TEXAS AND SOUTHWESTERN CATTLE RAISERS ASSOCIATION MEMBERS' AGRICULTURAL VULNERABILITY PERCEPTIONS AND PREPAREDNESS

A Thesis

by

PATRICK RYAN ALLEN

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

December 2011

Major Subject: Agricultural Leadership, Education, and Communications

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Approved by:

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	Traci L. Naile
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ABSTRACT

Texas and Southwestern Cattle Raisers Association Members' Agricultural Vulnerability Perceptions and Preparedness. (December 2011)

Patrick Ryan Allen, B.S., Texas A&M University

Co-Chairs of Advisory Committee: Dr. Tom "Andy" Vestal
Dr. Traci L. Naile

Protection of the agriculture and food infrastructure is the responsibility of all stakeholders in the food supply chain. Though many stakeholders emerge in the chain, producers are the primary line of defense to a disease epidemic. Many factors influence livestock producers' protective action decision process in relation to biological hazards. By identifying these factors in a specific producer population, more effective preparedness programs and messages can be developed by risk communicators.

The purpose and objectives of this study determined Texas and Southwestern Cattle Raisers Association (TSCRA) members' perceptions of vulnerability to the Texas cattle industry, perceived emergency preparedness level, barriers to adoption of protective actions, and sources of animal health information.

This study targeted 7,661 members of the TSCRA. An online survey questionnaire developed from previous research with similar populations allowed TSCRA members to respond to questions related to the objective of this study. A representative sample of TSCRA members from Texas, Oklahoma, and New Mexico responded to the survey.

Recognizing susceptibility to biological hazards, TSCRA members identified high levels of perceived trust and reliability in local veterinarians as a source of information, consistent with previous studies. Although the majority of members reported they did not have a biosecurity plan implemented on their operations, they did recognize the necessity of preventative practices. TSCRA members were neutral on all barriers to adoption of protective actions; however, the barrier "lack of information" was rated higher by means as a barrier to adoption of protective actions. When investigating differences among noncommercial and commercial operations managed by TSCRA members, no statistical differences were identified in this study. However, when investigating differences among TSCRA members and number of cattle managed, a weak positive correlation was identified for perception of hazard by threat in relation to more animals managed.

Findings of this study confirmed sources stating that the agriculture and food infrastructure is vulnerable to biological hazards as perceived by livestock owners. Similar perspectives of vulnerability were identified in previous studies among Oklahoma and Kansas producers further strengthening the need to protect the agriculture and food critical infrastructure as outlined by Homeland Security Presidential Directive – 9 (HSPD-9, 2004). Since it was determined that veterinarians are perceived to be the most reliable and trustworthy source of information by TSCRA members, local opinion leaders, such as veterinarians, should engage in train-the-trainer programs to ensure a consistent risk communication message is being disseminated.

DEDICATION

This study is dedicated to those men and women of the agriculture and food infrastructure who provide the world with a means to eat our favorite foods and a means to stay warm during the winter, among many other comforts we enjoy on a daily basis.

"When tillage begins, other arts follow. The farmers, therefore, are the founders of human civilization." – Daniel Webster

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TABLE OF CONTENTS

CHAPTER Page

Page

LIST OF FIGURES

LIST OF TABLES

CHAPTER I

INTRODUCTION

Background and Setting

It has been 10 years since the tragedy of the World Trade Center and Pentagon on September 11, 2001. Since this event, emergency managers have spent the interim preparing for and anticipating the next terrorist target in the United States (Lindell, Prater, Perry, & Nicholson, 2006). Environmental hazards such as hurricanes Katrina, Rita, and Ike have allowed coastal populations a firsthand view into the destruction caused by uncontrollable hazards and influenced decisions to prepare for future hazards (Lindell et al., 2006). Biological hazards leading to the Exotic Newcastle disease outbreak in California in 2002-2003 and the foot and mouth disease outbreak in the United Kingdom in 2001 showed the world the potential economic and social impacts generated by such events (Breitmeyer, Whiteford, & Shere, 2004; Horn & Breeze, 2006). The complex and dynamic cycle of preparing for, mitigating, responding to, and recovering from hazards constitute what is known as emergency management (Lindell et al., 2006).

This thesis follows the style of the *Journal of Agricultural Education*.

Historically, agricultural vulnerability has been overlooked and had less of a priority placed on the potential hazards that occur in this sector related to others (Horn & Breeze, 2006). Like humans, agricultural plants and animals are susceptible to many hazards, including infectious diseases, and due to the multitude of species involved in the sector, agricultural vulnerability is much more complex (Lindell et al., 2006).

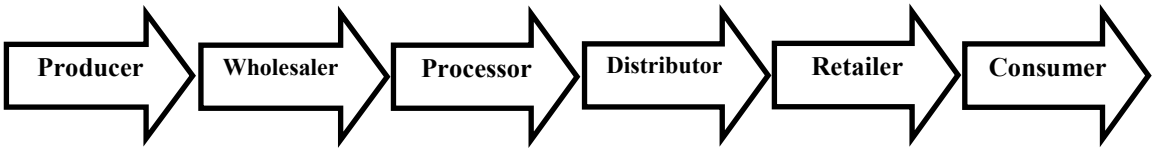
The agriculture infrastructure is defined by Spellman (2008) as "the physical production and distribution systems critical to supporting national security and economic well-being, including all activities essential to food, feed, and fiber production, including all techniques for raising and processing livestock" (p. 8). In 2003, Homeland Security Presidential Directive 7 (HSPD-7) added the agriculture infrastructure to the list of critical infrastructures to be protected. In accordance with the directive, agencies are charged with developing plans to prepare for and respond to terrorist incidents that target these critical infrastructures (HSPD-7, 2003).

In 2004, HSPD-9 was established to protect food and agriculture from hazards that occur unintentionally, intentionally, or through acts of terrorism (HSPD-9, 2004). The protection of food and agriculture as a critical infrastructure is integral to the continuity of the government and the American way of life. Although food and agriculture may be overshadowed by other critical infrastructures such as banking and finance, transportation, and energy, the economic and societal impacts of agriculture would cause devastating effects if the infrastructure was threatened (Horn & Breeze, 2006; Ceddia, Heikkila, & Peltola, 2008). The agriculture industry accounts for nearly 14 percent of the United States gross domestic product (GDP) (Moats, 2007; Horn &

Breeze, 2006). In perspective, the equine industry contributes more to the U.S. GDP than industries such as motion pictures, railroad, and tobacco manufacturing (Moats, 2007). Knowles (2005) identified a potential cost to the beef industry of $750,000 to $1 million per minute of every operating business hour caused by a national animal disease outbreak such as foot and mouth disease.

Producers are a major stakeholder in the food supply chain (see Figure 1) according to Ondersteijn (2004). Producers are the first line of defense against disease epidemics that may threaten food supply security and animal production in affected areas. (Ceddia, Heikkila, & Peltola, 2008; Dement, 2008).

Figure 1: Food Supply Chain



Source: Adapted from Ondersteijn, C.J., Wijnands J. H., Huirne, R. B., & van Kooten, O. (2004)

Founded in 1877, the Texas and Southwestern Cattle Raisers Association (TSCRA) has a 133 year history with Texas and surrounding states' livestock producers and is the largest livestock association in Texas (TSCRA, 2011). With more than 15,000 member families representing more than 4 million head of cattle, TSCRA strives to fulfill its mission to protect "the stewards of land and livestock in the Southwest" (TSCRA). Associations such as TSCRA are essential in reaching producers with industry information concerning animal health information and alerts (ANH, 2010). Known as risk communication, these types of information or alerts are issued primarily

to initiate or direct a protective action by the receiving audience (Lindell & Perry, 2004). The decision to take a protective action depends on the perceived characteristics of the threat (Lindell & Perry).

Focusing further on producers, a stakeholder dichotomy between commercial producers and noncommercial producers emerges. The two subgroups have many aliases, including noncommercial hobby, utility-seeking, semi-professional, and lifestyle, and the contrary, including commercial, profit-seeking, professional, and traditional (Ceddia et al., 2008). For this study, the terms noncommercial and commercial will be used to represent the producer dichotomy. The Foreign Animal and Zoonotic Disease Defense Center has identified noncommercial producers as difficult to reach with essential biosecurity or animal health information (Vestal & Degenhart, 2010). Both commercial and noncommercial producers, as receivers of an animal health alert, must make a decision about whether to take a protective action to protect themselves and their animals. With varying attitudes and perceptions of acceptable degrees of risk among livestock operations, the interpretation of risk communication varies by individual livestock owner (Ceddia et al., 2008; Lindell & Perry, 2004).

Statement of the Problem

The nation's food supply chain is vulnerable to a disease outbreak resulting in a potential disruption to consumers (Spellman, 2008). Texas and Southwestern Cattle Raisers Association members receive critical animal health information and alerts from various information sources. A description of TSCRA members' perceptions of biological hazards affecting the protective action decision process, or lack thereof, when

animal health information is disseminated may be used by risk communicators develop more effective preparedness programs and risk communication messages for livestock producers.

Purpose and Objectives

The purpose of this study was to describe TSCRA members' perceptions of biological hazards affecting livestock, identifying sources of trusted animal health information and barriers to making hazard adjustments.

To accomplish the purpose of this study, six objectives were identified:

1. Describe TSCRA members' perceptions of vulnerability to animal related hazards
2. Describe TSCRA members' perceptions of biological hazards emergency preparedness
3. Describe barriers faced by TSCRA members to making hazard adjustments for biological hazards
4. Identify sources of information preferred by TSCRA members
5. Determine whether differences exist between noncommercial and commercial TSCRA members' use of animals health information, perception of hazard by threat, and barriers to adoption of protective actions
6. Determine if correlations exist between number of cattle managed by TSCRA members and use of animals health information, perception of hazard by threat, and barriers to adoption of protective actions

Scope of the Study

In Texas, New Mexico, and Oklahoma, TSCRA is vital for reaching producers and providing credibility for this study. TSCRA members accessible via email lists who own livestock are the target population for this study. The researcher has identified TSCRA as a reliable organization with a representative producer member population in all regions of Texas and some regions of New Mexico and Oklahoma.

At the producer level of the food supply chain, producers traditionally receive alerts and information through various organizations and associations. This information targeted to producers is critical during an agriculture incident, such as disease outbreak, to rapidly report and contain the incident. It is important to understand if livestock producers are receiving this information and interpreting it into protective actions. Understanding this behavior of livestock producers is critical in ensuring continued safety and security of the Nation's food system.

Significance of the Study

It has been the role of public and private organizations to deliver trustworthy animal health information to the public to maintain an acceptable level of preparedness for disease outbreaks (Hardenbrook, 2005; Horn & Breeze, 2004; HSPD-7, 2003; HSPD-9, 2004; Kapucu, 2009; Senate Governmental Affairs Committee, 2004). The livestock industry is in constant motion from producer to wholesaler to processor and so on (Knowles, 2005; Spellman, 2008). With so many stakeholders in agriculture and the food industry, maintaining this fluidity without disruption requires organizations to use a

multitude of information channels to reach their targeted audiences with information (Spellman, 2008; USDA-APHIS, 2006).

The challenge arises when an effort is made by a risk communicating organization to promote a protective action and attitudes or perceptions inhibit the protective action decision process (Lindell & Perry, 2004). By describing aspects of the protective action decision process as it relates to the protection of livestock by TSCRA members, emergency preparedness organizations will better understand how to focus agriculture and food disaster educational efforts that may promote a positive behavioral change in other livestock producers.

Assumptions

The following were assumptions of this research study:

1. TSCRA members decide what risks are acceptable and when to take protective action.
2. TSCRA members maintain a level of readiness in defense of the food and agriculture infrastructure.
3. Organizations monitoring and disseminating information regarding the food and agriculture infrastructure maintain a level of knowledge adequate and necessary to provide scientifically sound educational material to stakeholders in the agricultural industry.
4. Respondents answered all questions honestly and to the best of their knowledge.
5. Perceived credibility in an institution increases protective action behavior

Limitations of the Study

The following were limitations of this study:

1. All respondents of this study were members of the Texas and Southwestern Cattle Raisers Association, creating possible bias to this association.
2. Not all TSCRA members were contacted; therefore, the generalizability of the responses is limited to members who were accessible via the TSCRA email list.

Definition of Terms

The following definitions are to aid the reader in understanding the operational context of key concepts used in this research.

Dissemination: A scattering or spreading abroad, as of ideas, beliefs. To disperse throughout (Merriam-Webster Dictionary Online, 2010)

Emergency preparedness: Pre-impact activities that establish a state of readiness to respond to extreme events that could affect a community (Lindell et al., 2006)

Agricultural emergency preparedness: An ongoing process implemented through a set of actions and technologies designed to protect livestock, crops, facilities, data, and other assets. (Extension Disaster Emergency Network, 2009).

Biological hazard: Bacteria, viruses, fungi, or toxins causing death or diseases to humans and animals (Ollis & MacLean, 2003).

Biosecurity: The measures taken to keep disease agents out of populations, herds, flocks, or groups of animals in which they do not already exist (Wingfield & Palmer, 2009).

Foreign animal disease: A disease that is not currently present in any animals in the United States (Dement, 2008).

Foot and mouth disease: A severe, highly infectious, viral non-fatal disease of cloven-hooved animals. (Dement, 2008).

Exotic Newcastle disease: END, previously known as velogenic viscerotropic Newcastle disease (VVND), is a viral disease that is usually fatal. It is one of the most infectious poultry diseases in the world. (Dement, 2008).

Highly pathogenic avian influenza: AI is a respiratory disease of wild and domestic fowl transmitted by direct contact with infected birds and indirect contact with contaminated equipment such as shoes, clothing, vehicles, etc (Dement, 2008).

Critical infrastructure: Systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters (Patriot Act, 2001, Sec. 1016e).

Hazard adjustment: A pre-impact action made to better respond to long-term disasters such as infectious diseases, hurricanes, or toxic chemical releases (Lindell & Hwang, 2008).

