THE INFLUENCE OF SOCIAL MEDIA AND OTHER MODES OF COMMUNICATION BEFORE AND AFTER THE TUSCALOOSA TORNADO

by

COURTNEY THOMPSON STOKES

JASON SENKBEIL, COMMITTEE CHAIR
VICKI TINNON
RACHEL RAIMIST

A THESIS

Submitted in partial fulfillment of the requirements
for the degree of Master of Science
in the Department of Geography
in the Graduate School of
The University of Alabama

TUSCALOOSA, ALABAMA

2013

ABSTRACT

The April 27th 2011 EF-4 Tuscaloosa, AL tornado forever changed the city, passing within 1 kilometer of the University of Alabama. The majority of the campus community had experience under tornado warnings, but had not experienced a tornado of this intensity. This research focuses on assessing the influence of social media (Facebook and Twitter) and other types of communication before and after the tornado for the University of Alabama campus community. Over 2,300 surveys were completed online by the students, staff, and faculty. Participants were asked questions concerning their demographic background, shelter seeking impetus, and preferred primary source of communication.

To address the influence of these types of hazard communication four objectives were formulated. The four objectives for this study included: 1) who used social media before and after the tornado, 2) how was social media used before and after, 3) did social media usage influence shelter-seeking behavior, and 4) did social media usage differ between the campus and city populations. With the uniqueness of this event, many individuals relied on Facebook and Twitter for weather updates and recovery information. Not only for the campus population, but the city population also saw an increase usage, especially with Facebook. The usage of these sites among the diverse population at UA and the city of Tuscaloosa could potentially shape how weather information is disseminated and how communities prepare and react during severe weather.

DEDICATION

This thesis is dedicated to all those who helped and encouraged me through the process of creating this manuscript. Even though this research concerns a tragic event, I believe this research can help officials and the general public in future events.

ACKNOWLEDGMENTS

I am pleased to have this opportunity to thank the many colleagues, friends, and faculty members who have helped me with this research project. First, I am appreciative of the resources and guidance that the Department of Geography has given me throughout the Master's program. Second, I couldn't have done this without my faith in the Lord and support from my family and one awesome advisor. My husband, especially, has been my number one encourager at all times and I am so appreciative of him and his love for me.

I am very thankful for the chance to have had Dr. Jason Senkbeil as my advisor and now as a friend. He gladly stepped in as committee chair at the end of my second year in the program due to circumstances out of my hands. Even though his schedule was probably more than full, he still made himself available whenever I needed help. I couldn't have turned this thesis around without his expertise and guidance.

My friends (especially Mary Lou, Ashley, Jaclyn, and Cory) who took time to listen to my thoughts and help me create this final piece of work that I am happy to say I am now very proud of. I couldn't have completed this thesis without each and every word of encouragement, prayer, and note that has come my way through this process. Thank you to anyone who has crossed my path and given me encouragement, I appreciated it so much.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

On April 27th 2011, a large long-track tornado traversed Tuscaloosa, Alabama resulting in the largest disaster in the city's history. The tornado caused approximately $2.2 billion dollars in damages, with significant devastation in Tuscaloosa's city limits. The storm destroyed homes in the neighborhoods of Rosedale, Forest Lake, Alberta, and Holt. Many University of Alabama students and faculty resided in these neighborhoods. The National Weather Service in Birmingham reported that the EF-4 rated tornado had maximum sustained winds at 190 mph in Holt and was on the ground for 80 miles. The tornado resulted in 1500 injuries and 65 fatalities. This particular supercell lasted 7 hours and 24 minutes and traveled approximately 380 miles (srh.noaa.gov, weather.com).

The April 27th, 2011 event started with an early round of storms, which damaged parts of northern Tuscaloosa County. Many residents in this area north of campus lost power, which left them with limited forms of communication. On campus, it was one week before final exams which meant many students were in the library studying oblivious to what would occur that afternoon. The University's severe weather plan went into action early that day with emails to alert the campus population about the severe weather possibility. Later in the day, the University suspended classes, but chose to stay open as a shelter for students, staff, and faculty. Although the tornado did not directly impact the campus, the three hardest hit areas in Tuscaloosa were homes for many of the students and employees.

Large-scale disasters such as the tornado outbreak of April 27th have prompted many research questions and provided many interdisciplinary research opportunities. As

a result of Tuscaloosa having a high percentage of college students, it has a dense population with considerable demographic variability. Researchers from many disciplines were able to conduct studies on the social, physical, and technological elements of the EF-4 tornado (Bunkers and Baxter 2011, Curtis and Mills 2012, Doswell III et al. 2012, Senkbeil et al. 2012, Simmons et al. 2012). Surveying and interviewing Tuscaloosa residents was a common method to collect data since many lines of communication were affected by the tornado. Senkbeil et al. (2012) surveyed residents on their shelter seeking plans and found that most residents would change their current severe weather plan for a future event. With the uniqueness of the event, Simmons et al. (2012) and Doswell III et al. (2012) studied the meteorological characteristics to see if an event of this magnitude could happen again. The damage swath was so wide in areas such as Tuscaloosa, spatial analyses were used to assess the damage so the recovery process could be documented (Curtis and Mills 2012, Zavodsky et al. 2012). One area of interdisciplinary research that has received less attention involves weather warning communication using social media both before and after the event.

Social media usage has been an important factor in hazard information communication and dissemination in recent disasters. The novel focus on social media in disasters has been discussed, but remains a relatively recent topic in this interdisciplinary field (Acquisti and Gross 2006, Cox and Plale 2011, Fontugne et al. 2011, Hyvärinen and Saltikoff 2010, Klotz 2011, Sutton et al. 2008). During the 2007 Southern California wildfires, Sutton et al. (2008) found a large dependence on social media sites due to their ability to disseminate information effectively. Local officials and meteorologists have touted social media use during severe events (Cox and Plale 2011, Klotz 2011).

Hyvärinen and Saltikoff (2010) looked at Flickr image locations of storm reports, since many local weather services have incorporated rapid visual posting from public reports. The overall usefulness of these social media sites has been studied during events such as the 2011 Tsunami in Japan. Hjorth and Kim (2011) found that these sites affect how the public experiences the disaster.

The efficacy of social media sites deserves more attention since these sites help fill such a large gap between the transfer of scientific weather information and the comprehension of that information both before and after an event. Current research is acknowledging these modes of tornado hazard communication (Coleman et al. 2011, League et al. 2010, Powell and O'Hair 2008, Schill 2009, Sherman-Morris 2010), but there seems to be a lack of established method protocols due to the recent advent of social media (Cox and Plale 2011, Fontugne et al. 2011, Hyvärinen and Saltikoff 2010, Klotz 2011, Sutton et al. 2008).

Tornado hazard communication research has been conducted after a tornado at Mississippi State University, in which, Sherman-Morris (2010) studied how the college communicates with the campus population through methods such as their campus alert system called Maroon Alert. Unfortunately social media was not included in that 2009 research. Facebook and Twitter are discussed in this thesis because of the high usage found among campus populations (Lenhart et al. 2010). With the creation of Facebook in 2004, followed by Twitter in 2006, the usage of these sites continues to grow annually. The University of Alabama population contains a diverse range of student, staff, and faculty users on these sites.

The primary goal of this research is to determine the influence of social media and other modes of communication before and after the Tuscaloosa, Alabama EF-4 tornado. The study population is a sample of members of the UA community including students, staff, and faculty. Although the campus did not take a direct hit from the tornado, the population in this area experienced the tornado warnings issued that day and the tornado passed within 1 mile of campus. This study addresses usage and possible influences of social media by utilizing qualitative and quantitative techniques. Specific objectives include analyzing how much social media was used before and after the tornado, and how that usage could be linked to certain variables such as age, gender, education, and years spent in Tuscaloosa (referred to as experience). Weather warning information was tracked by type for each respondent before and after the tornado for the campus population. Comparisons were also conducted between random campus samples and a sample of 211 non-campus respondents from Senkbeil et al. (2012).

Four primary research questions are analyzed in this thesis:

1. Who used social media before and after the tornado?

2. How was social media used before and after the tornado?

3. Did social media influence shelter-seeking behavior?

4. How does social media usage differ between the campus population and city respondents?

Following the introduction, this thesis is divided into four parts. The second chapter is a literature review, which includes topics such as communication during disasters, parasocial relationships, and social media usage. The third chapter describes

the methods and analyses used in order to answer the research questions addressed in this study. Results and Discussion from the statistical analyses are found in chapter four, with final conclusions summarized in chapter five.

CHAPTER 2

LITERATURE REVIEW

The intertwining of two fields of research, atmospheric hazards and societal interaction and response has emerged as a leading topic for researchers and recently garnered attention from government officials who have started to vocalize the need to understand their audiences in order to improve weather warnings (League et al. 2010). Some local officials and weather experts have explored the concept of empowering the public with an opportunity to join forces with them to enhance the warning process. This call for increasing preparedness for disasters has now turned into an initiative, Weather-Ready Nation, created by the National Oceanic and Atmospheric Administration. This initiative encourages individuals to learn about risks in their area which aide in preparation, so when an event occurs the country can recover faster (http://www.nws.noaa.gov/com/weatherreadynation). Studies have been conducted on how people have reacted in severe weather events, and particular theories about societal reaction and response to disasters have emerged.

One area that seemed to be lacking was the combination of warning communication technology in disasters and the exploration of the impact it could have on the public. The meteorology field has experienced increased technological capabilities (Barnes et al. 2007). Within recent years, for example, Doppler radar has seen major improvements, which has increased the abilities of meteorologists to accurately forecast events resulting in greater warning lead times. Social media technology also has seen an increase in capabilities with the advent of mobile media, for example, uploading pictures directly to Facebook from a cellphone. This has given people the ability to be (and the

desire to be) connected to information sources at all times, and at times, be the information source (Sutton et al. 2008).

Within this thriving area of research on advanced technology and society, there seems to be a lack of studies on the impact of social networking sites in disaster communication; specifically during and after a large event in a highly populated area. This research focused on the impact of social networking sites among the campus population before and after the April 27th, 2011 Tuscaloosa, AL tornado. The impact of these sites could have shaped perception and decision-making among individuals in the ways they received weather information before the tornado and the ways in which they responded or collected information during the search and recovery phase.

2.1 Hazard Threat/Vulnerability in Region

In order to address the impact that social media could have had on the target population in this study, a key hazard term should be defined. Vulnerability has been defined in hazard literature as the potential loss of life (Cutter 1996). It is also important to note that a hazard does not become a disaster until it impacts a vulnerable population (Collins et al. 2009). The April 27th, 2011 Tuscaloosa, AL tornado took a direct path through a largely populated area in the city center which created a disastrous event. Furthermore, the area was situated within a college town, which presented the unique combination of physical and social factors, which led this study to define the area as vulnerable. Within the hazard literature on vulnerability, there seemed to be a lack of research on a tornado intersecting a vulnerable university population.

The southeastern USA, in particular, has been found to be at a higher risk for multiple atmospheric hazards. Lightning (Ashley and Gilson 2009), hurricanes

(Czajkowski et al. 2011), hurricane spawned tornadoes (Moore and Dixon 2011, Moore and Dixon 2011, Schultz and Cecil 2009), extreme temperatures (Soulé 2005), and wind events (Schmidlin 2009, Schmidlin et al. 1998, Schmidlin et al. 2002, Schoen and Ashley 2011) represent a range of atmospheric hazards discussed in the literature. Many of these studies expanded upon past databases in order to acquire a more accurate temporal and spatial distribution of these events. Changnon (2011), for example, analyzed the temporal distribution of four major storms between 1950-2005. Results classified the Southeastern region of the United States as one of the highest hazard areas due to its proximity to the Gulf of Mexico, where hurricanes seemed to be a dominant factor.

