EFFECT OF SOURCE IN ONLINE VIDEO TRAINING FOR PRE-HARVEST STRATEGIES
FOR THE CONTROL OF *E. COLI*

by

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Abstract

Escherichia Coli (*E. Coli*) contamination has been a long-existing concern for those engaged in cattle production, often causing negative public health and economic consequences. The existence of pre-harvest practices that reduce *E. coli* contamination creates the opportunity to support human health by focusing on modifying behaviors in cattle production through educational communication. It is vital to consider how the communication can be modified to persuade the audience. This study examined the effects of different sources, such as a veterinarian or a cattle producer, presenting the educational message in a training video. An experimental design was used to examine how the information source used in a video relates to the source's credibility, as well as testing concepts related to the theory of planned behavior. A link to a video and an online questionnaire were distributed to cattle producers through the weekly news e-mail distributed by several beef industry organizations. The data analysis of 106 complete questionnaires found that no matter how a presenter was described in a training video there was no difference in the perceived credibility of the presenter. Also, no matter how the source was identified there was no difference in the variables related to the theory of planned behavior and possible behavior adoption. In addition to these results, this study found that no matter how the source was labeled, higher perceived credibility correlated with more positive attitudes, perceived norms, perceived behavior control and reported intention to adopt the suggested behaviors. This pattern provides evidence for credibility's relationship with possible behavior adoption, indicating that credibility of the source is an important consideration when message designers are constructing training videos.

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Dedication

This thesis is dedicated to my mom, Lou Ann Lambeth Chapes, who was with me when I started my master's degree journey, and my wife, Casey Fraites, who helped me see it finished.

Chapter 1 - Introduction

Background

Escherichia coli (E. coli) is a type of bacteria that resides in the gastrointestinal tract of humans and animals as part of the normal flora for healthy individuals. Generic *E. coli* is essential in that it aids in the digestion process for healthy individuals (Centers of Disease Control and Prevention, 2012). *E. coli* is part of a bacteria family that consists of several species that are both pathogenic (disease-causing) and non-pathogenic (non-disease-causing). From a pathogenic standpoint, six classes of *E. coli* are recognized. One of the categories includes Enterohemorrhagic (EHEC) *E. coli.*, also known as Shiga toxin-producing *E. coli* (STEC) (Buchanan & Doyle, 1997). A STEC species of *E. coli* that results in ongoing significant concern is *E. coli* O157:H7, which is found to reside in the gastrointestinal tract of wildlife, domestic animals and livestock. Cattle are known as a major reservoir of *E. coli* O157:H7 and, although not pathogenic to animals, *E. Coli* O157:H7 is pathogenic to humans. Fecal shedding of the *E. coli* O157:H7 from cattle is a major contamination source for food and water (Gansheroff and O'Brien, 2000).

E. coli O157:H7 causes disease in humans by causing large quantities of a toxin that adheres to the intestinal wall and results in severe damage to the intestinal lining. It is typically transmitted to humans through fecal-oral transmission from contaminated food and water (Centers of Disease Control and Prevention, 2012). Since 1982, when it was recognized as a human pathogen following two outbreaks, *E. coli* O157:H7 has been declared a public health concern in North America and several European countries (Buchanan & Doyle, 1997).

In the Unites States, it is estimated that 9.4 million cases of foodborne illness occur each year, resulting in 1,351 deaths annually (Scallan, Hoekstra, Angulo, Tauxe, Widdowson, Roy et

al., 2011). The Centers for Disease Control and Prevention (CDC) estimates that there are 265,000 STEC infections each year, with *E*. coli 0157:H7 causing 36 percent of these cases, and that the most susceptible populations include the young, elderly and individuals with compromised immune systems (2012). *E. coli* O157:H7 infections are preventable by proper food preparation, implementation of pre-harvest practices for beef cattle operations and strong enforcement of HACCP (Hazard Analysis Critical Control Point) regulations for food processing facilities (Food and Agriculture Organization of the United Nations, 2011).

In addition to being a great public health concern, *E. coli* O157:H7 also results in significant economic losses for the beef cattle industry. The United States Department of Agriculture (USDA) estimates almost 90,000 pounds of beef were recalled in 2013 *E. coli* O157:H7 contamination (USDA, 2014a). As a result of the public health issues and the economic impact on the beef industry, the beef industry has adopted procedures to reduce the occurrence of *E. coli* O157:H7 in meat processing facilities (Dargatz et al., 2013). In addition, the use of pre-harvest *E. coli* management strategies has been recognized as an important part of a safe beef products system (USDA, 2014b). The existence of these pre-harvest interventions creates the opportunity to positively impact human health by focusing on modifying behaviors and management strategies carried out in cattle production.

Problem Statement

There are many ways to educate cattle producers about the behaviors they can adopt to help reduce *E. coli* contamination on their operations. One method is using online videos to present these educational messages. This strategy is especially interesting in light of the growth in the popularity of online videos. Since 2009, the percentage of adults online who have watched or downloaded videos grew from 69% to 78% in 2013. In addition, 50% of adults online have

said they watched educational videos using the Internet, and 56% of these viewers have watched how-to videos (Purcell, 2013).

Using the Internet to deliver educational training videos is appealing when considering the number of cattle producers who use the Internet. According to the National Cattlemen's Beef Association – an organization with members that manage 90% of the nation's cattle – 85% of its members have Internet access and 70% of them have used it to learn more about beef industry issues (*NCBA 2013-2014 media kit – beef USA)*. In fact, when the USDA awarded a $25 million grant to 11 land-grant universities toward the control of *E. coli* contamination in the beef industry, one third of the grant was targeted toward extension and outreach efforts (Moser, 2012). As a result, in fall 2013 the Beef Cattle Institute at Kansas State University released a series of training videos that describe pre-harvest practices to help with the control of *E. coli* (Hambright, 2014). For communication and education efforts like these to succeed, it is important that communication designers consider how best to present messages to an audience so it can positively inform and impact the audience's behavior.

Purpose of Study

The purpose of this study is to examine how different ways of presenting messages in an online training video might impact the adoption of behaviors endorsed in the video message. Specifically, it will study the effects of different sources, such as a veterinarian or a cattle producer, presenting the educational messages in the programs. This study will use an experimental design to examine how the information source used in a video relates to source credibility concepts of expertise and trustworthiness. It will also use the theory of planned behavior to examine a video's possible impact on behavior adoption. The findings of this study

will provide information that can inform future communication efforts and programs that intend to educate cattle producers and encourage them to adopt pre-harvest strategies to control *E. coli*.

Theoretical Framework

This study intends to explore the relationship between the source of new information relating to *E. coli* control strategies for cattle producers and factors related to behavior adoption. To do so, the concepts regarding source credibility and the theory of planned behavior were used to inform this study.

Source credibility has been studied for many years and has long been identified as an important part of the communication process, "whether the goal of the communication effort be persuasion or the generation of understanding" (McCroskey & Young, 1981, p. 24). Credibility has been described as the judgments an audience member makes about the believability of the communicator (Callison, 2001). Over the years, research into the concept has identified many elements of credibility, but the two that have received the most attention are trustworthiness and expertise (Pornpitakpan, 2004). Trustworthiness is the extent to which the audience sees the assertions made by communicator to be valid. Expertise is the extent to which the speaker is seen to be capable of making correct statements (Hovland, Janis, & Kelley, 1953). Although cattle producers haven't been specifically studied, for dairy producers it was found that when assessing different sources of information about bovine growth hormone, the producers perceived different levels of expertise and trustworthiness for different sources. For example, veterinarians were seen as having both high levels of expertise and trustworthiness, while government sources were seen as having low trustworthiness and high expertise (Marquart, O'Keefe, & Gunther, 1995). Using the concepts of expertise and trustworthiness, this study will gauge the perceived credibility of the sources in a training video.

This study will also use concepts from the theory of planned behavior (TPB). This theory, an expansion of the theory of reasoned action, proposes that intention is the most important determinant of behavior (Ajzen, 1991). According to the TPB, the stronger the intention to perform a certain behavior, the stronger the likelihood of its performance. Also, the theory presents a model wherein intention is informed by attitudes toward the behavior, subjective norms and perceived behavior control. It is proposed that the more positive the attitudes and norms toward a behavior, and the greater the perceived control, the greater the intention to perform a certain behavior when given the opportunity (Ajzen, 2006). Reviews of research that used the TPB have found support for using this theory in relation to a wide variety of behaviors (Ajzen, 1991; Armitage & Conner, 2001). Based on this theory, the questionnaire used in this study will feature items that will allow participants to rate their attitudes, subjective norms, perceived behavior control and intentions to adopt strategies that can be used to help control *E. coli* contamination on their cattle production facilities.

Justification of Study

As explained above, the food safety and financial impact of *E. coli* contamination is an ongoing concern for those involved in the beef industry. This concern fuels an interest in education and communication that can inform cattle producers of the part they can play in the control of *E. coli* contamination of beef. While using online videos has become an attractive communication strategy for this education, more research is needed to better utilize this medium to communicate to the cattle producer audience. This study will provide a start to this research by examining how manipulating one element of a video, the source of information presenting the advocated messaged (and perhaps the perceived credibility of that source), has an impact on the producer's attitudes, subjective norms, perceived behavior control and intention to adopt the

behaviors advocated in the video. Understanding this relationship, if it exists, will help inform future education programs and communication campaigns on how best to present messages to cattle producers about pre-harvest *E. coli* contamination control strategies.

