AN ASSESSMENT OF AWARENESS AND KNOWLEDGE OF ZOONOTIC DISEASES BY AGRICULTURAL SCIENCE TEACHERS, 4-H AND YOUTH DEVELOPMENT EXTENSION AGENTS, AND AGRICULTURAL AND NATURAL RESOURCE EXTENSION AGENTS

A Dissertation

by

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DOCTOR OF PHILOSOPHY

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ABSTRACT

The purpose of this study was to assess the knowledge and awareness of agriculture science teachers, 4-H and youth development and agricultural and natural resource extension agents about zoonotic diseases. A needs assessment was conducted to assist in determining if agricultural science teachers, agricultural and natural resource agents, and agricultural extension agents were aware of and could identify zoonotic diseases, and whether they had received training or professional development regarding zoonotic diseases. Descriptive survey methodology and comparative analyses were used. The dependent variable was knowledge of zoonotic diseases. For the purpose of this study, knowledge of zoonotic diseases was limited to the prevention, detection, and control of the spread of zoonotic diseases. The target population of this study included agricultural science teachers, agricultural and natural resource agents, and 4-H and youth development agents in the state of Texas. A response rate of 66% (N=344) was achieved using an online survey.

In general, participants had not received training or taken a course about zoonotic diseases. They were not confident regarding their understanding of ways to reduce diseases that can occur with animal contact, and they were not very aware of information, from any source, about zoonotic diseases. Interestingly, participants identified themselves as having the educational responsibility for teaching youth about zoonotic diseases. Recommendations emerging from these findings included training/professional development for 4-H and youth development and agricultural and natural resource extension agents, and course work for agricultural science teachers. Several courses and trainings that are readily available are the North Carolina Institute for Public Health course, *Zoonotic Diseases and Public Health,* and the zoonotic disease curriculum for K-12 classrooms produced by the Foreign Animal

Zoonotic Disease Center. To increase the confidence level of extension agents and agricultural science teachers about zoonotic diseases and increase the percent of extension agents and animal science teachers who receive information about zoonotic diseases.

DEDICATION

Glory to the Lord. This is dedicated to my supportive fan and loving husband, Tim. I never would have been able to make it this far without you, and you are the reason I am where I am today.

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I would like to thank my committee members, Dr. John Rayfield, Dr. Tim Murphy, Dr. Robert Strong, and Dr. Chris Skaggs, for their guidance and support throughout the course of this research.

I am so thankful and blessed to have had these mentors assist me throughout this endeavor. As I started the Doc @ Distance program, I was unsure what my project would be and who would be my committee chair. I knew that I wanted a faculty member in College Station who would challenge me and force me to take the "bull by the horns." When I first met with Dr. Rayfield, we discovered that we had acquaintances in common and that we had a lot of the same interest in, and passion for, agriculture and youth. Therefore, it was only natural that I ask him to be my committee chair. Throughout this process, he has been there for every step—and I got what I asked for when I wanted someone who would challenge me! He has pushed me and encouraged me throughout, and I could not be more thankful for his mentorship and guidance. Toward the end of my program, Dr. Rayfield moved on to another university and handed the reins to Dr. Murphy. I believe that Dr. Murphy allowed to me fulfill my goals while still guiding me in the right direction.

I believe that for graduate students there is always a support system of family and friends. I am lucky to say that both my family and friends have been supportive throughout this process and been forgiving for all the times I could not attend gatherings. To my husband, Timothy: There are no words to express my gratitude for everything you have done (and not gotten to do) because of my passion for education.

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This work was supervised by a dissertation committee consisting of Professor(s) Dr. Timothy Murphy and Dr. Robert Strong of the Department of Agriculture Leadership, Education and Communication at Texas A&M University, and Professor(s) Dr. John Rayfield of the Department of Agricultural Education and Communications at Texas Tech University and Dr. Chris Skaggs of the Department of Animal Science at Texas A&M.

All work for the dissertation was completed by the student, under the advisement of Dr. Timothy Murphy of the Department of Agricultural Leadership, Education and Communication at Texas A&M.

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CHAPTER I

INTRODUCTION

Background of the Study

Zoonotic and infectious diseases comprise 29 of the 96 chief causes of human morbidity and mortality as listed by the World Health Organization (WHO) and the World Bank, and account for 25% of deaths (or more than 14 million deaths) annually around the world (Murray & Lopez, 1994; WHO, 2000). According to the Centers for Disease Control and Prevention (CDC), "a zoonotic disease is a disease that can be passed between animal and humans. Zoonotic diseases can be caused by viruses, bacteria, parasites, and fungi" (CDC, 2016, para. 1). Taylor, Latham, and Woolhouse (2001) reported that 61% of organisms that are known to be pathogenic to humans are zoonotic, and that 75% of newly emerging human pathogens are zoonotic. Multiple studies have found that the potential for a large-scale zoonotic disease outbreak in the United States would have a significant economic impact on commercial agriculture, as well as devastating human and animal life (Paarlberg, Seitzinger, Lee, & Matthews, 2008; Pederson et al., 2004; Chalk, 2003).

One priority in the United States Health and Human Services (USHHS) Framework for Preventing Infectious Diseases was the "prevention, detection, and control of the spread of zoonotic diseases" (USHHS, 2011, pp. 1). The CDC Framework includes a plan for improving education for the public. The USHHS have identified, as a high priority, methods used to prevent infections from spreading outside of areas related to animal agriculture. A long-standing goal of the United States Department of Agriculture (USDA) is the safeguarding of the animal production industry from intentional or accidental outbreaks of animal diseases (Animal and Plant Health Inspection Service, 1998, 2010).

Coufal (2007) found that 89,839 youth livestock projects were entered in Texas, and that there was an overall increase of 7.06% in market livestock projects in the state between 2000 and 2006. Given this and the fact that 75% of new pathogens are zoonotic in nature, the need to address the threat of a disease outbreak through educational methods is apparent. In Texas, 4-H and Future Farmers of America (FFA) programs are staples in the agriculture community, overseeing youth livestock projects, and county and state shows. According to the Texas State 4-H program (2015), more than 55,000 Texas youth are enrolled in 4-H community clubs in Texas. Another 600,000 Texas youth are involved in 4-H through special educational opportunities at school, in after-school programs, or at neighborhood or youth centers. The *Texas FFA Fact Sheet* (2015) reported 104,000 members for 2014, making it the largest FFA state association in the United States. The purpose of this study was to assess the knowledge, awareness and examine the differences, if any exist, between 4-H and youth development and agriculture and natural science extension agents, and agriculture science teachers on variables related to detecting, preventing, and controlling zoonotic diseases.

Statement of the Problem

Agricultural science teachers, 4-H and youth development extension agents, and agricultural and natural resource extension agents work to meet the needs of youth in youth livestock project endeavors. Agricultural science teachers and county extension agents seek to educate youth about zoonotic diseases, but resources for these programs are limited (Domestic One Health Activities, 2013). This situation has negatively affected the ability of the youth who show livestock, members of the public who attend livestock shows, and the livestock industry as a whole, to respond to potential and actual zoonotic disease outbreaks (Bryner, 2012). Limited educational resources for youth, and inadequate response to

potential and actual outbreaks, could damage the livestock show industry and the communities in which the shows are conducted.

Bender, Shulman, and the Animals in Public Contact organization (2004), identified 11 publications that described zoonotic disease outbreaks at petting zoos, farms, zoological parks, and livestock shows. A survey of public health veterinarians yielded an additional 16 zoonotic disease outbreaks that were never reported to the CDC (Bender and Shulman, 2004).

In 2015, four northwestern states cancelled poultry shows due to avian influenza outbreaks, according to the Wisconsin Junior Poultry Association (WJPA, 2015). Wisconsin experienced outbreaks in Jefferson, Chippewa, Barron, and Juneau counties. All shows in Minnesota, including county fairs and the State Fair, were canceled, and the Iowa Department of Agriculture and Land Stewardship canceled all live bird exhibitions in that state (WJPA, 2015). In the summer of 2015, there was an outbreak of avian influenza in Ohio. The Ohio 4-H program supported the Ohio Department of Agriculture's decision to cancel all live bird exhibitions at the county level and at independent fairs across the state, which was announced June 2, 2015, by Iowa Agriculture Director David Daniels (Espinoza, 2015). In the spring of 2017, an avian flu outbreak was reported in bird flocks in Alabama and Tennessee. On March 15, 2017, the State of Alabama's Department of Agriculture and Industries Commissioner, John McMillan, suspended all poultry exhibitions and bird sales until further notice (Owens, 2017) following confirmation of avian influenza in Tennessee, and the launch of three investigations into possible cases in Madison, Jackson, and Lauderdale counties. The state veterinarian for Ohio, Dr. Tony Forshey, recommended that exhibitions in that state not accept birds from Tennessee, Kentucky, Alabama, and Wisconsin

to protect the health of the birds in the state of Ohio (Poultryshowcentral.com, 2017). These statewide outbreaks are tied closely to our youth programs exhibiting livestock projects through 4-H and FFA programs.

Statewide livestock shows can last around three weeks, and draw attendees from across the state, country, and world. The economic impact of the Houston Livestock Show and Rodeo is impressive, increasing gross sales in the region "by nearly a half billion dollars [and] regional output is $320 million higher" (Smith, 2010, p. 4). For example, sales at the 2010 Houston Livestock Show and Rodeo (HLSR) reached $500 million, increasing regional economic output by $320 million, and regional personal income by more than $290 million (Smith, 2010). The HLSR also set a world record that year with 1,264,074 paid rodeo attendees, and 2,144,077 regular attendees who viewed 27,013 youth livestock entries (Smith, 2010). By comparison, the economic impact of the National Western Stock Show in Denver, Colorado, was approximately $100 million that in 2010 (National Western Stock Show, 2010). The Denver Gazette and the National Western Stock Show reported that the 2017 Stock Show had an economic impact of nearly $100 million (Mulson, 2017). This increase in tourism brings the host city an economic boost, but also an increased probability of a zoonotic disease outbreak. The economic impact of youth livestock exhibitions that benefits communities across the country could be threatened by zoonotic disease outbreaks.

Need for the Study

LeJeune and Davis (2004) estimated that annually, more than 125 million people attend livestock shows and visit petting zoos in the United States. A recent survey of 9,000 United States citizens found that 2% of respondents had visited an animal exhibit in the last five to seven days (Shiferraw et al., 2000). The researchers generalized the data to the United

States population to suggest that almost six million people regularly attended animal exhibits, creating a high risk of exposure to zoonotic diseases and underscoring the need for education about zoonotic diseases to youth and the public who participate in or attend livestock exhibitions. Zoonotic diseases are not confined to the United States. Snedeker, Anderson, Sargeant, and Weese (2012) found a need for the public to be educated through the Canadian Public Health Inspectors (PHI); the inspectors who participated in the study stated that their training in the area of zoonotic diseases was deficient. The inspectors rated their continuing education as fair and stated that it needed improvement. The PHI also recorded continuing education as an area needing improvement in both quality and quantity.

Carpenter, Christiansen, Dickey, and Thunes (2007) concluded that "fairs and livestock exhibitions are also an ideal venue to educate livestock exhibitors about biosecurity practices, just as state fairs have been used to educate the public on emergency planning for terrorist attacks and infectious disease outbreaks" (p. 23). These findings support the need for zoonotic disease awareness throughout livestock exhibitions.

Bender and Shulman (2004) concluded that

> recent outbreaks of zoonotic diseases associated with contact with animals in exhibition venues highlight concerns for disease transmission to public visitors. Only a handful of states have written guidelines for preventing zoonotic disease transmission in animal exhibition venues, and published recommendations currently available focus on preventing enteric diseases and largely do not address other zoonotic diseases or prevention of bite wounds" (Discussion section, para. 1).

These studies highlighted the need for additional information and data regarding the knowledge of agricultural science teachers, agricultural and natural resource agents, and 4-H and youth development agents who assist youth daily with livestock projects and livestock exhibits across Texas. The number of participants in animal exhibits, combined with recent disease outbreaks and a lack of knowledge and training for public health officials, also reflected the importance of this research.

Purpose and Objectives

The purpose of this study was to assess the knowledge and awareness of agricultural science teachers, 4-H and youth development agents, and agricultural and natural resource extension agents, about zoonotic diseases. To determine the need, the awareness of zoonotic diseases, level of training about zoonotic diseases, and ability to identify zoonotic diseases on the part of agricultural science teachers, agricultural and natural resource agents, and agricultural extension agents were studied. The specific objectives of this study were the following:

1. Identify participants' demographic characteristics:
    - Rural, suburban, urban
    - Ethnicity
    - Gender
    - Education level
    - Extension agent or agriculture science teacher
2. Determine the level of awareness of agricultural science teachers, agricultural and natural resource agents, and agricultural extension agents regarding zoonotic diseases related to livestock projects.

3. Determine the level of knowledge that agricultural science teachers, agricultural and natural resource agents, and agricultural extension agent have regarding zoonotic diseases related to livestock projects, and their knowledge regarding the "prevention, detection, and control of the spread of zoonotic diseases" (USHHS, 2011, pp. 1).
4. Examine the differences, if any exist, between agricultural and natural resource agents, 4-H and youth development extension agents, and agricultural science teachers on perceptions of zoonotic disease.

Definition of Terms

1. Agriculture education: A program of instruction in and about agriculture and related subjects (Talbert, Vaughn, Croom, & Lee, 2007, p. 4).
2. 4-H: A program to prepare youth to meet the challenges of childhood, adolescence, and adulthood through a coordinated, long-term, progressive series of educational experiences that enhance life skills and develop social, emotional, physical, and cognitive competencies (Texas 4-H, 2015).
3. FFA: National Future Farmers of America (FFA) Organization, an intercurricular organization for students interested in agriculture and leadership. It is one of three components of agriculture education (National FFA Organization, 2015).
4. Zoonotic disease: A disease that "can be passed between animals and humans" (U.S. Department of Health and Human Services, 2013, para. 2).
5. Agricultural science teacher: The following definition is used in this study:

> [An agricultural science teacher will] improve the quality of Agriculture, Food, and Natural Resources education instruction, counseling, management, and leadership to produce success for all students; use strategies for integrating academic and Agriculture, Food, and

Natural Resources education; contribute to the educational objectives of the public school system by providing information to agriculture, food, and natural resources students about career pathways as a guide to achieving necessary skills for continued education and employment; provide students with educational and equitable experiences leading to career preparation, continued education, and employment; enhance youth leadership and FFA as an integral part of instruction; provide students with the knowledge and skills necessary to compete in a global economy; and inform students about agriculture and agricultural literacy (Vocational Agriculture Teachers Association of Texas, 2015).

6. Agriculture extension 4-H & youth development agent: A professional who provides leadership or serves in a support role in implementing educational programs that address critical issues and/or emerging needs in the area of agriculture. This person identifies, recruits, and trains local volunteer leaders to enable them to effectively perform their duties while serving on committees and in clubs, and/or organizations; utilizes a variety of teaching methods, strategies/techniques, activities, and materials in conducting educational programs; and conducts Extension educational programs (Great Jobs Job Description, 2015).
7. Agriculture extension and natural resource agent: A professional who provides leadership for an effective educational program that supports the food and fiber industry, agriculture, and natural resources; is responsible for planning, implementing, and evaluating an effective outcome-based program that supports

identified issues in a specific county; and is responsible for effectively reporting, marketing, and interpreting results of programming efforts. (Great Jobs Job Description, 2015).

8. Detection, prevention, and control of spreading diseases: This

> "[r]equires sound, evidence-based health policies designed to ensure appropriate development and delivery of infectious diseases prevention measures; reduce[s] health disparities and improve[s] the health of vulnerable populations; and promote[s] engagement with global partners to reduce cross-border disease spread and contain outbreaks at their source" (CDC, 2011, para. 5).

9. Aerosol: Droplets that, for purposes of this study, "are passed through the air from an infected animal and are breathed in by a person. Most exposure occurs when droplets are created from birthing tissues, soil contaminated with feces, urine or bacteria and a person breathes in the dust particles" (The Center for Food Security & Public Health, 2017, p. 1).
10. Fomite: "[A]n inanimate (non-living) object that can carry a pathogen from an animal to a person. Examples of fomites include contaminated obstetrical (O.B.) chains, brushes, needles, clothing or bedding (straw, shavings)" (The Center for Food Security & Public Health, 2017, p. 1).
11. Vector: The name for what occurs "when an insect acquires a pathogen from one animal and transmits it to a person" (The Center for Food Security & Public Health, 2017, p. 1).
12. One Health: This is

> [t]he integrative effort of multiple disciplines working locally, nationally, and globally to attain optimal health for people, animals, and the environment. Together, the three make up the One Health triad, and the health of each is inextricable connected to the other in the triad (American Veterinary Medical Association, 2017).