In addition to hurricanes, another well-known hazard in the southeast region is tornadoes. Southern storms that produce tornadoes have drawn more attention due to a possible questioned area of high risk outside of the original tornado alley in the mid-section of the United Stations (Ashley 2007, Boruff et al. 2003, Changnon 2011, Dixon et al. 2011). Dixon et al. (2011) found an increase in tornadoes per decade potentially resulting from increased population centers and improved reporting methods. Dixon et al. (2011), proved that there is not a traditional tornado alley and that portions of Mississippi and Alabama historically have the most tornadoes per square kilometer than any location in the world.

It is important to conduct studies on campus populations due to fluctuations in population throughout the years, resulting in a unique study group. An example of this can be found in a study by Collins et al. (2009), which focused on students' preparedness for hurricanes. The study defined the University of South Florida undergraduate student population as resilient and vulnerable. Factors that contributed to their resiliency were

lack of possessions, more renting than owning a home, and a network of resources available from the university. This gave students a better chance of resisting a high level of vulnerability. In general, students have less life experiences due to their age that could increase their vulnerability. Results from this study showed that 79% of the students would adhere to evacuation orders, even though they did not have a plan in place. Overall, the student population was not overly concerned about a hurricane threat and did not seem to prepare accordingly. A hurricane could be said to be easier to plan and prepare for compared to tornadoes since there is an evacuation order included in the hurricane warning process. Therefore, within the findings of this study, even with an evacuation order in place, students remain vulnerable because they do not know what their plan would be.

Within the social vulnerability hazard literature, there are few studies on a tornado impacting a university population. Therefore, it is important to address vulnerability in the context of the study area. This will result in accurate observations of the impact social media had on perception and decision-making during the April 2011 Tuscaloosa tornado. In return, these findings could play a large factor in mitigation efforts in college towns.

2.2 Significant Weather Events (and University Preparedness)

Among significant severe weather events in the US, many have been chosen as particularly unique to study due to the combination of meteorological factors and the demographic affected (Corfidi et al. 2010, Lee et al. 2009, Schumacher et al. 2010). The only previous tornado outbreak to rival April 27th, 2011 was April 3rd and 4th, 1974 (Corfidi et al. 2010). The event produced 148 tornadoes and caused 335 deaths, which

qualified it as a large event. In this study, the meteorological variables were analyzed to try to understand how such a damaging system could form and affect so many areas. These events have rarely occurred near or on college campuses. When a large disaster occurred on or near a campus, the event reminded college officials that their response should be assessed for future improvements (Collins et al. 2008, Dolan 2006, Gow et al. 2008, Killacky and Rhoe-Collins 2008, Sherman-Morris 2010).

Attention has recently swayed towards the need for crisis management at educational institutions due to increased media coverage, which has revealed campus as an environment that needs constant monitoring due to safety concerns (Dolan 2006). It is crucial for educational institutions to know how to react properly and understand the audience they are warning (Mitroff et al. 2006, Schill 2009). Gow et al. (2008) raised the question of communication congestion at campuses. Their study found it was hard for a campus to act individually in times of crisis due to the numerous groups on campus, for example, living off campus or on campus.

Collins et al. (2008) specifically analyzed how institutions in Louisiana and Mississippi dealt with disseminating information and recovering as a campus after Hurricane Katrina. The institutions' administrators reported on the problem of locating their faculty and staff. While some of the locations received substantial damage from Hurricane Katrina, all of them mentioned the issue of trying to help those that were off campus. In the case that a large event occurs, this study suggested colleges should consider help from experts within the college first. Overall, Collins et al. (2008) stated planning and control are the most important factors for academic institutions, so they can focus on recovery succeeding an event.

Similarly, Sherman-Morris (2010) examined a unique opportunity to compare the university's planned response to the actual response. Results showed that students received the warning message mostly via text message, but still utilized television for their information. The study population seemed to have a good understanding of the warning and watch terms. Results show that when considering the potential impacts officials must consider who they are warning in order to anticipate how they react.

2.3 Parasocial Relationship and Weather Communication

Parasocial relationships are common with television personalities and their viewers or celebrities and their fans (Hopcroft et al. 2011). A parasocial relationship is a relationship that has been shown to impact a person's thoughts and feelings and could even impact how they react in crises. Sherman-Morris (2005) studied parasocial relationships and the Memphis, TN television market and associated audience. Results showed that the local weathercaster had a significant relationship with the audience, one to be classified as 'parasocial,' and proven to be powerful during severe weather. The power of the relationship has been found to influence how a person reacts in severe events; whether they choose to take precautionary action during severe weather or not. To further this theory, Klotz (2011) found that social media enhanced parasocial relationships with television personalities, especially television meteorologists, creating a more "connected" experience for the audience.

The development of new media resources, such as television stations having their own websites (Bates and King 1996) and more recently social media accounts, has created a new avenue for information dissemination. The audience now has a multitude of opportunities to develop a stronger relationship with their newscaster or meteorologist.

Television has proven to be one of the top weather information sources (Sherman-Morris 2005). In the case the cable connection is destroyed (i.e. downed power lines) due to severe weather, the weathercaster can still communicate with the audience via social media.

Results from Hopcroft et al. (2011) found a statistically significant relationship with social media interaction and affective commitment. These significant relationships were classified as reciprocal relationships, which have been shown to develop from parasocial relationships. This relationship could be a possible predictor due to a person's usage of social media according to Hopcroft et al. (2011). This transition has been continuing to break down what is known in news media as the "4th wall" built between the viewer and the newscaster.

Although very few studies have incorporated the idea that social networking sites could have a negative influence on warning communication, Leskovec et al. (2010) conducted a study on the importance of acknowledging positives and negatives of such networks. Similar to studying the benefits and drawbacks, Palen et al. (2007) studied the flexibility and ability of social media to breakdown the geographical constraints in order for recovery to occur. In this study, examples such as Hurricane Katrina (2005), the 2003 California wildfires, and preparedness in light of the avian flu epidemic were analyzed. Results showed that social networking sites could be the key utensils for "first responders," who, in this study were citizens.

When incorporating interdisciplinary fields, it is important to consider social theories such as the development of parasocial relationships. In order to accurately assess the possible impact of social media, it is crucial to address the psychological forces that

could increase or decrease an impact. Within the literature, parasocial relationship theory has been a recurring theme and seems to be viable in understanding the impact on many types of media communication. The parasocial relationship theory discussed was chosen specifically for this research due to the potential relationship that can develop among television personalities and their audiences on social media.

2.4 Warning Communication, Perception and Decision-Making

Warnings are an important tool used by officials to inform residents about potential hazards. The fields of emergency management and meteorology have now incorporated the public in the information gathering process. League et al. (2010) performed a case study on emergency management officials in Oklahoma and found that the importance of communicating threats to schools, hospitals, etc. has been a challenge among officials. The study found that emergency managers utilized storm spotters to decide whether or not to disseminate a tornado warning. Some officials feel it is a great addition to the information process, especially since the public is being educated on such events. Doswell III et al. (1999) discussed the integrated warning process and the value of having an informed public. Not only can the public become educated from voluntary weather programs such as SKYWARN, but they can also help meteorologists further investigate the dynamics of a tornado. Although officials hope for a proactive response from society, sometimes this has not been the case due to outside factors. The warning dissemination process has shown to be potentially shaped by how media presented information (Edwardson et al. 1985), as well as wording of the warning (Powell and O'Hair 2008).

Although most weather hazards have a warning system, the warning is not always the deciding factor for a person to adhere to a warning (Brommer and Senkbeil 2010, Lindell et al. 2005, Zhang et al. 2007). Hurricanes, tsunamis, flooding, thunderstorms, etc. all can be forecasted and warned prior to the event, which will give people a proper amount of time to react (Brotzge and Erickson 2008). Recent literature suggests that uncertainty of response may elicit a wrong decision, such as driving into flooded areas (Drobot et al. 2007). Dow and Cutter (2000) and Dillon et al. (2010) found that the majority of people were assessing personal risk and making decisions instead of depending on officials. Residents of Horry County, South Carolina, for example, placed more emphasis on gathering information and assessing personal risk (Dow and Cutter 2000). Decision makers placed more emphasis on safety precautions and how to get people to safety as efficiently as possible (Dillon et al. 2010).

Likewise, false-alarms by officials have been known to possibly impact how a person will perceive future events (Barnes et al. 2009, Brotzge et al. 2011). Sharma et al. (2009) analyzed the response of an East Indian population to a cyclone warning. The majority of the respondents believed that a cyclone was coming when a warning was issued, but struggled with the severity of the upcoming event. This study highlighted a personal tendency to confirm warnings. All of the respondents in this study confirmed the warning in some form; whether through friends or family, town leaders, and/or environmental cues.

Coleman et al. (2011) discussed the history of devolving weather warnings. They found officials have started customizing the warnings to the public that is in danger. One factor that has been found to be the reason for customizable warnings was the type of

technology on which a warning was received (i.e. cell phones, computer, etc.). The tornado warning process has developed a more accurate and precise warning system with the increase in technology and better forecasting tools. The warnings are being issued with proper lead-time (Brotzge et al. 2011), leaving a person time to take action. It is important to continue to improve the warning process and even create new hazard warning systems (Ashley and Gilson 2009) for some hazards to insure that the warning process is up to date with how and where the society is receiving the warnings. With a public that expects a forecast for their particular location, it has developed a need for the public to turn to many sources to confirm the information (Hammer and Schmidlin 2002).

Sherman-Morris et al. (2011) analyzed the importance that the public has placed on researching upcoming events by analyzing hurricane information via Google's search engine. Results showed that people were paying attention to forecasts prior to the event. With these findings, it is important to note that the public officials were still important sources for information, even though the general public has ventured to many sources for confirmation about a warning in the past.

Within warning communication, risk perception, and decision-making research there is an overall trend of the public seeking confirmation for a warning. However, where they seek confirmation and how that could reshape their perception or change their decision deserves more attention. With officials wanting more inclusion of the public in disseminating weather information, this could lead to exploration of social networking sites as an opportunity for the officials to collaborate with the public on warnings.

2.5 Social Media and Natural Disasters

To understand the impact social media has we must define social media. Social media can be defined as types of media that offer abilities such as creating and sharing content at a high rate (Asur and Huberman 2010). Within this type of median, social networking sites (SNS) have been created to give the society a platform to freely post information however they choose. The flexibilities and capabilities of social media have led to incorporation of the topic into numerous fields of research.

Kaplan and Haenlein (2010) found positive benefits of social networking sites when incorporated into business models. Conversely a downside of social media was found concerning the broad interaction between users across the world. This could possibly mean being too connected to a high number of people, ultimately hampering the need to know your neighbor. Since the creation of networking sites such as Facebook in 2004 and Twitter in 2006, people have had the opportunity to not only connect with acquaintances, but also people they do not know personally (Hutton and Fosdick 2011). Hutton and Fosdick (2011) found that these social networks have been dominant forces, but saw an increase in SNS users with the introduction of mobile phones that included Internet access (specifically Blackberry and the iPhone). This "hand-held" capability offers a new way to reach people during severe weather and one that should be considered when officials are disseminating watches and warnings.

