TORNADO THREAT PREPAREDNESS AND RESPONSE OF COLLEGE STUDENTS WITH COMPANION ANIMALS IN STILLWATER OKLAHOMA – A PILOT STUDY

By

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Abstract: Today, pet owners occupy 62% of households in the United States, and research suggests that number is on the rise (APPA 2018). The objective of this study is to explore the factors that affect risk perception, protective action, preparedness, and sheltering awareness of college students with pets with regard to a natural onset disaster, such as a tornado. This project also aims to provide tools to assist emergency mangers to understand how pet owners perceive natural disaster risks to themselves and their animal(s) and thereby guide their choices to take action. This project explores Trigg's (2015) and Thompson's (2016) notion of "pets as a protective action factor", where pet owners chose to act differently in emergencies because of the bonds to their pets. A theoretical lens, Protective Action Decision Model (Lindell, 2018), is used to establish hypothesis testing. This research was conducted in the form of an online controlled experiment and survey, with help from Oklahoma State University (OSU). It involved 119 OSU college students taking part in a computer simulation of tornado threat and a multiple choice questionnaire. The simulation (powered by *DynaSearch*) provided context of the danger to participants through visual (images) and written (text) information sources. After being allowed five minutes to view the information, the following questionnaire assessed participants' risk perception, their choices of protective action, pet preparedness, and awareness levels regarding peer and public shelters. Analysis of the data gathered through this experiment also compared the effects of demographics characteristics (age, education, cognitive abilities, and experiences) on pet disaster preparedness. The findings suggest strong pet preparedness predictors on the basis of respondents' age and direct tornado experience. Although the information from this pilot study is specific to Oklahoma State University students, the student community is a group with high diversity and is a valuable sample. Also, this experiment provides new tools that may be used for further research, possibly including larger groups and different disasters. Designing direct and clear messages targeted specifically at pet owners' concerns will help reduce the number of human and animal potential disaster victims, of special concern with increasing pet populations.

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CHAPTER I

INTRODUCTION

1.1 Disaster preparedness in college students

Animal preservation is a well-known concept to the field of emergency management. The effects of disasters on animals' populations have been observed by social scientists and disaster researchers throughout the past century (Prince, 1920; Barker, 1988; Hall *et al.*, 2004; Heath *et al.*, 2001; Farmer *et al*., 2016 and DeYoung *et al*., 2016). Disruption to household and emotional stability have always been the driving forces behind individuals' concern for companion animals (pets). Hence, funded governmental concern followed, especially during the twenty-first century, due to the overwhelming impact pets have on local and national economies. This has averaged 70.1 billion U.S. dollars between the years of 2011-2017, according to the 2018 annual American Pet Products Association Market Survey (APPA, 2018).

In order to address household response more properly, researchers have specifically focused on the impacts of the human/animal bond and using pets as a protective action factor in disastrous events (Leonard, 2007; Schaffer, 2011; Thompson, 2016; & Trigg,

2015; Farmer *et al*., 2016 and DeYoung *et al*., 2016). These studies have helped expand the scope of disaster management duties and authority throughout all phases of disaster: mitigation, preparedness, response, and recovery. They have added to the disaster literature by studying the effects disasters have on the animals closest to human beings, companion animals or pets. The Federal Emergency Management Agency (FEMA) published a report in 2010, examining how pet owners prepare for a disaster and how animals should be included in emergency plans (FEMA SI-11.a and SI-11.b, 2010). The majority of these researches were dependent on household survey data (Anderson, 2006). These included studies examining animal household preparedness using mock trials and exercises (Newman, 2005; Pines, 2009), survey studies examining pet evacuation logistics (Heath *et al*, 2001; Irvine, 2007; Edmonds & Cutter, 2008), interviewing pet owners for their evacuation decision (Brackenridge *et al.*, 2012), field examinations of pet shelters and how they operate (Robbins, 2012), professional exams looking at psychological impacts (Hall *et al.*, 2004), after action reports documenting animal reentry/recovery as well as animal disposal (McNabb, 2007 and Hudson, 2001), and pet commitment interviews (Johnson *et al.*, 1992; Staats *et al.*, 1996).

While these researchers have studied pets in large scale disasters, one of the gaps of the literature body present today is that the above studies did not focus on college students as pet owners, a typical vulnerable, diverse and fluctuant population group (Cutter, Boruff, & Shirley, 2003). Few studies have explored the effects of natural disasters on college students, however most lack data on pets or owner/pets relationship on the awareness and decision-making analysis. In a 2017 study examining immediate reactions to tornado warnings, a group of researchers comprising of Dr. M.K. Lindell and his colleagues used

college students from the University of Washington, yet no attention to companion animals and/or pets was taken in consideration in this study. (Jon *et al.*, 2017). Work carried out by Lovekamp and Tate examined Midwestern college students' risk perception and perceived preparedness to tornados and earthquakes, but did not account for pet ownership as an active variable among students in their adjustment action considerations. (Lovekamp and Tate, 2008). Similarly, Wu and his colleagues recruited students as student participants to demonstrate how civilians perceive hurricane threats to emergency managers and provided insight towards the protective action they are likely to undertake. Yet in neither of these cases were students asked about service animal dependence or pet ownership (Wu *et al*., 2015 a. and b.).

In addition, no known study has focused on tornado pet preparedness issues. Different from hurricane or flood threats which range from hours to days, tornado disaster only has a short lead time. The U.S National Weather Service (NWS) tornado probability of detection (POD) and false alarm ratio (FAR) have reported that roughly 75% of tornado lead warnings since 2003 have averaged thirteen (13) minutes across the United States (NOAA, 2012). Therefore, the level of preparedness for tornado threat is reasonably important, including for the increasing population of animal advocates and pet owners.

Previous studies concerning university students, pet ownership and disaster response, show the lack of preparedness in this group. For example, Simms and Tobin (2007) surveyed respondents about pet ownership when they examined hurricane risk perception and preparedness of undergraduate students at the University of South Florida. The authors found students to be lacking in all aspects of preparedness with regard to hurricane threats (Simms and Tobin, 2007). In the study, campus policies on companion animals prohibited

them from being on university property unless registered as service animals. Changes to campus policies have been made since, allowing leashed pets on campus grounds, as their online rules and regulations currently indicate (USF-6033, 2013).

In a higher education setting such as Oklahoma State University (OSU), providing emergency shelter for students is a complex process that requires many human factor considerations (capacity, duration of stay, accessibility, sustainability, etc.) and inter-agency cooperation (Facilities Management, Police, Fire Department, Emergency Management Services -EMS, Public Works, Environmental Health and Safety -EHS Department, etc.). This becomes an even more complex issue for academic institutions that have welcomed companion animals or pets and service animals on their property, as in the case of OSU-Stillwater. With regard to planning, for instance, additional measures must be taken into account when considering the space to be used for a culturally diverse student population and how they may respond to certain pets. Extra measures in mitigation include special animal training/certification for campus EHS personnel to conduct routine safety inspections on facilities and equipment. Additionally, special animal handling certification/training is required for individuals involved in animal response efforts on campus. Despite being increasingly more accepted by academic institutions across the United States, Oklahoma State University continues to face difficulties in planning for this vulnerable population on its Stillwater campus, (OSU – Human Resources, 2019; and OSU – Department of Wellness, 2019).

1.2 Pets as a factor for disaster preparedness

Although, U.S. census data (surveyed every 10 years) is publicly available and used when calculating public services (fire, ambulance, police, emergency management etc.), these

statistics fail to include college students and animal ownership questions. Also, there is not any type of official database for pets in communities in the United States and most colleges/universities don't keep track of this information. These factors, combined with the rise of natural disasters and their devastating impacts in recent years, have presented households with higher and more frequent chances for danger (Newman, 2005; Paek, 2010). This drew researchers' attention on household actions taken before, during, and after an incident by the more vulnerable people in society (Mileti, 1999; Tierney *et al.*, 2001 and Pines *et al.*, 2009). Vulnerable populations, as suggested by Mileti, Tierney, and others, are those groups who lack in their abilities and/or resources to deal with disasters *(e.g.* children, elderly, physically disabled, low income families, and college students) (Mileti, 1999; Tierney *et al.*, 2001 and Pines *et al.*, 2009; Cutter *et al.*, 2003; Wu *et al.*, 2017). It can also be argued that pets likewise fall under this category due to their reliance on human aid during disasters. The vulnerability perspective, as presented by Mileti, suggests that environmental hazards do not exist in a bubble, independent of society (Mileti, 1999). Also, communities generally have a heterogeneous make-up of ecological elements that alter the divisions of power resulting in the increased vulnerability of certain demographics over others (Peacock, *et al*., 1997). Experts have validated this notion in their observation of increased vulnerability among female college respondents as compared to their male colleagues (Lovekamp and Tate, 2008 and Wu *et al*., 2015b). Though no direct link between student living location choices and vulnerability have been observed as having an effect on hazard adjustment choices, responders' locations based on polygon

radar[1] were found to indicate factors for risk perception among the students in Dr. Lindell's study (Lindell, 2016). Therefore, the findings of this study would be useful for universities to address the above mentioned issues and aid first responders in case of an emergency.

1.3 Assessing college student and pet disaster preparedness in a university campus

The few objective studies that previously focused on animals in emergencies, portray a chaotic and often unfortunate outcome for companion animals and their owners (Hunt *et al.*, 2012; Heath & Linanbary, 2015; and Kocatepe *et al.*, 2018). Researchers have found that despite a region's socioeconomic status during times of disaster, many people will attempt to take their pets with them if they choose to evacuate their homes (Chadwin, 2017). This has been observed in the United States as well as internationally, as in the cases of the Chilean Volcano of 2008 and Japan Tsunami of 2011, where animal caregivers refused to evacuate without their pets (Tanaka *et al.* 2019). This suggest the importance to include pet influence on its owner behavior during a disaster, including inside a college campus environment.

In an effort to address the mentioned deficiencies in the current knowledge, this study explores college students' level of tornado risk perception, response, preparedness and shelter awareness with regard to their companion animals, more specifically pet(s). Previous researchers have found compelling evidence to assert that increased disaster education before an incident develops translates to a more likely prepared household when it matters most (Faupel and Kelly, 1992). Studies about animal safety carried out post Katrina (2005) by the American Society for the Prevention of Cruelty to Animals

[1] Polygon radar: public warning system developed by the National Weather Service (NWS) in which the warned area is outlined by a polygon rather than a county boundary, in an effort to reduce false alarm areas (Bergman, 2005)

(ASPCA), American Kennel Club (AKC), American Humane (AH), and National Fire Protection Association (NFPA), the National Science Foundation (NSF) and the Federal Emergency Management Agency (FEMA) resulted in volumes of education materials dedicated to the wellbeing of pets in disasters (Irvine, 2007; Heath *et al.*, 2001). This information is widely and freely available to the public. Here, we explore the effects of the increase in pet safety materials on household pet preparedness activities and owner awareness. Particularly, the goal of this study is to document and analyze the preparedness and awareness of Oklahoma State University, at Stillwater Oklahoma (OSU-Stillwater), pet owning students about the nature of tornados and their preparations to respond to such a common threat in the area. This research has direct applications in providing universities with information about the risk perception, protective action decision, sheltering awareness and pet preparedness of students towards tornados, and also provide students with additional safety information.

However, before all issues can be addressed they must first be identified and understood objectively. With regard to special terms, the daily use of animals in assistance, companionship, labor, physical aid, and emotional support capacities has resulted in a variety of sporadic terms being created, such as "*service animals", "companion animals", "comfort animals", "emotional support animals", "therapy animals", "visitation animals", assistive animals", "assistance animals", "psychiatric service animals", and "pets"* (Parenti *et al.*, 2013). The terms defined below, are the most relevant terms for this research project.

Companion animal (pet): A domesticated animal, such as a dog, cat, bird, rabbit, rodent, or reptile that is traditionally kept inside the home for pleasure rather than for commercial

or medical purposes, can travel in commercial carriers and be housed in temporary facilities. This type of animal is not recognized under the Americans with Disabilities Act (ADA) but is protected under the PETS act.

Service animal: Any guide animal individually trained to provide physical and/or medical assistance to a disabled individual. Including but not limited to vision/hearing impairment, rescue work, alerting others of owner in duress, etc. These animals are approved under ADA guidelines regardless of local or state certification and also covered under the Pet Evacuation and Transportation Standards (PETS) Act.

Here we consider the terms "companion animal(s)" and "pets" as equal and interchangeable. These terms are used in the context of this research project to describe canines (dogs) and felines (cats) living inside or around the same dwelling as their owners. This is not to be confused with the term "animal(s)" which, this study will refer to as wild (undomesticated) animals, which fall outside the scope of this research project due to the varying laws/policies that protect them. This distinction goes towards demonstrating that not all animals are companion animals (pets) as well as highlighting the differences in how these animals are cared for (hygiene and health care), housed/sheltered, and perceived by the general public. Although research and current policies carefully distinguish between *pets, service animals, and therapy animals,* these terms will all be considered under the same umbrella term of "companion animals" for the purposes of this study in order to highlight the human/animal living conditions and overall proximity to each other.

CHAPTER II

REVIEW OF LITERATURE

2.1 Animals safety in natural disasters events

Dangers facing companion animals (pets) from natural disasters such as tornados are due to the proximity they have to humans and their integration into all aspects of our daily lives. This is evident by the most common causes of death determined for companion animals in emergencies; extended neglect, toxic exposure, impact trauma from falling debris and car collisions (Ellis, 2001). The unique needs of this sub-population has been overlooked by disaster managers for decades. Today, pet owners occupy over two thirds of households in the United States (APPA, 2018) and remain an exceptionally vulnerable group to environmental disasters and emergencies due to the lack of community based resources available to them *i.e.* shelters, rescuers, and first aid/emergency responders (Farmer *et al.*, 2016 and DeYoung *et al.*, 2016). Research into the needs of livestock animals such as cattle and chickens in the wake of disaster has increased due to the overwhelming economic impact they have on the nation (Burrus *et al.*, 2002; Hall *et al.*, 2004). Unlike livestock, pets do not have an aggressive estimated impact on local and national economies, despite belonging to a multi-billion dollar industry. The lack of financial incentive behind this issue

has resulted in minimal funding for pet welfare projects and training campaigns in the past. Increased pet popularity among U.S. citizens, in the early 2000's (Clancy & Rowan, 2003) resulted in increased concern for domesticated animals in the wake of Hurricane Katrina (2005) in New Orleans. Media coverage of this event brought attention to animal considerations long overlooked in emergency planning (McNabb, 2007). This "focusing event" raised demand for action from policy makers by their constituents, resulting in many laws and policies being formed (Birkland, 2006). Their continued involvement in our daily lives has forced policy makers to include provisions for their wellbeing in emergency plans (Irvine, 2007). This made federal disaster funds contingent on state governments' considerations for people with service animals and/or pets in emergencies. This also gave the Federal Emergency Management Agency (FEMA) the authority to provide rescue and care services to pets in duress, as well as include pets in local community action plans and provide education materials for owners regarding their pet(s)' safety during emergency situations. Projects devoted to promoting household disaster preparedness included guidelines for hazard adjustment option including but not limited to; emergency kits, plans, trainings and record keeping (Paton, 2003). Among the most influential of these laws is the PETS Act.