Organization of Thesis

This thesis is divided into five parts. The first chapter provided a brief overview of the background and reasoning for this study, as well as a brief introduction to its theoretical framework. Chapter two will provide a more in-depth literature review about *E. coli*, using videos to communicate to cattle producers, the impact video interventions have on knowledge and behavior and why videos have an impact as explained by the cognitive theory of multimedia learning and social cognitive theory. This chapter will also provide an extended discussion of this study's theoretical framework and the hypotheses of this study. Chapter three will describe the methods that will be used in this study to obtain and analyze data. Chapter four will provide a description of the results of this study. Finally, chapter five will provide a discussion of the implications and limitations of the study, as well as areas for possible future research.

Chapter 2 - Literature Review

This chapter explores existing literature to address the following topics: background on *E. coli*, the education of cattle producers using online videos, the impact video has on knowledge and behavior, explanations why video has this effect and the theoretical framework of this study, including source credibility and the theory of planned behavior. After discussing these issues, the hypotheses of this study are introduced.

E. Coli

Escherichia Coli (*E. Coli*) is a large and diverse group of bacteria normally residing in the intestines of people and animals. Most types are harmless and are important to a healthy intestinal tract (CDC, 2012). Some types of *E. coli* have become pathogenic, or disease causing, to humans and animals. These types are divided into six classes including enterotoxigenic (ETEC), enteroinvasive (EIEC), enteroaggregative (EaggEC), enteropathogenic (EPEC), diffusely adherent (DAEC) and enterohemorrhagic (EHEC). EHEC, also know as shiga-toxin producing *E. coli* (STEC) is "unusually virulent" and has been the focus of much research and news coverage due to its association with foodborne outbreaks (Buchanan & Doyle, 1997). STEC is a type of *E. coli* that lives in the intestines of normal cattle, existing in a symbiotic relationship that does not harm the animal (USDA, 2014). The most commonly studied form, known as STEC O157:H7, is found in an estimated 28% of beef cattle (Gansheroff & O'Brien, 2000).

When a human is infected with *E. coli* 0157:H7, it can cause gastroenteritis, bloody diarrhea and vomiting (USDA, 2014). It can also cause mild fevers of less than 101 degree Fahrenheit. Most people recover after five to seven days but 5-10% of those infected develop a life-threatening condition called hemolytic uremic syndrome (HUS) (CDC, 2012). Symptoms

include destruction of red-blood cells, depressed platelet counts, lack of urine formation, swelling and acute renal failure (Buchanan & Doyle, 1997). While most people can become infected, young children and the elderly are more likely to develop HUS and severe symptoms from infection (CDC, 2012).

In addition to STEC O157:H7, there are also other types of STEC that can also cause disease in humans and whose prevalence are still being studied (Dargatz et al., 2013). These are usually called non-0157 STECS (CDC, 2012). For both these and *E. coli* 0157, food is the predominant transmission route, which is typically beef and produce contaminated by infected feces through water, direct contact or food processing (Rangel et al., 2005). Consequently, the United States Department of Agriculture Food Safety Inspection Service (USDA-FSIS) considers 0157 and non-0157 STECS to be "an adulterant" in ground beef (USDA, 2014, p. 28).

STECs were first recognized as a human pathogen after two outbreaks in 1982 that resulted in 33 hospitalizations from the undercooked fast-food hamburgers (Buchanan & Doyle, 1997). From 1982 to 2002, 350 outbreaks were reported in 49 states, resulting in 8,598 cases of *E. coli* 0157:H7 infection (Rangel et al., 2005). The Centers for Disease Control and Prevention (CDC) estimates that there are 265,000 STEC infections each year, with *E.* coli 0157:H7 causing 36 percent of these cases (2012). In addition to the public health impact of STECs, it also causes economic repercussions for the beef industry. The USDA-FSIS estimates that almost 90,000 pounds of beef was recalled in 2013, which was more than the 63,467 pounds recalled in 2012 and less than the 979,971 pounds recalled in 2011 (USDA, 2014a). More recently in 2014, *E. coli* 0157 infected 12 people and the Wolverine Packing Company recalled approximately 1.8 million pounds of ground beef on May 19, 2014 (CDC, 2014).

E. coli contamination can be reduced by the implementation of HACCP (Hazard Analysis Critical Control Point) systems in beef processing facilities, as well as the use of safe food handling practices by consumers and the food service industry. Additionally, pre-harvest strategies in animal production can play a role in preventing *E. coli* contamination (Food and Agriculture Organization of the United Nations, 2011). Numerous studies have found evidence that pre-harvest interventions are helpful in reducing *E. coli* shedding by beef cattle (Sargeant, Amezcua, Rajic & Waddell, 2007). For example, feeding activities can affect this shedding. Feeding cattle distiller grains can increase *E. coli* 0157 prevalence, while using certain feed additives can reduce it (Jacob, Calloway & Nagaraja, 2009). Additionally, commercial vaccines can also be used to reduce fecal prevalence of *E. coli* 0157 (Cull et al., 2012). The USDA also suggests that basic principles of cattle management such as clean water, clean feed, clean environment and biosecurity practices can provide the foundation for procedures used to control *E. coli* (USDA, 2014b). In fact, the USDA recommends that beef processors get cattle from producers who use one or more pre-harvest interventions, suggesting that the strategies are "the first control steps in an integrated beef products system" (p. 4). The existence of these pre-harvest interventions creates the opportunity to positively impact human health by focusing on modifying behaviors and management strategies carried out in cattle production.

Educating Cattle Producers Using Online Videos

There are several strategies to educate producers about these interventions, including the use of online training videos. Since YouTube was founded in 2005, the popularity of watching videos online has exploded. According to the Pew Research Center, the percentage of online adults who watch or download online videos has grown from 69% in 2009 to 78% in 2013. With this growth in popularity, the potential of online videos to be used as educational tools has also

grown. A Pew report found that 50% of adults online claim to watch educational videos and 56% watch "how-to" videos online (Purcell, 2013). These numbers highlight the potential for online videos as an educational communication tool, especially for reaching special audiences such as cattle producers. According to the National Cattlemen's Beef Association, an organization with 26,500 members who manage 90% of the nation's cattle, 85% of its members have Internet access and 70% of them have used the Internet to learn about beef industry issues (*NCBA 2013-2014 media kit - beef USA*).

One such program that is using online videos to educate cattle producers is Animal Care Training, maintained by the Beef Cattle Institute at Kansas State University. This program uses online videos to educate beef cattle producers and veterinarians about animal welfare, handling, and food safety practices. Animal Care Training is used by several organizations for online training, including the American Association of Bovine Practitioners, the National Cattleman's Beef Association and Beef Quality Assurance ("About Animal Care Training," n.d.).

In Fall 2014, the Beef Cattle Institute released a series of online training modules on Animal Care Training to raise awareness of pre-harvest strategies to reduce *E. coli* contamination as part of a $25 million USDA Coordinated Agricultural Project (CAP) grant (Hambright, 2014). While many of the online modules found on the BCI website, such as these STEC education modules, are informative, it is unclear how much influence they have on actual behavior adoption. Therefore, it is important to see what existing research has shown about the effectiveness of video intervention for affecting knowledge and behavior.

Impact of Video on Knowledge and Behavior

Several studies in the health communication literature suggest that videos can have a varying impact in regard to behavior adoption or related concepts such as attitudes change and

alteration of intentions. Early reviews of research related to video and television found that most video-based interventions were effective at having an impact on knowledge and behavior, and were at least as effective as other methods of information presentation, though the authors were doubtful that using video interventions had a long-term impact on knowledge and behavior since many studies did not include long-term follow-up (Gagliano, 1988; Nielsen & Sheppard, 1988). More recent research has continued to find support for varying levels of effectiveness in a variety of health behaviors such as condom acquisition (O'Donnell, San Doval, Duran, & O'Donnell, 1995), use of the female condom (Zimmers, E Privette, G Lowe, R H Chappa, F., 1999), patient self-care practices (Krouse, 2001), risky behavior related to STDs (Downs et al., 2004), and some self care behaviors related to heart-failure prevention (Albert, Buchsbaum, & Li, 2007). Other research has shown some impact of video on attitudes and knowledge about STDs and condoms in a health-clinic environment (Healton & Messeri, 1993), knowledge among individuals with sleep disorders (Murphy, Chesson, Walker, Arnold, & Chesson, 2000), intentions to sign a cornea-donation card (Bae & Kang, 2008) and positive attitudes toward mental health help-seeking (Demyan & Anderson, 2012).

The effectiveness of videos deployed specifically on the Internet has not been explored as much. One notable study found that a website that used videos was more effective than a website that did not use videos (Perrault & Silk, 2013). In the study, participants reviewed one of two versions of a website describing behaviors intended to reduce the cancer risk associated with the household chemical perfluorooctanoic acid (PFOA). One version featured embedded videos and one did not. Those who reviewed the website with the videos found the endorsed behaviors easier to perform and were more likely to state the intention to perform the behaviors than those who reviewed a website without the videos. Also, 15 days following exposure to the website,

participants in the video condition were more likely to have performed one protective behavior described on the website and in the videos. While this was only one study, its findings suggest videos could have a powerful impact when deployed online.

There is also some evidence for the effectiveness of videos when used to educate audiences about agricultural topics. A study looking at the effectiveness of a multimedia training tool for animal care workers found "substantial improvements" in knowledge-based exam scores following exposure to an online-training video (Reinhardt, Thomson, Retzlaff, Butler, & Valles, 2010). A later study looking at the impact that a 12-minute training video had on agricultural workers' food safety knowledge also found a significant improvement in some areas of knowledge, though it should be mentioned that the study also noted that the workers who participated in the study exhibited high levels of knowledge before exposure to the video. The study's authors highlighted that training videos "should be developed to reflect the reality of the target audience's workplace situation" (Mathiasen, Morley, Chapman, & Powell, 2012). The existing literature demonstrates that videos can be an effective tool to increasing knowledge, positive attitudes, intentions to adopt, and actual behavior adoption in relation to a wide variety of behaviors.

Why Does Video Have An Effect?