Hutton and Fosdick (2011) also found microblogging (i.e. Twitter) increased media-meshing, which means when two or more media are consumed at once. While this increase could have caused a poorly organized media outlet, Qualman (2011) reported that hashtags have been incorporated to create a more organized atmosphere despite the

influx of more information. Microblogging sites such as Twitter have allowed researchers to predict real-world outcomes. Asur and Huberman (2010) studied the incorporation of tweets to see if the data could predict a movie's overall popularity. Results showed that analyzing the rate of tweets could be a better predictor than market-based predictors. To enhance the reliability of disseminating with social media, they utilized a sentiment analysis where they classified tweets as positive, negative, or neutral. Despite the lack of organization among these social media sites, the use of hashtags could be the answer to researchers wanting to include this data in their work.

Initially, social media made the largest global impact within the younger demographics, but recent studies have found a spread in popularity to other demographics. Java et al. (2007) found that the overall purpose for usage on Twitter was to report daily activities, share, and seek information. Lenhart et al. (2010) found that people were increasing their profiles on SNS, especially with the usage of Twitter by a particular demographic. Results from this study found relationships between particular demographic groups and their usage of "wireless" Internet and SNS. Males used cell phones more for access over a computer, while females had more profiles on Facebook than males. Now that social media usage is spanning across all age groups and genders it is important to expand research questions that include diverse study groups.

Studies associated with social media have recently incorporated its usage in the weather realm (Cox and Plale 2011, Fontugne et al. 2011, Hyvärinen and Saltikoff 2010, Klotz 2011, McCafferty 2011, Sutton et al. 2008). It is important to note that multiple studies have included the interaction of these sites and weather warning communication, but few studies have addressed possible impacts on hazard communication. Since

Twitter offers a continuous stream of updates (data), Cox and Plale (2011) studied the ability for these data to improve weather observations. They found that many are tweeting current weather conditions, but it is difficult to incorporate tweets due to Twitter not releasing historical data.

There could be future opportunities to work with Twitter information because of improvements with geocoding public tweets. Hyvärinen and Saltikoff (2010) utilized Flickr's photo data, which included the image's metadata. The authors pulled a group of 200 photos from two groups (one being a group of meteorologists) to check the reliability of the information. Results showed that the most accurate sources came from devices that had automatic GPS, which was not available on all photos.

Fontugne et al. (2011) also used Flickr photos to prove the reliability of user-generated information. They pulled photos from two disasters, April 27th, 2011 Tuscaloosa tornado and the March 11th, 2011 earthquake in Japan. Both case studies proved that photos from the earthquake and tornado were accurate when overlaid with the disaster's path - the photos shared on Flickr for the Tuscaloosa tornado corresponded with population centers. This shows that more photos were uploaded midtown than in the suburbs. With the uniqueness of the tornado's location hitting a highly populated area, this allowed for more social media data. This study was unique in that it is one of the only articles that could be found that studied social media and the Tuscaloosa tornado.

An article by McCafferty (2011) proved the global importance of social media, because of these sites offering translations (Facebook offers over 70 translations). In this article, a Japanese blogger was able to do a blog post after an earthquake and utilized it

for recovery efforts. The blogger said that social media was a lifeline along with an important communication method during all stages of the event. Sutton et al. (2008) gave another example of social media use in a disaster, in an article about the 2007 California wildfires. During the wildfires, "backchannel communications activity" increased and many victims went from accessing social media for information to releasing information to help inform other victims. Sutton et al. (2008) found that although the wildfires were not planned and occurred so quickly, social media communications were able to keep up with the fast-paced event. Other results included social media's ability to create a more personalized information report, unlike news authorities that generalized the information, which made this source of communication valuable.

The inclusion of communication research within the hazard field is growing each year. Social media usage is on the rise with each severe weather event and disaster, which continues to give the research field more data. This type of communication requires additional analysis in a broader sense to address its usage since the memberships to these sites (i.e. Facebook and Twitter) continue to grow. In nine years, Facebook has grown to 1.06 billion users as of February 2013 (facebook.com). Similar growth can be found with Twitter, which has been available the past seven years and has grown to 500 million users as of February 2013 (twitter.com). Small analyses should be done in the future to monitor the impact of these sites after events to address why these sites are utilized before and after disasters.

Through reviewing numerous articles in this literature review, various holes in the literature were found. In the hazard articles, many are lacking the inclusion of social media usage. From the articles that did include this unique data, very few were

comparing before and after a disaster. This study chose to examine a vulnerable study area that included three diverse groups that are part of the campus community. Including all three groups allowed research questions to center around basic points that haven't been seen before in this type of research. This research will aid in understanding how people make important decisions before and after a large tornado such as the Tuscaloosa, AL April 27th, 2011 event.

CHAPTER 3

METHODS

3.1 Data Collection

This research was conducted using a survey-questionnaire sent out through an email list-serve to faculty, staff, and students of the University of Alabama. The survey contained a mixture of closed and open-ended questions where respondents could voluntarily supply longer written responses if desired. Some of the questions required at least a small open-ended response. This survey was constructed as part of a National Science Foundation RAPID grant # 113894 (received May 2011). The online survey was designed on Zoomerang, a common survey creator used in many types of research (Senkbeil et al. 2012). This platform offered various ways to format the survey, such as including open-ended questions or multiple answer questions, which provided flexibility to survey administrators. The Mayor of Tuscaloosa and University officials encouraged students to leave Tuscaloosa after the tornado. An email survey was the most efficient outlet for this study since the spring semester ended early after the tornado.

Upon permission of University officials, a list of campus email addresses was released for the dissemination of this survey. An email was composed and then approved through the Provost's office. Within this email was information about the purpose of the survey with a link to connect to Zoomerang. This email was sent out to 19,000 recipients, approximately 50% of the campus population that included students, faculty, and staff. A total of 3,600 recipients started the survey with 2,300 completions. This produced a final response rate of 12%. Once data collection ended, qualitative and quantitative techniques and spatial analysis were used for data analyses.

3.2 Survey Design

The 21 question mixed survey took approximately ten minutes. The survey included questions about experiences on April 27th, and contained a series of demographic questions. To measure the usage and importance of hazard communication types at different stages of the event, analyses were conducted on data from demographic questions found in Table 1 and experience questions in Table 2.

1. How old are you?	2. Are you male or female?	3. What is your race?	6. What is your highest educational degree?	7. How many years have you lived in Tuscaloosa?	8. What is the zip code of your home in the Tuscaloosa area? *
19-24 25-29 30-34 35-39 40-44 45-49 50-54 55-59 60-64 65-69 70+	Male Female	White Black/African American American Indian Asian Hispanic 2 or more races	High School Some College Associate Undergraduate Graduate Current Undergrad Current Grad	< 4 5 to 10 10 to 15 15 to 20 20+	

Table 1: Demographic questions with answer choices. Open-ended question labeled with an asterisk.

12. What was the most important factor that made you seek shelter from the tornado?	16. Before the tornado hit Tuscaloosa, what was your primary source of information?	17. In the hours after the tornado, how did you notify your friends and relatives that you were ok?	18. After the tornado, what was your primary source for information, assistance, and/or relief?
In person/video Local TV Internet/TV/Radar Environmental Cues Friend/Relative	Smartphone Weather Website Facebook Twitter Local TV Local Radio The Weather Channel NOAA Weather Radio Tornado Siren Text Message/Phone Call	Text Message Phone Call Facebook Twitter Unable to contact	TV Radio Newspaper Internet Facebook Twitter Telephone Personal Communication

Table 2: Experience questions with answer choices.

3.3 Qualitative Methods

The dataset used for qualitative analyses represented a large sample size that was comparable with the University's demographics. The response rate for this online survey was similar to Sherman-Morris (2010) at Mississippi State University, both between 10% to 15%. Descriptive summary techniques such as counts, sums, and percentages were first calculated in Excel. These results were then compared to the University population to ensure a representative sample was obtained from the population. Demographic data for the city of Tuscaloosa was used to compare to the university sample.

This methodology began with data from a survey question regarding how many years in Tuscaloosa the respondent had resided. This was an important question to include because it could show if years in Tuscaloosa could be linked to their preference in hazard communication source. Although this particular question could not be compared to city or campus data due to limited online information concerning how long a person has resided in Tuscaloosa, it was an important component in addressing who and how social media was used before and after the tornado.

It is essential to discuss particular limitations and important details about the data collected. Concerning age (question 1), the same age ranges were used on the survey as the U.S. Census survey. The highest educational level (question 6) seemed to be a question that was possibly misinterpreted by some respondents. Current students seemed to be split on which category best represented them. Some undergraduates could have chosen their highest education level as high school or they might have chosen some college due to the order of the options. Even though there was an option for current

undergraduate student, counts seemed to be split for the age group of 19-24. Some confusion could have occurred for the current graduate students, which could have chosen undergraduate degree instead of current graduate student. These limitations, although important to point out, should not skew the results of who used social media and how social media was used.

3.4 Spatial Analysis Methods

Spatial analysis showed social media usage by zip code before and after the tornado. Social media usage means Facebook or Twitter was chosen as a preferred source of hazard communication before or after the tornado. Data was imported into ARCMAP GIS to display Twitter and Facebook usage for all levels of the University sample.

Specific Research Questions were:

1. Did the usage of social media (Facebook and Twitter) vary between zip code regions?

2. Did the usage of social media (Facebook and Twitter) vary before and after the tornado?

In order to address these questions, a table was made in Excel that included the respondent's Tuscaloosa zip code and social media usage before and after. Only zip codes adjacent to campus were used in spatial analysis, which were 35476, 35473, 35406, 35405, 35404, and 35401. Streets/Roads, zip code tabulation zones, and places for Tuscaloosa County from the 2010 TIGER Census data were downloaded for analysis.

It is important to note that the campus zip code, 35487, was not listed in the Census data, but necessary to include in this study. This group contained 44 responses

and was added to the closest zip code group to campus, 35401. Sample sizes for each of the zip code regions have been listed in Table 3.

Zip Code	Sample Size
35401	1018
35404	333
35405	310
35406	147
35473	101
35476	27

Table 3: Sample sizes for zip codes used in spatial analysis.

Counts were used to calculate percentages for four variables. The four variables were Facebook before, Facebook after, Twitter before, and Twitter after. If the respondent chose Facebook or Twitter as a primary source of information before or after the tornado, it was coded with a '1' and if not a '0.' These percentages were then joined with the Census data in ARCMAP GIS with a unique field ID of "Zip Code."

3.5 Quantitative Methods

Categorical data from the survey were tested using a series of Chi-Square tests. In order to properly run a Chi-Square test, groups within demographic variables were combined in some cases to create a fair sample size for testing. The following demographic variables required group combination due to small group size: age, experience, and education. The survey offered many options for these variables, but for statistical purposes there were not enough responses within each group to be statistically significant. Due to the gender data being binary, it did not have to be combined.

Once formatted, numerous contingency tables were constructed to examine the relationships before and after the tornado between primary source of information and demographic variables. For the six primary sources (Facebook, Twitter, Internet, TV, Radio, and Telephone) there were four demographic variables (gender, age, experience,

and education) measured in two levels (before and after). The Chi-Square Contingency Tables were then analyzed to find which variables produced the greatest difference between the observed and expected values. The Pearson Chi-Square statistic was reported to see if any of these factors contributed to respondent preference in tornado hazard communication before and after the event. Respondents were not limited to one choice and many were simultaneously using multiple media sources. Thus, some respondents prioritized media usage by type and some did not. The Chi-Square tests use the counts of how many times that source was mentioned. One respondent could have contributed four count values for four different media types while another may have contributed only one or two counts.