2.2 Pets as a protective action factor

The structure of the common American household has constantly been adapting. The most common model concerning human protective action in emergencies is the Protective Action Decision Model (PADM)(Lindell, 2018) (Figure 1). This model grounds its theory on environmental and social cues that signal the onset of approaching danger to the family unit. Environmental cues are sights, sounds and smells taken from the immediate

surroundings while social cues are interpreted from viewing others' behavior. Warnings, however, are messages that are transmitted from a source via a channel to a receiver. This can result in different effects on receivers' beliefs and behaviors based their unique cognitive abilities (languages, reasoning), motor skills (senses and physical ability) and other demographic attributes such as economic status, education, and location (Lindell, 2018). In this decision model, external social/environmental sources (cues, warnings, and channels) trigger individuals' pre-decision process which forms their perceptions of events that drive them to take action, while holding personal characteristics such as cognitive abilities, demographic attributes, and experience as key influencing variables (Lindell and Perry, 2012). This model been the basis for many studies. For example, Nagele and Trainor used this model in analyzing the effects of new tornado information sources to the public and found varying degrees of significance among sociodemographic variables (Nagele and Trainor, 2012); Wu and his colleagues used this model and analyzed hurricane information tracking process (Wu *et al.*, 2015a).

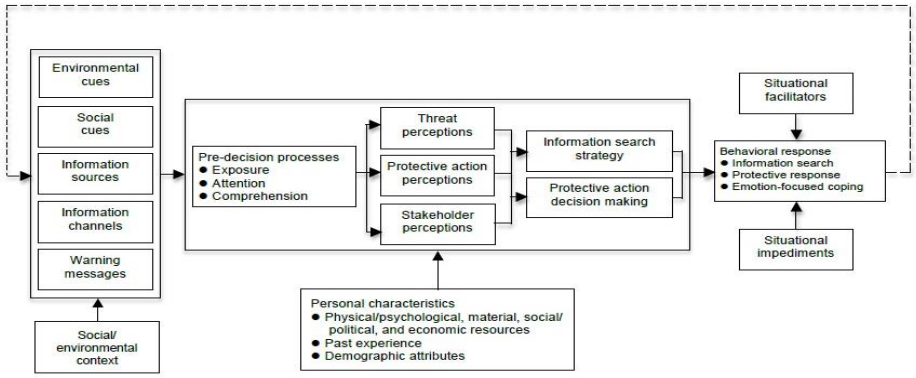

Figure 1. Protective Action Decision Model. Source: Lindell, 2018

Similarly, researchers from Australia examined the roles of prior experience and how experience motivating earthquake household preparedness (Becker *et al.*, 2017). Becker

and her colleagues categorize disaster experience into four types: direct disaster experience, indirect disaster experience, vicarious experience and life experience. In their study, direct experience means an individual who have directly experienced disaster damage or injury; indirect experience means an individual who have exposed to potential disaster threat but not being personally affected; vicarious experience means an individual knowing his/her friends or peers were impacted by disaster; finally, life experience means individuals' non-disaster related adverse event experience (Figure 2).

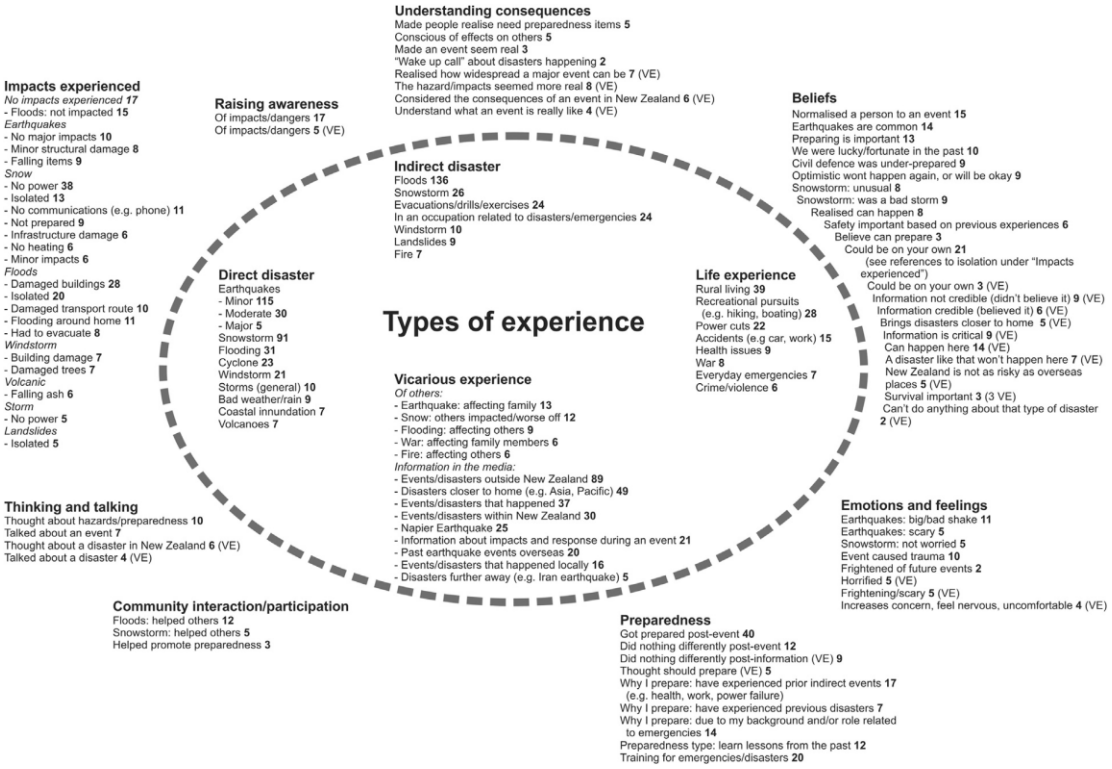

Figure 2. Core Categories and Codes of Experience. Source: Becker *et al*., 2017

Some researchers consider pets as members of the family unit and type of demographic variable (Walsh, 2009; Thompson & Trigg, 2016; DeYong and Peters, 2016). Increased proximity and integration with these animals has strengthened the attachment people share with their pets (Taboada and Brackenridge, 1994). This attachment causes pet owners to

put themselves in the path of danger for the sake of their domesticated animals (Farmer *et al.*, 2016). Grad students at Chapman University along with FEMA in 2013 showed the general disregard American citizens have towards self-protective actions (Wendel, 2014). While other research reveals that people subject themselves to harm for their own pets', as well as for strangers pets (Barker, 1988; Hall *et al.*, 20 04; Heath *et al.*, 2001). The result is a large portion of the American population putting themselves in danger for the sake of pets' with no sort of plan in place. This has led advocates for pet legislation to regard the primary goal behind protecting companion animals as the preservation of human life (Brackenridge *et al.*, 2012). This was a significant observation that was brought up in the wake of Hurricane Katrina and helped to push forward the 2006 PETS Act. It is now argued that if emergency planning is to acknowledge the human/animal relationship, enhanced safety would affect humans as well as pets (Leonard and Scammon, 2007). Finally, some scholars also use cognitive ability to examine how people respond and prepare for disaster/adverse events. These include the ability to identify and define a problem, recognize assumptions, evaluate arguments, and apply inductive and deductive reasoning to draw reasonable conclusions from the available information. Whitney and his colleagues suggest that individuals high in *Need for Cognition* (NFC) enjoy thinking and are likely to evaluate information and prepare for hazards (Whitney *et al*., 2004). Similarly, people with higher *Cognitive Reflection Test* (CRT) score were found more likely to avoid losses and achieve gains (Frederick, 2005). In both these studies however, researchers did not consider pet ownership as an active demographic variable for influencing participants' disaster perceptions and behaviors.

2.3 Past focusing events

The term "focusing event" as used in this paper, is to describe an event that reveals failed policies (Birkland, 2006). The following United States based disaster events have resulted in dramatic change to laws and policies formally in place, hence their classification as focusing events. Although each disaster event stands alone as to the cost of human and animal life, together they offer a deeper exploration of the recent impacts disasters have had on American companion animals (pets) and their owners. Some examples are described below.

- Hurricane Andrew 1992

This category five hurricane struck the Atlantic Coast in August of 1992, striking the Bahamas, Florida, and Louisiana. This was the most destructive storm to hit Florida until Hurricane Irma in 2017. The destruction cause by the storms' 170 mph wind speeds destroyed entire neighborhoods forcing thousands to seek shelter elsewhere. In this case, responders had difficulty identifying companion animals due to the overwhelming number of exotic pet species (reptiles, birds, marine life, etc.) owned by Floridians (Irvine, 2007). The lack of provisions regarding all companion animals, at the time, added to the confusion and left over 1000 pets abandoned and sanctioned to be euthanized by the state for lack of adequate housing facilities (Thompson *et al.*, 2014). This event coined the phrase "forgotten victims" with regard to pets being disregarded in disasters (Irvine, 2007).

- Hurricane Charley, Florida, 2004.

Hurricane Charley was a category four storm that landed in southwest Florida in the summer of 2004. The storm resulted in the mass evacuation of over two million residents from the area (Tobin *et al*., 2004). The devastating nature of Hurricane Charley took its toll

on local animal shelters and veterinary hospitals. The governor of Florida at the time of Hurricane Charley, requested out of state assistance to restore animal services in various sections of the state (Irvine, 2004). Hundreds of cats and dogs were evacuated to a local fire training tower and left with three days' worth of supplies. Clean water and food supplies ran scarce quickly and the entire holding facility suffered the impact of shortages. As conditions worsened on the ground, many animal foster caregivers and volunteers could not continue to stay in the affected area, resulting in many caged animals being left unsupervised in their last moments (Irvine, 2004). Accommodations outside the state had to be arranged for many animals emerging from the impact zone. The urgent circumstances of this mass evacuation presented a failure to establish proper tracking protocols for many animals. This ultimately resulted in an extremely lengthy identification and reunification process for everyone involved that continued for years after the impact of the storm (Irvine, 2006b).

- Hurricane Katrina, New Orleans, 2005.

Hurricane Katrina was a category five storm that hit the Gulf Coast of the United States in the summer of 2005. The subsequent flooding of New Orleans is regarded as the biggest impact of this storm. This forced over one million citizens to evacuate New Orleans with or without their pets (McGinley, 2018). Pet owners were told by responders that temporary shelters did not allow for the housing of animals citing sanitation, health, space, and aggression concerns (Irvine, 2006a). Some owners made arrangement with local humane societies for sheltering their pet(s). Others were faced with threats of force to leave pets behind by rescuers and first responders (Irvine, 2006a). In some instances, owners watched as their pets were released to fend for themselves. The assumption here was that pets could

survive unsupervised until animal rescue could be arranged (Irvine, 2006a). Media coverage of the event questioned this assumption as images of pet carcasses circulated news stations (Morris *et al.*, 2010). Pets that were left in care of humane organizations, were also left behind when conditions worsened as in the case of the hundreds of pets left at the New Orleans Convention Center. Here public transportation regulations forced volunteers and caregivers to abandon the animals they were caring for (Irvine, 2007). Though a number of pets were eventually rescued, the number of pets that perished is still unknown, however, the number is estimated to be in the thousands (Irvine, 2007).

The absence in pet policies during Hurricane Katrina resulted in many animals being separated from their owners (Irvine, 2007). This happened in one of three circumstances. The first is separation due to *loss* of pet. New Orleans residents who reported a loss of pet described two main circumstances: failure to properly secure the animal and/or destruction of property housing the pet (McNabb, 2007). Stories of pet loss became a regular occurrence on the news due to the overwhelming number of people who left their pets at home and came back to destroyed property. Next is separation due to *abandonment.* This is achieved at the owners' desire to relinquish current possession of their pet(s). However, scientists have argued that in the course of a disaster it isn't a "desire" to relinquish ownership but rather a perceived necessity. The leading reason behind this type of separation was owner's inability to safety evacuate with their pets (McNabb 2007, Brackenridge 2012). The final type of separation is *surrender* of pets to responding authorities. This type of separation saw the most outrage from the public, especially in cases where physical force was used by responders against victims of the hurricane. A story

emphasizing this point is that of the National Guard pointing guns at a family to force the surrender of their pet dog (McNabb, 2007).

Pet ownership is often viewed as one of the leading predictors of peoples' decision not to evacuate. This is because many pet owners find that they are unprepared to safely transport their animal(s) out of the home, especially if they own multiple pets and more than one animal species. Failure to prepare to move all animals in the house at a single time is viewed as the primary reason pet owners refuse to evacuate, followed by not knowing where they can take their pet(s) if they do manage to all leave the dwelling (Douglas *et al.*, 2017). Researchers agree that pet ownership is the foremost predictor of non-evacuation behavior among other factors such as gender and race (Heath *et al.*, 2001; Heath & Linanbary, 2015). For example, a 1998 study looking at 895 North Carolina residents post Hurricane Bonnie revealed that pet owners were twice as likely to decide not to engage in evacuation efforts (Whithead *et al*., 2000). Similarly, an experiment run on 531 residents along the Gulf of Mexico that asked questions to hypothetical storm scenarios reported that pet owning participants were 52% less likely to evacuate (Petrolia and Bhattacharjee, 2010). With regard to sheltering, it is important to note there are two types of shelters used by emergency management agencies in the United States, American Red Cross approved and locally planned (public) shelters. The difference between the two is that one is directly managed by the American Red Cross while the other is usually under local management designated by the facility manager and local authority having jurisdiction (AHJ). Peer shelters, on the other hand, are privately owned "safe areas" the owner may choose to grant access to neighbors and acquaintances (family, friends, neighbors, co-workers...etc.) in the event of a disaster. These can be above ground safe rooms, below ground storm shelters,

basements, garages or other area on the property determined to provide protection from disaster (Stillwater.org, 2019). Pet friendly shelters can fall under either authority but are usually scarce in number. For the purposes of this study, public and peer shelters are considered as pet-friendly due to the rules governing them and the fact that peer shelter owners have the final say on who's allowed on their property. It is assumed that if pet owners are aware of a peer shelter, then they have made arrangements to possibly be there, in the event of a disaster. Furthermore, the terms "pet friendly shelters" and "animal shelters", although very different, are often both used to describe the same thing. As in other areas of emergency management, there exists an assumption amongst scholars and practitioners that terms are self – explanatory and further description is not necessary (Quarantelli, 1995). The result is misunderstandings on the ground due to multiple ambiguous interpretations on the part of disaster victims as well as emergency planners (Quarantelli, 1995 and Glassey, 2018). For example, Quarantelli (1955) argues that "housing" and "sheltering" terms are used interchangeably across disciplines, however, disaster researchers and planners use the terms to represent different things. In the case of pets and sheltering, one major consequence is failure to account for pet owners and their pets when planning public shelters. In some states, less than half the counties offer the services of pet friendly shelters and less than that actually have written plans for the emergency sheltering of pets (FSERT, 2016). This had a direct effect in past natural disaster events, as cited below.