The existing literature establishes that video can have an impact on knowledge and behavior adoption. Several theories have been used in the literature to explain why media, such as videos, can educate and persuade. One example is the cognitive theory of multimedia learning, which has been popularized by Richard Mayer. The theory is based on an assumption called the "multimedia principle," or the assertion that "people learn more deeply from words and pictures than from words alone" (Mayer, 2005, p. 31). Mayer describes a multimedia

instructional message as a "communication containing words and pictures intended to foster learning," which would include educational messages in video (2005, p. 32). The theory claims that humans are able to learn from multimedia by selecting the relevant visual and auditory information, organizing this information and finally integrating it by building connections between newly acquired information and prior knowledge (Mayer, 2003).

Another popular theory in the literature is social cognitive theory, developed by Albert Bandura. One of the most important concepts in the theory is the human capability of vicarious learning, or "by observing the behaviors of others, an individual can develop rules to guide his or her subsequent behavior" (Pajares, Prestin, Chen, & Nabi, 2009, p. 285). Even though people have this capability to learn behavior vicariously, they do not perform everything they see and learn. They must be motivated to perform observed actions. This motivation is influenced by outcome expectancies and self-efficacy. Outcome expectancies "refer to the observer's perception of consequences (positive and/or negative) that are likely to result from a given behavior" (Moyer-Gusé, 2008, p. 412). Self-efficacy is one's ability "to exercise control over one's functioning and events that affect one's life" (Bandura, 2004, p. 78-79). It is possible to influence outcome expectancies and self-efficacy through vicarious experiences or social modeling, or "observing others perform behaviors" (Pajares et al., 2009, 286). Bandura developed this idea through a series of experiments he conducted that explored social learning's role in the transmission of aggressive behavior in children. These are now known as the "Bobo doll" experiments. In one of these experiments, pre-school children were exposed to a person who attacked and abused an inflatable clown doll. Another group were exposed to a model on film attacking the Bobo doll and another was exposed to a cartoon with a character performing similar actions. This experiment found that children in all of the conditions would reproduce the

aggressive behavior after the exposure. Bandura noted, "the available data suggests that of the three experimental conditions, exposure to the humans on film portraying aggression was the most influential" (Bandura, Ross & Ross, 1963, p.7). This provided evidence that media sources were valid models for learning behavior.

In many ways the cognitive theory of multimedia learning and social cognitive theory appear to be very different explanations of how media educate and persuade. Despite these differences, an understanding of the application of both theories reveals one important shared suggestion: the importance of source in presenting the message. For example, principles based on ideas found in the cognitive theory of multimedia learning provides guidance for individuals designing multimedia messages on how to present the information in a way that helps viewers build connections between new and old knowledge. One of these suggestions is called the personalization principle. The principle promotes the use of conversational narration and the use of pedagogical agents, or characters, in educational media. These agents are on-screen sources that can look and sound human who present the educational messages and can have a positive effect on learning outcomes (Clark & Mayer, 2003). The positive effect suggests that the source of the message can have an important impact on message uptake.

An application of ideas in social cognitive theory also suggests that source can have an important impact. This is exemplified in a strategy called entertainment-education. Entertainment-education is "the process of purposely designing and implementing a media message to both entertain and educate, in order to increase audience members' knowledge about an educational issue, create favorable attitudes, shift social norms and change overt behavior" (Singhal & Rogers, 2004, p. 5). The strategy is often associated with health-related messages, such as HIV/AIDS prevention and family planning. It has been used and seen success

worldwide, in places such as Mexico, India, Kenya, Brazil, Tanzania and St. Lucia (Poindexter, 2004). The most predominant theory found in the analysis of these entertainment-education interventions is social cognitive theory (Sood, Menard, & Witte, 2004).

Entertainment-education programs have incorporated concepts from social cognitive theory by using positive, negative and transitional role models, or characters. Positive models portray "beneficial styles of behavior," while negative models exhibit "detrimental views and lifestyles" (Bandura, 2004, p. 83). For example, *Twende na Wakati*, a program in Tanzania, featured the negative character of Mkwaju, "a promiscuous truck driver who does not use condoms and who ultimately becomes sick with AIDS" (Vaughan et al., 2000, p. 86). While these positive and negative characters provide examples for how audience members should or should not act, transitional characters provide examples demonstrating that there is always an opportunity for change. These models "are shown transforming their lives by moving from uncertainty or discarding adverse styles of behavior in favor of beneficial ones" (Bandura, 2004, p. 83). Through characters like this, media provides sources that give viewers examples of behaviors they can use to modify their own behavior. The application of social cognitive theory in entertainment-education programs, as well as the personalization principle from the cognitive theory of multimedia learning, demonstrates that the source of the message can play a strong role in the acceptance of the presented message. This conclusion is further explored in the theoretical background of this study.

Theoretical Framework

Video can have an impact on learning and behavior, as explained by the cognitive theory of multimedia learning and social cognitive theory. The question for programs that attempt to use videos to educate and train is how to modify video communications so the media can make as

significant impact as possible on the viewer, whether it be increasing knowledge, change attitudes or increase behavior adoption. It is important to note that communication is generally considered to have five broad variables, including source, message, channel, receiver and target variables (McGuire, 1984). For efforts that have already decided on the message (pre-harvest contamination control), channel (online videos), receiver (cattle producers) and target (behavior change) variables, it is important to consider how the source, or communicator, variable can be modified. As demonstrated by the personalization principle in the cognitive theory of multimedia learning and the use of models in entertainment-education as suggested by social cognitive theory, the role the source plays in communication is an important consideration. An important aspect of this variable is source credibility (McGuire, 1984). For this reason, this study will use source credibility as a theoretical basis.

In addition to source credibility, this study will also use the theory of planned of behavior as a theoretical foundation. It was decided to use this theory because the study will explore how the credibility of different sources in an online training video relate to concepts that are related to behavior adoption. Because of the interest in the relation to behavior adoption, theoretical models or constructs that help to understand what influences the adoption of certain behaviors, such as those in the theory of planned behavior, are useful when studying the online training videos that will be used in this study.

Source Credibility

Credibility has long been considered one of the most important communicator attributes and has been studied since the 1950s (Perloff, 2010). Credibility "refers to the judgments made by a message recipient concerning the believability of a communicator" (Callison, 2001, p. 220). It has also been described as "an audience member's perceptions of the communicator's

qualities" (Perloff, 2010, p. 166). The research into credibility has deconstructed the concept and identified many varied dimensions, such as competence, dynamism, objectivity, and goodwill (Pornpitakpan, 2004; Perloff, 2010). For example, studies of the credibility of television newscasters have included dimensions such as character, composure, and extraversion (Brann and Leezer-Himes, 2010). Despite these varied dimensions, the two aspects of credibility used with the "greatest regularity" are expertise and trustworthiness (Perloff, 2010, p. 167). A source's "expertness," also known as expertise, has been described as "the extent to which a communicator is perceived to be a source of valid assertions" (Hovland, Janis & Kelley, 1953, p. 21). Also, trustworthiness is "the degree of confidence in the communicator's intent to communicate the assertions he considers the most valid" (Hovland, Janis & Kelley, 1953, p. 21).

Many studies over the years have used these dimensions to examine how credibility has interacted with communication components such as message, channel, receiver, destination and, especially, source attributes (Pornpitakpan, 2004). For those in agriculture, there has been some research that has suggested that certain attributes of information sources can be quite powerful. In 2010, Blackstock et al. reviewed literature to shed light on the best mechanisms to influence behavior change in farmers to improve water quality on ranches. Their review suggested that "experience" and "occupation" were important attributes of sources and that farmers were more likely to process "in-group messages," or messages from individuals who share a similar agricultural background (p. 5632). Because of this finding they wrote, "the use of people from farming backgrounds or trusted networks is likely to enhance message uptake" (Blackstock et al., 2010, p. 5632).

Other research looking at information-source preferences support this interpretation (Vergot, Isreal & Mayo, 2005; Brunson & Price, 2009; Russel & Bewley, 2013). These studies

found that farmers and other rural landowners prefer to get information from other producers, extension agents and veterinarians (Vergot, Isreal & Mayo, 2005), friends and relatives, and extension sources (Brunson & Price, 2009), or consultants, nutritionists, and veterinarians (Russell & Bewley, 2013). Another study that sought to map a group of farmers' social and information-learning network found that local sources and practical experience were valued. The top sources for information were high-achieving farmers (Sligo & Massey, 2007). It should be noted that just because a source is the most used does not mean it is seen as the most credible. Meena and Meena (2012) published a study examining sources of information used by dairy producers in India. Though there was some variation depending on specific tribal village, the most used sources included fellow farmers, neighbors and the "village quack" (Meena & Meena, 2012). In contrast, the sources that were perceived to be the most credible were village development officers and extension personnel, in addition to neighbors. These findings suggest that being the most used information source is not the same as being perceived as the most credible.

There is also evidence that how the information source is labeled can affect perceived credibility. In 2013, Garnett conducted a study involving DTN/The Progressive Farmer subscribers, most of whom were active or retired agricultural producers. The participants were presented with a news story that was either labeled as coming from a farm media source (DTN) or a mainstream source (The Chicago Tribune). This label significantly altered perceived credibility, with respondents who had seen the farm media story perceiving the article as fair, more trustworthy, and less biased than the participants who read the mainstream media story. Earlier research carried out by Marquart, O'Keefe and Gunther (1995) also supported the perceived difference in the credibility of different information sources. In their research, they

found that dairy farmers perceived different levels of trust and expertise for different sources for receiving information about manufactured bovine growth hormone (BGH). For example, other dairymen were perceived to have higher levels of trust than expertise. The reverse was true for government officials. Assuming that cattle producers are similar to these dairy producers, this research provides evidence that it is important to consider trustworthiness and expertise when considering the credibility of sources of information.