Since little research has been specifically conducted on the influence of social media during a significant tornado event, pivot tables were utilized to summarize data and determine if Facebook or Twitter had any possible behavioral influence during the Tuscaloosa event. Behavioral influence was assessed from the question, "…What was the most important factor that made you seek shelter from the tornado?". Counts were observed for the five reasons to seek shelter for those who preferred Facebook and Twitter as a hazard communication source. To focus on social media users, only Facebook and Twitter users' responses were chosen for this question. Some of the reasons to seek shelter include other types of media communication (i.e. television meteorologist providing a landmark), so it was interesting to see if social media users stated to a common reason to seek shelter.

Since the campus population was overwhelmingly white and aged 19 - 24, it was important to compare random samples of the campus population against a non-campus

sample from the city of Tuscaloosa (Senkbeil et al. 2012). The sample from Senkbeil et al. (2012) was more representative of the population of Tuscaloosa. The last analysis included a sample from the city of Tuscaloosa (Senkbeil et al. 2012) and five randomly selected campus samples. The goal of this objective was to expand the analysis to find any further impact social media had as a hazard communication type before and after the tornado by comparing the campus samples to the city sample. Random samples for campus were selected in SPSS using the 'select data' tool. This method randomly selected 212 responses; this process was repeated five times and then each sample was exported for additional formatting in Excel. City and campus samples were compiled in Excel and coded with '1' if the respondent used Facebook (before and after) or Twitter (before and after) and '0' if they did not. For statistical comparisons among the groups, one way ANOVA was chosen in SPSS to find any statistical differences in usage. This was followed by a post hoc Tukey test to address which groups had the greatest differences in social media usage between the city and campus groups.

CHAPTER 4

RESULTS

4.1.1 Qualitative Results: Survey Population Analysis

Results from descriptive analysis on the dataset revealed key information concerning the survey population's gender, age, race/ethnicity, years in Tuscaloosa (referred to as experience), and highest education level. Comparisons concerning gender and ethnicity demographics between the city of Tuscaloosa and the University can be found in Table 4. Survey data used to compare to this information can be found in Figure 1.

	*University	**City
Male	46.80%	47.60%
Female	53.20%	52.40%
Black non-Hispanic	11.60%	42.70%
American Indian or Alaskan Native	0.60%	0.20%
Asian or Pacific Islander	0.90%	1.50%
Hispanic	1.50%	1.40%
White non-Hispanic	83.00%	54.10%
Race-ethnicity unknown	0.60%	0.60%

Source: *www.education-portal.com*

*Percentages derived from population of undergraduates (enrollment of 17,550).

**Percentages derived from population of city of Tuscaloosa (77,906).

Table 4: Comparison of University of Alabama data and Tuscaloosa city data. Percentage of undergraduate students at the University compared with demographics for the entire city (data from 2006-2007).

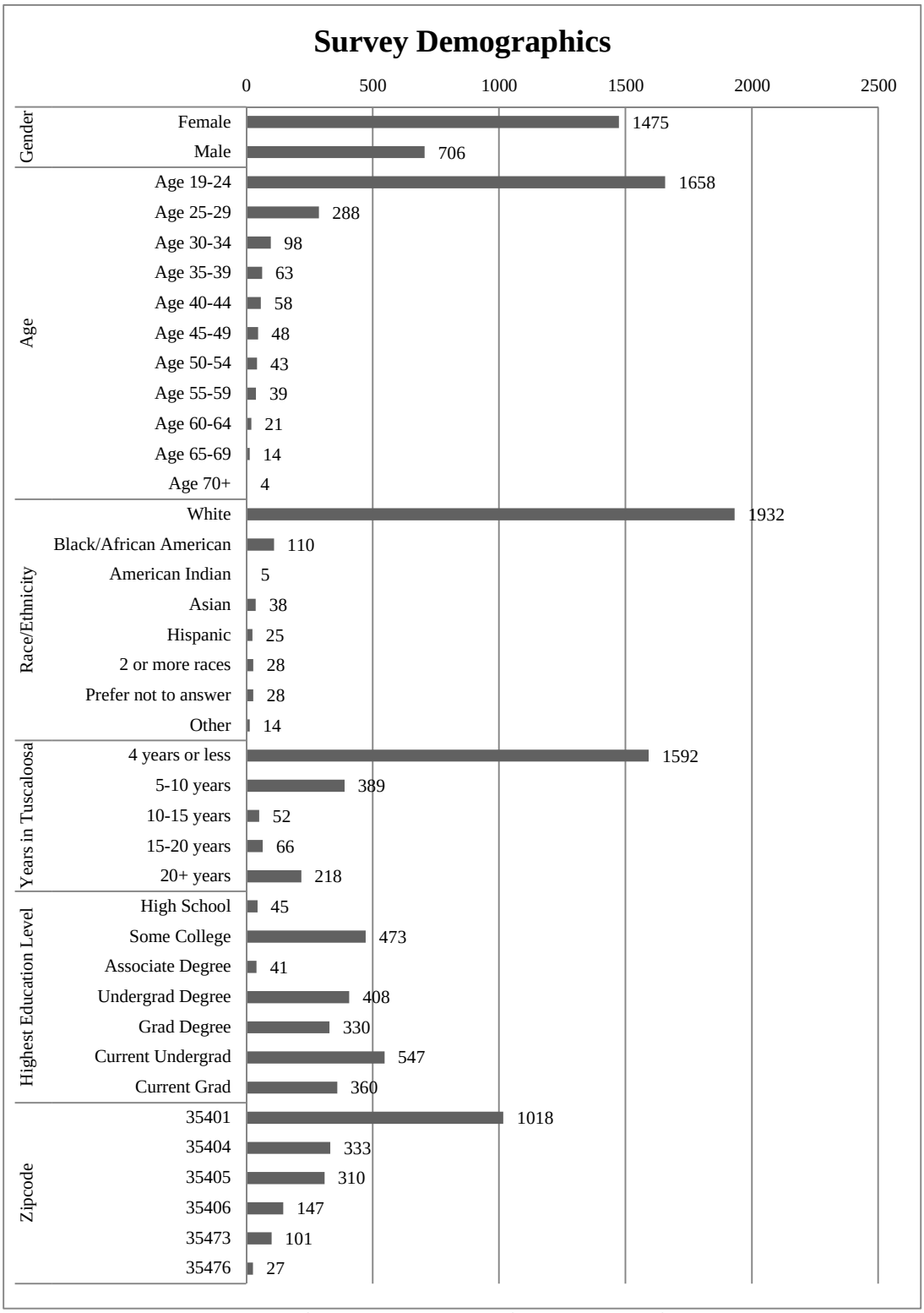

Figure 1: Demographic counts derived from the survey responses for the University of Alabama population.

Percentages were found and compared to the survey population for male and female. Results show the gender distribution from the survey responses as 68% female and 32% male. Data from the 2006-2007 enrollment of undergraduates show the gender distribution to be roughly 53% female and 46% male. The city of Tuscaloosa's population is 52% female and 47% male. The survey sample of 2,600 respondents was skewed towards a female distribution. The sample was also skewed towards the 19 - 24 year old age group (71%). The lack of representation within the older demographic among the survey respondents (1%) can be justified by looking at the city data for those 65 years or older which make up only 11.8% in Tuscaloosa. It is important to keep in mind that although the survey did have a majority of respondents from the 19 - 24 years old age group, other age groups were important to include for analyses to address any significance with age for communication type.

Race/ethnicity representation between the city of Tuscaloosa and the University (Table 4) are quite different, most notably among particular groups. The African American group makes up 11.6% of the University undergraduates, but in the city they represent 42.7%. White non-Hispanics make up 83% of the University undergraduates and 54% of the city. The survey population was 5% African Americans and 89% White non-Hispanic, which seems to be a fair representation according to the University data. Other data represented among the survey population were Asian (2%), Hispanic (1%), and American Indian (<1%). These lower representations are also found among the city and University data where similar percentages were reported.

Although data could not be found to compare to the years lived in Tuscaloosa survey question, it seems to be a fair representation of the University population, taking

into account the age groups represented. The majority of undergraduates who participated in the survey have resided in Tuscaloosa less than four years, which explains the high percentage within the 4 years or less group (69%). These percentages among years lived in Tuscaloosa responses helped this study incorporate experience into communication type. People who have lived in the area longer should have a better idea of the severe weather threat and may possibly have more dependence on particular communication types.

Information for comparison purposes could not be found for the University's educational composition, so counts and percentages were reported from the survey population data only. There were responses from each group with current student as the highest percentage (41%, combined current undergrad and grad). Some college (21%) and undergraduate degree (19%) were also well represented among the respondents. Lower representation among high school degree and associates degree was found among the campus population, with both reporting 2%. Overall, most educational degrees had representation in the survey dataset, which should be noted.

4.1.2 Qualitative Results: Communication Source Analysis

Descriptive analyses were performed for qualitative responses including reason to seek shelter, preferred source of communication before, source used for notification purposes, and primary source after the tornado (questions found in Table 2). All counts are reported in Figure 2.

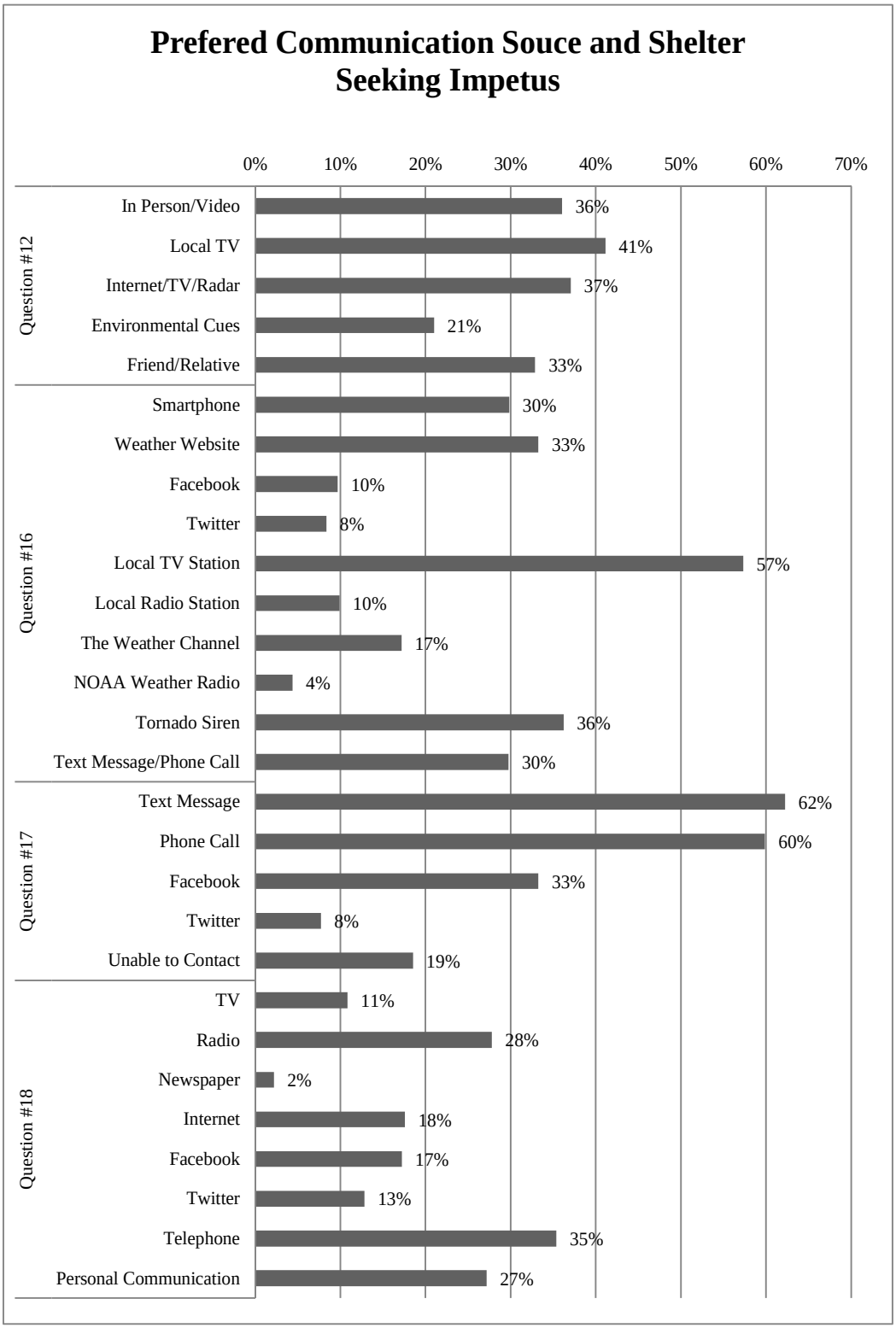

Figure 2: Summary of percentages for each question concerning communication and influence on reason to shelter.

