⁷ *Ibid.*

¹⁹⁸ *Ibid.*

influenza strains were named with certain geographic origins, because it was through those labs that were in closest proximity that viruses were analyzed. Participant X did not believe this was the case. Whereas participant A asserted, “if we look historically, we only see flus pop up where we are looking for them.” (Participant A) Participant A provided the example of Africa, where there is not as much flu research infrastructure and thus, it was rarely detected noting, “we can’t take the absence of evidence for places that aren’t testing to mean that there’s nothing emerging there.” (Participant A)

At the surface, it would appear that there is a solemn level of recognition in the epidemiological community that these naming conventions really do matter since the action of naming can turn a murky supposition into a codified reality. We see suggestive evidence from the interviews, and calls in the broader epidemiological community that this current naming convention is inappropriate. We also see calls from the broader research community to revise the naming convention.

BLAME METAPHORS

As the respondents earlier alluded to, and as publically stated by Dr. Fukuda of the WHO, there is a tendency to blame groups for influenza as opposed to viewing it as a natural occurrence. Scholars in STS have also studied this blame behavior.

In Debra E. Blakely’s “Social Construction of Three Influenza Pandemics in the *New York Times*,” she described how the social construction of influenza changed over time as scientific information became more accessible to the public. She found during her narrative discourse analysis that blame metaphors were commonly used to provide causation for the

disease.¹⁹⁹ These metaphors included “racial stereotypes, immorality, lifestyles, and government or authorities, in addition to war metaphors.”²⁰⁰ In the US, the 1918 pandemic was initially described as the “German sickness” and then finally was described as the “Spanish influenza” even though *New York Times* editorials pointed to the fact that there was no evidence linking it to prior “Spanish” diseases.²⁰¹ As the War progressed, the US troops from Kansas were sent to Europe where the disease spread. Historical evidence indicates that Spain was falsely blamed as the disease epicenter because a) Spain was a neutral country during World War I, b) The Spanish media reported on cases of flu, especially the case of Spanish King Alfonso XIII. Other countries may have had reporting biases and may not have reported on cases due to wartime press restrictions.²⁰² In fact, as recently as in 2009, European scientists were still performing laboratory studies to discredit the European origin of the disease.²⁰³ During the 1968 pandemic, much to the chagrin of Hong Kong Health Officials, the media converged on the usage of the term “Hong Kong flu.”²⁰⁴ It appears that Hong Kong received this unfortunate attribution since it was the place where the disease garnered “Western attention.”²⁰⁵ Interestingly, the Hong Kong City Councilor insisted that the flu be called the “China flu” since he insisted that it emanated from “Red China.”²⁰⁶

¹⁹⁹ Blakely, Debra E. "Social Construction of Three Influenza Pandemics in the New York Times." *Journalism and Mass Communication Quarterly* 80.4 (2003): 884-902. Print. 888.

²⁰⁰ Ibid.

²⁰¹ Ibid.

²⁰² Trilla, Antoni, Guillem Trilla, and Carolyn Daer. "The 1918 “Spanish Flu” in Spain." *Clinical Infectious Diseases* 47.5 (2008): 668. Barry, *The Great Influenza*, 171.

²⁰³ Ansart et al, “Mortality burden of the 1918-1919 influenza pandemic in Europe,” 105). In a similar vein “the Swine Flu Affair,” Silverstein describes the 1976 epidemic that “never was” as originating from the US in Fort Dix, New Jersey.

²⁰⁴ Blakely, Debra E. "Social Construction," 893.

²⁰⁵ Kilbourne, 11.

²⁰⁶ "The 'Hong Kong Flu' Began in Red China." *New York Times* 12/15/1968 1968: 1. Print.

Even as recently as the Swine Flu Pandemic of 2009, these blame metaphors persist. In a *Wall Street Journal* article, Mexico's chief epidemiologist noted that the pigs were originally from North America and the viral genetic material was actually from Europe and Asia.²⁰⁷ Curiously enough, he may be correct since the first place to detect the disease was actually California (named "A/California/07/09"). Interviewee H corroborated this information. Unsurprisingly, Smithfield Foods, operator of the pig facility, insisted it was not involved with the virus.²⁰⁸ Currently, scientists believe that the Swine flu pandemic first struck American breeding pigs on a Mexican farm. This debate continued as Thailand, one of the largest meat producers in the world, suggested calling the pandemic "Mexican Flu."²⁰⁹ This blame behavior is not unique as another study on Malaysian pig farms discovered that certain "out groups" described as "homosexuals, the homeless and prostitutes" were usually implied as being at greater infection risk of disease.²¹⁰

The interview respondents also noted similar reactions in their field. Participant A explained, "oh, we do that with every disease... certainly with infections. Oh, she gave that to me. Martha was sniffing in the office the other day I bet she gave it to me... it's something about human nature that we want to have, when we can, some thing to attribute our illnesses to." (Participant A) Finding blame is something Participant A felt was a common occurrence, to paraphrase, "We've always looked to blame the environment, other people, whatever we can find." (Participant A)

²⁰⁷ Campoy, Ana, and Lauren Etter. "Expert Says Farm Isn't Flu Origin." *The Wall Street Journal* 4/30/2009. Print: 1.

²⁰⁸ Ibid.

²⁰⁹ Bradsher, Keith. "The Naming of Swine Flu, a Curious Matter." *The New York Times* 28 April 2009. Print.

²¹⁰ Goodwin, Robin, Shamsul Haque, Sharifah Binti Syed Hassan, and Amreeta Dhanoa. 2011. "Representations of swine flu: perspectives from a Malaysian pig farm." *Public Understanding of Science* 20 (4): 477.

This blame behavior is not unique to pandemic influenza. Participant V found this to be the case with Ebola, detailing, “in Liberia, there’s stigma associated with families with people with Ebola.” Noting that survivors will get their houses burnt down, get fired from jobs, or be ostracized. Participant V adds, this is an ironic situation since once you’ve convalesced you can’t transmit it and you are immune.

The blame behavior does have consequences. It goes without saying that “many countries do not want to report an outbreak of disease that would cast a negative light on the countries.”²¹¹ In the case of Swine Flu, “for many Mexicans it is simply a scarlet A.”²¹² Mexican soccer teams are no longer welcome and even Mexican inhabitants of China are being put into quarantine. Due to these consequences, Participant V adds, “In some places, there might be a tendency for people to blame authorities for public health outcomes, regardless whether the blame is warranted or not and then public health authorities are reluctant to share information, and reluctant to be transparent about things.” (Participant V) Some epidemiologists did describe past occurrences of China withholding necessary information regarding pandemic response, for fear that it would impact travel or the poultry industry. These impacts may also transcend deep rooted religious suspicions as Participant A described, in Egypt, the accusation was that Muslims don’t keep pigs, it was the Coptic Christian minority that did and it was said that the pig kills were basically a way to harm a religious minority population.” (Participant A)

These blame metaphors have larger, international political-economic effects. Of course, pandemic influenza directly impacts a country’s economy through tourism and food production, it also impacts the country’s standing in the international community. As Stacy Lockerbie’s

²¹¹ Wolfgang, Ahrens. "Handbook of Epidemiology," 1343.

²¹² Lacey, Marc, and Andrew Jacobs. "Even as Fears of Flu Ebb, Mexicans Feel Stigma." *The New York Times* 4 May 2009, sec. Asia Pacific. Print.

work on *Exploring the Impact of Avian influenza in Vietnam* asserts, “While developing countries or countries receiving foreign aid are at the center of disease fatality and transmission, the rhetoric of blame serves to strengthen socio-economic divisions that divide East from West and North from South with adjectives like ‘modern’ and ‘primitive,’ ‘hygienic’ and ‘unhygienic.’”²¹³

UNVALIDATED INFORMATION

Two aspects of unvalidated information stand out. First, there is a tendency to provide information, even if it is unverified in order to assuage public demand. It is conjecture at best, but these attempts to fill in information results in providing inaccurate information. As participant X noted, there is a struggle between quick information, as usually seen in the media, as opposed to validated information, as usually seen in published journal articles.

For the 2009 Swine Flu pandemic, there is some debate about whether the pandemic was “transported” from Asia. In *The New York Times*, Donald McNeil, Jr. asserts two months after the initial case (with full caveats of limited information) that the flu could have come from Asia.²¹⁴ He found “Dr. Amy L. Vincent, a swine flu specialist at the Agriculture Department’s laboratory in Ames, Iowa” to insinuate that the flu could have been brought over by someone travelling from Asia.

Second, unvalidated information may be repeated if it appears to come from verified sources. Other contemporary scientists have also pointed toward Asiatic etiologies for influenza.

²¹³ Lockerbie, Stacy. 2008. *Global Panic, Local Repercussions: Exploring the Impact of Avian Influenza in Vietnam*. In *Globalization Working Papers*: Institute on Globalization and the Human Condition: i.

²¹⁴ McNeil, and Donald G. Jr. "In New Theory, Swine Flu Started in Asia, Not Mexico." *The New York Times*, 6/23/2009.

One example of “grapevine” miscommunication stands out. Scientist Joseph Chan used a network analysis to model influenza spread. In his work he emphasized that “several papers tracking H3N2 across continents have asserted that this tropical reservoir of influenza strains lies within East-Southeast Asia” and asserts that Asia is origin of influenza.²¹⁵ Upon researching the original sources Chan uses, we find that they do not support these claims. One original source was Viboud’s “perspectives” paper, “Influenza in Tropical Regions.” In it Viboud concludes “finally, more studies are needed to elucidate influenza seasonal patterns across large range of latitudes representing several tropical countries in both hemispheres.”²¹⁶ Viboud’s data focused on the migration of influenza from northern to Southern hemispheres, particularly from North to South America. Perhaps Chan took one of Viboud’s statements out of context or Viboud used imprecise or inaccurate language. Viboud did mention in passing “until very recently, the impact of influenza was believed to be insignificant in tropical regions... thanks to recent studies by Joseph S.M. Peiris and his colleagues from Hong Kong... Hong Kong is a subtropical city located within the likely epicenter of pandemic influenza in Southeast Asia.”²¹⁷ Nevertheless, when looking back to Peiris’ work, “Influenza-Associated Hospitalization in a Subtropical City,” it made no claims of epidemic origins and only compared hospitalization rates in Hong Kong and the US.²¹⁸ As noted, the interviewees who espoused Asiatic origins also reported “other experts” in the field as being the source of their belief.

²¹⁵ Chan, Joseph, Antony Holmes, and Raul Rabadan. 2010. "Network Analysis of Global Influenza Spread." *PLOS Computational Biology* 6 (11): 1.

²¹⁶ Viboud, Cecile, Wladimir J Alonso, and Lone Simonsen. 2006. "Influenza in Tropical Regions." *PLOS Medicine* 3 (4): 0470.

²¹⁷ Viboud et al., "Influenza in Tropical Regions," 0468.

²¹⁸ Wong, Chit Ming, Lin Yang, King Pan Chan, Gabriel M. Leung, Kwok H. Chan, Yi Guan, Tai Hing Lam, Anthony Johnson Hedley, and Joseph S. M. Peiris. 2006. "Influenza-Associated Hospitalization in a Subtropical City." *PLOS Medicine* 3 (4):0483-0492. Peiris was listed as the last co-author.

This example epitomizes my thoughts on the “dual nature of science.” What I mean by the dual nature of science is that science consists of the “known” and the “unknown.” Although science seeks knowledge, it delegitimizes itself when it admits that it lacks knowledge. Thus, scientists are pressured to fill in knowledge gaps. Sometimes, this process is based on past verified knowledge, sometimes this process is not so robust. Thus, when this knowledge filling process is based on unvetted information, it can potentially produce paradoxes.

I developed this concept of the dual nature of science in based on *Neo-Kantian Constructivism*. In this version of constructivism, Kant suggests when scientists agree on a claim, they literally make the claim true. The world corresponds to agreement, not the other way around.”²¹⁹ Since experts only have the information available to them at hand, “individuals impose structure on the world as they apprehend it.”²²⁰ Thus, epidemiologists may be espousing to these pandemic paradoxes because there may be an unmerited aura of scientific confidence that follows assumptions rather than facts. In other words, valid scientific information can be muddled by repeated assumptions. For instance, the belief that all pandemics will come Asia is not a truth, it is an unvalidated prediction based on some past experience, bias, an repeated rumors.