- Hurricane Gustav 2008:

Hurricane Gustav was an Atlantic storm that swept its way through Haiti and most of the US. Gulf Coast in the middle of the 2008 tropical storm season. The storm steadily moved

inland until it struck Louisiana as a category two hurricane. This was one of the first events to use the directives outlined in the 2006 PETS Act. The mayor of New Orleans, Ray Nagin, issued a mandatory evacuation of the entire city. This action led to the Louisiana State Animal Response Team (LSART) and Louisiana Department of Agriculture and Forestry (LDAF) overseeing the orderly evacuation and sheltering of companion animals from the state's coast, with assistance from local volunteers and various humane groups. Learning from the events of Katrina in 2005, where the state had established temporary shelters for animal evacuees but did not have provisions for evacuating the pets of people with no means of transportation, responders made safe transportation a top priority. This resulted in the safe evacuation of close to two million southern Louisiana residents and their pets (Thompson *et al.*, 2012).

- Colorado Flooding 2013

In the fall of 2013, a week of non-stop rain resulted in the flooding of many parts of the state of Colorado. Beginning on September 9th and progressing through the 15th, the rain overwhelmed the area between Colorado Springs and Fort Collins. This storm affected Boulder County the heaviest, which saw 9” of rainwater (Rumbach *et al.*, 2016). Over two thousand homes were destroyed because of the flooding, forcing thousands of people and their pets to evacuate and seek shelter in the neighboring city of Denver. Although Denver was also in bad shape due to the rains and floods, it was the only place in Colorado with facilities designed to house animal evacuees. Upon arrival, some evacuees were denied services due to the city of Denver’s breed specific legislations (BSL) regarding pit bulls clashing with the PETS ACT directives (Cattafi, 2008). The absence of BSL language in the PETS Act caused much chaos on the ground for pet owners and medical staff at

facilities. This increased stress on the animals themselves as well as the responders transporting them (Olson, *et al.*, 2015). To date, Denver has not adopted any provisions for incoming pit bulls from outside city limits in disasters, despite the US Supremacy Clause that establishes federal laws as taking precedence over state and county laws (Denver City Ordinance Sec.8-55, 2015).

Issues present in pet friendly shelters stem from prolonged stay, overcrowding, sanitation/hygiene, loss of pet, allergies, anxiety, phobias, and disease (Kocatepe, 2018). Aside from the concern with animal phobias, similar issues present themselves in animal shelters. Research done on pets in shelters has shown that prolonged captivity in stressful conditions results in long term post-traumatic stress (PTSD) for the animals, as well as eventually rejecting medical treatment (Hunt *et al.*, 2012). Attempting to avoid recurrence of these challenges prompted congress to push forward the Pets Evacuation and Transportation Act of 2006 (PETS Act). Numerous events both before and since the establishment of this act have provided opportunities to improve how we respond to pets in disasters.

2.4 Laws/policies regarding animals in disasters post Hurricane Katrina

Laws in the United States sometimes clash with each other depending on their issuing body of government, state or federal. On the states' level, there are a multitude of laws pertaining to the wellbeing of animals in emergencies, due to several states passing laws for the emergency management of pets within their borders. However, on the federal level there have only been a few laws concerned with animals in disasters. First and foremost is the ***Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act),*** signed into law on November 3rd 1988. It was introduced to amend the Disaster Relief Act of 1974

and is considered to be the grandfather document that pertains to all disasters. This law constitutes the statutory authority most federal disaster response activities, especially as they pertain to the Federal Emergency Management Agency (FEMA). Secondly, ***the Americans with Disabilities Act*** was signed into law in July of 1990. This is a civil rights law that prohibits the discrimination based on disability. This extends to individuals suffering medical conditions requiring service animals. Under separate provisions the ***Post Katrina Emergency Management Reform Act*** was passed in 2006. This covered important protocols to which FEMA was bound. A key protocol was included that after a major disaster or emergency declaration is made, accelerated Federal assistance could be dispatched by FEMA, in absence of a specific request at the state level, in an effort to save more lives faster and prevent needless suffering due to red tape. Following this, the ***Department of Homeland Security Appropriations Act*** was passed to decide and allocate resources to federal programs. This is important because this document outlines guidelines for the allocation of federal disaster funds when necessary. Finally, the ***Pets Evacuation and Transportation Act (PETS Act)***: Signed into law by congress in 2006, this law was intended to amend sections 405 and 502 of the Stafford Act (Leonard and Scammon, 2007). The PETS act is widely credited, today, for making pet safety a national priority in the United States. This policy combats the false assumption that pets can survive a disaster environment unsupervised (Irvine, 2007). Under this act, federal and local agencies are mandated to include pets in their disaster plans. Failure to do so could result in loss of funding from the Federal Emergency Management Agency (FEMA). As a result, disaster response plans must be revised nationwide to insure the inclusion of companion animals during all phases of disaster. The PETS act was intended to accommodate pets in order to

improve human safety in disasters. It does this by satisfying three important elements to pet emergency response; first, there is a significant planning element that directs the coordination efforts of all stakeholders and levels of government, second is the portion concerned with financial obligations for all preparedness and response operations, and third is the mandate that responders treat pets and service animals as individuals with or without their owners being present (Edmonds and Cutter, 2008). Since it's passing, local and federal emergency planning and response have been subject to the guidelines outlined in the Pets Act. In the disasters following Hurricane Katrina, there has been many reviews on the implications of this law. Hurricane Ike 2008 saw residents of Galveston, TX refuse to evacuate due to fear over their pets' safety. Researchers suspect the main reasons behind peoples' fears are ignorance towards the law and governmental mistrust (Breckenridge *et al.*, 2012). Sandra Breckenridge's (2012) study examined the effects of the human-animal bond on decisions to evacuate in the wake of Hurricane Ike. Here she found the bond to be a significant variable in determining evacuation behavior (Breckenridge *et al.*, 2012). Similarly, a study carried out by Thomas E. Drabek found over 50% of respondents sighting their pets as serious influencers in their decisions to evacuate (Drabek, 2001). Many residents of New Jersey opted to leave their pets home while they sought shelter elsewhere during Hurricane Sandy 2012 (Robbins, 2012). Their plan was to return home within a couple days. Underestimating the severity of the situation and failure to heed flood warnings resulted in multiple pets dying (Robbins, 2012). The same failures were seen again in Houston, TX during Hurricane Harvey 2017. In this instance pets were seen chained to posts and trees, with owner disregard for flood levels. New in this situation, however, was FEMA's official mandate regarding pet rescue which forced first responders

to make reasonable efforts at rescue and accommodations for them and their owners (Chadwin, 2017).

2.5 Companion animals in higher education facilities:

Colleges and universities have long been accepting of service animals on their premises provided the correct steps taken in informing administration and faculty. The use of emotional support animals by students, however, is a more recent trend (Huss, 2012). In recent years, many higher education institutions have registered increased requests by students and faculty for "service animals" as well as "emotional support animals" (Grossman, 2009). Some colleges have designated entire dorms as pet-friendly. As in the case of Eckerd College in Saint Petersburg Florida, where students may have up to two pets living with them on campus (Eckerd College, n.d.).Though it is the aim of most academic institutions to foster a welcoming, non-discriminative, environment for everyone present, research suggests that most colleges and universities have not taken the proper steps to include this portion of their academic population in their disaster plans despite provisions in the PETS Act that encourage these considerations (Von Bergen, 2015). Evidence of this is based on the pre-disaster mitigation program outlined as part of The Robert T. Stafford Act, funding provided to the Disaster Resistant University (DRU) program was granted by the U.S. Congress under a special rule to set aside funds specifically for universities to develop a strategy for vulnerability reduction (Yemaiel, 2006). Examples of such oversight can also be found in OSU's guide to tornado safety. Here exists explicit language regarding student and staff members' pet(s) in OSU's "approved storm shelters", although brief (OSU-Tornado Safety Procedures, 2019).

However, in OSU's incident and emergency response plan, there is no mention of "pet(s)" or "shelters" on campus (OSU- Emergency Response Plan, 2017).

Similarities in animal response efforts are observed throughout the decade since the passing of the PETS act, in mid-2006. In most instances, issues regarding the law, its parameters, and limitations have been leading factors in hindering rescue efforts. A recent study into Hurricane Harvey revealed many of the challenges to be the same as in Katrina 2005 (Glassey, 2018),especially in regard to the circumstances leading to pet abandonment, with the exception of pet surrender. Glassey's work also identified responders' level of awareness regarding the PETS Act as being low. Though some responders knew of the PETS Act's existence, only a small portion of interviewees knew any specifics about it. Those who did exhibit a knowledge of the law also expressed wide disapproval into how it was being implemented at the ground level. Glassey argues that despite the fact that the PETS act was in place during Harvey 2017, animal preparedness was scarce. He attributes this to the lack of critical evaluation and plan modification on part of the U.S. government (Glassey, 2018). However important, the issue of responder awareness falls beyond the scope of this study.

The importance of pets for their owners, including their response during a natural disaster, risking their own life, and the increase of pets in the vulnerable population group of college students raises the need for further studies and better awareness programs. This thesis focuses on this subject in an attempt to investigate the factors affect students' tornado risk perception, protective action decision, sheltering awareness and pet preparedness in a college campus as OSU-Stillwater. The results presented here will help in better directing proper information to this population group.

CHAPTER III

METHODOGLOGY

3.1 Research objective

This research examines demographic factors such as pet ownership, age, level of education, cognitive ability and their influence on college students' tornado risk perception and protective action, level of pet preparedness, and perceived shelter awareness. Academic institutions are generally significant gathering spots for all members of the community. In the case of OSU-Stillwater, during the academic year, students account for over two thirds of the city's population (USCB, 2010). Federal funding has already been devoted to the design and maintenance of university emergency plans for vulnerability reduction under the PETS Act. To this end, the following research questions and hypotheses were designed to gain a proper understanding of how college students at Oklahoma State University perceive risks to their households and how they prepare for imminent threats of environmental hazards, like a tornado event;

A. Risk Perception and Protective Action

RQA-1: Do student pet owners have different tornado risk perception than student non-pet owners when facing a tornado warning.

RQA-2: What is student pet owners' most preferred pet related protective actions when facing a tornado warning?

RQA-3: Do student pet owners and non-pet owners have different choice of non-pet related protective actions when facing a tornado warning.

B. Pet Preparedness:

RHB-1: Student pet owners prefer visual tornado information more than text information sources.

RQB-1: What are the most common pet preparedness activities for student pet owners?

RQB-2: What are the significant demographic predictors of pet preparedness among student pet owners?

C. Sheltering Awareness

RHC-1: Pet owner awareness with regard to emergency sheltering options is higher than non-pet owners.

RQC-2: Do student pet owners have different awareness regarding the proximity of pet-friendly shelters than non-pet owners?

3.2 Research design and measures

This study used *DynaSearch* to display tornado threat information and asked participants questions regarding to the tornado threat, tornado response, tornado information preference, tornado experience, pet preparedness, and their demographic characteristics. An internet browser program (e.g. Internet Explorer, Google Chrome) was needed to participate in the study. *DynaSearch* provides two major functions that help researchers to set up their study using the internet browser. A *Search Screen* is a screen that can be used to set up a disaster scenario by displaying visual and non-visual disaster information. A

Questionnaire Screen is a screen that can be used to ask study participants open-ended and close-ended questions. This study used *Search Screens* to display a sequence of a tornado threat and *Questionnaire Screens* to ask participants questions about their tornado risk perception, protective action decisions, perceived awareness regarding shelters and their demographic characteristics.

This study asked participants to view six *Search Screens* that shows a tornado threat developing from thunder storm watch to tornado warning (thunderstorm watch, thunderstorm warning, tornado watch, tornado watch, tornado warning, and tornado warning) (Appendix A). These *Search Screens* are followed by a series for *Questionnaire Screens* that ask participants different types of questions (Appendix B). Note that, a between-group manipulation was designed for the study. That is, all the participants were randomly selected into one of two (2) levels. Level one subjects were asked to report their individual risk perception and protective action decisions between viewing each of the six (6) weather advisories. Level 2 subjects were also asked to report their risk perception and protective action but only followed by the last (sixth) advisory.

To go through the whole experiment process, participants have to perform two major tasks. In the first task, participants who were randomly assigned to condition one (1) had to response to a *Questionnaire Screen* that includes one tornado risk perception and ten protective action questions every time when they finished viewing a *Search Screen* about the tornado threat. On the other hand, participants who were assigned to condition two (2) only had to answer one *Questionnaire Screen* that asks them about tornado risk perception and protective action decision after viewing all 6 *Search Screens (condition 1 = 60 and condition 2= 69)*. Next, task two used *Questionnaire Screens* to ask all participants 13

questions about their information preference, 10 questions about their tornado experience, 10 questions about their pet preparedness activities, 7 demographic questions, 4 tornado shelter awareness questions, 3 cognitive reflection questions, and 2 experiment feedback questions. The questionnaire screen would assess participants' preparedness and perceived awareness after viewing the search screen. Questions were presented in the following manner as not to overwhelm the participants; six (6) sets of multiple choice and open ended questions with demographic questions at the end. With regards to the lists generated through the questions for information preference (G1Q1 to G1Q13) and tornado experience (G2Q1 to G2Q10), a grouping mechanism among these variables became essential once it was clear they were measuring different levels of contributing factors i.e. death, injury, and property damage experienced directly and indirectly. For this, *Cronbach's Alpha* analysis was used as a tool to conduct a reliability test between the information preference variables. Reliability test are especially important when derivative variables are intended for subsequent predictive analysis (Santos, 1999). Therefore, if the results show low reliability (>0.7 cutoff), then variables within the scale had to be re-examined (Cronbach, 2004). This lead to the following grouping for these questions (G1Q1 to G1Q13); Visual 1, Visual 2, Visual 3, Visual 4, and Text sources. In grouping for the variables of tornado experience (injury, death, property damage, and disruptions to school/shopping), an already established mechanism in cataloging experience was used (Becker, 2017), see Figure 2. This led to the following breakdown with regards to the tornado experience questions (G2Q1 to G2Q10); Direct experience, Indirect Experience, and Vicarious Experience. This is further explained in the *Data Collection and Analysis* section. Although some perception questions (scenario 1-5) may be of value to this animal related study, it was not analyzed

due to insufficient sample size responding to both groups (Level #1; 26 pet owner respondents and Level #2; 39 pet owner respondents). Therefore this study only focused on respondents' risk perception from advisory six[2], pet preparedness, and shelter awareness along with demographic and cognitive questions will be addressed. The majority of pet related questions were designed to mirror disaster preparedness guidelines given in the official government preparedness website ("Pet preparedness pamphlet." Ready.gov, 2018). A pamphlet with the 9 most essential preparedness tasks is available at the end of this document, in the appendix (Appendix C). Other questions were designed to ascertain people's risk perception towards their animal charges. Questions addressing pet safety are displayed on the fourth (4^{th}) page of the questionnaire under "4-Pet Preparedness" and will address three issues; pet ownership, pet preparedness, and owner awareness regarding shelter options (Pet questionnaire provided in Appendix). Other category of survey questions include; 1- Risk perception and protective action, 2- Information Preference, 3- Tornado Experience, 5- Demographics, and 6- Cognitive reasoning. Demographic and cognitive related questions were available at the end of the questionnaire, with the option to pass on answering any of the question and still being able to successfully submit the results. Upon receiving the email invitation to take part in this study participants were redirected to a disclaimer regarding the experimental parameters, objectives, and limitations. Next, all participants were given five (5) minutes to navigate through the provided emergency information in order to ascertain which information is most reliable and meaningful to them before making decisions on how to act with their pets. This

[2] Both groups have to provide risk perception and protective action responses to advisory six.

limitation in time and information would help guide participants in choosing which information to view and review going forward.