Limitations of the Study

This research has several limitations, including the following:

1. The researcher conducted the study on participants selected from a predetermined population of agriculture science teachers, agriculture and natural resource agents, and 4-H and youth development agents. The results are not generalizable to agriculture science teachers, agriculture and natural resource agents, and 4-H and youth development agents as a whole, but may be informative in situations when population characteristics are similar.
2. The agriculture science teachers, agriculture and natural resource agents, and 4-H and youth development agents were identified on April 28, 2015. The agriculture science teachers were identified through the state online database, and the 4-H and youth development agents and agriculture and natural resource agents were identified through the Texas A&M AgriLife Extension Service. After that date, new agents or teachers could have been hired, or current ones could have changed positions or left the organization.

Significance of the Problem

The attempts of agriculture science teachers and county extension agents to educate youth about zoonotic diseases have been constrained due to the limited resources for these programs (Domestic One Health Activities, 2013). Shulaw and Bowman (2001) informed youth livestock exhibitors about biosecurity measures through an Extension fact sheet. Exhibitors were informed that if they exhibited their projects at more than one show, the exposure to other animals, equipment, and the show grounds would increase the risk of their animal or themselves contracting a zoonotic disease. Previous studies (Brashears et al., 2007; Dunn, 2011; Stevenson et al., 2011), have outlined recommended educational methods for, and assessed participant knowledge about, zoonotic diseases. Through evaluating participant knowledge about the zoonotic disease of E.coli in animal exhibit settings, providing recommendations for minimizing risks associated with animals in public settings, and an online module for disease prevention were areas recommended for additional educational materials concerning zoonotic diseases.

The lack of research on the topic of educating youth about zoonotic diseases suggested a need for such studies. Bender and Shulman (2004) and the Animals in Public Contact subcommittee of the National Association of State Public Health Veterinarians (2014) found that most states do not have a process for providing information on zoonotic diseases to exhibitors. The purpose of this study was to assess the knowledge and awareness, and examine differences, if they exist, between 4-H and youth development and agriculture and natural science extension agents, and agriculture science teachers, on variables of detect, prevent, and control of spreading zoonotic diseases.

Conceptual Framework

The conceptual framework addressed the "big picture" purpose behind the relationships under investigation. The framework was from the PREDICT, PREVENT, and RESPOND programs of the United States Agriculture in Defense (USAID) agency. These programs also presented objectives to implement in order to mitigate zoonotic disease transmission.

The presenter, Bery, (Global Risk Forum, 2012, p. 7) summarized the inputs of the PREDICT, PREVENT, and RESPOND efforts at the Global Risk Forum of the One Health Conference on February 21, 2012. The conceptual framework of this study was modeled after this presentation. Land clearing and new construction can intensify the transmission of disease, as can increasing population density, which in turn increases contact between people, domestic animals, and wildlife (Global Risk Forum, 2012). The processes in place for mitigating disease transmission related to environmental management and public health were identified by USAID as ways to reduce the risk of zoonotic disease transmission (Global Risk Forum, 2012). The presenter documented the potential exposure points. These potential exposure points were: biodiversity conservation, waste management, worker health, general public health and community health. The methods, processes and procedures through fomites/skin, food, water and air is a graphical depiction of risk reduction. From these, an operational framework was developed for this research. The operational framework illustrates the underlying connections between the researcher's ideas and the research performed.

The outcomes contained in the conceptual framework were educational briefs, mitigation checklists, regional planning tools, and disease reduction. Professionals in

biodiversity conservation, waste management, and public health developed these. The One Health material outlines the definition of One Health as the inter-relationship among humans, animals, and the environment, taking into account zoonotic diseases in each of those areas. These programs were used around the world to address the need identified in this study: to mitigate zoonotic disease outbreaks through educational materials, training, and policy changes through planning. The strategies listed were neither prescriptive nor exhaustive. The conceptual framework for this research also provided a framework for interpreting the study findings of this research (see Figure 1).

Factors Mitigating Zoonotic Disease Outbreaks

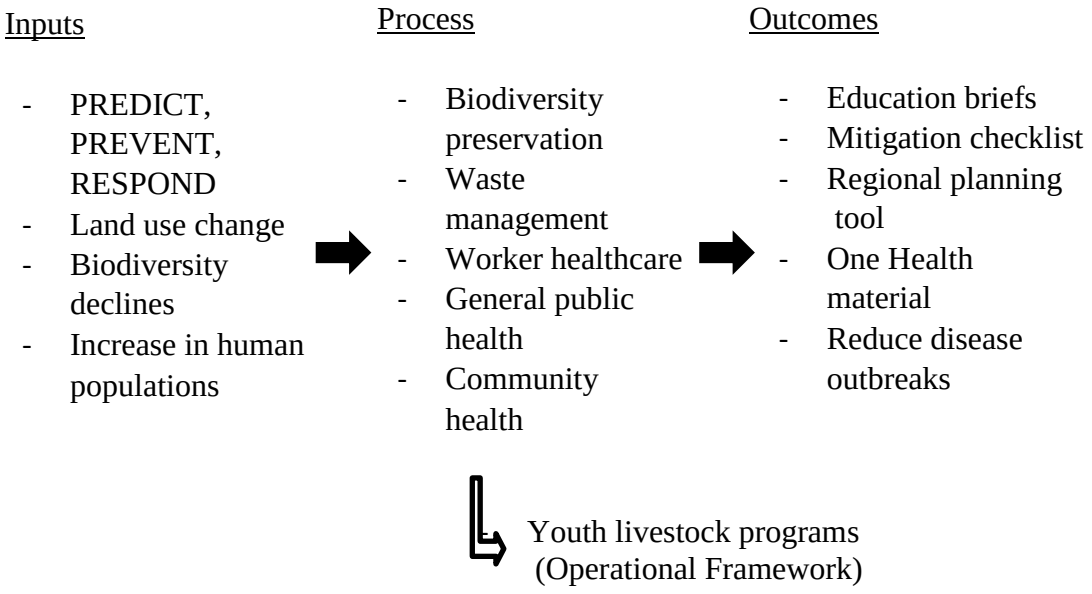

Figure 1. Conceptual Framework

CHAPTER II

REVIEW OF THE LITERATURE

Among many other benefits, 4-H and FFA programs provide youth with opportunities to participate in livestock projects and exhibitions in their county, and throughout the United States. Boyd, Herring, and Briers (1992) stated that throughout the history of 4-H and FFA, this experiential learning has helped youth develop valuable life skills, such as communication, problem solving, and self-understating. Numerous educational topics are included in projects throughout the Texas 4-H program. At the time of this research, not one was dedicated to zoonotic disease prevention (Texas 4-H Project Areas, 2015).

Educating 4-H and FFA Youth about Zoonotic Diseases

Zoonotic diseases are diseases that can be transmitted between humans and animals (Centers for Disease Control, 2013). The Ohio State University Extension Service fact sheet for youth livestock exhibitor's addresses biosecurity, but not as it relates to specific youth projects, and it does not provide supplemental education programs (Shulaw & Bowman, 2001). Shulaw and Bowman (2001) identified practical ways for exhibitors to lower their chances of introducing any new diseases to animals, including internal and external biosecurity measures. Curriculum booklets, called *be a Zoonotic Detective*, were funded by the CDC and printed by the University of Georgia for youth in the fifth and sixth grades in October 2013. These booklets were released to just three schools, as part of a pre- and post-test assessment of students' knowledge, to determine if the material was successful in educating participants about zoonotic diseases.

Gregory-Kreps and Balschweid (2006) used a pre- and post-test to determine high school students' knowledge and understanding of biosecurity issues through a program titled

The Animal Biosecurity Education Program for Youth. At the conclusion, the high school students' increase in knowledge and understanding of the biosecurity issues presented were statistically significant. Statistically significant means any differences observed between the groups studied were not due to chance. This led to a recommendation from the researchers that high school students be instructed using this educational curriculum. Stevenson et al. (2011) evaluated an Internet-based biosecurity educational module developed in the state of Washington for adult volunteers in the 4-H program for distribution to youth livestock exhibitors in their clubs. The module consists of an introduction and sections on livestock diseases, bio-security practices and implementation of bio-security, activities for youth, a summary, and a self-test. They found that the module effectively increased awareness of biosecurity issues in 4-H livestock projects to these volunteers. Based on these results, educational materials were developed for adult volunteers to take back to their 4-H or FFA clubs; however, dissemination via the Internet was not suggested.

Brashears et al. (2007) surveyed visitors at a petting zoo at a regional fair. The participants were randomly selected to answer a multiple-choice exam on *E. coli* from four constructs: general knowledge of *E. coli*, knowledge of *E. coli* prevention, knowledge of the implications of *E.coli*, and knowledge of *E. coli* transmission. Their statistical analysis of the data found that 73% of the participants were aware that hand washing prevented illness from *E. coli*, and a majority of the participants answered the other questions accurately; however, a much lower percentage understood *E. coli* transmission (28.8%) or had general knowledge of *E. coli* (37.3%). The researchers concluded that participants who had previously been involved in 4-H or FFA had more knowledge about the dangers, symptoms, and outcomes of *E.coli* infections. The strong relationship of r=.209 (significant at .001) identified in this

study between 4-H and FFA experience and knowledge of the zoonotic bacteria *E.coli* suggested a need to educate youth who participate in livestock exhibits about zoonotic diseases.

LeJeune and Davis (2004) suggested that outbreaks of zoonotic diseases associated with different types of animal exhibits would continue unless precautions were established. Slaughterhouse workers, veterinarians, veterinary technicians, ranching families, and agriculture workers have frequent animal contact, putting them at the highest risk level for contracting a zoonotic disease (Heponstall, Cockroft, & Smith, 2000). The population of at-risk individuals includes agriculture extension agents, 4-H and youth development extension agents, agriculture science teachers, and livestock consultants (Stevenson et al., 2011).

The Detection, Prevention, and Control of the Spread of Zoonotic Diseases

It is estimated that 150 million people each year visit agriculture fairs in North America (NASPHV, 2016). These fairs commonly provide educational materials and settings for the public to learn about animal agriculture, and to explore the human-animal bond. Within the past six years, human cases of influenza (multiple strains) have been associated with swine exhibitions. Between 2011 and September 2016, there were 364 human cases of influenza in 14 states (NASPHV, 2016). The largest outbreak occurred in 2012, with 309 human cases, resulting in 16 hospitalizations and one recorded death. The majority of these cases were associated with swine exhibitors and others in close contact with swine at agriculture fairs. As a result, the NASPHV put together a National Assembly of State Animal Health Officials (NASAHO, 2016) working group to develop measures for exhibitors and exhibition organizers to minimize influenza virus transmission between swine and people at fairs. The working group found a number of studies that showed influenza transmission increased

significantly at 72 hours. Therefore, it was recommended that fairs and exhibitions for swine be less than 72 hours (NASAHO, 2016).

The CDC recommends high-risk people avoid pig and swine barns at fairs (CDC, 2016). In September 2016 four human infections in Ohio and Michigan were identified as being from swine barns and fairs during the week of illness onset. “Pigs at fairs have reportedly tested positive for swine influenza infection” (CDC, 2016). The major concern with these swine influenza outbreaks at fairs was that the 2016-2017 seasonal flu vaccine was not formulated to protect against a strain of the swine influenza virus.

A similar report through Susan Scutti at CNN in October of 2016, identified 18 people with the variant swine flu, 16 of them children, who all attended agriculture fairs in Ohio and Michigan (Scutti, 2016). Scutti (2016) stated that participants should, “recognize that these animals carry influenza virus--they’re the source of them--and so appropriate hand hygiene is important.”

Keet (2016) with Contagion Live in November of 2016, with 18 cases identified, outlined that the CDC’s *Morbidity and Mortality Weekly Report* (MMWR) report “emphasizes that agricultural fair organizers should take preventive steps to protect the public. Including limiting the time that swine are on the fairgrounds, keeping ill swine isolated, having an on-call veterinarian, offering hand washing stations, and prohibiting food and beverages in animal barns.” The article outlines safety measures for people with high risk factors, and for people not at high risk.

Numerous zoonotic disease outbreaks have been documented throughout the United States that originated in petting zoos, livestock exhibits, and animal displays (NASPHV, 2009). In the NASPHV’s 2009 report, board members of the NASPHV and the Centers for

Disease Control (CDC) suggested a need to educate youth involved in livestock exhibits about zoonotic diseases, using the following eight outbreaks as examples:

1. New York, 1999, *E. coli* 0457:H7: 800 attendees at a state fair affected in the largest waterborne outbreak in the United States.
2. Pennsylvania, 2000, *E. coli* 0457:H7: 51 people affected after direct animal contact and lack of hand washing after visiting a dairy farm.
3. Minnesota, 2000-2001, *E. coli* 0457:H7: 84 people at a children's farm day camp affected after direct contact with calves.
4. Ohio, 2001, *E. coli* 0457:H7: 23 people affected at a fair through handling sawdust and eating and drinking where animals had previously been.
5. Oregon, 2002, *E. coli* 0457:H7: 60 people affected after visiting an exhibition hall that previously held goats, sheep, pigs, rabbits, and poultry.
6. North Carolina, 2004, *E. coli* 0457:H7: 15 people affected after visiting a sheep and goat petting zoo.
7. Florida, 2005, *E. coli* 0457:H7: 63 people affected after making contact with animals and sawdust/shavings at a fair.
8. Arizona, 2005, *E. coli* 0457:H7: associated with a short-term animal exhibit at a municipal zoo affected 44 people.

Stull, Peregrine, Sargeant, and Weese (2012) in their study, *Household knowledge, attitudes and practices related to pet contact and associated zoonosis,* concluded that there is a need to prevent zoonotic disease through educational materials such as brochures and booklets, for households with pets. The authors recommended that the effort be supported and promoted by veterinary, human health, and public health officials in each state. The

Center of Excellence for Emerging and Zoonotic Animal Diseases (CEEZAD) was founded "to help protect the nation's agricultural and public health sectors against high-consequence foreign animal, emerging and zoonotic disease threats" (CEEZAD, 2010, p. 1). CEEZAD's six-year strategic plan stated that zoonotic disease prevention is a near-term priority through developing programs that increase enrollment in foreign animal and zoonotic disease courses and courses in related disciplines (CEEZAD, 2010).

After prevention, there is also a duty to detect. Gray et al., in their 2012 study, *Influenza A (H1N1) pdm09 Health Show Pigs, United States*, found that five months after an influenza outbreak in humans, healthy show pigs showed evidence of the virus. The researchers noted that because the high risk of zoonotic influenza infection was found through raising show pigs, swine exhibitors and their families should get the seasonal influenza vaccine to reduce the likelihood of transmission.

Davis, Sheng, Newman, Hancock, and Hovde (2006) concluded that the solution to the issue of the transmission of zoonotic diseases in agricultural settings needed to be innovative in educational and outreach methods and able to accommodate different animal settings. Controlling the spread of disease in livestock settings can be achieved a number of ways. The Texas A&M AgriLife Extension Service publication, *Prevent the Spread of Zoonotic Diseases*, recommended, among other things, "washing your hands, practicing food safety, [using] biosecurity measures, [paying] attention to animal health, [taking] precautions when handling and caring for animals, and [cleaning and disinfecting] to kill disease causing germs" (p. 1).

The review of the scholarly literature showed strong supporting evidence to conclude that zoonotic diseases are present in livestock projects exhibited by youth across the state in

4-H and FFA programs (CEEZAD, 2010, Texas A&M AgriLife Extension Service, 2015; Davis et al., 2006, Stull et al., 2012). The research reviewed found that CEEZAD had made zoonotic disease prevention a near-term priority. Thus had an objective to leverage funding from the public health agencies to address zoonotic disease threats of agricultural importance. The AgriLife Extension Service produced materials on the prevention of the spread of zoonotic diseases through proper hand washing. Davis et al. (2006) found that hand sanitizers are part of the solution to the problem of zoonotic disease transmission. Stull et al. (2012) characterized the public's knowledge, attitudes and risks related to animal contact.

To address the problems identified, this study explored whether an educational need existed among agriculture science teachers and extension agents, and if so, to what extent, and whether additional curriculum materials needed to be developed.