These four questions (Table 2) offered the chance to pick more than one response so percentages can exceed 100. Very few respondents chose only one form of communication. People are more likely to use multiple sources during the warning process (Hammer and Schmidlin 2002) and of these multiple sources more traditional sources such as sirens or television warnings are typically chosen (Comstock and Mallonee 2005). Many times when classes are suspended, students are more likely to leave campus, giving them the option for seeking additional sources (Sherman-Morris 2010).

4.1.3 Question 12: Shelter Seeking Impetus

It was important to see what influenced this population to seek shelter once receiving a warning via their preferred source. Results show that local television meteorologist who mentioned a common landmark influenced 41% of the respondents. This option was hypothesized to be a high percentage due to proven parasocial relationships that can form with television meteorologists (Sherman-Morris 2005). Many local television stations use various types of methods to communicate to their audience (Whitney 2006), such as Internet, television, and radio. Results show that these other communication methods influenced 37% of the population to take action. With this option having a base source of the Internet, it is hypothesized to include Facebook and Twitter given that both are accessible on Internet and allow images such as radar to be uploaded.

On the other hand, 36% reported seeing the tornado on the ground in person or on video. Similar to that response was hearing environmental cues, which was hypothesized to be higher than 21% since most college students think they are not as vulnerable as the

common population (Collins et al. 2009). Lastly, 33% made the decision to seek shelter due to a friend or relative informing them via phone call, email, text, etc. This was expected to be higher since the majority of the population fell into the 19 - 24 years old age category, meaning they are still legally dependent on their parents/guardians.

4.1.4 Question 16: Preferred Source Before

Much like a person's shelter-seeking factor, it was also important to note any particular preference among the population for a primary source before the event. The most preferred source among the campus population was local television station, which made up 57% of the responses. There seemed to be a cluster of sources that made up 30% to 36% of the choices (in order from highest to lowest): tornado siren, weather website, smartphone, and text message/phone call. These results about tornado sirens and television reflect previous research (Comstock and Mallonee 2005, Schmidlin et al. 2009, Sherman-Morris 2005, Paul et al. 2003).

Results show that Facebook was chosen by 10% of the population and 8% chose Twitter as a primary source of weather information. This was predicted to be higher among this sample, since the majority of 19 - 24 year olds surveyed are enrolled in college. A possible reason Facebook was utilized more than Twitter as a primary source of weather information could result from its longer establishment as a social media outlet. Since these social networking sites could be used to share weather information (Sutton et al. 2008), it was notable to see how many respondents classified them as primary sources.

4.1.5 Question 17: Source for Notification Purposes

Many lost power before and during the event on April 27th, leaving them to explore other options to notify others that they were okay. Results showed that text

messages (62%) or phone calls (60%) were the most popular options. Facebook was used by 33% of the campus as a source to notify many people, which was expected due to the high number of young adults. Disruption in cell phone service was a problem, but social media included a unique feature that allows a message to "pend" until service is available. This was unique to Facebook and Twitter, unlike a text message, which would fail if it did not have service. Sadly, 19% were not able to contact anyone due to the event. This percentage of the population more than likely resided in the tornado's path where most of the cell phone service was devoted to emergency responders and any type of communication was completely disrupted.

4.1.6 Question 18: Preferred Source After

After the tornado, there were many ways to get information, assistance, and/or relief, although some options were limited to those in the affected areas. Results show that many types of communication were limited due to power outages after the storm, such as television due to cable outage, which could justify the major drop in preference to 11%. The source with the most responses was telephone, preferred by 35% of the sample. Similar results were found by Hammer and Schmidlin (2002). Phones are believed to be the most popular option due to accessibility. Another reason for the increase in preference for telephones for this population could be the result of smartphones and their various communication capabilities (i.e. applications for Facebook, Twitter, etc.).

Other important results included radio, which saw a large increase in usage as a preference at 28%. Many radio stations were broadcasting continuously and were a major source for important information. Radio stations were a communication outlet for

emergency officials and city officials, announcing such items as missing person lists, shelter locations, donation drop offs, etc. for those coming into town to help and those looking for help.

Facebook also saw a large increase in usage after the event by 17% of the population. Personal communication was the third most used source after the event by 27% of the campus population. Again, many preferred sources before the event could not be used afterwards, so the transition from before to after represents media type adaptation.

4.2 Spatial Results

Facebook and Twitter usage was analyzed before and after the tornado by zip code. The campus population was represented in many of the surrounding neighborhoods within the city (Table 1). Overall counts (Table 5) show that there was an increase in usage for Facebook among all zip code groups. However, Twitter usage did not increase nor decrease in 35404 and 35476 zip code groups.

Zip Code	Facebook Before	Twitter Before	Facebook After	Twitter After
35401	97	110	177	188
35404	32	25	48	25
35405	38	19	54	26
35406	10	12	21	16
35473	4	2	26	7
35476	3	0	6	0
Total Users	184	168	332	262

Table 5: Facebook and Twitter user counts before and after the tornado.

Percentages (Table 6) show that average Facebook usage among zip codes doubled after the tornado by roughly 9%. Facebook users increased drastically in the 35473 zipcode by roughly 22%, but could be the result of a smaller sample size (Table 5).

Twitter had a slight increase by 3% for average usage, but 35401 saw a greater than average increase of 7% in both Facebook and Twitter.

Zip Code	Facebook Before	Twitter Before	Facebook After	Twitter After
35401	10%	11%	17%	18%
35404	10%	8%	14%	8%
35405	12%	6%	17%	8%
35406	7%	8%	14%	11%
35473	4%	2%	26%	7%
35476	11%	0%	22%	0%
Average Usage	9%	6%	18%	9%

Table 6: Zip Code percentages for Facebook and Twitter usage. Calculated for each area along with average usage between Facebook and Twitter.

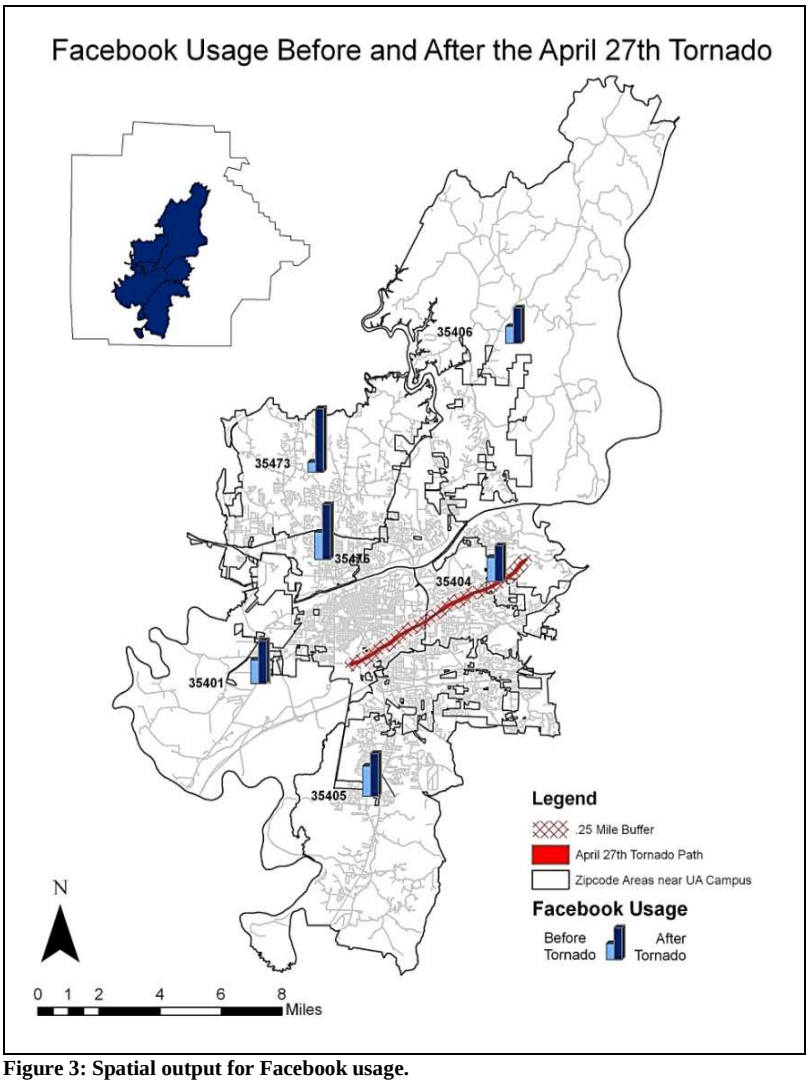

Figure 3: Spatial output for Facebook usage.