Protective action decision: The decision to take pre-impact actions based on environmental cues, social cues, warning components, and receiver characteristics (Lindell & Perry, 2004).

Noncommercial livestock and poultry producer: Livestock or poultry owners whose primary source of income is not from profits received from buying and selling

their animals. Garber et al. (2007) defines noncommercial poultry flocks as residences with fewer than 1000 birds other than non-food pet birds.

Risk communication: An attempt to promote appropriate protective behavior by those to whom the information is directed by sharing information about hazards affecting the community (Lindell et al., 2006).

CHAPTER II

REVIEW OF LITERATURE

In this chapter, the components related to agricultural vulnerability will be discussed. Beginning with pertinent literature related to biological hazards, the chapter will conclude with a description of the protective action decision model (PADM), which served as the theoretical framework for this study.

Biological Hazards

Biological hazards affect populations through the "infectivity of disease-causing micro-organisms and other such entities including viruses, infectious nucleic acids, and prions" (World Health Organization, 2004, p.6). A major concern in disease control organizations is that the biological hazards that occur in the agricultural industry could spread to humans (FAZD, 2011). Lindell et al. (2006) identified that "one-quarter of the world's deaths in 1998 were caused by infectious diseases" (p. 151). Social and economic impacts resulting from a biological event in the agricultural industry may cause consumer distrust and trade restrictions placed on the United States by its trading partners in an industry that exports total $140 billion in goods and provides 860,000 jobs annually, the impact of such restrictions would be immense (Horn & Breeze, 2006; USDA-APHIS, 2007).

For this reason, hazard adjustment educational material is disseminated by federal, state, and local organizations to inform producers about steps to prevent or mitigate a disease outbreak (Dement, 2008; Faries, 2008; Hamilton & Bruckner, 2010; Moore et al., 2008; USDA-APHIS, 2007). The hazard adjustments these educational

materials recommend are twofold. Primarily, producers should attempt to prevent contact with any type of disease by implementing preventive biosecurity practices at sites where animals are kept (Moore, Merryman, Hartman, & Klingborg, 2008; USDA-APHIS, 2007). Biosecurity is defined by Wingfield and Palmer (2009) as "the measures taken to keep disease agents out of populations, herds, flocks or groups of animals where they do not already exist" (p.101). Moats (2007) has identified biosecurity as surveillance and containment of the biological hazard because it is "security from transmission" (p. 74).

Second, in the event that a disease does infect producers' animals, monitoring for clinical signs and reporting of diseases in herds is essential to early detection of the disease so it can be promptly eradicated (Dement, 2008; Faries, 2008; Hamilton & Bruckner, 2010). Detection of an animal disease occurs at the local level and is the primary responsibility of the producer (Moats, 2007). Surveillance of a herd by owners or managers should encompass a broad range of diseases, not only the frequently occurring or types with which producers are familiar (Moats, 2007).

Foreign Animal Diseases

Foreign animal diseases pose risks to the entire United States agriculture and food infrastructure (Garber, Hill, Rodrigues, Gregory, & Voelker, 2007). A foreign animal disease is one that is not currently present in any United States animals but may have been controlled or eradicated from the U.S. in the past (Vestal & Degenhart, 2010). The United States monitors disease outbreaks and potential risk of outbreaks through several government-funded agencies, including the National Animal Health Monitoring

System through the USDA and the National Center for Foreign Animal and Zoonotic Disease Defense through the United States Department of Homeland Security (FAZD, 2010; Garber, 2007; USDA-APHIS, 2010). These organizations monitor disease outbreaks and exposure through a collaborative network of government agencies, industry representatives, academic institutions, animal health professionals, and producers (USDA-APHIS, 2010).

Producers are a vital member of this network, as they are the first line of defense to a potential disease outbreak (Dement, 2008). It is imperative that producers adopt hazard adjustments through biosecurity measures and surveillance of herds to reduce the chance of a disease outbreak (Dement, 2008). The decision to adopt any protective action, such as monitoring a herd in conjunction with biosecurity practices, involves several stages, including an information-seeking stage (Lindell & Perry, 2004). With under-represented groups of producers, such as noncommercial livestock producers, barriers such as a lack of knowledge in biological hazard preparedness may result in a catastrophic disease outbreak (Breitmeyer et al., 2004; Thompson et al., 2002; World Organization for Animal Health, 2010).

The poultry industry has experienced cases of commercial bird populations becoming infected from a disease outbreak originating in noncommercial flocks. In 2002, exotic Newcastle disease (END) was discovered in noncommercial poultry flocks in Los Angeles and Riverside counties in California (Breitmeyer et al., 2004). In the approximately 11 months between discovery and eradication, the disease spread from the noncommercial flocks to commercial flocks in four states—California, Nevada,

Arizona, and Texas. During eradication, 3.16 million birds were depopulated, including 22 commercial flocks, costing approximately $175 million in program costs and another $23 million in indemnity costs (Breitmeyer et al., 2004). Highly pathogenic avian influenza (H5N1), another highly contagious foreign animal disease affecting the poultry industry, was diagnosed in noncommercial flocks in 63 countries between 2003 and 2010 by the World Organization for Animal Health, causing immense economic damage.

In the livestock industry, foot and mouth disease (FMD) is a major foreign animal disease that is the world's most important pathogen. FMD can spread more than 170 miles as an aerosol floating in the wind from an infected farm (Horn & Breeze, 2006). FMD led to the depopulation of more than 11 million cattle, 42 million sheep, and 6.5 million pigs in the United Kingdom in 2001 (Thompson et al., 2002). In the United States, cloven-hoofed animals fully susceptible to the disease include 100 million cattle, 70 million swine, 10 million sheep, and many of the nation's 40 million wild animals (Horn & Breeze, 2006).

These foreign animal diseases not only threaten the economies of the country in which the outbreak is detected, but they also affect world trade through import and export restrictions placed on host countries, as was seen in the 2002-2003 exotic Newcastle outbreak in California (Breitmeyer et al., 2004; USDA-APHIS, 2007). Diseases also have social implications, such as distrust in the agriculture and food sector after an outbreak, even though it has been well documented that the outbreak has been

eradicated or is under control (Breitmeyer et al., 2004; Lindell & Perry, 2004; USDA-APHIS, 2007).

The U.S. agriculture industry is a unique infrastructure composed of many stakeholders along the food supply chain (Ondersteijn, 2004). Protecting this infrastructure at the producer level allows 2% of the United States' population to feed the entire nation and still have surpluses to export to the rest of the world (Hardenbrook, 2010; Horn & Breeze, 2006).

Critical Infrastructure Protection

Critical infrastructure protection did not appear in literature until 1997, when the Marsh Report first defined infrastructure as a "network of independent, mostly privately owned, manmade systems that function collaboratively and synergistically to produce and distribute a continuous flow of essential goods and services" (Marsh, 1997; Lewis, 2006). However, the concept has been evolving since the breakdown in communication during the Cuban Missile Crisis (Lewis, 2006).

In 2003, Homeland Security Presidential Directive 7 (HSPD-7) added agriculture and food to the list of critical infrastructures to be protected by organizations (Spellman, 2008). The USDA was established as the lead federal agency for threats pertaining to agriculture by this policy (Moats, 2007).

In 2004, HSPD-9 was established "in defense of United States agriculture and food" (p.1). The directive establishes a national policy to protect the agriculture and food critical infrastructure against vulnerabilities related to "disease, pest, or poisonous agents that occur naturally, are unintentionally introduced, or are intestinally delivered by acts

of terrorism" (HSPD-9, 2004). This policy made it necessary to communicate information and alerts regarding agricultural hazards to the public through a call to develop awareness and early warning capabilities (Moats, 2007).

The agriculture infrastructure is defined by Spellman (2008) as "the physical production and distribution systems critical to supporting national security and economic well-being, including all activities essential to food, feed, and fiber production, including all techniques for raising and processing livestock" (p. 8) Like other infrastructures, the agriculture infrastructure is mostly privately owned (Hardenbrook, 2005). Therefore, a strong relationship and trust to deliver information and alerts is essential for producers to maintain an acceptable level of preparedness and protection of the agriculture and food critical infrastructure (Hardenbrook, 2005; Horn & Breeze, 2004; HSPD-7, 2003; HSPD-9, 2004; Kapucu, 2009; Senate Governmental Affairs Committee, 2004). Moore et al. (2008) identified an abundance of literature regarding biological hazards faced by producers that provides varying recommendations for hazard adjustments, often contradicting each other and confusing the audience.

Source Credibility

The perception of credibility in an information source can increase compliance with protective action recommendations and is a critical part of risk communication (Lindell & Perry, 2004; Kasperson & Stallen, 1991). In risk communication, the ultimate goal is to influence a protective action in the message receiver (Lindell & Perry, 2004). Information from a credible source is more likely to reach this goal through accurately

conveying the real threat of the hazard and gaining notice by the receiver (Lindell & Perry).

Credibility of an institution is built over time through consistent, trustworthy communication from the organization (Kasperson & Stallen, 1991). Kasperson and Stallen (1991) suggest that trust in communication refers to the "expectancy that a message received is true and reliable and that the communicator demonstrates competence and honesty by conveying accurate, objective, and complete information" (p. 179). Kasperson and Stallen (1991) further break trust into five substructs: perceived competence, objectivity, fairness, consistency, and faith. Trust does not require equality from all substructs to exist due to a higher weight placed on any one over another by the receiver; however, trust exists through all five components (Kasperson & Stallen).

Trustworthy sources of information may be used by stakeholders to overcome a deficiency in knowledge of hazards and become important in developing disaster resiliency (Hardenbrook, 2005; Williams &Noyes, 2007). Risk information, regardless of the hazard, is internalized by the receiver, and the process to determine a need for protective action is initialized (Eiser et al., 2002, Lindell & Perry, 2004). The level of trust and distrust in the source of the risk information influences the decision to further continue the protective action process if the source is trusted, or to disregard the information as unreliable from an untrusted source (Eiser et al., 2002).

In a recent consumer study by Rosati and Saba (2004), the government and food industry was perceived as responsible for food safety assurance. However, the same study also found government organizations to be judged as least honest as trusted

sources of food hazard information, while private consumer and environmental organizations were most trusted. Dunaway and Shaw (2010) found the general public to place higher expectations on private organizations and local authorities for providing security and safety to their communities than on federal organizations. Further, trust in industry has eroded with government over the past 40 years (Peters et al., 1997). However, this same study cites that citizen groups are trusted over other sources (Peters et al.).

A source credibility problem in information sources poses a problem in effective risk management and decision making (Peters et al., 1997). The U.S. government, through presidential directives, has been charged to protect the nation's critical infrastructures (HSPD-7, 2003; HSPD-9, 2004). As mentioned in the biological hazards section of this study, producers receive information from various organizations in an effort to prevent or rapidly control a biological hazard before it becomes on outbreak (Spellman, 2008). In an effort to influence a protective action, communicating risk to specific populations, such as producers, depends on trust and credibility in the source of information (Eiser et al., 2002, Lindell & Perry, 2004, Peters et al., 1997).

Role of the Producer

The livestock industry, due to the constant movement of animals and various levels of operations, is vulnerable to a large-scale disease outbreak (Knowles et al., 2005; Spellman, 2008). This exceptional degree of vulnerability is partly due to the high concentration of animals in a relatively small geographic area in the central U.S. that accounts for 80% of fed cattle (Spellman, 2008). Preparedness and early identification

by producers is important to reduce the risk of a large-scale biological event from occurring (Dement, 2008; Spellman, 2008).

Preparedness is defined by the National Incident Management System (2008) as "a continuous cycle of planning, organizing, training, equipping, exercising, evaluating, and taking corrective action in an effort to ensure effective coordination during incident response focusing on the following elements: planning; procedures and protocols; training and exercises; personnel qualification and certification; and equipment certification" (p. 145). These pre-impact activities establish a state of readiness fitting the description of emergency preparedness provided by Lindell et al. (2006).

Along with preparedness, mitigation is a phase that takes place before a disaster (Lindell et al., 2006). Mitigation is defined by NIMS (2008) as:

> Activities providing a critical foundation in the effort to reduce the loss of life and property from natural and/or manmade disasters by avoiding or lessening the impact of a disaster and providing value to the public by creating safer communities. Mitigation seeks to fix the cycle of disaster damage, reconstruction, and repeated damage. These activities or actions, in most cases, will have a long-term sustained effect. (p. 143)

To efficiently and effectively protect against hazards, mitigation must be used in conjunction with preparedness (Lindell et al., 2006).

Conceptual Framework

Lindell and Perry's (2004) protective action decision model (PADM) was the primary basis for this study. The PADM characterizes the way people typically make

decisions about adopting hazard adjustments to protect against environmental and biological hazards in a sequential process (Lindell & Perry, 2004). The model incorporates a long history of disaster research theories into an inclusive model that accounts for environmental and social cues as well as risk communication factors that influence an individual to make protective action decisions. PADM also requires a definitive answer for each stage and accounts for information-seeking factors when an answer cannot be reached. Ultimately, the individual should be prepared to implement protective actions after completing the stages in the model to protect themselves from environmental or biological threats (Lindell & Perry, 2004).

Predecisional Processes

The PADM suggests that both environmental cues and risk communication factors prompt three pre-decisional processes required to bring information to conscious awareness—exposure to cues, attention to cues, and interpretation of cues (Lindell & Perry, 2004). For this study, environmental cues may be characterized by a producer's or neighboring producer's animals becoming sick and dying (Lindell & Perry). An example of risk communication would be warnings from local, state, or federal animal health professionals of biological threats to animals in a certain area. Lindell & Perry (2004) find that both environmental cues and risk communication are somewhat frivolous unless individuals are exposed to, heed, and comprehend the cues or information. Once the three pre-decisional processes are completed, the individual should cognitively continue to the decision stages (Lindell & Perry).

