

TRANSBOUNDARY ANIMAL DISEASE PREPAREDNESS AND RESPONSE EFFORTS:
DISCONNECTS BETWEEN FEDERAL AND STATE LEVELS OF GOVERNMENT

by

TARRIE A. CRNIC

B.S., Kansas State University, Manhattan, KS, 2004
DVM, Kansas State University, Manhattan, KS, 2006

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Approved by:

Major Professor
Katherine KuKanich, DVM, PhD, DACVIM

Abstract

Over the past few decades, animal and public health professionals have become increasingly concerned about the global animal population's vulnerability to Transboundary Animal Diseases (TADs). Through analysis of the lessons learned by the United Kingdom (UK), Taiwan, and Egypt in responding to FMD outbreaks in their countries, it becomes apparent that even with response plans in place at the time of an outbreak, problems still arose as the outbreaks progressed. To better understand why these deviations from the planned course occur, the concept of "disconnects" in the various "domains" of TAD emergency preparedness and response were explored for the United States (U.S.). Particular emphasis was placed on issues related to the collaboration and cooperation between the federal and state levels of government. The domains of communication, knowledge, and resourcing were selected to be analyzed due to their importance in TAD emergency outbreak preparedness and response.

The research questions this thesis explores concern three domains of TAD emergency preparedness and response that experience disconnects between federal and state levels of government. They also explore how these disconnects affect Food and Agriculture Security in the U.S. Three different methods were used to research these topics. Literature reviews of lessons learned and after action reports from TAD outbreak exercises and real events were conducted. Direct observations of the author's experiences at conferences, seminars, and training events were also included. Finally, personal interviews were conducted with Food and Agriculture Security experts.

Through this analysis, numerous disconnects emerged in each of the domains. Several disconnects traverse all three domains. These disconnects related to laboratory collaboration with the federal government, the process of declaring a federal emergency, and the roles and

responsibilities of individuals and groups involved in TAD outbreak preparedness and response. Overall, the disconnects affect the ability of state and federal governments to rapidly respond to and coordinate response efforts. This affects Food and Agriculture Security by compromising the safety, security, and ongoing operation of the food and agriculture sector. Further study will be needed to alleviate these disconnects so that better cooperation and collaboration can occur between federal and state levels of government.

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List of Abbreviations

| | |
|---------|---|
| AAR | After Action Report |
| AVIC | Area Veterinarian in Charge |
| COA | Council of Agriculture |
| DHS | Department of Homeland Security |
| EMRS | Emergency Management Response System |
| END | Exotic Newcastle Disease |
| EPA | Environmental Protection Agency |
| FAD | Foreign Animal Disease |
| FADD | Foreign Animal Disease Diagnostician |
| FAO | Food and Agriculture Organization |
| FEMA | Federal Emergency Management Agency |
| FMD | foot and mouth disease |
| FSIS | Food Safety and Inspection Service |
| GOARN | Global Outbreak Alert Response Network |
| HPAI | highly pathogenic avian influenza |
| ICS | Incident Command System |
| KS SART | Kansas State Animal Response Team |
| KVMA | Kansas Veterinary Medical Association |
| LIMS | Laboratory Information Management System |
| LIP | Livestock Indemnity Program |
| NAHLN | National Animal Health Laboratory Network |
| NRP | National Response Plan |

| | |
|------|---|
| OIE | World Organization for Animal Health |
| TAD | Transboundary Animal Disease |
| UK | United Kingdom |
| U.S. | United States |
| USDA | United States Department of Agriculture |
| WHO | World Health Organization |

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Chapter 1: Introduction

Over the past few decades, animal and public health professionals have become increasingly concerned about the global animal population's vulnerability to Transboundary Animal Diseases (TADs). According to the Food and Agriculture Organization (FAO), TADs are "those that are of significant economic, trade, and/or food security importance, which can easily spread to other countries and reach epidemic proportions, and where control/management, including exclusion, requires cooperation between several countries."¹ These diseases can affect the public health, economy, and food supply of afflicted countries. In order to prevent future outbreaks or minimize the effects of TAD events, emergency preparedness programs become necessary. Global organizations such as the World Organization for Animal Health (OIE) are dedicated to the collection, analysis, and dissemination of information regarding TAD outbreaks.² The OIE also provides guidelines to help nations prevent and control TADs. Regulations and practices based on these guidelines are now integrated into the world trade market. This has the effect of making preparedness and response to TADs a highly economically driven process.³ National institutions, such as the Department of Homeland Security in the United States (U.S.), seek to protect and defend their nation's agriculture and food supply. In the

¹ This term, first developed by the Food and Agriculture Organization, is increasing in use world-wide to overcome problems with older terminology like "foreign animal disease." Committee on Foreign and Emerging Diseases of the United States Animal Health Association, "Foreign Animal Diseases," (St. Joseph, Missouri: United States Animal Health Association, 2008). Pg. 18. Some may prefer the term "foreign animal disease" (or FAD), but the term is generally used by only U.S. officials. "FADs" are ones which originate in another country and can, or do, enter the U.S. Gary C. Smith, "What Are We Doing to Prevent Entry of Potentially Catastrophic Foreign Animal Disease into the USA," in *Range Beef Cow Symposium* (Casper, Wyoming: University of Nebraska-Lincoln, 2001). The term FAD has become less meaningful due to the rapid movement of disease across the globe and the increased chances of finding them in the U.S. At the same time, it is still arguably meaningful, as more of these diseases are entering new regions than they ever have in the past. Committee on Foreign and Emerging Diseases of the United States Animal Health Association, "Foreign Animal Diseases." Pg. 17.

² World Organization for Animal Health, "The OIE," http://www.oie.int/eng/OIE/en_objectifs.htm#6. Accessed April 2010.

³ Royal Society, "Infectious Diseases in Livestock Full Report," (July 2002). Pg. 2.

U.S., numerous federal departments are involved; they work together to develop a “coordinated agricultural and food-specific standardized response plan.”⁴ This plan should appropriate the roles of the federal, state, state, and private sector participants.⁵

There have been several TAD outbreaks of significance over the past few decades. One of the more highly publicized events is the foot and mouth disease (FMD) outbreak in the United Kingdom (UK) in 2001.⁶ Another noteworthy FMD outbreak occurred in Taiwan in 1997. Other countries, such as Egypt, have had several FMD outbreaks throughout the last 50 years. These three countries’ experiences with TADs are worthy of review, as they represent three different levels of capability in TAD preparedness and response.

United Kingdom Foot and Mouth Disease Outbreak

The emergency preparedness and response plans in the UK, based on a framework established by the European Union (EU), operated according to domestic FMD outbreak-control legislation passed in 1981 and 1983.⁷ The required responses involved introduction of biosecurity measures, such as movement restrictions, and institution of a “stamp out” policy.⁸

⁴ George W. Bush, "Homeland Security Presidential Directive-9," ed. Homeland Security, Homeland Security Presidential Directives (Washington D.C.2004). Pg. 3 paragraph (15).

⁵ Ibid.

⁶ FMD is a highly contagious and debilitating viral disease of cattle and swine. Animals also affected include sheep, goats, deer, and other cloven-hooved ruminants. Infected animals can have the symptoms of fever and blister-like lesions inside the mouth, on the tongue and lips, between the hooves, and on the teats. The blisters are usually followed by erosions. Infected animals often recover from the virus, but the virus causes the animal to lose productivity. USDA-APHIS Veterinary Services, "Foot-and-Mouth Disease Factsheet," (2007).

⁷ EU policy for FMD is established in Directive 85/511/EEC amended by Directive 90/423/EEC. UK domestic legislation is established in the Animal Health Act of 1981 and the Foot and Mouth Disease Order of 1983. Cumbria Foot and Mouth Disease Inquiry Panel, "Cumbria Foot and Mouth Disease Inquiry Report," (Cumbria, UK2002). Pg. 25-26.

⁸ Ibid. Pgs. 25-26,33. A stamping-out policy is used to rapidly eliminate a TAD or other emergency animal disease outbreak. A stamping-out policy requires several components. First, the infected zones must be designated. This is followed by an intense surveillance effort to identify the infected and contact premises. Quarantines must then be activated and stop-movement orders put in place. All of the animals that are susceptible to the disease at the infected and contact premises, or the entire infected area, are immediately slaughtered. The carcasses of these slaughtered animals must be disposed of, along with all materials that could potentially spread infection. After disposal, the premises are disinfected and cleaned. Finally, after all these steps have been completed, the premises must be maintained in the disinfected and disease free state for a prescribed period of time. William A Geering,

The massive scale of the 2001 outbreak complicated the implementation of these plans, forcing disease control officials to re-calibrate their response efforts as they encountered issues that had not been addressed in the scope of the existing response plan.⁹ The 2001 FMD outbreak in the UK involved 2030 cases. Approximately 6 million animals were slaughtered, including pigs, cattle, and sheep. The outbreak had a significant impact on the food and agriculture sectors, costing approximately £3.1 billion.¹⁰ Prior to this outbreak, the UK had been FMD-free since 1967.¹¹ The 1967 outbreak comprised 2000 reported cases and approximately 500,000 animals. The outbreak lasted 9 months.¹² Although the 1967 and 2001 outbreaks were similar in duration and in relative number of premises infected,¹³ they were substantially different in a number of ways. These differences, including the size of the infected area to the number of species infected, affected the scale and logistics of response operations.¹⁴

The large number of animals affected and geographic size of the 2001 outbreak created numerous concerns. The wisdom of the decision to cull animals from infected and contiguous premises to prevent the spread of the virus was debated in inquiries and lessons learned following the UK's FMD outbreak. Some inquiries questioned the need to cull animals in contiguous premises as well as infected premises; these questions created other questions about

Mary-Louise Penrith, and David Nyakahuma, "Manual on Procedures for Disease Eradication by Stamping Out," FAO Animal Health Manual (Rome: Food and Agriculture Organization of the United Nations, 2001). Forward.

⁹ Cumbria Foot and Mouth Disease Inquiry Panel, "Cumbria Foot and Mouth Disease Inquiry Report." Pg. 26.

¹⁰ Department of Environment Food and Rural Affairs, "Animal Health and Welfare: FMD Data Archive," <http://footandmouth.csl.gov.uk/>. Introduction. Accessed November 2010.

¹¹ Dr. Maggie Mort et al., "The Health and Social Consequences of 2001 Food & Mouth Disease Epidemic in North Cumbria," (Institute for Health Research, 2004). Pg. 9.

¹² LA Reynolds and EM Tansey, eds., *Foot and Mouth Disease: The 1967 Outbreak and Its Aftermath*, vol. 18, Welcome Witnesses to Twentieth Century Medicine (London: Wellcom Trust Centre for the History of Medicine at UCL, 2003). Pg. 3.

¹³ Cumbria Foot and Mouth Disease Inquiry Panel, "Cumbria Foot and Mouth Disease Inquiry Report." Pg. 30.

¹⁴ Both the 1967 and 2001 outbreaks had similar numbers of animals involved over a similar period of time in their early months. The outbreaks differed in their origin. The 2001 outbreak is believed to have been spread by an index case, whereas the 1967 outbreak was characterized by several farms being infected at the same time from the same source. Food and Rural Affairs Department of Environment, "Origin of the UK Foot and Mouth Disease Epidemic in 2001," ed. Food and Rural Affairs Department of Environment (2002). Pg.7.

whether or not sufficient resources were available for strict biosecurity enforcement.¹⁵ Indeed, large numbers of resources were needed to cull and dispose of the animals. Given the scale of the epidemic in the UK, disposal of animals from infected and contiguous premises presented a considerable challenge. Initially, disposal lagged behind the slaughter rate. After British troops were deployed, disposal became more efficient and backlogs were cleared. Initial methods of carcass disposal were burial on farms or incineration (in funeral pyres). On-site burial was complicated by environmental concerns, such as soil and water contamination. Incineration also raised environmental and public perception concerns due to the air pollution from funeral pyres that were in close vicinity towns and villages. Later, different disposal methods, such as rendering, were utilized.¹⁶ These methods had improved public perception and allowed for faster clearing of backlogged carcasses.

Communication was a major issue throughout the outbreak. Successes in communication included those communications occurring within communities. Radio and television were useful media utilized to disseminate information to the public, especially in rural areas.

Communication problems occurred regarding slaughter and disposal operations. The need for rapid response by authorities may have been a contributing factor. Improvement in communication between all entities, along with more consistent information distribution, was needed during the outbreak. Improvements were also needed in the following areas: policy explanation, use of all media sources, field personnel communication, information access systems, and written communication policies.¹⁷

¹⁵ Dr. Iain Anderson CBE, "Lessons to Be Learned Inquiry Report," (22, July 2002). Pg. 3. Contiguous premises were the premises that shared boundaries, or had contact with the infected premises (neighboring farms).

¹⁶ Cumbria Foot and Mouth Disease Inquiry Panel, "Cumbria Foot and Mouth Disease Inquiry Report." Pgs. 44 & 75. Slow burning pyres gave off acrid smoke, and as the number of pyres increased smoke became more apparent to communities near them. Pyres had a negative public perception due to public health concerns. Rendering became more common later in the outbreak, and had fewer effects on public health.

¹⁷ Ibid. Pgs. 33-35.

Taiwan Foot and Mouth Disease Outbreak

Taiwan suffered an FMD outbreak in 1997. On March 19, 1997 the first case of this outbreak in Taiwan was confirmed. Following confirmation of the first case, 6,156 premises were reported to be infected. Over a million pigs on these premises had been observed with clinical symptoms by the end of 1997. Millions of pigs either died from the disease or were slaughtered during eradication efforts.¹⁸ Publicly available information about this outbreak is not as rich as that related to the 2001 UK outbreak, but problem areas are nonetheless apparent. At the beginning of the outbreak, different groups debated the best way to prevent further spread of disease and to eradicate the virus. Farmers and meat processors were in favor of culling all animals. Taiwan's Council of Agriculture (COA), conversely, preferred a plan for disease control through vaccination, since the complete-cull plan could have serious economic, social, and political consequences. Culling also posed serious environmental consequences due to carcass disposal concerns.¹⁹ With the facts concerning the economic and environmental consequences of both options available, Taiwan's legislature adopted the COA's recommendation. All pigs on FMD-contaminated farms were to be destroyed, and all uninfected animals were to be vaccinated.²⁰ Taiwan had emergency response plans in place at the time of the 1997 outbreak. If an FMD outbreak was suspected, veterinarians were to restrict the

¹⁸ The combination of the stamping-out policy and a blanket vaccination policy was used to control the outbreak. Chinese Taipei, "Eradication of Foot-and-Mouth Disease in Chinese Taipei," (World Trade Organization, Committee on Sanitary and Phytosanitary Measures, 2003). Pg. 1.

¹⁹ The high water table in Taiwan was an environmental concern when disposing of the millions of pigs culled to control the FMD outbreak. Another challenge was the formulation of EPA regulations that took into consideration both local and regional environmental conditions in Taiwan. Terrance M Wilson and Carol Tuszynski, "Foot-and-Mouth Disease in Taiwan--1997 Overview," in *1997 Committee Reports--Committee on Epizootic Attack* (Emergency Programs and CEAH: VS-APHIS-USDA, 1997). Pg. 3. A water table is the "upper surface of a zone of saturation; the surface of the groundwater." The University of Arizona Cooperative Extension, "Youth Activities: Water Resources Glossary," <http://ag.arizona.edu/waterquality/YouthActivityPages/Glossary.html>. Accessed December 2010. Water tables are affected by precipitation, and high when precipitation is high. Burial is complicated by a high water tables due to concerns of surface water contamination and carcass resurfacing.

²⁰ Sophia Huang, "Taiwan's Hog Industry--3 Years after Disease Outbreak," *Economic Research Service/USDA* (October 2000). Pg. 1.

movement of animals from infected farms and destroy all sick, suspect, or potentially infected animals.²¹ Disinfection would follow this stage. Vaccine boosters were to be given if deemed necessary.²²

A problem arose in appraisal of value and reimbursement for animal loss. The initial indemnity paid to farmers for their culled animals was significantly more than what they would have received for healthy animals at market value. This led some farmers to intentionally bring FMD-infected animals to their uninfected farms to increase the amount they received for their animals. The indemnity amounts were adjusted to more appropriate levels soon after the problem of intentional farm infection was discovered, but the actions of these farmers added to the rapid spread of FMD throughout Taiwan.²³ The emergency response plan for FMD outbreaks called for veterinarians to restrict the movement of all animals to and from infected farms.²⁴ Despite this regulation, animal movements within the country still occurred and contributed to the scale of the outbreak. The government of Taiwan was unable to completely shut down livestock markets, and this furthered disease-control setbacks due to continued animal movement. Another factor contributing to continued animal movement was the fact that the outbreak occurred during the Chinese New Year, traditionally a time when animal movements increased.²⁵

²¹ To positively diagnose FMD, the presence of viral antigen or nucleic acid must be confirmed. Test methods that can, and are being used, include enzyme-linked immunosorbent assays (ELISA), lateral flow devices (LFD), reverse transcription polymerase chain reaction (RT-PCR), and virus isolation with cell culture. After the disease is confirmed the serotype must be identified. OIE, "Foot and Mouth Disease," in *OIE Terrestrial Manual: Manual of Diagnostic Tests and Vaccines for Terrestrial Animals 2009* (Paris: OIE, 2009). Chapter 2.1.5 Pg. 1.

