THE VIABILITY OF SOCIAL MEDIA FOR COMMUNICATING RISK:

INTERPRETATIONS OF EXPERIENCES DURING 2017

HURRICANE HARVEY THROUGH

PHENOMENOGRAPHY

by

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DEDICATION

I dedicate this dissertation to my most ardent supporter; my husband, James, who has embraced my desire to further my education by doing everything within his power to clear all obstacles from my path and enable me to finish. I love you.

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Definition   **Description**

<u>Crowdsourcing</u> – allows capable crowds (on the Internet) to participate in various tasks, from simply validating a piece of information or photograph as worthwhile to complicated editing and management, like Wikipedia (Gao and Barbier 2011)

<u>Disaster</u> – an "event that produces more loss than a community can handle." (Lindell, Prater, and Perry 2007)

<u>Emergency Management</u> – "applying science, technology, planning, and management to deal with extreme events that can injure or kill large numbers of people, do excessive damage to property, and disrupt community life." (Drabek 1991)

<u>Hazard</u> – "a source of danger or an extreme event that has the potential to affect people, property, and the natural environment in a given location." (Lindell, Prater, and Perry 2007)

<u>Phenomenography</u> – a qualitative research method that aims "to discover the key aspects of the variation in how a group of people experience or understand (collectively) the phenomenon under investigation" (Trigwell 2006, 368). It identifies similarities and differences in the way we experience and understand phenomenon in the world around us. According to Barnard and colleagues (1999) . . . "it is

essential to recognize the qualitatively different ways that phenomenon are experiences and understood" (212).

Phenomenology – a qualitative research method that "identifies the 'essence' of human experiences concerning a phenomenon, as described by the participants in a study." (Creswell 2009, 15)

Risk Communication – is providing information about a possible risk (type and magnitude) and what might be the future outcome for the individual, group, or community (Reynolds and Seeger 2014)

Social Media – is human communication, possessing characteristics of participation, openness, conversation, community, and connectedness. With new technology (the Internet), individuals can become sources of information online, sharing with anyone, friends or strangers (Mayfield 2006).

Social Media Platforms - "such as *Wikipedia, Twitter, Facebook, Pinterest, Flickr*, that are a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0" and allow interfacing with other individuals and groups (Cheng 2010).

Web 2.0 – "is a network platform that connects all devices regardless of the operating system they use." This includes PCs, tablets, smartphones, etc. (Brengarth and Mujkic 2016)

ABSTRACT

From August 17 to September 3, 2017, Hurricane Harvey struck the Texas Coastal Bend, stalled and meandered between Corpus Christi and Beaumont for four days. Originally recorded as a Category 4 hurricane with winds of 209 kph as it made landfall near Rockport, Texas, Hurricane Harvey produced historic rainfall totals and catastrophic flooding across southeast Texas and southwest Louisiana. The storm affected approximately 13 million people through Texas, Louisiana, Mississippi, Tennessee, and Kentucky, causing 68 direct deaths in Texas. The Houston metropolitan population of over six million was not prepared for the deluge that arose from 40 to 60 inches of rain falling on a flat coastal plain. The water rose quickly and calls to 9-1-1 from residents seeking assistance and rescue overwhelmed the system. Many turned to social media for assistance, where local residents helped coordinate rescues and relay messages. Emergency management organizations also enlisted *Twitter* and *Facebook* to post information, but there was scant official use of social media apparent during the crisis that gathered information from those affected.

Through the lens of phenomenography—a qualitative research method that aims to discover the key aspects of the variation in how a group of people experience or understand (collectively) the phenomenon under investigation—face-to-face interviews were performed with a selected group of residents and emergency management personnel to gain an in-depth understanding first, of how and why individuals turned to social media; second, how individuals' perceived the effectiveness of social media for hazard

assistance; and, finally, reactions and responses of emergency management officials to requests for assistance via social media. Three goals defined this research:

1) To shed understanding and perspective on how and why social media was used by individuals (victims) during the Hurricane Harvey event;

2) To learn how individuals judged social media as an effective means of communicating immediate and urgent needs for assistance; and

3) To investigate and understand how emergency managers and other officials viewed and utilized social media as an effective communication tool for assistance during the hurricane event.

This study found that participants' extent of use of social media included searching for information about the storm, sharing their personal experiences and those of others, contacting official agencies and news agencies, and receiving emergency management information. Participants received information from official emergency management agencies through text applications (push notifications) and from social media platforms, such as *Facebook* or *Twitter*, if they were following those pages. If an emergency management agency posted an alert or warning on *Facebook*, it popped-up on a participant's newsfeed. Participants also received posts from friends and family on social media platforms that apprised them of their friends' experiences as Hurricane Harvey unfolded. Social media postings included descriptions, comments, pictures and/or videos. Other postings included road closure information, links to radar, and/or locations of flooding. Homeowner's associations re-posted emergency management information to their residents, including evacuation notices and information on possible flooding. By producing specific reasons for the use of social media, the findings from this research

demonstrated the viability of the phenomenon and will assist government leaders and emergency managers toward developing future initiatives that include these Internet platforms in their hazard response and emergency communication plans.

The specific sorts of information sought by participants (IQ9) included flooding locations, rainfall forecasts, finding out how long the storm would last, the status of friends and family, and information not found on TV. The primary method for finding information (IQ10) was to see it "automatically pop-up" on *Facebook* or see it posted from a person or agency that they followed. A few looked around for specific news sites on *Facebook* or *Twitter*, but most found what they needed without searching. A majority of participants (71%) said that the information found on social media changed their perceptions of personal risk during the storm (IQ11). The reasons stated (IQ11a) included increasing their levels of awareness of the danger of the storm, concerns about needing to evacuate, how to evacuate with their pets, and getting tailored information specific to their location in Houston. Several participants mentioned that they had previous experience with hurricanes, and initially, discounted the hurricane's predicted impact because landfall was not expected near Houston; however, as they watched the storm strengthen, through images and information on social media, their levels of concern increased.

The platforms accessed included *Facebook, Twitter, Instagram, Snapchat, Nextdoor,* and *WAZE*. All participants were active on *Facebook*. Most participants were savvy enough to post pictures or videos, search for specific data, or open links for

additional information. The usefulness of the information on social media (IQ11b) was ranked as a "10" by 71% of the participants and a "9" by 14%, however, no one ranked it lower than a five. The only demographic that seemed impeded was the over 65 group, many of whom had not adopted the *smartphone* as more than a mobile telephone. Several older friends were contacted to participate but were not active users of social media. Personal need stood out as a quantifier for applying the process. The more danger/threat that was perceived by the participant, the more imperative was the search for information or assistance.