Decision Stages

The decision stages of the PADM identified in the core model—risk identification, risk assessment, protective action search, protective action assessment, and protective action implementation—are supplemented by information-seeking activities that include information needs assessment, communication action assessment, and communication action implementation (Lindell & Perry, 2004).

Risk Identification

This initial stage is determined by how the individual interprets the pre-decisional process through environmental cues or risk communication (Lindell & Perry, 2004). During this stage, the individual must determine whether a threat may affect him or her. Disaster researchers have found a positive correlation between threat belief and disaster response (Lindell & Perry).

Risk Assessment

If a threat is perceived to exist, then individuals may determine how the threat will directly affect them (Lindell & Perry, 2004). Immediacy of threat is strongly related to how individuals perceive risk (Lindell & Perry). For hazards that immediately threaten human life, research has shown a higher level of perceived risk than for hazards that affect property alone or occur infrequently (Lindell et al., 2006). For this study, foreign animal diseases have a direct effect on property and human life, depending on the type of disease. However, the infrequency in occurrence may affect the risk perceived by individuals (Lindell & Perry).

Protective Action Search

If a level of risk is determined to be unacceptable by individuals, retrieving appropriate protective actions from previous experience or seeking information from others becomes necessary (Lindell & Perry, 2004). In the event of a foreign animal disease outbreak, the infrequency of occurrence likely would rule out retrieving protective actions from previous knowledge. Therefore, seeking information from a trusted source likely would be the primary means of selecting a protective action.

Protective Action Assessment

After individuals choose an appropriate protective action(s), they may then assess the chosen action(s) (Lindell & Perry, 2004). This involves examining alternative actions, determining consequences for not taking the chosen protective action, and choosing whether to implement the protective action. Protective actions can be evaluated for implementation in various ways—efficacy, safety, time requirements, perceived implementation barriers, and perceived costs (Lindell & Perry). The end result of this stage is an adaptive implementation plan (Lindell & Perry). In the case of animal disease threats, a biosecurity implementation plan or animal quarantine plan may be the result of this stage.

Protective Action Implementation

After all stages have concluded, an individual should determine when to implement the protective action (Lindell & Perry, 2004). This depends on the protective action and the hazard for which the individual is seeking protection. For long-term hazards such as animal disease threats, the protective action—such as a biosecurity

plan—should be implemented and sustained (Lindell & Perry). These long-term protective actions are referred to as hazard adjustments (Lindell & Perry).

During all stages of the core PADM, three information-seeking stages may be used to conclude each core stage: information needs assessment, communication action assessment, and communication action implementation (Lindell & Perry, 2004).

Information Needs Assessment

This stage of information seeking is initiated by the individual's judgment that the available information is insufficient to precede further in the PADM core stages (Lindell & Perry, 2004). This may be the case with animal disease outbreaks, as individuals do not encounter outbreaks as frequently as other hazards. Subsequently, the next stage is where to get the information once it is determined that more information is needed (Lindell & Perry).

Communication Action Assessment

The range in sources of information used is vast and varies among groups of individuals and hazards (Lindell & Perry, 2004). Individuals likely will seek information from a source they believe is credible and trustworthy. This may not be a government official or local authority; however, it may be a peer or local opinion leader (Lindell & Perry).

Communication Action Implementation

The final step can have one of three outcomes (Lindell & Perry, 2004). The first is that the information is considered reliable and is used. Lindell and Perry (2004) found the second to be the information is determined unreliable and is unsuccessful and not

used. The third is that the information is no longer desired and information through another source or channel is sought (Lindell & Perry).

These three information-seeking stages supplement the core PADM in reaching a conclusion for each stage (Lindell & Perry, 2004). These stages likely would be used in a foreign animal disease outbreak due to the infrequency in occurrence, which can result in individuals' lack of knowledge of protective actions.

CHAPTER III

METHODOLOGY

Institutional Review Board

Texas A&M University and federal policy mandate that all research involving human subjects must be approved by the Institutional Review Board before data may be collected. In accordance with this policy, the Texas A&M University IRB reviewed and approved the proposal for this study. IRB application number 2011-0223 was approved and the researcher was granted permission to collect human subject data. Appendix A displays a copy of the IRB approval form.

Purpose and Objectives

The purposes of this study are to describe TSCRA members' perceptions of biological hazards affecting livestock, identifying utilized sources of trusted animal health information, and barriers to making hazard adjustments. By describing these aspects relating to protection of the food and agriculture infrastructure by TSCRA members, emergency preparedness organizations will better understand how to focus agriculture and food disaster educational efforts that may promote a positive behavioral change in other livestock producers.

To accomplish the purpose of this study, six objectives were identified:

1. Describe TSCRA members' perceptions of vulnerability to animal related hazards
2. Describe TSCRA members' perceptions of biological hazards emergency preparedness

3. Describe barriers faced by TSCRA members to making hazard adjustments for biological hazards
4. Identify sources of information preferred by TSCRA members
5. Determine whether differences exist between noncommercial and commercial TSCRA members' use of animals health information, perception of hazard by threat, and barriers to adoption of protective actions
6. Determine if correlations exist between number of cattle managed by TSCRA members and use of animals health information, perception of hazard by threat, and barriers to adoption of protective actions

Research Design

A correlational research design was used to describe the relationship between producers' decisions to adopt protective actions and information sources, producers' perceptions, and barriers to adoption of protective actions.

Correlational research is sometimes referred to as a form of descriptive research because it describes exiting relationships between variables without any attempt to influence the variables (Frankel & Wallen, 2006).

Instrumentation

An online questionnaire was developed based on instrumentation used in previous studies of Oklahoma and Kansas beef producers (Ashlock, 2006; Riley, 2007). Additional questions were generated based on pertinent literature and expert opinions. The instrument was divided into five sections based on the research objectives—

perceptions of vulnerability, perceptions of preparedness, perceptions of barriers to making hazard adjustments, sources of information, and demographics.

From the questions in the instrument, the researcher developed three constructs to characterize 1) perception of hazard by threat, 2) perceived barriers to adoption of protective actions from biological hazards, and 3) information sources sought for animal health information. Questions were grouped in conceptual scales to determine internal consistency before selecting the final scales.

Population

The target population for this study was members of the Texas and Southwestern Cattle Raisers Association (TSCRA) who were accessible via the TSCRA email list. TSCRA is the largest livestock association in Texas and represents members who manage more than 4 million cattle primarily in the states of Texas, Oklahoma, and New Mexico (TSCRA, 2011).

TSCRA members include of a wide variety of livestock owners with varying degrees of ownership as implied by their membership application (TSCRA, 2011). Livestock owners have three categories of membership from which to choose that best fits their individual operations (TSCRA). The first category is cattle raisers/landowners/wildlife operations or regular (TSCRA). Under this category, livestock owners pay dues in 28 brackets of cattle ownership starting at zero to more than 3000 head (TSCRA). The second category of TSCRA (2011) membership is an allied membership, which allows business owners and professional service providers who rely on the agriculture industry to support TSCRA through membership. The last

category is feedlot operations (TSCRA). This category includes commercial cattle feeding operations with three degrees of operation size from zero to more than 30,000 head (TSCRA). Although all three categories of membership have a direct benefit and connection to the livestock industry, livestock ownership is not a requirement to gain membership in TSCRA (2011).

According to TSCRA, approximately 7,661 members were contacted through the ConstantContact® system during this study. Using this number, at a confidence level of 95% and a margin of error of 5%, the representative target sample size was determined to be 367 responses (Krejcie & Morgan, 1970).

Data Collection

The TSCRA ConstantContact® email system was used to notify members of the survey link. Researchers submitted a draft notice and reminder email to the point of contact at TSCRA headquarters. This person formatted the message into the ConstantContact® program and sent it to members at the direction of the researchers. The first notice was sent to 7,661 members on April 19, 2011. TSCRA recorded 279 bounce backs from this initial email and 14 spam notices.

After the initial notice, the survey was allowed to run for one week before a reminder email was sent via ConstantContact® on April 26, 2011, in accordance with procedures outlined by Dillman et al. (2009). This email was sent to 7643 recipients; however, 262 messages bounced back and 5 spam reports were recorded.

The survey was closed May 3, 2011, after a representative sample was attained (N = 570). Due to the loyalty to agreements between TSCRA and TSCRA members, only two ConstantContact® emails were allowed to be distributed.

Data Analysis

The *Statistical Package for Social Sciences (SPSS®)* was used to analyze the data of this study. For objectives 1-4, descriptive statistics were used, including means, standard deviations, modes, medians, frequencies, ranges, and correlations.

To measure internal consistency for objectives 5 and 6, the researcher used Cronbach's alpha coefficient. For the original selected scales, the alpha ranged from .313 to .868 needing revision to provide consistency in the three constructs. The scales were modified to gain the final versions and a reliability coefficient greater than .65. To characterize Construct 1) perceived hazard by threat, researchers scaled items 4, 5, 6, and 7 and a Cronbach's alpha coefficient of .75 was found providing internal consistency. For Construct 2) perceived barriers to protective action adoption, items 16, 17, and 18 were identified as a scale with an alpha coefficient of .83. While Construct 3) information sources sought for animal health, items 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, and 32 were scaled and gained a coefficient of .771.

Validity

Validity of the instrument was established through two previous studies using the same instrument (Ashlock, 2006; Riley, 2007). Both of these studies established face and content validity though a panel of experts.

Reliability

Post-hoc reliability was established in previous studies using the instrument (Ashlock, 2006; Riley, 2007). Cronbach's alpha reliability scores were found to be .84 in Ashlock's (2006) study and .895 in Riley's (2007) study.

In this study, a post-hoc reliability analysis was performed for the two scales used in the instrument. The correlation coefficients calculated using Cronbach's alpha were found to be .879 and .783.

CHAPTER IV

FINDINGS

The agriculture and food infrastructure is vulnerable to disease outbreak resulting in a possible disruption in the food supply chain (Spellman, 2008; Moats, 2007). Producers are the first line of defense against such an occurrence and as informed stakeholders, have the decision to take protective action to prevent or mitigate biological hazards (Dement, 2008; Lindell & Perry, 2004).

The findings outlined in this chapter relate to TSCRA members' perceptions of preparedness and trusted sources of information regarding biological hazards. Data in this study were collected using an online questionnaire divided into five sections based on the study's objectives—perceptions of vulnerability, perceptions of preparedness, perceptions of barriers to making hazard adjustments, sources of information, and demographics.

SurveyMonkey.com®, an online survey tool, was used to collect responses from the target population over a two week period. TSCRA members were initially informed of the online questionnaire and provided with the website link through TSCRA's ConstantContact® email system. A subsequent reminder email was sent one week after the initial notification using the same TCSRA email system in accordance with procedures outlined by Dillman et al. (2009). Due to restrictions placed by TSCRA, only two email messages were transmitted to members. The survey was closed two weeks after opening and after a target sample (n = 368) was attained.

Purpose and Objectives

The purpose of this study was to describe TSCRA members' perceptions of biological hazards affecting livestock, identifying utilized sources of trusted animal health information, and barriers to making hazard adjustments. By describing these aspects relating to protection of livestock by TSCRA members, emergency preparedness organizations will better understand how to focus agriculture and food disaster educational efforts that may promote a positive behavioral change in other livestock producers.

To accomplish the purpose of this study, six objectives were identified:

1. Describe TSCRA members' perceptions of vulnerability to animal related hazards
2. Describe TSCRA members' perceptions of biological hazards emergency preparedness
3. Describe barriers faced by TSCRA members to making hazard adjustments for biological hazards
4. Identify sources of information preferred by TSCRA members
5. Determine whether differences exist between noncommercial and commercial TSCRA members' use of animals health information, perception of hazard by threat, and barriers to adoption of protective actions
6. Determine if correlations exist between number of cattle managed by TSCRA members and use of animals health information, perception of hazard by threat, and barriers to adoption of protective actions

Population

The population for this study was members of the Texas and Southwestern Cattle Raisers Association (TSCRA). For the purposes of this study, TSCRA members who directly own or manage livestock were targeted. To ensure the target population was reached, a question regarding quantity of livestock owned or managed was asked in the demographics section of the questionnaire.

Although TSCRA currently services over 15,000 members, not all were contacted during this study. Because TSCRA members vary so widely in demographics and geographic location, researchers collaborated with TSCRA to determine the best course to pursue in collecting data from members. A request for approval to collect data packet was compiled by the researchers and submitted to the executive board of the association. After adequate review, the method of data collection was approved and it was determined that an online survey would be most efficient in reaching members.

According to TSCRA , the first email was sent to 7,661 members. Of these, 279 emails bounced back and 1951 of the messages were opened. Of the 1,951 members who opened the message, 354 clicked on the survey link to the survey host website. Similarly, the reminder email was sent to 7,643 members with 262 bounce backs. 1,755 recipients opened the reminder message and 358 recipients clicked on the survey link. From this population, 570 responses were collected on SurveyMonkey.com®. From this, a response rate of 7.74% was calculated for the first email and a response rate of 7.73% was calculated for the second email.

Characteristics of TSCRA Members

Of the respondents who reported age (n = 496) the median age was 60 with a range of 18 to 100 and an average of 58.93 (SD = 11.617). Respondents (n = 490) to this question were mostly male accounting for 85.5% and 14.5% female.

White, Native Indian or Alaska Native, and Other where the only races reported by respondents with the majority being white (83.5 %) followed by American Indian or Alaska Native (.02 %), .01% reporting other, and 16.74% chose not to answer this question. No respondents reported their race as Asian, Black or African American, or Native Hawaiian or Other Pacific Islander. For the respondents who reported ethnicity (n = 457), 96.7% reported not Hispanic or Latino and 3.3% reported their ethnicity as Hispanic or Latino.