²² Chinese Taipei, "Eradication of Foot-and-Mouth Disease in Chinese Taipei." Pg. 5.

²³ Unknown, "Report on the 1997 Taiwan Foot and Mouth Disease Outbreak in Swine." Pg. 8.

²⁴ Chinese Taipei, "Eradication of Foot-and-Mouth Disease in Chinese Taipei." Pg. 5.

²⁵ Melissa McLaws and Carl Ribble, "Description of Recent Foot and Mouth Disease Outbreaks in Nonendemic Areas: Exploring the Relationship between Early Detection and Epidemic Size," *The Canadian Veterinary Journal* 48 (October 2007). Pg. 1057.

Taiwan may have had better communication networks in place during their outbreak than the UK did. In Taiwan, an education program was developed to inform the general public about the FMD eradication process. Multiple media outlets were used, including radio, television, video, advertising, newspapers, booklets, pamphlets, and posters.²⁶ In 1999, a disease-reporting software system was introduced in Taiwan. This computer network helped to link all government veterinary agencies at all levels by providing the latest, up-to-date information to anyone who had the authority to access it.²⁷

Foot and Mouth Disease in Egypt

Several serotypes of FMD have circulated, and currently circulate, in regions of the Middle East and Northern Africa. The most recent series of FMD outbreaks in Egypt began in early 2006.²⁸ Although a disease control program has been in place in Egypt to help control the spread of FMD outbreaks since before 2006, Egypt still faces sporadic outbreaks of FMD throughout the country.²⁹ The challenges faced by developing nations, like Egypt, differ from those of developed countries, like the UK. A major challenge that affects the control of FMD in Egypt is a lack of resources that other, more developed nations may possess. Veterinary services

²⁶ Chinese Taipei, "Eradication of Foot-and-Mouth Disease in Chinese Taipei." Pg. 3.

²⁷ Ibid. Pg. 4.

²⁸ NJ Knowles et al., "Foot-and-Mouth Disease Virus Serotype a in Egypt," *Emerging Infectious Diseases* 13, no. 10 (2007 Oct), <http://www.cdc.gov/EID/content/13/10/1593.htm>. Accessed July 2010. Articles vary regarding the dates of FMD outbreaks in Egypt prior to 2006. Some data suggest outbreaks date back as early as 1950, with the most severe outbreak occurring in 1987. European Commission for the Control of Foot-and-Mouth Disease, "Foot and Mouth Disease in Egypt," in *Reports Archive: 33rd Session*, ed. Agriculture and Consumer Protection Department Animal Production and Health Division (Food and Agriculture Organization of the United Nations, 1999). Other data suggest that there were no outbreaks of any serotype of FMD in Egypt between 1972 and 2000. Knowles et al., "Foot-and-Mouth Disease Virus Serotype a in Egypt."

²⁹ In Egypt, to prevent FMD from entering the country, live cattle, sheep, pigs, or deboned meat and animal products are not permitted to be imported from countries that have not been free from FMD for at least 6 months. Animals that are imported are quarantined for 33 days, and then vaccinated against FMD O1. When a premises is infected, it must be quarantined for 21 days following the recovery of the last infected animal. Ring vaccination is used for contact premises. Infected premises, farm utensils, and tools are to be disinfected. Another method used to prevent the disease is mandatory vaccination. European Commission for the Control of Foot-and-Mouth Disease, "Foot and Mouth Disease in Egypt." There may be various reasons that FMD continues to break out periodically in Egypt, but one may be a lack of disease reporting prior to importation of animals. Another reason may be lack of cooperation between quarantine stations and authorities. Knowles et al., "Foot-and-Mouth Disease Virus Serotype a in Egypt." Accessed November 2010.

often have to compete with other national governmental services for available resources. Animal movement also presents a challenge. Farmers regularly move animals across the countryside for grazing, watering, and trade. These movements bring various susceptible species into contact with one another, and thus potentially spread disease.³⁰ Herding of livestock throughout the countryside and through towns is a daily event. This practice poses a high risk for disease transmission.³¹

Lessons Learned from the UK, Taiwan, and Egypt and Looking Toward the U.S.

Taiwan, the UK, and Egypt have faced many issues during their respective FMD outbreaks, including their responses to the outbreaks and their preparation for future outbreaks. In the 1997 Taiwan FMD outbreak, movement restrictions and rapid spread of the virus due to animal movement proved to be very troublesome for outbreak control efforts. By contrast, while these issues did affect the UK's 2001 FMD outbreak response efforts, communication and disposal plans proved to be more considerable challenges in the UK FMD response efforts—issues with which the Taiwanese government appeared to have experienced a measure of success. Egypt, like Taiwan, also had problems with animal movements. In contrast to Taiwan and the UK, Egypt had more trouble with resourcing because it is a developing country.

The UK, Taiwan, and Egypt each had a national plan for TAD preparedness and response, but implementation at the local level raised problems. In the UK, communication between national and local officials was one of the main sources of trouble for outbreak responders. Updates and changes to the response plan had often been made at the national level,

³⁰ FAO, "Improved Animal Health for Poverty Reduction and Sustainable Livelihoods," ed. Animal Production and Health Division FAO Agriculture Department (Rome: Food and Agriculture Organization of the United Nations, 2002). Chapter 2.

³¹ The author has visited areas surrounding Cairo, Egypt, and Fayoum University in Al Fayoum, Egypt, and observed some of the local agricultural practices. The movement of animals across the countryside appeared to pose great potential for disease spread. Spread of disease to animals through contact with each other, the land, water sources, and people appeared to be a great challenge.

but this information did not always reach the appropriate state personnel in the field. This also affected communication between the state officials, the general public, and stakeholders. In Taiwan, the federal government was challenged with movement restrictions. Difficulties controlling the movement of swine from small local operations around markets and the initial inappropriate indemnity pricing plagued the government of Taiwan. Better collaboration between the federal and state officials concerning markets and appropriate indemnity pricing may have helped to slow the rapid spread of the outbreak. In Egypt, much of the trouble in preparing for and responding to TAD outbreaks has been, and still is a result of a lack of funding. National funding is not evenly distributed among the local veterinary authorities to properly prepare for and respond to outbreaks. In the outbreaks in the UK, Taiwan, and Egypt, better collaboration and cooperation between the national and local governments could have helped to provide the countries with a better response to their outbreaks. The lessons learned from these countries suggest that even with plans in place before outbreaks occur, problems still arise as an outbreak progresses. These are important observations for U.S. Food and Agriculture Security officials. Food and Agriculture Security is a U.S. Department of Homeland Security (DHS) research area. Food and agriculture are critical to the infrastructure of the U.S. according to DHS.³² It is a priority for ensuring the safety, security, and ongoing operation of the agriculture and food sector.³³ To better understand why these deviations from the planned course occur, further research is needed. Exploration of the concept of “disconnects” in the various “domains” of TAD emergency preparedness and response is one way to research this issue, particularly aspects related to collaboration and cooperation between federal and state levels of government.

³² Bush, "Homeland Security Presidential Directive-9." Pg. 1. This directive instructs that the food and agriculture system should be protected from terrorism, major disasters, and other emergencies.

³³Justin Kastner, "Introduction," in *Food and Agriculture Security an Historical, Multidisciplinary Approach*, ed. Justin Kastner (ABC-CLIO, 2010).

“Domains,” which refer to a broad dimension that is critical to emergency preparedness and response, may have specific subtopics. “Disconnects” refer to the presence of documented inequalities or differences of understanding concerning a domain or domain sub-topic. The areas of preparedness and response are part of the process of emergency management that also includes recovery and mitigation. Table 1 provides a complete list of conceptual definitions that are used in this research.

Table 1 Definition of Terms Used in This Thesis

| Term | Definition |
|-------------------|---|
| Domain | A broad dimension critical to emergency preparedness and response; domains may have specific sub-topics. |
| Government | A political system administrating and regulating a body of people. The local government is closest to those governed. The regional government involves groups of communities. The national government controls all the territory within its recognized borders. |
| Disconnect | The presence of a documented inequality or difference of understanding about a domain or domain sub-topic between levels of government. |

Exploring emergency preparedness and response through “domains” and “disconnects” has led the author to develop questions for further research to be addressed in this thesis. These questions relate to the U.S.’s ability to prepare for and respond to a TAD emergency. Two research questions have been developed to guide the research embodied in this thesis.

Research Questions

1. Within the U.S., what disconnects exist in the domains of communication, knowledge, and resourcing of emergency preparedness and response between the different levels of government, from federal to state, in the processes of planning for and responding to TAD emergencies?

2. How do these domain-specific disconnects affect Food and Agriculture Security in the U.S.?

With the above research questions providing guidance, this thesis evaluates the capabilities of national and state levels of government to cooperate and coordinate with one another in preparation for and response to TAD emergencies/incidents within the U.S. To that end, the thesis explores possible disconnects between federal and state units of government and responders, as well as how these disconnects may affect the security of a nation’s food and agricultural systems.³⁴

Table 2 summarizes the actual domains of interest to the author in this study. Each domain is divided into smaller subtopics so that disconnects can be more precisely identified. Each domain has been selected on the basis of its overall importance in the process of preparing for and responding to TAD emergencies.

Table 2 Domains of Emergency Preparedness and Response Addressed in this Thesis

| Domains | Communication | Knowledge | Resourcing |
|-----------------------------|-----------------------|--|------------------------|
| Subtopics in Domains | Command Structure | Veterinary Workforce Training | Equipment & Facilities |
| | Network Communication | Stakeholder Education | Personnel |
| | | Plans (preventative, contingency, eradication) | Finances |

³⁴ The author is a Homeland Security Career Development Fellow studying Food and Agriculture Security, which is a Department of Homeland Security research area. The author’s interest in Food and Agricultural Security has been increased following her participation in the Future Homeland Security S&T Professionals Meeting (October 2009), 2009 Annual AVMA Meeting (July 2009), Frontier Field trips to New Mexico State University (May 2009) and Washington DC (March 2010), Kansas Veterinary Medical Association (KVMA) day at the Capital (April 2010), and Kansas State Animal Response Team (KS SART) Companion Animal Decontamination Training (April 2010).

Communication is one of the most critical domains of emergency preparedness and response. Coordinated and efficient systems must be in place in emergency situations to enable the rapid flow of key information to the appropriate parties. A command structure must be in place for information to be efficiently analyzed so that rapid decision making can occur. Communication among members of this command structure is critical to the process.³⁵ The ability to communicate through networks is also a significant aspect communication. Multiple chains of command may be present among the varied networks needed to control a TAD emergency.³⁶ Disease notification plays a critical role in a TAD outbreak, and communicating the discovery of a TAD to the proper authorities is a significant step in the process of disease preparedness and response. Several organizations are responsible for TAD surveillance throughout the world. The chain of communication throughout these organizations is vital in preparation for and response to an outbreak. The three organizations that hold principal responsibility for this are the OIE, the FAO, and the World Health Organization (WHO).³⁷ An example of an important communication network established by these organizations is the

³⁵ The ability to make rapid decisions, convert those decisions into clear orders to be conveyed down the chain of command to those who will carry them out, and obtain results is required when handling a TAD emergency. Efficient mechanisms must be in place for the communication of information and instruction to be carried forward and back through the chain of command. Roeder P.L. Geering W.A., Obi T.U., "Manual on the Preparation of National Animal Disease Emergency Preparedness Plans," FAO Animal Health Manual (Rome: Food and Agriculture Organization of the United Nations, 1999). Chapter 2 paragraph 1.

³⁶ Several federal and local organizations, concerned with both human and animal health, will likely be required to work together in a TAD emergency situation. Negotiations and agreements should be made between these organizations on the most efficient mechanisms to coordinate responses and share responsibilities. This allows for rapid exchange of emergency information, such as disease reports and epidemiological data, between organizations. Ibid. Chapter 1 paragraph 2.

³⁷ The OIE promotes transparency and fair trading requirements. It also helps member countries improve their veterinary services and overall infrastructure. Its member nations are therefore responsible for reporting the occurrence of any of the OIE listed diseases. The FAO assists developing nations in responding to TADs. The FAO is also responsible for management of the Emergency Prevention System (EMPRES). The WHO, like the OIE, also promotes transparency and requires its member nations to report listed diseases. Francios-Xavier Meslin and Corrie Brown, "International Efforts at Detection & Control," in *Food Security in a Global Economy*, ed. Gary Smith and Allan M Kelly (Philadelphia, PA: University of Pennsylvania Press, 2008). Pgs. 160-161.

Global Outbreak Alert Response Network (GOARN), established by the WHO in 2000 to assist in the processes of information gathering and disease preparedness planning.³⁸

In order for accurate information to reach public and private stakeholders, there must be both internal and external communication pathways to follow.³⁹ Communication to all the individuals involved in a TAD emergency is important, and communicating response strategies to stakeholders increases awareness of the nature and consequences of TAD emergencies.⁴⁰ Well-established relationships between livestock health agencies, producers, processors, and media organizations can greatly enhance communication efforts.⁴¹

Overall, the domain of communication is critical to acquiring trust and support from the public. Communication must be balanced in the quantity of information provided, and in the quality and transparency presented.⁴² The best TAD emergency preparedness and response plans will be rendered useless if communications are not received in a timely manner and are not transparent to all those involved.⁴³

Another critical domain of emergency preparedness and response is that of knowledge. Knowledge of symptoms, diagnostic techniques, treatments, and control strategies for TADs is

³⁸ The GOARN includes official members of the WHO and affiliates such as the Red Cross, the Red Crescent, and Médecins Sans Frontières. Ibid. Pg. 161. The GOARN helps keep the global community constantly up-to-date on outbreak threats. It helps combat the spread of outbreaks globally, ensures that affected areas receive suitable assistance with technical issues, and contributes to long lasting outbreak preparedness. World Health Organization, "Global Outbreak Alert & Response Network," <http://www.who.int/csr/outbreaknetwork/en/>. Accessed November 16, 2010.

³⁹ Cowen Paula McNamara Tracey S. Inskeep II William, Meade Barry J., Wainwright Sherrilyn Hart, Major Larsen Thomas, Crom Randall L., Kiley Michael P., Franz David R., Koons Robin K., Captain Bailey Hugh, Captain Thomas Todd M., Huxsoll David L., "Fifth Annual Emergency Preparedness Satellite Seminar" (paper presented at the Fifth Annual Emergency Preparedness Satellite Seminar, September 13-14, 2000 2000).

⁴⁰ Communication with farmers, stakeholders, and the general public is important, and sometimes neglected in TAD emergency preparation and response. A sense of participation in the process can be attained through this communication. Awareness and publicity campaigns, personal visits, and discussion groups are more ideal forms of communication. Newspapers, radio, internet, and television can rapidly reach larger numbers of individuals. Geering W.A., "Manual on the Preparation of National Animal Disease Emergency Preparedness Plans." Chapter 4 paragraphs 27 & 29.

⁴¹ Kahrs Robert, *Global Livestock Health Policy: Challenges, Opportunities, and Strategies for Effective Action*, First ed. (Ames, IA: Iowa State Press, 2004). Pg. 13.

⁴² Ibid. Pg. 24.

⁴³ Ibid. Pg. 13.

essential in preparedness and response. Practical knowledge of or access to educational resources about these diseases is important for veterinarians.⁴⁴ Levels of knowledge of TADs will vary for each individual and their involvement in the event. Each individual responder will need a different level of knowledge to perform their role adequately. Knowledge and the ability to discuss technicalities of the outbreak in a reliable manner are necessary for health officials to have professional credibility. Without professional credibility, trust between responders and the public is difficult to establish. Dispersal of inaccurate information or refusal to defer to more knowledgeable individuals hinders the process of emergency preparedness and response.⁴⁵

It is important for both professionals and the public to be educated about the nature and consequences of TADs. Farmers, companies, trade officials, other stakeholders, and the general public should have access to information about TADs and explanations for why they require preparation and response planning. Extension services can provide information to the public and stakeholders through public meetings and printed educational media (brochures, pamphlets, posters, etc.). Private consultants can also be queried for more specific information than that which is provided by most extension services.⁴⁶

Knowledge and rehearsal of specific TAD contingency plans is important. Personnel who have the potential to be involved in the event should be aware of and trained in their roles.⁴⁷

For any contingency plan to be effective, it must be accessible and easily understood by all those

⁴⁴ Veterinarians, veterinary technicians, and other animal health staff may be the first individuals to come in contact with an FAD and or TAD. To be able to recognize the diseases when they come in contact with them, veterinarians must either have active knowledge or access to systematic and regularly scheduled training programs. Geering W.A., "Manual on the Preparation of National Animal Disease Emergency Preparedness Plans." Chapter 4 paragraph 18.