Although the importance of expertise hasn't been specifically studied, trust has been explored in other research. Heffernan, Nielson, Thomson and Gunn (2008) interviewed cattle and sheep farmers in the United Kingdom and found that veterinarians and other farmers were seen as the top sources for information relating to biosecurity. Through a content analysis of the interviews, they found that government sources were not trusted. The lack of trust in government by agricultural producers was also discovered in a group of sheep and cattle farmers in western Australia. Palmer, Sully and Fozdar (2009a, 2009b) conducted a survey and found that these Australian producers had high levels of trust for sources of biosecurity information such as neighbors, other farmers and animal health personnel (2009a). They also found that the participants had low trust for government sources. This was confirmed during in-depth interviews carried out by the same authors (2009b) who wrote that for these agricultural producers, "trust in the messenger is more important than the message" (p. 371). This research highlights the importance that source attributes, such as trust, and therefore credibility, has when communicating with agricultural producers.

To better understand the information source preference and source credibility as it relates to *E. coli* control, a preliminary survey of cattle producers asked which sources the producers were likely to get information about pre-harvest strategies for *E. coli* prevention. It also asked the

producers about the perceived credibility for each source (Chapes, 2015). A questionnaire was delivered to a convenience sample of cattle producers who were members of the e-mail newsletter mailing list of three beef cattle or agricultural organizations: the Kansas Farm Bureau, the Beef Cattle Institute at Kansas State University and the American Angus Association. For the study, 192 questionnaires were collected. The findings suggested that producers were most likely to get information from veterinarians and least likely to get information from government agents. Sources such as extension personnel, other cattle producers and beef industry organizations were found to be similar to each other in the likelihood to be used as information sources. In addition, the perceived credibility of veterinarians was significantly higher than the other sources; government sources had the lowest credibility rating. The other sources were similar to each other for perceived credibility. This preliminary study demonstrated that cattle producers are more likely to use certain information sources for *E. coli* control information than others, and that the source that they are most likely to use, veterinarians, is also perceived to be the most credible source. On the other hand, the source the producers are least likely to use, government agents, is also perceived to be the least credible. This research further highlighted the importance in considering the source of a message, and its potential credibility, when deciding how best to present a message encouraging the adoption of pre-harvest *E. coli* prevention strategies.

The Theory of Planned Behavior

The theory of planned behavior (TPB) – an expansion of the theory of reasoned action – is designed to "predict and explain human behavior in specific contexts" (Ajzen, 1991, p. 181). The theory states "the stronger the intention to engage in a behavior, the more likely should be its performance" (Ajzen, 1991, p. 181). The TPB describes three determinants of intention: 1) attitudes toward behavior, or "the degree to which a person has a favorable or unfavorable

evaluation or appraisal of the behavior in question;" 2) subjective norms, or "the perceived social pressure to perform or not to perform the behavior;" 3) and perceived behavior control, or "the perceived ease or difficulty of performing the behavior" (p. 188). Perceived behavior control can also be a direct determinant of behavior, meaning that it can be used with behavioral intention in the prediction actual behavior (see Figure 2.1).

Ajzen (1991) reviewed the findings of studies that looked at behaviors such as voting, losing weight, using condoms and attending class. His analysis of this research found that intentions and perceived behavioral control correlate "quite well" with the performance of a behavior. A later review of 161 articles using the TPB by Armitage and Conner (2001) supported the correlation of perceived behavior control and intention with behavior, though the prediction of self-reported behavior was superior to observed behavior. This review also found multiple correlations between attitudes, subjective norms and perceived behavior control with intention.

Research has also found support for using the TPB in predicting adoption of behaviors or practices related to agriculture. This includes a study that examined how beliefs influenced Australian landowner's intention to adopt riparian zone management practices, such as managing
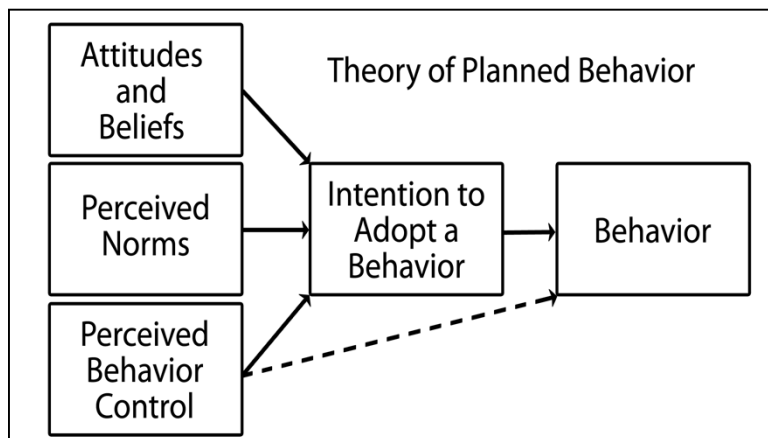

Figure 2.1 The Theory of Planned Behavior (Ajzen, 1991).

stock access to waterways and maintaining buffers between paddocks and water sources (Fielding, Terry, Masser, Bordia & Hogg, 2005). The study found land owners who had strong intentions to adopt these practices had more positive attitudes toward the behavior, perceived stronger normative support and perceived that barriers to adoption were less likely to prevent adoption of the behavior. The authors concluded that TPB was useful in identifying "the factors that influence the adoption of sustainable practices" (Fielding, et al., 2005, p.19). A follow-up set of studies that investigated the adoption of sustainable agricultural practices also found that attitudes and perceived behavior control were significant predictors of intention to adopt practices (Fielding, Terry, Masser & Hogg, 2008). The same study also found intentions to be a significant positive predictor of behavior.

A review of literature involving research into the adoption of agricultural best management practices found that "attitudes were most frequently positively associated with adoption," though this role of attitudes was "nuanced" since attitudes toward different topics, such as profitability, risk, or the environment, could have different effects on best-practice adoption (Prokopy, Floress, Kotthor-Weinkauf & Baumgart-Getz, 2008, p. 308-309). Another study that interviewed 46 cattle ranchers who had participated in a verotoxogenic *E. Coli* (VTEC) O157 intervention trial identified several barriers to the adoption of zoonotic control programs on the farm relating to behavioral, normative and self-efficacy beliefs. While these ranchers had "general positive attitudes to controlling zoonosis on the farm," intent was hindered by lack of self-efficacy and "unsupportive social norms" (Ellis-Iverson et al., 2010, p. 284). These studies demonstrate the usefulness of measures relating to the theory of planned behavior toward understanding the adoption, or lack thereof, of agricultural practices.

Hypotheses and Research Questions

The current study is interested in how source attributes, such as occupation/title, can impact perceived source credibility for online training videos. It will study the following hypotheses based on previous research suggesting veterinarians, other producers and government officials would have different perceived credibility.

> H_1: When comparing an online training video featuring a cattle producer with one featuring a government source, the video with the cattle producer will be seen as having more positive source credibility.

> H_2: When comparing an online training video featuring a veterinarian with one featuring a government source, the video with the veterinarian will be seen as having more positive source credibility.

This study is also interested in how the source's attributes in the training video can also have an impact on possible behavior adoption related to *E. coli* contamination.

> H_3: An online training video featuring a cattle producer will have a more positive relationship with attitudes, perceived norms, perceived behavior control and intention to adopt pre-harvest strategies related to *E. coli* contamination than a video featuring a government source.

> H_4: An online training video featuring a veterinarian will have a more positive relationship with attitudes, perceived norms, perceived behavior control and intention to adopt pre-harvest strategies related to *E. coli* contamination than a video featuring a government source.

> RQ_1: What will have a more positive relationship with attitudes, perceived norms, perceived behavior control and intention to adopt pre-harvest strategies related to *E. coli* contamination: a video featuring a cattle producer or a video featuring a veterinarian?

This study is also interested with the relationship between source credibility and possible behavior adoption.

> H_5: Higher source credibility will correlate with positive attitudes toward adopting pre-harvest strategies related to *E. coli* contamination.

> H_6: Higher source credibility will correlate with positive perceived norms toward adopting pre-harvest strategies related to *E. coli* contamination.

H_7: Higher source credibility will correlate with positive perceived behavior control toward adopting pre-harvest strategies related to *E. coli* contamination.

H_8: Higher source credibility will correlate to intention to adopting pre-harvest strategies related to *E. coli* contamination.

Chapter 3 - Methods

This study will examine the relationship between the perceived source credibility of sources that present information relating to the pre-harvest control of *E. coli* in an online training video and the potential adoption of these endorsed strategies. An online questionnaire will be used to conduct an experiment examining this relationship between source credibility and variables related to behavior adoption. This chapter introduces the methods that will be used in this study, including the design, variables, procedure and data analysis.

Design

This study will use a post-test only/control group experimental design, with one independent variable related to information source. An experimental design, in which "variables are manipulated and their effects upon other variables observed," was chosen because this research is interested in better understanding the cause and effect relationships between information sources and possible behavior adoption (Campbell & Stanley, 1963, p. 1). Isolating this causality relating to the variables of interest is something other more correlational or observational research designs are not capable of doing (Field & Hole, 2003). The dependent variables of interest for this research will be concepts related to source credibility (trustworthiness and expertise) and the theory of planned behavior (attitudes, subjective norms, perceived behavior control and intention to adopt behavior).

Independent Variables

Information source

The primary independent variable of this study will be the source of the information presented in the online training video. Previous research has shown that individuals involved in cattle production prefer to get new information related their operations from a variety of sources,

including veterinarians, other cattle producers and government sources such as extension agents or the USDA (Vergot, Isreal & Mayo, 2005; Breiner et al., 2007). In addition, those in agriculture perceive these sources as being different in terms of expertise and trustworthiness, and how the source of information is labeled can impact perceptions of credibility (Marquart, O'Keefe & Gunther, 1995; Chapes, 2015; Garnett, 2013). This study will manipulate this variable by changing how the source, or the presenter, in the training video is identified in the lower-third graphic used in the video. The presenter will either be identified as a veterinarian, a cattle producer or a government official from the USDA. In the control condition, no identifying lower third will be used. See Appendix C.