The following section describes how questions were asked in the *Questionnaire Screens briefly* and how the variables were coded. Please see Appendix for details about the tornado threat displays in the *Search Screens* (Appendix A) and the detailed survey questions in the *Questionnaire Screen* (Appendix B).

Risk Perception and Protective Action Questions: To assess participants' tornado risk perception after viewing the tornado threat displays in the *Search Screen*, participants were asked to report a tornado strike probability for Stillwater, Oklahoma (*0%=an event is impossible* to *100%=an event is definitely happening*). The protective action questions ask participants to report the likelihood of continuing what they were doing (*1= extremely unlikely* to *5= extremely likely*), protecting private property (*1= extremely unlikely* to *5= extremely likely*), monitor the TV or radio (*1= extremely unlikely* to *5= extremely likely*), stay home and move to secure room (*1= extremely unlikely* to *5= extremely likely*), evacuate home to seek shelter with nearby neighbor (peer) shelter (*1= extremely unlikely* to *5= extremely likely*), evacuate home and seek shelter at public facility (*1= extremely unlikely* to *5= extremely likely*), evacuate without destination in mind (*1= extremely unlikely* to *5= extremely likely*), secure pets in leashes and carriers (*1= extremely unlikely* to *5= extremely likely*), move pets indoors and shelter in-place (*1= extremely unlikely* to *5= extremely likely*), and finally respondents were asked the likelihood of evacuating their homes with their pet(s) in seek of shelter (1= *extremely unlikely* to *5= extremely likely*). The last three (3) questions in this category also provided an option for participants to indicate they are

non-pet owners (*I do not own a pet*). This option is recoded as missing data. An "*I do not wish to answer"* option is also included for participants to choose for all questions, this is also recoded as missing data.

Information Preference Questions: With regard to participants' experience on the experiment, after answering the first set of questions above, responders were asked about the extent to which they used visual and text (table) information. Visual information was asked (*1= Not at all* to *5= Very great extent*) in questions 1-4 as follows; 1- the polygon image, 2- the radar image, 3- both polygon and radar image, and 4- window view. Text information was made available in the table on the *Search Screen* and asked in the same manner as before (*1= Not at all* to *5= Very great extent*) for questions 5-13 as follows; 5- waring/watch status, 6- warning/watch location, 7- storm location, 8-storm moving speed and direction, 9- hazards information, 10- impact information, 11- location impact information, 12- precautionary/preparedness information, and 13- storm distance information. Answering "6" to any of the questions on this page indicated a participants' unwillingness to answer. This did not exclude their other responses from the study, if applicable. An *"I do not wish to answer"* option is also included for participants to choose. This is recoded as missing data.

Tornado Experience Questions: To understand students' personal experience with tornado events, they were asked about previous warning messages, protective action, property damage, injuries, and disruption to regular events. The questions were asked (*0=No, 1=Yes,*) as follows for warning message experience; 1- Ever seen a polygon on TV, 2- ever received a tornado warning and took protective action, and 3- ever

received a tornado warning and did not take protective action. When inquiring about property damage, respondents were asked about; 4- city property, 5- personnel property, and 6- property of acquaintance (friend, family, neighbor, or co-worker). With regard to personnel injury due to tornados, students were asked about; 7- injury to themselves or immediate family and 8- injuries to acquaintances (friend, distant family, neighbor, or co-worker). Finally, in order to grasp a quantifiable figure for disruption to regular activities, participants were asked to indicate whether they experienced disruption to; 9- attending school and 10- shopping routine, due to previous tornado events. An *"I do not wish to answer"* option is also included for participants to choose. This is recoded as missing data.

Pet Preparedness Questions: To asses participants' pet preparedness the following nine (9) questions were taken from website ("Pet preparedness pamphlet." Ready.gov, 2018) and answered (*0=No, 1= Yes*). Respectively, pet owning participants were asked if they had ever; 1-prepared three (3) days' supply of food, 2- prepared three (3) days' supply of water, 3- kept extra medicine safe, 4- kept medical record secure, 5- had a permanent form of identification in/on pet, 6- prepared enough carriers, 7- considered sanitation needs, 8- prepared picture with pet(s), and 9- prepared pets favorite toy/bedding in emergency kit. An option for participants to indicate they are not pet owners (*I do not own a pet*) is included. This option is recoded as missing data. An "*I do not wish to answer*" option is also included for participants to choose. This is recoded as missing data. A tenth, open ended, question asked participants about the type and number of pet(s) in their care. . All these questions were later recoded in to a

Pet Preparedness Index by adding all the values from these questions (*0=low pet preparedness level to 9=high pet preparedness level*).

Demographic Questions: To gain a sense and understanding of participant's unique points of view in their responses to the experiment, the following seven (7) demographic questions were asked; 1-age (*open ended figure),* 2- gender *(1= male and 2= female),* 3- ethnicity *(1= African American, 2- Asian/Pacific Islander, 3- Caucasian, 4- Hispanic, 5- Native American, 6- mixed, or 7- other),* 4- college education *(1- freshman, 2- sophomore, 3- junior, 4- senior, and 5- graduate student),* 5- country of high school *(open ended ordinal variable),* 6- which state is high school located *(open ended ordinal variable),* living situation on/off campus (*1=No or 2=Yes).* All these questions have an "*I do not wish to answer*" option for participants to choose. This is recoded as missing data.

Sheltering Awareness Questions: Also under the Demographic question(s) page, respondents were asked to indicated their estimated (best guess) proximity to peer shelters, where arrangements could be made for their pets ahead of time, and public shelters, where pets are not generally allowed, unless advertised as a pet-friendly shelter by the shelter owner/manager. These four (4) questions asked about distances in miles and minutes for both types of shelters and were answered as *(open ended ordinal variable).* Here, respondents either responded somewhat correctly to the question by indicating a feasible figure (response recoded as "1") indicating some sort of awareness regarding shelters, or they responded with "I don't know/declined to answer" (response recoded as "0") indicating no awareness regarding shelters.

Cognitive Reflection Questions: Though not essential to this projects' experimental design, cognitive questions were added for the sake of getting a better idea of responding students' abilities in critical thinking. These three (3) question were taken from a 2005 study examining the relationship between "better" cognitive responses and the ability to make informed decisions (Frederick, 2005). Here answers were in *open ended* form but later coded as either (1= correct answer or 0= incorrect answers). These variables were combined to create a Cognitive Reflection Index (*0=low cognitive ability* to *3=high cognitive ability*).

Experiment Feedback Questions: Final impressions from the student participants were asked in two (2) ways. The first was a likert scale similar to what they were used to in the previous questions asking the likelihood of taking similar action to their responses (*1= extremely unlikely* to *5= extremely likely*). The second feedback question was an *open ended ordinal variable* giving students the opportunity to provide productive suggestions and comments regarding their overall experience with this experiment/study.

3.3 Sampling Frame

Studies have consistently shown that 62%-75% of households report living with a pet or companion animal (Simms and Tobin 2007; Cattafi, 2008; and APPA, 2018). Therefore, a random sample approach was used to collect data from students who live with or without pet(s). In order to better understand college student pet owners' tornado response, preparedness efforts, and shelter awareness levels this research is carried out in the form of an online survey looking into both student pet owners and non-pet owners. Since Oklahoma is located in a high strike probability area for tornados, according to the National

Weather Service (NWS OK-Report, 2018), it is important to investigate tornado perceptions and responses of college students, a vulnerable population as indicated by literature (Cutter *et al.*, 2003). In additional, this study also investigated pet-owning college students' pet preparedness level and the factors that affects this variable. Therefore, the study's participants will be randomly selected from Oklahoma State University student body.

This study used a random sample of 3,000 OSU students email list (as of fall 2018). OSU is located in Stillwater, Oklahoma, a college town situated in a high tornado risk area (NOAA, 2018). The student email list was provided by the office of Institutional Research & Information Management, Oklahoma State University. An invitation and cover letter was attached to the simulation link and initially sent to each of the 3,000 randomly selected emails on February 25th, 2019 (Wave #1) (see Appendix D). Follow-up emails were sent out to 2,930 emails on March 11th, 2019 (wave #2). The next follow-up emails was sent to 2,911 emails on March 25th, 2019 (Wave #3) and the final follow-up emails was sent to 2,895 emails on April 2nd, 2019 (Wave #4). The process followed the internet survey approach proposed by Dillman, Smyth, and Christian in the 4th edition of their text "Internet, phone, mail, and mixed-mode surveys: the tailored design method" (Dillman *et al.*, 2014). Final data collection was done on April 29th, 2019. This study included responses from 120 participants for a total response rate of 4% between February and April of 2019. This was a small sample but proved to be significant through *power analysis (α = 0.01, μ=>5%-10%).*

As incentive for successful completion of the tornado simulation project was offered, four 100-dollar Amazon gift cards as prize awards were drawn on April 29th for all the

participants who responded to the email requests and participated the study. Entry into this prize contest required respondents to opt into the drawing by submitting a contact email. Participation in the incentive program was voluntary as the time required to complete this experiment was under an hour and the incentives were randomly assigned to participants, this did not constitute as an earning or financial profit for their time. Thus it is unlikely that the cash incentive ($100.00) resulted in any type of bias or distortion to the selection or response process. Following IRB protocols, any surprise or unforeseen complications with regard to the monetary incentives offered would have been documented in the field logs and brought to the attention of the faculty member overseeing this experiment, Dr. Tristian Wu (PhD) of the Department of Fire and Emergency Management Administration – College of Engineering Architecture and Technology at OSU-Stillwater.

3.4 Data analysis procedures

In this experiment, the unit of analysis was the Oklahoma State University students. After gaining IRB approval from Oklahoma State University's Institutional Research & Information Management office (Appendix), this instrument was designed and initiated on the platform *DynaSearch* on January 7th, 2019 (www.dynasheach.com). Graduate students from OSU's department of Fire and Emergency Management Administration volunteered to participate in the study to test the design and execution of the experiment on February 7th, 2019. Using their feedback, some questions were rephrased to be made clearer and more specific while maintaining the overall concept in order to properly answer the research questions outlined in this paper.

Quantitative statistical methods was used to answer each research question and hypothesis individually. To ensure greater accuracy in the results, the statistical analysis software

IBM SPSS Statistics Grad Pack 25.0 was used to run the respective tests/analysis on the data sets. a variety of statistical analysis techniques/tests were used to evaluate respondents' answers with regard to; a. risk perception and protective action, b. pet preparedness, and c. shelter awareness. These techniques/tests are explained in detail below. All Results are documented in the following chapter.

A. Risk Perception and Protective Action

RQA-1: Do student pet owners have different tornado risk perception than student non-pet owners when facing a tornado warning.

An *Independent sample t-test was used* to determine the mean difference of two (2) comparable populations (pet-owners vs. non-pet-owners) with regard to their tornado risk perception (RPA6Q1) when facing a tornado warning. In addition, *Levene's test* was used to see if the sample met the t-test assumption of equal variance.

RQA-2: What are student pet owners' most preferred pet related protective actions when facing a tornado warning?

A *Repeated Measure ANOVA* test was used to determine the mean differences among respondents' answers as to the likelihood to which they; a. leash their pets and place them in approved carriers, b. move pets to secure rooms indoors, and c. evacuate the home with their pet(s) facing a tornado warning. The survey questions used were the last three (3) protective action questions (RPA6Q9, RPA6Q10, and RPA6Q11) respectively as they relate directly to pet owners' decisions of protective actions during an emergency.

RQA-3: Do student pet owners and non-pet owners have different choice of non-pet related protective actions when facing a tornado warning.

In order to answer this question and understand the significance pet ownership has on non-pet related protective actions an *Independent sample t-test was used* to test the mean differences again. This time, however the tests were run seven (7) times, individually, on each of the questions relating to non-pet protective action (RPA6Q2 to RPA6Q8) and tested against both pet owning and non-pet owning students. Similar to RQA-1, *Levene's tests* were used to see if the sample meet the t-test assumption of equal variance.

B. Pet Preparedness:

RHB-1: Student pet owners prefer visual tornado information than text information sources.

Testing this hypothesis required additional steps due to the nature of the information that was asked in each question regarding the available sources (visual and text). Though using *Repeat measure ANOVA* was appropriate to determine the differences in responders' preference, a *Cronbach' Alpha* test was also run to determine the questions comparability to each other within the source group they belong to. The results show that the text information have a fairly good internal consistency (*Cronbach's* α = .91). Therefore, according to Cronbach, Assistance, & Shavelson (2004), all the survey response on how text information were used during the experiment were averaged into one variable-TextInfo. Therefore the Repeated Measure ANOVA was used to test the mean difference of the following breakdown/grouping: VisualPolygon, VisualRadar, VisualPolygon&Radar, VisualWindowView, and Text Info.

RQB-1: What are the most common pet preparedness activities for student pet owners?

For this question, *Repeated Measure ANOVA* tests determined the mean difference between respondents' answers. This time, these test were used to determine the most common pet preparedness activity among student pet owners among the nine (9) activities outlined in FEMA's information pamphlet (Appendix C). The survey questions used to convey this information were nine (9) of the preparedness questions, responses recoded as "1" for pet owners who took that step in preparedness and "0" for not doing the preparedness item.

RQB-2: What are the significant demographic predictors of pet preparedness among student pet owners?

For this research question *Multiple Linear Regression* was used to test the influence of different demographic variables (age, education, cognitive score, and tornado experience) on respondents' answers. Here, variables required an additional step of transformation due to the nature of the information I was after. Pet preparedness, cognitive score, and tornado experience were recoded into SPSS as follows; pet_prepadrness = $\sum$ (G3C1:G3C9) and Cognitive_score = $\sum$ (G5Q1:G5Q3). As for tornado experience, due to the variety of experiences being measured (damage, disruption, injury, and death) an appropriate grouping was needed to properly convey the types of experience being utilized in this analysis. The tornado experience questions were grouped based on the core categories found by Becker and her colleagues, where they found the type of experience to be a strong predictor in motivating household preparedness activities (Becker *et al.*, 2017). This led to the following breakdown with regard to experience for this study; 1. Direct tornado experience = G2Q5+ G2Q7, 2.