Texas 4-H Program

The concept of 4-H as a practical, hands-on learning organization came from the desire to make public school education more connected to rural life (National History Preservation Team, 2015). The Texas 4-H program began in 1908, when Tom Marks, a Jack County agriculture extension agent, organized a corn club with over 25 boys (Texas 4-H, 2015). Marks started the club to educate young boys about the new production technology that seasoned farmers were reluctant to adopt. Almost immediately, new clubs across the state began to grow, such as tomato clubs, pig clubs, and beef cattle clubs for girls (4-H History in Brief, 2015, pp. 4).

The 4-H insignia, a four-leaf clover with an "H" superimposed on each leaf was adopted in 1911 (Texas 4-H, 2015). The four H's represent head, heart, hands, and health. The H's emphasize the development of the total person: head for intellectual growth, heart

for loyalty and patriotism, hands for service, and health for better living (Texas 4-H, 2015). In 1919, the girls' club adopted the motto, To Make the Best Better, which became the motto for the state 4-H program (Texas 4-H, 2015). In addition, contests, such as livestock judging, clothing contests and grain judging, became part of the 4-H program. Businesses such as railroads and banks supported club work by offering prizes to members, which encouraged 4-Hers to do business with them.

A worldwide exchange of youth, called the International Farm Youth Exchange Program, was introduced in 1948. In the following years, the International farm Youth Exchange program became known as the Texas 4-H Council. Organized to provide officers for state leadership and direction for each county program—a practice still in place. Today, 4-H life skills development is built into 4-H projects, activities, and events to assist youth in becoming contributing, productive, self-directed members of society. The Texas 4-H vision and mission are as follows (Texas 4-H, 2015):

Vision:

> The Texas 4-H & Youth Development Program will continue to be a recognized leader in developing life skill, empowering youth and volunteers, and facilitating effective partnerships to create capable and responsible citizens (Texas 4-H, 2015, p.1).

Mission:

> To prepare youth to meet the challenges of childhood, adolescence and adulthood, through a coordinated, long-term, progressive series of educational experiences that enhance life skills and develop social, emotional, physical and cognitive competencies (Texas 4-H, 2015, p. 1).

Throughout 4-H history, the fundamental focus has been members' personal growth. As Kuhl (2009, p.18) noted, "Teaching youth new skills and assisting youth in growing into productive and contributable members of society through these hands on experiences remains essential today." Webster, Rodgers, and Mariger (2001) found that extension professionals were considered a fundamental communication link between health professionals, farmers, ranchers, and lay community members in the area of zoonotic disease information.

The 2015-2016 annual report the Texas 4-H system stated that 578,991 youth were enrolled. In 2015, there were 67 4-H and youth development in Texas (Texas 4-H Program, 2015).

Texas FFA Association

The National Future Farmers of America (FFA) organization was officially founded in 1928, but was initiated in 1917, when the Smith-Hughes Vocational Education Act established vocational agriculture programs throughout the nation. Nine years later, Henry Groseclose, a former agriculture education instructor, facilitated the organization of the Future Farmers of America in Virginia for young boys in agriculture classes, and these soon spread to schools across the country.

The FFA motto is "Learning to Do, Doing to Learn, Earning to Live, Living to Serve." Agriculture education "prepares students for successful careers and a lifetime of informed choices in the global agriculture food, fiber, and natural resource systems" (National FFA Organization, 2016, pp. 1).

The FFA education program was built around the three core areas of classroom/laboratory instruction, supervised agriculture experience programs, and FFA student organization activities/opportunities. In 2015, there were 507,763 members in 7,439

chapters in all 50 states, as well as Puerto Rico and the Virgin Islands. Members may be between the ages of 12 and 21, and FFA organizations are usually located in high schools. In 2015, there were 1,988 agriculture science teachers in Texas (Texas FFA Association, 2014).

Cooperative Extension

In 1871, the Morrill Land-Grant College Act of 1862 established the land-grant system of higher education institutions throughout the nation. In Texas, the first public institution of higher education was the Agricultural and Mechanical College of Texas, known since 1963 as Texas A&M University. In October 1876, the college opened for classes. In 1939, Dr. Seaman Knapp, a United States Department of Agriculture representative, established community demonstration plots on the Walter C. Porter farm in Terrell, Texas. The plots were so successful through growth and participants, that within the year, Dr. Knapp appointed 33 agents to help communities across the state of Texas implement the same (Texas A&M AgriLife History, 2015).

Between 1903 and 1914, the 33 extension agents throughout the state organized boys' and girls' tomato and corn clubs, which became the forerunners to the Extension program today that includes over one million young Texans. At the end of 1914, the Smith-Lever Act established the state-based Cooperative Extension Service, which were connected to the previously established land-grant universities. The following year, this was renamed the Texas Agricultural Extension Service (TAES) (Texas AgriLife History, 2015). In 1989, TAES was aligned under the College of Agriculture and Life Sciences at Texas A&M University, given the college's focus on teaching, research, extension, and service. In 2007, it was renamed the AgriLife Extension Service (Texas AgriLife History, 2015). In 2015, when this study was conducted, the state of Texas had 206 agriculture and natural resource extension agents (Texas A&M AgriLife Extension Service, 2015).

Needs Assessment

Gupta, Sleezer, and Russ-Eft (2007) defined a need as the empty space between one's current position or situation and one's desired position or situation. An indirect needs assessment gathers data by assessing opinions or beliefs to determine if there is a learning or performance gap that needs to be fulfilled. An indirect needs assessment approach uses secondary data and opinions about needs and issues. Completing an indirect needs assessment can be done at any. A direct needs assessment is carried out through formal research that gathers data. This type of assessment requires institutional approval and additional resources. Gupta (2007) stated that a knowledge and skills needs assessment is intended to ensure that training programs are developed based on identified needs.

A direct needs assessment outlined from Gupta, Sleezer, and Russ-Eft (2007) has three parts: pre-assessment, assessment, and action plan. The pre-assessment relates to data collection and what is known; the assessment phase relates to evaluating the data gathered; and the action plan (for this study) defines what the state needs, if anything, in terms of educating youth about zoonotic diseases.

The Borich Needs Assessment Model (1980) was created to produce logical data than other models by controlling the type and quality of data. The steps in this model are to list competencies, survey, rank competencies, compare high priority competencies, and revise the program or competency (Borich, 1980). "All competency statements should be checked against program activities and materials to insure that they actually represent program objectives" (Borich, 1980, p.39).

Harder and Wingenbach (2008) used a modified Borich model of needs assessment to compute agents' perceptions of competency statements related to the 4-H Professional

Research, Knowledge, and Competencies (4-H PRKC) model, which outlines the competencies essential to 4-H youth development programs.

Paul McCawley with the University of Idaho Extension in 2009 wrote a booklet called "Methods for Conducting an Educational Needs Assessment, Guidelines for Cooperative Extension System Professionals." He stated that a direct needs assessment is completed through a route of formal research that obtains data through its clientele. The advantage is being able to obtain need-based data that are specific to the study participants; however, it requires institutional approval and should be completed periodically to update program efforts. McCawley (2009) stated that embracing a comprehensive needs assessment will allow for an educator to accomplish the following: 1) verify and describe the current situation, 2) explain how the program will address that need, and 3) describe the expected impacts of the program.

Purpose and Objectives

The purpose of this study was to assess the knowledge and awareness of agriculture science teachers, 4-H and youth development agents, and agriculture and natural resource extension agents regarding zoonotic diseases. This assessment sought to determine if agriculture science teachers, agriculture and natural resource agents, and agriculture extension agents were aware of zoonotic diseases, had received training on zoonotic diseases, and could identify a zoonotic disease. The specific objectives were the following:

1. Identify participants' demographic characteristics:
    - Rural, suburban, urban
    - Ethnicity
    - Gender

- Education level
- Extension agent or agriculture science teacher

2. Determine the level of awareness of agricultural science teachers, agricultural and natural resource agents, and agricultural extension agents regarding zoonotic diseases related to livestock projects.
3. Determine the level of knowledge that agricultural science teachers, agricultural and natural resource agents, and agricultural extension agent have regarding zoonotic diseases related to livestock projects, and their knowledge regarding the "prevention, detection, and control of the spread of zoonotic diseases" (USHHS, 2011, pp. 1).
4. Examine the differences, if any exist, between agricultural and natural resource agents, 4-H and youth development extension agents, and agricultural science teachers on perceptions of zoonotic disease.

The study's operational framework, which shows the research and its variables at each stage of the study, is found in Figure 2.

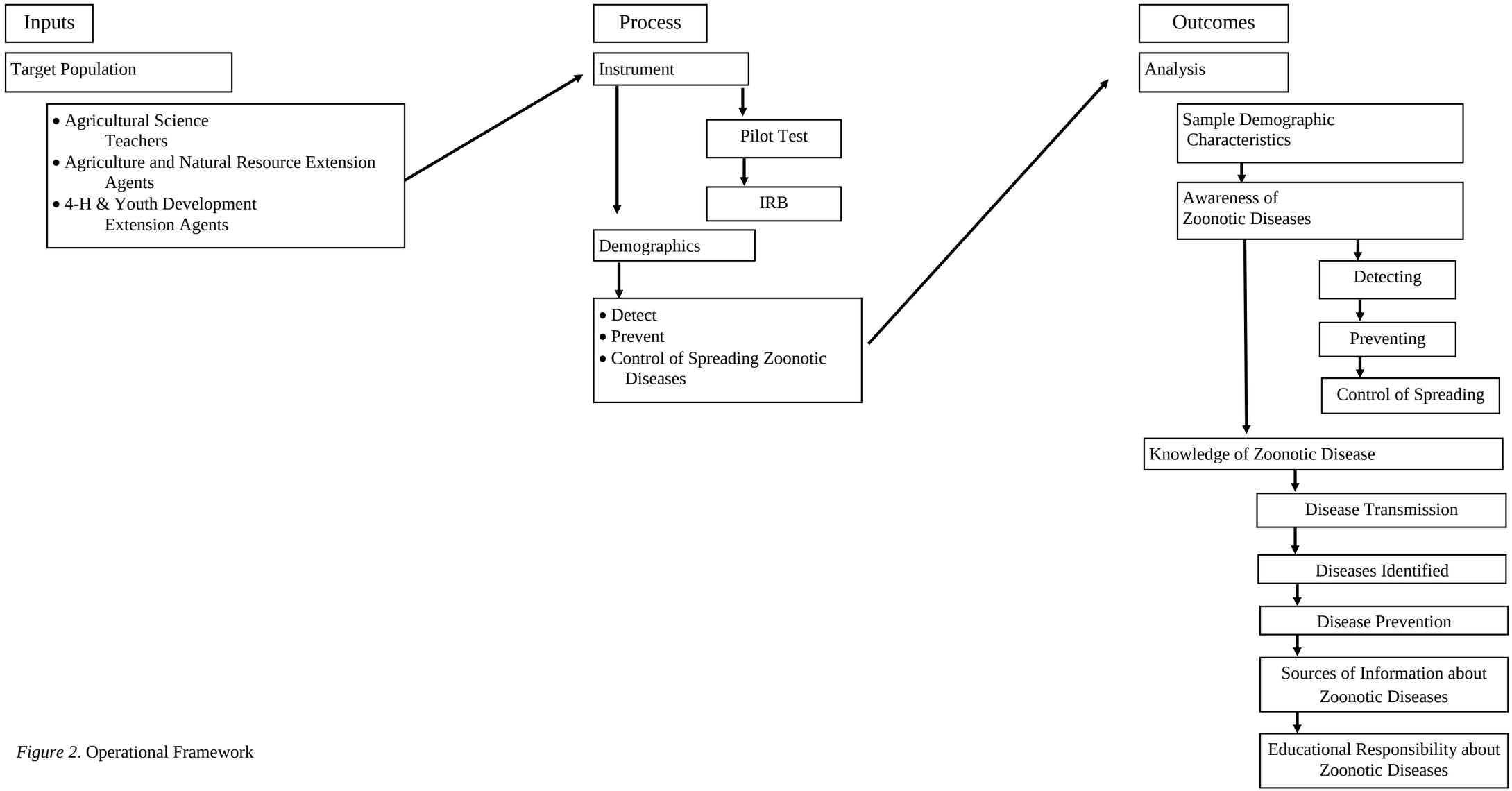

Figure 2. Operational Framework

CHAPTER III

METHODOLOGY

Purpose and Objectives

The purpose of this study was to assess the knowledge and awareness of agriculture science teachers, 4-H and youth development and agriculture and natural resource extension agents regarding zoonotic diseases. The demographic characteristics were participants' gender, ethnicity, level of education, geographic area, and professional role as extension agent or agriculture science teacher. The second section of the survey addressed participant awareness regarding the prevention, detection, and control of the spread of zoonotic diseases.

This study assessed the awareness of zoonotic diseases, training (if any), and ability to identify zoonotic disease by agricultural science teachers, agriculture and natural resource agents, and agriculture extension agents. The more specific objectives are listed below:

1. Identify participants' demographic characteristics:
    - Rural, suburban, urban
    - Ethnicity
    - Gender
    - Education level
    - Extension agent or agriculture science teacher
2. Determine the level of awareness of agricultural science teachers, agricultural and natural resource agents, and agricultural extension agents regarding zoonotic diseases related to livestock projects.
3. Determine the level of knowledge that agricultural science teachers, agricultural and natural resource agents, and agricultural extension agent have regarding zoonotic

diseases related to livestock projects, and their knowledge regarding the "prevention, detection, and control of the spread of zoonotic diseases" (USHHS, 2011, pp. 1).

4. Examine the differences, if any exist, between agricultural and natural resource agents, 4-H and youth development extension agents, and agricultural science teachers on perceptions of zoonotic disease.

Research Design

A descriptive survey methodology and comparative analyses were used. Descriptive research "attempts to describe existing conditions without analyzing relationships among variables" (Fraenkel, Wallen, & Hyun, 2012, p. 517). Descriptive studies are primarily concerned with discovering "what is," and thus are common in education research. The purpose of descriptive research is to describe an opinion, attitude, or behavior believed by a group of people on a topic. Borg and Gall (1989) stated that survey techniques are frequently used to collect descriptive data. The descriptive survey method used was the Tailored Method Design by Dillman, Smith, and Christian (2014). The Tailored Method Design applies a scientific approach in three ways: 1) reducing survey error 2) developing a set of survey procedures, and 3) developing survey procedures that focus on social exchange. The social exchange theory is utilized when rewards are perceived as high, costs are perceived as low and trust is established. Thus, this theory was used for this research.

The comparative analysis used was independent samples t-test. A t-test compares the means of two independent groups to determine if there was a statistical basis that the population means are significantly different. We used this comparative analysis to compare the means from the 4-H and youth development agents and agricultural and natural resource extension agents with the mean scores of the agricultural science teachers.

Fraenkel et al. (2012) defined dependent variables as those that the independent variable is presumed to affect. Independent variables are "those that the researcher chooses to study in order to assess their possible effects on one or more other variables" (Fraenkel et al., 2012, p. 38). The dependent variable in this study was knowledge of zoonotic diseases, referred to as "prevention, detection, and control of the spread of zoonotic diseases" (USHHS, 2011, para. 1). The independent variables were gender, ethnicity, education level, and whether the respondents were agricultural and natural resource extension agents, 4-H and youth development extension agents, or agricultural science teachers, and the geographic area where the respondents were located.

Population and Sample

The target population was agricultural science teachers, agricultural and natural resource extension agents, and 4-H and youth development extension agents in the state of Texas. This population was selected because these participants interact the most with youth who show livestock across Texas. This target population also includes the educators of youth who show livestock, and who would benefit from comprehending and implementing the results of this research.

Potential participants were identified through the Vocational Agriculture Teachers Association of Texas, 4-H and youth development agents, and agricultural and natural resource extension agents, in a list obtained from Dr. Jeff Ripley, Associate Director of County Operations at the Texas A&M AgriLife Extension Service. In 2015, when this research was conducted, the state of Texas had 67 4-H and youth development agents, 206 agricultural and natural resource extension agents, and 1,988 agricultural science teachers. The combined population was 2,261. A sample size was obtained by following the

recommendations of Dillman et al. (2009) that allowed for a representative statistical sample from the sample size equation. The Dillman et al. (2009) method was used to determine the sample size for agricultural science teachers, agricultural and natural resource agents, and agriculture extension agents. The participant sample size for 4-H and youth development extension agents was 60; for agricultural and natural resource extension agents, 137; and for agricultural science teachers, 322. Email was the best form of contact with participants due to their locations throughout the state of Texas. Email addresses were obtained from the Vocational Agriculture Teachers Associate of Texas and the 4-H and Youth Development agents. Email addresses for the agricultural and natural resource extension agents were obtained from Dr. Jeff Ripley.