Information gathering was not the primary purpose of the emergency management personnel interviewed for this study who were more concerned with getting critical information out to the public quickly and accurately during Harvey. Dispatchers and communication specialists monitored social media for rumors and incorrect information and then made posts to correct the information as soon as possible.

The primary positive aspect of using social media was how quick the message could be sent out and how wide the range could be. Unlike TV and radio, social media was, and is, not limited by how far the signal can travel through the air or become disrupted by electrical outages. The primary negative aspect was dealing with rumors, because like the original message, rumors can travel just as fast. They are difficult to stop and must be quickly handled and corrected.

The implications from this research point toward an increased need for emergency management to engage in the use of social media to not only send information but receive

requests for assistance. Dialing 9-1-1 and waiting for a limited number of operators to answer seemed unacceptable to many who were in need of assistance. The lack of full-time staffing for social media monitoring at emergency management agencies should be addressed, as well as the need to acquire monitoring software to filter and categorize social media information that is received.

CHAPTER I. INTRODUCTION

Through the lens of *phenomenography*, a qualitative research method that aims

"to discover the key aspects of the variation in how a group of people experience or

understand (collectively) the phenomenon under investigation" (Trigwell 2006, 368), this

research explored the viability and usefulness of social media as a communication

channel by residents and emergency management personnel during Hurricane Harvey,

August 2017. The chapter begins with a brief general discussion about hurricane

prediction and warning, the emergence of social media in disasters, and deficiencies in

social media as found in prior research—deficiencies that give credence to the rationale

for this research. Next, a statement of the research problem and purpose, is presented

along with the research goals and a list of study questions that reflected these goals and

guided this research. The chapter ends with a general discussion of how social media was

utilized as the Hurricane Harvey event unfolded.

1.1 Hurricanes, Predictions and the Geography of the Gulf Coast Plain

Each spring, usually in April or early May, the Colorado State University Tropical

Meteorology Team issues its forecast for the "Atlantic Hurricane Season" that runs from

June 1 to November 30, each year. This team, currently led by Dr. Phil Klotzbach, bases

its forecasts on historical weather records from at least the past 60 years, which allows

them to compare years with similar characteristics regarding hurricane activity (Colorado

State University 2017). The initial forecast indicated that 2017 would be a slightly below-

average year but was updated in August to reflect the high activity experienced in the

first nine weeks of the season. The National Oceanic and Atmospheric Administration

(NOAA) Climate Prediction Center announced its hurricane season outlook on May 25,

2017, with a less than 50 percent chance of above-normal hurricane activity; however, this was also updated in August to reflect the early-season activity (Early-season storms 2017) (Table 1.1). Six named storms had already occurred by August 9, 2017, two of which, Cindy and Emily, made landfall in the United States, and the number of upper level of storms (Category 3-5) was increased from 2-4 to 2-5. Because the peak of the Atlantic hurricane season occurs in late August through September it only takes one major landfalling storm to create problems for any of the large coastal populations. As a result, NOAA and the National Hurricane Center (NHC) notified the public of the increase in probabilities for named storms and major hurricanes to develop.

Table 1.1. 2017 Hurricane Predictions Disseminated by the National Oceanic and Atmospheric Administration (NOAA)

Average Number of Storms	Categories	May Predictions	August Update
	% chance of above normal season	45%	60%
12	# of named storms	11-17	14-19
6	# of hurricanes	5-9	5-9
3	# of major hurricanes	2-4	2-5

Source: http://www.noaa.gov/media-release/early-season-storms-one-indicator-of-active-atlantic-hurricane-season-ahead

Hurricanes are large cyclonic storms tracked by their center or *eye*; however, the actual size of a hurricane can be hundreds of miles in diameter, which allows for its effects to be widespread and sometimes difficult to predict (Blake and Zelinsky 2018). Hurricane Harvey was one such storm. Harvey made landfall on August 25, 2017, near Rockport, Texas, and dropped between 30-50 inches of rain in the Houston-Galveston metro area as

it traversed into south central Texas and back to the coast over a 6-day period, August 25-31, 2017 (Blake and Zelinsky 2018). This massive rain event occurred in a subregion of the Texas Gulf Coastal Plain—the Gulf Coastal Prairie. This subregion is located along the Texas coast between the Sabine River and Corpus Christi and is bounded on the northeast by the Pine Woods Belt, inland by the Post Oak Belt and in the southwest by the South Texas Plain. The coastal prairie is flat and generally grass-covered with large sections of underlying natural impervious rock (Texas State Historical Association 2018).

Further, the City of Houston is characterized by high amounts of pavement—a major factor related to flooding during Harvey—due to the lack of grass, soil or vegetation to capture stormwater runoff moving over streets, parking lots, sidewalks, and so forth. Data from the City of Houston as well as satellite images from *Google Earth 2017*, reveal that Houston's urban areas have more impervious surfaces than the suburbs. Because the majority of the city's pavement is concentrated within its major beltway (Loop 610), the impervious/pervious cover ratio approaches 1, where "1" indicates 100 percent coverage (Houston Galveston Area Council 2013).

Thus, given the physical geography of the relatively flat coastal plain, as well as, rapid urban development of the metro area, Hurricane Harvey affected over 6 million people, with varying degrees of damage, (Population – Census.gov 2016), from catastrophic flooding. While urban neighborhoods normally expect high water in heavy rainfall situations, many areas at a distance from the storm's landfall had not anticipated flood impacts.

1.2 Problem Statement and Goal of Research

Though watches and warnings were disseminated by NOAA and the NWS over the electronic and broadcast media, the rise of flood waters outpaced the timing of urgent information and instruction. In many flood prone areas, there was little to no time for evacuation. Because calls to 9-1-1 went unanswered for many residents due to the sheer volume of calls into the system (Silverman 2017), distress calls went out over other forms of communication, particularly, forms of social media (Erik Webb 2017). *Facebook, Twitter,* and *Instagram,* to name a few, displayed disaster scenes and text requests for help by residents trying to escape their flooded neighborhoods, find shelters, or contact loved ones. Thus, this research explored the extent to which social media was used, and was useful, for communicating warning and disaster information during Hurricane Harvey. This research considered both the at-risk public's and first responder's points of view, with a goal of understanding how this mode of communication might be employed in future disaster occurrences to save lives and properties.

1.3 The Phenomenon of Social Media

Social media is the electronic, and now digital, means of communication between individuals and groups with common interests (Mayfield 2006). The term encompasses diverse forms of communication, such as instant messages, texts, blogs, chat rooms, group forums, as well as media platforms such as *Twitter, Facebook, Instagram, YouTube,* and *LinkedIn.* Further, these forms appear on copious electronic devices, including computers, electronic tablets, and smartphones (Sykes and Travis 2012). In particular, *smartphones*--mobile phones that perform many of the functions of a computer, typically having a touchscreen interface, Internet access, and an operating system capable of running downloaded applications (Oxford 2019)—have made it

possible for social media to infiltrate the lives of people in almost every country due to their small size, light weight, and ease of use. In addition, *smartphones* hold more data and have multiple functions, including the ability to record audio and video, take pictures, surf the Internet, make and receive calls, and receive emergency notifications (Ahmad et al. 2016). Thus, given that diverse forms of social media now exist along with advances in hardware technology and are readily accessible and prevalent, one might ask: To what extent are first responders, call center dispatchers, or other pertinent emergency personnel employing social media during disasters as yet another means for disseminating and receiving urgent and life-saving communications?