Indirect tornado experience = G2Q1 + G2Q2 + G2Q3 + G2Q4+ G2Q9 + G2Q10, and 3. Vicarious experience = G2Q6 + G2Q8.

C. Sheltering Awareness

RHC-1: Pet owner awareness with regard to emergency sheltering options is higher than non-pet owners.

In answering this question *Cross Tabulation* analysis was the best SPSS tool to use to find the relationship between the variables. In this case, it was peer shelter awareness as compared to pet ownership and also, public shelter awareness and how pet owners perceive their awareness with regard to those. This also required some additional steps in recoding certain responses. With regard to the shelter awareness questions, if G4Q8 (miles) or G4Q9 (minutes) had a value then the response is coded as "1", same for questions G4Q10 (miles) or G4Q11 (minutes). However, if G4Q8 (miles) andG4Q9 (minutes) were missing then they were coded as "0" in the software and the same was done for G4Q10 (miles) or G4Q11 (minutes).

CHAPTER IV

FINDINGS

Before conducting statistical analysis on the data obtained from the experiment, a k descriptive analysis of all response was run. SPSS's Descriptive Statistics tool provided for the following information for the 119 student sample (n = 119):

Individual Demographics: The one common characteristic among all student respondents is that they listed graduating from U.S based high schools with the bulk of participants from the state of Oklahoma (66.4%). The majority of the sample was female (52.9%). The most common age among participants was 19-20 years old which comprised (43.7%) of respondents, least common were individuals above the age of 31 years old (0.32%, Mode = 9, SD = 4.5).. However, the largest academic group to respond were students in their senior year (30.3%, Mode = 4, SD = 1.2) and the majority of students appear to be living off of the university campus (%55.2, Mode = 3, SD= 0.49). Level 1 had 53 respondents while Level 2 had 66 respondents.

Pet demographics*:* Pet owners comprised (54.6%) of the responding sample with dogs as the more common pet (91 dogs vs. 40 cats). There were 27 pet owning participants in the

Level #1 group and 37 pet owners in Level #2. Results of the statistical analysis are as follows:

A. Risk Perception and Protective Action

With regard to the test of RQA-1 (do student pet owners have different tornado risk perception than student non-pet owners when facing a tornado warning?) shows non-significant result ($t_{(117)} = -0.414$, ns).First, the null hypothesis tested here was that two samples pet owners (n= 65) and non-pet owners (n= 54) had homogeneity in variance despite being different. Running the Levene's test resulted in a p value of 0.712 which is greater than the critical value (p= 0.05). Therefore, the result of Levene's test of equal variance suggest that the two groups have equal variance and it does not violate t-test's assumption. This suggests, pet owners and non-pet owners do not have different tornado risk perception when facing a tornado warning.

The findings of RQA-2 (*what is student pet owners' most preferred pet related protective actions when facing a tornado warning?*) indicate that pet owner respondents' ratings of preferred protective action are significantly different across groups (*Wilks' Lambda* = 0.719; $F_{(2,117)} = 22.866$, $p < 0.1$). Table 1 shows respondent rating of their greatest preferred protective action is moving pets to secure interior room when facing tornado warning, followed by the act of leashing pets and placing them in approved plastic carriers. The act of evacuating the residence with pet(s) was the least popular form of protective action as chosen by this group of respondents.

Table 1. Pet owners' likelihood of adopting pet related protective actions when facing tornado warning threat (*n=119*)

Pet Protective Action	Mean	S.D.
Leash pets and place in approved carriers	2.73	2.032
Move pets to secure interior room of the house	3.52	2.364
Evacuate residence with pet to seek shelter?	2.55	1.849
Wilks' Lambda = 0.719; $F_{(2,117)}$= 22.866, p< 0.1		

Analysis of RQA-3 (*Do student pet owners and non-pet owners have different choice of non-pet related protective actions when facing a tornado warning?)* revealed that mean choices among non-pet related protective action between pet owners and non-pet owners are not significantly different for the following actions; continue what I am doing ($t_{(117)}$ = 4.040, *ns*), monitor TV or radio ($t_{(117)}$ = 4.094, *ns*), stay home and move to secure interior room ($t_{(117)}$ = 0.496, *ns*), and evacuate to peer shelter ($t_{(117)}$ = 0.063, *ns*). However, they are different for the following actions; protect private property ($t_{(117)}$ = 14.509, p < 0.1) and evacuate to public shelter ($t_{(117)}$ = 4.921, p < 0.1).

- Pet owners' mean rating of protecting private property is 4.69, for non-pet owners the mean is 4.31.
- Pet owners' mean rating of evacuating to public shelter is 2.26, for non-pet owners the mean is 2.89.

This is outlined in detail in Table 2, below:

Table 2. Pet and non-pet owners' likelihood of adopting non-pet related protective actions when facing tornado warning threat

Non pet related protective action	Pet ownership	Mean	S.D.	N	t-statistic
RPA6Q2: continue what I am doing.	Owns pet(s)	2.26	1.47	65	$t_{(117)} = 4.04$, *ns*
	No pet(s)	1.93	1.33	54	
RPA6Q3: protect private property.	Owns pet(s)	4.69	0.75	65	$t_{(117)} = 14.51$, $p < 0.1$
	No pet(s)	4.31	1.32	54	
RPA6Q4: monitor TV or radio.	Owns pet(s)	4.80	0.71	65	$t_{(117)} = 4.094$, *ns*
	No pet(s)	4.63	0.92	54	
RPA6Q5: stay home and move to secure interior room.	Owns pet(s)	4.05	1.17	65	$t_{(117)} = 0.496$, *ns*
	No pet(s)	4.09	1.20	54	
RPA6Q6: evacuate to peer shelter.	Owns pet(s)	3.00	1.64	65	$t_{(117)} = 0.063$, *ns*
	No pet(s)	3.06	1.69	54	
RPA6Q7: evacuate to public shelter	Owns pet(s)	2.26	1.42	65	$t_{(117)} = 4.921$, $p < 0.1$
	No pet(s)	2.89	1.70	54	

B. Pet Preparedness:

In testing the validity of the research hypothesis RHB-1 (*Student pet owners prefer Visual tornado information than non-visual tornado information*), pet owner respondents' ratings of preferred information sources were significantly different across groups (*Wilks' Lambda* = 0.347; $F_{(12,107)} = 16.777$, $p < 0.1$). As indicated by the *Repeated Measures ANOVA* test and corroborated by the *Cronbach's Alpha* analysis, the results shows pet owning respondents found visual sources of information more appealing than written text information. Figure 3 depicts these results below.

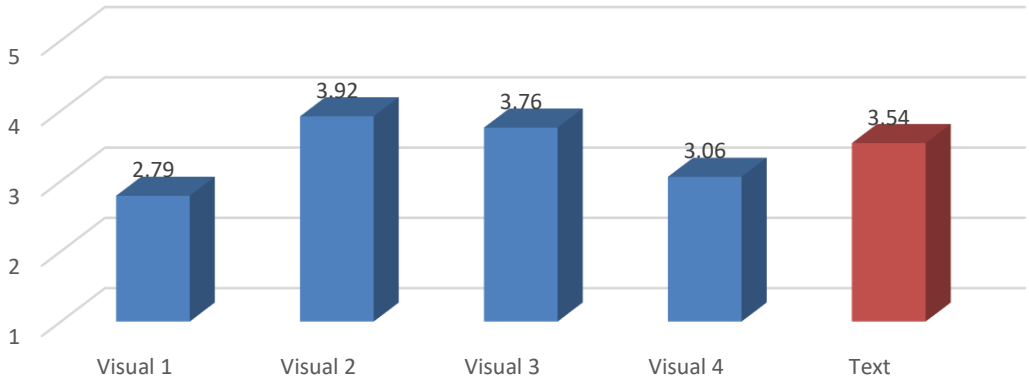

Figure 3. Pet owner preferred information source category

The findings for the first research question in this area RQB-1 (*What are the most common pet preparedness activities for student pet owners?)* found pet owner respondents' ratings of preferred pet preparedness activities to be significantly different across groups (*Wilks' Lambda* = 0.465; $F_{(8,51)}$= 7.32, p< 0.1). Table 3 and Figure 4 shows respondent rating of their most preferred pet preparedness action as providing permanent identification in the form of a collar or microchip (G3Q5), their least taken action regarding responders' pets is in keeping medical records in a secure place (G3Q4).

Table 3. The mean values of pet owners' pet related preparedness activities (n=59).

Pet related preparedness activities	Mean	S.D.
G3Q1: Prepare at least a three day supply in an airtight, waterproof container.	0.25	0.439
G3Q2: Prepare at least three days of water specifically for your pet(s).	0.27	0.448
G3Q3: Keep an extra supply of medicines your pet takes on a regular basis in a waterproof container.	0.22	0.418
G3Q4: Keep your pets' medical records in a waterproof container.	0.17	0.378
G3Q5: My pet(s) wears a collar with a ID tag or have a microchip with identification information	0.71	0.457
G3Q6: Prepare pet(s) carriers for transporting all of your pet(s).	0.39	0.492
G3Q7: Prepare pet(s) sanitation needs.	0.29	0.457
G3Q8: Prepare a picture of you and your pet(s) together.	0.47	0.504
G3Q9: Prepare your pets' favorite toys, treats or bedding in your pet emergency supply kit.	0.36	0.483
Wilks' Lambda = 0.465; $F_{(8,51)}$= 7.32, p< 0.1		

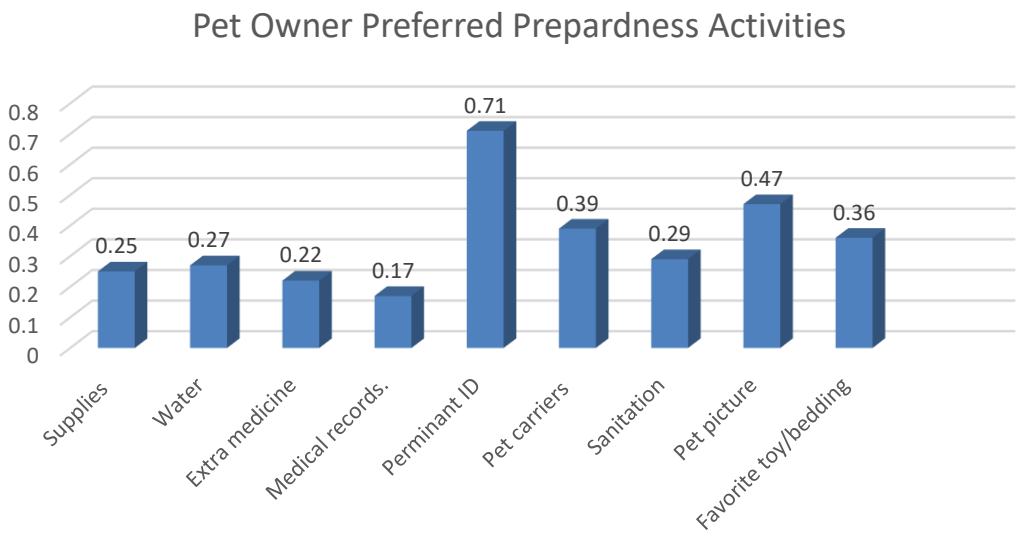

Figure 4. Pet owner preferred preparedness activities

In researching the effects of respondents' demographic characteristics RQB-2 (*what are the significant predictors of pet preparedness among student pet owners?),* the data showed

this model to be significant ($F_{(6, 36)}$ = 5.798, p < 0.01, Adj R^2 =0.407). Student age (t = 2.340, p < 0.05) and direct tornado experience (t = 3.894, p < 0.05) are the significant predictors of pet preparedness activities. The variable direct experience (Direct_EXP) is the strongest predictor of this model. When other variables constant, one unit change of the direct experience rating will result in 2.65 unit change in the rating of student pet preparedness (pet_prepardness). Table 4 presents these findings in more detail.

Table 4. Results of Multiple Linear Regression model for pet preparedness (n=119).

Model	Coefficient	t	Sig.
(constant)	-2.054	-0.947	0.350
Age	0.239*	2.340	0.025
Education	-0.618	-1.859	0.071
CRT_score	-0.110	-0.333	0.741
Direct_EXP	2.651*	3.894	0.000
Indirect_EXP	0.089	0.320	0.751
Vicarious_EXP	-0.293	-0.440	0.663
$F_{(6,36)}$ = 5.798, p < 0.01, *Adj* R^2 =0.407			
*the regression coefficient is significant at the 0.05 level			

C. Shelter Awareness

Finally with regard to shelter awareness RHC-1 (*pet owner awareness with regard to emergency sheltering options is higher than non-pet owners)*, the *Cross tabulation analysis* shows that pet ownership and sheltering awareness are significantly associated with each other ($\chi^2_{(1)}$ =4.25; p <.05). Table 5 shows that, among the pet owners, 63.5% of the pet owners are aware of their peer sheltering options whereas only 36.5% of the non-pet owners are aware of their peer sheltering options. Alternatively, with regards to public shelter awareness, there were no significant findings to report ($\chi^2_{(1)}$ =3.097; p >.05).

Table 5. Peer Sheltering Awareness between pet and non-pet owner.

		Pet Ownership		N
		Non-pet Owner	Pet Owner	
Peer Sheltering Awareness	Not Aware	55.40%	44.60%	56
	Aware	36.50%	63.50%	63
$\chi^2_{(1)} = 4.25$; $p < .05$				

CHAPTER V

CONCLUSION

Using current weather trend patterns as reference, it becomes clear that it is not a question of "if" a tornado threat happens again, but rather "when" the next will be happening in Stillwater. This is why it is imperative that the large student population (pet owning and non-pet owning) become as educated as possible about the options available to them in an emergency situation, in order for them to make the best choices in protective action(s) for everyone at home. The students in this study provided answers about the factors affecting tornado risk perception, protective action, pet preparedness, and sheltering awareness. These variables, found in the PADM (Lindell, 2018), were used to examine the significance of pet ownership as a protective action factor, as suggested by scientist in the past (Leonard, 2007; Schaffer, 2011; Thompson, 2016 & Trigg, 2015). As indicated by Dr. Lindell and his colleagues, individual hazard adjustment options and risk perceptions are influenced by key demographic variables such as gender, experience, education, cognitive abilities and as this study has demonstrated, pet ownership. Here the demographic variable of owning at least one pet (dog or cat) showed increased significance as disaster behavior predictors than other studied indicating variables such as cognitive abilities. One finding of this

research study, that coincided with previous studies of similar nature, is the high percentage of pet owners in the sample which accounts for (54.6%) of participants (APPA, 2018).

Although the data did not show significant difference between student pet owner and non-pet owners' tornado risk perception and most of the non-pet related protective action decisions, the findings did suggest that *Moving Pets to a Secured Interior Room of the House* is the most preferred pet related protective action among pet-owners. This informs emergency managers that pet owning students are more likely to seek shelter where they live. As such planning, mitigation, and response activities should take this into consideration. In planning for emergencies, local managers should make sure university buildings are set up to handle pet owning students seeking shelter in times of on-set weather warnings. Mitigating activities may include strategic distribution of pet owning student dorms as not to overwhelm any one building in times of emergencies and response personnel can be trained on handling pets and their owners in stressful environments and show consideration to the human animal bond at play in the moment.