Instrumentation

The online survey, developed by the researcher, was built and distributed through email using the Qualtrics program, the survey database that was used throughout Texas A&M. The survey consisted of five demographic questions, two questions regarding general awareness and understanding of risk, and one section, with four questions in each section, for each dependent variable (detecting, preventing, and controlling of zoonotic disease spread). There were four questions about each respondent's knowledge of zoonotic diseases, and two questions about where respondents might have received information or training, and who they believed should be responsible for disseminating such information and training (see Appendix G).

Pilot Test

The instrument contained a demographics section and an assessment section. After the instrument was developed, a pilot test was conducted through the University of Georgia

Extension program, chosen because of its extensive extension programs and the collegial relationship between the researcher, Merrideth Holub, and the extension programs specialist there, Dr. John Rayfield.

The survey was sent to twelve regional directors at the University of Georgia Extension Program, following the Tailored Method Design, which suggested sending an email survey every eight business days. At the conclusion of the pilot test, a measure of internal consistency was completed to determine how closely related a set of items were as a group (Cronbach's Alpha mean). Internal consistency proposes to measure whether several items will measure similar scores. After the completion of the pilot, a reliability test determined that Cronbach's alpha was .91. George and Mallery (2003) provide the following outline for reporting Cronbach's alpha: "_ > .9 – *Excellent*, _ > .8 – *Good*, _ > .7 – *Acceptable*, _ > .6 – *Questionable*, _ > .5 – *Poor* and _ < .5 – *Unacceptable*" (p. 231). Therefore, a Cronbach's alpha of .91 indicates a high level of reliability.

Institutional Review Board

Each research university has an institutional review board that assures federal regulatory agencies that their institution will comply with federal regulations on research involving human subjects. The Federal Policy for the Protection of Human Subjects (Common Rule) defined human subjects as ". . . a living individual about whom an investigator (whether professional or student) conducting research obtains (1) data through intervention or interaction with the individual, or (2) identifiable private information" (IRB, 2017, p. 1). After the researcher determined the nature and objectives of the study, she submitted an application in May 2015 to the Texas A&M Institutional Review Board (IRB), whose mission is "to assure the protection of human research participants and to ensure

Texas A&M University's compliance with the laws and regulations governing human subject research" (IRB, 2017). Following the IRB's rules and regulations, the researcher developed an information sheet for participants and attached one to each survey that was emailed to all potential participants (Appendix E). As required by the IRB, a consent waiver that waives the required signature of the informed consent form was developed and attached to the survey email (Appendix F).

Data Collection

Dillman (2009) recommended a three-communication strategy with recipients for data collection using Internet surveys. The first contact email introduces recipients to the survey, outlines logistics of the study, and stresses the importance of their response. The second message thanks participants who have completed the survey and reminds those who have not yet completed the survey to do so. The third message stresses the short time left to complete the survey and the importance of responding.

The survey followed the Tailored Method Design developed by Dillman et al. (2009), employing an initial email and two reminder emails sent every eight days. Dillman et al. (2009) also recommends that time of day is important, so each email was distributed prior to working hours. The Tailored Method Design methodology was developed for designing mail, email, and telephone surveys, and emphasized giving attention to all characteristics of questionnaires and survey implementation procedures. Using the Tailored Method Design, three consecutive emails were developed for the survey. The first introduced prospective participants to the survey, explained the purpose and importance of the survey, and asked them to complete the ten-minute survey. This first email was sent on September 28, 2015. Following the Tailored Method Design, every eight working days, a reminder email was sent.

The first was sent on October 6, 2015, and had the same content as the initial email, but also asked possible respondents to respond by the deadline. The second and final reminder email was sent on October 14, 2015. It stated that the researcher understood that the fall semester was busy and that their time was valuable, but still reminded them to answer the survey. The three emails can be found in Appendixes B, C, and D.

The researcher collected data using a web-based survey through Qualtrics at the College of Agriculture and Life Sciences at Texas A&M University in College Station, Texas. The data provided through the Qualtrics database system were analyzed using Microsoft Excel to obtain sums, standard deviations, means, and averages. None of the data contained any names or identifiers of the participants. Additionally, there was no interference with any of the participants throughout the study, and there were no questions in the instrument that collected any personal or private information from the participants to their responses for each survey.

Using the first method recommended by Linder, Murphy, and Briers (2001) early respondents were compared to late respondents. Successive waves were not identifiable, so the 350 usable respondents were organized by response end time and divided exactly in half. The variables of interest then had t-test conducted on them. The data were pooled for analysis after no significant differences were found on the variables of interest.

Data Analysis

Data were analyzed using SPSS® version 22.0. Data analysis occurred in three phases. Phase One consisted of describing the demographic characteristics of the responding agricultural science teachers, 4-H and youth development extension agents, and agricultural and natural resource extension agents, through frequencies and percentages. Phase Two

described the knowledge and awareness of zoonotic diseases on the part of agricultural science teachers, 4-H and youth development extension agents, and agricultural and natural resource extension agents. These were described through means, standard deviations, frequency, and percentages. In Phase Three the participants' data were recoded by their employing organization: one for agriculture and natural resources extension agents and 4-H and youth development extension agents, and two for agricultural science teachers. Participants scores on six scaled items, assessing awareness and knowledge in each of the three areas, detect, prevent, and control were compared between the two groups using independent sample t-tests.

Phase One

Frequencies and percentages were used to describe respondents' educational level; gender; ethnicity; geographic areas (rural (*>2,500 in population*), suburban (*>10,000 in population*), or urban (*>50,000 in population*)); and if they identified as agricultural science teachers, 4-H and youth development extension agent, or agricultural and natural resource extension agent.

The question for gender had two options: female and male. Ethnicity had six options: White or Caucasian, Hispanic or Latino, Black or African American, Native American or American Indian, Asian, and other. Levels of education options were associate's degree, bachelor's degree, master's degree, professional degree, doctorate, and other degree. The options for professional role were agricultural science teacher, 4-H and youth development extension agent, or agricultural and natural resource extension agent.

Phase Two

Frequencies and percentages were used to report when participants responded that they were aware of zoonotic diseases using a *yes* or *no* option. Understanding risks associated with zoonotic diseases also had a *yes* or *no* option.

Awareness of detecting, preventing, and controlling the spread of zoonotic diseases was reported through means and standard deviations. The answer choices were on a sliding scale of zero to 10 of *no awareness* (0) to *fully aware* (10).

The educational questions concerned disease transmission routes, diseases that could be transmitted to pets/livestock, ways to reduce the risk of diseases, best sources of information received, and who should educate youth about zoonotic diseases. Disease transmission routes were listed as aerosol, vector, direct contact, fomite, oral, and no knowledge. Transmitted diseases were rabies, HIV/AIDS, intestinal worms, MRSA, distemper, salmonella, giardia, measles, hepatitis, infectious diarrhea, ringworm, and no knowledge. Ways to reduce the risk were to wash hands; keep your pets and livestock healthy; keep children under five, the elderly, and immune-compromised people away from sick animals; clean up after your pets/livestock; store food for humans and animals separately; don't eat or drink in the same area as pets/livestock; vaccinate your pets/livestock; and no knowledge. The educational section answers were analyzed and are reported with percentages on bar graphs.

Once the survey was completed and closed, the data collected were reviewed. The researcher located 14 male and 11 female respondents that failed to complete the survey past the demographic questions. These respondents completed 2.25% of the survey, and were removed from the data that were reported. This removed 25 incomplete responses.

Phase Three

Awareness and knowledge regarding the prevention, detection, and control of zoonotic diseases are a priority in the United States Health and Human Services (USHHS) Framework for Preventing Infectious Diseases and thus used for this research (USHHS, 2011, pp. 1). Knowledge of zoonotic disease transmission, identification of diseases that can be transmitted, and procedures for controlling the reduction of risk were developed through previous research (Stull, Peregrine, Sargeant, and Weese, 2012; Snedeker, Anderson, Sargeant, and Weese, 2012; U.S. Department of Health and Human Services, Centers for Diseases Control and Prevention, 2011; Dunn, 2011; LeJeune and Davis, 2004). In Phase Three of this study, the researcher created six multi-item scales to examine differences between participants employed by Cooperative Extension and those employed by local school districts in their awareness and knowledge of each area of interest; detect, prevent, and control.

The first scale addressed awareness of detecting zoonotic diseases. The scale comprised four questions measuring awareness zoonotic diseases, procedures for detecting zoonotic diseases, awareness of available trainings or courses and resources for continued professional development. The items used a scale of zero for *no awareness* (0) to ten for *fully aware* (10). These items were summed resulting in a scaled score of zero to 40. The awareness of detecting scale reliability was determined using Cronbach's alpha, and found to be .87, which indicates high levels of internal consistency. An independent samples t-test on this scaled variable between these groups was conducted.

The second scale addressed awareness of preventing zoonotic diseases. The scale included four questions measuring awareness of sanitation and manure management, taking protective measures, understanding of ways to reduce disease, and controlling animal and

equipment movement for external zoonotic disease transmission. The four items used a scale of zero for no awareness (0) to ten for fully aware (10). These items were summed resulting in a scaled score of zero to 40. The awareness of detecting scale reliability was determined using Cronbach's alpha, and found to be .89, which indicates high levels of internal consistency. An independent samples t-test on this scaled variable between these groups was conducted.

The third scale addressed awareness of controlling the spread of zoonotic disease. The scale included four questions measuring awareness of precautions to take to reduce the risk of transmission, information about disease transmission, responsibility for providing information, and participant confidence in educating others. The four items used a scale of zero for no awareness (0) to ten for fully aware (10). These items were summed resulting in a scaled score of zero to 40. The awareness of detecting scale reliability was determined using Cronbach's alpha, and found to be .88, which indicates high levels of internal consistency. An independent samples t-test on this scaled variable between these groups was conducted.

The fourth scale addressed knowledge of transmission of zoonotic diseases. Participants were asked to identify disease transmission pathways from pets/livestock to people. The five possibilities pathways included aerosol, vector, direct contact, fomite, and orally. The final answer choice was no knowledge. Possible scores for this knowledge of transmission scale ranged from zero to five. Internal consistency for this knowledge scale was determined. The Cronbach alpha for the fourth scale was .74.

The fifth scale addressed knowledge of diseases that can be transmitted from pets/livestock to people. The correct answers were rabies, intestinal worms, methicillin-resistant staphylococcus aureus (MRSA), salmonella, hepatitis, infectious diarrhea, and

ringworm. The incorrect answer choices were HIV/AIDS, distemper, giardia, and measles. The final answer choice was no knowledge. Possible scores for this knowledge of diseases scores ranging from -4 to 7 (negative numbers were assigned for the wrong answer choices). Internal consistency for this knowledge scale was determined. The Cronbach alpha for the fifth scale was .74.

The sixth scale addressed knowledge of procedures for controlling the risk of zoonotic disease infections. There were seven correct answer choices: washing your hands, keep children and immune-compromised individuals away from sick animals, keep your pets/livestock healthy, clean up after your pets, vaccinate your pets/livestock, store your food and the animals' food separately. The eighth answer choice was no knowledge. Possible scores for knowledge of procedures for controlling diseases ranged from zero to seven. Internal consistency for this knowledge scale was determined. The Cronbach alpha for the sixth scale was .74.

These three multi-item scales addressing awareness, and the three addressing knowledge, were used to examine differences between participants employed by Cooperative Extension and those employed by local school districts in their awareness and knowledge of each area of interest; detect, prevent, and control. The data were re-coded by organization, one for agriculture and natural resources extension agents, 4-H and youth development extension agents, and two for agricultural science teachers. An independent samples t-test was conducted for each scale. The variables of interest used to create the scales were the knowledge and awareness items 11-13 and 15-17 respectively (Appendix G).

CHAPTER IV

FINDINGS AND DISCUSSION

Purpose and Objectives

The purpose of this study was to assess the knowledge and awareness of agricultural science teachers, 4-H and youth development agents, and agricultural and natural resource extension agents regarding zoonotic diseases. The study asked the agricultural science teachers, agricultural and natural resource agents, and agriculture extension agents who responded if they were aware of zoonotic diseases, had received training on them, and could identify a zoonotic disease. The study had the following objectives:

1. Identify participants' demographic characteristics:
    - Rural, suburban, urban
    - Ethnicity
    - Gender
    - Education level
    - Extension agent or agriculture science teacher
2. Determine the level of awareness of agricultural science teachers, agricultural and natural resource agents, and agricultural extension agents regarding zoonotic diseases related to livestock projects.
3. Determine the level of knowledge that agricultural science teachers, agricultural and natural resource agents, and agricultural extension agent have regarding zoonotic diseases related to livestock projects, and their knowledge regarding the "prevention, detection, and control of the spread of zoonotic diseases" (USHHS, 2011, pp. 1).

4. Examine the differences, if any exist, between agricultural and natural resource agents, 4-H and youth development extension agents, and agricultural science teachers on perceptions of zoonotic disease.

Findings and Discussion

Research Objective One

Respondents' demographic characteristics were described using frequencies and percentages. Males comprised 57.1% (n=200) and females, 42.6% (n=149). Ethnicities were white or Caucasian 92% (n=322) and Hispanic or Latino 4.6% (n=16). For the level of education attained, those with a master's degree were 49.1% (n=172) and with a bachelor's degree, 48.0% (n=168). These results are depicted in Table 1.

For geographic areas, rural made up 48.3% (n=169); suburban, 26.9% (n=94); and urban, 24.9% (n=87). In terms of professional role, agricultural science teachers comprised 72.9% (n=255); agricultural and natural resource extension agents, 16.9% (n=59); and 4-H and youth development extension agents, 8.6% (n=30) (see Table 1).

The demographics were also separated by organization type. The group of extension agents compromised the agricultural and natural resource agents and 4-H and youth development extension agents. There were 58 males and 30 females, for a total of 88. Ethnicities were white or Caucasian 79; Hispanic or Latino, four; black or African American, two; and Native American or American Indian, two. For the level of education attained, those with an associate's degree were one; bachelor's degree, 12; master's degree, 72; professional degree, two; and doctorate, one. For geographic areas, 41 were from rural areas, 20 were from suburban areas, and 28 were from urban areas (see Table 1).

In the group of agricultural science teachers, there were 140 male and 115 female respondents. Ethnicities were white or Caucasian, 238; Hispanic or Latino, 12; black or African American, two; Native American or American Indian, two; and one who identified as Asian. For the level of education attained, there were 155 with a bachelor's degree, 98 with a master's degree, and two with a doctorate. For agricultural science teachers, 127 identified as living in rural areas, 70 from suburban areas, and 58 from urban areas.

Table 1

Sample Demographic Characteristics (N=350)

Characteristic	Extension Agents *f*	Agricultural Science Teachers *f*	Total *f*	%
Gender				
Male	58	140	200	57.1
Female	30	115	149	42.6
Ethnicity				
White or Caucasian	79	238	322	92.0
Hispanic or Latino	4	12	16	4.6
Black or African American	2	2	5	1.4
Native American or American Indian	2	2	4	1.1
Asian	0	1	1	.3
Other	0	0	0	0
Level of Education				
Associate's Degree	1	0	2	.6
Bachelor's Degree	12	155	168	48.0
Master's Degree	72	98	172	49.1
Professional Degree	2	0	4	1.1
Doctoral Degree	1	2	1	.3
Other	0	0	0	0
Geographic Area				
Rural	41	127	169	48.3
Suburban	20	70	94	26.9
Urban	28	58	87	24.9
Extension Agent or Agricultural Science Teacher				
Agriculture & Natural Resource Extension Agent			59	16.9
4-H and Youth Development Agent			30	8.6
Agricultural Science Teacher			255	72.9

Note. Not all percentages total 100% and not all frequencies total 350 due to missing data.

Research Objective Two

A majority of respondents (n=350) were aware of zoonotic diseases: 85.4% (n=299), with 14.3% (n=50) not aware. A comparable majority stated that they understood the risks associated with zoonotic diseases: 83.1% (n=291), with 16.9% (n=59) stating they did not have this understanding (see Table 2).

Table 2

Sample Demographic Characteristics (N=350)

Characteristic	*f*	%
Awareness of Zoonotic Diseases		
Yes	299	85.4
No	50	14.3
Understanding of Risks Associated with Zoonotic Diseases		
Yes	291	83.1
No	59	16.9

Note. Not all percentages total 100% and not all frequencies total 350 due to missing data.

The participants were divided regarding their awareness of detecting zoonotic diseases. The two most common responses were as follows: 1) I am aware of possible zoonotic diseases that can occur with animal contact (m=7.25, SD=2.47), and 2) I am aware of information that is available, from any source, about diseases that you can get from animals (m=6.49, SD=2.70). The lowest constructs were as follows: 1) I am aware of proper procedures for detecting and handling zoonotic diseases in animals (m=5.35, SD=2.84), and 2) I have received training or taken a course about zoonotic diseases (m=3.59, SD=2.95). Twenty-four respondents did not answer the question regarding awareness of detecting zoonotic diseases (see Table 3).