While first responders and dispatchers at emergency call centers have increased their usage of social media as a risk communication tool, the use of this media mainly consists of postings of outgoing information via a website rather than two-way communication with the public. Thus, this research explored the extent to which social media was used by emergency management personnel as well as the at-risk public to communicate information and warnings during Hurricane Harvey.

1.4 Background: The Emergence of Social Media in Disasters

The phenomenon of social media as a means of day-to-day informal, interpersonal communication has achieved wide acceptance and explosive growth over the past two decades, yet few studies have examined how the various types of social media are used in communicating risk during a disaster event. In-depth disaster research about this phenomenon and its usage is relatively new, and much still needs to be investigated regarding how individuals and emergency managers perceive social media as a viable means of communicating risk information (Hoang 2009).

The broadcast media news and newspaper accounts were among the first to acknowledge that individuals were turning to social media when traditional, official lines of communication were being overwhelmed during a large disaster event. For instance, during Hurricane Harvey the *Houston Chronicle* noted that the League City Police Department posted a request early Saturday morning, August 26, 2017, via *Facebook,* for volunteers with low-water or flat-bottom boats to assist with water rescues in local neighborhoods. The response was so great that by approximately 11:30 a.m. police personnel posted a "thank you" and explained that they had so many volunteer notifications that it would take some time to contact everyone (Guthrie 2017). In another instance, one Baytown neighborhood group decided to work together to protect parts of their evacuated neighborhood by scheduling duty shifts via their *Facebook* page (Blakinger 2017).

Over the past decade, disaster researchers have begun to investigate the phenomenon of social media and how it has been used during an event. In the Malaysia Airlines MH370 crisis, a case study by Husain et al. (2014) found that the use of social media changed the timeframe for crisis communication responses by corporate officials, particularly for public relations personnel. The authors noted that *internal communications needed to be quicker* in order to respond to external/public inquiries because the company's reputation and brand were at stake. External communications, such as *Facebook, Twitter*, and personal blogs were quick to share information about a crisis, good or bad, and posted *any information* they wished without considering journalistic boundaries or accuracy. The case study concluded that corporations needed to

be mindful of how the public perceive their initial and continued responses to a situation or else the company might find themselves with a *negative reputation.*

The Beijing, China rainstorm in 2012 that caused severe urban flooding (Y. Wang et al. 2015) was studied for how text streams on *Sina-Weibo*, the most popular microblogging site in China and similar to *Twitter,* were used for *timely distribution of emergency messages, and how those messages changed over the course of the event.* A study by Kavanaugh et al. 2012, focused on how county officials in Arlington, Virginia might use social media to *manage crisis situations,* especially for underrepresented populations, and to foster *better interaction* by increasing public participation in non-traditional ways. Other studies include some mention of *how fast information travels* on social media (Kavanaugh et al. 2012; Al-Saggaf and Simmons 2015; Y. Wang et al. 2015; David, Ong, and Legara 2016), but also indicate that there is *much misinformation* included in such sharing (Kavanaugh et al. 2012; Husain et al. 2014; Y. Wang et al. 2015).

One of the earliest documentations of the use of social media during a disaster, referred to as *digital volunteer activity*, was recorded in New Orleans during Hurricane Katrina, in 2005 (Hughes and Tapia 2015). Blogs and online forums were used by local citizens, as well as those far away, to connect with loved ones, neighbors, and friends. In another disaster, *Facebook* was used during the Virginia Polytechnic Institute and State University (i.e., Virginia Tech) school shooting as a means of early *crowd-sourcing* to check on friends and the *effects of the incident*. The public also used social media during the Southern California wildfires of 2007, as well as in the aftermath of the Chinese earthquake in Sichaun, 2008, as a means of *gathering, seeking, and sharing information*

(Hughes and Tapia 2015). These unofficial uses of social media by the public to assist others during disasters garnered the attention of emergency responders and official organizations to the potential usefulness of this communication medium during disasters (Hughes and Tapia 2015).

1.5 Deficiencies in Past Research

The limitations of this early research on disasters and social media usage were, typically, that the works were often *descriptive*, and/or did not *delve deeply enough* into why individuals increasingly turned to social media as a means of obtaining disaster assistance (Stewart and Wilson 2016; Lachlan et al. 2016; Y. Wang 2015). Many studies only considered the points of view of government officials or disaster response organizations, characterized by one-way communications rather than including the public's input (Mehta, Bruns, and Newton 2017; Kesetovic, Maric, and Ninkovic 2017; Roshan, Warren, and Carr 2016). Still others only addressed *barriers to government agencies' use* of social media in disaster situations (Haataja, Laajalahti, and Hyvarinen 2016; Plotnick and Hiltz 2016; Anson et al. 2017). Analysis of text streaming without personal feedback via interviews also *limited knowledge* of the *why of it,* not just the *how and when*, so many individuals received and passed along information on social media instead of getting their assistance or information from official sources.

1.6 The Use of Social Media in 2017 Hurricane Harvey

This research focused on the recent 2017 Hurricane Harvey event that impacted the Houston-Galveston metro area. The hurricane was deemed to be the most disastrous event ever for several reasons: 1) the center of the storm did not actually pass over Houston-Galveston metro Area but, nonetheless, caused catastrophic flooding; 2) the

strength of the storm at landfall (Category 4) was the greatest since Hurricane Brett (Category 3) in 1999 (Keneally 2017); 3) the time that it remained a hurricane, tropical storm, and depression (117 hours) was record-breaking; 4) the length of time the rain bands remained over the Houston-Galveston area (6 days) and Southeast Texas region (7 days) was extreme; 5) the amount of rainfall it left in that region (over 1 trillion gallons) was unprecedented; and 6) the number of homes and businesses flooded (over 200,000) was significant (Blake and Zelinsky 2018).

Media coverage pointed out the usefulness of social media as a rescue tool, and in *Time* magazine (Rhodan 2017), Nikki Usher of George Washington University said this was the "first major natural disaster of the social media age." Multiple news stories anecdotally reported specific incidents, such as when Maritza Ritz Willis used *Twitter* to notify someone that she and her two children were being flooded. Ms. Willis tweeted her situation, address, and that she could not get through to 9-1-1. Willis then also posted her situation and location on *Facebook*. About an hour later she posted a "thank you" to whoever had gotten her information to the rescuers (Rhodan 2017). Another story reported that a *Twitter* post went viral after texting that personnel at a nursing home in Dickinson, Texas left its residents sitting in chairs half under water, causing the post to gain priority and draw attention to the situation (Rhodan 2017).