Education levels in TSCRA vary from below a high school education to a doctoral degree. The average TSCRA member respondent to this questionnaire had attained a Bachelor's degree accounting for 41.3% of total respondents (n = 491). In order of highest to lowest percentage of respondents, the education level varied from high school (15.9%), Master's degree (14.5%), Associate degree (13.4%), Doctoral degree (8.4%), Professional degree (6.3%), and below high school (.2%).

Characteristics of Operations

Respondents were asked how many cattle they were responsible for. The question was worded in way as to not exclude respondents who cared for animals they did not own such as feedlot managers. The average herd size reported by respondents (n = 481) was 1349.91 (SD = 13763.470). The size of herds ranged from 0 to 275,000 with

a median of 100 animals. This is slightly higher than the 2007 Agriculture Census for Texas finding the majority of farms with a herd size of between 20 and 49 cattle (USDA-NASS, 2007).

According to the definition of a noncommercial livestock owner presented in this study, a producer whose primary source of income is not from the sale of their animals is categorized as a noncommercial producer. From this, 80.5% of total respondents (n = 481) reported that the profits from the sale of their animals was not their primary source of income resulting in 19.5% of respondents reporting their livestock as their primary source of income.

Table 1
TSCRA Members' Income Earned from the Sale of Animals

Income Range	*n*	%
Less than $1,000	40	8.6
$1,000 to $4,999	49	10.5
$5,000 to $9,999	58	12.4
$10,000 to $19,999	94	20.2
$20,000 to $49,999	91	19.5
$50,000 or more	134	28.8

Related to the previous, respondents (n = 446) were asked about income earned from the sale of their animals ranging from less than $1,000 to $50,000 or more (see Table 1). Although the majority the respondents (n = 134) earned $50,000 or more, the average income from the sale of animals by respondents (n = 94) was between $10,000 and $19,999 (see Table 1).

TSCRA membership does not require members to be responsible for animals in any particular state. They have no requirements on where your operation is located or if the producers' primary residence is locate in the same location as their operation. Respondents were asked in what county is their operation. Counties from Oklahoma, Texas, and New Mexico were represented by the respondents. The majority of respondents had operations located in Texas with only 73 of 254 counties not represented. Of the respondents who answered if their residence is located in the same location as their primary residence (n = 475), 56.2% live in the same location as their operation while 43.8% do not.

Respondents also reported memberships in various agriculture organizations. While 93.7% of total respondents (n = 479) considered their affiliation with TSCRA and other organizations as memberships, 6.3% reported themselves as not being members of agriculture organizations. Respondents who wrote their organization affiliation in the text box provided (n = 414), with respondents able to report multiple affiliation, 9.2% reported to be members of local agriculture organizations while 30.2% reported to be members of national level and 96.9% respondents are members of state or regional organizations.

Findings Related to TSCRA Members' Perception of Vulnerability

The first three questions were related to producers' perception of vulnerability of biological hazards to livestock operations.

When asked about level of agreement regarding the susceptibility of disease outbreak in the Texas cattle industry, respondents somewhat agreed ($M = 4.03$, $SD = 1.007$, $Mdn = 4.00$) that the Texas cattle industry is susceptible. A five point Likert scale was used to rate level of agreement with disagree being the lowest level of agreement to agree being the highest.

Questions 2 and 3 were also rated on a five point Likert scale; however, to gauge threat level, the scale used the Department of Homeland Security Threat Level codes (low, guarded, elevated, high, severe) established in previous research using this instrument (Ashlock, 2006; Riley et al, 2007).

Table 2
TSCRA Members' Perceived Level of Susceptibility by Operation

	Level of Threat %						
Operation Type	Low	Guarded	Elevated	High	Severe	*M*	SD
Noncommercial/hobby livestock herds	20.8	35.3	24.1	17.2	2.5	2.45	1.08
Commercial livestock	15.2	37.1	30.6	14.8	2.3	2.52	.993

Respondents to question two were instructed to gauge level of susceptibility to noncommercial/hobby livestock herds and commercial livestock operations (see Table 2). Of the total respondents (N=552), the average respondent (M = 2.45, SD = 1.08, Mdn = 2.00) perceived noncommercial herds to be a slightly less of an elevated threat level ranked by means than commercial livestock operations. Respondents (n = 533) felt commercial herds were just barley at an elevated (M = 2.52, SD = .993, Mdn = 2.00) threat level.

Table 3
TSCRA Members' Perceived Level of Susceptibility by Cause

	Level of Threat %						
Causes of Susceptibility	Low	Guarded	Elevated	High	Severe	*M*	SD
Intentional introduction of a biological agent to the food supply chain	24.6	36.3	24.1	13.3	1.8	2.31	1.04
Unintentional introduction of an infectious disease to the food supply chain	25	41.6	21.5	10.1	1.8	2.22	.992
Poor biosecurity practices used by livestock producers	24.4	38.7	25.9	9.2	1.8	2.25	.986
Lack of knowledge of infectious diseases that threaten livestock	16.1	31.9	31.4	17.3	3.2	2.60	1.05

Respondents were asked to gauge the level of threat to the Texas cattle industry by causes of susceptibility. Four causes were presented (see Table 3) in which respondents gauged threat by using the Department of Homeland Security Threat Levels. Respondents found three of the four causes of susceptibility to be the second lowest threat level of guarded. Ranked by means, the threat of an unintentional introduction of an infectious disease was found to have the lowest mean of 2.22 (*SD* = .992, *Mdn* = 2.00). Respondents found intentional introduction of a biological agent to the food supply chain to be guarded (*M* = 2.31, *SD* = 1.04, *Mdn* = 2.00) followed by a guarded (*M* = 2.25, *SD* = .986, *Mdn* = 2.00) level of threat for poor biosecurity practices used by producers as ranked by means. Respondents perceived only a lack of knowledge of infectious diseases to be an elevated threat level (*M* = 2.60, *SD* = 1.05, *Mdn* = 3.00).

Findings Related to TSCRA Members' Perceived Level of Preparedness

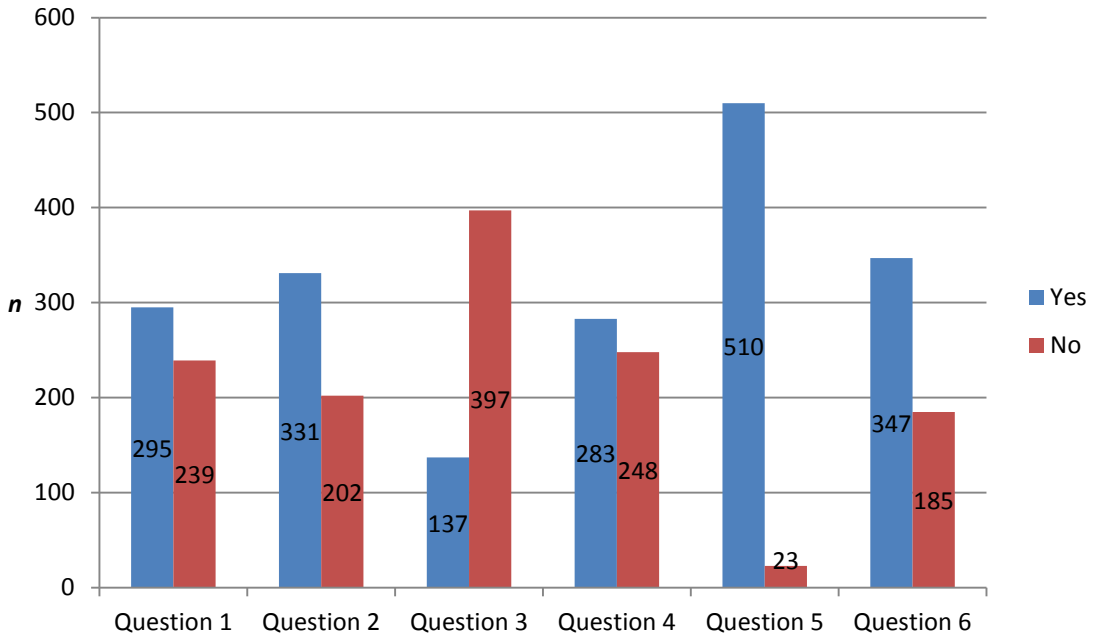
The following questions are related and designed to measure the perceived emergency preparedness level for biological hazards guided by the second objective of this study. The questions also measure preparedness steps respondents have taken in protection of their operations prior to completing the questionnaire. The following six questions allowed respondents the option to mark "yes" or "no" in response to preparedness related questions.

The first question (see Figure 2) was asked as a follow-up to the first section of the questionnaire related to vulnerability and to transition into the preparedness section. Respondents were asked if they believe that their herd is susceptible to an animal disease outbreak. Of the total respondents to this question (*n* = 534), over half (55.2%) perceived

that their operation was susceptible while 44.8% believe that their operation is not susceptible.

Question two (see Figure 2) asked respondents if they believed they had enough information about protecting their animals from a disease outbreak. While the majority (62.1%) of the total respondents (n = 533) perceived that they have enough information, 37.9% felt they had inadequate information in this area.

Figure 2: TSCRA Member Preparedness for Animal Disease Outbreak



The third question (see Figure 2) asked respondents if they had a biosecurity plan for their respective operations. 24% of respondents reported as having a biosecurity plan while the majority (69.6%) do not have any biosecurity plan in place on their operation. Similarly, the fourth question (see Figure 2) aimed at identifying if producers perceived

it necessary to implement preventative biosecurity measures in places where they keep animals. For this question, of the total respondents (n = 531), 49.6% perceived these measures necessary while 43.5% believed the opposite.

Question five asked respondents if they believe it is necessary to monitor animals for clinical signs of health problems. An overwhelming majority of 95.7% of total respondents (n = 533) believe this is a necessity with a meager minority of 4.3% believing it not necessary. The sixth question (see Figure 2) followed-up question five by asking respondents if they perceived that they have enough information regarding the

Table 4
TSCRA Members' Confidence Levels

	Level of Agreement %						
	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	*M*	SD
I am confident in my preparedness to protect my animals in the event of a livestock disease outbreak	4.3	10.8	24.8	39.5	20.9	3.62	1.06
I am confident in my ability to respond to a disease outbreak in my herd	3.6	6.9	15.9	40.5	32.8	3.92	1.05

clinical signs of infectious disease to monitor their animals for unusual symptoms. To this, the majority (65.2%) of respondents believed they have enough information, while 34.8% need more information to adequately monitor their herds.

Respondents were asked to gauge their level of agreement related to their level of confidence in two areas of preparedness (see Table 4).A five point Likert scale was used with disagree being the least level of agreement and agree being the highest level of agreement. Of the total respondents (n = 537), the average respondent (M =3.62, SD = 1.06, Mdn = 4.00) somewhat agreed that they are confident enough in their preparedness level to protect their animals. Similarly, the average respondent (M = 3.92, SD = 1.05, Mdn = 4.00) somewhat agreed in their confidence level to respond to an animal disease outbreak in their herd.

Table 5
TSCRA Members' Perceived Barriers to Adoption

	Level of Agreement %						
Barriers	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	*M*	SD
Lack of Information	16.9	15.7	30.5	27.9	9	2.96	1.21
Lack of Resources	18.2	17.1	32.1	24.1	8.5	2.87	1.21
Lack of Infrastructure	15.8	15.6	38.2	22.2	8.1	2.91	1.15

Findings Related to Barriers to Adoption of Protective Actions

The following set of questions was related to perceived barriers faced by producers that negatively influence adoption of protective actions by TSCRA members in relation to the third objective of this study. Three possible barriers were listed that respondents were asked to mark their level of agreement on a five point Likert scale in making decisions to protect their animals from a disease outbreak (see Table 5).

Of the total respondents (n = 534) who responded to lack of information as a barrier to adoption, the average respondent (M = 2.96, SD = 1.21, Mdn = 3.00) was neutral on the subject. This was similar with the barriers of lack of resources (M = 2.87, SD = 1.21, Mdn = 3.00) and lack of infrastructure (M = 2.91, SD = 1.15, Mdn = 3.00) in which respondents reported a neutral level of threat.

Rating these barrier by means, the average respondent reported the lack of information (M = 2.96, SD = 1.21, Mdn = 3.00) as the highest barrier in adopting protective actions. This was followed closely by lack of infrastructure (M = 2.91, SD = 1.15, Mdn = 3.00) and lack of resources (M = 2.87, SD = 1.21, Mdn = 3.00).

Findings Related to TSCRA Members' Perceived Information Sources

The final section of the questionnaire was related to sources used by TSCRA members to gather and receive information regarding the health of their animals. In relation to the final objective of this study, four subsections regarding information used by producers to make informed decisions were outlined in the questionnaire.

Table 6
Information Sources Sought by TSCRA Members

	Level of Agreement %						
Information Sources	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	*M*	SD
Local or consulting veterinarian	1.9	2.1	8.6	27.6	59.5	4.41	.881
Livestock associations	2.1	2	7.6	33	55.3	4.37	.873
Internet	4.5	3	10.2	40	42.3	4.13	1.02
Magazine	3.9	3.5	12.5	46.8	33.3	4.02	.976
Other livestock producers	2.7	4.3	13.8	47.7	31.4	4.01	.933
County extension office	8.8	7.5	20.8	31.8	31.2	3.69	1.23
State land-grant institution	15.5	6.3	24.4	25	28.8	3.45	1.37
USDA	13.5	8.6	26.8	29.5	21.5	3.37	1.28
Local agricultural retailers/service providers	14.2	7.3	24.1	39.6	14.8	3.34	1.23

Table 6
Continued

Information Sources	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	*M*	SD
Television news	25	10.7	20.6	28	15.7	2.99	1.42
Radio news	25.1	12	26.3	22.6	14	2.88	1.38
Weekly newspaper	34.4	7.6	16.9	27.4	13.7	2.78	1.49
Daily newspaper	40.2	9.2	18.6	21.6	10.4	2.53	1.45
High school agriculture science teacher	46.3	14.9	25.9	9.1	3.8	2.09	1.19

These subsections were information sources sought by TSCRA members about animal health issues, perceived reliability of source of information about animal health issues, perceived trustworthiness of information sources about animal health information, and preferred formats of animal health information.