Moreover, this dual nature of science aligns with David Turnbull’s work looking into local knowledge production. In it, he claims, “what philosophers from Duhem to Rorty have shown is that our scientific and technological ways of knowing about the world, far from being epistemologically secure or privileged, are riddled with indeterminacies.”²²¹ I conjecture that

²¹⁹ Sismondo, Sergio. *An Introduction to Science and Technology Studies*. West Sussex, United Kingdom: John Wiley & Sons Ltd, 2010. Print: 68.

²²⁰ Sismondo, 69.

²²¹ Turnbull, David. *Masons, Tricksters, and Cartographers*. London: Taylor & Francis, 2000: 7.

these unstated indeterminacies are masking themselves as scientific fact, and as a result, can lead to pandemic paradoxes.

Additionally, Chan's use of models overemphasizes the predictive ability of science. Although one can say that pandemics have a higher probability of coming from Asia (which we have found to be not accurate), it is not a certainty. Turnbull best summarizes other STS scholar's beliefs on this stating:

For Cartwright, and also for Ian Hacking, models are 'the intellectual tools that help us understand phenomena and build bits and pieces of experimental technology. They enable us to intervene in processes and to create new and hitherto unimagined phenomena. But models are by their very nature artificial, finite, constructs. Nonetheless they can be inconsistent and yet still prove useful even in the light of theory change.'²²²

Thus, the overemphasis of models and unverified information are fueling these paradoxes.

SEASONAL VERSUS PANDEMIC DEFINITIONS

The textbook definitions of epidemic versus pandemic are very clear-cut. It is something that most students learn in high school. According to the CDC self-study course on epidemiology in public health, an "epidemic refers to an increase, often sudden, in the number of cases of a disease above what is normally expected in that population in that area."^{223,224}

²²² Turnbull, 9.

²²³ "An Introduction to Applied Epidemiology and Biostatistics." *Principles of Epidemiology in Public Health Practice, Third Edition*. CDC, 2012. Web. 15 February 2014.

According to the same source, a “pandemic refers to an epidemic that has spread over several countries or continents, usually affecting a large number of people.”^{225, 226}

The interviews revealed both differences and similarities between definitions of seasonal versus pandemic influenza. For example, I found that the working definitions and boundaries between seasonal and pandemic varied greatly. As participant A aptly noted, “it depends on what you mean by ‘pandemic influenza.’”(Participant A) After discovering the ambiguity in definitions, I amended the interview questions for subsequent interviews with, “how do you define seasonal versus pandemic influenza.” This may be a large contributor as to why many contend that pandemic influenza comes from Asia. As most epidemiologists would contend that seasonal influenza has a higher likelihood of emerging from Asia, they do not necessarily believe that pandemic influenza always comes from Asia. I conjecture that the malleable definitions between seasonal and pandemic influenza may serve as semiotic boundary objects, in other words providing a communication tool to the public at large while at the same time attempting to satisfy a requirement of science to have standardization of terms.

For some participants, the definitions hinged on morbidity (severity of illness) versus mortality (the number of deaths). Participant Y defined, “well in my mind, when I think of pandemic, I think about something that’s spread from person to person that has severe morbidity... so in my mind I see it differently than... the technical definition.” Although Participant V used the “textbook definition,” Participant V added for a pandemic, ““a new strain

²²⁴ Friis, Robert H., and Thomas A. Sellers. *Epidemiology for Public Health Practice*. Sudbury, Massachusetts: Jones and Bartlett Publishers, 2009. Print: 18.

²²⁵ "An Introduction to Applied Epidemiology and Biostatistics." *Principles of Epidemiology in Public Health Practice, Third Edition*. CDC, 2012. Web. 15 February 2014.

²²⁶ Friis, Robert H., and Thomas A. Sellers. *Epidemiology for Public Health Practice*, 18.

of influenza that is more contagious, more easily spread, or more virulent than the recent seasonal influenza and spreads throughout the world.” (Participant V)

For other participants, the definitions hinged on linkages between time and space. For example, Participant Z explained, “Pandemic can occur at any time not specific to a typical season, spread throughout different locations at that time. Whereas seasonal is a more predictable timeframe for a flu that we know comes up at a certain time of year and usually migrates with a certain consistency and pattern. Maybe a little more predictable. I could be wrong, but that’s my opinion.” (Participant Z)

A pandemic influenza can become a seasonal influenza, and the more novel the strain, the more likely it would be characterized as a pandemic strain. As participant C notes, “you can move from pandemic to seasonal... Now, ironically, now the 2009 H1N1 is a common strain. It has become a seasonal flu.” (Participant C) Participant C described seasonal influenza as regular occurrences that contain strains “we know about.” (Participant C) As Participant X explains, “so normally what happens is that pandemic virus settles down and the second year and the third year it just causes expected, normal epidemic waves, and it’s still the same virus. Maybe with a few extra mutations maybe not, but all of a sudden in year two or year three we change into calling it seasonal influenza. So that’s normally the way that those two names are used.” (Participant X) Participant X also noted a scientific function for labeling something a “pandemic” since it allows “the World Health Organization or media organizations to call it a pandemic virus to raise awareness. I think that that is appropriate. There is an appropriate amount of alertness that needs to be had that first year.” (Participant X)

There appears to be a desire to neatly label influenza information. As Participant P notes:

I think it goes back to our nature of putting things in boxes to better understand them and to categorize them and to make it more black and white for discussion, so looking at what has happened historically or what some of the more memorable events have been and what the origins of those have been, maybe you tend to apply from one strain to the next similar events that took place to cause that. For me personally, it can happen anywhere, these new strains can emerge. From my knowledge we looked at South America to prepare for seasonal influenza. But I think some farming practices or animal husbandry practices in certain parts of the world are more likely to facilitate transmission, especially if you have very dense populations or populations living in close proximity to the animals where that transmissibility could occur a little more readily. That's not to say that things don't crop up in rural Indiana or Idaho, cause I know they do. I think some of the more recent, larger spread newsworthy events have happened in certain locations that people tend to see more commonly. (Participant P)

Instead of generalizations, we then deal with definitions. In other words, attempts to delineate seasonal versus pandemic influenza in an objectified fashion actually result in personalized definitions of these terms. As a modification “of what Star calls ‘boundary objects,’ that is, they are ‘objects which are both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites,’” we see what I see as a “boundary term.”²²⁷ Although there are textbook definitions of pandemic versus seasonal, epidemiologists do not espouse to them in the strictest of sense. Epidemiologists use them as indicators of risk and severity. Epidemiologists will use the term “seasonal” influenza even though it may occur across wide areas and many continents (which would be defined as a “pandemic”), because it is an expected occurrence. Epidemiologists will use the term “pandemic” influenza even though it is still isolated in one

²²⁷ Turnbull, David. 2000. *Masons, Tricksters, and Cartographers*. London: Taylor & Francis: 11.

area, because it is a novel virus with the potential for high mortality. Thus, it would appear that the textbook definitions are useful to epidemiologists to generalize disease impact on populations, and that these definitions may serve as malleable boundary object wherein epidemiologists could communicate to the greater public the severity of disease regardless of whether they meet textbook standards.

SITUATED KNOWLEDGES

The supposed boundaries between seasonal versus pandemic influenza revealed a juxtaposition between time and space. This is mainly, a supposed “objective” view that seasonal influenza starts in Asia, circles the globe, and then the cycle begins anew. As Participant H explains, “in reality, the Earth experiences two influenza seasons corresponding usually to winter. Realizing that winter occurs at different times in the Northern and Southern Hemispheres illustrates our biased view of influenza. There is a flu season in the Northern Hemisphere and a flu season in the Southern Hemisphere.” (Participant H) As Participant A details, “working the flu, think of it in the US as there is this flu season in Asia and there’s flu season in the US and we kind of trade it back and forth but it actually does circle the globe and there is a flu season in Africa.” (Participant A)

What we find are two, drastically different perspectives – the “Northern” (I will position this as a North American or European perspective) versus “Southern” (what I position as the African, Southeast Asian) perspective. However, what we see in the scientific and media narrative are almost exclusively Northern perspectives. As participant X notes, “The reason that we have a seasonal influenza is that there is a very Western and a very Northern viewpoint on influenza that influenza is a winter’s disease so we Westerners call it seasonal influenza. In

tropical countries, it is not seasonal, so Western scientists have tried to fit it into a different construct. So they can see why it's different, or if it's different, and does it come from somewhere else. At the end of the day it's all the same virus, and probably the best way to describe it is that when a new virus comes into the population like in 2009 it's appropriate to call it a pandemic virus because it normally spreads across the globe quite quickly, say, in a matter of 6 – 12 months. It is normally a matter of some urgency because there's always a little bit of a potential that the new virus is dangerous.” (Participant X) Participant A contends concerning the two different flu seasons, “sadly, epidemiologists who don't have that global perspective think that it's this mystery as to why things show up here, every year, oh why?” (Participant A)

Using Haraway's “Situated Knowledges” where she illuminates science's “god-trick of seeing everything from nowhere, but to have put the myth into ordinary practice,” I question this “god-trick” perspective where I view Northern perspectives having a louder voice than Southern perspectives which are rarely mentioned in the research literature.²²⁸

SUMMARY

As noted, I have found that the paradox of attribution is caused and fueled by the following factors: finding the index case, disease naming conventions, blame metaphors, unvalidated information, seasonal versus pandemic influenza definitions, and situated knowledges. In following with epidemiological precedence, many seek to find the index case of the disease. Moreover, disease naming conventions only add merit to the importance (even if there is little) of finding the origin of the disease. These origins fuel the desire to blame specific

²²⁸ Haraway, “Simians,” 581.

locations, groups, and individuals for disease. Malleable definitions between seasonal and pandemic influenza inadvertently misconstrue origins but allow for semiotic boundary objects between epidemiologists and the public. Finally, Northern perspectives greatly trump all other perspectives thereby situating the origin and cause of pandemic influenza as “somewhere else,” and that somewhere else, is almost always Asia.

CHAPTER 5 – THE PARADOXES OF PREVENTION AND ACTION

Considered as two distinct paradoxes, the paradox of prevention and the paradox of action appear to be influenced by similar forces. The paradox of prevention highlights systemic encouragement of specific industrial practices even though emerging evidence suggests that these same practices may actually encourage the development and spread of pandemic influenza. The paradox of action contrasts the incongruous actions taken despite the existence of internationally recognized methods to stop pandemic spread. These both appear to be linked by the growth of the epidemiological sciences – in particular, with the growth in education and training. In addition, these paradoxes are linked to the “standpoint relativism” of epidemiology within different cultures. Not only do these differences exist between countries, but also between the “rural” versus “urban” of the same country. The study of these paradoxes also revealed conflicts within the field of epidemiology itself ranging from differences in specialization to potential differences in schools of thought. Furthermore, this relativism exists within the different specializations of epidemiologists themselves. Hence, this chapter focuses not necessarily on the lack of consensus, but the reasons for the lack of consistency in the field of epidemiology regarding prevention and action.

THE PARADOX OF PREVENTION

The paradox of prevention describes the belief that pandemic influenza can be mitigated through the widespread use of certain practices, such as large-scale farming, even though the evidence supporting these claims is inconclusive at best. We know that two factors encourage the spread of pandemic influenza – genetic mutation and animal-to-animal (including human) contact. The inherent genetic character of influenza makes it extremely dangerous. Random

mutations can cause pandemic strains of influenza. Mixing of strains can also cause pandemic strains. Genetic mixing can occur either through animal-to-animal or species-to-species interactions. In animal-to-animal mutations, for example, a wild bird with one strain of influenza can visit a farm and infect a pig with another strain of influenza. The two strains can genetically combine in the pig to produce a more virulent, third strain. In species-to-species infection, a similar process occurs, in this case, a sick chicken in the same coop can infect another sick chicken with a different strain and the genetic mixing can occur in that manner. If the new strain that is produced causes the chicken to die immediately, that would be the end of the story. However, if the new strain manages to infect other animals in the vicinity – dogs, sheep, pigs, horses, and especially humans – that potentially could be the start of a new pandemic.