Social media platforms also provide a nucleus for other forms of assistance called *crowdsourcing. Twitter* hashtags of #SOSHouston and #SOSHarvey filled social media sites and obtained responses from savvy social media organizers who used *Google* spreadsheets to track requests and responses. *Zello,* an application (app) by CEO Bill Moore in Austin, Texas, was used by volunteer groups to coordinate locations and

rescues, particularly by the "Cajun Navy," a Louisiana group that rescued 20,000 residents from the Baton Rouge floods in August 2016 (Bailey 2017) and convoyed to Texas when flooding from Harvey became serious. An online mapping project called *U-Flood* was developed by the environmental firm Marine Weather and Climate, based out of Galveston, that used a simple map interface to allow Houston-area citizens the ability to mark roads as "flooded" or "clear." This community effort was important to rescuers enroute to areas where assistance was needed, often indicating detours around areas underwater (Sherr 2017).

This type of social media data collection, i.e., *crowdsourcing*, has begun to alter the general opinion regarding the need for "professional" mapping. The need for extensive training in cartography has been diminished by the availability of open-source mapping platforms (*OpenStreetMap, MyMaps* by *Google*), GPS, and personal mapping software, blurring the distinction between expert and non-expert (Goodchild and Glennon 2010, 233). Open-source data are applications or software freely available to the public without restriction (Bazilian et al 2012, 2), opening possibilities for crowdsourcing, which refers to "information obtained from a crowd of many observers," and "likely to be closer to the truth than information obtained from one observer" (Goodchild and Glennon 2010, 233).

Emergency management consultant, Rob Dudgeon, opined on National Public Radio (NPR) that technology and accepted norms of communication are outpacing government's ability to manage, and that demand will increase dramatically during an epic event like Harvey so that call centers will find it impossible to keep pace with the call volume (Silverman 2017). Social media, though, may give people a way to reach out,

but because of the variety of platforms and messaging styles available, the volume of messages was likened to trying to "drink from a fire hose" (Silverman 2017). Sorting and categorizing keywords and hashtags for specific, relevant information is labor intensive and time consuming. Most call centers and emergency management offices are not yet equipped to manage these data streams, so they did not use the technology. Dudgeon explained that, consequently, people needing assistance are advised by official postings and news programs to call 9-1-1 instead of using social media for their needs, yet it was used and helped some during the Harvey disaster (Silverman 2017).

There are a variety of disaster response organizations at all levels; national, state, and local. The Federal Emergency Management Agency (FEMA) is a national level, federal agency that uses a top-down command structure to coordinate and facilitate assistance to areas that have experienced a disaster event. This organization does not specifically discuss social media in its National Response Framework (FEMA 2016) but does acknowledge that state and local emergency response teams should include the use of current technologies in order to make effective, timely decisions during disaster situations. Nongovernmental organizations (NGOs) include voluntary, nonprofit, or faith-based organizations that support response activities by providing services such as emergency shelter, food supplies, and other essentials needed by those affected by disasters. National level NGOs include the American Red Cross (ARC) and National Voluntary Organizations Active in Disaster (National VOAD). The ARC is often the first NGO notified of a pending disaster and are quick to mobilize volunteers. This organization accepts donations, organizes blood drives, provides training and first aid certification, preparedness information, organizes volunteers to deploy to disaster

locations, maintains a website with opportunities and contact information, and also participates in social media communication via *Facebook* and *Twitter* pages for local chapters.

National VOAD is a coalition of nonprofit organizations that was founded in 1970 as a response to Hurricane Camille that affected the Gulf Coast in 1969. Its purpose is to aid in all phases of disaster and provide "communication, coordination, collaboration, and cooperation" among the various organizations, preventing haphazard deployment of people and supplies, duplication of efforts, as well as providing needed training for volunteers. The organization also maintains a social media presence on *Facebook* and *Twitter* for local chapters, providing information and links to other emergency management sites (NVOAD.com 2017).

1.7 Aims of the Research through the Perspective of Phenomenography.

The qualitative research approach using the lens of "phenomenography" was employed to investigate the extent to which social media in Hurricane Harvey was: 1) chosen by residents seeking assistance, 2) seen to be an effective communication tool, 3) used within and between the groups of victims, and 4) utilized as a means of communication by emergency managers.

The perspective of *phenomenography* was chosen due to the "newness" of social media as a risk communication tool, and paucity of prior research (Jennings, Arlikatti, Andrew, and Kim 2017) and the need to *understand the experiences* of those who accessed social media for various reasons during the hurricane. A detailed explanation of phenomenography, and how it differs from phenomenology is presented in Chapter IV, Methodology; however, briefly, *phenomenography* is a qualitative research method that

aims "to discover the key aspects of the variation in how a group of people experience or understand (collectively) the phenomenon under investigation" (Trigwell 2006, 368). It identifies similarities and differences in the way we experience and understand phenomenon in the world around us. According to Barnard and colleagues (1999) . . . "it is essential to recognize the qualitatively different ways that phenomena are experienced and understood" (212). Phenomenography and phenomenology both aim to reveal human experience and awareness as an object of research; however, Barnard (1999) explains that phenomenography is less interested in individual experience than it is in emphasizing collective meaning. It is a second-order approach which does not engage in the psychological reduction of data, rather it is "phenomenal," or "experiential" and aims to describe the world as it is understood, that is, as people experience and explain it (213). Face-to-face interviews were performed with a selected group of residents and emergency management personnel to gain an in-depth understanding first, of how, and why individuals turned to social media; second, how individuals' perceived the effectiveness of social media for hazard assistance; and, finally, reactions and responses of emergency management officials to requests for assistance via social media.

Thus, three goals defined this research:

1) To shed understanding and perspective on how and why social media was used by individuals (victims) during the Hurricane Harvey event;

2) To learn how individuals judged social media as an effective means of communicating immediate and urgent needs for assistance; and

3) To investigate and understand how emergency managers and other officials viewed and utilized social media as an effective communication tool for assistance during the hurricane event.

1.8 Research Questions

The following questions guided this research:

1) To what extent did residents of the Houston-Galveston metro area use social media during Hurricane Harvey?

Sub questions:

a) What was the process of risk communication involving social media?

b) Does the process of risk communication vary by specific demographic or personal need;

2) To what extent did individuals believe that social media was an effective means of communicating immediate and urgent needs for assistance;

3) To what extent did emergency management personnel provide channels of information gathering during Hurricane Harvey?