Table 3

Respondents Mean Scores for Awareness of Detecting Zoonotic Diseases (N=326)

Characteristic	*M*	*SD*
I am aware of possible zoonotic diseases that can occur with animal contact.	7.25	2.47
I am aware of information that is available, from any source, about diseases that you can get from animals.	6.49	2.70
I have received training or taken a course about zoonotic diseases.	3.59	2.95
I am aware of proper procedures for detecting and handling zoonotic diseases in animals.	5.35	2.84

Note. Scale of No Awareness, Not Very Aware, Somewhat Aware to Fully Aware (0-10)

For the construct of preventing zoonotic diseases, the means were closely associated. The highest constructs were as follows: 1) I am aware that when working with animals that are showing signs of disease or have an open wound, you are supposed to take protective measures like wearing gloves or use hand hygiene (m=8.31, SD=2.08), and 2) I am aware that sanitation and manure management assist with internal zoonotic disease transmission (m=7.84, SD=2.38). The two lowest constructs were as follows: 1) I am aware that by controlling animal movement, vehicle and equipment movement, location and construction of buildings and separation of species and ages assist with external zoonotic disease transmission (m=7.84, SD=2.38), and 2) I am confident with my level of understanding of ways to reduce disease that can occur with animal contact (m=7.03, SD=2.51). Twenty-five respondents did not answer the question regarding awareness of preventing zoonotic diseases (see Table 4).

Table 4

Respondents Means Scores for Awareness of Preventing Zoonotic Diseases (N=325)

Characteristic	*M*	*SD*
I am aware that by controlling animal movement, vehicle and equipment movement, location and construction of buildings and separation of species and ages, assist with external zoonotic disease transmission.	7.71	2.46
I am aware that sanitation and manure management assists with internal zoonotic disease transmission.	7.84	2.38
I am confident with my level of understanding of ways to reduce disease that can occur with animal contact.	7.03	2.51
I am aware that when working with animals that are showing signs of disease or have an open wound, you are supposed to take protective measures like wearing gloves or using hand hygiene.	8.31	2.08

Note. Scale is No Awareness, Not Very Aware, Somewhat Aware to Fully Aware (0-10)

Participants (n=328) completed the question regarding their awareness of controlling the spread of zoonotic diseases. The highest construct was that participants were aware of precautions to take with animals to reduce the risk of disease (m=7.48, SD=2.38). The other three constructs were all closely related: 6.01, 6.24, and 6.63. The three statements with the lowest levels of awareness are as follows: 1) I believe that I should be responsible for providing information about zoonotic diseases to people in the community, students, or families (m=6.63, SD=2.83), 2) I am confident enough to educate other about zoonotic diseases that can be found in animals (m=6.24, SD=2.96), and 3) I am aware of information, from any source, about zoonotic diseases (m=6.01, SD=2.86). Twenty-two people did not answer the question regarding their awareness of controlling the spread of zoonotic diseases (see Table 5).

Table 5

Respondents Means Scores for Awareness of Controlling the Spread of Zoonotic Disease (N=328)

Characteristic	*M*	*SD*
I am aware of information, from any source, about zoonotic diseases.	6.01	2.86
I believe that I should be responsible for providing information about zoonotic diseases to people in the community, students, or families.	6.63	2.83
I am aware of precautions to take with animals to reduce the risk of disease.	7.48	2.38
I am confident enough to educate other about zoonotic diseases that can be found in animals.	6.24	2.96

Note. Scale of No Awareness, Not Very Aware, Somewhat Aware to Fully Aware (0-10)

The majority of 4-H and youth development extension agents, agricultural and natural resource extension agents and agricultural science teachers stated that they had received information about zoonotic diseases 62.6% (n=219). Another 33.7% (n=118) stated that they had never received any information, from any source, about diseases that you can get from animals, or about precautions to take with pets/livestock to reduce the risk of disease (see Table 6).

Table 6

Proportion of Respondents Who Have Received Information (N=350)

Characteristic	*f*	%
Received Information		
Yes	219	62.6
No	118	33.7

Note. Not all percentages total 100% due to missing data

Research Objective Three

In research objective three, respondents were asked three questions about their knowledge of zoonotic diseases. The first was respondent's frequency of zoonotic disease transmission methods. The respondents were all asked to choose all that apply. The distribution of answers was the following: direct contact (89%), orally (75%), vector (64%), aerosol (48%), fomite (36%), and no knowledge of how zoonotic diseases can be transmitted (7%). Vector, direct contact, orally, aerosol, and fomite are all correct answers for transmission methods for zoonotic diseases (see Figure 3).

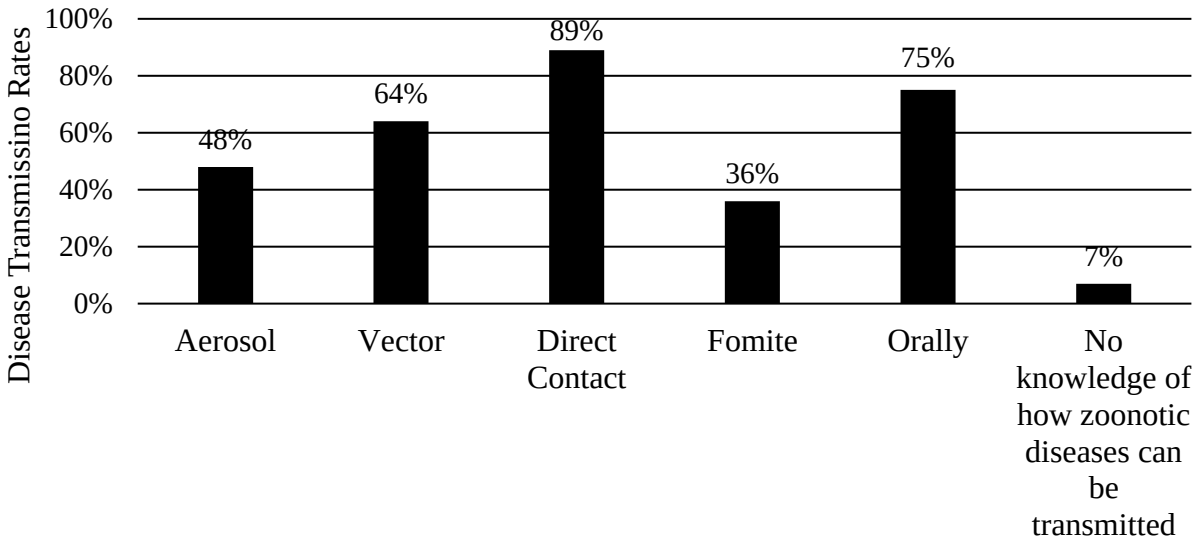

Figure 3. Respondents Frequency of Zoonotic Disease Transmission Methods

Participants were asked to choose which disease that they believed could be transmitted from pets/livestock to people (diseases are listed in Figure 4). The correct answers that were most often identified were rabies (92%), ringworm (90%), and salmonella (77%). The answers that were incorrect but the respondents choose them were hepatitis (24%), distemper (20%), and HIV/AIDS (15%). One participant stated no knowledge of which of the listed diseases were zoonotic in nature (1%) (see Figure 4).

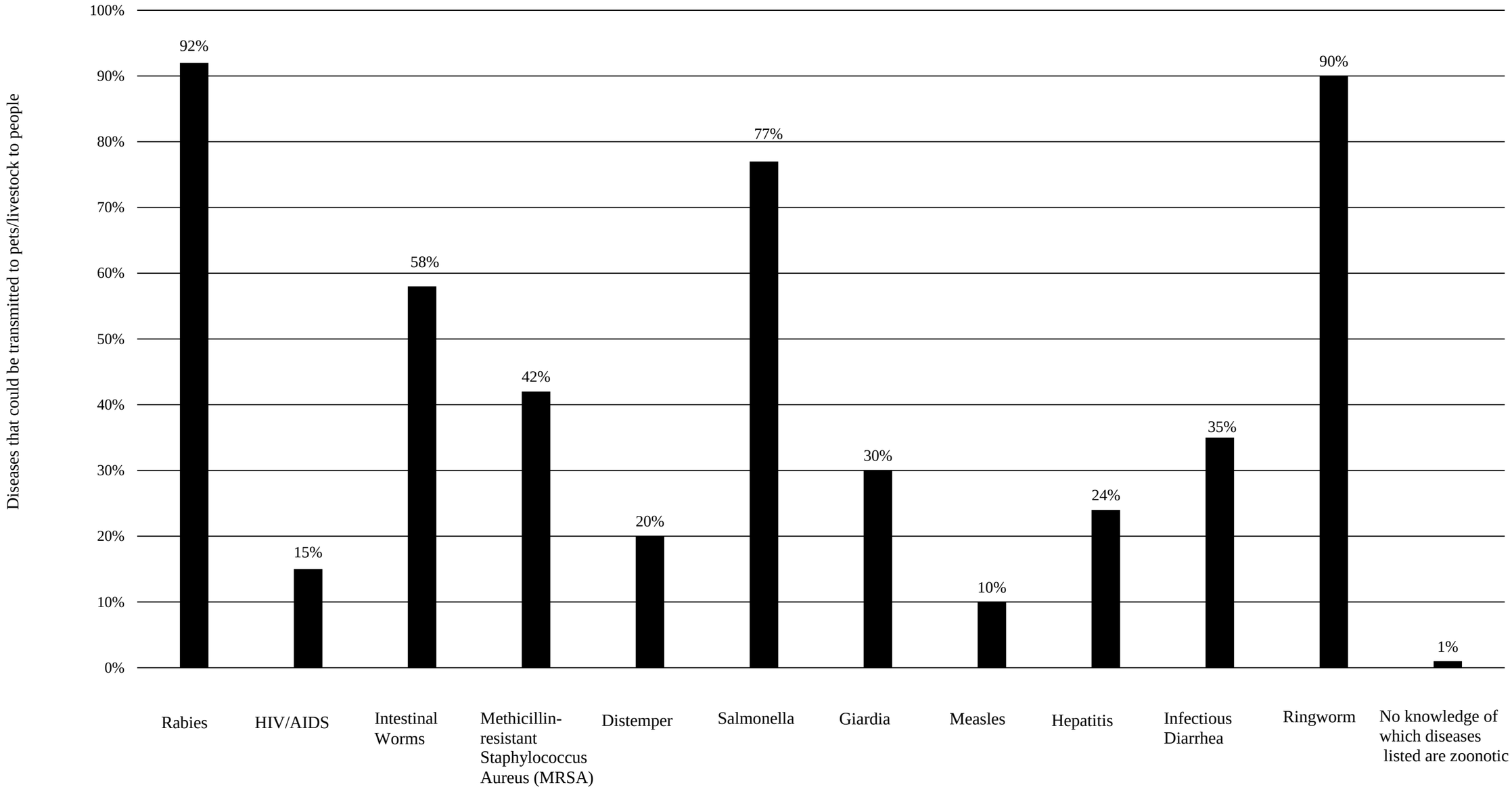

Figure 4. Diseases Identified as Zoonotic by Respondents

Figure 5 depicts the benchmark scores for respondents' views regarding the different ways to reduce the risk of zoonotic infections. A majority of participants chose all answer choices. Illustrating participant's knowledge about preventing zoonotic diseases, their answer choices ranged between 95 and 81 percent. The constructs with the highest scores were wash hands (95%), followed by vaccinate your pets/livestock, clean up after your pets/livestock, and keep your pets/livestock healthy (93%). The lowest construct was no knowledge of ways to reduce the risk of zoonotic infections (2%).

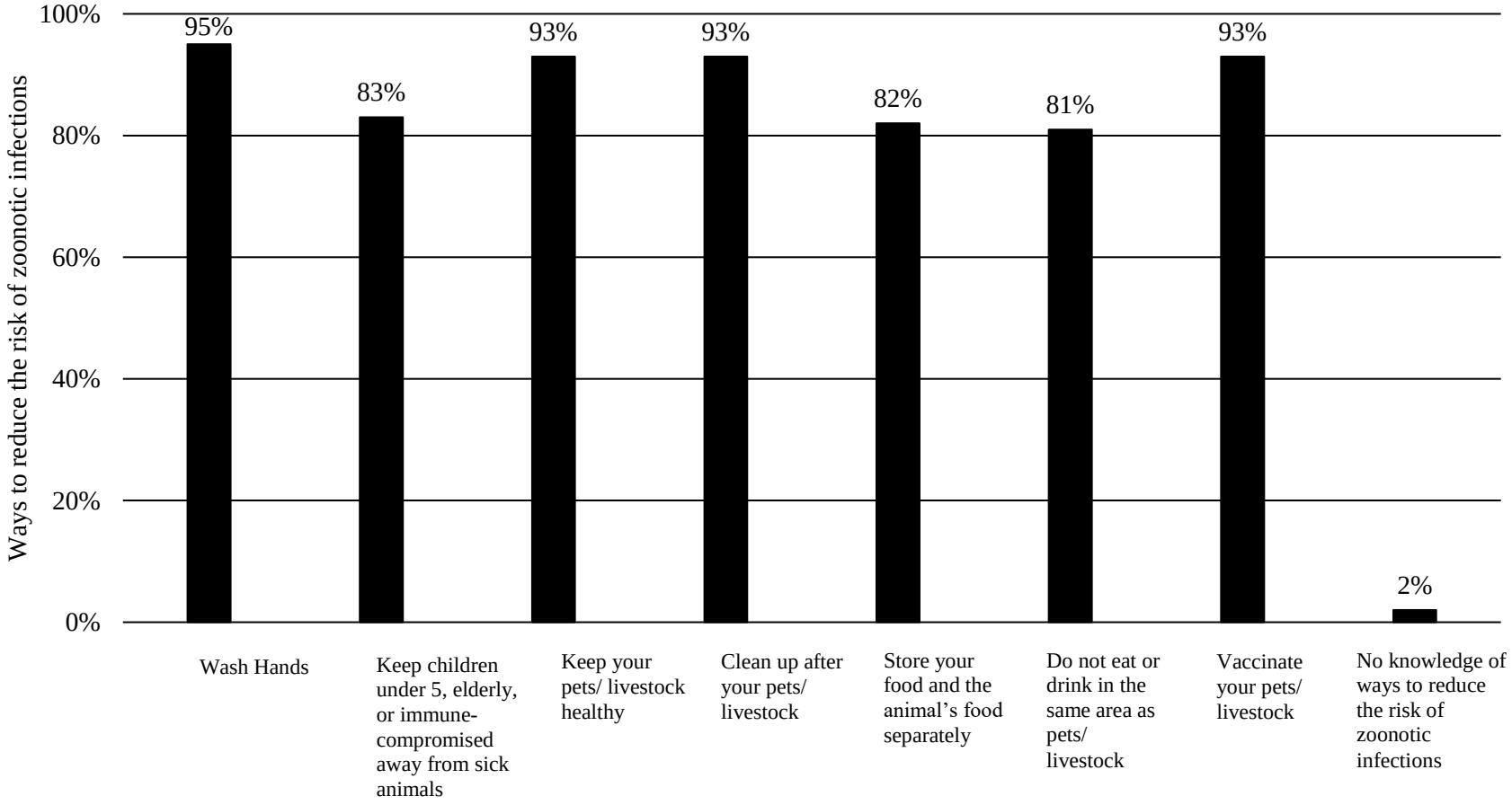

Figure 5. Zoonotic Disease Prevention Methods Identified by Respondents

Figure 6 shows respondents' views on the best sources of information about zoonotic diseases. The highest-rated construct was veterinarian (34%), and most participants received information about zoonotic diseases from a college course (39%) and professional development (34%).