Demographics

Demographic information, such as age, race and gender, will be collected as part of the questionnaire. Also, questions related to size of herd on operation, years in cattle production, location of and role on the operation will be included. The questions related to cattle production were inspired by data collected in the 2012 USDA Census of Agriculture (USDA, 2012c).

Dependent Variables

Source credibility

As seen in the literature, credibility is considered to be combination of expertise and trustworthiness (Perloff, 2010). Expertise is the audience's evaluation of the source's competence related to what is being communicated, while trustworthiness is "the audience's belief in the integrity of the source" (Callison, 2001, p. 220). This study will measure source credibility using a scale similar to ones used in previous studies (McCroskey & Young, 1981; McCrosky & Tevan, 1999; Sinaga & Callison, 2008; Johnston & Warkentin, 2010). The survey instrument is designed to create a source credibility rating through a series of 8-point semantic

differential scales. Expertise is composed of five dimensions: Experienced/Inexperienced, Informed/Uninformed, Trained/Untrained, Qualified/Unqualified, and Expert/Not Expert. Trustworthiness is composed of five dimensions: Honest/Dishonest, Trustworthy/Untrustworthy, Open minded/Closed minded, Fair/Unfair, and Ethical/Unethical. For this questionnaire, an even-numbered eight-point scale was used. While the elimination of a neutral middle-point answer through the use of an even-numbered scale may frustrate certain respondents, it can also help control ambivalent answers and force participants to think about the issue (Weijters, Cabooter & Schillewaert, 2010; Pett, Lackey & Sullivan, 2003; Nowlis, Kahn & Dhar, 2002). The eight-point scale was used over a scale that featured fewer categories because it has been suggested that scales that use fewer than seven categories result in less reliable scores (Preston & Colman, 2000).

Attitudes

Referring to "the degree to which an individual has a favorable or unfavorable evaluation or appraisal of the behavior," this variable is an important element found in the theory of planned behavior (Bae & Kang, 2008, p. 88). Attitude will be measured using a scale similar to ones found in literature (Ajzen, 2006; Bae & Kang, 2008; Fielding, Terry, Masser & Hogg, 2008). Participants will respond to the statement, "For me, adopting and using *E. coli* prevention and control strategies in the forthcoming months is: useful/important/worthwhile." The responses will be collected with a seven-point semantic differential scale. For example, "Useful" is paired with "Of no use."

Subjective norms

This variable "assesses the perceived social pressure on the individual to perform or not to perform the behavior" in question (Bae & Kang, 2008, p. 88-89). Much like attitude,

subjective norm will be assessed with three items based on scales used in previous literature (Ajzen, 2006; Bae & Kang, 2008; Fielding, Terry, Masser & Hogg, 2008). The items include: "if I adopt and use *E. coli* prevention and control strategies on my ranch, other cattle producers would (1 – Strongly disapprove to 8 – Strongly approve); most cattle producers think that using prevention and control strategies for *E. coli* is (1 – Undesirable to 8 – Desirable); most cattle producers think I should use practices that can help control *E. coli* contamination on my ranch (1– Strongly Disagree to 8 – Strongly Agree).

Perceived Behavior Control

Another element of the theory of planned behavior, perceived behavioral control refers to an "individual's perception of the extent to which performance of the behavior is under his or her control" (Bae & Kang, 2008, p. 89). Perceived behavior control is often associated with the concept of self-efficacy found in Bandura's social cognitive theory (Ajzen, 1991). This variable will be measured with three items inspired by previous literature (Ajzen, 2006; Bae & Kang, 2008; Fielding, Terry, Masser & Hogg, 2008). The items include: how much control do you have over the control of *E. coli* on your ranch? (1 – Very little control to 8 – A great deal of control); for me, to use strategies that can help control *E. coli* on my ranch is (1 – Impossible to 8 – Very possible); how difficult is it for you to help prevent *E. coli* contamination on your ranch? (1 – Very difficult to 8 – Very easy).

Intention to Adopt Behavior

Seen as the direct antecedent of behavior performance, intention is "an indication of how hard an individual is willing to try and of how much of an effort the individual is planning to exert to perform the behavior" (Azjen, 2006; Bae & Kang, 2008, p. 89). The theory of planned behavior states that "the more favorable the attitude and subjective norm, and the greater the

perceived control, the stronger should be the person's intention to perform the behavior in question" (Azjen, 2006, p. 1). Intention will be measured with three questions based on items found in the literature (Ajzen, 2006; Bae & Kang, 2008; Fielding, Terry, Masser & Hogg, 2008). The items include: I intend to adopt or use prevention and control strategies for *E. coli* on my operation (1 – Strongly disagree to 8 – Strongly agree); I expect to adopt or use prevention and control strategies for *E. coli* on my operation in the near future (1 – Strongly disagree to 8 – Strongly agree); in the forthcoming months, I am likely to adopt or use prevention and control strategies for *E. coli* on my operation (1 – Strongly disagree to 8 – Strongly agree).

Procedure

This research will use a web-based questionnaire developed in Qualtrics, an online survey tool. The 9:22 minute training videos with content based on information provided by the Beef Cattle Institute at Kansas State University will be presented to the participants in Qualtrics. The training videos will be exactly the same, each featuring the same talent to represent a veterinarian, a cattle producer or government official. The only difference between the video for each condition will be the lower-third graphic presented toward the start and the end of the video that identifies the name and title of the source/narrator.

Participants were individuals involved in cattle production. These included individuals who were managers or employees on ranches. The participants could be involved in feedyard, cow-calf or stocker operations. For this particular study, the information and link to the questionnaire was distributed to cattle producers through the weekly news e-mail distributed by organizations whose membership includes cattle producers. The organizations that assisted with this research included the Kansas Farm Bureau, the Beef Cattle Institute at Kansas State University, the American Angus Association and the Kansas Livestock Association. The survey

link was included in the Kansas Farm Bureau's semiweekly e-mail that was sent to 11,221 addresses on October 13, 16, 20, 23, 27 and 30, and on November 10 and 13, 2015. The addresses on this list include Kansas Farm Bureau voting members, or members who have an agricultural interest with income earned through production agriculture. The link was also sent to 960 members of the Beef Cattle Institute's e-mail newsletter subscriber list on October 16 and 22, and November 3, 2015. Also, the survey link was included in the American Angus Association's 3,448 member Angus Journal Daily newsletter e-mail on October 13 and 22, and November 6, 2015. The link was also shared on the Angus Journal's Facebook page on October 16 and November 7. The information and link was also sent to 1,200 members of the Kansas Livestock Association on October 19, 2015. As a way to recruit more cattle producers for the study, All Beef Quality Assurance state coordinators and advisory boards were also given a chance to distribute the link to the survey to producers in their states on October 29, 2015.

When a participant followed the link from the e-mail message or newsletter, they were presented with a consent message. After agreeing to participate in the research, the user was randomly sorted into one of the four conditions in the experiment. Once starting the questionnaire, the participants were presented with a question that asked if they are involved in cattle production. After this, the participants were presented with the training video, either the program featuring the veterinarian, the cattle producer, the government official or an unidentified source. After watching the video, the participant was shown the questions related to source credibility and the theory of planned behavior. Before the final demographic questions, the participants were presented with a manipulation check question that asked if they could remember how the presenter in the video was identified. At the end of the questionnaire, the

participants were given a message that thanked them for their time and an explanation for the research.

Data Analysis

The data from the online questionnaire was analyzed in IBM SPSS Statistics, Version 23.0, a software statistical analysis tool. Questions intended to measure the same theoretical variable, such as trustworthiness or intention, were tested for reliability. Only items that score higher than a 0.8 in Cronbach's alpha analysis were used. A score of 0.8 in this analysis is a reflection of good internal consistency and suggests the items are measuring the same concept (Field & Hole, 2003).

The data from each item related to each dependent variable were recoded into a composite score for trustworthiness, expertise, attitudes, subjective norms, perceived behavior control and intention. An Analysis of Variance (ANOVA) test was used to test for statistical differences between the four conditions in the experiment for these dependent variables. Also, a Pearson's r correlation was used to check for the relationship between credibility and the variables related to the theory of planned behavior.

Chapter 4 - Results

For this study, 168 questionnaires were collected. After removing incomplete data sets and participants who did not identify themselves as being a cattle producer at the start of the survey, 106 complete questionnaires were included in the data analysis. Two data sets from participants who did not identify themselves as a cattle producer were included because they identified themselves as an owner/hand or employee at a cattle operation in other questions. Of the completed questionnaires, 27 of the participants viewed the video with the veterinarian, 26 viewed the video with the government official, 26 viewed the video with the cattle producer, and 27 watched the video where the presenter was not identified.

Cattle producers who participated in the study were different ages, with nearly half (48.1 percent) being 55 years old or older. The rest included 22.6 percent who were younger than 35, and 29.2 percent who were between 35 and 54 years old. Sixty-nine (65.1 percent) identified themselves as male, with the rest identifying themselves as female (33.0 percent), other (0.9 percent) or preferred not to answer (0.9 percent). Most of the participants identified themselves as non-Hispanic white (88.7 percent), with the second largest group being producers who preferred not to answer (10.4 percent). A large group of the participants had spent 10 or more years in cattle production (82.1 percent). Most of the participants worked at a Cow-Calf operation (79.2 percent), with the rest working at Stocker (7.5 percent), Feedyard (5.7 percent) or other types (7.5 percent) of cattle production operations. Operations represented by the participants included those with 49 head of cattle or less (22.7 percent), 50-199 head (39.6 percent) or 200 or more head (37.7 percent). Kansas was the most represented state (52.8 percent), with Idaho (7.5 percent), Ohio (6.6 percent) and Nebraska (4.7 percent) being the next

most represented. The participants had mix of education levels, from some college or less (26.4 percent), college degree (38.7 percent), or some post-graduate work or degree (34.9 percent).