Findings Related to Information Sources Sought

For this subsection, respondents were asked to rate their level of agreement for information sources (see Table 6) sought regarding animal health issues. Respondents were given the option to provide sources of information they use other than those provided in the questionnaire in the "other (please describe)" text box. Sixteen responses were recorded and are as follows: APHIS-CDC, consult with Noble Foundation, emails from Texas Animal Health Commission (listed by three other respondents), emails from state veterinarian, fellow veterinarians, professional meeting/literature/veterinary journals, my farm manager, Texas professional school resources i.e. Texas A&M University, trade magazines and newspapers, TSCRA, meeting at local auction barns, and Livestock Weekly.

For the information sources provided to respondents in the questionnaire, no average respondent reported disagreement with any sources. However, respondents somewhat disagreed that Ag. Teachers (M = 2.09, SD = 1.19, Mdn = 2.00) were sought after as animal health information sources. Respondents were neutral on the daily newspaper (M = 2.53, SD = 1.45, Mdn = 3.00), weekly newspaper (M = 2.78, SD = 1.49, Mdn = 3.00), television news (M = 2.99, SD = 1.42, Mdn = 3.00), radio news (M = 2.88, SD = 1.38, Mdn = 3.00), USDA (M = 3.37, SD = 1.28, Mdn = 4.00), and local

agricultural retailers/service providers (other than veterinarian or extension office) (*M* = 3.34, *SD* = 1.23, *Mdn* = 4.00) as an information source.

Respondents somewhat agreed that state land grant institution (university) (*M* = 3.45, *SD* = 1.37, *Mdn* = 4.00), magazines (*M* = 4.02, *SD* = .976, *Mdn* = 4.00), county extension office (*M* = 3.69, *SD* = 1.23, *Mdn* = 4.00), other livestock producers (*M* = 4.01, *SD* = .933, *Mdn* = 4.00), internet (*M* = 4.13, *SD* = 1.02, *Mdn* = 4.00), and livestock associations (*M* = 4.37, *SD* = .873, *Mdn* = 5.00) are sought after sources of information. The highest level of agreement was reported for the local or consulting veterinarians (*M* = 4.41, *SD* = .881, *Mdn* = 5.00) as a sought after source of information by TSCRA respondents.

Sources of Information Perceived to be Reliable

Similar to the previous subsection, respondents were given the same sources in the questionnaire and allowed the opportunity to mark their level of agreement regarding reliability those sources (see Table 7). Respondents were given the opportunity to provide any reliable sources not listed in the "other (please describe)" text box.

Four valid responses were recorded and are as follows: APHIS – CDC, Noble Foundation is very good on research and programs offered, and the Texas Animal Health Commission.

Table 7
TSCRA Members' Perceived Reliable Information Sources

	Level of Agreement %						
Information Sources	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	*M*	SD
Local or consulting veterinarian	.4	1.4	4.7	22.7	70.8	4.62	.678
Livestock associations	.8	1.4	7.1	37.5	53.2	4.41	.751
County extension office	4.9	3.8	14	33	44.3	4.08	1.08
Other livestock producers	2	3.1	21.7	51.2	22	3.88	.853
State land-grant institution	7.9	3.6	21.6	27.4	39.5	3.87	1.20
Internet	3.8	5.4	23.5	48.6	18.7	3.73	.953
Magazine	5.5	6.7	20.6	45.9	21.2	3.70	1.05
USDA	8.4	4.6	25.6	32.9	28.5	3.69	1.18
Local agricultural retailers/service providers	7.4	4.4	27.5	44.4	16.3	3.58	1.05
High school agriculture science teacher	19.6	13	43	17.2	7.2	2.79	1.16

Table 7
Continued

Information Sources	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	*M*	SD
Radio news	22.1	16.3	32.1	24.1	5.4	2.74	1.2
Weekly newspaper	26	16.1	24.3	27.8	5.8	2.71	1.28
Television news	26.7	16.8	28.3	23.8	4.4	2.62	1.23
Daily newspaper	32.2	19.3	28.4	16.9	3.2	2.4	1.19

For the listed sources of information, respondents somewhat disagreed that the daily newspaper (*M* = 2.4, *SD* = 1.19, *Mdn* = 2.00) is a reliable source of animal health information. While respondents disagreed with none of the provided sources, the average respondent felt neutral about radio news (*M* = 2.74, *SD* = 1.2, *Mdn* = 3.00), television news (*M* = 2.62, *SD* = 1.23, *Mdn* = 3.00), high school agricultural science teachers (*M* = 2.79, *SD* = 1.16, *Mdn* = 3.00), and weekly newspaper (*M* = 2.71, *SD* = 1.28, *Mdn* = 3.00) as reliable sources of information.

For the magazines (*M* = 3.70, *SD* = 1.05, *Mdn* = 4.00), the internet (*M* = 3.73, *SD* = .953, *Mdn* = 4.00), local agricultural retailers/service providers (other than veterinarian or extension office) (*M* = 3.58, *SD* = 1.05, *Mdn* = 4.00), other livestock producers (*M* = 3.88, *SD* = .853, *Mdn* = 4.00), the county extension office (*M* = 4.08, *SD* = 1.08, *Mdn* = 4.00), livestock associations (*M* = 4.41, *SD* = .751, *Mdn* = 5.00) the state land-grant institution (University) (*M* = 3.87, *SD* = 1.20, *Mdn* = 4.00), and the USDA (*M* = 3.69, *SD* = 1.18, *Mdn* = 4.00), respondents somewhat agreed these are sources are reliable. The average TSCRA respondent agreed that their local or consulting veterinarian (*M* = 4.62, *SD* = .678, *Mdn* = 5.00) is a reliable source of animal health information.

Findings Related to Trustworthy Sources of Information

The following subsection attempted to measure perceived trustworthy sources of animal health information used by TSCRA members. Similar to the previous subsections, a five point Likert scale was used to identify respondents' level of agreement with each source listed as trustworthy (see Table 8). Following the listed sources, respondents were given the opportunity to identify trustworthy sources not

listed. Four valid responses were recorded and are as follows: APHIS – CDC, the Cattleman Magazine, and the Texas Animal Health Commission was identified twice.

For the sources listed, respondents neither disagreed or somewhat disagreed with any sources of animal health information as being trustworthy. However, respondents were neutral on the daily newspaper (M = 2.48, SD = 1.19, Mdn = 3.00), weekly newspaper (M = 2.73, SD = 1.23, Mdn = 3.00), radio news (M = 2.78, SD = 1.17, Mdn = 3.00), television news (M = 2.61, SD = 1.22, Mdn = 3.00), and high school agricultural science teachers (M = 2.96, SD = 1.16, Mdn = 3.00) as trustworthy sources.

Respondents somewhat agreed that magazines (M = 3.55, SD = 1.10, Mdn = 4.00), the internet (M = 3.65, SD = .96, Mdn = 4.00), local agricultural retailers/service providers (other than veterinarian or extension office) (M = 3.62, SD = 1.07, Mdn = 4.00), the county extension agent (M = 4.17, SD = 1.02, Mdn = 4.00), livestock associations (M = 4.44, SD = .747, Mdn = 5.00), state land-grant institutions (universities) (M = 4.00, SD = 1.17, Mdn = 4.00), the USDA (M = 3.74, SD = 1.20, Mdn = 4.00), and other livestock producers (M = 3.96, SD = .823, Mdn = 4.00) are trustworthy. TSCRA respondents agree that the local or consulting veterinarian (M = 4.65, SD = .626, Mdn = 5.00) is a trustworthy source of animal health information.

Table 8
Perceived Trustworthy Sources of Information by TSCRA Members

	Level of Agreement %						
Information Sources	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	*M*	SD
Local or consulting veterinarian	.4	.4	4.5	22.3	72.3	4.65	.626
Livestock associations	1.1	.4	8	34.7	55.9	4.44	.747
County extension office	4.4	1.7	13.8	33.1	47.1	4.17	1.02
State land-grant institution	6.5	3.4	19.3	25.4	45.5	4	1.17
Other livestock producers	1.6	2.3	19.1	52.3	24.7	3.96	.823
USDA	6.6	4.5	23.2	31.4	32.3	3.74	1.20
Internet	3.8	6.7	27.2	45.8	16.5	3.65	.96
Local agricultural retailers/service providers	7.9	3.3	25.6	45.1	18.1	3.62	1.07
Magazine	8.3	7.2	21.9	46.4	16.1	3.55	1.10
High school agriculture science teacher	16.8	9.5	43.7	20.8	9.2	2.96	1.16
Radio news	20.1	16.1	35.4	23	5.4	2.78	1.17

Table 8
Continued

Information Sources	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	*M*	SD
Weekly newspaper	24.1	15.9	28.2	27	4.8	2.73	1.23
Television news	26.7	16.5	29.9	22.5	4.4	2.61	1.22
Daily newspaper	29.9	17.9	28.9	20.8	2.5	2.48	1.19

Preferred Formats of Animal Health Information

This subsection aims to identify the preferred format in which TSCRA members receive animal health information. A list of formats was provided for respondents to mark their level of agreement regarding their preferences. A five point Likert scale was used with disagree denoting the lowest level of agreement and agree marking the highest agreement level (see Table 9).

Following the listed formats provided on the questionnaire, a free response text box marked "other (please describe)" was offered for respondents to indentify formats that were not listed. Ten valid responses with multiple formats per response were recorded. Respondents identified educational presentations, seminars, trade shows, magazines, email, standard mail, internet subscriptions to various daily livestock reports, my vet and livestock association magazines, peer reviewed research and statistically significant clinical trials, professional journals, Texas Animal Health Commission emails, TSCRA, USDA newsletters, and vet visits supplemented by follow-up on websites in the free response text box in this subsection.

For the formats listed in the questionnaire, respondents disagreed on none of the preferred formats listed; however, they indicated a somewhat agreement level for television news ($M = 2.36$ $SD = 1.32$, $Mdn = 2.00$), Facebook ($M = 1.84$, $SD = 1.07$, $Mdn = 1.00$), Twitter ($M = 1.74$, $SD = .994$, $Mdn = 1.00$), blogs ($M = 1.85$, $SD = 1.05$, $Mdn =$

1.00), YouTube (*M* = 1.86, *SD* = 1.06, *Mdn* = 1.00), and RSS feeds (*M* = 2.19, *SD* = 1.15, *Mdn* = 2.00) as a preferred format. Respondents were neutral on radio news (*M* = 2.42, *SD* = 1.32, *Mdn* = 3.00), e-mail lists (*M* = 3.03, *SD* = 1.36, *Mdn* = 3.00), newspaper articles (*M* = 2.73, *SD* = 1.35, *Mdn* = 3.00), and e-mails (other than lists) (*M* = 3.08, *SD* = 1.33, *Mdn* = 3.00) as preferred formats to receive information.

Respondents indicated a somewhat agreement level for magazine articles (*M* = 3.70, *SD* = 1.12, *Mdn* = 4.00), newsletters (*M* = 4.04, *SD* = .984, *Mdn* = 4.00), websites (*M* = 3.75, *SD* = 1.11, *Mdn* = 4.00), standard mail (*M* = 3.8, *SD* = 1.1, *Mdn* = 4.00), county extension publications (*M* = 4.04, *SD* = 1.03, *Mdn* = 4.00), county extension meetings (*M* = 3.97, *SD* = 1.15, *Mdn* = 4.00), and livestock association meetings (*M* = 4.25, *SD* = 1.1, *Mdn* = 4.00). From the listed formats, the average TSCRA respondent indicated no high level of agreement for preferred formats to receive animal health information.

Table 9
Formats Preferred by TSCRA Members

	Level of Agreement %						
Formats	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	*M*	SD
Livestock association meetings	2.1	2.3	12.3	35.6	47.7	4.25	.906
County extension publications	4.5	2.5	16.5	37	39.5	4.04	1.03
Newsletter	4.8	1.7	13	46.4	34.2	4.04	.984
County extension meetings	6.6	3.4	17.8	30.7	41.5	3.97	1.15
Mail	6.6	3.1	24.1	36.8	29.5	3.8	1.1
Websites I find	8	3.8	18.1	45.6	24.5	3.75	1.11
Magazine articles	8.7	3.5	18.9	47.1	21.8	3.70	1.12
E-mail, other than lists	20.8	6.9	30.3	27.5	14.6	3.08	1.33
E-mail lists	23.8	6	27.9	28.5	13.8	3.03	1.36
Newspaper articles	29.4	10.7	25.6	25.6	8.6	2.73	1.35
Radio news	38.4	10.8	27.2	17.3	6.3	2.42	1.32

Table 9
Continued

Formats	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	*M*	SD
Television news	41.1	10.1	25.6	18	5.2	2.36	1.32
RSS feeds	42.7	7.9	39.1	7.9	2.4	2.19	1.15
You Tube	55.7	9.6	29.4	3.6	1.7	1.86	1.06
Blogs	55.2	10.6	29.1	3.8	1.3	1.85	1.05
Facebook	56.5	10.2	27.5	3.8	1.9	1.84	1.07
Twitter	60	9.8	27.6	1.1	1.5	1.74	.994

Findings Related to Noncommercial and Commercial TSCRA Members' Operations

To determine differences among noncommercial and commercial TSCRA members' operations in relation to the three constructs identified in this study, an analysis of variances was used to analyze the data. The one-way ANOVA, $F(1, 478) = 1.447$, $p = .230$, demonstrated that there were no statistically significant differences between noncommercial and commercial TSCRA members' operations and Construct 3) sources of animal health information sought. This was similar to TSCRA members' responses to Construct 2) barriers to adoption of protective actions with a one-way ANOVA, $F(1, 479) = .641$, $p = .424$, indicating no statistical difference.