FARMING PRACTICES

Although there is great variation in farming practices, there are two antithetical types of farming that are commonly discussed: “industrial farming” and “backyard farming.” For the most part, industrialized farms are associated with “developed countries.” In general, the animals are genetically similar. The genetically similar animals then grow to become similar, which produces a more reliable product. Moreover, most industrial farms house a large number of animals. As of 2013, typical industrial poultry farms in the U.S. contained about 15,000 chickens.²²⁹ These animals are usually housed in very confined spaces. On the other hand, “backyard” farms are generally associated with “developing” countries. They typically have

²²⁹ Stevenson, Steve and Don Schuster. "Large-Scale Pastured Poultry Farming in the U.S. (Research Brief #63)." *Center for Integrated Agricultural Systems*, 2003. Web. 18 February 2013.

very small numbers of chickens with some farms having as few as one chicken. Typically, backyard farms allow access to outside fields, and hence, the appellation “backyard.”

We must recognize that these are highly loaded terms. On one hand, “industrial” or “factory” farms are intertwined with notions of “modernity.” Industrialized nations are usually the ones that have mastered standardization and mass production methods. Industrial farming is inextricably linked to the successes of mass production in a manner similar to influenza vaccination and is promulgated in the same manner. On the other hand, though there is an abundance of evidence that the process of vaccine production and prophylaxis is helpful in preventing pandemics, there is no empirical comparison on whether industrial or “backyard” farms fare better during flu season. In terms of pandemics and industrial farms, there is simply a lack of evidence.

“Backyard” farming practices have also been taken to mean “backward processes.” As WHO spokesman, Peter Cordingley proclaimed, concerning small scale farming in Asia, “worse than any misconceptions, though, is the continuing *ignorance* (italics added) in Asia, the fact that after two years people still know so little about risky practices.”²³⁰ Contrary to the WHO spokesman’s note, farmers in Asia are quite cognizant of both their options and risks. There are educational campaigns such as the continuous public service announcement videos that are designed to educate the public on pandemic influenza.²³¹ Of course, Mr. Cordingley, could then contend, as he is quoted saying, “education campaigns in the affected countries are still not

²³⁰ Parry, Jane. "Best Defence against Avian Flu Is to Fight the Virus in Asia." *Bulletin of the World Health Organization* 83.12 (2005): 881-968. Print.

²³¹ Avian Influenza: Vietnam Public Service Announcement." Publisher, 2011. Web. 17 April 2013.

getting through to the individuals most at risk,” implying a lack of understanding of risks and also raising issues of compliance.²³²

Compliance on many issues in Vietnam is quite high if the government champions the initiatives. Take, for example, Participant W, who compared the issue of compliance between pandemic influenza initiatives and motorcycle helmet safety in Vietnam. Participant W noted that because of its authoritarian government, after a law was passed mandating the use of motorcycle helmets, adults began wearing helmets “almost overnight.” Participant F’s description was confirmed by WHO reporting which shows two pictures, one before the law was enacted where virtually none of the adults wore motorcycle helmets; and another post enactment photo, where almost all adults wore helmets.²³³ Subsequent literature supports this claim. Statistics from a helmet study show that in major Vietnamese cities there is a 90-99% compliance rate with recent motorcycle helmet laws.²³⁴ This is in comparison to the US, where in states with partial helmet laws, 49% of adults are observed to wear helmets as opposed to 89% compliance in states with universal helmet laws.²³⁵ Thus, as Participant F noted, when laws are championed by the government, Vietnamese citizens easily understand the implications of such initiatives, and generally will comply with government mandates unless there are other confounding factors.

There are many arguments for both farming practices. Many would argue that industrial farms are the cornerstone of the food supply chain and production process. There is no doubt that industrial farming provides food and nourishment to meet the world demand. Many would

²³² Ibid.

²³³ WHO. "Motorcycle Helmet Wearing Becomes Law in Viet Nam." *Violence and Injury Prevention and Disability (VIP)* (2007). Web.

²³⁴ Pervin, Aaron, and et. al. "Viet Nam’s Mandatory Motorcycle Helmet Law and Its Impact on Children." *Bulletin of the World Health Organization* 87 (2009): 369-73. Print.

²³⁵ "Current State Motorcycle Helmet Laws and Fatality Rates." (2014). Web. 15 September 2015.

argue that these small-scale farms provide a higher quality product, since backyard farms are associated with pastoral notions of “free range” chickens. In addition, small-scale farms are generally viewed as more humane since animals are allowed more space.

Specifically concerning pandemic influenza causes, when comparing industrial farming to backyard farming there is an inverse relationship between the number of animals and the number of people. In industrial farms, there are many animals and few people to tend them, whereas in backyard farms, many people can be exposed to animals (e.g. a family) but there are fewer animals. In industrial farms, usually, there is little human-to-animal interaction, so in theory, humans are unlikely to get sick. However, the animals remain confined, and this allows a pandemic strain to emerge and infect other animals.

Another advantage of an industrial farming system is its ability to be regulated. Nevertheless, even though epidemiologists in the US and US agencies mandate that exporter countries such as China test and report flu incidence, these same rules do not apply to US farms. Currently, the US depends heavily on industry-self regulation. Unfortunately, producers do not openly report testing for fear of a loss of business.²³⁶ Branswell found significant new strains that emerge from industrial farms usually are only reported if they are “noteworthy” in the scientific literature, often a year or more after they are discovered.²³⁷ Thus, there is no rapid information on industry levels of pandemic influenza since there are no mandated tests. Moreover, as other researchers have noted, violations in biosecurity and biocontainment are routine.”²³⁸ What we do know is that the Swine influenza pandemic, along with a host of other outbreaks, has been linked

²³⁶ Branswell, Helen. 2011. "Infectious Disease: Flu Factories." *Scientific American*: 48-51.

²³⁷ Branswell, "Infectious Disease: Flu Factories," 50.

²³⁸ Giles-Vernick, Tamara, Susan Craddock, and Jennifer Gunn, eds. *Influenza and Public Health: Learning from Past Pandemics*. London: Earthscan, 2010. Print: 108.

to both industrial farms in the United States and backyard farms in Asia.²³⁹ As participant A noted, “it only takes one bird-bird interaction of a bad sort to cause emergence to happen.” (Participant A)

Although this is still up for debate, “industrialized farms” may in fact create an increased risk for novel pandemic viruses.^{240,241} The literature on pandemic influenza (not supported by the poultry industry or conversely animal rights/environmental groups) also questions the use of industrial farms noting:

Although recent studies have focused on environmental factors that contributed to the persistence and spread of HPAI virus (H5N1) in southeastern Asia, Europe, and Africa (4–6), general knowledge concerning mechanisms of emergence and persistence of HPAI viruses is limited. We propose that because the ecologic landscape in which avian influenza viruses evolve differs markedly between natural (i.e., wild birds) and artificial (e.g., intensive poultry farming, free-grazing ducks, and live bird markets) conditions, selective pressures differ. These phenomena are likely to explain virulence heterogeneity among avian influenza viruses and why HPAI viruses do not naturally emerge or persist in natural ecosystems.²⁴²

A group of international researchers go beyond this sentiment to implicate industrial farms as the primary culprits of disease creation, noting many causes including: a) the fact that the livestock intentionally are bred to have less genetic diversity, but this “offers fewer immune

²³⁹ According to the [poultrysite.com](http://www.thepoultrysite.com) which tracks disease outbreaks and issues concerning poultry. <http://www.thepoultrysite.com>.

²⁴⁰ Gregor, “Breeding Grounds.”

²⁴¹ Gregor, “Chicken Run.”

²⁴² http://wwwnc.cdc.gov/eid/article/16/7/09-0389_article.htm (CITE)

firebreaks against outbreaks (Garret and Cox, 2008; Megens, et al, 2008)”;^{243,244} b) because animals are literally “cooped up,” this can lower their immune system responses;²⁴⁵ c) because animal lifespans from birth to the production line have been reduced, this may encourage the development of more virulent strains;²⁴⁶ because of these younger animals, this also may encourage strains that attack “younger, more robust immune systems;”²⁴⁷ and d) sometimes these industrial farms actually take the place of natural wetlands, where migrating birds still visit, which may lead to genetic mixing (of pandemic strains) across species.²⁴⁸

Participant U mirrored these concerns stating that, “large scale farming would be counterproductive for a couple of reasons.” These included crowding, which would increase the changes of spreading respiratory disease. (Participant U). In addition, Participant U noted that, “also, my understanding is that the more crowded the conditions, the more there is a desire to use prophylactic antibiotics. Not only could you increase the likelihood of spreading influenza in your herd or flock, you could also be promoting antibiotic resistance.” (Participant U)

Again, in using the 2009 Swine Flu pandemic as an example, studies show an “analysis of the H1N1 swine flu virus isolated from human cases in California and Texas reveals that six of the eight viral gene segments arose from North American swine flu strains circulating since

²⁴³ Muira, William M., and *et. al.* "Genome-Wide Assessment of Worldwide Chicken Snp Genetic Diversity Indicates Significant Absence of Rare Alleles in Commercial Breeds." *Proceedings of the National Academy of Sciences* 105.45 (2008): 17312-17. Print.

Muir, W. M., and *et. al.* "Commercial Chickens Are Losing Genetic Diversity." *National Association of Science Writers: Biodiversity* (2008). Web.

²⁴⁴ Giles-Vernick, Tamara, Susan Craddock, and Jennifer Gunn, eds. *Influenza and Public Health*, 108.

²⁴⁵ *Ibid.*

²⁴⁶ *Ibid.*

²⁴⁷ *Ibid.*

²⁴⁸ Giles-Vernick, Tamara, Susan Craddock, and Jennifer Gunn, eds. "Influenza and Public Health,"109.

1998, when a new strain was first identified on a factory farm in North Carolina.”²⁴⁹ These findings were confirmed by the Smith *et al* study.²⁵⁰

In a counterargument, the use of “backyard farms” may increase exposure of humans to animals, thereby increasing the likelihood of pandemic influenza. In fact, many outbreaks have been linked to the transmission of influenza from animal hosts to human hosts. Unfortunately, backyard farms rarely are sites for any genetic testing unless there is in fact suspicion for causing outbreaks. In other words, backyard farms also face a lack of reporting except for a few articles such as “The Role of Backyard Poultry Flocks in the Epidemic of Highly Pathogenic Avian Influenza Virus (H7n7) in the Netherlands in 2003” or “Detection and Isolation of Influenza a Virus Subtype H1n1 from a Small Backyard Swine Herd in Colorado.”²⁵¹ Literature searches yield few articles on the number of animal to human transmissions.

In general, there is a lack of consensus in the scientific literature concerning the use of industrial methods. The Food and Agricultural Organization (FAO) of the United Nations sums up the debate between “backyard” and “industrial” farms as culprits of disease in the following manner:

Much is not known of the Disease and its Origins –

There is a range of unresolved questions regarding the emergence and spread of H5N1 HPAI since 1996. One school of thought suggests that rapidly expanding intensive or industrial farming has played a pivotal role whereas others see this largely as a disease of smallholder poultry, brought about by failure or inability to implement appropriate biosecurity/quality management systems as

²⁴⁹ Gregor, 1.

²⁵⁰ Smith, Gavin J.D., et al. "Letter: Origins and Evolutionary Genomics of the 2009 Swine-Origin H1n1 Influenza a Epidemic." *Nature* 459 (2009): 1122.

²⁵¹ Bvinck, V, and et. al. "The Role of Backyard Poultry Flocks in the Epidemic of Highly Pathogenic Avian Influenza Virus (H7n7) in the Netherlands in 2003." *Preventive Veterinary Medicine* 88 (2009): 247-54. Print. Weller, Christina B., et al. "Detection and Isolation of Influenza a Virus Subtype H1n1 from a Small Backyard Swine Herd in Colorado." *Journal of Veterinary Diagnostic Investigation* 25.6 (2013): 782-84. Print.

smallholder flocks expanded. FAO argues that both have played a role and any attempt to blame a particular practice or sector for emergence of this disease fails to recognise the complexity of the poultry industry and the pitfalls and benefits of the various management systems employed from a veterinary, social and economic perspective. The crucial role of ducks in open farming systems and of live bird markets as reservoirs of infection also needs to be recognised as well as ways by which these risks are managed or have failed to be managed.”²⁵²

Nevertheless, because there is a dearth of evidence it is unclear as to why these industrial methods are being encouraged in developing nations as opposed to backyard methods. As Lockerbie explores the “local repercussions” of Vietnam, she notes, “the global perception of the virus is markedly erroneous; government-sanctioned and commercial farms are construed as ‘safe’ and ‘clean’ spaces in the developing world when much of the research indicates just the opposite.”²⁵³ We can conjecture, then, that market forces encouraging profits may be the driving force behind industrial farm support.