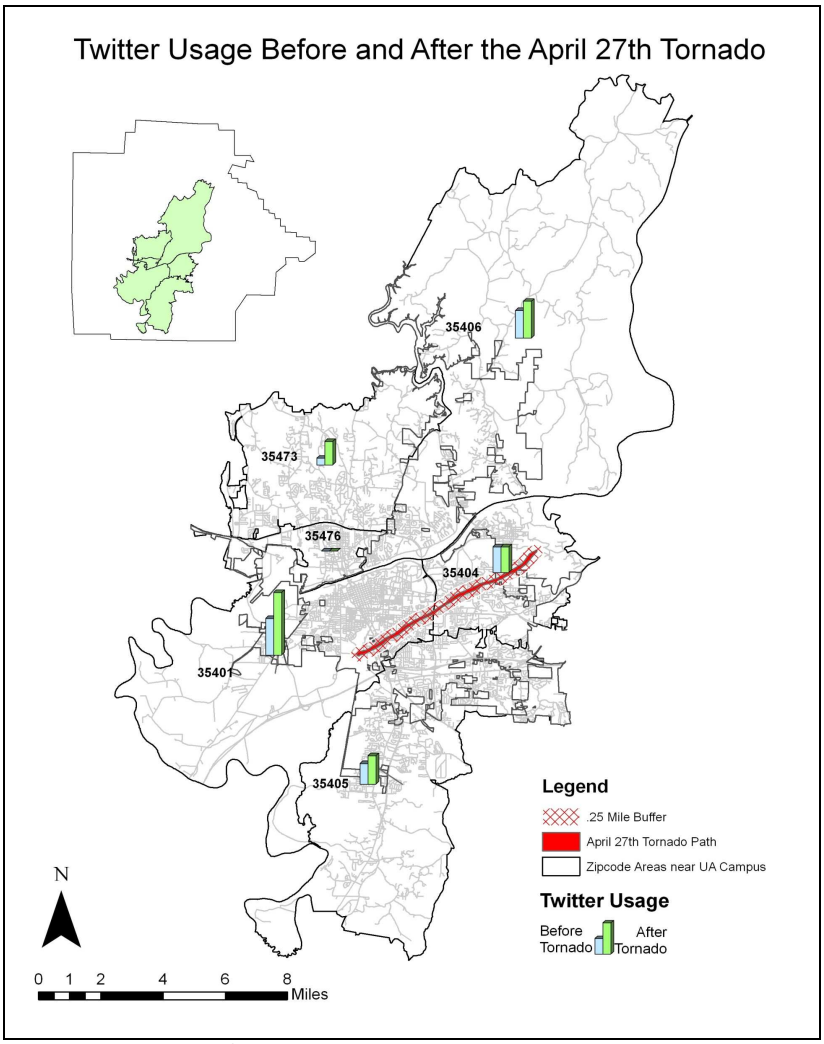

Figure 4: Spatial output for Twitter usage.

Results from the spatial output showed the most drastic increase occurring within the 35401 area, which is typically where more students live. The 35476 area (northwest of campus) did not have any Twitter usage before or after. An important finding concerned before usage for Twitter, which had a higher preference than Facebook in the 35401 zip code, but was lower in all other zip codes. This could be due to the fact that Twitter offers a shorter type of communication (limited to 150 characters), as well as, Twitter being the newer social media. Facebook seems to be growing in popularity with teenagers and older adults due to open membership.

4.3.1 Quantitative Results

Contingency table results were analyzed to find any significance between six information types and three demographic variables. These tables were used to find if any particular type of group used a certain form of information at an anomalous rate compared to other groups. All significant values are reported in Table 7. Other values listed in the table are Pearson Chi-Square values and degrees of freedom for each pairing. For this study, all p-values at or less than .05 were reported as statistically significant.

Demographic Variable	Info. Type	Sig. Value	Pearson Chi-Sq.	Df
Education				
	Facebook	p= .001	18.127	4
	Twitter	p= .012	12.823	4
	TV	p= .028	10.888	4
	Telephone	p= .011	16.639	6
Age				
	Facebook	p= .003	11.407	3
	TV	p= <.001	47.919	4
Experience				
	TV	p= <.001	23.443	3
	Telephone	p= .001	18.705	4

Table 7: Variables that had a significant Pearson Chi-Square value at <0.03.

4.3.2 Education vs. Information Type

Results from a series of contingency tables using education as the demographic variable showed four significant information types. Significant values for Facebook, Twitter, television, and telephone can be found in Table 7. In order to discover relationships among these significant information types, differences were calculated to find the greatest difference in observed and expected values.

Edu. Group	Info Type	Before O	Before E	Before O - E	After O	After E	After O - E
Current Grad	Telephone	144	160.8	-16.8	112	95.2	16.8
Current Grad	Facebook	17	32.2	-15.2	73	57.8	15.2
Grad Degree	TV	233	246.6	-13.6	49	35.4	13.6
HS/Some College	Twitter	67	56.2	10.5	75	85.8	-10.5

Table 8: Observed and Expected data from significant education groups for significant before and after communication source.

Telephone had a significant value of 0.01 (Table 7) and the group of current graduate students had the greatest difference at 16.8 (Table 8). This group's usage was lower than expected before and higher after the event. There was an overall decrease in telephone usage for all educational groups, which was more than likely because of poor cell phone service after the event.

Facebook had a significant value of < 0.01 (Table 7). The group of current graduate students had the greatest difference of 15.2 between the observed and expected values (Table 8). This group's Facebook usage was under the expected value before the tornado and over the expected value after the event, leading to speculation that this group used other sources to make decisions before the tornado. However, once that source was not available, usage increased with Facebook possibly due to the instantaneous nature of social media. On the other hand, current undergraduate students had the opposite for their usage before and after. It was expected that this group of students might use it for information before the tornado due to their typical daily usage. Overall Facebook had a trend in usage that seemed to increase as education level decreased.

Television had a significant value of 0.03 (Table 7) among the group with a graduate degree. This group had a difference of 13.6 between observed and expected

counts (Table 8). Those with graduate degrees or current graduate students were the only groups that had below the expected count for television usage before the tornado. This could be due to these groups being more likely to remain on campus as opposed to the other groups who might have left campus to be at their residence. The other groups had lower than the expected counts after the tornado, which could be because the majority of these groups live closer to the path of the tornado and that a majority of the city lost power.

Twitter had a significant value of 0.012 (Table 7) and the group with a high school degree and/or some college had the greatest difference of 10.5 (Table 8). The usage was over the expected before and under the expected after the event; the only other group to have this usage pattern was current undergraduate student. Overall, Twitter usage was higher with less education.

Education has been found to have an influence on which information type a person utilizes to make decisions during a severe event (Blanchard-Boehm and Cook 2004, and Schmidlin et al. 2009). In this study, social media usage decreased as education level increased. Conversely, telephone and television usage increased as education level increased. Facebook and Twitter usage was most significant with current graduate students, although the overall usage was lower among graduate students.

4.3.3 Age vs. Information Type

Similar to education, age seemed to have a large influence on the type of communication chosen, specifically with television and Facebook. The most significant age group was 19 - 24 year olds. Even though some seem to think this group only uses

more modern media, these results prove that they seem to also use traditional media such as television.

Age Group	Info Type	Before O	Before E	Before O - E	After O	After E	After O - E
Age 19 - 24	Facebook	194	177.4	16.6	299	315.6	-16.6
Age 19 - 24	Television	1287	1247.5	39.5	142	181.5	-39.5

Table 9: Observed and Expected data from significant age groups for significant before and after communication source.

Facebook responses showed the largest difference between observed and expected counts among ages 19 - 24 (Table 9). The difference of 39.5 for the youngest age group was one of the largest differences recorded in the study, possibly due to this group being the only group that had a greater count before the event. This age group though was dismissed from classes and the majority went home.

It should be noted that television usage among the 19 - 24 age group was the only group to be under the expected count afterwards, possibly due to the high population of student housing along the tornado path. The other groups increased after the tornado, which suggests residents being further away from campus and experiencing less damage.

Class dismissal was announced on various media including Facebook, but the campus remained open, which kept the other age groups off Facebook and the students more likely to use Facebook. Facebook usage afterwards was lower than expected unlike the other age groups (25 years old plus). The age group with 30 years of age and older had a larger increase in Facebook usage after the tornado. This age group has been found to have an increased membership since Facebook started open membership, so this could be why they are more likely to go to such media after an event when other types are not available (www.kenburbary.com).

4.3.4 Experience vs. Information Type

Experience in Tuscaloosa was found to be a determining factor for those who use television and telephone as information types before and after the tornado (Table 10). Television and experience had a significant value of < 0.001 (Table 7) and the most significant group were those that have lived in Tuscaloosa 4 years or less with a difference of 27.2 (Table 10).

Among observations with other experience groups, results revealed decreased usage before the event and increased usage after the tornado. This could be due to where the population resides. People who have resided in Tuscaloosa longer are more likely to have a permanent residence with a land telephone line as opposed to someone who is residing in an apartment or temporary housing for school. The significant groups with experience were expected to be similar to those from the variable age since these two normally coincide with one another.

Exp. Group	Info Type	Before O	Before E	Before O - E	After O	After E	After O - E
< 4 years	Television	1161	1133.8	27.2	134	161.2	-27.2
15 - 20 years	Telephone	33	51.9	-18.9	51	32.1	18.9

Table 10: Differences were calculated for significant experience groups for before and after communication source.

Telephone and experience had a significant value of <0.01 (Table 7) and the most significant experience group were those that have lived here 15-20 years with a difference of 18.9 (Table 10). The longer a person resided in Tuscaloosa the more likely they were to choose telephone as a means of communication with a lower than expected count before, but a higher than expected count after.

4.4 Shelter Factor and Social Media Usage

To further address any impact Facebook and Twitter could have had on decision making among the residents before the tornado, a series of pivot tables were analyzed to

find any connection with shelter factor and social media type. Counts for shelter factors were discussed previously in this chapter, with the largest number of responses, 41%, for the local television meteorologist influence (Figure 1). This result coincides with some of the main communication preferences belonging to television for many respondents before and after the event for much of the survey population. Not far behind, with 37% of the responses, was from the influence of Internet, television, or radar. This result led to questioning if they were going to social media sites to make their decisions since most meteorologists have expanded their memberships to sites such as Facebook and Twitter accounts (Butterworth et al. 2010).

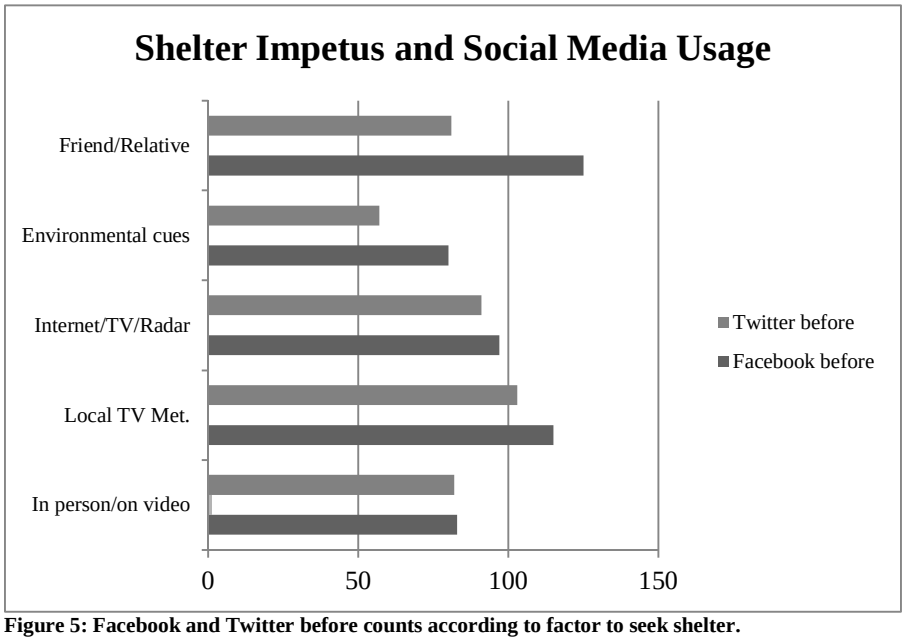

Figure 5: Facebook and Twitter before counts according to factor to seek shelter.

The pivot table results, depicted in Figure 5 include all counts for before Facebook and Twitter for each shelter seeking impetus. Some important findings for before the tornado communication type and shelter factor were that Facebook users were more likely to seek shelter due to a friend or relative informing them via phone call,

email, text, etc. Interestingly, social media users before the event were least likely to take action due to hearing or seeing environmental cues (rain, wind, hail, etc.).