Of the 106 participants, 66 of them (62.3 percent) correctly identified how the presenter was identified in the manipulation check question, while the 22 (20.7 percent) either misidentified the presenter or couldn't remember. Of the 27 producers who watched the video with the veterinarian, 24 (88.9 percent) correctly identified the presenter. Of the 26 who watched the government official video, 15 (57.7 percent) correctly identified their presenter, and of the 26 who watched the video with the cattle producer, 18 (69.2 percent) correctly remembered their presenter. Finally, of the 27 who watched the video where the presenter was not identified, 9 (33.3 percent) correctly noticed that the presented was not identified.

Data Transformation

Before beginning analysis of collected data, certain reverse coded items were recoded to have their low and high score ordered left to right to make data analysis easier. These included the Experienced/Inexperienced, Trained/Untrained, Qualified/Unqualified, Expert/Not expert, Open-minded/Closed-minded, Fair/Unfair, and Ethical/Unethical items related to source credibility. Also, the Useful/Of no use and Worthwhile/Not worthwhile items related to attitudes and beliefs, and the Approve/Disapprove and Strongly Agree/Strongly Disagree items related to subjective norms were recoded. Finally, the Very possible/Impossible item related to perceived behavior control and the two Strongly Agree/Strongly Disagree statements related to intention to adopt behavior were recoded as well.

Next, the five items related to expertise were averaged into a combined score (α=.84), as were the five items related to trustworthiness (α=.89). The items for expertise and trustworthiness were averaged to create a combined score for credibility. Following this, the

three items related to attitudes and belief were averaged into a composite score (α=.89). This was also done for the three items related to subjective norms (α=.76), perceived behavior control (α=.81), and intention (α=.82).

Data Analysis

Source and Credibility

Hypothesis 1 predicted that when comparing the online training video featuring the cattle producer with the video with the government source, the cattle producer video would have more positive perceived credibility. In addition, Hypothesis 2 predicted that the video with the veterinarian would also have more positive perceived credibility than the video with the government official. To test these hypotheses, a one-way between subjects ANOVA was conducted to compare the effect of how the source in the video was identified on perceived credibility of the source in the video. This test found that there was not a significant effect of source on perceived credibility at the $p<.05$ level for all of the videos [$F(3, 102) = 0.59$, $p = 0.62$]. Since no significant differences were found, H_1 and H_2 were not supported. See Table 4.1.

Following this first test, one-way between subjects ANOVAs were also conducted to compare the effect of how the source in the video was identified on perceived credibility on the

Table 4.1

Perceived Credibility of Sources in Online Training Videos

Information Source	Expertise Mean	Trustworthiness Mean	Credibility Mean	Standard Deviation
Veterinarian	7.1	7.0	7.1	0.8
Government Sources	6.9	6.9	6.9	1.1
Cattle Producer	6.6	6.7	6.7	1.4
Unidentified	6.9	7.0	7.0	1.1

Note: Sources ranked with eight-point semantic differential scales.

perceived trustworthiness and expertise, the component elements of source credibility. At the p<.05 level, these tests found that there was no significant effects of source on trustworthiness [$F(3, 102) = 0.36$, $p = 0.78$] or expertise [$F(3, 102) = 0.77$, $p = 0.51$]. These findings provide additional evidence that H_1 and H_2 were not supported.

Next, data from respondents who did not correctly identify how the source was labeled in the video were removed so only participants who noticed how the host was identified were included. This left 66 data sets to analyze. With this data, a one-way between subjects ANOVA was run to compare the effect of source on credibility for these participants. This test found that there was still not a significant effect of source on perceived credibility at the p<.05 level for all of the videos [$F(3, 62) = 0.29$, $p = 0.83$]. Additional one-way between subjects ANOVAs conducted also found no significant effects of source on trustworthiness [$F(3, 62) = 0.41$, $p = 0.75$] or expertise [$F(3, 62) = 0.24$, $p = 0.87$]. These findings further suggest that that H_1 and H_2 were not supported.

As a post-hoc exploration of the relationship between source and credibility, data from the manipulation check question that asked participants to remember how the source in the video was labeled was used to identify participants who believed they watched a video that featured a veterinarian, government official, cattle produced or unidentified source. Based on this manipulation questions, 24 participants believed they watched a video featuring a veterinarian, 15 believed they watched a video with a government official, 18 believed they watched a video with a cattle producer and 9 thought they saw the video with the unidentified source. Though these groups did not feature ideal numbers for statistical analysis, a one-way between subjects ANOVA was conducted to compare the effect of believed source on perceived credibility. This test found that there was not a significant effect of believed source on credibility at the p<.05

level [$F_{(3, 62)} = 0.29$, $p = 0.83$]. Further one-way between subjects ANOVAs conducted also did

not find any significant effects of believed source on perceived trustworthiness [$F_{(3, 62)} = 0.41$,

$p = 0.75$] and expertise [$F_{(3, 62)} = 0.24$, $p = 0.87$]. These post-hoc analyses further suggest that

source in the video does not have a significant effect on perceived credibility.

Source and the Theory of Planned Behavior

Hypothesis 3 predicted that an online training video featuring a cattle producer would

have a more positive relationship with attitudes, perceived norms, perceived behavior control and

intention to adopt suggested behaviors than a video featuring a government official. Hypothesis 4

also predicted that the video featuring the veterinarian would also have a more positive

relationship with these measures related to the theory of planned behavior. Also, Research

Question 1 asked what would have a more positive relationship with attitudes, norms, perceived

behavior control and intention, the video with the cattle producer or the veterinarian. To test

these hypotheses, a one-way between subjects ANOVA was conducted to compare the effect of

source on attitudes for all videos. This test found that source did not have a significant effect on

attitudes at the $p<.05$ level [$F_{(3, 102)} = 1.72$, $p = 0.17$]. Further one-way between subjects

Table 4.2

Theory of Planned Behavior Measures

Information Source in Video	Attitudes	Subjective Norms	Perceived Behavior Control	Intention to Adopt Behavior
Veterinarian	6.7	6.3	5.8	5.9
Government Sources	6.3	5.9	5.5	5.6
Cattle Producer	6.5	6.6	6.2	6.3
Unidentified	7.2	6.6	6.3	6.3

Note: Sources ranked with eight-point semantic differential scales.

ANOVAs also did not find a significant effect of source on subjective norms [$F_{(3, 102)} = 1.61$, p = 0.19], perceived behavior control [$F_{(3, 102)} = 1.59$, p = 0.20], and intention to adopt behavior [$F_{(3, 102)} = 1.18$, p = 0.32]. These findings suggest that how the source was identified in the training video, whether as a veterinarian, cattle producer, government official or unidentified, had no effect on the measures related to the theory of planned behavior and possibly potential behavior adoption. Thus, H_3 and H_4 were not supported. Also, the findings suggest the answer to RQ_1 is that neither the video with the cattle producer nor the video with the veterinarian has a more positive effect on attitudes, subjective norms, perceived behavior control or intention to adopt pre-harvest strategies related to *E. coli* contamination. See table 4.2.

Next, data from the 66 respondents who correctly identified how the source was identified in the manipulation check question were used to run a one-way between subjects ANOVA to compare the effect of source on attitudes for all videos. This test found that source did not have a significant effect on attitudes at the p<.05 level for these participants [$F_{(3, 62)} = 2.14$, p = 0.11]. Further one-way between subjects ANOVAs also did not find a significant effect of source on subjective norms [$F_{(3, 62)} = 2.32$, p = 0.08] and perceived behavior control [$F_{(3, 62)} = 1.57$, p = 0.21]. However, an ANOVA run to compare the effect of source on intention to adopt behaviors did find a significant effect [$F_{(3, 62)} = 4.91$, p = 0.004]. Post hoc comparisons using the Tukey HSD test found that the mean score for intention for unidentified source video (M=7.48, SD=0.91) was significantly different from the veterinarian (M=5.91, SD=1.34), government official (M=5.47, SD=1.98) and cattle producer videos (M=6.78, SD=1.23). There were no significant differences between the other sources for intention. While a significant difference was found, these findings provide further evidence that H_3 and H_4 were not supported.

Credibility and the Theory of Planned Behavior

Hypothesis 5 predicted that higher perceived source credibility would correlate with positive attitudes toward adopting pre-harvest strategies related to *E. coli* contamination. To test this hypothesis, a Pearson's r correlation was computed to assess the relationship between credibility and attitudes. This test found a positive correlation between the two variables, $r = 0.624$, $n = 106$, $p = 0.000$. This finding suggests that higher perceived credibility of the source in the video positively relates to more positive attitudes toward pre-harvest *E. coli* control strategies. Thus, H_5 was supported.

Hypothesis 6 predicted that higher source credibility would also correlate with positive perceived norms. A Pearson's r correlation was computed to assess the relationship between credibility and norms to test this hypothesis. This test found a positive correlation between the two variables, $r = 0.333$, $n = 106$, $p = 0.000$. While this was also not a strong relationship, the finding also suggests that higher credibility positively relates with positive subjective norms. Thus, H_6 was also supported.

In addition, Hypothesis 7 predicted that higher source credibility would correlate with positive perceived behavior control. A Pearson's r correlation was also computed to test the relationship between credibility and perceived behavior control. A positive correlation was found between the two variables, $r = 0.219$, $n = 106$, $p = 0.024$. While less strong than the relationships found with the previous two variables, this finding still suggests that higher credibility positively relates with positive perceived behavior control. Thus, H_7 was supported as well.