In order to direct questions toward this topic, during the interview process, I posed the following questions:

In your viewpoint, how do you believe pandemic influenza can be prevented?

- a. How did you form this viewpoint?
- b. What is your opinion about certain farming practices – do you believe they contribute to pandemics?

²⁵² Jutzi, S. C. and J. Domenech (2006). Avian Influenza: A Global Animal Health Crisis with Profound Challenges to Science and Society. Agriculture Department Animal Production and Health Division, Food and Agriculture Organization of the United Nations.

²⁵³ Lockerbie, *Global Panic*, 5.

- c. How do you feel about this apparent paradox? Take for instance, recommendations to use industrialized processes.

One surprising finding was that many epidemiologists interviewed felt that farming practices were outside of their realm of expertise. For the most part, the epidemiologists who were interviewed specialized in “human epi” and were not “vets,” or epidemiologists who studied animal health. As a result, towards the end of the interview process, only one epidemiologist who specialized in ecology of infectious diseases and worked in Vietnam, felt qualified to answer this line of questioning. This participant noted that backyard farms were potentially sources of pandemic influenza in Vietnam due to the sheer number of backyard farms that the Vietnamese population had. In addition, this participant noted that “this is very difficult to study because there are too many factors and very difficult to say and have (or champion) one farming practice.”

Thus, my analysis found that additional research needs to be done concerning the paradox of prevention. The epidemiologists who were interviewed and who felt comfortable speaking on the topic, agreed that industrialized processes allowed for regulation and monitoring, yet they also found that, with these industrialized processes, there is a potential to spread pandemics. While there is little to no regulation and monitoring in backyard farms, they too have the potential to spread pandemic disease. Concerning the amount of regulations and standards, participant X noted, “It does not mean necessarily that they [industrial farms] are less susceptible to outbreaks that just means that, well that’s what they chose as an economic system of managing and selling poultry meat. Of course, an advantage is that you can have standards, but a disadvantage is that you put a lot of chickens together in a very small space and if a disease gets into a facility like that it can wipe out a lot of chickens.” (Participant X)

Insisting on a change that may or may not be beneficial for mitigating pandemic influenza spread potentially can divert resources that epidemiologists could better use elsewhere. It is an economic question for producers and small-scale farmers whose livelihoods may depend on these epidemiological recommendations.

SUPERMARKETS, WET MARKETS, STOCK MARKETS

While industrial and backyard farming practices garner much attention, much less research attention is given to the process of distribution and how that impacts pandemic disease progression. In fact, there are few studies which show how potentially sick animals can spread pandemic influenza. Intertwined with the sale and distribution of potentially sick animals is the cost of production. There are costs from the original farmers, distribution chains, and so forth, all the way up to major impacts on global economies. Even on a deeper level, there are cultural costs to the ways animals are sold, distributed, and eaten.

In the current literature, there is a dichotomy between industrial methods of distribution, which this dissertation will generalize as “supermarkets,” and what is known as “wet markets.” In general, in the “supermarket model,” factory farms produce animals and these animals are processed on a mass scale. In general, there is oversight through strict regulation, monitoring, and hygienic practices. The animal products are then neatly packaged and distributed in a form familiar to Americans: shrink wrapped meat products. Wet markets, are generally associated with Asian countries and tied to backyard farms (although it is entirely possible that wet markets sell meat from large scale farms, and vice versa). In general, the animals may be still alive or the market vendor slaughters the animal close to the time of sale.

Even though there were no direct interview questions on this issue, one area that was commonly mentioned during the interview process was the abundance of wet markets. These

wet markets are typically open air markets where animals are sold live to the consumer. In particular, Participant X believed that far more dangerous than backyard farming was the practice of selling animals through wet markets, where one sick animal could be exposed to other sick animals, or hundreds of potential customers.²⁵⁴ The key implication of wet markets involved the live human to animal interface. In a similar practice, in the United States, documented exposures to humans have been noted in country fairs, where pigs are displayed. Sometimes these pigs can be sick and can infect humans.²⁵⁵ In other cases, pigs can pass influenza to other pigs. When the pigs then return to their home farms, they can infect even more pigs.

Culturally unique issues arise when discussing wet markets. Having live animals displayed can be a sign of freshness. In many Asian countries, there is such an emphasis on freshness that traditionally people may buy groceries every day or even more than once a day.

One related finding concerns the Thai system of poultry distribution and its impact on pandemic disease progression. Although this was not a topic under study, Participant X noted that Thailand might have fared much better in stopping pandemic influenza due to its distribution methods. Although Thailand also uses extensive backyard farming (and industrial farming) and wet markets, the wet markets do not have live animals. The majority of the Thai population is Buddhist, specifically from the Theravada School of Buddhism. Participant X noted that because of this religious tradition, animals are slaughtered humanely before sale and this is why Thailand was able to quickly stop avian influenza pandemics. Again, this information is suggestive, but preliminary and will require future research.

²⁵⁴ Chen, Yu, and et. al. "Human Infections with the Emerging Avian Influenza A H7N9 Virus from Wet Market Poultry: Clinical Analysis and Characterisation of Viral Genome." *The Lancet* 381.9881 (2013): 1916-25. Print.

²⁵⁵ Bowman, Andrew S., and et. al. "Swine-to-Human Transmission of Influenza A(H3N2) Virus at Agricultural Fairs, Ohio, USA, 2012." *Emerging Infectious Diseases* 20.9 (2014): 1472-80. Print.

As we see then, it is unclear why large scale farming is encouraged, while backyard farming is discouraged. Both systems have their strengths and weaknesses and the scientific research is still too preliminary to determine whether one is indeed better than the other in terms of pandemic prevention. However, based on Lockerbie's and Scoones work, we can conjecture that global trade regimes and economic forces outside the recommendations of epidemiologists may be fueling this paradox. The significance of these economic and political relations will be informative and remains as an area of potential future study.

THE PARADOX OF ACTION

The paradox of action describes the actions taken by health entities to curb disease spread that are in direct contrast to standard epidemiological recommendations. Although epidemiologists strive to prevent the spread of disease, there may be other factors at work that impact their decision on which methods to use. In both Vu [no relation to the author of this dissertation] and Lockerbie's research, they found that although most evidence indicated that the best way to treat avian influenza in Vietnam was through vaccination of animals, Vietnamese epidemiologists continued to cull animals. The majority of international assessments agree that "the mass culling of poultry to contain outbreaks of avian flu is no longer acceptable and should be replaced by the vaccination of flocks. That was the conclusion of experts at a joint conference in Paris of the UN Food and Agriculture Organization (FAO) and the World Organisation for Animal Health (OIE)."²⁵⁶ Nevertheless, "the Vietnamese government continues to order massive slaughtering of chickens reared outside of government-sanctioned farms. This is a deliberate

²⁵⁶ Butler, Declan. "Vaccination Will Work Better Than Culling, Say Bird Flu Experts." *Nature* 434.7035: 810. Print.

public relations attempt to preserve an international image and to restore faith in foreign investment; however it makes little sense in local communities.”²⁵⁷ As Vu and Lockerbie suggest, the Vietnamese epidemiologists engaged in control efforts in order to provide enumerable results (dead chickens) and to “save face.” These efforts provided a concrete measure to show that government-sanctioned farms were actively controlling the pandemic. They reassure that investors, especially foreign ones, should trust that these government sanctioned farms will reliably produce safe products.

The paradox of action is revealing, since as a scientific discipline it would appear that although epidemiologists maintain consensus on methods of treatment and monitoring policies, in reality, there may be a double standard for actual implementation. In other words, this study found that although there are scientifically accepted practices, actual practices deviated for many reasons. Firstly, as we will soon show, epidemiology is not a monolithic institution. It is a relatively young field that has differences across different specializations and differences between applied and theoretical foundations. I found that the differences in training did not necessarily lead to paradoxes. It was unclear whether the differences in the specializations and practice regimens may lead to influenza paradoxes. Even though I showed earlier that there were no differences in the understanding of science between Vietnamese and US epidemiologists, there are distinctions due to social, cultural, and even economic factors which are a major contributor to these apparent paradoxes.

²⁵⁷ Lockerbie, Stacy. *Global Panic*, 8.

EPIDEMIOLOGY IS A YOUNG FIELD

In contrast to other sciences, epidemiology can be considered a relatively young field with modern epidemiology coalescing in the 20th century. One possible explanation for these varying recommendations is that epidemiology is a relatively young field and has not yet had the opportunity to coalesce with concrete recommendations. We will see below that although there are large differences as to how one becomes an epidemiologist, these don't necessarily impact what epidemiologists recommend.

The definition of epidemiology has developed significantly within the last few centuries. Epidemiology can be traced as far back as the 17th century with the description of “large-scale outbreaks of infectious diseases” with plague descriptions like in Spanish physician Angelerio’s “*Epidemiología*.”²⁵⁸ Many advancements in epidemiology occurred in the 20th century as definitions of epidemiology were being formed. In 1919, epidemiology was described as “the study of the determinants of infectious diseases.”²⁵⁹ This definition implied that people studying non-infectious diseases were not epidemiologists.”²⁶⁰ This definition was expanded in 1927 to include “the study of disease, any disease, as a mass phenomenon.”²⁶¹ Contemporary epidemiology, according to the International Epidemiology Association’s “Dictionary of Epidemiology is:

The study of the distribution and determinants of health-related states of events in specified populations, and the application of this study to control of health problems.²⁶²

²⁵⁸ *A History of Epidemiologic Methods and Concepts*. Ed. Morabia, Alfredo. Basel, Switzerland: Birkhauser Verlag, 2004. Print: 3.

²⁵⁹ *A History of Epidemiologic*, Comstock, Part II.

²⁶⁰ *A History of Epidemiologic*, 116.

²⁶¹ Greenwood, 1935, p.15 (Italicized by Morabia, 117).

²⁶² Last updated, 2001. Morobia, 120.

There are large differences between epidemiological training and certification. In contrast to medical doctors, epidemiologists do not have a set training regimen or requirement for certification.²⁶³ For the most part, epidemiologists have at least a masters degree or Ph.D. in public health or epidemiology. There are epidemiologists who work in the field of epidemiology but have no formal training in it. For instance, medical doctors who later work in public health. Surprisingly, there is no formal certification process for becoming an epidemiologist. Certification is voluntary through the Certification Board of Infection Control and Epidemiology, Inc. (CBIC).²⁶⁴ Although a bachelor's degree in epidemiology is mandatory for certification, "lacking the formal education of a bachelor's degree may qualify if they are registered medical technologists, nurses, clinical laboratory scientists or physicians. Educational requirements can also be waived with a certain level of professional practice experience."²⁶⁵

The participants I interviewed also had very diverse backgrounds. Most were epidemiologists, professors, or practicing doctors. They had a range of educational backgrounds which include biology, psychology, math, public health, epidemiology, medical etymology, and English. Although some were successful, published epidemiologists, they did not necessarily have degrees in epidemiology or public health.

In response to questions regarding the development of the field of epidemiology (or "epi"), participants believe that the number of public health programs have grown in recent years. (Participant A). According to a study on public health schools in the US, in 1960, there

²⁶³ U.S. Department of Labor "Epidemiologists." Occupational Outlook Handbook. Publisher, 2015. Web. 15 November 2015.

"CBIC." Publisher, 2015. Web. 15 November 2015

"Epidemiology & Research." Web 2015. Web. 15 November 2015.

²⁶⁴ CBIC.

²⁶⁵ Ibid.

were only 12 accredited public health schools in the US.²⁶⁶ This is in contrast to 2011, where there were at least 46 schools of public health.²⁶⁷ Participants did make clear distinctions between public health (what was considered a much broader field) and epidemiology. Furthermore, they noted that Masters in Public Health programs have grown significantly only recently. Prior to this, there were just undergraduate degrees in public health. Up until 1980, the traditional route was to go to medical school and then become an epidemiologist with no training at all. This trend abated since, for some, the cost of medical school outweighed the gains of working for a lower salary as an epidemiologist. (Participant A) Currently, people of many different academic backgrounds may become epidemiologists. As Participant Y notes, “you can see that behavioral scientists end up working as epidemiologists.” (Participant Y)

Amidst all of these different backgrounds and modes of training, when posed with a general question, “In your viewpoint, what epidemiological measures would you use to prevent pandemic influenza?” most participants made the same general recommendations for discouraging pandemic influenza. These recommendations included handwashing, surveillance/early detection, good hygiene, vaccinations, staying home from school, and public education.