⁴⁵ Robert, *Global Livestock Health Policy: Challenges, Opportunities, and Strategies for Effective Action*. Pg. 233.

⁴⁶ Ibid. Pg. 258.

⁴⁷ Technical contingency plans outline strategies for disease detection, containment, and elimination. They should also contain standard operating procedures, enterprise manuals, and individual officer job descriptions. Geering W.A., "Manual on the Preparation of National Animal Disease Emergency Preparedness Plans." Chapter 6 paragraph 2.

involved in disease emergency preparation and response. Preparation and response efforts can be hindered by uninformed, untrained, or confused responders. Trial exercises of contingency plans are also important for participants to gain knowledge of the plan's effectiveness. Plans that appear effective in writing may not be effective in practice. Trial exercises also help train responders who were not actively involved in the initial development of the plan.

Knowledge in TAD emergency preparedness and response is critical. All individuals involved, from the top animal health officials to the general public, should have knowledge of what to expect to prevent or respond to a TAD emergency. The domain of communication intertwines deeply with the domain of knowledge, as most knowledge is obtained through communication.

A third domain critical to TAD emergency preparedness and response is resourcing. Resourcing is a core component of preparation for emergencies. However, the role and use of these resources becomes more critical in the response phase. Numerous resources (financing, manpower, equipment, land, buildings, etc.) may be needed to respond to a TAD emergency. A critical step to prepare for TAD outbreaks should be to itemize all resources that are currently available for use in case of emergency, as well as those that will need to be acquired. Discrepancies between these two lists provide information on areas that will require further procurement of resources.⁴⁸

Early warnings and reactions, as part of contingency planning, require having the capacity to apply the necessary resources needed to counter a TAD emergency efficiently.⁴⁹ Surveillance programs can assist in early warning efforts. Operation and support of surveillance systems requires extensive resources. Effective surveillance and early warning systems require

⁴⁸ Ibid. Chapter 6.

⁴⁹ Ibid. Introduction paragraph 10-11.

field personnel, laboratory facilities, testing supplies, and finances to all be appropriately allocated. Appropriate time allocation is also important, as many surveillance programs have difficulty procuring the resources necessary to conduct a sufficient assessment of population disease levels.

Alongside contingency plans for specific TADs, resource and financial plans should be part of TAD emergency preparedness and response, and these plans should have legislative backing. Access to adequate resources requires support from federal and state governments, farming communities and organizations, and livestock marketers and traders. Failure to have resource and financial plans in place prior to a TAD emergency can restrict emergency efforts. National government agencies may not be the only source of financial support; public-private partnerships may be arranged prior to a TAD emergency to provide extra funding. It is not uncommon for a TAD emergency preparedness and response effort to exhaust, or go beyond, the resources and finances available in the affected country. To provide additional funds and resources, international agreements should also be part of early planning efforts.⁵⁰

Animal disease control centers are important during an animal disease emergency. In the U.S., the Plum Island Animal Disease Center holds the responsibility for being a disease control center. Plum Island helps protect U.S. animal industries and exports (livestock, crops, etc.) from TADs through research and diagnosis.⁵¹ It provides resources during an emergency at both state and national levels.⁵² All national animal disease control centers maintain the inventory lists

⁵⁰ Ibid. Chapter 6. The federal and state governments may establish agreements with other countries or organizations outside the United States to provide extra resources. The agreements enhance TAD outbreak preparedness and response plans because of the communication networks and extra resources they provide.

⁵¹ Luis L Rodriguez, "About Us: Plum Island Animal Disease Center," United States Department of Agriculture Agricultural Research Service, <http://www.ars.usda.gov/AboutUs/AboutUs.htm?modecode=19-40-00-00>. Accessed June 2010.

⁵² Animal disease control centers can be involved in resourcing by maintaining up-to-date lists of available personnel and other resources, deploying staff, ordering and dispensing supplies, and administering finances. These

necessary for resource planning. The resources on the inventory list are also ordered and dispersed from this location. This center deploys resources (personnel, equipment, finances) to the state animal disease control centers. Disease control officers at the state centers use the provided resources to perform their duties and for education.⁵³

Equipment, facilities, personnel, and finances are all necessary in a TAD emergency preparedness and response plan. It is not uncommon, even if all the above planning steps are taken, for resources to be exhausted during such an emergency. For this reason, it is critical for the federal and state levels of government to have established relationships and communication networks with potential outside resource suppliers.

The domain of resourcing is intimately intertwined with the other two domains highlighted in this thesis—communication and knowledge. Communication is necessary for making known the availability and/or deficiency of resources, as well as for finding outside suppliers to provide missing resources. Knowledge is necessary for enabling policy makers and responders to understand what resources are needed in order for TAD emergency preparedness and response efforts to succeed. Accurate resourcing requires knowledge of which testing kits are the most accurate, where the nearest capable laboratories are, what personnel to deploy, where to deploy personnel, and who to contact when a TAD outbreak occurs. All of these domains are related, and they provide a strong foundation for emergency preparedness and response plans.

The domains and subtopics discussed above do not represent an exhaustive list of all domains and topics related to TAD preparedness and response. The three domains identified

roles will vary between the national and local centers. Geering W.A., "Manual on the Preparation of National Animal Disease Emergency Preparedness Plans." Chapter 2 paragraphs 9 & 13.

⁵³ Lubroth Juan Geering W.A., "Preparation of Foot-and-Mouth Disease Contingency Plans," FAO Animal Health Manual (Rome: Food and Agriculture Organization of the United Nations, 2002). Chapter 8.

appear to be the most comprehensive and are well documented; they provide a reasonable set of areas in which to search for disconnects. The more specific subtopics are also somewhat comprehensive; they facilitate the study of particular topics within each of the domains. Other domains and subtopics could be proposed, but the author contends that the selected domains and subtopics provide a sufficiently robust context for this thesis.

Methods

To review, this thesis considers two questions:

1. Within the U.S., what disconnects exist in the domains of communication, knowledge, and resourcing of emergency preparedness and response between the different levels of government, from federal to state, in the processes of planning for and responding to TAD emergencies? How do these domain-specific disconnects affect Food and Agriculture Security in the U.S.?

In an effort to answer these questions, three separate methods were used. These methods included literature review, direct observation, and personal interviews. The author first conducted a literature review of past TAD emergency response reports.⁵⁴ The author reviewed more than a dozen response reports for potential disconnects. These reports refer to areas of concern identified during actual outbreaks or exercises (simulated outbreak conditions). The lessons learned from these events were used to help identify disconnects in TAD emergency preparedness and response plans. The author also reviewed literature concerning TAD control, emergency management, agricultural security, and public health; web searches and online database queries were conducted to procure materials that were unavailable in print.

⁵⁴ After Action Reports (AARs) from disease outbreak exercises (no clinical disease present at the time) conducted by individual states, such as Kansas and Texas, have been analyzed for similar disconnects that occur during these training sessions.

The author used direct observations at conferences, seminars, exercises, and field trips relating to TAD emergency preparedness and response to help answer the research questions.⁵⁵ The author attended two exercises simulating TAD outbreaks. Direct observations can be advantageous because actual behavior and responses are viewed—not just read about. This technique can also help reveal how a response unfolds. These revelations can be used to develop theories to test for further study. Direct observations can be used to verify and establish a level of confidence in conclusions.⁵⁶ Potential biases are inherent in direct observation. The method effect may bias the data collected. The method effect involves a researcher influencing the observed individual through either their presence or their actions. To avoid this, unobtrusive observation should be used whenever possible. The data collected are also influenced by the researcher’s decisions about what should and should not be noted during the observations. The use of other research methods helps to verify data collected through direct observation.⁵⁷

Personal interviews were also conducted with U.S. Food and Agriculture Security experts. Those interviewed included homeland security experts, state and federal veterinarians, and area emergency coordinators. The experts that were interviewed for this thesis currently work in either Kansas or Washington, D.C. While they currently work in these locations, many of them have also worked in other locations throughout the U.S. Therefore, the experts interviewed have knowledge of issues faced by locations other than the ones in which they are currently working. At their convenience, state and national veterinarians, agricultural officials, and other animal disease control officials were interviewed through either direct contact or phone

⁵⁵ The author has attended emergency preparedness exercises and training sessions while conducting this research project. Observations and lessons learned from these exercises will help answer the research questions posed in this thesis. Observations from conferences such as the Annual AVMA Conference and Future Homeland Security S&T Professionals Meeting have also been sources of data analyzed.

⁵⁶ Jarol B. Manheim and Richard C. Rich, *Empirical Political Analysis: Research Methods in Political Science*, 4th ed. (White Plains N. Y.: Longman Publishers USA, 1995). Pg. 201.

⁵⁷ *Ibid.* Pgs. 214-217.

conversation. These interviews helped provide understanding of the experiences of the respondents.⁵⁸ This information will differ from the information gained from the literature reviews. Personal insights into interactions between responders and relationships can be gained from interviews, which are not available in written reports such as lessons learned. Elite interviews were used to attain information that the respondent alone may possess.⁵⁹ A slightly different set of questions was posed to each respondent so that their particular expertise in their area could be tapped. Admittedly, the data collected during these personal interviews have a large potential for bias, which occurs largely in the respondent's reactions to the interviewer, the questions, and the setting of the interview.⁶⁰ Although numerous steps were taken to reduce the potential for bias,⁶¹ the author recognizes that bias, however slight, may yet be present in the data collected from personal interviews. Nevertheless, the research approach embodied in this thesis is similar to those embraced by other scholars, and it provides a reasonable and robust way to answer the research questions.

Exploring the issue of “domains” and “disconnects” through both literature-based as well as interview-based research is not a unique idea. Though other scholars may not use the terms “domain” and “disconnect,” many have explored these concepts in their research. For example, one study used a blended approach of literature review and personal interviews to look at state intergovernmental cooperation in disaster recovery plans. The authors investigated state intergovernmental relations in post-disaster situations, as well as the challenges presented by

⁵⁸ Irving Seidman, *Interviewing as Qualitative Research: A Guide for Researchers in Education and the Social Sciences*, 3rd ed. (New York, NY: Teachers College Press, 2006). Pg. 9.

⁵⁹ Rich Richard C Manheim Jarol B, *Empirical Political Analysis: Research Methods in Political Science*, 4th ed. (White Plains N. Y.: Longman Publishers USA, 1995). Pg. 162.

⁶⁰ Ibid. Pg. 155.

⁶¹ Steps taken to reduce respondent bias included: wording questions in the shortest form possible, making questions as unambiguous as possible, avoiding use of the words “and/or” in a question, avoiding questions that encourage one response rather than another, avoiding argumentative questions, avoiding use of wording in a question that is unfamiliar to a respondent, and providing the possibility of not having an opinion or answer to a question. Ibid. Pgs. 157-160.

limited coordination, uncertainty, conflict among officials, and other disputes.⁶² This author's research is similar to the "disconnect" issue investigated in this thesis. Research concerning the failures of Hurricane Katrina⁶³ relief efforts also highlight challenges similar to those explored in this thesis. One article describes the resourcing challenges presented by the evacuation process and availability of shelters.⁶⁴ Another article, more opinion-based, describes the failures in personnel, organization, communication, and bureaucracy.⁶⁵ These articles investigate concepts similar to the "domain" issues of communication and resourcing. Failures and challenges associated with natural disaster response comprise most of the publicly available research, but infectious disease pandemics have also been studied for related problems using similar methods. An article in the *Journal of Public Health Management and Practice* uses the combined methods of literature review, database searches, and personal interviews to research the planning involved in the 1918 pandemic influenza outbreak.⁶⁶ This article investigates a number of concepts similar to both "domains" and "disconnects." Integration of physicians into health care plans is a concept similar to the "domain" of resourcing. The analysis of the different state and state plans

⁶² This article provides examples of a methodology and research topic that are similar to those used in this thesis. Clair B. Rubin and Daniel G. Barbee, "Disaster Recovery and Hazard Mitigation: Bridging the Intergovernmental Gap," *Public Administration Review* 45 (1985).

⁶³ Hurricane Katrina made landfall along the Gulf Coast of the U.S. on August 29, 2005. It affected the states of Louisiana, Mississippi, and Alabama.

⁶⁴ This article is an example of similar research into resourcing misappropriation. Evacuation transportation and shelter availability are the two key resourcing challenges discussed in this article. Joanne M. Nigg, John Barnshaw, and Manuel R. Torres, "Hurricane Katrina and the Flooding of New Orleans: Emergent Issues in Sheltering and Temporary Housing," *The ANNALS of the American Academy of Political and Social Science* 604, no. 113 (2006).

⁶⁵ This article is more of an opinion based article than a research project. It still represents an investigation into similar issues as those studied in this thesis. Ron Westrum, "All Coherence Gone: New Orleans as a Resilience Failure," <http://www.resilience-engineering.org/REpapers/Westrum.pdf>. Accessed June 2010.

⁶⁶ Similar research is done in this article regarding personnel resourcing disconnects. The failure to integrate physicians into state and local response plans is an example of a disconnect. Jacob Lauer, Justin Kastner, and Abbey Nutsch, "Primary Care Physicians and Pandemic Influenza: An Appraisal of the 1918 Experience and an Assessment of Contemporary Planning," *Journal of Public Health Management and Practice* 14, no. 4 (2008).

is similar to the issue of “disconnects.”⁶⁷ This thesis’ analysis involves identification of disconnects that emerge from the literature review, direct observations, and personal interviews.

Thesis Structure and Forecast of Chapters

In the following chapters, the domains and their subtopics will be analyzed in an effort to answer the above research questions. Chapter two will explore the domain of communication and its subtopics. Chapter three will explore the domain of knowledge. Chapter four will cover the last domain of resourcing. Chapters two, three, and four will begin with a reintroduction of the domains and their importance. Following this introduction, the chapters will explore the observed disconnects present within each domain through document and literature analysis, direct observations, and personal interviews. Each chapter will close with a discussion of the discovered disconnects, as well as their impact on Food and Agriculture Security. The final chapter, five, will combine the conclusions reached from previous chapters and describe the significance of the thesis project’s findings in the area of Food and Agriculture Security research.

The author of this thesis is a Department of Homeland Security Career Development Fellow and Master of Public Health student, who aspires to work within government services in the prevention of and response to TAD outbreaks within the U.S. This thesis was written in an effort to learn what domains of TAD outbreak preparedness and response were in need of improvement. The findings presented here may be stepping stones for further research into solutions for the discovered disconnects. The author hopes that the questions answered in this thesis will provide future scholars with ideas for further investigation and analysis.

⁶⁷ Ibid. Pgs. 382-384.

Chapter 2: Disconnect Analysis of the Domain of Communication

Introduction

The domain of communication in TAD preparedness and response holds great value. It is the central domain of the three domains explored in this thesis. In the event of a TAD outbreak, communication must flow rapidly and efficiently in order for preparation and response efforts to be successful. The chain of command, communication networks, and risk communication pose complex problems in the domain of communication. The potential disconnects in these areas are numerous.

It is difficult to establish successful chains of command and communication networks. Many plans look adequate in print, but they fail to measure up when used in the event of an actual TAD outbreak. The complex nature of the world today makes the process even more complicated. A TAD outbreak can seriously threaten a country's economy and food supply, and success of the command chain and timely release of information can ultimately save or condemn the affected industry.

The next section pays special attention to disconnects within the domain of communication, featuring insights from the TAD preparedness and response literature, interviews with experts, and direct observations.

Analysis

Simulation exercises are a common way to test TAD preparedness and response plans so that officials can observe the strengths and weaknesses of the plans. After action reports (AARs) from these exercises present valuable information useful in the analysis of disconnects between federal and state levels of government.

Laboratories active in TAD response efforts communicate with other laboratories throughout the country and with animal health officials to exchange information regarding test results. In order for response efforts to be successful, test results must be effectively communicated to the correct individuals at the correct locations. In a series of exercises simulating potential outbreaks of highly pathogenic avian influenza (HPAI), potential disconnects were identified in the communication of test results, specifically the failure of these results to reach the correct location. During the simulation, participants discovered that sample identification numbers in the laboratory information management system (LIMS) did not correspond with those used by the United States Department of Agriculture's (USDA) Emergency Management Response System (EMRS). This lack of correlation meant that laboratory technicians were forced to seek out additional information from sample labels—often difficult to read—in order to accurately communicate the results.⁶⁸ Such lack of correlation between the sample identification systems serves as an example of a communication disconnect.