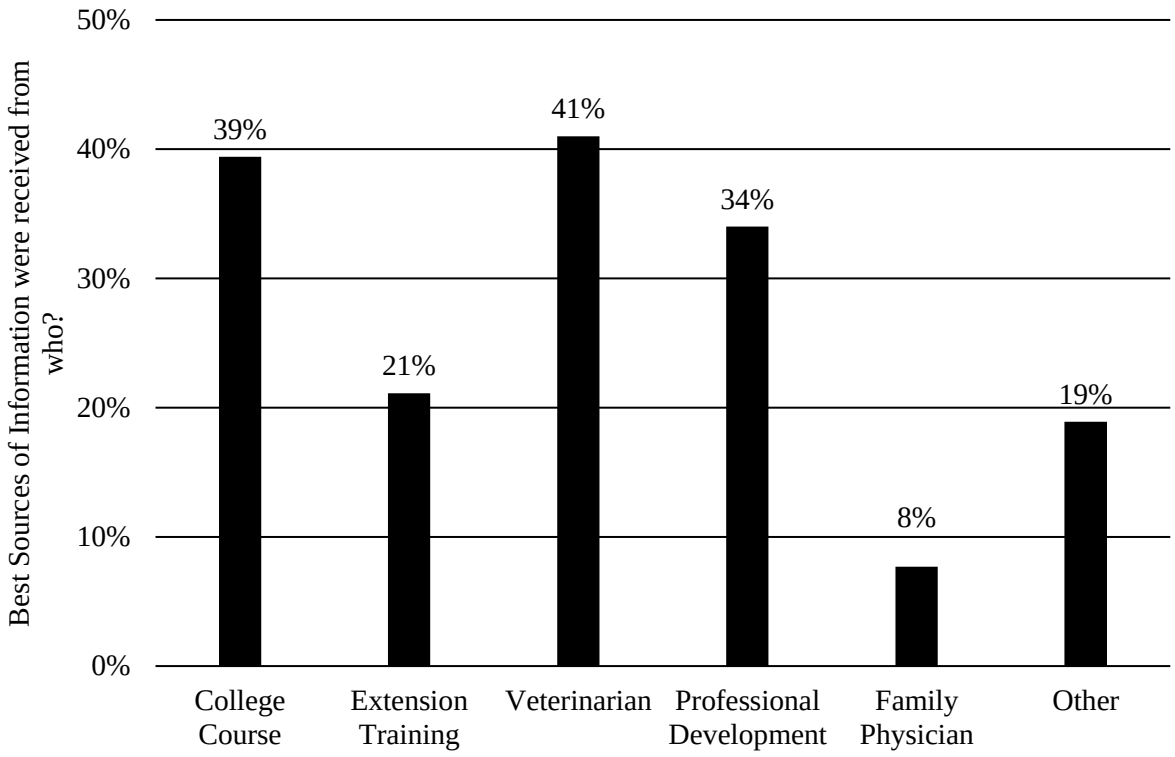

Figure 6. Sources of Information about Zoonotic Diseases Identified by Respondents

Figure 7 asked the participants whom they believed should teach youth who show livestock, about zoonotic diseases. Six of the seven constructs were distributed into three tiers. The top tier constructs were agricultural science teachers (92%) and county extension agents (87%). The second tier constructs were veterinarians (70%) and parents (60%). The third tier constructs were public/private schools (28%) and your family physician (22%). The choice of other yielded 6%.

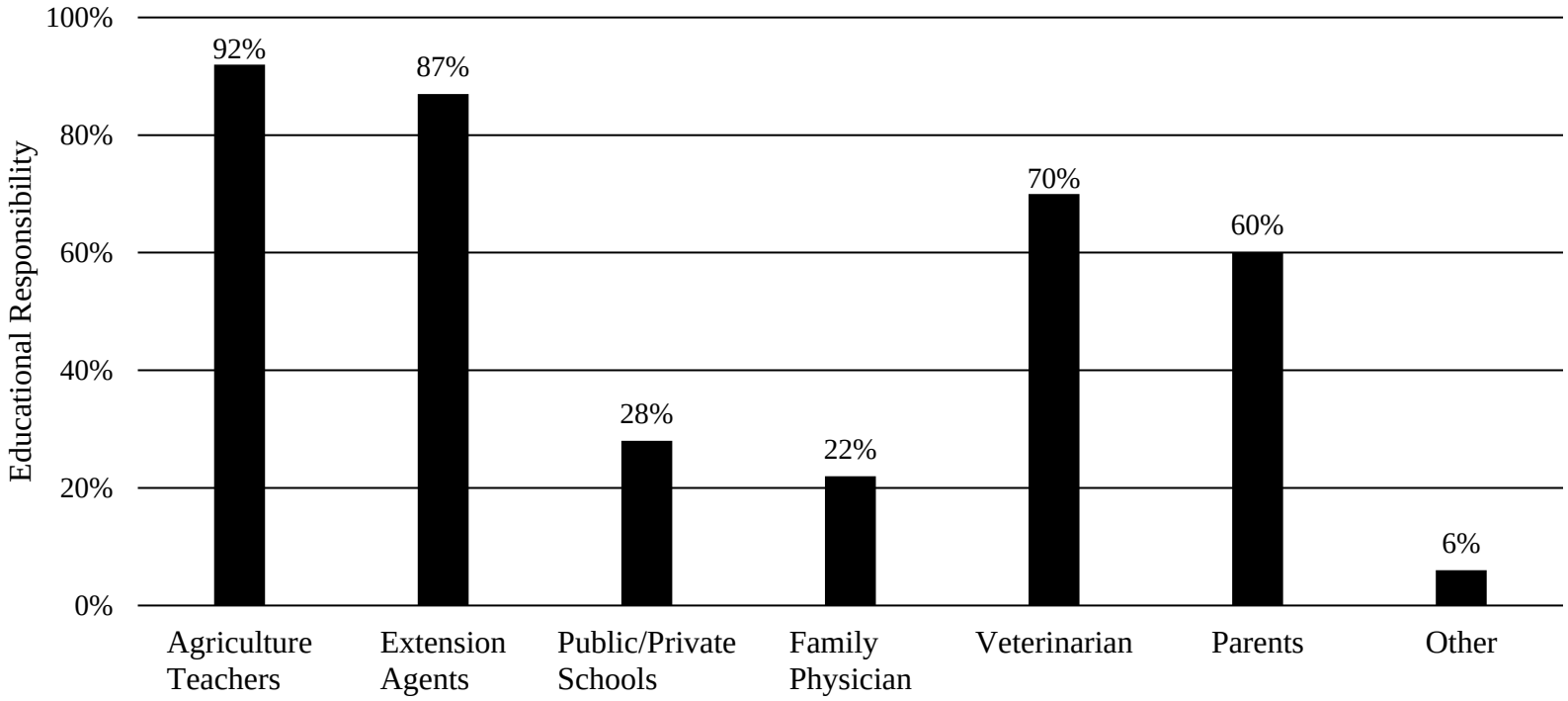

Figure 7. Educational Responsibility about Zoonotic Diseases

Research Objective Four

Awareness of detecting zoonotic diseases by extension agents (m=24.96) and by agricultural science teachers (m=20.15) were statistically different. There was no significant difference between participant's awareness of preventing zoonotic diseases. There was a significant difference between agricultural science teachers (m=24.15) and extension agents (m=27.30) on their awareness of controlling the spread of zoonotic diseases. These findings are illustrated in Table 7.

There was a significant difference between agricultural science teachers (m=3.0) and extension agents (m=3.55) on the knowledge question asking participants to identify ways diseases can be transmitted. Fomite was the least-chosen answer choice by both groups. There was no significant difference found between extension agents and agricultural science teachers in their ability to identify diseases that can be transmitted between pets/livestock to people, but based on the scored scale, the extension agents and agricultural science teachers both had a low score of 67 percent. There was no significant difference found in knowledge of procedures for controlling the risk of zoonotic disease infections. These findings are illustrated in Table 7.

Table 7

Differences in Knowledge and Awareness of Participants By Organization

Scale	Mean	SD	*t*	*df*	p
Awareness Scales					
Detecting Zoonotic Diseases					
Extension Agents	24.96	9.89	3.84	342.00	0.00
Agriculture Science Teachers	20.15	10.27			
Preventing Zoonotic Diseases					
Extension Agents	30.65	8.98	1.66	342.00	0.10
Agriculture Science Teachers	28.48	11.16			
Controlling the Spread of Zoonotic Diseases					
Extension Agents	27.30	10.11	2.37	342.00	0.02
Agriculture Science Teachers	24.15	11.02			
Knowledge Scales					
Transmission Knowledge					
Extension Agents	3.55	1.35	2.86	342.00	0.01
Agriculture Science Teachers	3.00	1.63			
Disease Knowledge					
Extension Agents	3.40	1.45	-0.3	342.00	0.77
Agriculture Science Teachers	3.46	1.49			
Reducing Risk Knowledge					
Extension Agents	6.39	1.28	1.08	342.00	0.28
Agriculture Science Teachers	6.17	1.78			

Note. Extension Agents *n*=89, Agriculture Science Teachers *n*=255

CHAPTER V

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter provides the summary of the findings, conclusions drawn from the findings, and recommendations for future research, and further connects the findings to the theoretical framework. The implications of this study, applicable to professionals in the Texas A&M AgriLife Extension Service and to agricultural science teachers in Texas, are also provided.

Purpose and Objectives

The purpose of this study was to assess the knowledge and awareness of agricultural science teachers, 4-H and youth development and agricultural and natural resource extension agents regarding zoonotic diseases. To determine this need, agricultural science teachers, agricultural and natural resource agents, and agriculture extension agents were surveyed to find out if they were aware of zoonotic diseases, had received training on zoonotic diseases, and could identify a zoonotic disease. The objectives were the following:

1. Identify participants' demographic characteristics:
    - Rural, suburban, urban
    - Ethnicity
    - Gender
    - Education level
    - Extension agent or agriculture science teacher
2. Determine the level of awareness of agricultural science teachers, agricultural and natural resource agents, and agricultural extension agents regarding zoonotic diseases related to livestock projects.

3. Determine the level of knowledge that agricultural science teachers, agricultural and natural resource agents, and agricultural extension agent have regarding zoonotic diseases related to livestock projects, and their knowledge regarding the "prevention, detection, and control of the spread of zoonotic diseases" (USHHS, 2011, pp. 1).
4. Examine the differences, if any exist, between agricultural and natural resource agents, 4-H and youth development extension agents, and agricultural science teachers on perceptions of zoonotic disease.

Summary of Findings

This study provided an indication of agricultural science teachers,' agricultural and natural resource agents,' and 4-H and youth development extension agents' awareness and knowledge of zoonotic diseases. Although these results were not generalizable to all agricultural science teachers, agricultural and natural resource agents, and agriculture extension agents in the United States, they still provided insight into participants' knowledge and awareness of zoonotic diseases.

Research Objective One

Research Objective One sought to investigate the demographic variables: rural, suburban, and urban geographic location; ethnicity; gender; education level; and professional role as agricultural and natural resource extension agent; 4-H and youth development extension agents; or agricultural science teacher.

More than half of the respondents were male (57%). The response rate of the 255 agricultural science teachers was 79%. There were 1,988 agricultural science teachers throughout the state of Texas (Texas FFA Association, 2015), and the sample surveyed included 322 agricultural science teachers. The 4-H and youth development extension agents

had a 50% response rate with 30 respondents. The sample size that was surveyed was 60 4-H and youth development extension agents out of the 67 reported in the state of Texas (Texas 4-H Program, 2015). The agricultural and natural resource extension agents had a 43% response rate, with 59 respondents from a sample size of 137 agents. There were 206 agricultural and natural resource extension agents reported in the state of Texas (Texas AgriLife Extension Service, 2015).

Research Objective Two

The goal of Research Objective Two was to determine the level of awareness of zoonotic diseases related to livestock projects regarding the detection, prevention, and control of the spread of zoonotic diseases on the part of agricultural science teachers, agricultural and natural resource agents, and agriculture extension agents.

Regarding awareness of zoonotic diseases, 85% of respondents were aware, and 14% were not aware. This suggested that these professionals are aware and that the general public should be educated about prevention through educational materials about zoonotic diseases that should be made readily available for people with livestock. Stull et al. (2012) found that these educational materials need to be supported by veterinarians, human health professionals, extension agents, and public health professionals throughout Texas.

The summary of the findings for Research Objective Two yielded two key elements. First, extension agents and agricultural science teachers reported that they had not received training or taken a course about zoonotic diseases; on a zero to 10 point scale, m=3.59. In contrast, most participants were aware of possible zoonotic diseases that could occur through animal contact (m=7.25). Furthermore, participants were aware of information that is available, from any source, about diseases that humans can get from animals (m=6.49), and

aware of proper procedures for detecting and handling zoonotic diseases in animals (m=5.35).

Participants' awareness of preventing zoonotic diseases and of controlling the spread of zoonotic diseases shows that extension agents and agricultural science teachers were highly aware of ways to prevent zoonotic diseases, with an overall average mean of 7.7. The data shows that participants were moderately aware of information on zoonotic diseases, and of the responsibility for providing information about zoonotic diseases, and were confident in their ability to educate others about controlling the spread of zoonotic diseases, with an overall mean of 6.59.

Research Objective Three

Research Objective Three sought to determine the level of knowledge, if any, of zoonotic diseases related to livestock projects in the area of detection, prevention, and the control of the spread of zoonotic diseases on the part of agricultural science teachers, agricultural and natural resource agents, and agriculture extension agents.

Research Objective Three focused on respondents' knowledge, if any, of zoonotic disease transmission modes, the zoonotic diseases that can be transmitted, ways to reduce the risk of infection by zoonotic diseases, and sources of information on zoonotic diseases. The first figure Sixty-four percent of participants identified vectors as the transmission routes for zoonotic diseases. The next figure shows the diseases that participants identified as transmissible from pets/livestock to people: rabies (92%), ringworm (90%), and salmonella (77%). A large number of participants were knowledgeable about different ways to reduce the risk of zoonotic infections in youth with pets/livestock projects. The answer choices had a response rate between 95 to 81 percent. Participants indicated that that their best sources of

information about zoonotic diseases were received from sources other than family physician, college course, professional development, veterinarian, and extension training (19%).

Research Objective Four

Participants' perceptions of detecting zoonotic diseases (m=24.96, m=20.15) and awareness of controlling the spread of zoonotic diseases (m=24.15, m=27.30) were statistically significant different. However, there was no significant difference found in participants' perceptions of preventing zoonotic diseases (m=30.65, m=24.48). The initial knowledge question was found to be statistically significant difference between extension agents (m=3.55) and agricultural science teachers (m=3.00).

Conclusions

Research Objective One

The demographics for gender were split almost evenly, at 57.1% male and 42.6% female. The participants identified themselves through their role of 4-H and youth development agents (30), agriculture and natural resources agents (59) and agricultural science teachers (255). The majority of the participants also had either a bachelor's degree (168) or a master's degree (172).

Research Objective Two

Research Objective Two sought to determine participants' level of awareness for detecting, preventing, and controlling the spread of zoonotic diseases (CDC, 2011). The data suggested that extension agents and agricultural science teachers were aware of zoonotic diseases but had received no training or coursework on the subject.

Awareness and understanding the risk associated with zoonotic diseases. The majority of participants (83%) had an understanding of the risks associated with zoonotic

diseases. This suggested that extension agents and agricultural science teachers throughout the state of Texas, at a minimum, comprehended and were aware (85%) of the risks associated with zoonotic diseases. Extension professionals are the connection between lay community members, farmers and ranchers, and health care and veterinary professionals, for sharing information and educating communities about zoonotic diseases. The findings of this study supported Webster et al.'s (2001) findings that extension professionals were a fundamental communication link to the public on zoonotic disease information.

Awareness of detecting zoonotic diseases. The data showed that extension agents and agricultural science teachers lacked training, professional development, and courses provided by their state or local agencies on zoonotic diseases. Very few participants stated that they had taken courses or received training on zoonotic diseases. However, as Grey et al. stress in their 2012 study of *Influenza A (H1N1) pdm09 Health Show Pigs, United States*, there is a high risk of zoonotic influenza infection between show pigs and young swine exhibitors.

While participants were moderately aware of the proper procedures for detecting and handling a zoonotic disease outbreak, a need for improvement was suggested, given that LeJeune and Davis (2004) found that outbreaks of zoonotic diseases that are related to animal exhibits would continue unless safeguards are launched. Participants were confident in their awareness that zoonotic diseases can occur through animal contact.

The implication was that extension agents and agricultural science teachers needed more training and education about the detection of zoonotic diseases. They are aware of, but not knowledgeable about, these diseases. We can conclude, as Stull et al. (2012) did, that there is a direct need for prevention through educational materials. Stevenson et al. (2011)

disseminated an educational model through extension agents to adult 4-H volunteers however; the rural area and limited internet access restricted the success of the trainings. Another implication is that training on zoonotic diseases for county extension agent and agricultural science teachers in Texas is minimal to nonexistent. Therefore, one recommendation is to develop such materials and training programs.

Awareness of preventing zoonotic diseases. Extension agents and agricultural science teachers were confident in their awareness of preventing zoonotic diseases, with means between 7.03 to 8.31. Stull et al. (2012) concluded that efforts needed to be supported and promoted by veterinary, human health, and public health officials for zoonotic disease prevention through educational materials. Zoonotic disease prevention has been made a near term priority by the CEEZAD (2010).