Although it cannot be proven through the interview process, the varying epidemiological recommendations in the research literature cannot be tracked to the varying backgrounds of epidemiologists.

²⁶⁶ Rosenstock, Linda, Karen Helsing, and Barbara K. Rimer. "Public Health Education in the United States: Then and Now." *Public Health Reviews* 33, no. 1 (1/2011): 39-65.

²⁶⁷ Ibid

SPECIALIZATION IN EPIDEMIOLOGY

As noted in the STS literature, there is a general trend in many scientific fields towards specialization. This is especially true of the field of medicine as detailed in Starr's *The Social Transformation of American Medicine*.²⁶⁸ Epidemiology too, has its share of subspecialties. For instance, of the participants who were interviewed, there were experts in many specialized areas such as infectious diseases, injury, reproductive health, molecular, and veterinary epidemiology. As many historians of epidemiology have noted, there is a marked difference between "classic" and modern epidemiologists.

Although I did not know this before undertaking this research, specialization was critically important to the issue of preventative action in that epidemiologists rely heavily on the expertise of other, more specialized epidemiologists. During the interviews, it was a commonplace occurrence that epidemiologists would refer to others in more targeted fields. For instance, a neonatal epidemiologist would refer to the work of a molecular epidemiologist to answer specific questions on particular influenza strains. Although all participants were comfortable speaking about pandemic influenza, specialization was the key factor in the level of engagement through which participants wished to respond to questions concerning epidemiological recommendations for farming practices.

While there was a heavy dependency on other epidemiological sources of expertise, there was one major exception – theoretical epidemiologists. For the most part, many epidemiologists interviewed were "field epis," or epidemiologists who have worked within the populations that they studied. Many noted clear differences between "field" and "theoretical" epidemiologists, or those who have not worked in the field. Many participants noted that these "theoretical epis"

²⁶⁸ Starr, P. (1982). *The Social Transformation of American Medicine: The Rise of a Sovereign Profession and the Making of a Vast Industry*, Basic Books.

tended to perform more statistical work or model making and would not necessarily understand the nuances of field work. As the historian Morobias notes, there is a:

Strong contrast in the professional backgrounds and profiles between the generation of epidemiologists who contributed to this new phase and the classic epidemiologists. Many [classic epidemiologists] have PhDs but not MDs. Most if not all have a strong background in mathematics or statistics. This generation went further in the formalization of methods and concepts. As a result, the discipline (has become) much more mathematical. Where classic epidemiology expressed concepts that had no necessary mathematical translations, almost all concepts (e.g. bias, confounding, interaction, etc.) in modern epidemiology can be written in either in words or equations.²⁶⁹

Thus, it appears that specialization in the epidemiological sciences leads to a sense of resource sharing wherein which one epidemiological specialty could depend on another for outside expertise. Nevertheless, this camaraderie was not shared by “theoretical epidemiologists.” Since there was only one “theoretical epidemiologist” interviewed, this may be an unfair assessment. As noted earlier, this was an area that was unknown at the start of this research, and thus this discussion is preliminary. Future research outside the scope of this dissertation may shed additional light on the paradox of prevention in regard to epidemiological specialization.

STANDPOINT EPIDEMIOLOGY: CULTURAL AND SOCIETAL DIFFERENCES

In borrowing from Standpoint Feminism, wherein contemporary scholars such as Andermahr would advise a “relational” worldview, we see that epidemiological practices do

²⁶⁹ *A History of Epidemiologic*, 121.

change within different cultures and societies.²⁷⁰ These differences are apparent between the US and Vietnam. As we saw earlier, between the US and Vietnam there are few differences between the understanding of science and the training in epidemiological sciences. Nonetheless, there are large disparities within Vietnamese cultures and societies which inform epidemiologists on what methods they choose despite of how effective these methods are in comparison to each other.

As noted, I chose to study epidemiologists in the US and Vietnam in order to see whether cultural difference had an impact on epidemiological decision making. I found that, indeed, cultural factors play a role in how epidemiologists proceed. In general, epidemiologists proceed in the most culturally attuned way in order to prevent or stop disease spread.

The most prevailing cultural difference appeared to be the differences in the emphasis on individualism and communalism. Generally, the US as having an emphasis on individualism, as opposed to Vietnam, which has a very communal culture. As Participant A notes when comparing methods of isolation “if we look at the balance between individualism and communalism, where do we [Americans] err? People say we err on independent freedom, personal freedom where in China or Vietnam, you could have a negative impact for your community because [you are not quarantined]. In China or Vietnam, the mindset would be, “take me away and box me up because I want what is better for the community and don’t worry about me,” (Participant A) This is in stark contrast to what Participant A noted was the American mindset, noting, “there’s no way. So the message I think is not that we would impose that in the US, because it would fail, but that we learn how to communicate globally epi better and that we do let people be educated about what other countries around the world are doing so that we can being to decide on the individual narrative of what to protect ourselves and our

²⁷⁰ Andermahr, Sonya, Carol Wolkowitz, and Terry Lovell. *A Concise Glossary of Feminist Theory*. New York, London: Arnold, 1997. Print.

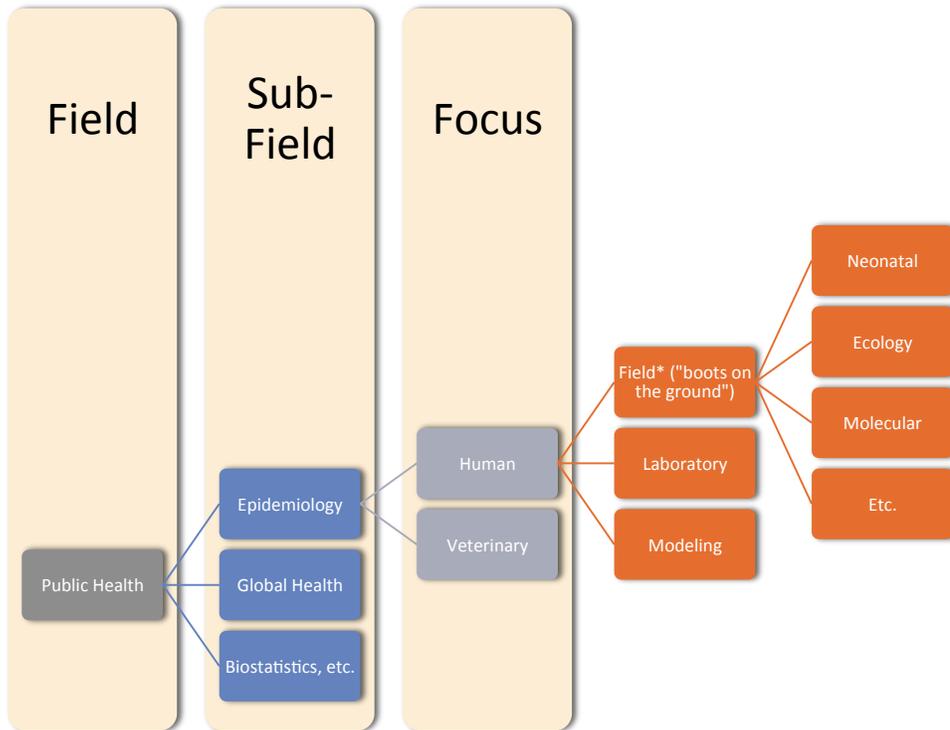
families.” (Participant A) Participant U also noted that in Vietnam, not as much attention is paid to civil liberties.

One unanticipated finding of this study was a rough mapping of the field of epidemiology. As Figure 2 below shows, epidemiologists are nestled within the field of Public Health, but epidemiologists are structurally divided as human or veterinary epidemiologists.²⁷¹ Even further, epidemiologists have self-organized into field**, laboratory, or modeling epidemiologists.²⁷² To go even further, each of these have sub-disciplines such as neo-natal epidemiologists, injury epidemiologists, and so forth. For instance, epidemiologists would fall under the umbrella of public health; each of these could be a field, laboratory, or modeling epidemiologists; each of these could specialize in areas such as injury, neonatal, etc.

²⁷¹ For the most part, the interview respondents never mentioned the term “human” epidemiologist until it was juxtaposed to a veterinary epidemiologist. The term “epidemiologist” was taken to mean “human epidemiologist.” This figure is only meant to be representative and does not provide all of the branches of epidemiology.

²⁷² Field** is confusing since it mirrors the larger scientific field. Field** in this context refers to epidemiologists with “boots on the ground” experience, who go into the community, as a part of their work activities. Also, potentially, epidemiologists could have self-organized into more categories, but this study only identified three thus far.

FIGURE 2: BRANCHES IN THE FIELD OF EPIDEMIOLOGY



Even at a deeper level, due to specialization in their respective epidemiological field, there appear to be differences and disagreements within the field itself. Although not explicitly noted by interview subjects, there appears to be derision when mentioning modeling epidemiologists, in particular. For instance, when asking about models that show the origin of pandemic influenza as occurring in Asia, many participants noted that due to the lack of “field,” tacit knowledge, these models were perhaps more informative rather than predictive.

SOCIETAL DIFFERENCES

Vietnam and the United States also have drastically different societal structures, impacting epidemiological decision making. The epidemiologists who work in Vietnam who were interviewed in this study are more than qualified (and mostly have) worked around the world. These epidemiologists by training were no different from those in the US. We then have

to question why many epidemiologists used the method of culling in Vietnam as opposed to more widely accepted practices of vaccination. Although most epidemiologists with the Vietnamese perspective agreed that vaccination should be the primary way of prevention, they noted reasons why epidemiologists in Vietnam initially culled animals and why that method failed. The three primary reasons were public participation in combating influenza, resources, and the healthcare system.

There is one published work that uses an STS approach to examine pandemic influenza in the US. Carlo Caduff in his 2010 work “Public prophylaxis: Pandemic influenza, pharmaceutical prevention and participatory governance” argued that the US vaccination strategy morphed to include public participation.²⁷³ This public participation was primarily in response to ethical concerns that were raised in light of a potentially limited vaccine supply. Caduff showed how public participation impacted the development of vaccination schemes. We will soon see how the lack of public participation greatly influenced epidemiological action.

As noted earlier, the Vietnamese people are very compliant as long as there are no other confounding factors. Vietnamese people understand implications of their actions. According to UNESCO (United National Educational, Scientific and Cultural Organization), the literacy rate in Vietnam is around 90% as of 2005 (as opposed to 86% in the US).^{274, 275} In contrast to the earlier example of motorcycle helmet compliance, in terms of pandemic influenza, there are many confounding factors as to why Vietnamese farmers would not allow the government to cull

²⁷³ Caduff, “Public prophylaxis: Pandemic influenza, pharmaceutical prevention and participatory governance.” *BioSocieties*, 5(2) 199-218.

²⁷⁴ Can, Truong Quoc. Country Profile: Viet Nam: United National Educational, Scientific and Cultural Organization (UNESCO).

²⁷⁵ “The U.S. Illiteracy Rate Hasn't Changed in 10 Years.” Huffington Post 6 September 2013, sec. Books. Print. The statistics behind literacy in the US vary greatly, since it is not tracked by UNESCO. Nevertheless, most estimates found hover around this referenced number.

their animals. As Participant V notes, there is a “generalized lack of faith in the government’s ability to do anything to combat avian flu or any other flu.” (Participant V) Moreover, although there were official government promises of compensation, farmers may have received much less compensation for culling than what was originally promised, if anything at all according to Participant X. This would have a major impact on small scale farmers whose livelihoods depended on their animal production.

The original decision to cull may have been a resource issue. As Participant X noted, vaccination is a timely and expensive process. Epidemiologists in Vietnam may not have had the resources for vaccines or the ability to produce such vaccines (even with international assistance) in the short-term. Thus, initially, it may have been the simplest method at the time as Participant X noted, “culling is difficult, but sometimes it’s just necessary.” (Participant X) Nevertheless, the culling strategy was not successful, as Participant X notes, “It is challenging and it affects people’s livelihoods.” (Participant X) For small-scale farmers, there may have been extensive logistics and resource issues involving the correct methods to vaccinate animals, and so it was largely unused. Moreover, Farmers would choose not to self report as there were economic considerations. (Participant W) Overall, it would appear that Vietnamese epidemiologists, even though they understood that vaccination would provide more useful outcomes, chose culling instead due to the interplay between what resources were at hand, and the assumption that farmers would cooperate.