In addition, the experiment did yield interesting results in the relationships between pet preparedness and its demographic predictors among pet owners. Where age and previous direct experience play significant roles as predictors for pet preparedness activities options. The results on experience are similar to the study conducted by Becker *et al*. (2017) suggesting that direct disaster experience have higher association with developed preparedness. On the other hand, however, cognitive ability is not a significant predictor of pet preparedness in this study. This finding is different from what literature suggested (Frederick, 2005; Whitney *et al*., 2004). When further investigate the pet preparedness

items, this study found that the greatest preparedness activity among respondents was insuring some sort of permanent identification was on their pet(s).

In the analysis of perceived shelter awareness, the results indicate pet ownership is not a significant predictor in public shelter awareness but more pet owning students are aware of peer shelter compared to non-pet owning students. This is most likely due to the limited availability of shelters that are animal specific or pet-friendly. Though the City of Stillwater has a humane society and animal control facility, these do not operate as shelters for individuals and their pets, and there are no shelters advertised on the Oklahoma State University campus (PCART- SOPs, 2015). This leaves a large portion of student pet owners uncertain about where they can go during times of onset natural disasters. In line with previous risk perception and warning experiments that utilize a student sample, similar to Wu *et al*. (2015a), pet owning students prefer the use of visual information sources over text communications. Finally, the high response rate of student pet owners indicating their priority to protecting property should be further studied due to some respondents possible construing their pet(s) as personal property while the question was intended for inanimate objects only (house, car, trailer, personal items).

Pets on university campuses such as Oklahoma State University, are becoming more popular among students and more necessary for individuals with disabilities. Whether they are providing a medical service to a student/faculty member or providing for emotional support, these animals' presence is a welcomed one on campus (OSU – Human Resources, 2019; and OSU – Department of Wellness, 2019) and as such they need to be regarded as part of the community needing protection in emergencies. This extends to the consideration given to these animals with regard to risk perception and planning efforts. Oklahoma State

University officials can use the results of this study to begin examining their own documents in order to provide students and faculty with more up to date resources that better reflect the universities true policies and capabilities.

The overall impressions left by this study suggest an increase in Oklahoma State University pet owning students' knowledge and preparedness for an onset disaster, such as a tornado threat. This could be attributed to a multitude of factors, including increased pet related safety materials, and public awareness campaigns since the passing of the PETS Act. This suggests pet owners are better prepared for natural disasters today than in Hurricane Katrina in 2005. However, policies have changed to accommodate this vulnerable population (pets) on the federal level, local cooperation is of utmost importance to see these plans succeed. Disaster managers and pubic responders can benefit from this research in designing warning messages specifically targeted at pet owners and ensure there is language including pets in local standard s and guidelines. This isn't to say that by getting a pet(s), non-pet owning students will become more prepared for emergency situations or suddenly become more aware about available emergency sheltering options in their neighborhoods, but it a significant indicating factor of shelter awareness and preparedness among college students, as this experiment suggest.

Limitations and Recommendations

Insufficient sample size resulted in not being able to test pet owners' risk perception and protective action changes throughout the scenarios (Advisory 1-thunderstorm watch to Advisory 6-thunderstrom warning) in groups 1 and 2. This will be a standing objective for future similar research to pursue. For this, future research should consider a combination of pre-incentive and post incentive options when soliciting survey participants as research

has shown this to yield greater results in participation (Fernandez, 2010). It is also worth mentioning that, although researcher have established the validity of using students as a compatible representation of the populace (Lindell and Whitney, 2000 and Huang *et al.*, 2016), this was a pilot study done on university students. Although there is a less apparent diversity in the demographics of college students than the general public, previous researchers indicates that the results of student studies on risk perception are comparable to studies using household samples (Lindell and Whitney, 2000 and Huang *et al.*, 2016). However, this experiment is worth repeating on a larger more diverse sample that doesn't suffer as many additional vulnerabilities as college students may face. Furthermore, facts can be difficult to establish regarding awareness and disaster preparedness activities under high stress situations during and after an incident (Melemai, 2011). A method for addressing these issues is to collect survey responses from respondents *e.g.* college students, before the onset of a natural hazard.

With regard to Oklahoma State University, campus officials must address the disconnect between different departments' official guidelines regarding the presence of animals in emergency storm shelters on the Stillwater campus and make changes where necessary (OSU – Human Resources, 2019; and OSU – Department of Wellness, 2019). Unlike the situation at the University of South Florida, where only one building is designated as a pet friendly dormitory, pets should be given an occupancy load in multiple buildings as not to overwhelm any one structure when students choose not to evacuate with their pet(s). Finally, the university warning system at Oklahoma State University is in text form. Efforts should be taken to include visual information in this platform, as this study has shown visual warning messages to be more appealing to university students than text.

This paper is an effort to add to the growing, but limited, body of research regarding pet risk perception and decisions with regard to companion animals. As such, this paper supports the efforts of the United States PETS Act and acknowledges the progress it has brought to the field of disaster management. All disasters since the passing of PETS have provided opportunities to advance what is known about companion animals in emergencies situations. Ignoring these many opportunities for policy improvement adds to the devastation of the events as the damage is intensified emotionally, financially, and physically, both to pets and their owners emerging from disasters, such as tornados. This places unnecessary burdens on victims of disasters as well as responders. Understanding the degree to which animals are used as a protective action factors in emergencies is the first step in developing appropriate tactics that will guide pet owners in making more educated decisions in disasters with regard to themselves and their companion animal(s).

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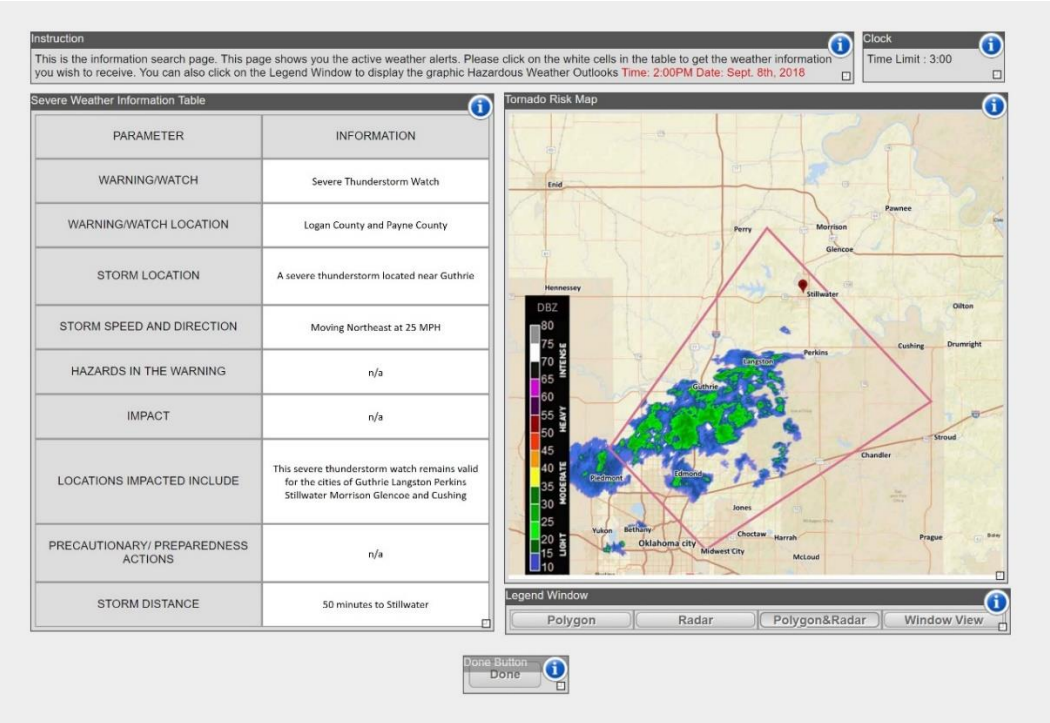
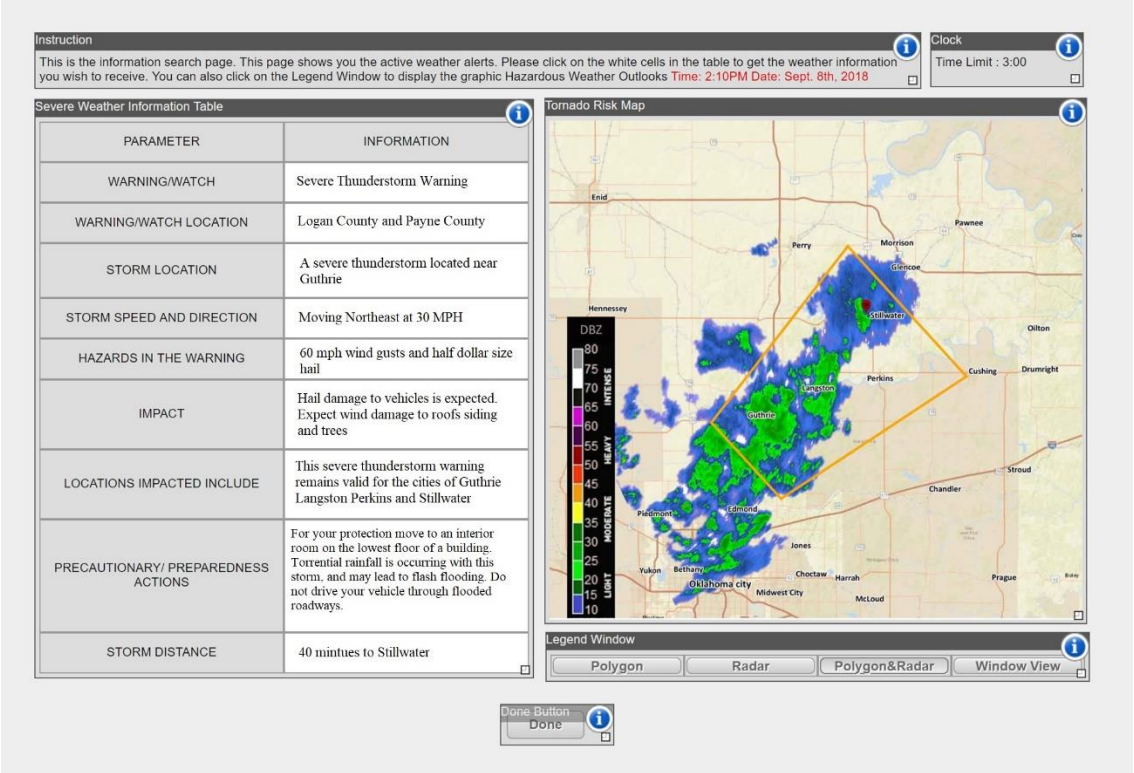
APPENDICES

APPENDIX A: *DynaSearch* – Screenshot of *Search Screen*:

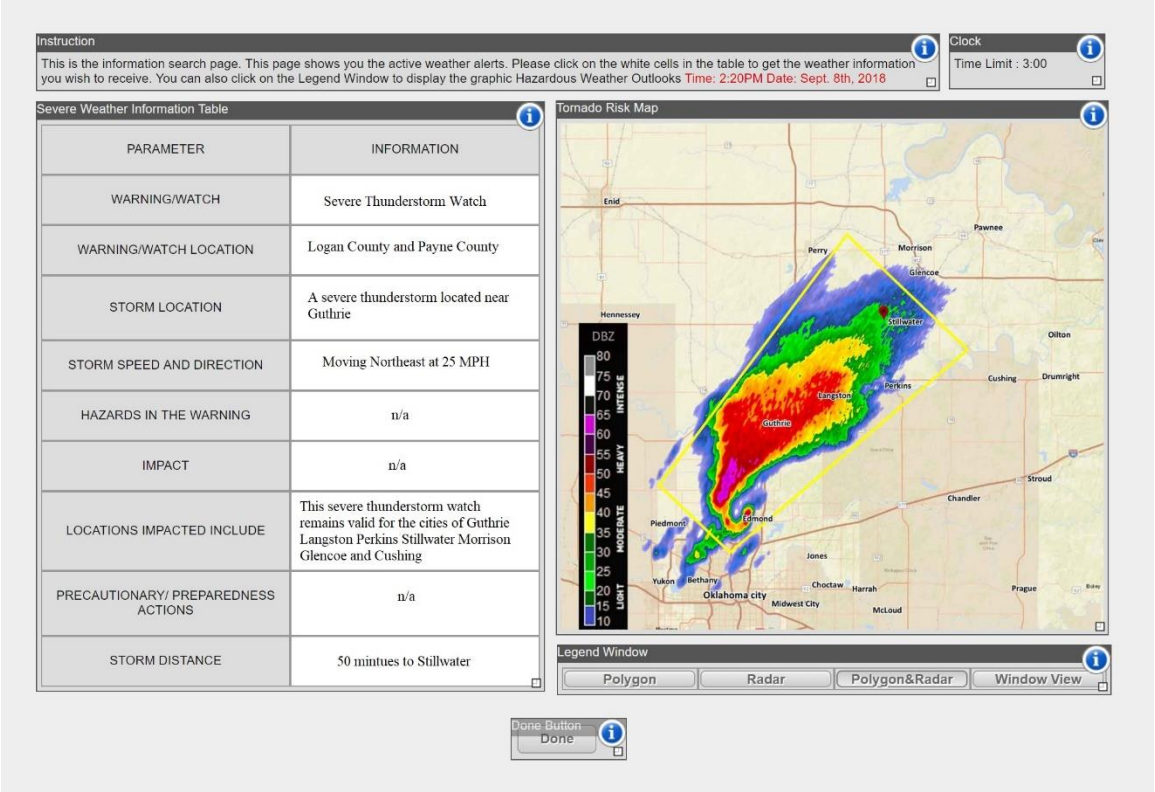
Advisory 1: Thunderstorm Watch



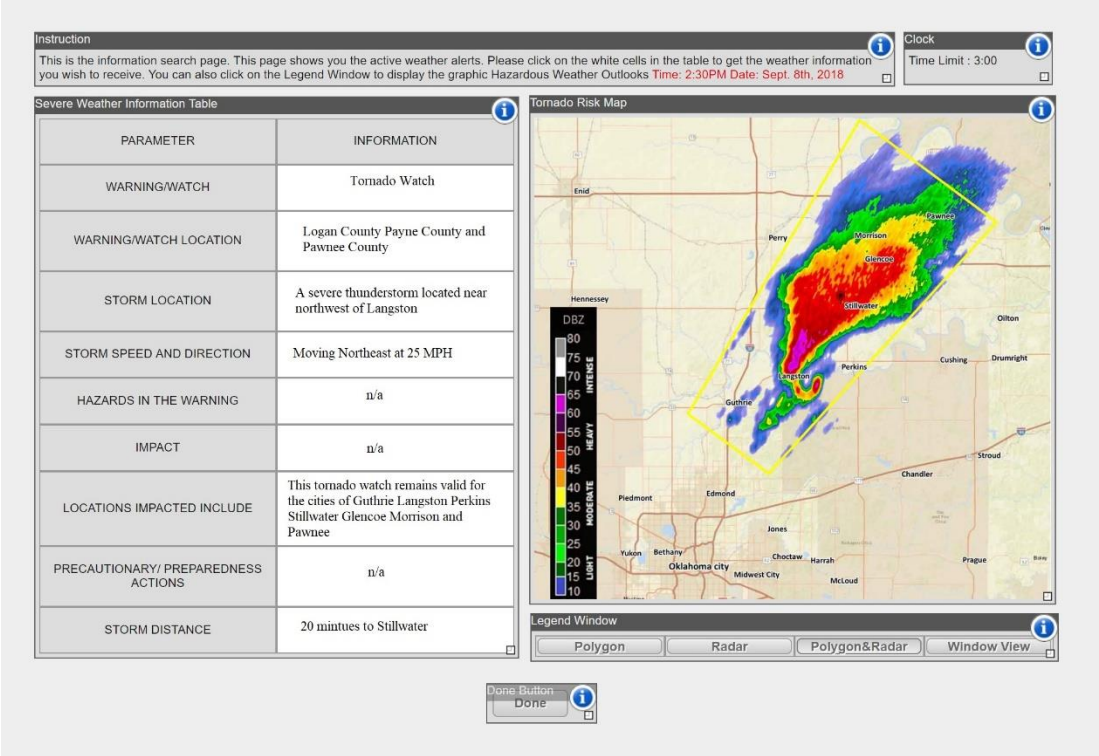
Advisory 2: Thunderstorm



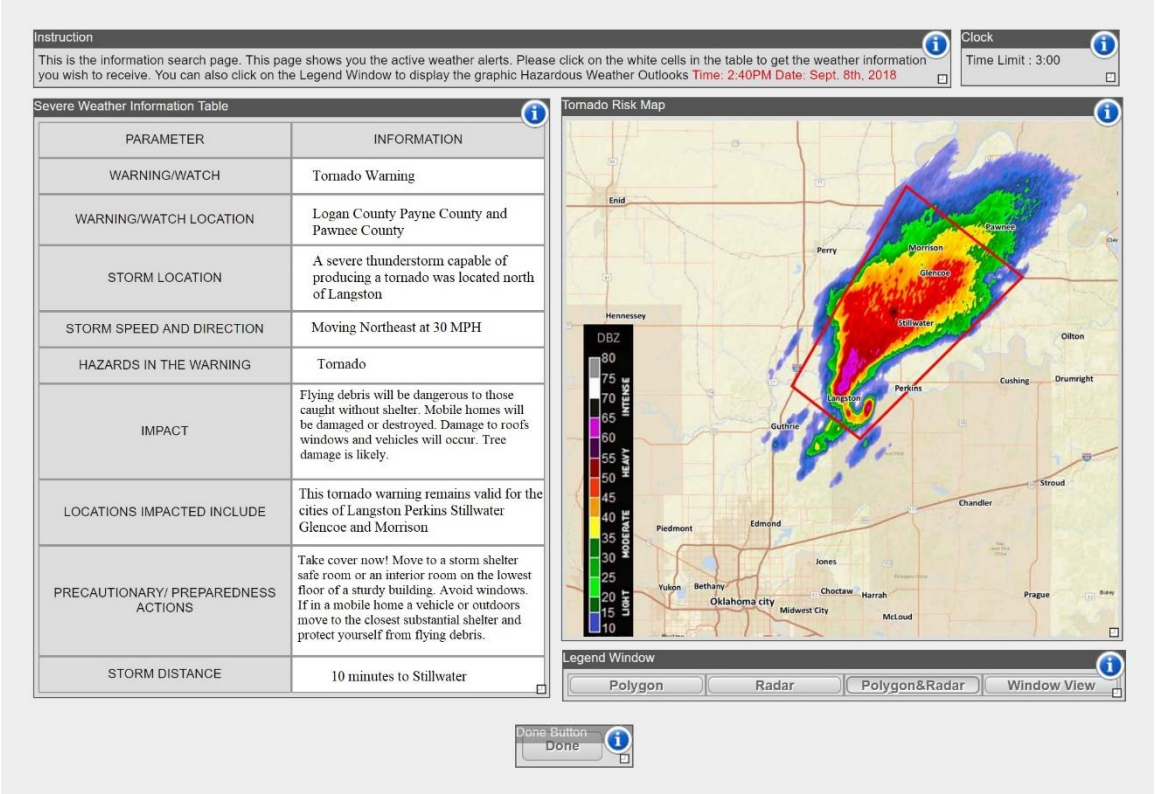
Advisory 3: Thunderstorm



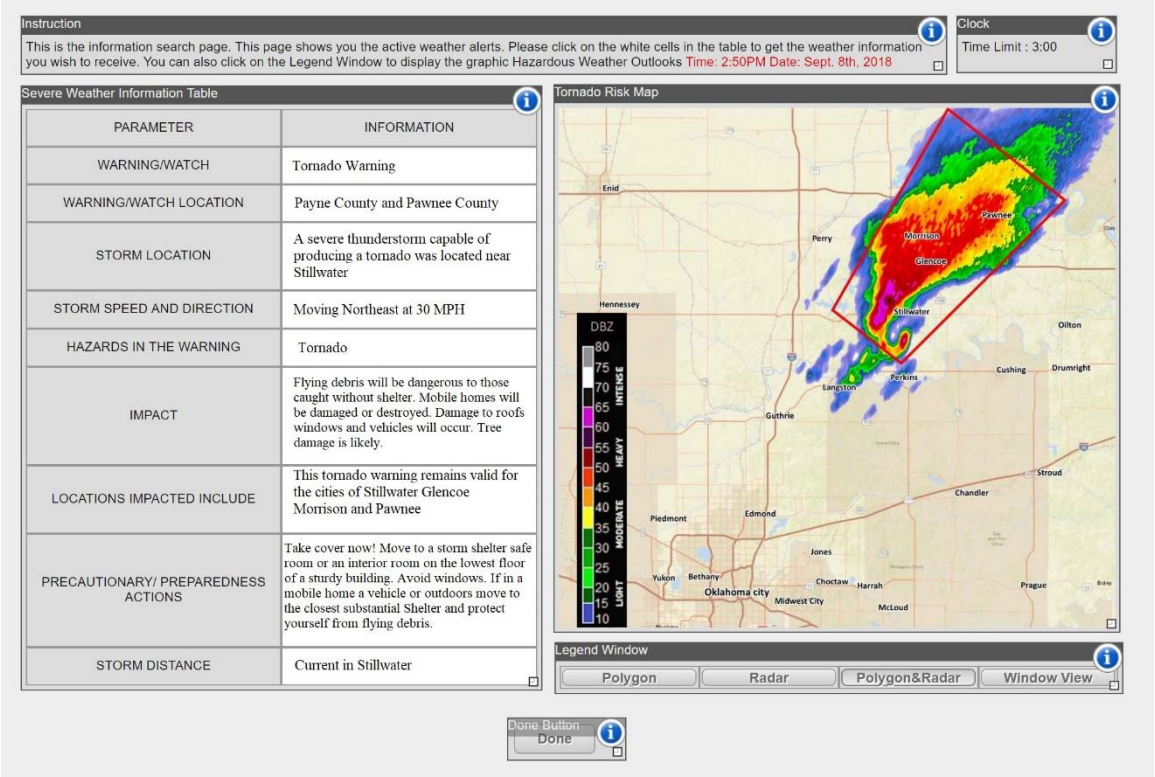
Advisory 4: Thunderstorm



Advisory 5: Thunderstorm



Advisory 6: Thunderstorm



APPENDIX B: Survey Questions:

1) You are a resident of Stillwater, Oklahoma. This section asks you questions about you tornado risk perception and household response actions based on the information in the previous weather advisory. Please click on the section title to show the questions.

A. Risk Perception Question

(Q1) Please enter a tornado strike probability for Stillwater, Oklahoma. Remember that a strike probability is a number that ranges from 0% to 100%, where 0% indicates that an event is impossible, 50% indicates the likelihood is neutral, and 100% indicates that it will definitely happen. Numbers between 0% and 100% indicate varying degrees of belief that the event could occur. If you do not wish to answer this question, please type "I do not wish to answer."

B. Household Response Action Questions

Based on the previous weather advisory, please decide the likelihood of you taking the following response actions.

B-1. Continue what I am doing.

1	Extremely unlikely
2	Somewhat unlikely
3	Neutral
4	Somewhat likely
5	Extremely likely
6	I do not wish to answer

B-2.Protect private property. Have your doors, windows, and garage doors closed.

□	Extremely unlikely
□	Somewhat unlikely
□	Neutral
□	Somewhat likely
□	Extremely likely
□	I do not wish to answer

B-3.Monitor TV or radio

□	Extremely unlikely
□	Somewhat unlikely
□	Neutral
□	Somewhat likely
□	Extremely likely

□	I do not wish to answer

B-4.Stay home and move to an interior room in the home (e.g. a closet), in a bathtub, or a tornado shelter.

□	Extremely unlikely
□	Somewhat unlikely
□	Neutral
□	Somewhat likely
□	Extremely likely
□	I do not wish to answer

B-5.Leave my home and take shelter in either an above or below ground tornado shelter at a nearby neighbor, friend, or families' house

□	Extremely unlikely
□	Somewhat unlikely
□	Neutral
□	Somewhat likely
□	Extremely likely
□	I do not wish to answer

B-6.Leave my home and take shelter at a public tornado shelter

□	Extremely unlikely
□	Somewhat unlikely
□	Neutral
□	Somewhat likely
□	Extremely likely
□	I do not wish to answer

B-7.Leave my home with no destination in mind, simply to get out of the path of the storm

□	Extremely unlikely
□	Somewhat unlikely
□	Neutral
□	Somewhat likely
□	Extremely likely
□	I do not wish to answer

(Q9)B-8. Leash your pets or place them in airline-approved plastic carriers (Please select "I do not have pets" if you do not have one)

□	I do not have pets
□	Extremely unlikely
□	Somewhat unlikely

□	Neutral
□	Somewhat likely
□	Extremely likely
□	I do not wish to answer

(Q10)B-9. Move your pets to an interior room in the home (e.g. a closet), in a bathtub, or a tornado shelter (Please select "I do not have pets" if you do not have one)

□	I do not have pets
□	Extremely unlikely
□	Somewhat unlikely
□	Neutral
□	Somewhat likely
□	Extremely likely
□	I do not wish to answer

(Q11)B-10. Leave your home and take shelter somewhere else with your pets (Please select "I do not have pets" if you do not have one)

□	I do not have pets
□	Extremely unlikely
□	Somewhat unlikely
□	Neutral

□	Somewhat likely
□	Extremely likely
□	I do not wish to answer

2) The following three sections asks you questions about your experience on this experiment, your tornado experience, Preparedness for pet and your demographic characteristics. Please make sure you scroll down your screen to answer all the questions before you click on the SUBMIT button; and do not hit ENTER on your keyboard while you are answering the questions. Thank you!

A. Your experience on the experiment

A-1. To what extent did you use the Polygon Image?

□	Not at all
□	Small extent
□	Moderate extent
□	Great extent
□	Very great extent
□	I do not wish to answer

A-2. To what extent did you use the Radar Image?

□	Not at all
□	Small extent
□	Moderate extent

□	Great extent
□	Very great extent
□	I do not wish to answer

A-3. To what extent did you use the Polygon plus Radar Image?

□	Not at all
□	Small extent
□	Moderate extent
□	Great extent
□	Very great extent
□	I do not wish to answer

A-4. To what extent did you use the Window View Image?

□	Not at all
□	Small extent
□	Moderate extent
□	Great extent
□	Very great extent
□	I do not wish to answer

A-5. To what extent did you use the Warning/Watch Status information in the table?

□	Not at all
□	Small extent
□	Moderate extent
□	Great extent
□	Very great extent
□	I do not wish to answer

A-6. To what extent did you use the Warning/Watch Location information in the table?

□	Not at all
□	Small extent
□	Moderate extent
□	Great extent
□	Very great extent
□	I do not wish to answer

A-7. To what extent did you use the Storm Location information in the table?

□	Not at all
□	Small extent
□	Moderate extent
□	Great extent

□	Very great extent
□	I do not wish to answer

A-8. To what extent did you use the Storm Moving Speed and Direction information in the table?

□	Not at all
□	Small extent
□	Moderate extent
□	Great extent
□	Very great extent
□	I do not wish to answer

A-9. To what extent did you use the Hazards in the Warning information in the table?

□	Not at all
□	Small extent
□	Moderate extent
□	Great extent
□	Very great extent
□	I do not wish to answer

A-10. To what extent did you use the Impact information in the table?

□	Not at all
□	Small extent
□	Moderate extent
□	Great extent
□	Very great extent
□	I do not wish to answer

A-11. To what extent did you use the Locations Impacted information in the table?

□	Not at all
□	Small extent
□	Moderate extent
□	Great extent
□	Very great extent
□	I do not wish to answer

A-12. To what extent did you use the Precautionary/Preparedness actions information in the table?

□	Not at all
□	Small extent
□	Moderate extent

□	Great extent
□	Very great extent
□	I do not wish to answer

A-13. To what extent did you use the Storm Distance information in the table?

□	Not at all
□	Small extent
□	Moderate extent
□	Great extent
□	Very great extent
□	I do not wish to answer

3) The following three sections asks you questions about your experience on this experiment, your tornado experience, Preparedness for pet and your demographic characteristics. Please make sure you scroll down your screen to answer all the questions before you click on the SUBMIT button; and do not hit ENTER on your keyboard while you are answering the questions. Thank you!

B. Your tornado experience

Have you ever...

B-1. seen a warning polygon on TV?

□	No

□	Yes
□	I do not wish to answer

B-2. received a tornado warning and took protective action?

□	No
□	Yes
□	I do not wish to answer

B-3. received a tornado warning but did not take protective action?

□	No
□	Yes
□	I do not wish to answer

Have you ever experienced a tornado that caused

B-4. damage to property in your city

□	No
□	Yes
□	I do not wish to answer

B-5. damage to your home

□	No

□	Yes
□	I do not wish to answer

B-6. damage to the home of a friend, relative, neighbor, or coworker you know personally

□	No
□	Yes
□	I do not wish to answer

B-7. injury to you or members of your immediate family

□	No
□	Yes
□	I do not wish to answer

B-8. injury to a friend, relative, neighbor, or coworker you know personally

□	No
□	Yes
□	I do not wish to answer

B-9. disruption to your school that prevented you from attending

□	No
□	Yes

□	I do not wish to answer

B-10. disruption to your shopping and other daily activities

□	No
□	Yes
□	I do not wish to answer

4) This section asks you to consider possible items or activities that pet owners prepare their pets for disasters. We would like to know if you have done any of the following activities. If you do not have any pet, please simply select "I do not have a Pet"

C. Have you done any of the following for your pet?

C-1. Prepare at least a three day supply in an airtight, waterproof container.