Related to noncommercial and commercial TCSRA members' operations and perceived hazard to the Texas cattle industry from various threats, Construct 1, again, no statistically significant differences were found using the one-way ANOVA, $F(1, 478) = .111$, $p = .739$.

Findings Related to Number of Cattle Managed by TSCRA Members

To determine if a correlation exists between the number of cattle managed by TSCRA respondents and the three constructs indentified in this study, data were subjected to Pearson's Product Moment correlation analysis. Analysis of Construct 2, barriers to adoption of protective actions, and 3, information sources sought by TSCRA members, resulted in no significant correlation was found with correlations of .066 and -.051 respectively.

Construct 1, perceived hazard by threat, resulted in a weak positive correlation of .093 was indicated by Pearson's correlation analysis. This suggests TSCRA members

perceive increased threat to their animals when they manage or care for more animals. However, with a positive correlation of .093, this statistic is not strong evidence that TSCRA members actually perceive a higher level of threat for the more animals they manage.

Chapter Summary

The average TSCRA member who completed this questionnaire was a 58 year old (M = 58.93*;* SD = 11.617*)* white (n = 476) male (M = 1.14*,* SD = .352). On average, he had attained the education level of a bachelor's degree (M = 4.06, SD = 1.392) and was a member of at least one agricultural organization (M =1.06, SD = .243).

Livestock operations ranged in size from 0 to 275,000 head of cattle with an average of 1349 (M = 1349.91, SD = 13763.47) head. By definition, the majority of operations are noncommercial meaning the primary source of income is not from the sale of animals (M =1.80, SD = .397) and an average income of between $10,000 and $19,999 ($M$ = 4.18, SD = 1.624). Most respondents lived in the same location where they ran their operations (M = 1.44, SD = .497).

The average TSCRA member indicated that the Texas cattle industry is somewhat susceptible to disease outbreak (M = 4.03, SD = 1.007). In relation to types of operations, respondents perceived noncommercial (M = 2.45, SD = 1.078) and commercial (M = 2.52, SD = .993) operations to be at the same level of threat—guarded. Respondents felt similar regarding the different threats to the livestock industry, rating the identified threats of intentional introduction of a biological agent to the food supply chain (M = 2.31, SD = 1.041), unintentional introduction of a biological agent to the

food supply chain (*M* = 2.22, *SD* = .992), poor biosecurity practices used by livestock producers (*M* = 2.25, *SD* = .986) as guarded. However, the threat of lack of knowledge of infectious disease that threaten livestock (*M* = 2.60, *SD* = 1.051) was rated as elevated by respondent.

TSCRA members involved in this study indicated a belief that herds are susceptible to an animal disease outbreak (*M* = 1.45, *SD* = .498) and felt there is sufficient information about protecting their animals from disease (*M* = 1.38, *SD* = .486). Most producers reported to not have an implemented biosecurity plan (*M* = 1.74, *SD* = .437); however, respondents believed it is necessary to implement preventative biosecurity measures (*M* = 1.47, *SD* = .499). An overwhelming number (N=510) of respondents indicated the necessity of monitoring animals for clinical signs of disease (*M* = 1.04, *SD* = .203) and subsequently, respondents believed to have enough information regarding clinical signs of infectious diseases (*M* = 1.35, *SD* = .477). In producers' ability to protect animals, respondents indicated similar agreement levels (somewhat agree) in confidence in current preparedness levels (*M* = 3.62, *SD* = 1.062) and in ability to respond to a disease outbreak (*M* = 3.92, *SD* = 1.048).

Related to barriers to adoptions of protective actions, respondents indicated neutral agreement for all barriers listed in the questionnaire. However, ranked by means, a lack of information was ranked the highest as a barrier to adoption of protective actions (*M* = 2.96, *SD* = 1.21).

TSCRA members indicated information sources used regarding animal health issues. Respondents indicated that the internet (*M* = 4.13, *SD* = 1.02), local or

consulting veterinarians (*M* = 4.41, *SD* = .881), livestock associations (*M* = 4.37, *SD* = .873) were the most utilized sources of information as ranked by means.

Similarly, respondents perceived local or consulting veterinarians (*M* = 4.62, *SD* = .678), county extension offices (*M* = 4.08, *SD* = 1.08), and livestock associations (*M* = 4.41, *SD* = .751) to be most reliable sources of information ranked by means.

In this study, sources of information perceived to be trustworthy were identified my producers. Respondents indicated local or consulting veterinarian (*M* = 4.65, *SD* = .626), the county extension office (*M* = 4.17, *SD* = .747), livestock associations (*M* = 4.17, *SD* = 1.02), and state land-grant institutions (universities) (*M* = 4, *SD* = 1.17) to be most trustworthy compared to other listed sources as ranked by means.

Lastly for the descriptive objectives, respondents were asked to identify preferred formats to receive animal health information. TSCRA members who completed this section of the questionnaire indicated that county extension publications (*M* = 4.04, *SD* = 1.03), county extension meetings (*M* = 3.97, *SD* = 1.15), newsletters (*M* = 4.04, SD = .984) and livestock association meetings (*M* = 4.25, *SD* = .906) were most preferred formats ranked by means.

For objectives 5 and 6 investigating the differences among noncommercial and commercial TSCRA members as well as the differences among TSCRA members related to the number of animals managed, the only statically significant correlation that emerged was related to number of animals managed. This weak positive correlation of .093 give minimal evidence to suggest that the most animals TSCRA members managed, the higher threat perceived by that operator. Other than this statistic, when comparing the

identified construct to type of operation in objective 5 and number of animals managed in objective 6, no statistical differences emerged.

CHAPTER V

CONCLUSIONS, RECOMMENDATIONS, AND IMPLICATIONS

The agriculture and food infrastructure is vulnerable to many hazards due to its many levels of stakeholders and overall complexity (Spellman, 2008). Legislation from the early 2000s led to agriculture being placed on a list of critical infrastructures to be protected from unintentional and intentional hazards (HSPD-7, 2003; HSPD-8, 2004; Spellman, 2008). Biological hazards, such as disease epidemics, have negatively impacted domestic and global economies and led to social stigma placed on the affected industry further impacting economies with trade restrictions (Breitmeyer et al., 2004; USDA-APHIS, 2007; Horn and Breeze, 2006).

Producers are the first line of defense against biological hazards on their respective operations (Dement, 2008). Producers are responsible for several protective actions that could prevent or mitigate the likelihood of biological hazards affecting herds (Moats, 2007; Moore et al., 2008; USDA-APHIS, 2007). Several factors become relevant with the decision to take a protective action arises (Lindell & Perry, 2004). Related to the Protective Action Decision Model by Lindell and Perry (2004), producers will engage in an information seeking stage when making the decision to take a protective action. From this model, the objective of this study sought to measure several components related to the protective action decision process.

Statement of the Problem

The Nation's food supply chain is vulnerable to disease outbreak resulting in a potential disruption to consumers (Spellman, 2008). Texas and Southwestern Cattle

Raisers Association members receive critical animal health information and alerts from various information sources. It is necessary to determine TSCRA members' perceptions of biological hazards affecting the protective action decision process, or lack thereof, used when animal health information is disseminated. The results may be used by risk communicators in better developing preparedness programs and risk communication messages targeted livestock producers.

Significance of the Study

It has been the role of public and private organizations to deliver trustworthy animal health information to the public to maintain an acceptable level of preparedness for disease outbreak (Hardenbrook, 2005; Horn & Breeze, 2004; HSPD-7, 2003; HSPD-9, 2004; Kapucu, 2009; Senate Governmental Affairs committee, 2004). The livestock industry is in constant motion from producer to wholesaler to processor and so on (Spellman, 2008; Knowles, 2005). With so many stakeholders in agriculture and the food industry, in order to maintain this fluidity without disruption, organizations must use a multitude of information channels to reach their targeted audiences with information (USDA-APHIS, 2006; Spellman, 2008).

The challenge arises when an effort is made by a risk communicating organization to promote a protective action and attitudes or perceptions inhibit the protective action decision process (Lindell & Perry, 2004). By describing aspects of the protective action decision process as it relates to the protection of livestock by TSCRA members, emergency preparedness organizations will better understand how to focus

agriculture and food disaster educational efforts that may promote a positive behavioral change in other livestock producers.

Purpose and Objectives

The purpose of this study was to describe TSCRA members' perceptions of biological hazards affecting livestock, identifying sources of trusted animal health information and barriers to making hazard adjustments.

To accomplish the purpose of this study, six objectives were identified:

1. Describe TSCRA members' perceptions of vulnerability to animal related hazards
2. Describe TSCRA members' perceptions of biological hazards emergency preparedness
3. Describe barriers faced by TSCRA members to making hazard adjustments for biological hazards
4. Identify sources of information preferred by TSCRA members
5. Determine whether differences exist between noncommercial and commercial TSCRA members' use of animals health information, perception of hazard by threat, and barriers to adoption of protective actions
6. Determine if correlations exist between number of cattle managed by TSCRA members and use of animals health information, perception of hazard by threat, and barriers to adoption of protective actions

Methods and Procedures

The Texas and Southwestern Cattle Raisers Association (TSCRA) was instrumental in the success of this study. With permission and aided by TSCRA personnel, a target population of 7,661 producers was determined efficiently reachable through consensus between TSCRA and researchers. This population consisted of TSCRA members who utilized the ConstantContact® email system to maintain contact with the association.

An online survey questionnaire developed from previous research with a similar population served as the instrument to measure this study's objectives (Riley, 2007). Content of the survey was minimally modified to better align with the study's objectives based on expert opinion. Validity and reliability of the instrument were confirmed though previous research (Ashlock, 2006; Riley, 2007).

TSCRA members were initially contacted through the ConstantContact® email system, notified of the survey, and provided with a link to the survey site. Related to the procedures suggested by Dillman (2009), a second reminder email was sent after one week to members who had not responded to the initial email. Due to restrictions agreed upon by TSCRA and researchers prior to data collection, only a total of two emails were sent and the survey was closed one week after the first reminder email and after a target representative sample (n=367) was attained.

Data was analyzed using two statistical analysis methods. The first used descriptive statistics to find frequencies, percentages, means, and standard deviations in

the raw data. The second method included ANOVA and correlations to identify relationships in the data.

Summary of Findings

Findings Related to Demographics

The majority of respondents were white (N=476) males (85.5%) in his late 50s (M = 58.93, SD = 11.617) and not of Hispanic ethnicity (96.7%). Only 14.5% of respondents reported their gender as female. The majority of respondents had earned a bachelor's degree (41.3%, M = 4.06, SD = 1.392) declining drastically as the education levels progressed (Master's = 14.5%, Doctoral = 8.4%, Professional = 6.3%). A very high percentage (93.7%, M =1.06, SD = .243) of respondents reported memberships in at least one agricultural organization with the majority of these organizations being at the state and regional level (96.9%).

TSCRA members who completed this questionnaire held operations in 181 counties in Texas and several operations were reported in New Mexico and Oklahoma. Of these operations, the average herd size was 1349; however, herd sizes were reported to range from 0 to 275,000. Of these, the majority of respondents (80.5%, M =1.80, SD = .397) reported their primary source of income not generated from their operations identifying them as noncommercial. The average income (M = 4.18, SD = 1.624) for these operations was reported as between $10,000 and $19,999.

Findings for Objective 1: Perceptions of Vulnerability to Hazards

The average TSCRA respondent (M = 4.03, SD = 1.007) believed that the Texas cattle industry is somewhat susceptible to an animal disease outbreak. However, when

asked about susceptibility by operation type, respondents generally believed that noncommercial (M = 2.45, SD = 1.078) and commercial operations (M = 2.45, SD = 1.078) are equally susceptible rating them the second lowest threat level of guarded.

Respondents were asked to gauge the level of threat that certain factors have on susceptibility on operations. Though the average respondent selected a guarded threat level for the threats of intentional introduction of biological agent (M = 2.31, SD = 1.041), poor biosecurity practices by producers (M = 2.25, SD = .986), and unintentional introduction of infectious disease in the food supply chain (M = 2.22, SD = .992). For the threat of lack of knowledge of infectious diseases that threaten livestock, respondents found this to be an elevated level of threat (M = 2.60, SD = 1.051).

Findings for Objective 2: Perceptions of Emergency Preparedness

Related to preparedness, the average TSCRA respondent believes their individual operation is susceptible to an animal disease outbreak (M = 1.45, SD = .498); however, respondents (M = 1.38, SD = .486) indicated they believe they have enough information about protecting their animals from disease outbreak.

The average respondent (M = 1.38, SD = .437) did not have a biosecurity plan in place at the time of this questionnaire even though they believe it is a necessity to implement preventative biosecurity measures (M = 1.47, SD = .499).

An overwhelming majority (95.7%) of respondents believe it is necessary to monitor their animals for clinical signs of health problems (M = 1.04, SD = .203) relating to the majority (65.2%) feeling they have adequate information regarding infectious disease to sufficiently monitor herds (M = 1.35, SD = .477).

Respondents were asked to gauge their level of confidence in their operational preparedness to protect their animals and ability to respond to a disease event. The findings indicated that respondents were generally "somewhat" confident in both areas: preparedness to protect (M = 3.62, SD = 1.062) and ability to respond (M = 3.92, SD = 1.048).

Findings for Objective 3: Barriers to Adoption

Three barriers were presented that respondents were asked to gauge their level of agreement regarding adoption of protective actions. Though the average TSCRA respondent was neutral on all barriers, varying means emerged in which a lack of information as a barrier to the adoption of a protective action was ranked highest by means (M = 2.96, SD = 1.21).

Findings for Objective 4: Preferred Information Sources

Four areas related to information were measured in this study—information sources sought by producers, perceived reliable sources, perceived trustworthy sources, preferred format to receive information.

For animal health information sources sought by respondents, local or consulting veterinarians (M = 4.41, SD = .881), livestock associations (M = 4.37, SD = .873), and the internet (M = 4.13, SD = 1.02) were identified by most utilized sources of information ranked by means.