Local television meteorologists were simultaneously using various media throughout the day during their coverage of the tornado (i.e. Twitter, Facebook, UStream). Results showed that the local television meteorologist providing a familiar landmark of where the tornado was located was the most likely reason for Twitter users to seek shelter and the second highest reason for Facebook users to seek shelter. These results seem to lead us to believe that the parasocial relationships that have been proven between broadcasters and people (Knepp et al. 2012, Sherman-Morris 2005) continue to spread to social networking sites.

4.5 Campus vs. City

Results from comparing city data from Senkbeil et al. (2012) to five campus groups helped to determine differences in social media usage between heterogeneous groups. Although the city sample had a smaller number of Facebook and Twitter users, it was important to find out if campus used social media more than the general public during the April 27th tornado.

Source	F Stat	Sig. Value
Facebook Before	2.813	0.016
Twitter Before	3.349	< .01
Facebook After	1.963	0.081
Twitter After	7.699	< .01

Table 11: ANOVA results including F stat and significant value.

One Way ANOVA results (Table 11) indicated that there were significant differences between campus and city usage for all variables except Facebook after (f stat= 2.813, p value= .016). The city chose Facebook as a primary mode of communication after the tornado nearly as much as the campus; possible reasons for this

will be discussed later. Following the One Way ANOVA test, a Post Hoc Tukey test analyzed the differences between groups.

	Facebook Before	Twitter Before	Twitter After
Group 1	0.017	0.01	0.034
Group 2	0.029	< .01	< .01
Group 3	0.185	0.248	< .01
Group 4	0.124	0.062	< .01
Group 5	0.049	0.354	0.127

Table 12: Post Hoc Tukey results showing significant values with group 6 (city).

Post Hoc Tukey tests showed overall campus used social media more than the city except with Facebook after. Twitter after showed four groups with significantly different usage when compared with the city, which was the most reported in this test.

To further discuss any possible reasons the city's usage seemed to be similar to the campus groups' Facebook usage after the event, storm damage percentages were calculated to see if any similarities could be found. The city sample reported 52% with some level of damage and the campus sample reported 30% of damage. The city sample reported 19.9% destroyed and the campus reported 3.6% destroyed. This could help explain the similarity between populations since after the tornado those that reported damage might have had more pressing needs than communication. The damage percentages could have also been linked to a loss of power giving these populations less of an opportunity to communicate via social media.

CHAPTER 5

CONCLUSION

Large events such as the April 27th Tuscaloosa tornado need to be thoroughly researched, especially when they occur so close to a college campus. Universities have tried to prepare for such events, but never know how the campus population will organize, react, and recover. The diversity on college campuses offers a range of responses to severe weather hazard communication. In this study, demographic variables such as gender, age, experience (years in Tuscaloosa), and education were tested against information and communication types to see if any significant relationships could be found. Since social media is relatively new within the field of hazard research, very little has been revealed about the implications of such media.

Due to the timing of the event at the end of the semester, an email survey was the best method to use to reach this group in a timely fashion. The response rate for this study was comparable to Sherman-Morris (2010) campus study, leaving this study with a very large sample size for analyses. No well-defined methodology that includes social media and hazard research has been defined, so various techniques were used to address the goals of this study. The four objectives for this study included: 1) who used social media before and after the tornado, 2) how was social media used before and after, 3) did social media usage influence shelter-seeking behavior, and 4) did social media usage differ between the campus and city populations. Qualitative techniques were used to analyze the descriptive characteristics of the study population. Spatial techniques were utilized to address any variability before and after the tornado with social media usage

between zip codes. Quantitative techniques were used to analyze any statistically significant relationships between media type and demographic variables.

By incorporating multiple variables for such a large dataset, this study was able to incorporate unique methods to address the study's objectives. A summary of important findings revealed the following:

- 35401, the zip code that included campus, used social media the most.
- Facebook was chosen by 10% of the campus population as a primary source of communication before the tornado, and 17% after the tornado.
- Twitter was used by 8% of the campus population as a primary source of communication after the tornado, and 13% after the tornado.
- 33% of the campus population used Facebook as a source of notification, while 8% used Twitter.
- 41% of social media users took shelter due to a cue from the local TV meteorologist. And 37% used Internet, TV, or radar.
- Campus used social media more than the city with the exception of Facebook usage after the tornado.

Overall, it seemed that parasocial relationships remained intact even when the typical line of communication, in this study television (before= 57%, after= 11%), was not an option. Even though the younger demographic who would have been thought to only use social media for hazard communication, findings revealed over 50% of respondents chose multiple sources that included more traditional types such as television before the tornado. Since this type of research is so new to the field, most of the results here were simply reported and could not be compared with other studies. Due to this, results from campus were compared with the city data from Senkbeil et al. (2012) where social media usage was different from the campus groups except with Facebook after the tornado.

The idea of including social media as a type of weather information and multidirectional communication tool initially was due to the dominance of 19 – 24 year olds on campus. Surprisingly though the younger demographic were not the only ones turning to these sites to stay connected throughout the event as shown by other age groups using Facebook. Future studies should include all types of media, including social networking sites, to further any conclusions about these sites building stronger relationships between a broadcaster and the audience.

These results could help the University understand the best way to stay connected with their population during events. The majority of students living off campus will leave if classes are canceled, so they need to know how to communicate most efficiently when a severe weather event occurs again. Broadcast meteorologists that are utilizing social networking sites such as Facebook and Twitter could possibly be creating stronger relationships with their audiences. It is also important for broadcasters to notice that even though power can go out and cause a television to not be used during/after events, their viewers will follow them on Twitter or Facebook for updates. More implications of these results could include finding a way to filter weather information on these sites. Since these sites are open for anyone, many false alarms could be created which might negate their effectiveness.

REFERENCES

Acquisti, A., Gross, R. (2006). Imagined Communities: Awareness, Information Sharing, and Privacy on the Facebook. *PET*, 1-22.

Ashley, W.S., Gilson, C.W. (2009). A Reassessment of U.S. Lightning Mortality. *Bulletin of the American Meteorological Society*, October, 1501-1518.

Ashley, W. (2007). Spatial and Temporal Analysis of Tornado Fatalities in the United States: 1880-2005. *Weather and Forecasting*, 22, 1214-1228.

Asur, S., Huberman, B.A. (2010). Predicting the Future with Social Media. Retrieved from http://arxiv.org/abs/1003.5699v1.

Barnes, L.R., Gruntfest, E.C., Hayden, M.H., Schultz, D.M., Benight, C. (2007). False Alarms and Close Calls: A Conceptual Model of Warning Accuracy. *Weather and Forecasting*, 22, 1140-1147.

Barnes, L.R., Schultz, D.M., Gruntfest, E.C., Hayden, M.H., Benight, C.C. (2009). Corrigendum: False Alarm Rate or False Alarm Ratio? *Weather and Forecasting*, 24, 1452-1454.

Bates, B.J., King, R.E. (1996). Television and the Web: How Local Television Broadcasters are Using the World Wide Web. Presented at *Broadcast Education Association Convention, Management and Sales Division*, Las Vegas, NV, April 1996.

Blanchard-Boehm, R. D., & Cook, M. J. (2004). Risk communication and public education in Edmonton, Alberta, Canada on the 10th anniversary of the 'Black Friday' tornado. *International Research in Geographical & Environmental Education, 13*(1), 38-54.

Boruff, B. J., Easoz, J.A., Jones, S.D., Landry, H.R., Mitchem, J.D., Cutter, S.L. (2003). Tornado Hazards in the United States. *Climate Research*, 24, 103-117.

Brommer, D.M., Senkbeil, J.C. (2010). Pre-landfall evacuee perception of the meteorological hazards associated with Hurricane Gustav. *Natural Hazards*, DOI 10.1007/s11069-010-9532-7.

Brotzge, J., Erickson, S. (2008). Tornado Warnings with Zero or Negative Lead Times. *Weather and Forecasting*, 24, 140-154.

Brotzge, J., Erickson, S., Brooks, H. (2011). A 5-yr Climatology of Tornado False Alarms. *Weather Forecasting*, 26, 534-544.

Bunkers, M. J., & Baxter, M. A. (2011). Radar tornadic debris signatures on 27 April 2011. *Electronic Journal of Operational Meteorology*, *12*(7), 1-6.

Butterworth, R. E., Kloesel, K. A., & Veil, S. R. (2010, June). An assessment of broadcasters' use of new media and radar technology in tv severe weather coverage: benefits, challenges, and a need for training. *38th Conference on Broadcast Meteorology*.

Changnon, S.A. (2011). Temporal Distribution of Weather Catastrophes in the USA. *Climatic Change*, 106, 129-140.

Coleman, T.A., Knupp, K.R., Spann, J., Elliott, J.B., Peters, B.E. (2011). The History (and Future) of Tornado Warning Dissemination in the United States. *Bulletin of the American Meteorological Society,* May, 567-582.

Collins, K.R., Savage, R., Wainwright, W. (2008). Facing Diaster: A Tale of Two Colleges, One System, and Their Response to Hurricane Katrina. *Community College Journal of Research and Practice*, 32, 184-202.

Collins, A., Cramer, S., Norlund, J., Simms, J.L., Kusenbach, M., Tobin, G.A. (2009). Shooting at Hurricanes: Disaster (Mis)Perceptions and (Un)Preparedness of Florida Undergraduates. USF RUE Hurricane Study, July 2009, University of South Florida, Tampa, FL, 1-88.

Comstock R, Mallonee S. (2005). Comparing reactions to two severe tornadoes in one Oklahoma community. Disasters [serial online]. September 2005;29 (3): 277-287. Retrieved from: Academic Search Premier, Ipswich, MA.

Corfidi, S.F., Weiss, S.J., Kain, J.S., Corfidi, S.J., Rabin, R.M., Levit, J.J. (2010). Revisiting the 3-4 April 1974 Outbreak of Tornadoes. *Weather and Forecasting,* April, 25, 465-510.

Cox, J., Plale, B. (2011). Improving Weather Observations with the Public Twitter Stream. Retrieved from: http://www.cs.indiana.edu/l/www/ftp/techreports/TR691.pdf

Curtis, A., & Mills, J. W. (2012). Spatial video data collection in a post-disaster landscape: The Tuscaloosa Tornado of April 27th 2011. *Applied Geography*,*32* (2), 393-400.

Cutter, S.L. (1996). Vulnerability to Environmental Hazards. *Progress in Human Geography*, 20, 4, 529-539.

Czajkowski, J., Simmons, K., Sutter, D. (2011). An Analysis of Coastal and Inland Fatalities in Landfalling US Hurricanes. *Natural Hazards*, 59, 1513-1531.

Dillon, R.L., Tinsley, K.H., Cronin, M. (2010). Why Near-Miss Events Can Decrease an Individual's Response to Hurricanes. *Risk Analysis*, 31, 3, 440-449.

Dixon, P.G., Mercer, A.E., Choi, J., Allen, J.S. (2011). Tornado Risk Analysis, Is Dixie Alley an Extension of Tornado Alley? *Bulletin of the American Meteorological Society*, April, 433-441.

Dolan, T.G. (2006). Few Schools Are Ready to Manage a Crisis. *The Education Digest*, October, 4-8.

Doswell III, C.A., Moller, A.R., Brooks, H.E. (1999). Storm Spotting and Public Awareness since the First Tornado Forecasts of 1948. *Weather and Forecasting*, 14, 544-557.