This conflicted with other findings, however. The respondents were aware of zoonotic disease prevention measures, but not detection procedures. This was perhaps because agricultural science teachers and extension agents have had experience with zoonotic diseases as professionals in agriculture. Heponstall et al. (2000) noted that ranching families and agriculture workers have frequent animal contact, which puts them at the highest risk level for contracting a zoonotic disease. This is perhaps seen in the 2012 *Influenza A* outbreak in healthy show pigs (Gray et al., 2012). This is defined as the gap between what is our current position/situation and our desired position/situation, in other words, a need (Gupta et al., 2007). This need could be addressed by making available materials such as *Prevent the Spread of Zoonotic Diseases*, by Texas A&M AgriLife Extension Service (2015).

Awareness of controlling the spread of zoonotic diseases. Participants were slightly confident in where to gather information, from any source, about zoonotic diseases.

Davis et al. (2006) concluded that the solution to the common issue of transmission of diseases in animal exhibit settings is to be innovative and be able to acclimate to the inconstancy of livestock settings and county resources. Gregory-Kreps and Balschweid (2006) assessed an *Animal Biosecurity Education Program for Youth* in high schools through a pre- and post-test that indicated an increase in knowledge; therefore, this resource could be used as a valid tool for extension agents and agricultural science teachers.

Participants' confidence. The survey participants were confident in their awareness of precautions to take with animals to reduce the risk of zoonotic disease transmission. The Shulaw and Bowman (2001) article that provided applicable ways to reduce the introduction of any new diseases and internal and external biosecurity measures supported this confidence. Furthermore, while the participants believed they should be responsible for providing information about zoonotic diseases, they were not confident in their ability to detect these diseases. The participants recognized that they should be disseminating information about the "detection, prevention, and control of the spread of zoonotic diseases," but they were not knowledgeable about these topics (USHHS, 2011, para. 1).

Research Objective Three

The data from the first and second research objectives illustrated that the participants were somewhat aware (6.66) of the "prevention, detection, and control of the spread of zoonotic diseases" (USHHS, 2011, para. 1). It must be noted, however, that awareness did not necessarily mean knowledgeable. The findings for the five areas of the participants' knowledge of zoonotic diseases are discussed below.

Disease Transmission Routes. Vector (64%) direct contact (89%) were the most common answers, and no knowledge (7%) was less common. According to the Center for

Food Security and Public Health at Iowa State University (2008), all of the possible answer choices are viable disease transmission routes; direct contact, aerosol, oral, fomite, and vector-borne transmission. Fomite was the lowest chosen (36%).

Respondent's frequency of zoonotic disease transmission methods. The three highest data points were rabies (92%), ringworm (90%), and salmonella (77%), suggesting that the participants were somewhat knowledgeable about diseases that could be transmitted from animals to humans. This supported the work of Stull et al. (2012), and established that participants to some degree were knowledge about transmitted diseases, perhaps due to the nature of their professions and their direct contact with a number of the diseases listed as answer choices.

Zoonotic disease prevention methods identified by respondents. All participants ranked all of the answer choices highly. The lowest of the answer choices was, do not eat or drink in the same area as pets/livestock (81%), and the highest was, to wash your hands (95%). In the Nebraska-Lincoln Extension Guide, authors Nold et al. (2004) outlined and educated extension agents and agricultural science teachers about how to prevent the spread of animal diseases applications for youth livestock shows. This guide defined zoonotic diseases and outlined how to prevent the spread of diseases. This indicated that participants were knowledgeable in ways to reduce the risk of zoonotic infections.

Sources of information about zoonotic diseases identified by respondents. Participants reported that they either were not provided with quality information or had few opportunities to receive valuable information on the topic of zoonotic diseases. The top answer was veterinarian (41%), and the lowest was other (19%) and family physician (8%). This suggested that extension agents and agricultural science teachers were not provided

enough information or professional development about zoonotic diseases in terms of both quality and quantity.

Educational Responsibility about Zoonotic Diseases. Participants strongly believed that they should be the point person for teaching youth about zoonotic diseases. Agricultural science teachers (92%) and extension agents (87%) were ranked the highest. This, however, contradicted other findings. The respondents believed they should be teaching youth even though they do not believe they are provided the information needed. The lowest-ranked answer choice was family physician, which was the same as in the study by Kersting et al. (2009), who found that over 50% of physicians stated they were mostly uncomfortable or strongly uncomfortable with their comprehension of zoonotic diseases. Comprehension of agricultural science teachers, 4-H and youth development, and agricultural and natural resource extension agents across the state, their awareness and knowledge about zoonotic diseases, and the need for additional high-quality curriculum can be concluded from these findings.

Participants were asked if they were aware of zoonotic diseases. The participants also stated that they were the ones who should teach youth about zoonotic diseases. Therefore, participants have identified themselves as educators, but reported limited awareness and knowledge of the "prevention, detection, and control of the spread of zoonotic diseases" (USHHS, 2011, para. 1). These results suggested that educational and training material on zoonotic diseases need to be developed for this population.

Research Objective Four

Extension agents (m=24.96) were more aware of detecting zoonotic diseases than agricultural science teachers (m=20.15). Extension agents (m=3.55) were more

knowledgeable about identifying ways that diseases can be transmitted through aerosol, vector, direct contact, fomite, orally and no knowledge than agricultural science teachers (m=3.00). One explanation could be that 82% of extension agents participating in the survey had completed their master's degree. Additional research would be needed to conclude that having a master's degree influences knowledge about zoonotic diseases. Extension agents were statistically significant on the awareness section of controlling the spread of zoonotic diseases (m=27.30) than agricultural science teachers (m=24.15).

There was no significant difference found between participants when asked to please identify which diseases they think can be transmitted from pets/livestock to people. However, each group still received a "failing grade" of 67.27% for extension agents (m=3.40) and 67.81% for agricultural science teachers (m=3.46). There was no significant difference between the groups, and both of them are still not adequately knowledgeable about identifying diseases that can be transmitted. These findings support the need for educational trainings for participants.

This study compared participants employed by Cooperative Extension and those employed by local school districts regarding their awareness and knowledge of each area of interest; detect, prevent, and control. Significant differences would have meant that efforts to reach the two groups would have benefited from customization. The two groups were not statistically different on three of the variables, and the differences were small on the three scales that were statistically different. Since both groups rely on similar resources for information and professional development efforts to address these needs may be unified, simplifying the development of the curriculum materials and professional development programs.

Recommendations

Based on these conclusions, the researcher's recommendations for state of Texas 4-H and youth development agents, agricultural and natural resource extension agents, and agricultural science teachers are as follows.

The first recommendation is mandatory training, and/or professional development, and/or course work. Mandatory training and/or professional development sessions for 4-H and youth development agents and agricultural and natural resource extension agents, and course work for agricultural science teachers, could be provided through the appropriate state agencies to train community and county leaders who would provide educational sessions for members of both programs across the state.

The training/professional development could be provided by AgriLife Extension District Offices and could take place during a required district meeting while all agents attend. The training and professional development could be taught by an Extension professional who is knowledgeable about zoonotic diseases. The material in these trainings could be developed through AgriLife Extension in conjunction with the Foreign Animal Zoonotic Disease Center (FAZD). The material would include information on detecting, preventing, and controlling the spread of zoonotic diseases. Participants should be made aware of important information about zoonotic diseases that has been previously published. The content of this training could include something similar to the training that is offered through The Center for Food Security and Public Health, *Youth in Animal Agriculture: Excellence in Exhibition*. This free, online training program has six areas: Introduction to Influenza Zoonosis and Disease Risks; Zoonotic Disease Transmission; Zoonotic Disease Prevention and Biosecurity; Highly Pathogenic Avian Influenza Case Study; Influenza A

Virus of Swine Origin Case Study; and One Health Agencies and Careers (Youth in Animal Agriculture: Excellence in Exhibition, 2017). These sections effectively address disease risks, transmission, and prevention. Participants also identified that they had not received training or taken a course about zoonotic diseases, and this recommendation would fill this deficit. This is supported in the findings, showing that participants reported that the second-best sources of information were received in professional development sessions. Davis et al. (2006) also concluded that the solution was to be innovative in educational and outreach methods in relationship to zoonotic diseases. The training and professional development or courses could be tracked in the employees' TrainTraq website at Texas A&M. This is also could track course completion if this training were mandatory. For the agricultural science teachers, it is recommended that a course be included in their certification curriculum. The zoonotic disease professionals in Texas A&M's College of Agriculture and Life Sciences, in conjunction with FAZD, could develop the material in this course. This course material could cover the detection, prevention, and control of the spread of zoonotic diseases.

An example of current training that is available to the public is 20 minutes in length and presented by Dr. Carl Williams, DVM, MA, of the North Carolina Institute for Public Health (NCIPH). The course title is Zoonotic Diseases and Public Health. The course gives a brief overview of various zoonotic diseases, investigations for such diseases, and their importance to public health (Williams, 2017). This would be a short, online course that is readily accessible to extension agents and agricultural science teachers. Another online course that is free and available to extension agents and agricultural science teacher is the readily used PEER (Partnership for Environmental Education and Rural Health) program from the College of Veterinary Medicine & Biomedical Sciences at Texas A&M (Johnson,

2000). The FAZD Educational System produced a K-12 zoonotic disease curriculum that introduces and shows how zoonotic diseases are intertwined through your life. The lesson plans can be easily downloaded from their website and used in club meetings or in the school classroom. These free lesson plans incorporate hands-on activities for youth (Budke, 2015).

The second recommendation is to increase the confidence levels of Extension agents and agricultural science teachers about zoonotic diseases. With proper zoonotic disease training and professional development, the confidence level of extension agents and agricultural science teachers should be raised, along with their level of understanding of ways to reduce zoonotic diseases that can occur with animal contact. Participants identified in the survey that they are not confident with their level of understanding of ways to reduce disease. This could be done with the proper training and professional development and course work that was outlined above.

The third recommendation is to increase the percentage of Extension agents and animal science teachers who receive information on detecting, preventing, and controlling the spread of zoonotic diseases. This study found that that 34% of participants have never received any information pertaining to zoonotic diseases. One solution would be to utilize AgriLife Communications and regional FFA offices to disseminate this valuable information through email notifications. Another would be to widely disseminate PubMed, an online notification system, and encourage these professionals to register and receive notifications of zoonotic outbreaks nationwide. The participants identified themselves as having the educational responsibility. There were a number of opportunities for state agencies, such as the State 4-H office, AgriLife Extension, and the FAZD Center, to make an educational and public health impact through these areas. An opportunity for training is to offer online

material. Different options of free online materials that are readily available are offered in the first recommendation.

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APPENDIX A

DIVISION OF RESEARCH

TEXAS A&M UNIVERSITY

DATE: September 03, 2015

MEMORANDUM

TO: John Rayfield
ALRSRCH - Agrilife Research - Ag Leadership, Education & Communication

FROM: Dr. James Fluckey
Chair, IRB

SUBJECT: Expedited Approval

Study Number: IRB2015-0545D

Title: Assessment of Agriculture Science Teachers and Extension Agents Awareness and Knowledge of Zoonotic Diseases

Date of Determination:

Approval Date: 09/03/2015

Continuing Review Due: 08/01/2016

Expiration Date: 09/01/2016

Documents Reviewed and Approved: Only IRB-stamped approved versions of study materials (e.g., consent forms, recruitment materials, and questionnaires) can be distributed to human participants. Please log into iRIS to download the stamped, approved version of all study materials. If you are unable to locate the stamped version in iRIS, please contact the iRIS Support Team at 979.845.4969 or the IRB liaison assigned to your area.

Submission Components			
Title	Version Number	Version Date	Outcome
Consent - Information Sheet 04-17-12-1	Version 1.2	08/18/2015	Approved
3rd Email	Version 1.1	08/18/2015	Approved
2nd Email	Version 1.1	08/18/2015	Approved
Initial Email	Version 1.1	08/18/2015	Approved
Survey for IRB	Version 1.0	08/18/2015	Approved

750 Agronomy Road, Suite 2701
1186 TAMU
College Station, TX 77843-1186
Tel. 979.458.1467 Fax. 979.862.3176
http://rcb.tamu.edu

Document of Consent: Waiver approved under 45 CFR 46.117 (c) 1 or 2/ 21 CFR 56.109 (c)1
Waiver of Consent:

Comments:

- Research is to be conducted according to the study application approved by the IRB prior to implementation.
- Any future correspondence should include the IRB study number and the study title.
- This protocol has been approved for 2260 participants.

Investigators assume the following responsibilities:

1. **Continuing Review:** The study must be renewed by the expiration date in order to continue with the research. A Continuing Review application along with required documents must be submitted by the continuing review deadline. Failure to do so may result in processing delays, study expiration, and/or loss of funding.
2. **Completion Report:** Upon completion of the research study (including data collection and analysis), a Completion Report must be submitted to the IRB.
3. **Unanticipated Problems and Adverse Events:** Unanticipated problems and adverse events must be reported to the IRB immediately.
4. **Reports of Potential Non-compliance:** Potential non-compliance, including deviations from protocol and violations, must be reported to the IRB office immediately.
5. **Amendments:** Changes to the protocol and/or study documents must be requested by submitting an Amendment to the IRB for review. The Amendment must be approved by the IRB before being implemented.
6. **Consent Forms:** When using a consent form or information sheet, the IRB stamped approved version must be used. Please log into iRIS to download the stamped approved version of the consenting instruments. If you are unable to locate the stamped version in iRIS, please contact the iRIS Support Team at 979.845.4969 or the IRB liaison assigned to your area. Human participants are to receive a copy of the consent document, if appropriate.
7. **Post Approval Monitoring:** Expedited and full board studies may be subject to post approval monitoring. During the life of the study, please review and document study progress using the PI self-assessment found on the RCB website as a method of preparation for the potential review. Investigators are responsible for maintaining complete and accurate study records and making them available for post approval monitoring. Investigators are encouraged to request a pre-initiation site visit with the Post Approval Monitor. These visits are designed to help ensure that all necessary documents are approved and in order prior to initiating the study and to help investigators maintain compliance.
8. **Recruitment**: All approved recruitment materials will be stamped electronically by the HRPP staff and available for download from iRIS. These IRB-stamped approved documents from iRIS must be used for recruitment. For materials that are distributed to potential participants electronically and for which you can only feasibly use the approved text rather than the stamped document, the study's IRB Study Number, approval date, and expiration dates must be included in the following format: TAMU IRB#20XX-XXXX Approved: XX/XX/XXXX Expiration Date: XX/XX/XXXX.
9. **FERPA and PPRA:** Investigators conducting research with students must have appropriate approvals from the FERPA administrator at the institution where the research will be conducted in accordance with the Family Education Rights and Privacy Act (FERPA). The Protection of Pupil Rights Amendment (PPRA) protects the rights of parents in students ensuring that written parental consent is required for participation in surveys, analysis, or evaluation that ask questions falling into categories of protected information.
10. **Food:** Any use of food in the conduct of human research must follow Texas A&M University Standard Administrative Procedure 24.01.01.M4.02.
11. **Payments:** Any use of payments to human research participants must follow Texas A&M University Standard Administrative Procedure 21.01.99.M0.03.
12. **Records Retention**: Federal Regulations require records be retained for at least 3 years. Records of a study that collects protected health information are required to be retained for at least 6 years. Some

APPENDIX B

October 5, 2015

Texas A&M University in conjunction with the One Health Initiative would like to ask for your participation in the Assessment of Agriculture Science Teachers and Extension Agents Awareness and Knowledge of Zoonotic Diseases. The purpose of this study is to determine if there is need to educate youth about the impact and influence of zoonotic diseases could have on their livestock projects and family.

The survey will take approximately 10 minutes to complete. Do not add your name or other identifying data to the survey. Please note the following characteristics of this study:

your participation is voluntary;
your identity will remain confidential;
you can elect to withdraw at any time without penalty;
there are no positive or negative benefits from responding to this survey;
there is no compensation;
the survey will be used for research;
the data obtained from this survey may be published.

Please click on the following link to be forwarded to the survey:

Assessment of Ag Science Teachers and Extension Agents Awareness and Knowledge of Zoonotic Diseases

Your response is important. Getting direct feedback from you is important in improving the quality of educational materials. Thank you for your help by completing the survey.

If you have any questions, you can contact Merrideth Holub, at (979) 204-6417 or e-mail at mholub@cvm.tamu.edu.