1	I do not have any pet
2	No
3	Yes
4	I do not wish to answer

C-2. Prepare at least three days of water specifically for your pet(s).

□	I do not have any pet
□	No
□	Yes

□	I do not wish to answer

C-3. Keep an extra supply of medicines your pet takes on a regular basis in a waterproof container.

□	I do not have any pet
□	No
□	Yes
□	I do not wish to answer

C-4. Keep your pets' medical records in a waterproof container.

□	I do not have any pet
□	No
□	Yes
□	I do not wish to answer

C-5. My pet(s) wears a collar with a ID tag or have a microchip with identification information

□	I do not have any pet
□	No
□	Yes
□	I do not wish to answer

C-6. Prepare pet(s) carriers for transporting all of your pet(s).

□	I do not have any pet
□	No
□	Yes
□	I do not wish to answer

C-7. Prepare pet(s) litter and litter box if appropriate, newspapers, paper towels, plastic trash bags and household chlorine bleach to provide for your pets' sanitation needs.

□	I do not have any pet
□	No
□	Yes
□	I do not wish to answer

C-8. Prepare a picture of you and your pet(s) together.

□	I do not have any pet
□	No
□	Yes
□	I do not wish to answer

C-9. Prepare your pets' favorite toys, treats or bedding in your pet emergency supply kit.

□	I do not have any pet

□	No
□	Yes
□	I do not wish to answer

C-10. Please list the number and type of pet(s) you own (i.e. 2-dogs) (please type "no pet" if you do not have pet)

5) D. Your demographic characteristics (If you do not wish to answer, please simply pick "I do not wish to answer" or type "I do not wish to answer")

D-1. What is your age?

D-2.What is your sex

□	Male
□	Female
□	I do not wish to answer

D-3.To which of the following ethnic groups do you belong and identify?

□	African American
□	Asian/Pacific Islander
□	Caucasian

□	Hispanic
□	Native American
□	Mixed
□	Other
□	I do not wish to answer

D-4.What is your current education level

□	freshmen
□	sophomore
□	junior
□	senior
□	graduate student
□	I do not wish to answer

D-5. In which country is your high school located?

D-6. In which state is your high school located?

D-7. Are you paying your rent to Oklahoma State University?

□	No

□	Yes
□	I do not wish to answer

E. Shelter Related Questions (If you do not wish to answer, please simply type "I do not wish to answer"; If you do not know the answer, please simply type "I do not know")

E-1. Please let us know how far it is to the nearest peer's shelter (mile)

E-2. Please let us know how long it would take to get nearest peer's shelter (minutes)

E-3. Please let us know how far it is to the nearest public shelter (mile)

E-4. Please let us know how long it would take to get to the nearest public shelter (minutes)

6) The followings are questions that can help us identify your cognitive reflection process. If you do not wish to answer these questions, please simply type "I do not wish to answer"

F. Cognitive Reflection Questions

F-1. A bet and a ball cost $1.10 in total. The bet costs $1.00 more than the ball. How many

F-2. If it takes 5 machines 5 minutes to make 5 widgets, how many minutes would it take 100 machines to make 100 widgets?

F-3. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how many days would it take for the patch to cover half of the lake?

How likely do you think you will take the same protective actions if the severe weather scenario in this experiment was real?

□	Extremely unlikely
□	Unlikely
□	Neutral
□	Likely
□	Extremely likely
□	I do not wish to answer

If you wish to win the 100 dollar Amazon gift card, please give us your OSU email address. We will contact you if you are one of the winners (If you don't want join the draw, please type "I do not wish to participate").

Do you have any suggestions or comments on this experiment (if you do not, please just type no)?

***End of survey sample**

APPENDIX C: Pet preparedness activities pamphlet from www. ready.gov:

1 Prepare
Get a Pet Emergency Supply Kit.

Just as you do with your family's emergency supply kit, think first about the basics for survival, particularly food and water. Consider two kits. In one, put everything you and your pets will need to stay where you are. The other should be a lightweight, smaller version you can take with you if you and your pets have to get away. Plus, be sure to review your kits regularly to ensure that their contents, especially foods and medicines, are fresh.

Food. Keep at least three days of food in an airtight, waterproof container.

Water. Store at least three days of water specifically for your pets in addition to water you need for yourself and your family.

Medicines and medical records. Keep an extra supply of medicines your pet takes on a regular basis in a waterproof container.

First aid kit. Talk to your veterinarian about what is most appropriate for your pet's emergency medical needs. Most kits should include cotton bandage rolls, bandage tape and scissors; antibiotic ointment; flea and tick prevention; latex gloves, isopropyl alcohol and saline solution. Include a pet first aid reference book.

Collar with ID tag, harness or leash. Your pet should wear a collar with its rabies tag and identification at all times. Include a backup leash, collar and ID tag in your pet's emergency supply kit. In addition, place copies of your pet's registration information, adoption papers, vaccination documents and medical records in a clean plastic bag or waterproof container and also add them to your kit. You should also consider talking with your veterinarian about permanent identification such as microchipping, and enrolling your pet in a recovery database.

Crate or other pet carrier. If you need to evacuate in an emergency situation take your pets and animals with you provided that it is practical to do so. In many cases, your ability to do so will be aided by having a sturdy, safe, comfortable crate or carrier ready for transporting your pet. The carrier should be large enough for your pet to stand, turn around and lie down.

Sanitation. Include pet litter and litter box if appropriate, newspapers, paper towels, plastic trash bags and household chlorine bleach to provide for your pet's sanitation needs. You can use bleach as a disinfectant (dilute nine parts water to one part bleach), or in an emergency you can also use it to purify water. Use 16 drops of regular household liquid bleach per gallon of water. Do not use scented or color safe bleaches, or those with added cleaners.

A picture of you and your pet together. If you become separated from your pet during an emergency, a picture of you and your pet together will help you document ownership and allow others to assist you in identifying your pet. Include detailed information about species, breed, age, sex, color and distinguishing characteristics.

Familiar items. Put favorite toys, treats or bedding in your kit. Familiar items can help reduce stress for your pet.

2 Plan
What You Will Do in an Emergency.

Be prepared to assess the situation. Use whatever you have on hand to take care of yourself and ensure your pet's safety during an emergency. Depending on your circumstances and the nature of the emergency the first important decision is whether you stay put or get away. You should understand and plan for both possibilities. Use common sense and the information you are learning here to determine if there is immediate danger.
In any emergency, local authorities may or may not immediately be able to provide information on what is happening and what you should do. However, watch TV, listen to the radio or check the Internet for instructions. If you're specifically told to evacuate, shelter-in-place or seek medical treatment, do so immediately.

Create a plan to get away. Plan how you will assemble your pets and anticipate where you will go. If you must evacuate, take your pets with you if practical. If you go to a public shelter, keep in mind your animals may not be allowed inside. Secure appropriate lodging in advance depending on the number and type of animals in your care. Consider family or friends willing to take in you and your pets in an emergency. Other options may include: a hotel or motel that takes pets or a boarding facility, such as a kennel or veterinary hospital that is near an evacuation facility or your family's meeting place. Find out before an emergency happens if any of these facilities in your area might be viable options for you and your pets.

Develop a buddy system. Plan with neighbors, friends or relatives to make sure that someone is available to care for or evacuate your pets if you are unable to do so. Talk with your pet care buddy about your evacuation plans and show them where you keep your pet's emergency supply kit. Also designate specific locations, one in your immediate neighborhood and another farther away, where you will meet in an emergency.

Talk to your pet's veterinarian about emergency planning. Discuss the types of things that you should include in your pet's emergency first aid kit. Get the names of vets or veterinary hospitals in other cities where you might need to seek temporary shelter. You should also consider talking with your veterinarian about permanent identification such as microchipping, and enrolling your pet in a recovery database. If your pet is microchipped, keeping your emergency contact information up to date and listed with a reliable recovery database is essential to your being reunited with your pet.

Gather contact information for emergency animal treatment. Make a list of contact information and addresses of area animal control agencies including the Humane Society or SPCA, and emergency veterinary hospitals. Keep one copy of these phone numbers with you and one in your pet's emergency supply kit. Obtain "Pets Inside" stickers and place them on your doors or windows, including information on the number and types of pets in your home to alert firefighters and rescue workers. Consider putting a phone number on the sticker where you could be reached in an emergency. And, if time permits, remember to write the words "Evacuated with Pets" across the stickers, should you flee with your pets.

3 Stay Informed
Know About Types of Emergencies.

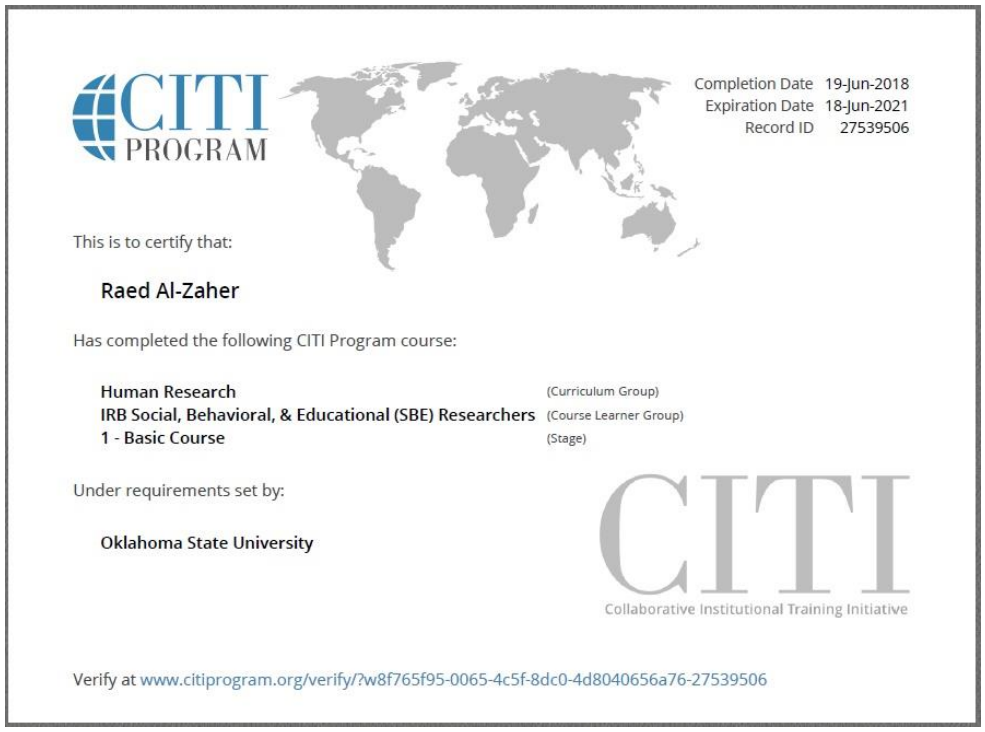
Some of the things you can do to prepare for the unexpected, such as assembling an emergency supply kit for yourself, your family and your pets, is the same regardless of the type of emergency. However, it's important to stay informed about what might happen and know what types of emergencies are likely to affect your region as well as emergency plans that have been established by your state and local government. For more information about how to prepare, visit **www.ready.gov** or call 1-800-BE-READY.

Be prepared to adapt this information to your personal circumstances and make every effort to follow instructions received from authorities on the scene. With these simple preparations, you can be ready for the unexpected. Those who take the time to prepare themselves and their pets will likely encounter less difficulty, stress and worry. Take the time now to get yourself and your pet ready.

Preparing for Your Pets Makes Sense.
Get Ready Now.

APPENDIX D: CITI Certificate:

CERT #1: IRB Social Behavioral and Educational (SBE) Researchers:



CITI PROGRAM

Completion Date 19-Jun-2018
Expiration Date 18-Jun-2021
Record ID 27539506

This is to certify that:

Raed Al-Zaher

Has completed the following CITI Program course:

Human Research (Curriculum Group)
IRB Social, Behavioral, & Educational (SBE) Researchers (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

Oklahoma State University

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w8f765f95-0065-4c5f-8dc0-4d8040656a76-27539506

APPENDIX E: Invitation letter to participate in study:

Subject: 2018 Stillwater Tornado Study (Participate in our study and win a $100 Amazon Gift Card)

Dear Students,

You are receiving this email because you are currently enrolled in OSU undergraduate programs. As you might know, residents in Stillwater experience severe thunderstorm or receive tornado warning/watch during tornado seasons. Drs. Wu and Murphy are interested in understanding people's tornado information search preference and their decisions on protecting themselves and their pets. We are inviting you to participate in our online survey about thunderstorm and tornado hazards. The survey will show you different types of severe weather information and ask you some questions that have been designed to help us learn how you response to severe weather events in Stillwater. We also would like to understand how you prepare your pets for possible tornado threats. This survey is anonymous. No one, including the researcher, will be able to associate your responses with your identity.

Of course, you may decline to participate in this study or decline to answer any question that you feel invades your privacy, but please remember that withholding information from us necessarily limits the study's scientific validity and our ability to present an accurate result. You may withdraw participation at any time without penalty. Refusing to participate will not affect your grades in this class or your relationship with Oklahoma State University.

However, if you participate and finish the survey, you will have a chance to wind a $100 Amazon Gift Card. We only need 200 study participants. Therefore, only the first 200 participants will be able to participate in the lottery. We will randomly select four winners and contact them through their OSU email.

If you wish to participate in this study, please click on the following survey link to take this survey. Note that, you have to use your computer to do the survey. Tablet or cell phone's internet browser does not work. Please Click Here, or copy and paste the following URL to your browser and take the survey:

https://www.cs.clemson.edu/dynasearch/blind.php?expid=213&token=jvzzeDdnLsQfLGB05gLWrQZjWAr56qQg

We want to thank you in advance for your cooperation and invite you to contact us at the email addresses below if you have any questions.

Sincerely,

Hao-Che (Tristan) Wu
Tristan.wu@okstate.edu

Haley Murphy
Haley.C.Murphy@okstate.edu

VITA

Raed M. Al-Zaher

Candidate for the Degree of

Master of Science

Thesis: TORNADO THREAT PREPARDNESS AND RESPONSE OF COLLEGE STUDENTS WITH COMPANION ANIMALS IN STILLWATER OKLAHOMA – A PILOT STUDY

Major Field: FIRE AND EMERGENCY MANAGEMENT ADMISTRATION

Biographical:

Education:

Completed the requirements for the Master of Science in Fire and Emergency Management Administration at Oklahoma State University, Stillwater, Oklahoma in July, 2019.

Completed the requirements for the Bachelor of Science in Fire Protection and Safety Engineering Technology at Oklahoma State University, Stillwater, Oklahoma in 2016.

Experience:

Graduate Research Assistant (GRA) in the Department of Fire and Emergency Management at Oklahoma State University, 2018-2019.
Fire administration intern for the City of Stillwater Fire Department, Stillwater Oklahoma, 2017-2018.

Professional Memberships:

President of OSU chapter of the International Association of Emergency Managers (IAEM), 2018-2019.
Active member of Oklahoma Medical Reserves Corps (OKMRC) since 2017.