Finally, Hypothesis 8 predicted that higher source credibility would correlate with more positive intentions to adopt pre-harvest strategies related to *E. coli* contamination. A final Pearson's r correlation was computed to test the relationship between credibility and intention.

This test found a positive relationship between the two variables, $r = 0.258$, $n = 106$, $p = 0.008$. Though not very strong, this finding suggests that higher perceived credibility positively relates with positive intentions to adopt pre-harvest control strategies for *E. coli* contamination mentioned in the online training videos. Thus, H_8 was supported.

Chapter 5 - Discussion

Escherichia coli contamination is an ongoing food safety concern, especially for those in the beef production industry. Outbreaks of *E. coli* can result in risks to human health, bad publicity and economic losses. As demonstrated in the highly publicized 2015 *E. coli* outbreak linked to Chipotle, which resulted in 53 cases by December 2015, *E. coli* contamination is still a major health and food safety issue (Centers for Disease Control and Prevention, 2015). Though this outbreak was not linked to beef products, those in the beef industry can still play a vital role in efforts to prevent future outbreaks. The beef industry can help prevent future outbreaks through the use of HACCP (Hazard Analysis Critical Control Point) systems in beef processing facilities and the use of safe food handling practices the food service industry. Also, the use of pre-harvest strategies on ranches and feedyards can play a role in preventing *E. coli* contamination (Food and Agriculture Organization of the United Nations, 2011).

Educating cattle producers about what they can do on their operations has been recognized as an important part of efforts to help reduce *E. coli* contamination. Although there are many ways to provide this education, the use of online training videos has grown in acceptance. Building off the general growth in popularity of online videos, including educational and how-to videos (Purcell, 2013), beef industry groups have turned to using online training as a way to educate cattle producers. For example, the Beef Quality Assurance program offers online training to cattle producers for its certification, even offering this training for free at certain points of the year (BQA free certification period, 2016).

The issue for groups that wish to use online video training is how to best present training messages to educate cattle producers and convince them to adopt the suggested behaviors. The

findings in the current study have important implications for message presentation in relation to training videos, specifically for *E. coli* contamination control.

Implications

The current study was based on previous research that found agricultural producers often prefer particular sources to for obtaining information (Vergot, Isreal & Mayo, 2005; Brunson & Price, 2009; Russel & Bewley, 2013); similarly, different information sources were often perceived to have varying degrees of perceived credibility (Marquart, O'Keefe & Gunther, 1995; Chapes, 2015). Also, previous research has suggested that the manner in which a source was labeled can affect the perceived credibility of the source (Garnett, 2013). Despite this earlier research, the current study found that no matter how a presenter was described in a training video – whether as a veterinarian, a cattle producer, a government official or with no label – the perceived credibility of the presenter was essentially the same. In addition, no matter how the source was identified, there was no difference on the video's effect on the variables related to the theory of planned behavior and possible behavior adoption.

These findings suggest that the importance cattle producers place on certain sources for acquiring new information, especially related to *E. coli* control, does not appear to apply when the information is presented in the form of training videos. The one finding at odds with other results in this study is that participants who remembered that the source was unidentified reported significantly higher intentions to adopt suggested behaviors than respondents who watched videos with identified sources. This discrepancy provides further evidence that source does not translate to video form.

In addition, this study provides further evidence for the importance of credibility in the presentation of messages. The importance of source is seen in the finding that no matter how the

source is labeled, higher perceived credibility correlates with more positive attitudes, perceived norms, perceived behavior control and reported intention to adopt the suggested behaviors. The finding of this correlation provides evidence that perceived credibility is related to possible behavior adoption, indicating that credibility of the source is an important consideration when video designers are constructing educational messages for their training videos. These video producers will need to decide on the best way to make sure the information source in their videos is perceived to be highly credible, which, as this study suggests, may not include considering how a source is labeled.

Future research should consider exploring how other considerations that go into designing a training video's message can affect perceived credibility of the presenter in the video and of the video itself. These factors could include the sponsor or creator of the video, types of supporting footage used, length of the video or even the music used in the production. This research should also explore if these factor have stronger effects on attitudes, norms, perceived behavior control and intention to adopt behaviors than the perceived credibility of the information source. Future research should also explore the long-term results of presenting a message that is seen as highly credible with a training video, which could correlate to higher reported values for the variables derived from the theory of planned behavior, and if the use of the credible message would translate to actual behavior performance. The fact that there are hundreds of decisions related to the production of a video creates seemingly endless avenues of possible research.

Limitations

The current study has several limitations that must be considered when examining the research findings. This study found that no matter how a source in a video was labeled, through

the use of the lower-third graphic, there was no difference on perceived credibility of the information source and the video's effect on the variables related to the theory of planned behavior. It is entirely possible that the use of the lower-third graphic, and only the graphic, to change how the source was perceived may not have been a strong enough manipulation. Even if the source was labeled as a veterinarian, the presenter was dressed the same and looked the same as he did in the video where he was labeled as a cattle producer or government source. This simple manipulation was chosen to control for the effect of other variables and to reduce video production time. Nonetheless, it is possible if the source had more visual clues of his role, such as wearing a stethoscope, it would have further highlighted the role the source was supposed to take. The same is true for the government source and cattle producer.

Another limitation that must be considered is the sample frame used to recruit the participants for this experiment. In order to recruit from the population of interest of actual cattle producers, the link to the online questionnaire was sent to the members of the e-mail news mailing lists of several cattle industry organizations. It's possible that this sample frame of cattle producers does not fully represent the larger population of cattle producers in the United States. Also, the low response rate to the request to watch the video and complete the questionnaire also created the possibility that the group of producers who volunteered to participate does not represent the entire sample frame. Though the random presentation of video treatment condition that each participant viewed should help to control for these effects, it is a limitation that exists.

Conclusion

Despite these limitations, the findings of this study are applicable to efforts that intend to use online training videos to educate cattle producers about pre-harvest *E. coli* control strategies. Using videos to educate has grown in popularity and video producers must consider how to

persuade viewers to accept their message and adopt suggested behaviors. This study demonstrates that perceived credibility of the presenter of the message in the video correlates with more positive attitudes, perceived norms, perceived behavior control and intention to adopt the suggested behaviors. This suggests that credibility affects behavior adoption. Also, this research suggests that changing the type of source is the video, from government official to cattle producer to veterinarian, does not effect how the video is perceived. While future research is needed, the findings of this study only highlights the importance of crafting the message of a video to appeal to the intended audience.

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Appendix A - Questionnaire

PAGE 1

The purpose of this research project is to examine how cattle producers respond to an online training video related to pre-harvest strategies for the control of *E. coli*. This first item checks to see if you are a cattle producer.

I am personally involved in cattle production, either in a managerial or employee position, at a feedyard, cow-calf or stocker operation.
_____ Agree   _____ Disagree

PAGE 2

The next few items involve semantic differential scales. These questions attempt to rate your feelings about the narrator/host of the training video by using paired, opposite words. Please select the point between the two words that best captures your attitude toward the host.

For each pair of adjectives below, mark the point between them that reflects your feeling about the individual who presented the information in the video.

Experienced	○	○	○	○	○	○	○	○	Inexperienced
Uninformed	○	○	○	○	○	○	○	○	Informed
Trained	○	○	○	○	○	○	○	○	Untrained
Qualified	○	○	○	○	○	○	○	○	Unqualified
Expert	○	○	○	○	○	○	○	○	Not expert
Dishonest	○	○	○	○	○	○	○	○	Honest
Untrustworthy	○	○	○	○	○	○	○	○	Trustworthy
Open-minded	○	○	○	○	○	○	○	○	Closed-minded
Fair	○	○	○	○	○	○	○	○	Unfair
Ethical	○	○	○	○	○	○	○	○	Unethical

PAGE 3

The next items attempt to rate your feelings toward *E. coli* control and prevention strategies for cattle production operations.

For me, adopting and using *E. coli* prevention and control strategies in the forthcoming months is:

Useful	○	○	○	○	○	○	○	○	Of no use
Unimportant	○	○	○	○	○	○	○	○	Important
Worthwhile	○	○	○	○	○	○	○	○	Not worthwhile

PAGE 4

The next items are more questions that attempt to rate your feelings toward *E. coli* control and prevention strategies for cattle production operations.

If I adopt and use *E. coli* prevention and control strategies on my ranch, other cattle producers would:

Approve	○	○	○	○	○	○	○	○	Disapprove

Most cattle producers think that using prevention and control strategies for *E. coli is:*

Undesirable	○	○	○	○	○	○	○	○	Desirable

Most cattle producers think I should use practices that can help control *E. coli* contamination on my ranch.

Strongly Agree   O   O   O   O   O   O   O   O   Strongly Disagree

PAGE 5

The next items ask you how much control do you think you have over *E. coli* contamination on your operation.

How much control do you have over the prevention of *E. coli* on your ranch?

Very little control   O   O   O   O   O   O   O   O   A great deal of control

For me, to use strategies that can help control *E. coli* on my ranch is:

Very possible   O   O   O   O   O   O   O   O   Impossible

How difficult is it for you to prevent *E. coli* contamination on your ranch?

Very difficult   O   O   O   O   O   O   O   O   Very easy

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The next items ask if you plan on using *E. coli* control strategies on your operation.

I intend to adopt or use prevention and control strategies for *E. coli* on my operation.

Strongly Agree   O   O   O   O   O   O   O   O   Strongly Disagree

I expect to adopt or use prevention and control strategies for *E. coli* on my operation in the near future.

Strongly Disagree O   O   O   O   O   O   O   O   Strongly Agree

In the forthcoming months, I am likely to adopt or use prevention and control strategies for *E. coli* on my operation.