Notification of the TAD outbreak is an important aspect of the domain of communication. Notification involves communicating the occurrence of a TAD to U.S. state and federal government officials as well as animal health officials of global organizations. After a suspected TAD outbreak has been identified, samples are taken from the affected animals and sent into laboratories for testing. Initial test results are either “negative” or “presumptive-positive.”⁶⁹ Following a presumptive-positive test result, further tests are needed confirm the positive result and to determine the specific strain of the disease. The notification process begins

⁶⁸ Joel Silverman and Rosemary Speers, "A Wing and a Prayer" Summary and Analysis of the NAHLN HPAI Exercise Program," (2009). Pg. 63. Also complicating this disconnect was a lack of an electronic interface between the National Animal Health Laboratory Network (NAHLN) LIMS repositories and EMERS. To relay test results, faxes or phone calls were used.

⁶⁹ Preliminary diagnostic tests conducted by the laboratory to indicate whether or not “disease” is present. The results of these test are either presumptive-positive or presumptive negative. Presumptive-positive test results require further testing for confirmation of the disease.

during the time that these confirmatory tests are performed. This process can become a disconnect when there is ambiguity regarding the timing of the announcement and the person/agency responsible. This ambiguity has been illustrated in TAD simulation exercises. Confusion can arise among participants—state, state, and federal—about whether notification proceedings should start after the initial presumptive-positive test result or after confirmation of the results.⁷⁰

In the event of a TAD outbreak, a federal declaration of emergency increases the availability of numerous response resources. The federal government will declare a state of emergency once state and state offices have provided sufficient evidence that the outbreak is severe enough to require federal support.⁷¹ Disconnects and communication errors can occur during this exchange of information. Examples of these errors include: incorrect or insufficient information submitted by states to the Federal Emergency Management Agency (FEMA), incorrect information exchanged through the FEMA chain of command, misinterpreted attainment of the requirements to qualify for a federal declaration of emergency, and delayed

⁷⁰ Silverman and Speers, "A Wing and a Prayer" Summary and Analysis of the NAHLN HPAI Exercise Program." Pg. 19. When a local veterinarian suspects a TAD case, they report the disease to a state veterinarian or livestock commissioner. Foreign animal disease diagnosticians (FADDs) are then dispatched to investigate the case and collect samples if necessary. The FADD will send the samples to a certified laboratory capable of testing for the disease of interest. Once the sample is received, the laboratory will run diagnostic tests to either confirm or deny the presence of the disease on a presumptive basis. This test result may be either falsely positive or negative. This is partly why federal government officials prefer to wait for further confirmatory tests (serotyping) before they declare the disease present. If the presumptive-positive result turns out to be negative, then the industry could have been negatively impacted by an early declaration of disease when there was no disease actually present. On the opposite side, full response resources and actions are not available until the disease is declared, and waiting for further confirmation may result in further spread of the disease.

⁷¹ "As set forth in the Stafford Act, a governor seeks a presidential declaration by submitting a written request to the President through the FEMA regional office. In this request the Governor certifies that the combined local, county, and state resources are insufficient and that the situation is beyond their recovery capabilities. Following a FEMA regional and national office review of the request and the findings of the preliminary damage assessment, FEMA provides the President an analysis of the situation and a recommend course of action." FEMA, "Declaration Process Fact Sheet," FEMA, http://www.fema.gov/media/fact_sheets/declaration_process.shtm. Accessed September 2010.

communication at FEMA and to the president of the U.S. These disconnects further decrease already insufficient resources.⁷²

The Stafford Act, which provides guidelines for federal declarations of emergencies, does not have specific provisions for TAD outbreaks.⁷³ This may add to the communication disconnect relating to federal emergency declaration. Delays or rejections of requests for declaration can arise. Discussions and agreements that must take place to provide the necessary resources can cause these delays.

Effective communication in the early stages of a TAD outbreak is vital. The early communication process can be a source of confusion. The issue of how information exchange will occur prior to disease confirmation has been raised numerous times. This information exchange should occur through a secure and confidential communication network to prevent premature leaks of information that could cause undue panic. Individuals need to be identified who can be trusted with this information. The quarantine and stop movement message to the public needs to be developed. A disconnect may occur if these communication issues are not discussed and resolved among the state and federal animal health and government officials prior to an actual TAD outbreak.⁷⁴

TAD outbreaks are initially handled at a state level.⁷⁵ The federal government becomes more intensely involved once a federal emergency is declared. A communication network is

⁷² Javier M. Ekboir, *Potential Impact of Foot-and-Mouth Disease in California: The Role and Contribution of Animal Health Surveillance and Monitoring Services* (Davis, CA: Regents of the University of California Agricultural Issues Center, 1999). Pg. 43.

⁷³ Analytic Services Inc., "High Plains Guardian: Military Assistance to Civil Authorities (MACA)," (Topeka: National Agricultural Biosecurity Center Kansas State University, Adjutant General State of Kansas, ANSER, 2004). Pg. 18.

⁷⁴ "NAHLN FMD Table Top Exercise in Topeka Kansas," (2010).

⁷⁵ After a dispatched FADD has sent samples to the laboratory for testing, local level response efforts begin. The affected premises may be quarantined and biosecurity measures may be established to prevent further spread of the potential disease. After a presumptive-positive test result is received, further restrictions will likely be put in place at the local level to contain the disease. Local surveillance will also be going on at this time to identify animals that

established between state and federal levels of government so they can work together to respond to an outbreak. However, a potential disconnect in communication between the state and federal levels may occur prior to a declaration of emergency.⁷⁶ The state has initial control of all TAD outbreaks. The federal government gains information about the situation only if the state government communicates the information.

Diagnostic tests are run at state (if there is an approved state laboratory) and federal laboratories to confirm the presence of a TAD. Diagnostic results from these laboratories must be reported to appropriate individuals.⁷⁷ Confusion regarding who should versus who wants to receive these results is a potential source of disconnects.⁷⁸ Expedient communication between laboratories and animal health officials is essential for appropriate response efforts. Disconnects occur in the absence of a well-established chain of communication between the state and federal levels of government and the laboratories.

State and federal animal health officials must have well-established communication capabilities with state livestock owners during TAD outbreaks. Information concerning quarantine, biosecurity, carcass disposal, decontamination, and indemnity must be readily available to those affected. This communication cannot effectively take place if the roles and responsibilities of those providing the information are not clear. A disconnect can occur if state

may have been in contact with the source or sources of the disease. Stop-movement orders may also be issued to prevent further entry or exit of the disease from the area. Housing and care for animals detained due to the stop movement must also be provided. These are all measures that the local level of government should be prepared to take prior to the involvement of the federal government.

⁷⁶ Interview with Dr. Barry Erlick Animal Health and Homeland Security Expert, Personal Interview, Oct 21 2010.

⁷⁷ Individuals who may receive diagnostic reports include, but are not limited to, the USDA/APHIS state Area Veterinarian in Charge (AVIC), the state veterinarian, and the U.S. Secretary of Agriculture.

⁷⁸ Interview with Dr. Barry Erlick Animal Health and Homeland Security Expert.

and federal animal health officials are unclear as to who is responsible for providing this information. This disconnect can extend to the method of communication.⁷⁹

Good personal interaction and mutual trust are key components of successful communication.⁸⁰ Good relationships between state and federal agencies involved in containing an outbreak are also important.⁸¹ These relationships can be adversely affected by personality and ego conflicts among personnel. Through previous outbreaks or exercises, certain states have more experience than others in communicating and organizing with the federal government. These prior experiences help establish communication networks and personal relationships that could assist in later outbreaks.⁸² Personality and ego conflicts, and inadequate professional working relationships, may all contribute to a communication disconnect. Anti-federal government sentiment, present in some states, may also contribute to the communication disconnect.⁸³

Communication throughout the chain of command can be affected by bureaucracy, which can hinder inter-agency and intra-agency communication at both the federal and the state levels. As more agencies become involved in TAD outbreak preparedness and response efforts, there is an increase in the layers of communication through which information needs to pass.

⁷⁹ Ibid. The information must be in forms that are accessible to the intended audiences. Those responsible for providing it must know what information outlets are appropriate. Therefore, the communication disconnect with the livestock owners also occurs when they cannot access the information due to inappropriate information outlets.

⁸⁰ Interview with Dr. William Brown Kansas Livestock Commissioner, Personal Interview, October 14 2010, Interview with Dr. David F. Vogt Kansas Area Veterinarian in Charge Personal Interview, Oct 22 2010, Interview with Sandy Johnson Kansas Department of Agriculture Homeland Security Specialist, Personal Interview, Oct 14 2010. This was a recurring theme throughout the author's interviews.

⁸¹ Interview with Dr. William Brown Kansas Livestock Commissioner.

⁸² Interview with Sandy Johnson Kansas Department of Agriculture Homeland Security Specialist. Mrs. Johnson noted that the state of Kansas has well-established relationships between the state and federal agencies that would be involved in a TAD outbreak.

⁸³ Interview with Dr. David F. Vogt Kansas Area Veterinarian in Charge Dr. Vogt noted that some states are more "anti-fed" than others, and this may lead to decreased cooperation between the state veterinarian (state government official) and the Area Veterinarian in Charge (AVIC) (federal government official). Interview with Sandy Johnson Kansas Department of Agriculture Homeland Security Specialist. Mrs. Johnson also commented on the potential for a communication disconnect between state and federal animal health officials.

Communication networks become more confusing and complicated as they expand. Disconnects can happen when bureaucracy slows communications or when communications get lost due to the complexity of the network.⁸⁴

Information regarding plans, regulations, and policies needs to be part of the communication process. Each state may have different TAD outbreak preparedness and response plans, regulations, and policies. The federal government also has its own version of information needed for TAD preparation and outbreak response. This information is scattered between the state and federal government agencies, and is not available in one place. The lack of a single source to communicate this information may cause a disconnect.⁸⁵

During the course of a TAD outbreak, information regarding the status of the outbreak is communicated to the public through numerous media outlets. A potential disconnect occurs when it is unclear whether the state or federal government is responsible for providing this communication. Questions arise relating to what information should be communicated, who should communicate it, when it should be communicated, and how it should be communicated.⁸⁶

Language barriers can also be a source of a communication disconnect. State and federal government officials must be able to communicate with the general public involved in the outbreak. At times, interpreters may be needed to communicate with the farmers and their staff.

When personnel are not available to interpret, communication breaks down. Communication

⁸⁴ Interview with Dr. William Brown Kansas Livestock Commissioner. Dr. Brown noted that, in Kansas, the separation of the Kansas Animal Health Department from the Kansas Department of Agriculture made the agency more responsive and adaptable. This was, in part, due to the fact that communications had to go through fewer layers and bureaucracy. Interview with Sandy Johnson Kansas Department of Agriculture Homeland Security Specialist. Mrs. Johnson noted that this same separation also had the potential to be harmful to communication. The separation of the departments made communication between them more complicated, as personnel had to know when and where communications were taking place to receive them. Information sharing would, according to Mrs. Johnson, be easier if the departments were under the same roof. The author extrapolated that this intrastate communication disconnect could also extend to state and federal agency/department communication.

⁸⁵ Interview with Sandy Johnson Kansas Department of Agriculture Homeland Security Specialist.

⁸⁶ Ibid. Mrs. Johnson brought up the issue of phone banks in her interview with the author. Questions into who was responsible for setting up the phone bank, who needed to answer the phones, and who would be accepted by the public to be answering the phone were brought up.

should also consider cultural differences. Personnel must be able to understand cultural differences, especially when those differences may alter the way a message is understood.⁸⁷

Communicating with industry, stakeholders, and the general public is part of TAD outbreak preparedness and response. Better plans can be constructed, better organization can be established, and more effective responses can occur if animal health officials communicate properly with these groups. Disconnects between these groups and the state and federal government can occur when they do not effectively communicate with one another. Industry officials and the general public may have concerns and ideas related to TAD outbreak preparedness and response. The state and federal levels of government can improve their plans and response efforts by establishing communication networks with these groups.⁸⁸

AARs are often written after TAD outbreak simulation exercises in an effort to document the information garnered from the exercises (i.e., lessons learned). The reports are usually made available to the individuals and groups that were involved in the exercise. The lessons learned from these exercises are not always communicated to state and federal government officials who were not directly involved in the exercise. This potential lack of communication is a disconnect. If the lessons learned from these exercises are not shared among all potential groups involved in TAD outbreaks, the experience may not result in optimal learning. A disconnect can also occur if the policies that are developed from these exercises are not communicated between the state and federal levels of government.⁸⁹

⁸⁷ Interview with Dr. David F. Vogt Kansas Area Veterinarian in Charge

⁸⁸ Ibid.

⁸⁹ Interview with Craig Beardsley NABC Project Administrator, Personal Interview, Oct 6 2010.

It is important that policy changes are communicated between the state and federal levels of government.⁹⁰ It is also important for government officials to communicate this information to diagnostic laboratories. Disconnects can occur when the policy changes are not communicated to those whom they affect. Delays in communication can also be attributed to this disconnect. For example, if the federal government were to change its policies regarding which diagnostic tests were acceptable, and with whom diagnostic test results should be shared, a failure to communicate this information with diagnostic laboratories would adversely affect diagnosticians' ability to perform their role.⁹¹

Conclusions

The table below, which lists the communication disconnects that emerged through literature review, direct observations, and personal interviews, will be followed by a discussion of the disconnects and their significance to Food and Agriculture Security.

Table 3 Disconnects in the Domain of Communication

Disconnects

Failure of laboratories and federal agencies to correlate their sample identification systems

Confusion regarding the timing of and responsibility for notification

Inadequate information sharing between the state and federal government to attain a federal declaration of emergency

Failure of Stafford Act to cover TAD* outbreaks

Lack of established communication plans between the state and federal government

Failure to adequately share information prior to federal declaration of emergency

⁹⁰ It is important for information regarding policy changes to also reach individuals outside the government. Local veterinarians, farmers, and even the general public may need to be informed of policy changes.

⁹¹ Interview with Craig Beardsley NABC Project Administrator.

Confusion regarding the chain of communication for test results

Confusion regarding responsibility of communication decisions

Lack of working professional relationships, poor personal relationships, and personality conflicts

Bureaucratic interference

Lack of a single communication resource to share plans, regulations, and guidelines

Inability to overcome language and cultural barriers

Lack of communication networks with industry, stakeholders, and civilians

Failure to share lessons learned from simulations, AARs**, and real events

Failure to share information with laboratories concerning policy changes

*TAD: Transboundary Animal Disease
**AAR: After Action Report

The National Animal Health Laboratory Network (NAHLN) is a group of state diagnostic laboratories that actively and passively surveys the U.S. for animal diseases in cooperation with the USDA. These laboratories are located throughout the country to provide convenient locations for rapid diagnosis and support in the event of a TAD outbreak. The NAHLN and its surveillance capabilities are directed by Homeland Security Presidential Directive-9 to protect U.S. infrastructure.⁹² Three of the disconnects that emerged in this chapter concern laboratory communication.

The first disconnect relates to discrepancies between the sample identification systems of the NAHLN laboratories and federal government agencies. During TAD outbreaks, foreign

⁹²Lee M Myers, "Agriculture and Food Defense," in *Homeland Security Protecting America's Targets*, ed. James JF Forest (Westport, CT: Praeger Security International, 2006). Pg. 184. Agriculture and Food Defense and Security are part of protecting the critical infrastructure of the U.S.

animal disease diagnosticians (FADDs) collect samples to be sent to the NAHLN laboratories. These samples are labeled according to the animal and premises from which they were taken. The samples are sent to a NAHLN laboratory for testing to either confirm or deny the presence of the disease. The USDA sends sample identification information through the EMRS. Samples are given identification numbers through both these of systems, but they are not the same numbers. When the NAHLN laboratory sends test results to the USDA, technicians must rely on information other than tracking numbers, which are usually hand-written on test tubes. Information can be misread, and therefore the results could be inappropriately assigned.⁹³ The failure of the NAHLN laboratory and federal agencies to correlate their identification systems could lead to confusion regarding sample results and loss of time. These losses could be detrimental to the surveillance and diagnostic capabilities that the laboratories provide for Food and Agriculture Security.

The second disconnect relates to communication between the federal government and the NAHLN laboratories regarding policy changes that may affect the procedures and diagnostic capabilities of the laboratory. The laboratory network is supposed to function under standardized protocols and procedures.⁹⁴ These may change due to policy changes, and delayed communication of these changes may affect the time and resources needed for laboratory operations.