As noted, in this study I did not interview many veterinary epidemiologists, so this is an area of additional study. However, at another level, it may be that although epidemiologists did not recommend culling, government officials chose to cull anyway. As Lockerbie claims, “The Vietnamese government continues to order massive slaughtering of chickens reared outside of

government-sanction farms. This is a deliberate public relations attempt to preserve an international image and to restore faith in foreign investment, however it makes little sense in local communities.”²⁷⁶

The Vietnamese health system may also have influenced what epidemiologists chose in order to stop pandemic spread. As Participant V notes, “The public health system is viewed as something less than competent.” (Participant V) Healthcare is not free, and there are drastic differences in the level of care you receive in a private versus a public health institution. (Participant V)

Nevertheless, in the end, Vietnam was able to curb pandemic spread. As Participant W noted (to paraphrase) what the MOH (Ministry of Health) was able to do (after the change in strategy to vaccination) was impressive to stop the pandemic.

Again, one critical area of future study will be a detailed explanation of veterinary epidemiologists and their views on the political economy of pandemic influenza. There were two findings in this study that open the door to additional research. First, the epidemiologists who worked in both the US and Vietnam noted no real “difference” working in these countries, yet the optimism from the epidemiologists who have worked in Vietnam mirrored the positive outlook message from large multinational organizations as described in Chapter 2. Most of these epidemiologists were funded by international organizations (not funded by the Vietnamese government) and there was little comment about international disputes outside of institutional credit. Moreover, although the published literature almost always lists scholars who have studied outside of Vietnam as a first author, none of the participants made mention of any institutional inequalities.

²⁷⁶ Lockerbie, “Global Panic,” 5.

CHAPTER 6 – CONCLUSION – A TITLE RECONSTRUCTED

*One flu east, one flu west,
One flu over the cuckoo's nest....*

In this study I examined influenza paradoxes through the lens of epidemiologists working in the United States and Vietnam. I identified three influenza paradoxes – the paradox of attribution, the paradox of prevention, and paradox of action – and interviewed epidemiologists to see if, indeed, these were paradoxes, and if so, how they could be explained. With an STS foundation, I crafted hypotheses as to why these paradoxes endure (see Chapter 1). I used concepts in STS as an “applied method” to examine four research questions (see Chapter 3). At the onset of this research it was unclear what I would find and what impact my findings would have on science studies; or conversely, what impact STS could have on the epidemiological sciences. By the end of this study, I realized that the paradoxes in this case study may have profound negative impacts on mitigating pandemic influenza. Thus, scientific paradoxes can be identified and can be explained, but can still be problematic. Moreover, these paradoxes may not be unique to pandemic influenza. It may be that paradoxes run rampant in science. I believe that STS is in a unique position of providing resources to other scientific fields in order to identify and neutralize these paradoxes.

It would appear then, that these paradoxes occur because of the known and unknown—that is, the dual nature of science. The dual nature of science encompasses the obvious – clearly, science is “what we know,” and science is also recognizing “what we don’t know.” Within the realm of “what we know,” science is currently oriented

towards convenient categorizations. In this particular case – that of epidemiologists – the science is currently very specialized and heavily segmented. On one hand, this specialization allows for small groups of people to become focused, highly skilled experts in very particular sub specialties. For instance, statistical epidemiologists may focus exclusively on modeling the disease progression of one strain of viral encephalitis. We will see this as a recurring theme as the desire to label, bin, and contextualize amorphous knowledge can lead to misinterpretation, and misunderstanding of information. It is within the realm of “what we don’t know” where we find the breeding ground for potential paradoxes. In areas where “we don’t know,” there is a gap filling process. As opposed to potentially delegitimizing the science by stating “we don’t know this,” there is a tendency to “fill in the gaps” with unvetted information. These islands of uncertain knowledge can provide opportunities for paradoxes to develop. Most dangerously, it is within the realm of “what we don’t know, but what we assume others know” that nurtures these paradoxes.

The dual nature of science allows for the three C’s of collaboration, conflict and competition which, in turn, feed pandemic influenza paradoxes. Collaboration masks unexamined assumptions as expert knowledge. Conflict and competition obscure underlying socioeconomic and political motives.

EXPLAINING THE PROBLEM: INFLUENZA PARADOXES

The scientific narrative generally agreed upon by the biomedical literature and the majority of epidemiologists I interviewed was relatively straightforward: pandemic influenza does not come from Asia, it is unclear whether industrial farming is a better

means of production than other methods, and culling is not the proven method for response. Nevertheless, we see that Asia is commonly implicated as the disease origin, other farming practices are actively discouraged, and animals are still culled.

In looking at the paradoxes of attribution, prevention, and action; one could argue that countries in Asia, particularly Vietnam, have disparities in scientific knowledge when compared to the U.S., so epidemiologists in Vietnam are unable to correctly attribute, prevent, and act on pandemic influenza. That argument assumes in some way that the US (or the West) has a privileged position of superiority in the sciences. In Chapter 2 I showed that this argument is not valid. The development of medicine and public health science in Vietnam occurred roughly in parallel with the US and other European countries (in particular, France). Currently, Vietnamese epidemiologists and their research are on par, or even at the forefront, of public health research. Moreover, researchers in both Vietnam and the US oftentimes collaborate successfully. This equality of scientific understanding also invalidates notions of knowledge disparities being the cause of the paradoxes of action and prevention. Since we found the material knowledge of pandemic influenza was not in itself producing these paradoxes, I needed to interview epidemiologists to go in depth as to what could be causing this misunderstanding. From the interviews, I found no correlation based on where epidemiologists have worked (Vietnam vs. the United States vs. internationally). Though the sample size was small, there was no evidence to indicate that where epidemiologists

worked factored into where they thought pandemic influenza came from, the use of certain production methods, or how “best” to act.²⁷⁷

The paradoxes in pandemic influenza should be of grave concern. When and if a pandemic response is directed to the wrong location, resources such as money, medicine, vaccines, medical staff, and so forth may be wasted with potentially tragic consequences. If, in fact, factory means of production and culling are not the best practices, this may be increasing the probability for pandemics. If these paradoxes are not resolved, more people will get sick, and more people will die.

THE PARADOX OF ATTRIBUTION

With the paradox of attribution we see that even though pandemic influenza may originate from any location, it is oftentimes attributed to Asia. The reasons for this are not intuitive. Some epidemiologists who worked in Vietnam thought it originated from Asia, and those in the US noted that many pandemics originated from the US, and vice versa. Again, there was no apparent relationship between where epidemiologists worked and their thoughts on the origin of pandemic influenza. The common discussion thread was by definition, the paradox itself, that pandemic influenza may come from Asia. Roughly a third of epidemiologists thought that it does, but then again, most (even those pointing out Asiatic origins) believed that it does not have to come from Asia.

I found that the paradox of attribution arose from an amalgam of six factors:²⁷⁸ the tradition of finding the index case, disease naming conventions, blame metaphors,

²⁷⁷ Although the sample size was small, after the tenth interview, respondents generally started to repeat previous responses. Although participants added in additional nuances and some questions were added, I believe there may have been a saturation of responses.

unvalidated information, seasonal versus pandemic influenza definitions, and situated knowledges. Epidemiologists may point to Asia as the source of pandemic influenza because they “traditionally” find a source of the disease. In other words, because finding the index case for diseases such as Ebola and cholera are so successful, epidemiologists may be applying successful methods at their disposal for one problem for use in another problem, that of pandemic influenza. With naming conventions, it may be that due to successful surveillance, laboratory work, and unclear guidelines, Asia may be the victim of a “Matthew Effect” of blame wherein which successful pandemic identification leads to pandemic cause or blame. As knowledge providers, it may be that, for purposes of wanting to inform the public, any tentative information or preliminary hypotheses, even if they are not correct, are promulgated by the media before they are verified. In other words, in a pandemic event, the public desire for information may lead to providing information, even if it is not accurate, even if it is not from informed professionals such as epidemiologists. Seasonal and pandemic influenza definitions play a large role in the misattribution of pandemic influenza, since both definitions are amorphous even within the epidemiological community. Since (arguably) seasonal influenza could be construed as coming from Asia, there may be confusion between seasonal and pandemic influenza. Where people experience pandemic influenza may also play a role in assigning a place of origin. There are in fact, two different “seasonal influenzas” – a “Northern” perspective from North America (and Europe) and a “Southern” perspective that views the progression of influenza in a drastically different light.

²⁷⁸ Possibly, there are additional causes, but these were the ones identified and corroborated by discussions with the epidemiologists.

THE PARADOXES OF PREVENTION AND ACTION

The paradox of prevention encourages the use of industrial methods even though the scientific benefit behind using large-scale methods remains unclear. This is not to undermine the fact that industrial practices help feed large populations, but it does illustrate that one reason to encourage industrial processes should not be to prevent pandemic influenza. Moreover, ways to prevent pandemic influenza may be rooted in other traditional distribution methods such as “wet markets.”

The paradox of action questions the multitude of actual epidemiological responses in light of standardized epidemiological recommendations. For example, if the standard solution for stopping pandemic influenza is vaccinating birds, we question why is it that Vietnamese epidemiologists cull birds. Again, the answer is not as easy as making the unfair assumption that Vietnamese epidemiologists do not have sufficient knowledge. On the contrary, we find that the specialization in the field of epidemiology itself positions these experts with different understandings and objectives. For example, a veterinary epidemiologist can cull birds, but an epidemiologist cannot cull humans. I found that the primary difference between these different recommendations stems from the social and cultural differences in the country within which the epidemiologists work. In other words, these epidemiologists are experts and understand the “textbook” methods for pandemic prevention and response. However, these epidemiologists modify their strategies based on the available resources, cultural implications, and social structures. As with bakers who modify the “ideal” recipe based on humidity and elevation, epidemiologists do the same in response to variations in resources, cultural understandings, and social acknowledgements.

RESEARCH QUESTIONS

This brings us back to the original research questions posed at the beginning of this study. I provide a cursory response to each question below, but I believe the potential of these individual questions will be fully realized when they are examined holistically.

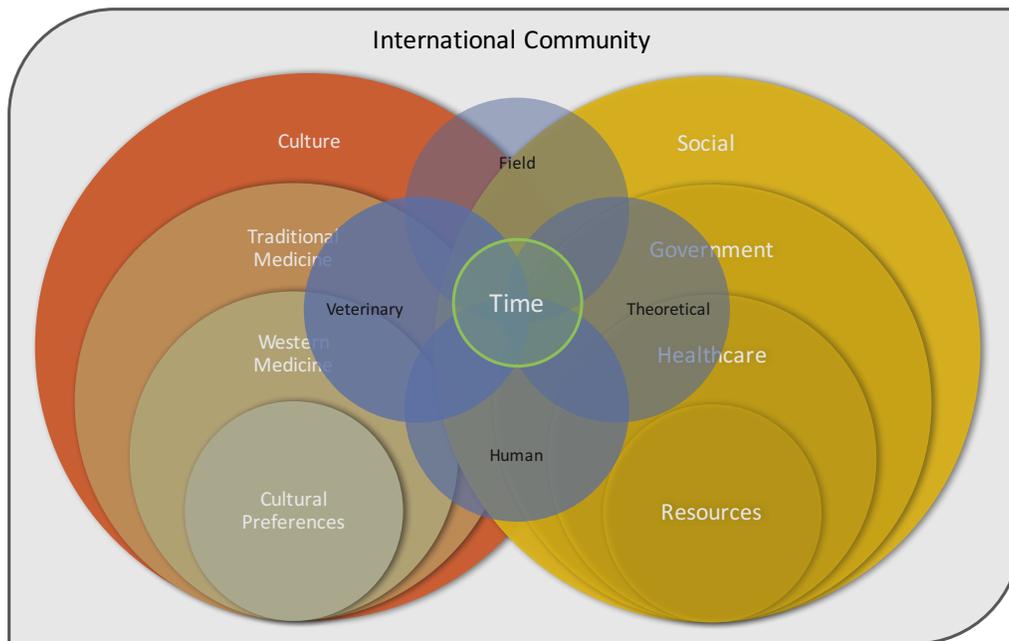
- Are there social and cultural factors that may influence a pandemic investigation?
 - Yes. Epidemiologists note that social institutions such as specific government and healthcare systems impact the resources available for a pandemic investigation. They also note that cultural nuances, rules against, let's say separating a sick mother and her child, impact how individuals are treated in an epidemic.
- Are there differences in how “textbook investigations” are performed as opposed to field-based investigations?
 - Yes. Epidemiologists point out that there are three different realms of epidemiology – modeling (statistical), research (experimental), and field. These three different settings color the epidemiological recommendations.
- Are these paradoxes explainable?
 - Yes. This study shows that the paradox of attribution is caused by six factors: the index case, disease naming conventions, blame metaphors, unvalidated information, seasonal versus pandemic influenza definitions, and situated knowledges. More research is needed, but the paradox of prevention is fueled by systems of food production and economic interests may be at play. The paradox of action comes from the fact that

epidemiology is a relatively “young” field wherein which there are differences in specialties, and differences in resource availability.