Sub questions:

a) How was social media instrumental in risk communication?

b) Which method was easiest, most difficult, most effective to use?

c) What were the positive and negative aspects of the methods for the social media used?

4) How might the use of social media improve risk communication between governmental agencies and the affected public during a hazard event?

1.9 Rationale for this Study

This research called for employing a qualitative approach, specifically, the perspective of phenomenography utilizing face-to-face interviews, to delve deeper into understanding the lived-experiences of those who suffered through Hurricane Harvey, and to understand why these individuals felt that they needed to call upon a relatively new means of communication to seek assistance. Through the lens of phenomenography, this research also aimed to understand the extent to which social media actually provided effective communication, or not. In addition, this researcher grew up in the Houston area and had extensive experience with hurricane hazards, as well as some limited experience as a 9-1-1 dispatcher. Having the ability to understand some of the processes explained by the participants aided this research by connecting the researcher directly with the participants through previous experiences, which increased the level of trust and openness about the topic.

Previous research in the area of disaster management using social media, has primarily, employed quantitative or mixed methodology. Numerical data was collected through surveys, focus groups, and open-ended questions for statistical testing in order to generalize to a larger populace. While informative, studies using a quantitative approach were limited in that they could not ask "why." These questions are invaluable and constructive for understanding the individual decision processes and choices toward specific behaviors. Using a qualitative approach that employs the analysis of "worded" data allows the researcher to ask probing questions that speak to motivations, perceptions of risk, and behavioral components that led to seeking social media for disaster assistance. The stresses of a disaster such as Hurricane Harvey may intensify that need to

use social media, but without the proper questions, there are no specific answers as to "why." The findings from this research will aid Emergency Management and other government entities in understanding the lived-experiences of individuals who are drawn to social media, in developing new methods of communicating risk, and providing effective responses to their constituents during a hazard event.

1.10 Contribution

This research added to the emerging base of research literature in the area of social media and its use during disaster events. The analysis of in-depth interviews though the lens of phenomenography assisted in a better understanding of the lived experiences of individuals during a disaster event, why they turned to social media for assistance and how the experiences differed. The analysis of interviews also determined whether social media was an effective tool/system for conveying pertinent information related to disaster/natural hazard events (i.e. location of event, specific needs during the event, condition status in the area affected, etc.) and, if so, how might it be better developed and utilized for communicating risk during a disaster/natural hazard event, and why governmental agencies have not developed platforms to make use of this information source. Furthermore, the advantage of a qualitative approach is that it indicated where modification might be made in the existing general model of risk communication for future empirical testing.

With each disaster event, the availability of social media makes its use a given, but the lack of its incorporation by government entities has raised questions as to "why." Actions taken during Hurricane Harvey have illustrated the importance of social media in critical situations. Therefore, the findings of this research will be useful for informing and

assisting emergency management officials in further considering the use of social media in their arsenal of tools for communicating risk and receiving public feedback in real-time. This research will add specific information from actual residents who used social media during the disaster event and their reflections on its effectiveness. Interviews with first responders and emergency management personnel will inform policy makers of possible uses and developments needed to provide assistance to the public during disaster events. By researching the emerging technology of crowd-sourced mapping during the disaster, policy makers may be informed of upgrade possibilities to their risk communication systems that need not start from scratch, while supporting education about, and funding for, these new processes being developed. Finally, opportunities and directions in future theoretical development in risk communication will ensue from this research.

CHAPTER II. BACKGROUND OF EMERGENCY RESPONSE, SOCIAL MEDIA, AND HURRICANES

This chapter begins by discussing some of the actions that occur during the emergency response phase of a disaster, communication concerns, and first responders. This is followed by a short explanation about hurricanes along the Texas Gulf coast and a brief background on social media, and who uses it. The chapter concludes with a short note about federal policies and local implementation.

2.1 Emergency Response and 9-1-1

In a crisis there never seems to be enough "boots on the ground" to assist. Dialing 9-1-1 is the standard for requesting help in an emergency. However, in a catastrophic event such as the massive flooding caused by Hurricane Harvey there are hundreds of calls coming into the 9-1-1 call center simultaneously. Managers may have planned and alerted additional staff to be on hand, but some may have been affected by the disaster as well, and unable to reach the call center. Ultimately, no matter how many staff are on hand, there will never be enough incoming lines or bodies available to answer the hundreds of calls per hour generated by a disaster on the scale of Hurricane Harvey. Some callers will have to be put on "hold" because it takes time to log the location, name of the caller, nature of the emergency, and then dispatch the proper authority to help. As those calls are logged and requests dispatched to first responders, there may be personnel shortages within those groups, as well, and for the same reasons. The call centers or Emergency Management Operations Centers could also be affected by the disaster. Tornadoes often accompany rain bands produced by hurricanes, so even if flood waters are not a problem, a tornado might conceivably damage a center and leave it inoperable.

Because of these delays at 9-1-1 call centers, and in desperation, many people will reach out via social media for help (Rhodan 2017; Silverman 2017).

In Hurricane Harvey, due to the massive number of calls to 9-1-1 centers for rescues from rising flood waters, the Houston MSA 9-1-1 system placed people on hold; (however, there is now a "Text to 9-1-1" system available in many areas, including the region of Texas affected by Hurricane Harvey). This non-verbal system was developed primarily for callers who might be endangered if they were heard speaking to 9-1-1, or for the hearing impaired who needed assistance. Many who called were unaware of the Text to 9-1-1 option, but even if they had been aware, texting their situation to 9-1-1 may not have brought on the help needed in a timely manner. According to an anonymous dispatcher at the Alamo Heights Police Department 9-1-1 call center, text messages to 9-1-1 were not put into the phone queue in chronological order. These text messages were separate and addressed only after the phone calls in the system subside and there were available personnel to handle them.

Communication between emergency management groups is essential (police and fire, rescue workers and emergency management agencies), as well as between local, state, and federal groups. The lack of interoperability between emergency communication systems during the September 11, 2001 attacks on the World Trade Center made it clear that provisions needed to be made by emergency management agencies (Jennings et al. 2017). *The Texas Disaster Act of 1975* amended in 2009, states that the Texas Department of Transportation's (TX DOT) responsibility, being a member of the communications coordination group, is to facilitate coordination and collaboration between agencies during emergencies (Texas Disaster Act 1975, 25). This document also

states that the Governor's office is responsible for developing a plan to promote interoperability of communications between federal, state, and local agencies, as well as first responders (*Texas Disaster Act 1975,* 73), while TX Dot is responsible for "disseminating emergency public service messages to motorists" (Texas Disaster Act 1975, 23).