Sincerely,

Merrideth Holub & Dr. John Rayfield

APPENDIX C

October 6, 2015

We recently sent you an email asking you to respond to a brief survey about your knowledge and awareness of zoonotic diseases as an extension agent or agricultural science teacher. Your responses to the survey are important and will help in developing zoonotic curriculum at Texas A&M University.

Texas A&M University in conjunction with the One Health Initiative would like to ask for your participation in the Assessment of Agricultural science Teachers and Extension Agents Awareness and Knowledge of Zoonotic Diseases. The purpose of this study is to determine if there is need to educate youth about the impact and influence of zoonotic diseases could have on their livestock projects and family.

This study will involve 4-H, agricultural, natural resource agents, and agricultural science teachers throughout Texas.

The survey will take approximately 10 minutes to complete. Do not add your name or other identifying data to the survey. Please note the following characteristics of this study:

your participation is voluntary;
your identity will remain confidential;
you can elect to withdraw at any time without penalty;
there are no positive or negative benefits from responding to this survey;
there is no compensation;
the survey will be used for research;
the data obtained from this survey may be published.

Please click on the following link to be forwarded to the survey: Assessment of Ag Science Teachers and Extension Agents Awareness and Knowledge of Zoonotic Diseases

Your response is important. Getting direct feedback from you is important in improving the quality of educational materials. Thank you for your help by completing the survey.

If you have any questions, you can contact Merrideth Holub, at (979) 204-6417 or e-mail at mholub@cvm.tamu.edu.

This research study has been reviewed by the Institutional Review Board-Human Subjects in Research, Texas A&M University. For research-related problems or questions regarding subjects' rights, you can contact the Institutional Review Board through Ms. Michelle Billings, IRB Program Coordinator, Office of Research Compliance, (979) 845-7037, mbillings@tamu.edu

APPENDIX D

October 14, 2015

The fall semester is a busy time for you, and I understand how valuable your spare time is during this time of year. I am hoping you may be able to give about ten minutes of your time before the end of the month to help us collect important information for Texas A&M University by completing the short survey.

If you have already completed the survey, we really appreciate your participation. If you have not yet responded, we would like to urge you to complete the survey. We plan to end this study next week, so I wanted to email everyone who has not responded to make sure you had a chance to participate.

The survey will take approximately 10 minutes to complete. Do not add your name or other identifying data to the survey. Please note the following characteristics of this study:

your participation is voluntary;
your identity will remain confidential;
you can elect to withdraw at any time without penalty;
there are no positive or negative benefits from responding to this survey;
there is no compensation;
the survey will be used for research;
the data obtained from this survey may be published.

Please click on the following link to be forwarded to the survey:

Assessment of Ag Science Teachers and Extension Agents Awareness and Knowledge of Zoonotic Diseases

Your response is important. Getting direct feedback from you is important in improving the quality of educational materials. Thank you for your help by completing the survey.

If you have any questions, you can contact Merrideth Holub, at (979) 204-6417 or e-mail at mholub@cvm.tamu.edu.

Thank you,

Merrideth Holub

APPENDIX E

Texas A&M University Human Subjects Protection Program – Information Sheet

Project Title: *Assessment of Ag Science Teachers and Extension Agents Awareness and Knowledge of Zoonotic Diseases*

You are invited to take part in a research study being conducted by Dr. John Rayfield and Merrideth Holub, a researcher from Texas A&M University. The information in this form is provided to help you decide whether or not to take part. If you decide you do not want to participate, there will be no penalty to you, and you will not lose any benefits you normally would have.

Why Is This Study Being Done?
The purpose of this study is to determine if 4-H, agricultural, natural resource agents, and agricultural science teachers in the state of Texas are knowledgeable and aware of zoonotic diseases.

Why Am I Being Asked To Be In This Study?
You are being asked to be in this study because you are a 4-H, agricultural and natural resources agent or an agricultural science teacher within the state of Texas.

How Many People Will Be Asked To Be In This Study?
There will be 2,260 agricultural science teachers, 4-H agents, and agricultural and natural resource agent (participants) invited to participate in this study throughout the state.

What Are the Alternatives to being in this study?
The alternative to being in the study is not to participate.

What Will I Be Asked To Do In This Study?
You will be asked to answer questions in short on-line survey. Your participation in this study will last up to 10 minutes.

Are There Any Risks To Me?
The things that you will be doing are no greater than minimal risks than you would come across in everyday life. There will be no physical, criminal, social, financial, economic, psychological risk as well as risks associated with breach of privacy or confidentiality associated with this study.

Will There Be Any Costs To Me?
Aside from your time, there are no costs for taking part in the study.

Will I Be Paid To Be In This Study?
You will not be paid for being in this study; however, an incentive is that the data after the study is completed will be provided to you so that you can make changes or adjustments in your curriculum or program changes.

Will Information From This Study Be Kept Private?
The records of this study will be kept private. No identifiers linking you to this study will be included in any sort of report that might be published. Research records will be stored securely and only Dr. John Rayfield and Merrideth Holub will have access to the records.

Information about you will be stored in locked file cabinet; computer files will be protected with a password.

Information about you will be kept confidential to the extent permitted or required by law. People who have access to your information include the Principal Investigator and research study personnel. Representatives of regulatory agencies such as the Office of Human Research Protections (OHRP) and entities such as the Texas A&M University Human Subjects Protection Program may access your records to make sure the study is being run correctly and that information is collected properly.

Information about you and related to this study will be kept confidential to the extent permitted or required by law.

Who may I Contact for More Information?
You may contact the Principal Investigator, John Rayfield PhD., to tell him/her about a concern or complaint about this research at 979-845-5039 or jrayfield@tamu.edu. You may also contact the Protocol Director, Ms. Michelle Billings at (979) 845-7037or mbillings@tamu.edu. For alternate contact (Co-PI) contact Merrideth Holub M.S., 979-845-5039, mholub@cvm.tamu.edu.

For questions about your rights as a research participant, to provide input regarding research, or if you have questions, complaints, or concerns about the research, you may call the Texas A&M University Human Research Protection Program office by phone at (979) 458-4067 or toll free at 1-855-795-8636, or by email at irb@tamu.edu.

What if I Change My Mind About Participating?
This research is voluntary and you have the choice whether or not to be in this research study. You may decide to not begin or to stop participating at any time. If you choose not to be in this study or stop being in the study, there will be no effect on your job or relationship with Texas A&M University.

By completing the survey(s), you are giving permission for the investigator to use your information for research purposes.

Thank you,

John Rayfield, PhD
Merrideth Holub, MS

APPENDIX F

Texas A&M University Human Subjects Protection program – Waiver of Consent or

Documentation of Consent for the Use of Human Subject Research

This form may be included with the any Application form when requesting a Waiver of Written Documentation of the Consent Process or a Waiver or Alteration of the Consent Process.

A waiver or alteration of the consent process according to 45 CFR§46.116 (c) and (d) would waive part or all of the consent process. Examples of the use of this waiver are in deception research (waiving elements of consent) or research to analyze data (waiving consent all together). A waiver of documentation of consent according to 45 CFR §46.117(c) would waive the required signature of the informed consent form and would require the use of an information sheet to provide to participants that contains all the elements of informed consent according to 45 CFR§46.116(a). Examples of the use of a waiver to documentation of consent would be for the use of internet surveys.

In order to ensure that the waiver is considered and documented appropriately, please provide a reasonable amount of detail in your responses.

I. Project Identification

Title of Project	*Assessment of Ag Science Teachers and Extension Agents Awareness and Knowledge of Zoonotic Diseases*
Principal Investigator	*Dr. John Rayfield*
IRB Protocol # (if assigned)	

II. Waiver of Consent - 45 CFR§46.116

Provide protocol-specific reasons and justification on how all the following criteria are met:
The research involves no more than minimal risk to the participants. Protocol-specific explanation: There are no more than minimal risks associated with the answering of the survey. At most it allows the participants an opportunity to reflect on their curriculum in their classrooms and county education programs related to zoonotic diseases.
The waiver or alteration will not adversely affect the rights and welfare of the participants. Protocol-specific explanation: The rights and welfare of the participants will not be adversely affected due to the waiver.
The research could not practicably be carried out without the waiver or alteration. Protocol-specific explanation: With the large number of participants from across the state it would not be practical to collect written consent. Therefor the waiver of consent is being asked for the internet survey.

Whenever appropriate, the participants will be provided with additional pertinent information after participation. Protocol-specific explanation: After the completion of the survey there will be information provided to the participants about the data collected and how it impacts their educational objectives provided to the students.
IRB Use Only ☐ Approved ☐ Denied ☐ Portions of the study ☐ All of the study Comments:

OR

II. Waiver of Documentation of Consent - 45 CFR§46.117

Provide protocol-specific reasons and justification on how *at least one* of the following criteria are met:
The only record linking the participant and the research would be the consent document, and the principal risk would be potential harm resulting from a breach of confidentiality. Each participant will be asked whether the participant wants documentation linking the participant with the research, and the participant's wishes will govern. Protocol-specific explanation:
That the research presents no more than minimal risk of harm to participants and involves no procedures for which written consent is normally required outside of the research context. In cases in which the documentation requirement is waived, the IRB may require the investigator to provide participants with a written statement regarding the research. Protocol-specific explanation:
IRB Use Only ☐ Approved ☐ Denied ☐ Portions of the study ☐ All of the study Comments:

APPENDIX G

SURVEY

Assessment of Ag Science Teachers and Extension Agents Awareness and Knowledge of Zoonotic Diseases

Through the College of Agriculture & Life Sciences at Texas A&M University we would like to ask for your participation in the following survey as part of a research study being conducted by Dr. John Rayfield and Merrideth Holub, a researcher from Texas A&M University. The purpose of this study is to determine if 4-H & Youth Development agents, Agricultural and Natural Resource agents and agricultural science teachers in the state of Texas are aware and/or knowledgeable of zoonotic diseases. You are being asked to be in this study because you are a 4-H, agricultural and natural resources agents or an agricultural science teacher within the state of Texas. The survey will take approximately 10 minutes to complete. Do not add your name or other identifying data to the survey.

Please note the following characteristics of this study:

your participation is voluntary;
your identity will remain anonymous;
you can elect to withdraw at any time without penalty;
there are no positive or negative benefits from responding to this survey;
there is no compensation;
the survey will be used for research and, the data obtained from this survey may be published.

Who may I Contact for More Information?

You may contact the Principal Investigator, John Rayfield PhD., to tell him/her about a concern or complaint about this research at 979-845-5039 or jrayfield@tamu.edu. For alternate contact (Co-PI) contact Merrideth Holub M.S., 979-845-5039, mholub@cvm.tamu.edu.

For questions about your rights as a research participant; or if you have questions, complaints, or concerns about the research, you may call the Texas A&M University Human Subjects Protection Program office at (979) 458-4067 or irb@tamu.edu.
This research is voluntary and you have the choice whether or not to be in this research study. You may decide to not begin or to stop participating at any time. If you choose not to be in this study or stop being in the study, there will be no effect on your job or relationship with Texas A&M University. By completing the survey(s), you are giving permission for the investigator to use your information for research purposes.

Thank you,
John Rayfield, PhD and Merrideth Holub, MS

Q3 Gender:
- ❍ Male (1)
- ❍ Female (2)

Q4 Please specify your ethnicity:
- ❍ White or Caucasian (1)
- ❍ Hispanic or Latino (2)
- ❍ Black or African American (3)
- ❍ Native American or American Indian (4)
- ❍ Asian (5)
- ❍ Other (6)

Q5 What is the highest degree or level of school you have completed? If currently enrolled, highest degree received.
- ❍ Associate Degree (1)
- ❍ Bachelor's Degree (2)
- ❍ Master's Degree (3)
- ❍ Professional Degree (4)
- ❍ Doctorate Degree (5)
- ❍ Other (6)

Q6 Extension Agent or Agricultural science Teacher?
- ☐ Agricultural and Natural Resources Extension Agent (1)
- ☐ 4-H & Youth Development Extension Agent (2)
- ☐ Agricultural science Teacher (3)

Q7 Which of the following best describes your geographic area
- ❍ Rural (> 2,500 in population) (1)
- ❍ Suburban (> 10,000 in population) (2)
- ❍ Urban (> 50,000 in population) (3)

Q8 I am aware of what zoonotic diseases are?
- ❍ Yes (1)
- ❍ No (2)

Q9 I understand what risks are associated with zoonotic diseases in animals.
- ❍ Yes (1)
- ❍ No (2)

Q10 The next section is broken down into three sections with four questions each in the areas of detect, prevent and control of spreading zoonotic diseases. (Please scroll down to view all sections) According to the CDC a zoonotic disease is defined as a disease that can be passed

between animals and humans. Viruses, bacteria, parasites, and fungi can cause zoonotic diseases.

Q11 Please answer the following four questions around the area of detecting zoonotic diseases.

- _____ I am aware of possible zoonotic diseases that can occur with animal contact (1)
- _____ I am aware of information that is available, from any source, about diseases that you can get from animals (2)
- _____ I am aware of trainings or courses about zoonotic diseases (3)
- _____ I am aware of proper procedures for detecting and handling zoonotic diseases in animals (4)

Q12 Please answer the following four questions around the area of preventing zoonotic diseases.

- _____ I am aware that by controlling animal movement, vehicle and equipment movement, location and construction of buildings and separation of species and ages assist with external zoonotic disease transmission (1)
- _____ I am aware that sanitation and manure management assist with internal zoonotic disease transmission (2)
- _____ I am confident with my level of understanding of ways to reduce disease that can occur with animal contact (3)
- _____ I am aware that when working with animals that are showing signs of disease or have an open wound you are supposed to take protective measures like wearing gloves or use hand hygiene (4)

Q13 Please answer the following four questions around the area of controlling the spread of zoonotic diseases.

- _____ I am aware of information, from any source, about zoonotic diseases. (1)
- _____ I am aware that I should be responsible for providing information about zoonotic diseases to people in the community, students, or families. (2)
- _____ I am aware of precautions to take with animals to reduce the risk of disease (3)
- _____ I am confident enough to educate others about zoonotic diseases that can be found in animals. (4)

Q14 In the final section of the survey there are five questions covering your knowledge of zoonotic diseases. Please answer to the best of your ability.

Q15 Zoonotic diseases can be transmitted through, which of the following (choose all that apply):

- ❑ Aerosol (1)
- ❑ Vector (2)
- ❑ Direct contact (3)
- ❑ Fomite (4)
- ❑ Orally (5)
- ❑ No knowledge of how zoonotic diseases can be transmitted (6)

Q16 Please identify which diseases you think can be transmitted from pets/livestock to people?

- ❑ Rabies (1)
- ❑ HIV/AIDS (2)
- ❑ Intestinal worms (3)
- ❑ Methicillin-resistant Staphylococcus Aureus (MRSA) (4)
- ❑ Distemper (5)
- ❑ Salmonella (6)
- ❑ Giardia (7)
- ❑ Measles (8)
- ❑ Hepatitis (9)
- ❑ Infectious Diarrhea (10)
- ❑ Ringworm (11)
- ❑ No knowledge of which of the diseases listed are zoonotic (12)

Q17 Which of the following are ways that you can reduce the risk of zoonotic infections for yourself/youth with pets'/livestock projects?

- ❑ Wash hands (1)
- ❑ Keep children under 5, elderly, or immune-compromised away from sick animals (2)
- ❑ Keep your pets/livestock healthy (3)
- ❑ Clean up after your pets/livestock (4)
- ❑ Store your food and the animal's food separately (5)
- ❑ Don't eat or drink in the same area as pets/livestock (6)
- ❑ Vaccinate your pets/livestock (7)
- ❑ No knowledge of ways to reduce the risk of zoonotic infections (8)

Q18 Have you ever received information from any source about diseases that you can get from animals or precautions to take with pets/livestock to reduce the risk of disease?

- ❍ Yes (1)
- ❍ No (2)

If Yes Is Selected, Then Skip to Click to write the question text

Q20 If yes, then please select which of the following were the best sources of information were received from.

- ❑ College course (1)
- ❑ Extension training (2)
- ❑ Veterinarian (3)
- ❑ Professional Development (4)
- ❑ Family Physician (5)
- ❑ Other (6)

Q19 Who do you believe should teach youth, who show livestock, about zoonotic diseases?

- ❑ Agriculture Teachers (1)
- ❑ Extension Agents (2)
- ❑ Public/Private Schools (3)
- ❑ Family Physician (4)
- ❑ Veterinarian (5)
- ❑ Parents (6)
- ❑ Other (7) _____

Thank you for your time and effort in answering the survey. Your input is greatly appreciated and goes to better the future for our youth showing livestock and their health.

Dr. John Rayfield & Merrideth Holub