Respondents were asked to rate the most reliable sources of information regarding animal health issues. From this, the average TSCRA respondent identified local or consulting veterinarians (M = 4.62, SD = .678), livestock associations (M =

4.41, *SD* = .751), and county extension offices (*M* = 4.08, *SD* = 1.08) as the most reliable sources of information ranked by means.

Using the same list of information sources, researchers aimed to identify perceived trustworthy animal health information sources by TSCRA members. Researchers found respondents perceive local or consulting veterinarians (*M* = 4.65, *SD* = .626), livestock associations (*M* = 4.17, *SD* = 1.02), county extension offices (*M* = 4.44, *SD* = .747), and land-grant universities (*M* = 4, *SD* = 1.17) as the most trustworthy sources of information ranked by means.

Finally, respondents were provided a list of formats and instructed to identify the level of agreement regarding preferred format for each. Of the formats listed in the questionnaire, livestock association meetings (*M* = 3.97, *SD* = 1.15), county extension publications (*M* = 4.04, *SD* = 1.03), newsletters (*M* =4.04, *SD* = .984), and county extension meetings (*M* = 3.97, *SD* = 1.15), and were the preferred formats to receive animal health related information by the majority of respondents.

Findings for Objective 5: Differences between Noncommercial and Commercial

Three Constructs were identified to determine if differences existed between noncommercial and commercial TSCRA member operations. For the three Constructs of 1) perceived hazard by threat, 2) perceived barriers to adoption of protective actions, and 3) information sources sough for animal health, no statistical differences were found through subjecting the data to a one way ANOVA.

Findings for Objective 6: Relationship to Number of Cattle Managed

Using the three Constructs identified in this study, researchers subjected the data to Pearson's Product Moment correlation analysis. This resulted in a weak positive correlation of .093 for Construct 3, perceived hazard by threat. For Constructs 1 and 2, no statistical differences were found.

Conclusions

Conclusions Related to Demographics

Characteristics of TSCRA members in this study show similarities to producers in other states. In a study by Ashlock (2007), the average Oklahoma beef producer was male and was 59.5 years old.

This is consistent with a study by Riley (2007) with Kansas feedlot managers. Riley (2007) found a high percentage of respondents to be in their 50s and a majority having attained a bachelor's degree. Of these respondents, the majority were members of an agricultural association at the state or regional level (98.6%) (Riley, 2007).

Conclusions for Objective 1: Perceptions of Vulnerability to Hazards

Spellman (2008) identifies the United States food supply chain as vulnerable to disease outbreak consistent with TSCRA members' perceived outlook toward the Texas cattle industry. Ashlock (2007) and Riley (2007) found similar statistics in their studies with Kansas and Oklahoma producers. Like the respondents of this study, the respondents in Ashlock's (2007) study believed the Oklahoma cattle industry is susceptible to a biological hazard such as agroterroism. Similarly, Riley at al. (2007)

found that Kansas beef producers perceived their feedlots to be susceptible to an agroterrorism event.

Both Ashlock (2007) and Riley (2007) identified large operations as having a higher susceptibility rate due to more rapid rates of spread compared smaller operations. This was contrary to the findings of this study in that respondents rated both commercial and noncommercial operations as equal threat levels.

Ashlock (2007) and Riley (2007) measure susceptibility related to agroterrism meaning the intentional introduction of a biological agent into the food supply chain. While this study measures susceptibility related to biological hazards in general, the average respondent indicated a guarded threat level for agroterrorism events rating them the same threat level as unintentional biological hazards.

The threat of lack of knowledge about animal diseases to biological hazards was the only threat that the average TSCRA member identified as elevated threat level. Relating this to the Protective Action Decision Model, individuals who deem their knowledge or information insufficient in a particular hazard during the risk assessment stage may take several paths. They may perform an information needs assessment to gain more knowledge. They may also recall on previous experience on the hazard to gain more knowledge and seek appropriate protective actions. Another possibility is that the individual may decide to stop the protective action decision process in this stage due to a lack of knowledge and not take any further protective action.

Conclusions for Objective 2: Perceptions of Emergency Preparedness

This study found that the average respondent believed their own operation was susceptible to a disease outbreak consistent with Knowles et al. (2005) and Spellman (2008). Respondents also indicated that they had ample information to protect their operations. Both of these findings are contrary to the findings by Ashlock (2007) in Oklahoma producers. The results of this study more closely align with the findings in Riley (2007) in that Kansas feedlot managers believed their operations were susceptible and that they have adequate information to protect their against a terrorist attack aimed at the feedlot industry.

Moats (2007) and Spellman (2008) indicated that there are certain preparedness measures that should be utilized on operations to prevent of mitigate the impacts from a biological event in the agriculture and food infrastructure. These include surveillance, or monitoring, of herds for disease or unusual health symptoms and implementing biosecurity measures combined with disease preventative biosecurity practice implemented on operations (Faires, 2008; Moats, 2007; Moore et al., 2008; Spellman, 2008; USDA-APHIS, 2007).

The findings of this study indicate that while producers strongly feel it is necessary to monitor animals for disease and have utilized available information on the subject; however, they have not done the same for biosecurity measures even though they indicate it a necessity. This was contrary to the findings in Riley (2007) that indicated the majority of large scale feedlot operations in Kansas have varying degrees of a biosecurity plan implemented on their operations.

Related to confidence levels, the majority of producers in the Kansas and Oklahoma studies indicated they agree that they confident in the biosecurity measures on their operations leading to the protection on their animals (Ashlock, 2007; Riley 2007). Similar to this, respondents from this study indicated they somewhat agree that they are confident in their preparedness level to protect their animals in a disease event and ability to respond to an event.

Conclusions for Objective 3: Barriers to Adoption

A priority to the risk communication process is to influence a protective action in the receiver (Lindell & Perry, 2004). A major component of the protective action decision model proposed by Lindell and Perry (2004) is the information seeking stages. Of these, the information needs assessment allows individuals to make a judgment related to available information on a particular hazard (Lindell & Perry, 2004). From this, individuals may find information to be insufficient inhibiting advancement in the protective action decision process (Lindell & Perry, 2004).

Respondents to this study indicated a lack of information as a barrier to adoption of a protective action and ranked by means, this barrier emerged higher than the others. Though this barrier was not rated very high in level of agreement, it likely influences TCSRA producers' decision to take protective actions related to their operations as indicated by the protective action decision model.

Conclusions for Objective 4: Perceived Information Sources

The perception of credibility can lead to increase complicate with the protective action decision model (Lindell & Perry, 2004). By identifying creditable sources, risk

communication will be more efficient (Kasperson & Stallen, 1991). Local or consulting veterinarians were rated highly among preferred information source, reliable information source, and trustworthy information source by respondents in this study. This was consentient with the findings by Ashlock (2006) and Riley (2007) in that Oklahoma and Kansas producers indicated veterinarians as the preferred information source when seeking information related to animal health issues. Similarly, Ashlock (2006) and Riley (2007) found veterinarians to be rated most reliable and trustworthy source of information consistent with the findings in this study with Texas producers as ranked by means.

Several researchers found the federal government to be the least trusted among sources of information by individuals and the trust levels have eroded greatly over the past 30 years (Dunaway & Shaw, 2010; Peters et al., 1997; Rosati & Saba, 2010). However, the average TSCRA member indicated they somewhat agree the USDA is a trustworthy source of information ranking the federal department in the top six sources as ranked by means.

Livestock associations were in the top levels of agreement by the average TSCRA respondent as preferred sources of information, trustworthy sources, and reliable sources in this study. This is contrary to perceptions by Oklahoma producers rating breed associations as neutral in trustworthiness and reliability (Ashlock, 2006). However, the findings related to TSCRA members are consistent with those found in Kansas (Riley, 2007). Although Kansas producers did not rate livestock associations the highest level of agreement in trustworthiness and reliability, they did perceive this

source the second highest level of agreement in trustworthiness and reliability (Riley, 2007). The internet was also highly agreed upon by TSCRA respondents as a preferred source similar to producers in Oklahoma, ranking the internet as the third highest preferred source on information by means (Ashlock, 2006).

The average TSCRA member who completed this questionnaire believed county extension offices to be a reliable and trustworthy source of information. This is consistent with Oklahoma producers' perception of county extension as a trustworthy and reliable source of information (Ashlock, 2006). However, with Kansas producers, Riley (2007) found the majority of respondents rated county extension as trustworthy, but felt neutral in reliability.

TSCRA members prefer to receive information in the format of county extension publications, county extension meetings, newsletters, and livestock association meetings as ranked by means. Riley (2007) found county extension meetings to be in the top four most preferred formats for Kansas producers. Livestock associations rated in the top two preferred formats among Kansas producers, similar to findings in Texas producers (Riley, 2007).

Conclusions for Objective 5: Differences between Noncommercial and Commercial

When analyzed for statistical differences among TSCRA noncommercial and commercial members' operations against the three Constructs, no statistical differences emerged. Ashlock (2006) and Riley (2007) found in their studies that commercial operations where perceived to be more susceptible to an agroterrorism event due to their size and complexity when compared to smaller hobby operations. TSCRA operations

exhibited no differences between noncommercial and commercial in perceived hazard by threat, barriers to protective action adoption, and information sources sought for animal health issues.

This suggests that TSCRA operations, regardless of type, identify Construct 1, perceived hazard by threat, similarly in the first stage of the PADM model risk assessment. Too, TSCRA operations identify Construct 2, barriers, in the protective action assessment stage and Construct 3, seek information, in the information seeking stages of the PADM model similarly regardless of the type of operation they run.

Conclusions for Objective 6: Relationship to Number of Cattle Managed

The three Constructs were analyzed against the data in a correlation analysis to identify any relationships to the number of cattle owned by TSCRA members. No statistical differences were found in Constructs 2 and 3 suggesting that regardless of how many cattle a TSCRA member manages, they perceive barriers to adoption of protective action and seek information about animal health issues similarly. However, a weak positive correlation was found in relation to Construct 1, perceive hazard by threat. This weakly suggests that TSCRA members perceive a higher level of threat in relation to the more animals they manage.

This affects how TSCRA members would act in the first stage of the PADM model. A TSCRA member who manages fewer animals may not identify a risk, or hazard, after completing the predecisional processes, thus negatively impacting the rest of the protective action decision process. Whereas, a TSCRA member who manages

more animals, may quickly identify risk and proceed through the other stages of the PADM model.

Recommendations for Practitioners

Texas producers seem to agree that they possess sufficient information to protect their herds from a biological hazard, yet, implementation of protective actions was found to be minimal. The characteristics of the study's population likely contributed to this finding as the majority of the respondents were noncommercial in type. Whereas, commercial operations are more likely to have a formal biosecurity plan in place. However, it was found that noncommercial and commercial TSCRA operations do not perceive hazards by threat differently; therefore, programs should be developed with the last two stages of the protective action decision model considered—protective action assessment and protective action implementation. For operations with large number of animals, programs with a focus not on the first stage of the PADM, but on the later stages should be developed and delivered. Whereas, educational programs on the first stage of the model in the different hazards and implications of each should be developed and delivered to TSCRA members with fewer animals.

The data suggests that members believe biosecurity practices are necessary but may not know how or what to implement on their operations and with a lack of knowledge in animal disease found in respondents, information regarding protective implementation should be targeted to this population.

Programs using state and national information of on-farm biosecurity practices should be developed and marketed by local veterinarians, county extension offices, and

livestock associations to the communities they serve. These sources of information were found to be credible by TSCRA members and the development of an educational network using these sources would be beneficial at community levels. Veterinarians and county extension offices may conduct assessments at the local level, to gain an understanding of how to better protect operations on an individual basis as part of the overall educational program. Using a combination of face-to-face meetings and educational publications/newsletters may be the best format to deliver these programs or pertinent animal health information as suggested by the data.

It is also recommended that veterinarians, county extension personnel, and livestock association personnel actively engage in train-the-trainer programs to gain the most recent and relevant information regarding agricultural vulnerability. By gaining this knowledge, these local and regional opinion leaders will better be able to convey a consistent preparedness message to producers.

Recommendations for Future Research

Producers are the first line of defense from a disease epidemic event (Dement, 2008). Producers vary in type and demographics. For this study, producers were identified in two categories—noncommercial and commercial. Though both stakeholders have a similar goal—protection of their animals, targeting educational programs to these groups may differ.

Further research should be conducted indentifying solely the noncommercial producer subgroup as a target population without the bias of membership in state or regional livestock association. It may be difficult to efficiently collect data from this

group and maintain a representative sample for the population; however, by identifying the objectives of this study in a nonaffiliated noncommercial subgroup, organizations will better understand how to design biological hazard preparedness educational programs target to this population.

This study may be replicated with producers, in general, without known affiliation to a livestock association. All respondents in this study were members of the Texas and Southwestern Cattle Raisers Association creating a possible bias to this association.

Implications

The Foreign Animal and Zoonotic Disease Defense Center identifies noncommercial livestock and poultry owners as the most difficult population to reach with critical animal health information (Vestal & Degenhart, 2010). The majority of respondents to this study identified themselves as noncommercial livestock producers and also identified themselves as susceptible to biological hazards.

A major component of risk communication is influencing a protective action in the receiver of the message. Yet, according to the findings in this study, producers perceive themselves to have sufficient information to protect their animals, but fail to implement biosecurity plans on their operations even though they see these preventative measures as a necessity. This lack of adoption with sufficient information supports the Moore et al. (2008) study citing an abundance of literature related to biological hazards often overwhelming and confusing individuals seeking information.

However, Texas producers do report to monitor their animals for disease or unusual health symptoms. This could lead to rapid reporting of a potential foreign animal disease resulting in an early detection and eradication of the hazard (Faries, 2008). However, surveillance is only a response to mechanism for producers to a potentially highly infectious disease that is already in the herd. Without, the proactive implementation of preventative biosecurity practices on the operations, producers will inevitably loose livestock in a biological disease event.