Doswell III, C. A., Carbin, G. W., & Brooks, H. E. (2012). The tornadoes of spring 2011 in the USA: a historical perspective. *Weather*, *67*(4), 88-94.

Dow, K., Cutter, S.L. (2000). Public orders and personal opinions: household strategies for hurricane risk assessment. *Environmental Hazards*, 2, 143-155.

Drobot, S.D., Benight, C., Gruntfest, E.C. (2007). Risk factors for driving into flooded roads. *Environmental Hazards*, 7, 227-234.

Edwardson, M., Kent, K., McConnell, M. (1985). Television News Information Gain: Videotex versus a Talking Head. *Journal of Broadcasting and Electronic Media*, 29, 4, 367-378.

Fontugne, R., Won, Y., Cho, K., Fukuda, K. (2011). Disasters seen through Flickr cameras. *2011 Special Interest Group on Data Communication Conference.* Toronto, Canada.

Gow, G.A., McGee, T., Townsend, D., Anderson, P., Varnhagen, S. (2008). Communication Technology, Emergency Alerts, and Campus Safety. *IEEE Technology and Society Magazine*, Summer, 34-41.

Hammer, B., Schmidlin, T.W. (2002). Response to Warnings during the 3 May 1999 Oklahoma City Tornado: Reasons and Relative Injury Rates. *Weather and Forecasting*, 17, 577-580.

Hjorth, L., & Kim, K. H. Y. (2011). The Mourning After A Case Study of Social Media in the 3.11 Earthquake Disaster in Japan. *Television & New Media*, *12*(6), 552-559.

Hopcroft, J., Lou, T., Tang, J. (2011). Who Will Follow You Back? Reciprocal Relationships Prediction. *Proceedings of the 20th ACM International Conference on Information and Knowledge Management*. New York, NY.

Hutton, G., Fosdick, M. (2011). The Globalization of Social Media: Consumer Relationships with Brands Evolve in the Digital Space. *Journal of Advertising Research*, doi: 10.2501/JAR-51-4-564-570.

Hyvärinen, O., Saltikoff, E. (2010). Social Media as a Source of Meteorological Observations. *Monthly Weather Review*, 138, 3175-3184.

Java, A., Song, X., Finin, T., Tseng, B. (2007). Why We Twitter: Understanding Microblogging Usage and Communities. Retrieved from: http://aisl.umbc.edu/resources/369.pdf

Kaplan, A.M., Haenlein, M. (2010). Users of the World, Unite! The Challenges and Opportunities of Social Media. *Business Horizons* 53, no.1, 59-68.

Killacky, J., Rhoe-Collins, K. (2008). Guest Editors' Introduction to the Special Issue: Hurricane Katrina's Impacts on Community and Technical Colleges in Louisiana and Mississippi. *Community College Journal of Research and Practice*, 32, 163-166.

Klotz, A.M. (2011). Social Media and Weather Warnings: Exploring the New Parasocial Relationships in Weather Forecasting (unpublished Master's thesis). Ball State University, Muncie, IN.

Knepp, S., Kresovich, A., Parker, E., Ray, S. (2012). We May Never Meet But we Tweet: Examining the Effect of Twitter on Parasocial Relationships. *Association of Education Journalism and Mass Communication Midwinter Conference,* Norman, OK, March 2012.

League, C.E., Diaz, W., Philips, B., Bass, E.J., Kloesel, K., Gruntfest, E., Gessner, A. (2010). Emergency manager decision-making and tornado warning communication. *Meteorological Applications*, 17, 163-172.

Lee, K.L, Meyer, R.J., Bradlow, E.T. (2009). Analyzing Risk Response Dynamics on the Web: The Case of Hurricane Katrina. *Risk Analysis*, 29, 12, 1779-1792.

Lenhart, A., Purcell, K., Smith, A., Zickuhr, K. (2010). Social Media & Mobile Use Among Teens and Young Adults. Retrieved from: http://pewinternet.org/Reports/2010/Social-Media-and-young-Adults.aspx

Leskovec, J., Huttenlocher, D., Kleinberg, J. (2010). Signed Networks in Social Media. *28th ACM Conference on Human Factors in the Computing System.* Retrieved from: http://arxiv.org/abs/1003.2424v1.

Lindell, M.K., Lu, J.C., Prater, C.S. (2005). Household Decision Making and Evacuation in Response to Hurricane Lili. *Natural Hazards Review*, November, 171-179.

McCafferty, D. (2011). Brave, New Social World. *Communications of the ACM,* 54, 7, 19-21.

Mitroff, I.I., Diamond, M.A., Alpaslan, C.M. (2006). How Prepared Are America's Colleges and Universities for Major Crises? *Change*, January/February, 60-67.

Moore, T.W., Dixon, R.W. (2011). Climatology of Tornadoes Associated With Gulf Coast-Landfalling Hurricanes. *The Geographical Review*, 101, 3, 371-395.

Moore, T.W., Dixon, R.W. (2011). Tropical Cyclone-Tornado Causalities. *Natural Hazards*, DOI 10.1007/s11069-011-0050-z.

Palen, L., Hiltz, A.R., Liu, S.B. (2007). Online Forums Supporting Grassroots Participation in Emergency Preparedness and Response. *Communications of the ACM*, 50, 3, 54-58.

Paul, B. K., Brock, V.T., Csiki, S., Emerson, L. (2003). *Public response to tornado warnings: A comparative study of the May 4, 2003, tornados in Kansas, Missouri, and Tennessee*. Natural Hazards Center.

Powell, S.W., O'Hair, H.D. (2008). Communicating Weather Information to the Public: People's Reactions and Understandings of Weather Information and Terminology. Retrieved from: http://downdraft.caps.ou.edu/reu/reu07/papers/powell_final_paper.pdf

Qualman, E. (2009). Socialnomics: How Social Media Transforms the Way We Live and Do Business. *Business Book Summaries,* Published on April 18, 2011, 1-10.

Schill, M.T. (2009). Communicating in Times of Crisis: How College and Universities Alert their Campuses of Emergencies (unpublished Master's thesis). Creighton University, Omaha, NE.

Schmidlin, T.W., King, P.S., Hammer, B.O., Ono, Y. (1998). Behavior of Vehicles During Tornado Winds. *Journal of Safety Research*, 29, 3, 181-186.

Schmidlin, T., Hammer, B., King, P., Ono, Y., Miller, L.S., Thumann, G. (2002). Unsafe at Any (Wind) Speed? Testing the Stability of Motor Vehicles in Severe Winds. *Bulletin of American Meteorology Society*, December, 1821-1830.

Schmidlin, T. W., Hammer, B. O., Ono, Y., & King, P. S. (2009). Tornado shelter-seeking behavior and tornado shelter options among mobile home residents in the United States. *Natural Hazards*, *48*(2), 191-201.

Schmidlin, T.W. (2009). Human Fatalities From Wind-Related Tree Failures in the United States, 1995-2007. *Natural Hazards*, 50, 13-25.

Schoen, J.M., Ashley, W.S. (2011). A Climatology of Fatal Wind Events by Storm Type. *Weather and Forecasting*, 26, 109-121.

Schultz, L.A., Cecil, D.J. (2009). Tropical Cyclone Tornadoes, 1950-2007. *Monthly Weather Review*, 137, 3471-3484.

Schumacher, R.S., Lindsey, D.T., Schumacher, A.B., Braun, J., Miller, S.D., Demuth, J.L. (2010). Multidisciplinary Analysis of an Unusual Tornado: Meteorology, Climatology, and the Communication and Interpretation of Warnings. *Weather and Forecasting*, 25, October, 1412-1429.

Senkbeil, J. C., Rockman, M. S., & Mason, J. B. (2012). Shelter Seeking Plans of Tuscaloosa Residents for a Future Tornado Event. *Weather, Climate, and Society, 4*(3), 159-171.

Sharma, U., Patwardhan, A., Parthasarathy, D. (2009). Assessing adaptive capacity to tropical cyclones in the East coast of India: a pilot study of public response to cyclone warning information. *Climatic Change*, 94, 189-209.

Sherman-Morris, K. (2005). Tornadoes, television and trust- A closer look at the influence of the local weathercaster during severe weather. *Environmental Hazards*, 6, 201-210.

Sherman-Morris, K. (2010). Tornado warning dissemination and response at a university campus. *Natural Hazards*, 52, 623-638.

Sherman-Morris, K., Senkbeil, J., Carver, R. (2011). Who's Googling What? What Internet Searches Reveal about Hurricane Information Seeking. *Bulletin of the American Meteorological Society*, August, 975-985.

Simmons, K., Sutter, D., & Pielke, R. (2012). 8. Blown away: monetary and human impacts of the 2011 US tornadoes. *The Geneva Reports*, 107.

Soulé, P.T. (2005). A Comparison of 30-yr Climatic Temperature Normals for the Southeastern United States. *Southeastern Geographer*, 45, 1, 16-24.

Sutton, J., Palen, L., Shklovski, I. (2008). Backchannels on the Front Lines: Emergent Uses of Social Media in the 2007 Southern California Wildfires. *Proceedings of the 5th International Sysytems for Crisis Response and Management Conference- Washington, DC, UA May 2008.*

Whitney, D. (2006). Stations Looking for Any Edge in a Storm. *Television Week*, *25*(17), 65.

Zavodsky, B., Case, J., Kozlowski, D., & Molthan, A. (2012). The SPoRT-WRF: Evaluating the Impact of NASA Datasets on Convective Forecasts.

Zhang, F., Morss, R.E., Sippel, J.A., Beckman, T.K., Clements, N.C., Hampshire, N.L., Harvey, J.N., Hernandez, J.M., Morgan, Z.C., Mosier, R.M., Wang, S., Winkley, S.D. (2007). An In-Person Survey Investigating Public Perceptions of and Responses to Hurricane Rita Forecasts along the Texas Coast. *Weather and Forecasting*, 22, 1177-1190.

APPENDIX

It was important to receive approval from the UA Institutional Review Board as quickly as possible in order to get the email survey sent out in a time-sensitive manner. This research study was part of a rapid grant from the National Science Foundation that was approved contingent upon IRB approval to ensure the email survey complied with all rules and regulation set by the UA IRB.

Institutional Review Board for the Protection of Human Subjects

THE UNIVERSITY OF ALABAMA RESEARCH

Jason C. Senkbeil, Ph.D.
Department of Geography
College of Arts & Sciences
The University of Alabama

Re: IRB # EX-11-CM-044 "Tornado Hazard Perception and Warning Communication Prior to the 4/27/11 Tuscaloosa Tornado"

Dear Dr. Senkbeil:

The University of Alabama Institutional Review Board has granted approval for your proposed research.

Your protocol has been given exempt approval according to 45 CFR part 46.101(b)(2) as outlined below:

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

Your application will expire on May 3, 2012. If your research will continue beyond this date, complete the relevant portions of Continuing Review and Closure From. If you wish to modify the application, complete the Modification of an Approved Protocol Form. When the study closes, complete the appropriate portions of FORM: Continuing Review and Closure.

Should you need to submit any further correspondence regarding this proposal, please include the assigned IRB application number.

Good luck with your research.

Sincerely,

Carpantato T. Myles, MSM, CIM
Director & Research Compliance Officer
Office for Research Compliance
The University of Alabama

152 Rose Administration Building
Box 870117
Tuscaloosa, Alabama 35487-0117
(205) 348-8461
FAX (205) 348-8882
TOLL FREE (877) 820-3066