The third disconnect relates to the communication of test results. The laboratory standards for procedures and protocols should use the chain of communication for test results. There are a number of individuals who need to receive results, including the U.S. Secretary of Agriculture, the state AVIC, and the state veterinarian. If the laboratory lacks an established

⁹³ Silverman and Speers, "'A Wing and a Prayer' Summary and Analysis of the NAHLN HPAI Exercise Program." Pgs. 62-63.

⁹⁴ Myers, "Agriculture and Food Defense." Pg. 184.

chain of communication regarding who should receive results and when, security and timing of communications may be compromised.

Several disconnects in the domain of communication are the result of poorly established, ineffectively used communication networks. Lack of communication networks between the federal and state levels of government and industry, stakeholders, and civilians delays the process of information sharing. These delays give rise to various risks in Food and Agriculture Security. The risks include ineffective preparation for TAD outbreaks,⁹⁵ increased spread of disease, ineffective response efforts, and inadequate availability of resources. Disconnects relating to the decision regarding the responsibility, method, timing, and information to be shared also affect the communication network. Communication networks have limited functionality when these decisions are not finalized. The decisions about timing, method, content, and responsibility of communications affect public reactions and market stability domestically and abroad. Information sharing outside TAD outbreaks is also important for preparedness efforts.

Failure to share lessons learned from exercises and actual events affect preparedness efforts. Exercises and real events do not generally involve the U.S states at one time, thus the information gained from them is not always available throughout the U.S. The lessons learned from TAD outbreak exercises and actual events provide insight on the measures needed to improve TAD preparedness and response efforts. Planners who have access to these lessons can use them to improve their plans; those who do not cannot.⁹⁶ These disconnects regarding failure to share lessons learned can weaken preparedness and response plans throughout the U.S.

⁹⁵ Ibid. Pg. 183.

⁹⁶ As an example, Kansas and Oklahoma produce a set of lessons learned from a simulation exercise, and share them between themselves but not their neighboring states Missouri, Nebraska, and Arkansas. The TAD preparedness and response plans of Oklahoma and Kansas have the potential to improve from the lessons learned. The TAD preparedness and response plans of Missouri, Nebraska, and Arkansas do not have the same potential for improvement since Kansas and Oklahoma did not share the lessons learned from their exercise.

A federal declaration of emergency provides resources to state and state governments in need of supplemental assistance.⁹⁷ Three disconnects in the domain of communication relate to the process of applying for and receiving a federal declaration of emergency. Accurate communication of the information required to meet the qualifications is vital in attaining these resources. In the case of TAD outbreak emergencies, this is critical because TADs are not specifically addressed in the Stafford Act. These disconnects relating to acquiring a federal declaration of emergency can affect the availability of resources needed in a state or state TAD outbreak response. Ineffective response can lead to further spread of the disease and disrupt Food and Agriculture Security. A declaration of an emergency also affects the communication network itself; prior to a declaration, the exchange of information between state governments and the federal government may be limited.

These remaining three disconnects affect the communication process in all of the areas discussed in the previous paragraphs. Food and Agriculture Security is positively affected by effective communication; it improves the ability of state and state governments to coordinate with one another in a secure and timely manner. Preparing for and responding to a TAD outbreak requires good communication. Bureaucratic interference, personal and professional relationship challenges, personality clashes, and language and cultural differences can all inhibit communication. Numerous government agencies, on both the state and federal levels, are involved in TAD outbreaks. All of these agencies must communicate with each other for coordinated and timely response efforts to occur. Interference between governmental agencies disrupts this needed communication. Good personal and professional relationships also help reduce the potential for bureaucratic interference.

⁹⁷ FEMA, "Declaration Process Fact Sheet."

The ability of TAD responders to communicate through the barriers that language and culture may present is important. Personnel who are multilingual and have an understanding of how cultural differences affect perceptions of communication are a critical resource. Lacking the communication ability that these personnel provide may lead to misunderstandings with farmers, stakeholders, and the general public.

Chapter 3: Disconnect Analysis of the Domain of Knowledge

Introduction

The domain of knowledge is essential to the success of TAD response and preparedness plans. A state, region, or community may have a written plan in place at the time of a TAD outbreak, but if personnel involved in the outbreak are not knowledgeable of its contents, it is not useful. The officials involved in developing and amending the plans must also be knowledgeable of the current practices, techniques, and standards concerning TAD diagnosis and control. This knowledge is attained through communication efforts between officials and TAD preparedness and response plan rehearsals.

The general public should also have knowledge of TAD preparedness and response efforts. Officials can help ease tension and prevent panic by providing the public with information about the importance of and reasoning behind actions taken during a TAD outbreak. Animal health officials, extension services personnel, private consultants, and state veterinarians are all resources for this knowledge. Information should be provided as openly and accurately as possible to maintain trust among those affected by the TAD outbreak.

Information concerning the organizations and industries involved in TAD outbreak preparedness and response is also vital. Each individual and organization must understand their role and responsibility when preparing for and responding to a TAD outbreak. This knowledge enhances the communication and resourcing abilities of the responders. Responders who do not understand their roles and responsibilities hinder response efforts. TAD outbreak preparedness and response efforts are more likely to be successful when those involved have information about their colleagues. This awareness of each other's abilities, training, techniques, and access to resources allows for a more rapid and efficient effort.

This chapter outlines the disconnects within the domain of knowledge, featuring insights gained from the TAD preparedness and response literature, interviews with experts, and direct observations.

Analysis

Samples must be safely and swiftly transported from suspect/infected premises to laboratories. This can only occur if field personnel have knowledge of appropriate packaging methods and available transport services. Simulation exercise AARs illustrate that many field personnel are unaware of the transport services available through the National Veterinary Stockpile.⁹⁸ This lack of ready information delays the transportation of high-priority samples to the appropriate laboratories.⁹⁹

TAD preparedness and response plans involve surveillance programs before, during, and after outbreaks. These programs include information regarding the acceptable types of samples needed for laboratory tests and the number of animals needed for adequate sample collection. This information can change over time, and therefore may result in disconnects. One disconnect occurs when state and state plans are not kept abreast of the procedures that have been adopted by the federal government as the most accurate and efficient.¹⁰⁰ Being trained in appropriate sampling procedures is as important as having knowledge of what needs to be collected from the animals for samples.

⁹⁸ The National Veterinary Stockpile (NVS) is a resource for the states during a TAD outbreak. It provides resources including supplies, equipment, field tests, vaccines, and support services. Homeland Security Presidential Directive 9 established the NVS in 2004. USDA APHIS Veterinary Services, "National Veterinary Stockpile Science-Based Logistics Improving Disease Response."

⁹⁹ Silverman and Speers, "'A Wing and a Prayer' Summary and Analysis of the NAHLN HPAI Exercise Program." Pg. 16.

¹⁰⁰ Ibid. Pg. 20. Protocols should contain information on what samples are appropriate to be sent to the lab, information on who to contact concerning number of samples to be sent and when, and the sampling frequency. Inappropriate information may result in samples overwhelming laboratories in quantity for processing and disposal.

Clear definitions of technical and policy terminology are also important, and knowledge of markets, populations, and livestock values are vital in making the definitions clear. For example, the federal indemnity program reimburses farmers for animals lost based on their “fair market value.”¹⁰¹ However, the definition of fair market value is unclear in the program.¹⁰² A disconnect can occur when state industry members, farmers, and other stakeholders disagree with the federal government on “fair market value” for indemnity payments.

An individual’s knowledge of his or her specific roles, responsibilities, and procedural training plays an integral role in TAD preparedness and response efforts. It may also be necessary for individuals across different fields to understand each other’s roles. A potential knowledge disconnect arises when federal and state officials are not fully informed about the tasks they are expected to perform. This disconnect could lead to suboptimal performance of tasks that are key to effective response efforts.¹⁰³

Many federal, state and state agencies are involved in TAD preparedness and response efforts. Each agency has its own chain of command, and there are also chains of command between the agencies. Knowledge of and respect for the positions of each agency in the chain of command is important to all TAD outbreak responders. Disconnects arise when officials within the various levels of government do not understand one another’s leadership roles in the chain of command.¹⁰⁴ This knowledge disconnect can also lead to communication disconnects.

Access to information regarding TAD outbreak preparedness and response is important. The existence of the plans themselves is important, but if they are not accessible to those who

¹⁰¹ “USDA bases the Livestock Indemnity Program (LIP) national payment rate for eligible livestock owners on 75 percent of the average fair market value of the livestock.” USDA Farm Service Agency, “Fact Sheet Livestock Indemnity Program (LIP),” (2009).

¹⁰² Ekboir, *Potential Impact of Foot-and-Mouth Disease in California: The Role and Contribution of Animal Health Surveillance and Monitoring Services*. Pg. 46.

¹⁰³ Analytic Services Inc., “High Plains Guardian: Military Assistance to Civil Authorities (MACA).” Pgs. 20-21.

¹⁰⁴ APHIS-FSIS, ““Birds of a Feather” APHIS-FSIS H5N1 Avian Influenza Outbreak Exercise,” (APHIS-FSIS, 2006). Pg. 5.

need the information, they are not optimally effective. Information pertaining to why certain measures are taken is also useful. A USDA/FSIS official—remarking on what could be considered a knowledge-related disconnect regarding outbreak preparedness and response plans—noted that some farmers and ranchers do not have access to some technologies. Much of the information about outbreak preparedness and response efforts is only available through the use of technology. Providing these farmers with paper copies may be the only way to share information with them.¹⁰⁵ This can be considered a disconnect for federal and state responders. If state authorities provide information via only the internet or television news networks, they may not reach all of their intended audiences. Lack of knowledge regarding public needs is the source of this disconnect. This also extends to the needs of animal health officials. A plan may be easy to access prior to an outbreak, but during an outbreak, when state and federal animal health officials are in the field, access may become more difficult. Both state and federal government officials should have access to the state TAD plan whenever they are in need of it.¹⁰⁶

Knowledge of state and federal regulations is an important part of TAD preparedness and response plans. Plans for carcass disposal, biosecurity, and quarantine may all be affected by state, state, or federal regulations. Understanding which level of government is responsible for setting these regulations is also essential. Disconnects can occur if TAD preparedness and response plans do not take these regulations into account.¹⁰⁷ Poor understanding of regulations

¹⁰⁵ Don Kautter, "NCFPD 2010 Biennial Meeting," in *Partner Perspectives on the Future Defense, Security, and Safety of the Food System* (2010).

¹⁰⁶ "NAHLN FMD Table Top Exercise in Topeka Kansas." Author attending this simulation exercise in May 2010.

¹⁰⁷ Interview with Dr. Barry Erlick Animal Health and Homeland Security Expert. In the author's interview with Dr. Erlick, he noted that if a TAD response plan had a carcass disposal strategy in place that did not coincide with EPA regulations, a disconnect could occur. The question of who has the authority to make the regulations further complicates this issue. This authority could also change depending on the nature of the TAD disease—zoonotic versus not zoonotic.

unique to other states or countries can be another source of knowledge disconnects. This is important for surveillance, quarantine, carcass disposal, regionalization,¹⁰⁸ and resource sharing.

Regionalization itself may be a source of disconnects. Knowledge of the regionalization process, who controls it, and who will assist with it is vital. Confusion may arise between state and federal levels of government regarding the qualifications needed for an area to be declared “disease-free,” who has the power to make such a declaration, and how that declaration is then validated.¹⁰⁹ This is especially important for a TAD outbreak impacting multiple states.

Unaffected states may want to reestablish trade, and the process of regionalization is a way to accomplish that.

Knowledge and respect of the chain of command are essential in any emergency. The chain of command may, and likely will, change over the course of a TAD outbreak. Local (town, county, or region), state, and federal responders must work together under one set of objectives. Overall authority must be established from the top down. Disconnects occur when TAD responders are unclear as to which agency or level of government has overall authority.¹¹⁰ This disconnect can affect all levels of the chain of command, from the leader of overall agency operations to the leader of a specific task.

¹⁰⁸ Regionalization/Zoning: The OIE defines regionalization/zoning as “procedures defining subpopulations of a distinct health status within a territory for the purpose of disease control and/ international trade defined primarily on a geographical basis.” OIE, “Terrestrial Animal Health Code Chapter 4.3 Zoning and Compartmentalisation,” OIE, http://www.oie.int/eng/normes/mcode/en_chapitre_1.4.3.htm. Accessed November 2010.

¹⁰⁹ Interview with Dr. Barry Erlick Animal Health and Homeland Security Expert. Dr. Erlick also mentioned issues relating to how the countries bordering the U.S. will be willing or able to assist with the regionalization process.

¹¹⁰ Ibid. Dr. Erlick stressed the importance of establishing roles and responsibilities among the federal agencies. He noted that there needed to be more clear definition of the roles and responsibilities of the involved agencies, and that they needed to work together. If this did not occur, then command structure would start to fall apart at the intermediate level. Interview with Dr. David F. Vogt Kansas Area Veterinarian in Charge, Interview with Sandy Johnson Kansas Department of Agriculture Homeland Security Specialist. Other interview subjects also reiterated the important of having knowledge of the chain of command.

Regular changes in personnel can lead to a knowledge disconnect regarding roles and responsibilities.¹¹¹ Frequent personnel changes lead to confusion in the chain of command. State and federal personnel interact regularly during a TAD outbreak, and if they do not have adequate knowledge of their roles and responsibilities, response efforts may be affected. It is vital for both federal and state personnel to be knowledgeable not only of their roles and responsibilities but those of their colleagues.

Individuals who are unaware that they even have roles and responsibilities in the event of a TAD outbreak are also potential sources of disconnect. TAD outbreak preparedness and response planning should involve all parties that have the potential to play a role, and failure to involve all parties may have negative effects during the outbreak. State organizations such as banks and small business organizations should be included in state and federal planning efforts.¹¹²

It is important for accurate and precise information to be provided in TAD outbreak and response plans. There is a potential for a disconnect when state plans provide inadequate information regarding federal requirements. If the plan is unclear, then the knowledge that the plan provides is ineffective.¹¹³ This disconnect may be further complicated by a state's expectations that responders will have knowledge of federal guidelines and regulations. This is a potential knowledge gap, since state and state TAD outbreak responders may have knowledge of state guidelines and regulations, but not of federal ones.¹¹⁴

¹¹¹ Interview with Dr. Barry Erlick Animal Health and Homeland Security Expert.

¹¹² Interview with Dr. David F. Vogt Kansas Area Veterinarian in Charge

¹¹³ Interview with Sandy Johnson Kansas Department of Agriculture Homeland Security Specialist. Mrs. Johnson noted that a potential source of confusion in a TAD outbreak response plan may come from the information documented about the quarantine zones. She has observed the quarantine circle documented as 6 miles, when the OIE actually requires them to be 6.2 miles (10km). If the only source of this information a responder can access is the inaccurately documented quarantine circle, then the responder's knowledge is inaccurate.

¹¹⁴ Ibid.

The Incident Command System (ICS) is a well-established system for incident response. Federal emergency management officials are required to have knowledge of ICS. There is a knowledge disconnect if state emergency management officials do not have the same knowledge of ICS.¹¹⁵ Federal government officials will use ICS when they become involved in a TAD outbreak. If state government officials are not knowledgeable of this system, the effectiveness of the outbreak response efforts will decrease. Federal and state emergency responders need to train and exercise their knowledge of ICS together.

Not all aspects of TAD preparedness and response plans are written down in a document. Oral agreements and understandings between states themselves or between state and federal officials are also part of TAD preparedness and response. These oral agreements may be a source of disconnect. A change in leadership or personnel may affect these agreements, especially when these agreements are brought up during a TAD outbreak and the leaders are unaware of the agreements to which their predecessor committed. This lack of knowledge may have a negative impact on response efforts.¹¹⁶

Both federal and state emergency response personnel have to know how to respond to natural disasters and manmade disasters, but there may be a knowledge gap for animal disease outbreak emergencies. Understanding the dynamic nature of animal disease outbreaks is important for emergency responders. A disconnect can occur between state and federal emergency responders when there are different expectations regarding each other's understanding of animal disease outbreaks. If one group has knowledge and the other does not, response efforts may be hindered.¹¹⁷

¹¹⁵ Ibid.

¹¹⁶ Ibid.

¹¹⁷ Interview with Dr. David F. Vogt Kansas Area Veterinarian in Charge

Conclusions

The table below, which lists the knowledge disconnects that emerged through literature review, direct observations, and personal interviews, will be followed by a discussion of the disconnects and their significance to Food and Agriculture Security.