- Do these paradoxes serve a purpose?
 - These paradoxes represent important scientific problems with potentially grave impacts that are largely being ignored.

As these brief responses show, this simple analysis that reduces these paradoxes to cause and effect cannot provide the explanatory power needed to fully explain the issues at hand. What we find in this study are a multitude of factors that are shaping and concealing these paradoxes. However, when these factors are reconstituted, they then point towards emergent themes. As figure 3 below shows, within the international community, there are different and overlapping factors that all impact these three pandemic influenza paradoxes very differently. For instance, the difference in healthcare availability may not affect the paradox of prevention as it would the paradox of action.

FIGURE 3: PANDEMIC INFLUENZA FACTORS



STS IN PRACTICE

This visual interpretation emphasizes the messy nature of these paradoxes and why the field of epidemiology has not been able to identify them. This is in no way meant to detract from the important work that epidemiologists do and their many successes in combating diseases. As epidemiology is highly focused, and highly specialized, there is little opportunity for epidemiologists to analyze and solve these problems. Moreover, in the culture of science it may not be felt acceptable to question these murky spaces where others may be viewed as having the scientific expertise. This represents an opportunity for STS applied scholarship. In a similar manner to how engineers have systems engineers to augment the field, STS scholars, with the appropriate scientific understanding, can work with experts in these fields to use the same methods of knowledge discovery to augment science at hand. In other words, STS is in a privileged

position to examine these paradoxes holistically. STS can actively engage the science and use tools from the STS toolbox and apply it to other fields of science holistically.

THE DUALITY OF SCIENCE

These paradoxes may be masked by the veneer of the classical vision of science – the idealized version of the “objective” scientist in the white coat. This classical vision, as detailed in the 1930s by Merton described the normative structure of science as consisting of a system of knowledge certification, a store of collected knowledge, values and mores, and any varied combination of the previous three. Merton saw the social structure of science as consisting of four “mores,” or highly enforced norms, which he termed “institutional imperatives.” The first “institutional imperative” was *universalism*, where knowledge is, in his view, established based on impersonal criteria. Therefore, in this “democratized” environment, factors such as ethnicity, religion, class, etc. should play no role in the establishment of truth claims. The second “institutional imperative” was *communism*, or common ownership of knowledge.²⁷⁹ Therefore, social collaboration would be highly encouraged and secrecy discouraged. Thirdly, science was characterized by *disinterestedness*, a situation in which science is not performed for personal gain, but for the advancement of scientific knowledge as a whole. Fourthly, science needed *organized skepticism* which can be loosely construed as an impartial examination of beliefs. Merton observed that scientists are recognized in many ways. This includes priority, or acknowledgement that he/she was the first to make a discovery.²⁸⁰ In addition,

²⁷⁹ Merton later called this “Communalism.”

²⁸⁰ Merton, Robert K. 1979. *The Sociology of Science: Theoretical and Empirical Investigations*: University of Chicago Press: 298.

a scientist can be recognized with a stratified system of eponymy. That is, his/her name could be attached to his/her discovery. Curiously, the way in which the name is attached corresponds to the impact of the discovery. In the years since Merton's proposal, STS has significantly moved away from these "Mertonian Ideals," but they remain "ideals" that the general public expects.

In borrowing from the ideas of how classical physics was unable to characterize the behavior of light until it accepted what, at the time, seemed like the impossibility of particle/wave duality, I propose that these paradoxes arise because of the dual nature of science. That one part of science is "what we think we know" and another part of science is "what we don't know." However, in light of the "Mertonian ideals," for people, scientists, and policy makers the "what we don't know" is difficult to accept. In comparison to the duality of light – that it consists of waves and particles, I propose the duality of science – that science consists of what "we know" and "don't know." When we "don't know" we may be making unverified assumptions that are peppered by past events, cultural biases, and so forth that fuel paradoxes.

But what is light really?... Once before we put a similar question when we asked: is light a wave or a shower of light corpuscles? At that time there was every reason for discarding the corpuscular theory of light and accepting the wave theory, which covered all phenomena. Now, however, the problem is much more complicated. There seems no likelihood of forming a consistent description of the phenomena of light by a choice of only one of the two possible languages. It seems as though we must use sometimes the one theory and sometimes the other, while at times we may use either. We are faced with a new kind of difficulty. We have two contradictory pictures of reality; separately neither of them fully explains the phenomena of light, but together they do!

WHAT WE KNOW

Knowledge fuels paradoxes because it is mediated. These are not new ideas, but as many STS scholars have shown, knowledge is a representation of nature that is interpreted by human values, society, policy, culture, scientific “schools of thought,” and so forth. Some knowledge, including that of tacit knowledge, is never written down or communicated. This knowledge must then be communicated to others. There are transformative communication spaces between scientists, between scientists and the media, between the media and the public, between scientists and policymakers, and these interactions can go on indefinitely. Herein lies the crux of the issue: during these communication processes many factors such as assumptions, biases, and political-economic issues force the selective recontextualization of knowledge. These interpretations and re-interpretations then allow for hybrid spaces where paradoxes can thrive.

As figure 4 below shows, this mediated knowledge allows for not only different scientific (knowledge) perspectives, but different perspectives between scientists in different fields, groups of lay people, the media, etc. Knowledge also fuels paradoxes because it covers up what we don’t know.

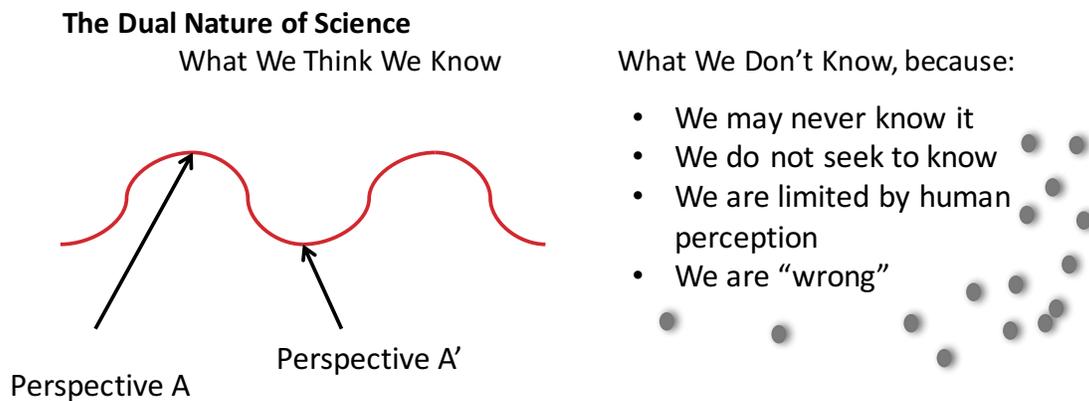
WHAT WE DON’T KNOW

Paradoxes can arise because there is no clear distinction between “what we know” and “what we don’t know.” On one hand, “ideal” scientists are expected to already have

²⁸¹ Einstein and Infeld, 278-279 (in later versions, pp. 262-263)

“objective” knowledge. On the other hand, their job is to find knowledge. They are under great pressure from laboratories, governments, and non-government organizations to have knowledge. When they do not, they may communicate that, or they may rely on the expertise of others, but as the knowledge (or lack thereof) is constantly being re-interpreted, their original message might be repackaged in the form of paradoxes.

FIGURE 4: REPRESENTATION OF THE DUAL NATURE OF SCIENCE



In figure 4, I provide a visual analogy from the dual nature of light with the dual nature of science. On one hand, with knowledge, there can be many different perspectives (perspectives A and A’); those coming from different cultural contexts, different epidemiological schools of thought and practice. On the other hand, I show the limits of knowledge. As in this figure, when communicating knowledge, it is difficult to explain all of the forces that create knowledge and at the same time convey that there is information that is currently unknown. In “unknown areas,” experts are pressured into making assumptions. It is through this communication of known and unknown that paradoxes arise.

From this comparative case study, I found that this dual nature of science can be seen through scientific collaboration, conflict, and competition. Specific to the realm of epidemiology is the desire for a time-critical response.

COLLABORATION

Collaboration is essential in combating pandemic influenza and epidemiologists have been very successful. As we have seen, pandemic influenza is a global threat that requires international response among NGOs, multinational corporations, governments, epidemiologists, and everyday people. At a more macro level, even epidemiologists must collaborate between different subspecialties in order to combat pandemic influenza. Almost everyone would agree that this level of collaboration lays the foundation for success through sharing of ideas, research, and communications. Nevertheless, this same collaboration might be fueling paradoxes by masking them as expert knowledge. In other words, these interdisciplinary efforts, forced by necessity into a time-critical response, allow for the promulgation of unvetted information. For instance, during a pandemic event, a field epidemiologist might have to rely on the expertise of a modeling epidemiologist to help provide likely locations of where smaller outbreaks may occur. Again, when there is an information gap, science seeks to promptly fill it. The field epidemiologist likely would not question the assumptions of the disease modeler, assumptions based on time, weather patterns, and so forth. Each partner in the collaboration would have to mutually trust in each other's expertise.

Contemporary science can be highly specialized and highly segmented. What I mean is that science mirrors the information which it studies. As we know, science is

roughly organized by the field, and then sub-field. In this study I found that epidemiologists have several sub-specialties. As described in Chapter 5, epidemiologists can sub-specialize in a variety of fields. For instance, a human epidemiologist can sub-specialize in neo-natal care.

Collaboration can produce paradoxes when highly specialized experts must rely on others. During one of the interviews, an epidemiologist (who was also a public health physician) noted, “I wouldn’t want to go head to head with an infectious diseases epidemiologist.” (Participant O) Some epidemiologists interviewed had no opinions on the origins of influenza, but relegated their opinion to other experts. One noted, “I’m going to guess that it’s plausible and it might come from Asia, and most of the experts might mention that it is one of the top suspected places of where it might come from.” (Participant U)

As shown in Chapter 4, collaboration can foster paradoxes because of the murky use of terminologies. When epidemiologists between focuses and sub-fields communicate, they may have different definitions of “epidemic” versus “pandemic,” and these definitions change over time. As Participant E notes, “now, ironically, now the (formerly pandemic) 2009 H1N1 is a common strain. It has become a seasonal flu.” (Participant E)

CONFLICT

There are different types of conflicts that may fuel paradoxes. Of course, there may be scientific conflicts, or theoretical disagreements. For instance:

Helen Longino's *Science as Social Knowledge* (1990, also Longino 2002) is an attempt to explain how social ideology and the larger social context can play an important role in scientific inquiry, without abandoning objectivity and room for specific criticisms of science. Longino's goal is to show the role of values in science, while leaving room to criticize the justifications of specific claims. She focuses on background assumptions: what a fact is evidence for depends on what background assumptions are held. This allows people to agree on facts and yet disagree about the conclusions to be drawn from them. At the same time, which background assumptions people choose, and which one they choose to question, will be strongly informed by social values.²⁸²

As shown in Chapter 5, there can be “blame metaphors” and conflict resulting from the political economy of influenza. Again, the dual nature of science comes into play. Since science does not have the information to stop pandemic influenza, this gap in knowledge is supplanted by biases and blame for certain groups. Also, these epidemiological recommendations are clearly not made in a vacuum, as Participant C notes, “the planning's not around science research issues, it's around government responsibilities in the event of a pandemic.” (Participant C)

One of the results of the study was that although there was collaboration, there were subtle conflicts between sub-focuses of epidemiology. In particular, there were smidgens of disdain for epidemiologists who were “modelers” because they have “never been in the field.”²⁸³ Field epidemiologists would comment on how “modelers” are very “helpful” but lack the “boots on the ground” knowledge to provide actionable advice. Although this study did not interview modeling epidemiologists, perhaps these

²⁸² Sismondo, Sergio. *An Introduction to Science and Technology Studies*. West Sussex, United Kingdom: John Wiley & Sons Ltd, 2010. Print. 76.