2.1.1 First Responders

Locations of victims may be hard to find in the chaos of the event and first responders may not be the first to arrive. Local citizens may be there to aid, particularly when roads in and out of a disaster area are blocked, flooded, or somehow impassable (Krimsky 2007). In other words, these local "first responders" may do the rescuing. If 9-1-1 has been contacted, but the first responders who were dispatched cannot reach the party in question, how does 9-1-1 know who got rescued already, or still needs help? These were some of the issues related to Hurricane Harvey involving 9-1-1 requests for help. In many of these instances, social media was used by the public to ask for or to render assistance during the disaster event.

2.2 Historical Background

2.2.1 Hurricanes and the Texas Coast

Tropical cyclones in the form of depressions, tropical storms, and hurricanes have been noted along the Texas Gulf Coast since 1527 by mariners, explorers, and settlers. An increase in population and a greater number of surviving records made 1829 a primary date of reference for reliable documentation of these storms (Roth 2010). Though there is a season for tropical cyclones, there are also cycles of occurrence according to long-term trends dating back to 1829 (Price 1956). Dr. Price refers to the 11-

year cycles with increased landfall occurrence as "hurricane-rich" periods while the 14-

year cycles with decreased landfall occurrence are referred to as "hurricane-poor"

periods; however, Price notes that these are average periods and may vary by a year or

two. According to Roth (2010) the previous period that ended in approximately 2014 was

a hurricane-rich period, thus the current period would be considered a hurricane-poor

period. Regardless of statistics, it only takes one storm like Harvey to make life difficult

for those along the coast.

2.2.2 Social Media Beginnings

Social media, also known as social networking, is a broad term used to describe a

wide array of web-based platforms that connect users to services or other users via their

own public pages. The variety of technology used to access these places on the Internet

began with desktop computers, followed by wireless laptops, then the smaller tablets, and

now the smartphone, which seems to dominate as the most popular mobile means of

communicating (Houston et al. 2014). Social media blossomed onto the scene in the mid-

1990s and has become the primary source for news, information, and entertainment for

an increasing number of people every day, across the globe. Communicating warnings

about natural hazards and following the disaster as it unfolds is an important part of that

information, and the method of communication has had to evolve with the new

technology. New forecasting technologies have increased lead times for anticipating

weather situations, and warnings can be sent immediately via mobile applications (apps)

to a smartphone. Those warnings may also be tailored to a specific location employing

GPS enabled apps that use satellites to determine the latitude/longitude of that location

and weather region. This technological capability aids those who travel for work or for those on vacation in unfamiliar locations.

2.2.3 Rate of Adoption of Social Media and Its Technology

While social media use is widespread, the rates of adoption by individuals will vary. Rogers (1962, 1983) developed the Diffusion of Innovation Model (DIM) that categorized the general population into five categories according to how quick they were to adopt a new innovation and are as follows:

1) Innovators - usually higher social class, very social, and/or risk-takers;

2) Early Adopters – usually higher social class, high in opinion leadership, more social than later adopters, make judicious choices to maintain position;

3) Early Majority - typically take longer to adopt new innovations, have above average social status, have contact with Early Adopters;

4) Late Majority – usually adopt much later than most due to increased level of skepticism, have contact with Early Majority and Late Majority groups; and

5) Laggards – usually last to adopt an innovation, have an aversion to change, considered more traditional, usually lower social status, usually oldest of adopters, and only in contact with family and friends.

There is also a category of *Leap-froggers* who are resistant adopters that are slow to upgrade their initial adoption and often must leap over interim generations of technology in order to have the most recent version. These adopters tend to "sign-up" in a normal bell curve with regard to numbers over time (Figure 2.2.3a).

Diffusion Innovation- Adoption
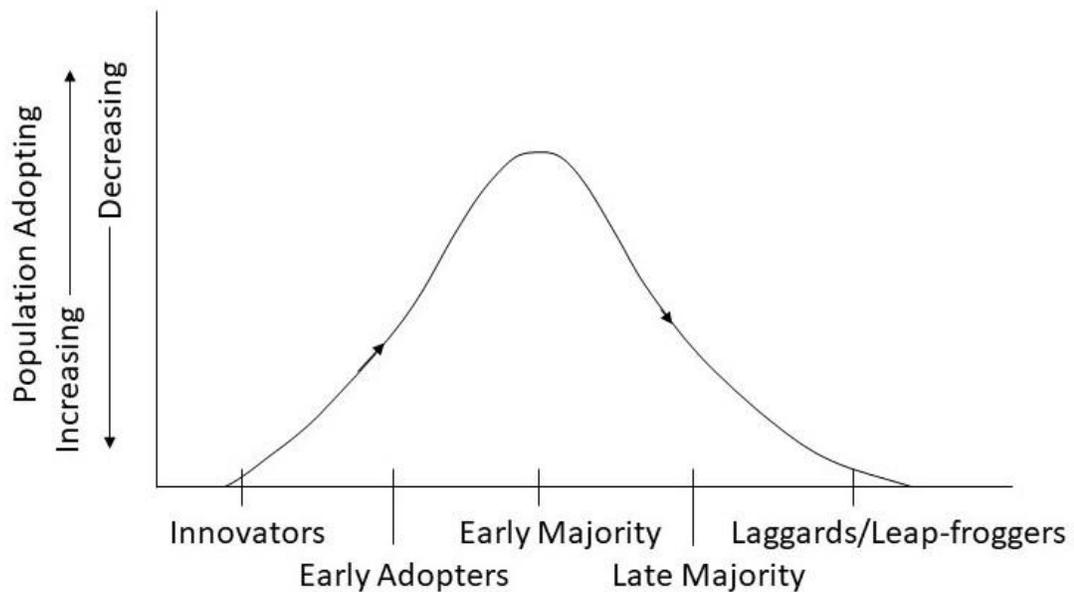
Figure 2.2.3. Diffusion, Innovation, Adoption (Rogers 1983)

Social media adherents are currently found in the *Late Majority Stage* but moving into

the Laggards stage. The adoption of social media began with *The Innovators* who were

those in business with connections to new technology, which then quickly spread to the

young adults who became *Early Adopters* because they were quick to see the advantages

to having a mobile device that could "do it all." Their parents came along next (*Early*

Majority) as the need to keep up with their offspring increased, as well as their new-

found freedom to be away from home but still connected. When the *Early Adopter*

young adults became parents and their children got older, the parents (*Early Adopters*)

needed to stay connected with their children, making this younger generation part of the

Late Majority. Grandparent generations of first adopters have been slow to adopt

(*Laggards*), but many have joined the "circus" that is social media just to keep up with

the grandkids and great grandkids (*Leap-froggers*). These grandparents are often taught

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by their grandkids how to operate their new smartphone because this older generation missed out on the earlier phases of the technology (Rogers 1962, 1983).