Table 4 Disconnects in the Domain of Knowledge

| Disconnects |
|---|
| Failure to know all transportation possibilities for diagnostic samples |
| Failure to know the roles and responsibilities of other responders |
| Failure to know the chain of command |
| Failure to know the appropriate outlets for information sharing |
| Inability to access information about TAD* outbreak preparedness and response plans |
| Failure to know regulations about quarantine, carcass disposal, and decontamination |
| Failure to understand the process of regionalization |
| Failure to provide information regarding roles and responsibilities to all groups that have them during a TAD* outbreak |
| Failure to understand the use of the Incident Command System |
| Misunderstandings concerning oral agreements versus documented agreements |
| Failure to understand animal disease response methods and expectations |

*TAD: Transboundary Animal Disease

TAD outbreaks constitute an agricultural emergency. These incidents must be handled promptly and in a coordinated manner.¹¹⁸ Homeland Security Presidential Directive-5 calls for DHS to coordinate a National Response Plan (NRP), which summarizes the roles and responsibilities of responders. The directive also instructs states to adopt the NRP and to develop state level plans to protect agriculture. These plans should be developed to manage domestic incidents, including TAD outbreaks.¹¹⁹ Disconnects that relate to knowledge of roles and responsibilities, including an individual's knowledge of their own roles and responsibilities as well those of other responders and officials, can lead to confusion among responders and slow response efforts. Understanding roles and responsibilities also requires understanding the chain of command. Coordinated handling of TAD outbreaks requires responders to not only understand roles and responsibilities, but also whom they should report to. This knowledge also affects the security of information exchange. Disconnects regarding the understanding and use of ICS also directly affect the coordination and promptness of response efforts. Inconsistent use of the ICS between affected states, communities, and organizations can result in ineffective use of resources, ineffective communication, and ineffective planning. Verbal, non-documented personal agreements between responders and animal health officials are also involved in the coordination of TAD preparedness and response efforts. Confusion regarding these agreements can affect the organization of resources and communication. A final disconnect that has the potential to affect TAD preparedness and response effort coordination involves knowledge of regulations. When there is not a consistent understanding of the regulations for quarantine, carcass disposal, and decontaminations, coordination deteriorates. All of these steps must be

¹¹⁸ Myers, "Agriculture and Food Defense." Pg. 185.

¹¹⁹ Ibid. Pg. 181. In 2008, the National Response Framework (NRF) replaced the NRP. Department of Homeland Security, "National Response Framework," http://www.dhs.gov/files/programs/editorial_0566.shtm. Accessed December 6, 2010.

completed in a prompt and coordinated fashion to in order prevent the spread of the TAD and control the outbreak.

Knowledge of TAD preparedness and response plans and methods are important to preventing and controlling disease outbreaks. For coordinated and prompt response efforts occur, preparedness plans need to be able to be quickly, safely, and successfully put into action.¹²⁰ Two disconnects that have emerged involve knowledge of these plans. These involve actual knowledge of the content of the plan accessibility of this knowledge. This extends to the knowledge of how to respond to animal disease emergencies as opposed to other types of emergencies. TAD outbreak preparedness and response plans cannot effectively prevent and control TADs unless responders can access and understand them. It is also important for emergency responders who do not handle animal disease outbreaks on a regular basis to understand how the plan may be different from other emergency plans. Emergency response teams handle responses to natural disasters more often than disease outbreaks. TAD outbreaks are, in some ways, more dynamic than natural disasters, as disease outbreaks change and evolve as time progresses while natural disaster situations generally do not change after the initial event has occurred.¹²¹ Responders to TAD outbreaks must adapt to the situation as it changes. Understanding the differences in responding to various types of emergencies is crucial to successful responses.

Regionalization is a method used to open trade from regions, or zones, that have been confirmed to be disease-free. In the event of a TAD outbreak, quarantine is used to prevent the spread of disease. If quarantine is successful, the disease can be limited to a certain region and

¹²⁰ Myers, "Agriculture and Food Defense." Pg. 185

¹²¹ Not all natural disaster situations are the same. If events continue to occur after the initial event, then the situation becomes more dynamic. The course of time in which events will continue to occur in natural disaster situations is generally still much shorter than that of a TAD outbreak. Changes in the course, area affected, and number of animals affected will continue to change and evolve over a longer period of time.

leave others disease-free. Other countries may later agree to trade with these disease-free regions. An example for use of this process would be the 2002-2003 Exotic Newcastle Disease (END) outbreak in the U.S. The disease occurred in California, Arizona, New Mexico, Texas, and Nevada, while the remainder of the country was disease-free.¹²² By using regionalization, poultry trade could still occur with countries who agreed to import from the disease-free region of the U.S. Regionalization can open trade with disease-free regions before a disease is eradicated entirely from an infected region. It may also be used if a TAD becomes endemic to the infected region. Knowledge of the regionalization process and the requirements is important for secure and transparent trading. Disconnects in knowledge about the regionalization process can lead to the trade of potentially diseased animals or animals that are inaccurately certified as disease-free. Understanding who defines and certifies this disease-free status is an important aspect of this disconnect.

The NAHLN was discussed in chapter 2. Disconnects involving these laboratory networks also exist within the domain of knowledge. When there is a suspected TAD event in the U.S., a FADD will collect samples and send them off to a NAHLN laboratory. A potential disconnect occurs in knowledge of the transportation methods needed to safely transfer these samples to the laboratory. Samples must be appropriately packaged so that the samples cannot spread the disease that they are potentially carrying to either humans or other animals. It is also important to have access to information about secure and rapid transportation services. This disconnect can lead to delays in samples reaching the laboratories and thus delays in diagnosis. It can also lead to lost samples that could potentially be used to further spread the disease,

¹²² Dr. Kati Steneroden, Dr. Anna Rovid Spickler, and Dr. Radfor Davis, "Newcastle Disease," (Ames: The Center for Food Security & Public Health Iowa State University, 2004).Pg. 2 Slide 10.

particularly if such samples fell into the hands of an individual seeking to harm the food and agriculture industry.

The final disconnect in the domain of knowledge involves the domain of communication. As discussed in the previous chapter, it is important for communication networks to establish what information is to be released, who will release it, when it will be released, and how it will be released. Knowledge of appropriate outlets for information sharing is part of understanding how information will be released. Each individual that may have a role in a TAD outbreak may not have the same access to information. Today, the internet is a common outlet for information sharing, but not all individuals have access to technology to connect to the internet. Other individuals may rely solely on the internet, so having only print copies of information will not benefit them. This disconnect in the understanding of which information outlets can and should be used can affect any of the other disconnects mentioned in this chapter. All of these disconnects rely on access to the information, and if the outlet used is not accessible to the individual that needs the information, they will not have all the knowledge that they may need.

Chapter 4: Disconnect Analysis of the Domain of Resourcing

Introduction

The domain of resourcing relates to the tools that are necessary to prepare for and respond to a TAD outbreak. This includes, but is not limited to, equipment, personnel, facilities, time, and finances. The success of preparedness and response efforts relies on quick and reliable access to these resources. Many prior agreements, policies, and plans are required for these resources to be available. Arrangements may be needed with industry, stakeholders, animal disease control centers, national equipment stockpiles, and other countries to provide resources. It is not uncommon for resources to be used up through TAD outbreak response efforts, even with considerable prior planning.

Organizing financial plans and resourcing agreements should be part of TAD outbreak preparedness. Understanding the availability of resources and finances prior to an outbreak is essential. Financial plans and policies that are in place prior to a TAD outbreak prevent the unnecessary confusion and disorganization that occurs when the funding for operation of preparedness and response efforts starts to diminish. Without access to resources outside the state or country, responders quickly exhaust existing resources early in response and surveillance efforts. Agreements with other countries and organizations should exist to help provide resources when the U.S. supply diminishes.

Resources are most heavily used in the response phase of a TAD outbreak, but are also necessary in the preparedness phase. Surveillance programs, for example, use numerous resources to prepare for and monitor a TAD outbreak. Successful surveillance requires access to personnel, testing supplies, laboratories, and time. Establishing adequate and efficient surveillance programs is vital to successful TAD outbreak preparedness. Surveillance programs

should not use more resources than are necessary, as the same resources will also be needed for response efforts.

Analysis

TAD outbreaks present difficulties for laboratories in resource availability and financing. Several AARs from actual events and simulated outbreaks have highlighted this problem. Regulatory constraints limit the amount of testing and operational supplies laboratories can acquire or have on hand at a given time. Initial response efforts rapidly consume laboratory testing supplies. Lag time between the accumulation of cases and the declaration of a state of emergency may be a source of a disconnect. A declaration of a federal emergency can ease financial constraints at the state level.¹²³

Laboratories must have resources (e.g., personnel, supplies, and equipment) accessible in inventory when TADs occur. AARs from a recent series of exercises simulating an HPAI outbreak noted that, at the time the exercises were occurring, there was not a system of national standards in place for animal health laboratory resources.¹²⁴ This lack of national standards is a source of potential disconnect. The finance and resource planning process of TAD preparedness and response is complicated by this lack of federally established standards. Response efforts can be hindered when state and state laboratories do not possess adequate resources and finances due to inappropriate planning.

A resourcing disconnect identified through TAD exercises relates to the availability of facilities for cattle that were in-transit when a stop movement order was issued. One report from an exercise in the Texas panhandle states that up to 10,000 cattle trucks could be in transit on any

¹²³ Silverman and Speers, "'A Wing and a Prayer' Summary and Analysis of the NAHLN HPAI Exercise Program." Pg. 39.

¹²⁴ Ibid. Pg. 22.

day.¹²⁵ National and state TAD response plans call for stop movement when TADs, such as FMD, are suspected. Local authorities are responsible for housing these animals until they are cleared for movement. The disconnect can occur when local authorities do not have pre-arranged lists of available facilities and equipment to manage them.

The availability of finances during an outbreak is another area where disconnects can occur. It is important for farmers, ranchers, and feedlot managers to receive indemnity for animals lost through disease control and eradication efforts. The federal and state governments currently only pay indemnity for animals that are destroyed during TAD control and eradication efforts. Animals that die of the disease prior to being destroyed are not covered by indemnity.¹²⁶ This is a potential disconnect when TADs such as Rinderpest occur.¹²⁷

The U.S. has not experienced an outbreak of FMD since the early 1900's. Events during an outbreak in 1914-1915 illustrate a financial disconnect. At a hearing in the U.S. House of Representatives, the state of Illinois addressed concerns about the amount of financial responsibility the state should have in controlling its FMD outbreak. The federal government's role in the quarantine and eradication of the disease, as well as the financial burden of those measures, was a concern for the state.¹²⁸ Differing views about the financial responsibilities held by each level of government can present a disconnect.

¹²⁵ Jim Amend, Suzanne Burnham, and Ken Waldrup, "The Panhandle Exercise," (Amarillo2003). Pg. 15

¹²⁶ "The "Food, Conservation, and Energy Act of 2008" authorized the Livestock Indemnity Program (LIP) to provide benefits to livestock producers for livestock deaths in excess of normal mortality caused by adverse weather that occurred on or after Jan. 1, 2009, and before Oct 1, 2011, including losses because of hurricanes, floods, blizzards, diseases, wildfires, extreme heat, and extreme cold." USDA Farm Service Agency, "Fact Sheet Livestock Indemnity Program (LIP)."

¹²⁷ Amend, Burnham, and Waldrup, "The Panhandle Exercise." Pg. 29. Rinderpest causes a high level of mortality in cattle. Rinderpest and FMD may result in the same total number of animals lost, but Rinderpest, as a disease, will kill more animals than FMD. Since the LIP does not cover animals that die of the disease, the farmer may receive less indemnity if Rinderpest was the infectious disease present as opposed to FMD.

¹²⁸ Committee on Claims, *To Reimburse the State of Illinois*, First Session, May 13 1916. Pg. 4.

Indemnity is also linked with emergency declarations. Federal funding for indemnity becomes available after a disease is confirmed and an emergency is declared. Without the promise of these funds, cooperation between farmers and animal health officials may be compromised.¹²⁹ State officials need full cooperation between these groups for early TAD response efforts to be successful. A lack of full cooperation may occur due to limited security in the guarantee of indemnity funds. Reimbursement for losses is a major source of strife—and represents a potential disconnect—between local (community, county, and region), state, and federal officials during TAD preparedness and response efforts.

The military is an important resource that can be used for TAD response efforts. They can provide personnel to support field operations such as stop movement, boarder control, and carcass disposal. A disconnect can occur when the state and state plans do not appropriately describe the roles of military personnel and resources. Agreements between state officials and military groups, such as state National Guard units, that are not made prior to TAD outbreaks may lead to inadequate availability of necessary resources.¹³⁰ Prior discussions and agreements between states and the military provide descriptions of the roles the military is capable of and expected to fill.

Another disconnect can occur regarding the availability of the military as a resource. The military plays a number of roles in the U.S., some of which may conflict with the roles expected of them during TAD outbreaks. Many military personnel are often deployed overseas for national campaigns.¹³¹ This can lead to a disconnect if the state and state TAD outbreak response plans expect military personnel and equipment to be an available resource, but due to

¹²⁹ Analytic Services Inc., "High Plains Guardian: Military Assistance to Civil Authorities (MACA)." Pg. 16. States have concerns similar to those of the federal government regarding the release of funds for indemnity.

¹³⁰ Ibid. Pg. V. This article also suggests agreements with the USDA and Department of Defense regarding the role their personnel in TAD outbreak response efforts.

¹³¹ Ibid. Pg. 15.

deployment, they become partly or completely unavailable. The use of the military as a resource can cause disconnects as a result of both lack of availability and inefficient use when they are available.

There are various types of emergency declarations, each of which provides new levels of resources to TAD outbreak response efforts. Emergency declarations are often intimately tied to the process of disease confirmation. A resourcing disconnect can occur when either the state or federal government delay declaring a federal emergency while disease confirmation is pending. Contributing to this disconnect are the recommendations of federal officials for the state and local officials to provide unrelenting rapid response efforts for disease control.¹³² Resources are required during this time of uncertainty between discovery of initial cases and confirmation of the disease as required for the declaration of emergency. Inadequate agreements between state and federal officials regarding resource availability for early response efforts contribute to this disconnect.

Finances are a major source of disconnect during TAD outbreaks. Questions arise in an outbreak relating to the responsibilities for financing early response efforts—prior to declaration of an emergency or disaster. Both the state and federal levels of government have a responsibility in providing finances. Disconnect occurs when the understanding between these levels of government is unclear regarding where the responsibilities lie.¹³³

Laboratories will have a significant role to play in a TAD outbreak. They will handle the influx of samples to be tested for initial disease confirmation, and later, for the continued presence of the disease. Numerous testing supplies and personnel are needed for these tests to be handled. A resourcing disconnect may occur if the laboratories are not kept up-to-date on the

¹³² Ibid. Pg. 15.

¹³³ "NAHLN FMD Table Top Exercise in Topeka Kansas."

expectations held by the state and federal governments—possibly leading to the use of inappropriate testing methods, inadequate availability of testing supplies, and personnel.¹³⁴

Each state has a different resourcing capability for TAD preparedness and response. These differences in capabilities may be a source of a disconnect. Some states may be better prepared to handle a TAD outbreak than others. Resourcing is a major aspect of preparation. States rely on the federal government to supply resources like vaccines, decontamination equipment, and finances, with some states more reliant on the federal government than others. Disconnects can occur when prior agreements are not made to coordinate efforts for obtaining and distributing these resources. Questions may also arise as to who should be responsible for providing and obtaining these resources. They arise due to factors such as the origin of the outbreak—for example, whether the infection was intentional or accidental—and spread from state to state. These two issues lead to disconnects among the states themselves and between the state and federal government.¹³⁵

When a TAD outbreak occurs state governments often expect certain resources to be available from either their neighboring states or the federal government. An example of a resource that some states may expect to have access to is the National Veterinary Stockpile (NVS). The NVS provides resources to states that need to respond to TAD outbreaks. States with agreements with the NVS will expect to have NVS resources available to them.¹³⁶ These expectations can lead to a disconnect. The expectations may not always be shared by the

¹³⁴ Ibid.

¹³⁵ Interview with Dr. Barry Erlick Animal Health and Homeland Security Expert. Dr. Erlick also noted that resources, other than those needed to respond to the outbreak, may be a challenge for states to acquire. Quarantine will affect the ability of resources to be transported to the affected area. Supply chains may become backed-up with the slow of the economy caused by the outbreak. Interview with Sandy Johnson Kansas Department of Agriculture Homeland Security Specialist. Mrs. Johnson also commented on this potential disconnect. She noted that each state had different groupings of agencies, and therefore different resourcing methods. She also noted that within the federal government there was a potential disconnect in resourcing responsibilities.