Strongly Agree   O   O   O   O   O   O   O   O   Strongly Disagree

PAGE 7

How was the presenter or host in the video identified?

        a.   Veterinarian

        b.   Government Official (USDA)

        c.   Cattle Producer or Owner

        d.   Not Identified

        e.   Can't Remember

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The next items ask you about your cattle operation and your role on the ranch.

How many head of cattle are on your operation?

        a.   Less than 10
        b.   10 to 19
        c.   20 to 49
        d.   50 to 99
        e.   100 to 199
        f.   200 to 499
        g.   500 to 999
        h.   1,000 to 2,499
        i.   2,500 or more

What type of operation do you work on?

        a.   Cow-Calf
        b.   Stocker
        c.   Feedyard
        d.   Other: _____

In which state is your operation primarily located?: _____

How many years have you, personally, been involved in cattle production?

a. 2 years or less
   b. 3 or 4 years
   c. 5 to 9 years
   d. 10 years or more

What is your role on your operation?

   a. Owner
   b. Employee
   c. Other: _____

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Almost done! Just a few more demographic questions.

What is your age?: _____

What is the highest level of education you have completed?

   a. Some high school
   b. High school graduate
   c. Some college
   d. Trade/technical/vocational training
   e. College graduate
   f. Some postgraduate work
   g. Post graduate degree
   h. Prefer not to answer

How do you describe yourself? Please check the one option that best describes you.

   a. American Indian or Alaska Native
   b. Hawaiian or Other Pacific Islander
   c. Asian or Asian American
   d. Black or African American
   e. Hispanic or Latino
   f. Non-Hispanic White
   g. Prefer not to answer

Gender

   a. Male
   b. Female
   c. Other
   d. Prefer not to answer

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You have reached the end of the questionnaire. Thank you for your help!

The purpose of this research project is to examine how cattle producers respond to an online training video related to pre-harvest strategies for the control of *E. coli*. It will inform communication efforts directed at educating cattle producers about pre-harvest strategies that can be used to help control *E. coli* contamination.

If you are interested in entering your name for a chance to win a $25 VISA gift card, click the following link:
(LINK TO SURVEY)

Thanks again for your time!
You can close your browser window or tab to exit.

Appendix B – Script for Training Video

VIDEO	AUDIO
Fade in to title graphic: "Helping to Control *E. coli* Contamination on the Ranch: You Make the Difference"	Music fades in with Title graphic
Dissolve to shot of host/narrator, set on cattle operation. Cattle visible in background. Lower Third Graphic: VERSION 01 Robert Smith, DVM Prairie Veterinary Services VERSION 02 Robert Smith USDA Food Safety and Inspection Service VERSION 03 Robert Smith Owner, Frank Ranch Group	Narrator: Hello! Thank you for watching this training video! *E. coli* contamination is an on-going concern for those working in the beef industry, with severe public health and financial implications. The goal of this training is to inform you, the cattle producer, of actions you can take that will help reduce *E. coli* contamination in your operation.
Dissolve to images of *E. coli* bacteria.	Narrator: *Escherichia coli*, or *E. coli*, is a type of bacteria with hundreds of different strains. Most strains are harmless and can even be beneficial to cattle. However, there is a subgroup of more dangerous strains known as Shiga toxin-producing *E. coli,* or STEC, that can infect humans and can cause serious illness and even death. The most common and well-known member of the STEC subgroup is *E. coli*

	O157:H7, but there are other serotypes, or strains, that can cause serious illness in humans. If these strains are detected in meat, the product will be adulterated, or deemed unsafe for human consumption, and condemned or recalled.
Dissolve to images of scientists working in lab. Animate statistics over images.	Narrator: The Centers for Disease Control and Prevention, or CDC, estimate that there are approximately 265,000 cases of illnesses with nearly 30 deaths attributed to *E. coli* annually in the US. Of the total number of cases due to *E. coli*, 75% are found to be of ground beef origin.
Dissolve to shots of individual/s working with cattle.	Narrator: The beef industry is a complex system with several different components that all contribute to producing a safe and wholesome product for consumers.
Dissolve to back to shot of host/narrator	Narrator: No matter your role in the beef industry, it is important to understand that your individual actions and efforts affect the rest of the production system and the safety of the final beef products.

Dissolve graphic over video:
 	
Actions to Reduce *E. coli* Contamination:
  1. Hygiene
  2. Management
  3. Vaccines
	Narrator: Actions involving hygiene, management and vaccination behaviors can all reduce *E. coli* contamination.

Dissolve to Full Screen Graphic: 1. Hygiene	NO VO – Music
B-Roll of employees cleaning boots/hands/etc	Narrator: No matter where a worker is in the

	production chain, good personal hygiene will always help reduce the spread of pathogens among animals, meat products, workers, and workers' families.
B-Roll of handwashing.	Narrator: Illnesses can be spread easily by unclean hands. Proper hand-washing includes using soap to lather from the fingertips to the elbows. Rub vigorously for 20 seconds, or about how long it takes to recite the alphabet twice, and be sure to scrub the back of the hands, between the fingers, and under the nails. Then rinse thoroughly and dry with a clean disposable towel. Be sure to wash hands after handling cattle, treating animals, using the restroom, and before eating.
B-Roll of employees wearing hats B-Roll of Cleaning Boots	Narrator: Wearing hats and bandanas is a good way to decrease the exposure of hair to feces, blood, and other animal fluids that can cause illness. Clothes or coveralls that come in contact with animals should be removed before entering the office, restroom, or leaving for home. Boots should be sprayed with a high pressure sprayer to remove any manure or mud and then scrubbed with disinfectant or soap and rinsed, and should be left at work if possible.
Dissolve to Full Screen Graphic: 2. Management	NO VO –Music
B-Roll of Cattle herd	Narrator: In addition to good hygiene, there are several management interventions that can help combat *E. coli* O157:H7 in the herd.
B-Roll of Moving Cattle	Narrator: Stressed cattle have an increase in

	fecal *E. coli* O157:H7 shedding. Stress can be caused by a number of factors, but is often caused by improper or aggressive handling of the cattle. When working, sorting, and moving cattle to new pens, handling should be kept to a minimum and workers should move and work as calmly and quietly as possible.
Images of water/feed troughs	Narrator: Proper feed and water management on the ranch or feedlot can help reduce *E. coli* spread among cattle.
B-Roll of worker cleaning water trough	Narrator: Because E. coli O157:H7 is easily spread through water, water troughs should be kept as clean as possible. Organic matter like feces and feed should be removed frequently from troughs as such matter promotes bacterial growth. For water troughs that are easily accessible such as in drylot pens, screens or pool skimmers can be used to remove organic material. Anti-bacterial chemicals such as chlorine, sodium caprylate, or trans-cinnamaldehyde can be added to the water troughs that are less accessible for longer-term control.
B-Roll of someone stepping into feed bunk. Use red X to highlight fact that it is something that you shouldn't do.	Narrator: It is also important to help keep feed and feed bunks clean by avoiding stepping in the feed bunk. Shoes and boots are often contaminated with manure that can be easily transferred into the feed bunk.
B-Roll of Feed Truck	Narrator: Tractors, loaders, trucks and other vehicles which are used to clean pens or haul dead or sick animals out of pens should not be

	used to load and mix feed. If it is necessary to use the same vehicles for both purposes, the vehicle should be thoroughly cleaned and disinfected before entering the feed preparation area. This cleaning should include all surfaces that will come in contact with the feed, but also the tires and surfaces that will be contacted by the operator.
B-Roll of cattle at feed bin Images of additives B-Roll of producer talking with veterinarian.	Narrator: Use of specific feed ingredients and feeding strategies has been shown to impact the shedding of *E. coli*. Additives such as citrus pulp, Tasco-14 from brown seaweed, essential oils, and whole cottonseed are ingredients currently available that have been shown to reduce *E. coli* O157:H7 shedding; however, the practicality of using such additives may be limited due to cost. When considering diet modifications, consult with your veterinarian or nutritionist to optimize the diet for your needs.
B-Roll of cattle	Narrator: Pest management and prevention of other animals and varmints from entering pens is a biosecurity issue and is important not only to prevent the transmission of *E. coli*, but many other diseases as well.
Dissolve to Full Screen Graphic: 3. Vaccines	NO VO –Music
B-Roll of cattle being vaccinated Images of injecting cattle Images working with vaccine Image of producer consulting with veterinarian	Narrator: Vaccines can also be an important component of pre-harvest control and prevention of *E. coli* O157:H7 shedding in cattle. The Siderophore Receptor and Porin Protein (SRP) vaccine is currently available and

	has been shown to reduce shedding of E .coli by blocking the ability of the bacteria to absorb iron, causing the bacteria to die. Another type of vaccine is the Type III Secreted Protein (TTSP), which is commercially available in Canada and currently under review for approved use in the United States. It has been shown to reduce fecal prevalence and shedding of *E. coli* O157:H7, similar to the SRP vaccine. It is essential to work with your veterinarian to design a vaccination protocol that promotes herd health and performance.
Dissolve to footage of Host/Narrator	Narrator: Wherever you are in the beef production system, your actions and efforts to reduce disease affect the ability to produce safe, high quality beef for consumers. Ongoing research and field trials have provided effective intervention options that reduce *E. coli* O157:H7. All is needed is for you, the cattle producer, to choose to adopt these behaviors and practices. With consistent and widespread use of intervention techniques through all phases of production, we can provide a safe and wholesome product to beef consumers everywhere.

Appendix C – Examples of Lower Third Graphics

Figure C.1 Veterinarian Lower Third Graphic

Figure C.2 Government Official Lower Third Graphic

Figure C.3 Cattle Producer Lower Third Graphic

Figure C.4 Unidentified Presenter