This diffusion/adoption situation is germane to the discussion of social media and disasters because many in the Baby Boomer generation, born between 1946 and 1964, are still not a part of the social media crowd. Many elderly adults in their 60s, 70s, or 80s are not computer savvy nor do they own a smartphone. Further, as the rest of the Baby Boomer generation reaches retirement age, it will continue to be necessary to use television, radio, and newspapers as information channels. With regard to emergency management organizations, adoption of new technologies for implementation in their communication systems such as social media applications have been slow (Tapia et al. 2011), often because of a lack of commitment on the part of upper management or lack of training, personnel, or resources (Hughes and Tapia 2015). Although individuals in those organizations may make use of social media on a personal level, that quantity of knowledge is often insufficient to support the development of Information Technology (IT) systems necessary to analyze the amount of data generated by a crisis situation (Tapia et al. 2011).

2.3. Legal Background, Laws and Legislation Passed

Congress has expressed interest in how federal response and recovery might be improved as they have seen social media used by international, state and local organizations. The Federal Communications Commission (FCC) and Federal Emergency Management Agency (FEMA) decided to implement a Personal Localized Alerting Network (PLAN) in May 2011. The emergency alert system normally sent via radio and

television will now include mobile phone text messages to those who request it (Sykes and Travis 2012).

2.4 Implementation of Legislation and/or Laws into Policy

Per a news release on September 24, 2014, Sonya Lopez-Clausen of the Greater Harris County 9-1-1 office explained that the Text to 9-1-1 service was active for the Harris and Fort Bend County areas. The slogan "Call if you can. Text only if you can't." was used to indicate the preferred use of the new system. Texting to 9-1-1 is primarily aimed at situations where speaking to a 9-1-1 operator might put the caller in danger, or for the deaf or hearing impaired to get emergency assistance. Calling is still recommended as the fastest means of getting help (George 2014).

CHAPTER III. LITERATURE REVIEW

This chapter begins with a review of the literature relating to risk communication, followed by social media and how it has been studied. Emergency management and social media are discussed with regard to the lack of implementation at the local levels. The chapter concludes with a synopsis of current research theories about communicating risk.

3.1 Risk Communication: What is it?

There are many ways to examine the theory of risk communication during disaster events. Classical theory defines a process of general communication and it involves a process of *hearing* information – the message, *understanding* its meaning, *believing*, or internalizing the information, *confirming* the validity of the information among social networks (e.g., family, friends, co-workers, etc.) and then *acting* upon the information (Blanchard 1992). The model also assumes that individuals repeat and modify this process in making decisions to save lives and properties.

Overall, the aim of risk communication is to provide information about a potential or possible risk (type and magnitude) and what might be the future outcome for the individual, group, or community (Reynolds and Seeger 2014). By relating a potential or possible future outcome, those who communicate risk hope to elicit a response from the person hearing the information that will keep them out of harm's way. Communicating risk involves a variety of communication channels, characteristics of senders and receivers, and an awareness of possible behavioral responses (Blanchard 1992).

Communication risk is a cornerstone of emergency management and is conceptualized and utilized by all levels of government including:

    1) the federal government with agencies such as the Department of Homeland Security (DHS), the Federal Emergency Management Agency (FEMA), and the Environmental Protection Agency (EPA);

    2) state government agencies, such as the Department of Transportation (DOT), the Department of Public Safety (DPS), and the Office of the Governor;

    3) local governments, such as the Office of the Mayor, local police, fire and emergency medical service departments, Emergency Operations Centers (EOC); and

    4) Non-Governmental Organizations (NGOs) such as the American Red Cross (ARC), many religious denomination groups (Baptist, Methodist, Catholic, Episcopal, Jewish) as well as non-denominational (Salvation Army), and Save the Children.

All of these agencies, departments, and organizations employ risk management techniques to inform the public, coordinate operations between themselves and related groups, gather local situational information, and update real-time information (Reynolds and Seeger 2014).

The research literature that addresses risk communication is slowly expanding to include various aspects of social media as a communication component due to its speed, interactive ability, availability, and popularity with a wide audience that spans multiple demographics (Houston et al. 2014; Pechta, Brandenburg, and Seeger 2010; Al-tai and Ali 2017). Being included in the category of Information and Communication Technology (ICT), social media as a risk management or communication tool has become a popular topic for scholars in recent years, gaining prominence due to the changes in how information moves through the communication process. The public must

no longer wait to see video about a disaster on news programs due to the availability

Facebook or *Twitter* feeds that display immediate visuals from individuals at the

epicenter of the event (Veil, Buehner, and Palenchar 2011). Because this information

bypasses official channels, emergency managers and public safety officials are hard-

pressed to control public perceptions of what is going on or how the situation is being

handled by authorities (Husain et al. 2014).

The use of wireless technologies in the form of *smartphones* and electronic

tablets (*e-tablets*) has made documenting and communicating information during disaster

events accessible to the public, making them informal journalists and/or first responders

(Veil, Buehner, and Palenchar 2011). Neighbors are often first on the scene of disaster

events and can notify emergency officials and first responders of crisis situations via

formal channels like 9-1-1 or informal channels like *Facebook* or *Twitter* (Krimsky

2007). Disaster relief organizations and concerned individuals can use social media as a

channel for assistance without ever having been to the location of the incident by

accessing online information and contacting the necessary personnel (Hughes and Palen

2012). This posted information often causes a surge in attention to the event and prompts

reposting or sharing on social media websites, traveling across the globe in seconds

(Hoang 2009; Veil, Buehner, and Palenchar 2011). Increased consumption of all types of

media from television to news websites to blogs can be termed "global crisis

communication" (Thelwall and Stuart, 2007, 189; Hoang 2009).

3.2 Social Media: What is it?

Social media, as defined by Merriam-Webster.com, is "a form of electronic communication (such as websites for social networking and microblogging) through which users create online communities to share information, ideas, personal messages, and other content (such as videos)." This term is closely related to social networking, defined as "the creation and maintenance of personal and business relationships, especially online" (Merriam-Webster 2017). The term "online" is defined as "connected to, served by, or available through a system and especially a computer or telecommunications system (such as the Internet), and finally, the "Internet" is defined as "an electronic communications network that connects computer networks and organizational computer facilities around the world" (Merriam-Webster 2017). These four terms are specifically connected to current technologies used by people, businesses, organizations, and governments to communicate socially, economically, and in official capacities. These communications have been happening for centuries using other means, such as hand-written letters, printed newspapers and other printed materials, telegraphs, teletypes, and telephones. Edosomwan et al. (2011) discusses the beginnings of the current electronic form of social media by explaining the development of social networks and earlier technologies available for communicating, including email in the 1960s, ARPANET developed by the U.S. government and *CompuServe* as a time-sharing computer service, both in 1969. He points out that social networking sites aimed at single-interest groups began to develop in the 1990s, such as *Six Degrees, Blogger*, and *Napster,* though most of these sites have disappeared or evolved into newer versions. 2003 saw the launch of *MySpace* and *LinkedIn*, and 2004 brought in *Facebook Harvard*,

and 2005 brought in *Yahoo!360* and *YouTube*. *Facebook* has evolved from being

available only to Harvard students into one of the most popular social media sites on the

globe, and *LinkedIn* has continued to be a popular site for business networking.