¹³⁶ USDA APHIS Veterinary Services, "National Veterinary Stockpile Science-Based Logistics Improving Disease Response."

potential source. It is also possible that the resources that are needed are already in use somewhere else. In the case of TAD outbreaks, it is possible for several states to be affected by the disease. States that are affected first receive the first rounds of resources from the federal government. As the disease progresses, more states may become affected and they further deplete resources. The states that become involved late in the outbreak expect to receive the same resources as the states initially involved. This is where the disconnect can occur.¹³⁷

Personnel availability is a large resourcing aspect of TAD outbreak preparedness and response efforts. Financial constraints may affect the availability of both state and federal personnel. When decreased numbers of available personnel are available, each available responder must take on more roles. A resourcing disconnect may occur if states expect to have full access to certain federal personnel, but they do not since fewer are available and will have to be shared with other states.¹³⁸

Indemnity for lost animals in a TAD outbreak is a major source of potential disconnect. However, animal loss is not the only income compensation that farmers need. Indemnity for down time and loss of business at the affected premises are also disconnects. The federal government covers indemnity for animal loss, but it does not compensate farmers for loss of business while their farm is quarantined, depopulated, and decontaminated. This disconnect

¹³⁷ Interview with Craig Beardsley NABC Project Administrator. Mr. Beardsley also noted that the expectations of resource sharing between states may also be considered a disconnect. States may share resources during an outbreak in an effort to control the outbreak, and prevent its spread. States that are not affected may not want to share their resources once a neighboring state becomes infected. This may be due to a factor such as keeping the resources within their own state in case they become infected. They may also have the resources that are expected to be shared already in use elsewhere.

¹³⁸ Interview with Sandy Johnson Kansas Department of Agriculture Homeland Security Specialist, Interview with Dr. William Brown Kansas Livestock Commissioner, Interview with Dr. David F. Vogt Kansas Area Veterinarian in Charge Each of these officials commented on the fact that the current economy may affect the number of government positions at both the state and federal level. This decreased number of positions would result in more responsibility for the personnel that remain. This increased responsibility may result in a loss of close relationships between officials.

relates to who, if anyone, is responsible for compensating farmers for this lost time.¹³⁹ Insurance policies covering loss of business may be necessary to compensate farmers when the government cannot.¹⁴⁰

Conclusions

The table below, which lists the knowledge disconnects that emerged through literature review, direct observations, and personal interviews, will be followed by a discussion of the disconnects and their significance in Food and Agriculture Security.

Table 5 Disconnects in the Domain of Resourcing

Disconnects

Lack of resources prior to a declaration of federal emergency

Lack of national resourcing standards for laboratories

Lack of lists of available facilities and resources to manage them

Confusion regarding indemnity for animal loss due to depopulation versus disease

Confusion regarding financial responsibility for TAD* response efforts

Confusion regarding the responsibility for indemnity prior to a federal declaration of emergency

Poor understanding of the use of the military as a resource

Lack of availability of the military as a resource

Lack of resource availability prior to a federal declaration of emergency

Failure to keep laboratories up-to-date on testing

¹³⁹ Interview with Dr. David F. Vogt Kansas Area Veterinarian in Charge Dr. Vogt also commented on the disconnect caused by the unclear definition of “fair-market-value” in relation to indemnity for animal loss.

¹⁴⁰ Agribusiness insurance policies may cover personal and business loss due to interruption of business (such as TAD outbreak control). Allen Financial Insurance Group, "Agribusiness Farm & Ranch Policy," <http://www.eqgroup.com/agribusiness.htm>. Accessed December 7, 2010.

requirements

Confusion regarding individual state capabilities

Inconsistent expectations of individual states of support from other states

Failure to understand the relationship between finances and personnel availability

Confusion regarding indemnity for loss of business

*TAD: Transboundary Animal Disease

Indemnity is a major source of resourcing disconnects. Over the course of a TAD outbreak, questions arise concerning indemnity for animals lost due to depopulation versus those that are lost to death from the disease and indemnity for loss of business. These questions involve whether indemnity will be paid at all, who is responsible for paying it, and when it will be paid. The prospect of indemnity payments affect farmers' willingness to participate in disease control efforts. It may be harder to get the cooperation of a farmer who is not guaranteed the promise of compensation for his or her lost animals and business. There is also potential for further spread of disease, like in the Taiwan FMD outbreak, through farmers introducing the disease to their farm in order to receive indemnity. While both of these may be extreme cases, they have the potential to affect the ability of responders and animal health officials to rapidly control and eradicate a TAD outbreak.

The NAHLN also has disconnects in the domain of resourcing. When a TAD outbreak occurs, the NAHLN, as a network of laboratories, provides a system of facilities, supplies, and personnel that can be accessed throughout the U.S. NAHLN laboratories will be responsible for testing samples that the state FADDs send them. They will perform the tests to either positively or negatively confirm presence of the disease they are certified to handle. Large numbers of samples will be tested to continue to track the presence of the disease after it is confirmed, and

after it is eradicated to demonstrate freedom from the disease.¹⁴¹ The resourcing disconnects in the laboratories occur when there is not a national standard for the resources that should be immediately available at the time of an outbreak. Inadequate knowledge of the requirements and policy changes made by the federal government also affect the resources available to the laboratory. Each laboratory in the NAHLN is certified to work with different diseases. This complicates resourcing, as each laboratory will need different equipment and supplies to test for the diseases for which they have been certified. Insufficient laboratory resources can lead to decreased diagnostic capabilities.

Federal declarations of emergency have been discussed in the previous chapter regarding disconnects in the domain of communication. This chapter mentioned that communication disconnects could lead to a diminished availability of resources. TAD outbreaks always begin at the state level. When a farmer or state veterinarian notices signs of illness in an animal that lead to suspicion of a TAD, he or she notifies the state animal health authorities. The case is investigated at the premises. Quarantine and biosecurity measures are placed on the premises until the disease is either confirmed or denied. If the disease is confirmed, further investigations are conducted to ascertain all the contacts of the infected animal. These contacts are also investigated and potentially quarantined. Further cases of the disease may arise while containment efforts continue on the first case and its contacts. Disease control efforts continue until the disease is eradicated. The state and state governments are responsible for providing the necessary resources for this process until the federal government becomes involved. Various resourcing disconnects occur in the time between when a TAD outbreak is first discovered and when a federal emergency is declared. Large numbers of supplies and finances can be used up in

¹⁴¹ USDA APHIS, "About NAHLN," http://www.aphis.usda.gov/animal_health/nahln/about_nahln.shtml. Accessed November 21, 2010.

this time period, which is also the reason a federal declaration of emergency is eventually needed. Finances and supplies need to be available prior to arrival of help from the federal government. State and state government officials are on their own for an undefined amount of time before the federal government becomes involved. Financial and resourcing plans need to be in place prior to an outbreak, or these resources may run out in the early stages of the outbreak.¹⁴² Diminished supplies and finances slow response efforts and provide the opportunity for disease to spread. A disconnect also exists combining both indemnity and the declaration of emergency. Indemnity for animal loss due to depopulation is paid for through the USDA's LIP. The disconnect regards who is financially responsible prior to the involvement of the federal government. Questions arise as to if the state government pays the indemnity and is then reimbursed by the federal government, and if this is true, how will the states acquire the finances needed to pay the indemnity. These issues influence the potential cooperation of farmers and response efforts to the TAD outbreak.

The availability of resources is a central disconnect in the domain of resourcing. It has already emerged in the disconnects involving indemnity and the declaration of emergency. Various factors affect the availability of resources including prior planning, finances, and capabilities. Effective TAD outbreak preparedness and response plans include resourcing and financial plans. These plans require knowledge of existing resources and finances, and information on where more may be acquired. Disconnects can arise due to the differences between a state government's capabilities and its expectations. Each state government has a different capability to resource and finance a TAD outbreak. A less capable state may need more assistance from neighboring state governments and the federal government. A state government that expects assistance from outside may be inadequately prepared to handle an outbreak when

¹⁴² Myers, "Agriculture and Food Defense." Pg. 187.

that assistance does not become available when it is needed. The use of the military is also a source of disconnect concerning resource availability. The military may be a helpful resource during a TAD outbreak, but their use is limited, as is their availability. Inappropriate use of the military in TAD outbreak response efforts may add to confusion already in place regarding the roles and responsibilities of other responders. The military is also a resource that has limited availability due to the deployment of personnel either inside or outside the U.S. Financial availability disconnects can result in decreased availability of personnel, equipment, and supplies. A final disconnect that relates to resource availability involves listing of available facilities and resources necessary to manage them. Stop movement orders are given to prevent the spread of a disease, and holding facilities are needed to accommodate the stopped animals. A state or region issues a stop movement order when a TAD outbreak is suspected either inside or outside the area. Stop movement orders require that all livestock related traffic be stopped and screened.¹⁴³ The animals on these vehicles need a place to be unloaded and cared for if they are not cleared to continue to their final destination. The animals will then need holding facilities until their fates are decided. These facilities require personnel to take care of the animals and food to feed them. When these facilities, and the resources to manage them, are not available there is an increased chance for disease spread and increased strain on the transportation system.¹⁴⁴

Financial resources are also a central disconnect. They play a role in all of the previously listed disconnects. Finances must be available to purchase and support all the resourcing needs

¹⁴³ Sumner County Hazard Mitigation Planning Committee, "Sumner County Emergency Operations Plan," in *Incident Annex - Foreign Animal Diseases* (2010). Pg. 5.

¹⁴⁴ When adequate holding facilities are not available, there is increased traffic backlogged due to the stop movement efforts. The trucks that the animals are being transported in must also have a place to be stored until they are cleared to continue or the stop movement order is lifted. If these trucks cannot move either because they do not have a holding facility or the animals in them don't have one, they can potentially slow traffic.

of a TAD outbreak. Finances are needed for supplies, equipment, personnel payroll, and indemnity. A disconnect specific to finances is financial responsibility. Understanding who holds financial responsibility for each aspect of TAD outbreak preparedness and response efforts between the local, state and federal governments is important. Response efforts are slowed and resources are diminished by confusion of financial responsibility.

Chapter 5: Conclusions

Significance of Disconnects in the Domains of Communication, Knowledge, and Resourcing on Food and Agriculture Security

To review, the research questions to be answered by this thesis are:

1. Within the U.S., what disconnects exist in the domains of communication, knowledge, and resourcing of emergency preparedness and response between the different levels of government, from federal to state, in the processes of planning for and responding to TAD emergencies?
2. How do these domain-specific disconnects affect Food and Agriculture Security in the U.S.?

The table below—which lists disconnects in the domains of communication, knowledge, and resourcing that emerged through a literature review, direct observations, and personal interviews—is followed by discussion of the conclusions reached in the previous chapters and their effect on Food and Agriculture Security in the U.S.

Table 6 Disconnects in all Three Domains of TAD Preparedness and Response

| Communication | Knowledge | Resourcing |
|--|---|--|
| Failure of laboratories and federal agencies to correlate their sample identification systems | Failure to know all transportation possibilities for diagnostic samples | Lack of resources prior to a declaration of federal emergency |
| Confusion regarding the timing of and responsibility for notification | Failure to know the roles and responsibilities of other responders | Lack of national resourcing standards for laboratories |
| Inadequate information sharing between the state and federal government to attain a federal declaration of emergency | Failure to know the chain of command | Lack of lists of available facilities and resources to manage them |
| Failure of Stafford Act to cover TAD* outbreaks | Failure to know the appropriate outlets for information sharing | Confusion regarding indemnity for animal loss due to depopulation versus disease |
| Lack of established communication | Inability to access information about | Confusion regarding financial |

| | | |
|--|---|--|
| plans between the state and federal government | TAD* outbreak preparedness and response plans | responsibility for TAD* response efforts |
| Failure to adequately share information prior to federal declaration of emergency | Failure to know regulations about quarantine, carcass disposal, and decontamination | Confusion regarding the responsibility for indemnity prior to a federal declaration of emergency |
| Confusion regarding the chain of communication for test results | Failure to understand the process of regionalization | Poor understanding of the use of the military as a resource |
| Confusion regarding responsibility of communication decisions | Failure to provide information regarding roles and responsibilities to all groups that have them during a TAD* outbreak | Lack of availability of the military as a resource |
| Lack of working professional relationships, poor personal relationships, and personality conflicts | Failure to understand the use of the Incident Command System | Lack of resource availability prior to a federal declaration of emergency |
| Bureaucratic interference | Misunderstandings concerning oral agreements versus documented agreements | Failure to keep laboratories up-to-date on testing requirements |
| Lack of a single communication resource to share plans, regulations, and guidelines | Failure to understand animal disease response methods and expectations | Confusion regarding individual state capabilities |
| Inability to overcome language and cultural barriers | | Inconsistent expectations of individual states of support from other states |
| Lack of communication networks with industry, stakeholders, and civilians | | Failure to understand the relationship between finances and personnel availability |
| Failure to share lessons learned from simulations, AARs**, and real events | | Confusion regarding indemnity for loss of business |
| Failure to share information with laboratories concerning policy changes | | |

*TAD Transboundary Animal Disease
**AAR After Action Report

The food and agriculture sector is vulnerable to attack by bioterrorists who seek to disrupt the U.S. economy and cause unrest and reduced trust in the protection that is provided by the U.S. government. This can be accomplished through the introduction of TADs into areas

previously free of these diseases. Not only do these diseases pose a threat to animals, but depending on the disease, they may also pose a threat to humans.¹⁴⁵ Food and Agriculture Security—a priority research area for the U.S. Department of Homeland Security to protect critical infrastructure—requires effective collaboration between federal and state levels of government. They must plan, train, and exercise together to effectively secure the food and agriculture sectors. The general public expects the federal and state levels of government to swiftly respond to TAD outbreaks with informed decision making and coordinated communication and resourcing.¹⁴⁶ Disconnects in the domains of communication, knowledge, and resourcing can affect the ability of the federal and state levels of government to respond to TAD outbreaks.

Many of the disconnects in a particular domain affect another domain. Disconnects concerning the communication network affect resourcing. Another example of this would be disconnects that concern knowledge of the chain of command affect coordination and security of communication. It is also noteworthy that many of the identified disconnects also occur between groups other than the federal and state governments. While this thesis focuses on disconnects between the federal and state levels of government, it is also important to consider what other groups may suffer from these disconnects. These other groups include, but are not limited to, regional and county emergency response teams and town and county law enforcement troops. Disconnects also emerged in domains outside the three that were researched in this thesis. While the three domains that were chosen have are important in the process of TAD preparedness and

¹⁴⁵ Myers, "Agriculture and Food Defense." Pg. 175.

¹⁴⁶ Ibid. Pg. 180. These outbreaks may be either accidentally or intentionally introduced into the U.S. Regardless of the nature of the introduction they must be prepared for and responded to in a prompt and coordinated fashion. Security is maintained through the prevention of entry of TADs into the U.S. and control and eradication of them in the case that they do enter.

response, other domains also have important roles in the process. Other potentially important domains include technology, regulations/laws, and management/organization.

Interactions between the NAHLN and the federal government are a source of disconnects in all three domains. The NAHLN must have the ability to safely and rapidly receive samples, test them for disease, and communicate the results to federal and state government animal health officials. Confusion concerning disease status, potential spread to humans, and effects on trade markets may result from the disconnects decreasing the capability of the laboratories to perform their roles in a TAD outbreak. When the laboratories cannot perform their roles adequately, there is potential for further spread of the disease and prolongation of the duration of the outbreak. This compromises Food and Agriculture Security because increased spread of the disease may, in the case of zoonotic diseases, affect public safety. A prolonged outbreak may compromise the availability of safe and secure food inside and outside the U.S.

The process of declaring a federal emergency is also a source of disconnects in more than one domain. While two domains are affected, ultimately federal declaration of emergency disconnects amount to resourcing issues. Availability of resources to prevent and respond to TAD outbreaks is central to securing the food and agriculture sectors. Unclear understanding of the process and end results of a federal declaration of emergency lead to uncoordinated resourcing and slowed response efforts, which in turn prolong the time it takes to control and eradicate a disease.

Disconnects regarding roles and responsibilities along the chain of command cross all three domains. Animal health officials and TAD outbreak responders coordinate and cooperate with one another before, during, and after a TAD outbreak. Diminished knowledge of roles and responsibilities leads to disorderly communication along the chain of command and disorganized

allocation, dispersal, and use of resources. Coordination of TAD outbreak preparedness and response efforts are negatively impacted by the effects of disorderly communication and disorganized resourcing.

The remaining disconnects that emerged are specific in which domains and subtopics of TAD preparedness and response they affect, but their overall affect of Food and Agriculture Security is much more general. Reoccurring throughout this discussion of the significance of these disconnects on Food and Agriculture Security is the need for rapid and coordinated response to TAD outbreaks. Regardless of the specific aspect of TAD preparedness and response affected, disconnects ultimately decrease the ability of the federal and state levels of government to coordinate and cooperate with one another. Food and Agriculture Security is compromised by this diminished coordination.