It is likely the barrier to adoption of protective actions of "lack of information," as indicated by respondents, has negatively impacted the implementation stage of the protective action decision process.

In the information seeking stages of the protective action decision model, individuals must identify credible information sources to determine if protective action is necessary (Lindell & Perry, 2004). Like Kansas and Oklahoma producers, Texas producers perceive information from veterinarians as trustworthy and reliable (Ashlock, 2006; Riley, 2007). Livestock associations and county extension offices are also held in high regard as viable animal health information sources for Texas producers. Utilizing the preferred format of publications and meeting, these sources must target noncommercial producers in educational programs related to biological hazards.

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APPENDIX A

IRB APPROVAL

TEXAS A&M UNIVERSITY
DIVISION OF RESEARCH AND GRADUATE STUDIES - OFFICE OF RESEARCH COMPLIANCE

1186 TAMU, General Services Complex
College Station, TX 77843-1186
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Human Subjects Protection Program — Institutional Review Board

DATE:	30-Mar-2011
MEMORANDUM	
TO:	ALLEN, PATRICK RYAN 77843-3578
FROM:	Office of Research Compliance Institutional Review Board
SUBJECT:	Initial Review

Protocol Number:	2011-0223
Title:	Texas Livestock Producers' Agricultural Vulnerability Perceptions and Preparedness
Review Category:	Exempt from IRB Review

It has been determined that the referenced protocol application meets the criteria for exemption and no further review is required. However, any amendment or modification to the protocol must be reported to the IRB and reviewed before being implemented to ensure the protocol still meets the criteria for exemption.

This determination was based on the following Code of Federal Regulations:
(http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.htm)

45 CFR 46.101(b)(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior, unless: (a) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (b) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

APPENDIX B

SURVEY INSTRUMENT

Texas livestock producers' perceptions of biosecurity vulnerability and

Vulnerability in the Texas cattle industry

The following questions ask about your perceptions of whether disease outbreaks could occur in the Texas cattle industry and about potential sources of disease outbreaks. Please select the answer choice for each question that best describes your views.

The Texas cattle industry is susceptible to an animal disease outbreak.

- ◯ Disagree
- ◯ Somewhat disagree
- ◯ Neutral
- ◯ Somewhat agree
- ◯ Agree

In your opinion, what is the level of susceptibility for the following types of operations?

Noncommercial livestock operations are defined as livestock operations whose owners' primary sources of income are not from profits received from buying and selling their animals.

	Low	Guarded	Elevated	High	Severe
Noncommercial/hobby livestock herds	◯	◯	◯	◯	◯
Commercial livestock	◯	◯	◯	◯	◯

What level of threat do you see each of the following posing to the Texas cattle industry?

	Low	Guarded	Elevated	High	Severe
Intentional introduction of a biological agent to the food supply chain	◯	◯	◯	◯	◯
Unintentional introduction of an infectious disease to the food supply chain	◯	◯	◯	◯	◯
Poor biosecurity practices used by livestock producers	◯	◯	◯	◯	◯
Lack of knowledge of infectious diseases that threaten livestock	◯	◯	◯	◯	◯

Preparedness in the Texas cattle industry

The following questions are related to the health and biosecurity of your herd. Please select the answer choice for each question that best describes your views.

Texas livestock producers' perceptions of biosecurity vulnerability and

For the following questions, please mark Yes or No.

	Yes	No
Do you believe your herd is susceptible to an animal disease outbreak?	◯	◯
Do you believe you have enough information about protecting your animals from a disease outbreak?	◯	◯
Do you have a biosecurity plan on site for your operation?	◯	◯
Do you believe it is necessary to implement preventive biosecurity measures at the place you keep your animals?	◯	◯
Do you believe it is necessary to monitor your animals for clinical signs of health problems?	◯	◯
Do you believe you have enough information regarding the clinical signs of infectious diseases to monitor your herd for unusual health symptoms?	◯	◯

For the following questions, please mark your level of agreement.

	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree
I am confident in my preparedness to protect my animals in the event of a livestock disease outbreak.	◯	◯	◯	◯	◯
I am confident in my ability to respond to a disease outbreak in my herd.	◯	◯	◯	◯	◯

I have encountered the following barriers in making decisions to protect my animals from a disease outbreak.

	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree
Lack of information	◯	◯	◯	◯	◯
Lack of resources (e.g., capital)	◯	◯	◯	◯	◯
Lack of infrastructure	◯	◯	◯	◯	◯

Information about animal health issues

The following questions are related to how you gather information about animal health issues. Please select the answer choice for each question that best describes your views.

Texas livestock producers' perceptions of biosecurity vulnerability and

I seek information about animal health issues from the following sources.

	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree
Daily newspaper	◯	◯	◯	◯	◯
Weekly newspaper	◯	◯	◯	◯	◯
Magazine	◯	◯	◯	◯	◯
Radio news	◯	◯	◯	◯	◯
Television news	◯	◯	◯	◯	◯
Internet	◯	◯	◯	◯	◯
Local or consulting veterinarian	◯	◯	◯	◯	◯
County extension office	◯	◯	◯	◯	◯
High school agricultural science teacher	◯	◯	◯	◯	◯
Local agricultural retailers/service providers, other than veterinarian or extension office	◯	◯	◯	◯	◯
Other livestock producers	◯	◯	◯	◯	◯
Livestock associations	◯	◯	◯	◯	◯
State land-grant institution (university)	◯	◯	◯	◯	◯
USDA	◯	◯	◯	◯	◯

Other (please describe)

Texas livestock producers' perceptions of biosecurity vulnerability and

I consider the following sources of information about animal health issues to be reliable.

Reliable is defined as providing consistent and well-balanced information.

	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree
Daily newspaper	◯	◯	◯	◯	◯
Weekly newspaper	◯	◯	◯	◯	◯
Magazine	◯	◯	◯	◯	◯
Radio news	◯	◯	◯	◯	◯
Television news	◯	◯	◯	◯	◯
Internet	◯	◯	◯	◯	◯
Local or consulting veterinarian	◯	◯	◯	◯	◯
County extension office	◯	◯	◯	◯	◯
High school agricultural science teacher	◯	◯	◯	◯	◯
Local agricultural retailers/service providers, other than veterinarian or extension office	◯	◯	◯	◯	◯
Other livestock producers	◯	◯	◯	◯	◯
Livestock associations	◯	◯	◯	◯	◯
State land-grant institution (university)	◯	◯	◯	◯	◯
USDA	◯	◯	◯	◯	◯

Other (please describe)

Information about animal health issues

The following questions are related to how you gather information about animal health issues. Please select the answer choice for each question that best describes your views.

Texas livestock producers' perceptions of biosecurity vulnerability and

I consider the following sources of information about animal health issues to be trustworthy.

Trustworthy refers to your level of belief in the information provided by the sources.

	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree
Daily newspaper	◯	◯	◯	◯	◯
Weekly newspaper	◯	◯	◯	◯	◯
Magazine	◯	◯	◯	◯	◯
Radio news	◯	◯	◯	◯	◯
Television news	◯	◯	◯	◯	◯
Internet	◯	◯	◯	◯	◯
Local or consulting veterinarian	◯	◯	◯	◯	◯
County extension office	◯	◯	◯	◯	◯
High school agricultural science teacher	◯	◯	◯	◯	◯
Local agricultural retailers/service providers, other than veterinarian or extension office	◯	◯	◯	◯	◯
Other livestock producers	◯	◯	◯	◯	◯
Livestock associations	◯	◯	◯	◯	◯
State land-grant institution (university)	◯	◯	◯	◯	◯
USDA	◯	◯	◯	◯	◯

Other (please describe)

Texas livestock producers' perceptions of biosecurity vulnerability and

I prefer to receive information about animal health issues in the following formats.

	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree
Television news	◯	◯	◯	◯	◯
Radio news	◯	◯	◯	◯	◯
Newspaper articles	◯	◯	◯	◯	◯
Magazine articles	◯	◯	◯	◯	◯
Newsletter	◯	◯	◯	◯	◯
Websites I find	◯	◯	◯	◯	◯
Facebook	◯	◯	◯	◯	◯
Twitter	◯	◯	◯	◯	◯
Blogs	◯	◯	◯	◯	◯
You Tube	◯	◯	◯	◯	◯
RSS feeds	◯	◯	◯	◯	◯
E-mail lists	◯	◯	◯	◯	◯
E-mail, other than lists	◯	◯	◯	◯	◯
County extension publications	◯	◯	◯	◯	◯
County extension meetings	◯	◯	◯	◯	◯
Livestock association meetings	◯	◯	◯	◯	◯
Mail	◯	◯	◯	◯	◯

Other (please describe)

Demographic information

The following questions ask for basic information about you. This information will be used to classify the answers you have provided throughout this survey but cannot be used to identify you.

What is your age?

Age

What is your gender?

◯ Male

◯ Female

Texas livestock producers' perceptions of biosecurity vulnerability and

What is your race? (Mark all that apply.)

- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ White
- ☐ Other race

What is your ethnicity?

- ○ Hispanic or Latino
- ○ Not Hispanic or Latino

What is the highest level of education you have achieved?

- ○ Below high school
- ○ High school
- ○ Associate degree
- ○ Bachelor's degree
- ○ Master's degree
- ○ Professional degree
- ○ Doctoral degree

Demographic information

The following questions ask for basic information about you. This information will be used to classify the answers you have provided throughout this survey but cannot be used to identify you.

At any one time, what is the largest number of cattle you are responsible for?

Number of cattle ☐

Are profits from the sale of your livestock your primary source of income?

- ○ Yes
- ○ No

Texas livestock producers' perceptions of biosecurity vulnerability and

In 2010, the income I earned from the sale of my animals was:

- ◯ Less than $1,000
- ◯ $1,000 to $4,999
- ◯ $5,000 to $9,999
- ◯ $10,000 to $19,999
- ◯ $20,000 to $49,999
- ◯ $50,000 or more

In what county is your operation?

Is your operation in the same location as your primary residence?

- ◯ Yes
- ◯ No

Are you a member of any local, regional, state, or national organizations related to the agriculture industry?

- ◯ Yes
- ◯ No

If yes, which ones?

APPENDIX C

INTRODUCTION EMAIL

To: Texas and Southwestern Cattle Raisers Association member
Subject: Texas cattle industry biosecurity survey

Dear TSCRA member:

As a livestock producer in Texas, you can give valuable feedback that will provide insights about how producers can better prepare for animal health issues. Your views about susceptibility to and preparedness for animal health issues in your livestock are essential in creating programs and resources that will help producers be better prepared for such events. The knowledge you can provide is vital in the protection and continuity of our food supply, as well as the well-being of the citizens of Texas and the nation.

The primary purpose of this study, "Texas livestock producers' perceptions of biosecurity vulnerability and preparedness," is to ensure emergency preparedness organizations accurately understand the needs and perceptions of Texas cattle producers in the protection of their animals. The Texas and Southwestern Cattle Raisers Association and Texas A&M University have assisted in the preparations for this study. A report about the results will be shared with the association so that your views may be incorporated into future resources.

This survey will take approximately 15 minutes to complete. Please respond to the questions based on your knowledge and perceptions. You will be able to access the survey one time from your computer. If you are not able to access the online survey or prefer a printed version of the survey, please e-mail Patrick Allen at pallen@aged.tamu.edu or call him at 979-862-7650.

By clicking the link below, you are giving your consent to participate in this study. To access the online survey, please use your Internet browser of choice and go to:

[Survey Link]

Your responses are completely voluntary and will be treated confidentially. Responses to this survey will be stored in an online, password-protected account until the survey is closed and then will be stored on a password-protected spreadsheet on the researcher's computer.

You may choose to withdraw from the survey at any time without penalty. The risks associated with this project are not greater than those ordinarily encountered in daily life.

Thank you for taking your valuable time to complete this survey. If you have any questions, please contact Patrick Allen at 979-862-7650 or Dr. Traci Naile at 979-458-3705. This research study has been reviewed by the Human Subjects' Protection Program at Texas A&M University. For research-related problems or questions

regarding your rights as a research participant, you can contact these offices at 979-458-4067 or irb@tamu.edu.

Sincerely,

Patrick Allen
Graduate Assistant
Department of Agricultural Leadership, Education and Communications
Texas A&M University

Please note: If you do not wish to receive further emails about this study, please click the link below, and you will be automatically removed from our mailing list.
[RemoveLink]

APPENDIX D

REMINDER EMAIL

To: Texas and Southwestern Cattle Raisers Association member
Subject: Texas cattle industry biosecurity survey reminder

Dear TSCRA member:

Just a friendly reminder that we need your insights! A week ago, you received a link to an online survey that will help us learn about your perceptions about health issues that could impact your animals. The results of this study will help emergency preparedness organizations understand the needs of Texas cattle producers and provide educational resources that meet those needs.

This survey will take approximately 15 minutes to complete and is available only until **XXX**. Please respond to the questions in terms of your knowledge and perceptions. Your responses are voluntary and will be treated confidentially.

You will be able to access the survey one time from your computer. If you are not able to access the online survey or prefer a printed version of the survey, please email Patrick Allen at pallen@aged.tamu.edu or call him at 979-862-7650.

To access the online survey, please use your Internet browser of choice and go to:

[Survey Link]

Your immediate response is greatly appreciated.

Thank you for taking your valuable time to complete this survey. If you have any questions, please contact Patrick Allen at 979-862-7650 or Dr. Traci Naile at 979-458-3705. This research study has been reviewed by the Human Subjects' Protection Program at Texas A&M University. For research-related problems or questions regarding your rights as a research participant, you can contact these offices at 979-458-4067 or irb@tamu.edu.

Sincerely,

Patrick Allen
Graduate Assistant
Department of Agricultural Leadership, Education and Communications
Texas A&M University

Please note: If you do not wish to receive further emails about this study, please click the link below, and you will be automatically removed from our mailing list.
[RemoveLink]

VITA

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