²⁸³ Unfortunately, of the epidemiologists who responded to this study, none of them were modelers in pandemic influenza, so this is can be an area of future study.

disagreements may have pitted the statistical (modeling) likelihood that pandemic influenza *should* occur in Asia with opinions of whether it *will* occur in Asia.

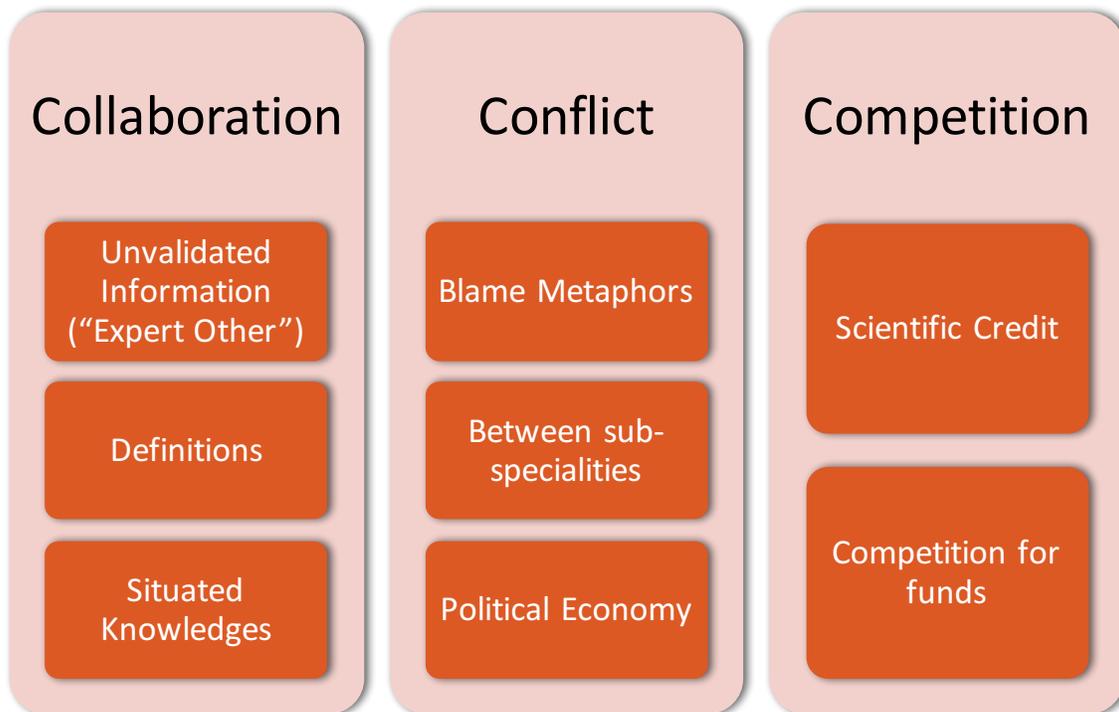
COMPETITION

Perhaps in direct contrast to Mertonian *disinterestedness*, competition may be fueling these paradoxes. The speed of an epidemiological response is usually directly correlated to epidemiological success. There is now scientific credit for the “first” person or laboratory that identifies a new influenza strain. As shown in Chapter 4, credit may be motivating scientists and laboratories to be the first. Nevertheless, when they are the first laboratories to identify a strain, they inadvertently have named the strain with the country or city in which the laboratory is based. In particular, during the recent Swine Flu pandemic, Participant H noted that there was quite a large dispute between two international laboratories concerning recognition for a strain discovery. The first lab in one country sent the strain to a second lab in another country. When the second lab analyzed the strain and was about to publish the results, there was quite an uproar over which lab would get credit for that discovery. (Participant H)

The desire for scientific credit may be motivating scientists (in not just epidemiology) to provide haphazard responses, and there is a desire to “Manage the public fears.” (Participant E) In other words, with gaps in knowledge on how to stop pandemic influenza, “talking heads” may seek to provide any information available to “manage public fears.” However, the epidemiologists interviewed note that this desire for speed may outweigh the desire for verified information. In regard to the news, “it’s quicker, but it wouldn’t say it’s more reliable, but it’s certainly quicker.” (Participant G)

In particular, the desire to be ““Maybe the issue of news and healthcare is a very interesting one, it’s good that we are seeing experts step up and take up leadership roles in news reporting. There are others, but there’s also room for and a need for better healthcare journalism.” (Participant U) As shown in Chapter 5, these public responses also allow for the recognition that would provide for funds – either from research institutions, governments, or non-government organizations.

FIGURE 5: COLLABORATION, CONFLICT, AND COMPETITION



CONCLUSION

This comparative case study has demonstrated that things are not always as they seem. I have argued that specific to pandemic influenza, there are three paradoxes of attribution, prevention, and action. I have also shown that these three paradoxes arise from the dual nature of science. This dual nature manifests itself through three factors:

collaboration, conflict, and competition. Specific to this case study, we find a vibrant epidemiological community that has been very successful in combating disease. Nevertheless, I argue that this specialized success has masked paradoxes that can impact lives. As these epidemiologists note, “there are a lot of questions and a lot of answers in this conversation.” (Participant G) This is an opportunity for STS scholars since “all these things are so complex and nobody’s studying this.” (Participant G) Epidemiologists are experts in their field, and perhaps they summarize it best – “I think in epidemiology in general we need more human sciences. Definitely! And through your work (that is, the work of STS scholars) there is an element of that and I think it’s a really really really an important thing to do.” (Participant F)

Epidemiologists are receptive to collaborating with STS scholars in order to reach a common goal of preventing disease. A future study allowing for collaboration between epidemiologists and STS scholars could provide recommendations to other epidemiologists and policy makers on how to resolve these paradoxes. By extension, this research illustrates a prime opportunity for STS scholars to work in collaboration with scientists from many other fields as well. I hope that this dissertation allows for a stepping stone for both a recognition of scientific paradoxes and an applied STS collaboration with other scientific disciplines.

APPENDIX A – TEMPLATE CONSENT DOCUMENTS

**VIRGINIA POLYTECHNIC AND STATE UNIVERSITY
Informed Consent for Participants
In Research Projects Involving Human Subjects**

Title of the Project:

A Cross-Cultural Investigation of Pandemic Influenza Paradoxes in Epidemiology

Investigator:

Chrissy Vu
Tel. (703) 679-8926
Virginia Polytechnic Institute and State University (Virginia Tech)
E-mail: InterVu@vt.edu

Purpose of the Study:

The purpose of this study is to conduct a sociological examination into the field of epidemiology through the thoughts and viewpoints of Epidemiologists. This study will focus on standards of practices in the field of epidemiology. Possibly, these findings will shed light on establishing updated approaches and practices in the epidemiological community. The topic of pandemic influenza will be used as an anchoring point for many of the interview questions.

For this study, there will be approximately 30 participants. All participants will be over the age of 21 and will have knowledge of epidemiology.

Procedures:

Should you agree to participate, you will be asked to participate in a 45-60 minute audio-recorded interview. Before scheduling interviews, you will be sent via mail or e-mail two copies of consent documentation. After you return these signed consent documents by mail or e-mail, you can schedule your interview. Audio recordings are not required, but are useful in ensuring accuracy of the conversation. Interviews may be performed in person, phone, or other internet-based telecommunications. You will be asked a series of questions and will be provided ample time to contribute their own thoughts and opinions. These questions will focus on the nature of your epidemiological work in the US or Vietnam. In particular, these questions will be geared towards any work you've done in relation to pandemic influenza. In addition, you will be asked for demographic information [e.g. age, sex, occupation, etc.].

Risks:

This is a minimal risk study. Although demographic information will be collected [e.g. age, sex, occupation, etc.], no attributable information such as names will be released. However, in exceptional cases, where participants grant expressed permission to be identified and where direct quotations will be used, participants will have the right to review and edit their quotes. In such cases, there is a minimal risk that they may face

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disciplinary action from their employer if they describe violations of standards of conduct.

Benefits:

The anticipated benefits of this research will include a better understanding of the field of epidemiology. No promises or guarantee of benefits or compensation have been made to encourage you to participate.

Extent of Anonymity and Confidentiality:

If you consent to the recording of the interview, at no time will this audio recording be released to anyone other than individuals working on the project without your written consent. This audio recording will only be digitally stored in password-protected device(s). This recording will not be transmitted in anyway over the Internet. You are free to stop the recording at any time and have the right to have your records destroyed. After three years, the audio recording of this interview will be destroyed by deleting the file from the storage device (i.e. moving the file to the “recycle (PC)”/“trash” (Mac) bin and emptying the bin). Participants will remain anonymous unless they provide express written consent to be identified. In compiling the study results, different participants will be assigned a non-identifiable tracking numbers or letters (e.g. no use of initials). These numbers or letters would in no way identify the participant (e.g. “respondent B3 answered the question in the following manner”). Any identifiable information will be stored separately from this coded data and only individuals working on the project (the Investigator and the Chairwoman of the Investigator’s dissertation committee, Dr. Doris T. Zallen) will have access to this identifiable information. If you do not consent to the recording of this interview, notes will be taken and stored in the same manner as the audio recordings.

The Virginia Tech (VT) Institutional Review Board (IRB) may view the study’s data for auditing purposes. The IRB is responsible to the oversight of the protection for human subjects involved in research.

Compensation:

No compensation will be provided.

Freedom to Withdraw:

Your participation in this interview is entirely voluntary.

You are free to refuse to answer any question that you choose and to end the interview at anytime.

Questions or Concerns:

Should you have any questions about this study, you may contact the research investigator: Chrissy Vu at InterVu@vt.edu or (703) 679-8926.

By continuing with this interview, you agree:

By signing Consent Form, I indicate that I have read conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent:

Subject Signature

Date

Should you have any questions or concerns about the study's conduct or your rights as a research subject, or need to report a research-related injury or event, you may contact the VT IRB Chair, Dr. David M. Moore at moored@vt.edu or (540) 231-4991.

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Consent to Audio Record the Interview

Title of Project: A Cross-Cultural Investigation of Pandemic Influenza Paradoxes
in Epidemiology

Investigator: Chrissy Vu
Ph.D. Candidate
Department of Science and Technology in Society
Virginia Polytechnic Institute and State University (Virginia Tech)

I agree to allow an audio recording to be made of the interview between myself and Ms.
Chrissy Vu that is being conducted on _____.

I understand that I am free to not answer any of the questions and can ask, at any time,
that the audio recorder be stopped. I am also free to withdraw my permission for the
audio recording of our conversation.

The audio recording will be erased after three years. All interview recordings and records
will be stored in password protected folders and devices accessible only to Chrissy Vu
and Dr. Doris Zallen.

Participant's Signature

Date

APPENDIX B – TEMPLATE INTERVIEW QUESTIONS

1. What is your occupation?
2. What is your educational background?
3. Would you consider yourself an epidemiologist?
4. Do you follow the news or research on pandemic influenza?
5. Have you followed it in the US, Vietnam, or both?
6. In your viewpoint, what is the origin of pandemic influenza?
7. In your viewpoint, how do you believe pandemic influenza can be prevented?
 - a. How did you form this viewpoint?
 - b. What is your opinion about certain farming practices – do you believe they contribute to pandemics?
8. In your viewpoint, what epidemiological measures would you use to prevent pandemic influenza?
 - a. How did you form this viewpoint?
9. How do you feel about these paradoxes?
 - a. Origin
 - b. Prevention
 - c. Action
10. Let's say an index case was not found during an influenza pandemic (such as Swine Flu), what would have been the different outcome?
11. Is there anything else that I should have asked or any additional information that you wanted to provide?
12. If I have additional questions, may I get back in touch with you?

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