The disconnects that emerged throughout this thesis need concrete solutions whenever possible. While not all of the disconnects are able to be solved at this time, some have more potential to be solved than others. Many communication disconnects could be solved by responders having access to a computerized information sharing network. Developing a system that could link TAD outbreak planners and responders to one another for information sharing would help increase communication abilities. Linking the information sharing systems of the NAHLN and the USDA would be an example of this information sharing network. Increased use of resourcing stockpiles such as the NVS would help alleviate some of the disconnects relating to resourcing. Stockpiles, like the NVS, provide resources to states and communities before the federal government is either needed or able to provide resourcing support.

This thesis explored the domains of TAD emergency preparedness and response in which disconnects occurred, and how they could potentially affect Food and Agriculture Security.

Further exploration of this subject is needed. Many of the disconnects that emerged in this thesis reoccurred throughout the analysis. This indicates that, while the disconnects are noted areas for concern, they are still in need of answers for how to prevent them. The author hopes that the disconnects that emerged in this thesis will open future research ideas for how to mitigate these disconnects and improve collaboration and cooperation between the federal and state levels of government in handling TAD emergency outbreaks. Examples of areas for further study include whether other countries suffer from similar disconnects and how they compensate for them, how can better collaboration be established between the laboratories and governmental agencies, what steps need to be taken to involve all the appropriate groups in TAD preparedness and response planning, and have any of the disconnects relating to indemnity actually contributed to lack of cooperation between farmers and animal health officials.

This thesis builds on concepts relating to Food and Agriculture Security studied by other scholars in the *Frontier* program at Kansas State University. A concept being studied by these scholars is the hazards of potentially contaminated food imports.¹⁴⁷ Nyambok's study relates to Food and Agriculture Security given that contaminated food imports may have a negative impact on the safety of the food consumers purchase. Disconnects in the domains of TAD preparedness and response can affect consumer food safety. If the disconnects prevent proper preparation for a TAD outbreak, a zoonotic TAD could infect the livestock, and thus compromise the safety of the food supply. Prolonged TAD outbreak response efforts also decrease the availability of food supply provided by livestock. Another concept studied is the effect of naturalistic decision-

¹⁴⁷ Edward Nyambok is a scholar in the *Frontier* program studying aquaculture contaminants and the hazards they pose to consumers. Edward Nyambok, "Edward Nyambok FIX Project," http://frontier.k-state.edu/index.php?option=com_content&task=view&id=62&Itemid=39. Accessed November 2010.

making on food safety and food defense.¹⁴⁸ Krusemark's study related to Food and Agriculture Security because efficient decision making impacts food protection for consumers. Several disconnects that emerged through this thesis relate to decision making. For example, disconnects caused by confusion regarding the timing of the declaration of a TAD outbreak may have a negative impact on trade and consumer perception.

Providing answers and solutions to the disconnects that have emerged throughout this thesis may not be easy. Some of the disconnects arise due to the nature of human behavior itself, and cannot be solved by either better planning or through the use of technology. Human nature may prevent some of these disconnects from ever being fully prevented, but this should not prevent Food and Agriculture Security experts from continuing to strive for improvement. Continued research and cooperative efforts are needed to prevent compromising the safety, security, and ongoing operations of our food and agriculture systems that result from disconnects in the domains of communication, knowledge, and resourcing.

¹⁴⁸ Katie Krusemark is a scholar in the Frontier program who studied whether or not food safety and food defense educational programs incorporated methods that helped professionals make good decisions. Katie Krusemark, "Katie Krusemark FIX Project," http://frontier.k-state.edu/index.php?option=com_content&task=view&id=160&Itemid=39. Accessed November 2010. "Naturalistic decision-making aims to determine how humans actually make decisions in real-world settings." Kathryn S. Krusemark, "Decision-Making Applications in Food Safety and Food Defense" (Kansas State University, 2009). Pg. 17.

Bibliography

- Allen Financial Insurance Group. "Agribusiness Farm & Ranch Policy."
<http://www.eqgroup.com/agribusiness.htm>. Accessed December 2010.
- Amend, Jim, Suzanne Burnham, and Ken Waldrup. "The Panhandle Exercise." Amarillo, 2003. Pgs. 15, 29.
- Analytic Services Inc. "High Plains Guardian: Military Assistance to Civil Authorities (MACA)." Topeka: National Agricultural Biosecurity Center Kansas State University, Adjutant General State of Kansas, ANSER, 2004. Pgs. V, 15-16, 18, 20-21.
- Anderson CBE, Dr. Iain. "Lessons to Be Learned Inquiry Report." 22, July 2002. Pg. 3.
- APHIS-FSIS. ""Birds of a Feather" APHIS-FSIS H5N1 Avian Influenza Outbreak Exercise." APHIS-FSIS, 2006. Pg. 5.
- Bush, George W. "Homeland Security Presidential Directive-9." edited by Homeland Security. Washington D.C., 2004. Pgs. 1, 3 Paragraph (15).
- Chinese Taipei. "Eradication of Foot-and-Mouth Disease in Chinese Taipei." 6: World Trade Organization, Committee on Sanitary and Phytosanitary Measures, 2003. Pg. 1, 3-5.
- Committee on Foreign and Emerging Diseases of the United States Animal Health Association. "Foreign Animal Diseases." 472. St. Joseph, Missouri: United States Animal Health Association, 2008. Pg. 18.
- Cumbria Foot and Mouth Disease Inquiry Panel. "Cumbria Foot and Mouth Disease Inquiry Report." Cumbria, UK, 2002. Pg. 25-26, 30, 33-35, 44, 75.
- Department of Environment Food and Rural Affairs. "Animal Health and Welfare: FMD Data Archive." <http://footandmouth.csl.gov.uk/>. Accessed November 2010.
- Department of Homeland Security. "National Response Framework."
http://www.dhs.gov/files/programs/editorial_0566.shtm. Accessed December 2010.
- Ekboir, Javier M. *Potential Impact of Foot-and-Mouth Disease in California: The Role and Contribution of Animal Health Surveillance and Monitoring Services*. Davis, CA: Regents of the University of California Agricultural Issues Center, 1999. Pgs. 43, 46.
- European Commission for the Control of Foot-and-Mouth Disease. "Foot and Mouth Disease in Egypt." In *Reports Archive: 33rd Session*, edited by Agriculture and Consumer Protection Department Animal Production and Health Division: Food and Agriculture Organization of the United Nations, 1999.
- FAO. "Improved Animal Health for Poverty Reduction and Sustainable Livelihoods." edited by Animal Production and Health Division FAO Agriculture Department. Rome: Food and Agriculture Organization of the United Nations, 2002. Chapter 2.
- FEMA. "Declaration Process Fact Sheet." FEMA,
http://www.fema.gov/media/fact_sheets/declaration_process.shtm. Accessed September 2010.
- Food and Rural Affairs Department of Environment. "Origin of the UK Foot and Mouth Disease Epidemic in 2001." edited by Food and Rural Affairs Department of Environment, 36, 2002. Pg. 7.
- Geering W.A., Lubroth Juan. "Preparation of Foot-and-Mouth Disease Contingency Plans." Rome: Food and Agriculture Organization of the United Nations, 2002. Chapter 8.
- Geering W.A., Roeder P.L., Obi T.U. "Manual on the Preparation of National Animal Disease Emergency Preparedness Plans." Rome: Food and Agriculture Organization of the United

- Nations, 1999. Introduction Paragraphs 10-11; Chapter 1 Paragraph 2; Chapter 2 Paragraphs 1, 9, 13; Chapter 4 Paragraphs 18, 27, 29; Chapter 6 Paragraph 2.
- Geering, William A, Mary-Louise Penrith, and David Nyakahuma. "Manual on Procedures for Disease Eradication by Stamping Out." Rome: Food and Agriculture Organization of the United Nations, 2001. Forward.
- Huang, Sophia. "Taiwan's Hog Industry--3 Years after Disease Outbreak." *Economic Research Service/USDA* (October 2000): 4. Pg.1.
- Inskeep II William, Cowen Paula McNamara Tracey S., Meade Barry J., Wainwright Sherrilyn Hart, Major Larsen Thomas, Crom Randall L., Kiley Michael P., Franz David R., Koons Robin K., Captain Bailey Hugh, Captain Thomas Todd M., Huxsoll David L. "Fifth Annual Emergency Preparedness Satellite Seminar." Paper presented at the Fifth Annual Emergency Preparedness Satellite Seminar, September 13-14, 2000 2000.
- Interview with Craig Beardsley NABC Project Administrator. Personal Interview, Oct 6 2010.
- Interview with Dr. Barry Erlick Animal Health and Homeland Security Expert. Personal Interview, Oct 21 2010.
- Interview with Dr. David F. Vogt Kansas Area Veterinarian in Charge Personal Interview, Oct 22 2010.
- Interview with Dr. William Brown Kansas Livestock Commissioner. Personal Interview, October 14 2010.
- Interview with Sandy Johnson Kansas Department of Agriculture Homeland Security Specialist. Personal Interview, Oct 14 2010.
- Kastner, Justin. "Introduction." In *Food and Agriculture Security an Historical, Multidisciplinary Approach*, edited by Justin Kastner: ABC-CLIO, 2010.
- Kautter, Don. "NCFPD 2010 Biennial Meeting." In *Partner Perspectives on the Future Defense, Security, and Safety of the Food System*, 2010.
- Knowles, NJ, J Wadsworth, SM Reid, KG Swabey, AA El-Kholy, and AOA El-Rahman. "Foot-and-Mouth Disease Virus Serotype a in Egypt." *Emerging Infectious Diseases*, no. 10 (2007 Oct), <http://www.cdc.gov/EID/content/13/10/1593.htm>. Accessed July & November 2010.
- Krusemark, Kathryn S. "Decision-Making Applications in Food Safety and Food Defense." Kansas State University, 2009. Pg. 17.
- Krusemark, Katie. "Katie Krusemark FIX Project." http://frontier.k-state.edu/index.php?option=com_content&task=view&id=160&Itemid=39. Accessed November 2010
- Lauer, Jacob, Justin Kastner, and Abbey Nutsch. "Primary Care Physicians and Pandemic Influenza: An Appraisal of the 1918 Experience and an Assessment of Contemporary Planning." *Journal of Public Health Management and Practice* 14, no. 4 (2008): 379-86. Pgs. 382-384.
- Manheim Jarol B, Rich Richard C. *Empirical Political Analysis: Research Methods in Political Science*. 4th ed. White Plains N. Y.: Longman Publishers USA, 1995. Pgs. 155, 157-160, 162, 201, 214-217.
- Manheim, Jarol B., and Richard C. Rich. *Empirical Political Analysis: Research Methods in Political Science*. 4th ed. White Plains N. Y.: Longman Publishers USA, 1995.
- McLaws, Melissa, and Carl Ribble. "Description of Recent Foot and Mouth Disease Outbreaks in Nonendemic Areas: Exploring the Relationship between Early Detection and Epidemic Size." *The Canadian Veterinary Journal* 48, (October 2007): 12. Pg. 1057.

- Meslin, Francios-Xavier, and Corrie Brown. "International Efforts at Detection & Control." In *Food Security in a Global Economy*, edited by Gary Smith and Allan M Kelly, 196. Philadelphia, PA: University of Pennsylvania Press, 2008. Pgs. 160-161.
- Mort, Dr. Maggie, Dr. Ian Convery, Dr. Cathy Bailey, and Josephine Baxter. "The Health and Social Consequences of 2001 Food & Mouth Disease Epidemic in North Cumbria." 153: Institute for Health Research, 2004. Pg. 9.
- Myers, Lee M. "Agriculture and Food Defense." In *Homeland Security Protecting America's Targets*, edited by James JF Forest. Westport, CT: Praeger Security International, 2006. Pgs. 175, 180-181, 183-185, 187.
- "NAHLN FMD Table Top Exercise in Topeka Kansas." 2010.
- Nigg, Joanne M., John Barnshaw, and Manuel R. Torres. "Hurricane Katrina and the Flooding of New Orleans: Emergent Issues in Sheltering and Temporary Housing." *The ANNALS of the American Academy of Political and Social Science* 604, no. 113 (2006).
- Nyambok, Edward. "Edward Nyambok FIX Project." http://frontier.k-state.edu/index.php?option=com_content&task=view&id=62&Itemid=39. Accessed November 2010.
- OIE. "Foot and Mouth Disease." In *OIE Terrestrial Manual: Manual of Diagnostic Tests and Vaccines for Terrestrial Animals 2009*. Paris: OIE, 2009. Chapter 2.2.5 Pg. 1.
- . "Terrestrial Animal Health Code Chapter 4.3 Zoning and Compartmentalisation." OIE, http://www.oie.int/eng/normes/mcode/en_chapitre_1.4.3.htm. Accessed November 2010.
- Reynolds, LA, and EM Tansey, eds. *Foot and Mouth Disease: The 1967 Outbreak and Its Aftermath*. Vol. 18, Welcome Witnesses to Twentieth Century Medicine. London: Wellcom Trust Centre for the History of Medicine at UCL, 2003. Pg. 3.
- Robert, Kahrs. *Global Livestock Health Policy: Challenges, Opportunities, and Strategies for Effective Action*. First ed. Ames, IA: Iowa State Press, 2004. Pgs. 113, 24, 233, 258.
- Rodriguez, Luis L. "About Us: Plum Island Animal Disease Center." United States Department of Agriculture Agricultural Research Service, <http://www.ars.usda.gov/AboutUs/AboutUs.htm?modecode=19-40-00-00>. Accessed June 2010.
- Royal Society. "Infectious Diseases in Livestock Full Report." July 2002. Pg. 2.
- Rubin, Clair B., and Daniel G. Barbee. "Disaster Recovery and Hazard Mitigation: Bridging the Intergovernmental Gap." *Public Administration Review* 45, (1985): 57-63.
- Seidman, Irving. *Interviewing as Qualitative Research: A Guide for Researchers in Education and the Social Sciences*. 3rd ed. New York, NY: Teachers College Press, 2006. Pg. 9.
- Silverman, Joel, and Rosemary Speers. "'A Wing and a Prayer' Summary and Analysis of the NAHLN HPAI Exercise Program." 2009. Pgs. 16, 19-20, 22, 39, 62-63.
- Smith, Gary C. "What Are We Doing to Prevent Entry of Potentially Catastrophic Foreign Animal Disease into the USA." In *Range Beef Cow Symposium*, 11. Casper, Wyoming: University of Nebraska-Lincoln, 2001.
- Steneroden, Dr. Kati, Dr. Anna Rovid Spickler, and Dr. Radfor Davis. "Newcastle Disease." 8. Ames: The Center for Food Security & Public Health Iowa State University, 2004. Pg. 2 Slide 10.
- Sumner County Hazard Mitigation Planning Committee. "Sumner County Emergency Operations Plan." In *Incident Annex - Foreign Animal Diseases*, 2010. Pg. 5.

- The University of Arizona Cooperative Extension. "Youth Activities: Water Resources Glossary." <http://ag.arizona.edu/waterquality/YouthActivityPages/Glossary.html>. Accessed December 2010.
- Committee on Claims. *To Reimburse the State of Illinois*, First Session, May 13 1916. Pg. 4.
- Unknown. "Report on the 1997 Taiwan Foot and Mouth Disease Outbreak in Swine." Pg. 8.
- USDA-APHIS Veterinary Services. "Foot-and-Mouth Disease Factsheet." 2007.
- USDA APHIS. "About NAHLN."
http://www.aphis.usda.gov/animal_health/nahln/about_nahln.shtml. Accessed November 2010
- USDA APHIS Veterinary Services. "National Veterinary Stockpile Science-Based Logistics Improving Disease Response."
- USDA Farm Service Agency. "Fact Sheet Livestock Indemnity Program (LIP)." 2009.
- Westrum, Ron. "All Coherence Gone: New Orleans as a Resilience Failure."
<http://www.resilience-engineering.org/REpapers/Westrum.pdf>. Accessed June 2010.
- Wilson, Terrance M, and Carol Tuszynski. "Foot-and-Mouth Disease in Taiwan--1997 Overview." In *1997 Committee Reports--Committee on Epizootic Attack*, 8: Emergency Programs and CEAH: VS-APHIS-USDA, 1997. Pg. 3.
- World Health Organization. "Global Outbreak Alert & Response Network."
<http://www.who.int/csr/outbreaknetwork/en/>. Accessed November 2010.
- World Organization for Animal Health. "The OIE."
http://www.oie.int/eng/OIE/en_objectifs.htm#6. Accessed April 2010.