Edosomwan et al. also explains the distinct difference between social networking and

social media; that social networking is the engagement of people choosing to associate

because of common interests, where as social media is the transmission or sharing of

information with a wide audience.

Online social media is the Internet equivalent of what the telephone party line was

in the mid-twentieth century; the fastest and easiest way to communicate with people. As

the Internet expanded from government and academia to the public arena, people across

the country and across the globe began to log in, set up personal web pages, business

sites, and online organizational meeting places (Edosomwan et al. 2011). They have

shared stories, pictures, videos, local and international news, as well as personal triumphs

and losses with anyone who was interested.

3.2.1 How is Social Media Used?

Computers were the first to connect to the Internet, but today's wireless

capabilities (*Wi-Fi* and *Bluetooth*) have allowed anyone with a *smartphone, e-tablet* or

Bluetooth headset to interact with friends, businesses, or even 9-1-1 (Childs 2014;

Landsbergen 2010). With an Internet connection, a person can enter the World Wide

Web (WWW), and use a web browser (*Google Chrome, Firefox*, etc.) to enter a subject

into a search engine, the term for a software program that uses database information to

locate key words on various websites (Dictionary.com 2017). Current popular search

engines include *Google, Bing*, and *Yahoo*, which provide instant links to websites about

the queried topic. These websites may provide a variety of content, including email, video conferencing, academic works, newspaper articles, personal blogs, reference materials, videos, music, movies, games, or other forms of entertainment. Social media sites can also be used by businesses as collaboration tools for colleagues to work remotely on projects and have instant contact with other members of the team (Childs 2014). These functions are provided free of charge to those who use them, but must be supported in some way, so the companies who provide the browsers, search engines, and websites allow advertising. These ads are not so different from current print or television ads. They range from static picture, wallpaper, or text displays at the tops or bottoms of webpages to floating banners, pop-ups, and videos.

Though the context of social media may seem complex with its many applications, channels of connection, and vectors for information, it remains a relatively simple way to engage others in communication and exchanging ideas. For example, *YouTube* has become a widely used platform for sharing videos; educational pieces, concerts and music videos, home-made videos of daily events, and disasters (Childs 2014). *Facebook* is one of the most popular social networking sites which allows users to set up a personal or business page, maintain a friends list, upload photos, comment on other people's pages, live stream other content, make their information public or limited to select friends, and market their own businesses. The positive aspects of social media and social networking are many, as noted above, but there are negatives to the technology. Being online and posting personal information can leave individuals and businesses open to cyberattacks, identity theft, or malicious attacks (Childs 2014).

3.3 Emergency Management and Social Media during Disasters

Emergency management's use of social media has often been a one-way process of relaying emergency information to the public using a static website, or text message alerts (Kesetovic, Maric, and Ninkovic 2017; Haataja, Laajalahti, and Hyvarinen 2016). The messages were outgoing with little opportunity for community feedback on the same communication channel. After Hurricane Katrina, many local, state, and federal emergency management organizations began including social media communication channels in their non-emergency and emergency situations (Haataja, Laajalahti, and Hyvarinen 2016). Channels of communication, such as Text to 9-1-1, *Facebook* pages, *Twitter* feeds, and *YouTube* videos are becoming more common, but are subject to individual agency policies and limitations. For instance, the *Texas Emergency Management Statutes*, updated effective September 1, 2011, requires that "local, state, and federal agencies, and first responders… implement and maintain a statewide integrated public safety radio communication system." (*Texas Disaster Act 1975*), but there is no mention of Internet communication systems.

Many emergency management agencies and organizations are reluctant to implement social media for the following reasons:

1) there is a lack of sufficient staff for sending and receiving messages, or lack of funds to provide for adequate staffing (Al-Taie and Ali 2017; Anson et al. 2017; Plotnick and Hiltz 2016);

2) there is no stated policy regarding the use of social media (Plotnick and Hiltz 2016);

3) there is a lack of skilled personnel, or lack of available training (Anson et al. 2017; Haataja, Laajalahti, and Hyvarinen 2016; Plotnick and Hiltz 2016);

4) there is a lack of trust in the data from unofficial sources (Plotnick and Hiltz 2016);

5) there is a lack of appropriate software support to deal with the volume of incoming information (Plotnick and Hiltz 2016);

6) the organizational culture will not accept the use of new technology (Anson et al. 2017; Haataja, Laajalahti, and Hyvarinen 2016); and

7) the organization does not consider public interaction as their role (Haataja, Laajalahti, and Hyvarinen 2016).

Many of these barriers are budgetary in nature or speak to the local culture and may require more facts or specific policies that require participation in social media communications.

3.4 Current Research Theories

It is an inherent part of the human condition to communicate with others, particularly during times of stress or danger. Over half of the world's current population lives in cities (Hogan and Marandola 2012), and when people are in close proximity to one another, risk increases, possibly from disease, crime, or natural disaster. Communicating risk is important for many reasons, but protection of life and property is primary. Risk communication is defined as "an interactive process of exchange of information and opinion among individuals, groups, and institutions" (Committee on Risk 1989) in Krimsky (2007), with Lundgren and McMakin (2009) adding "concerning a risk or potential risk to human health or the environment." The Environmental Protection Agency (EPA 2002) defines risk communication as "the process of informing people about hazards to their environment or health. Communicating risks is a two-way exchange in which organizations inform target audiences of possible risk and gather information from those affected by the risk."

Risk communication and crisis communication are often used interchangeably, however, they are not the same (Wendling, Radisch, and Jacobzone 2013). *Risk*

communication involves discussing the possibility of being affected by an event, and may include short-term warnings as well as long-term, low-key messages of potential threat or risk from a hazard occurrence (Blanchard 1992; Reynolds and Seeger 2014). On the other hand, *Crisis communication* is associated with and urgent, unexpected event that requires immediate consideration and response (Reynolds and Seeger 2014). *Disaster communication* is also different from risk and crisis communication as it has been primarily used by mass media in a general way to give warnings or show coverage of a disaster event (Houston et al. 2014). Nonetheless, risk, crisis, and disaster communication are all employed in all phases of a disaster's lifecycle---before, during, and after any event that poses a threat to properties, injuries, or loss of life (Wendling, Radisch, and Jacobzone 2013).

The study of risk communication evolved from the broadcast media, specifically, the invention of television which opened the doors for reaching a mass audience. Tornado warnings were conveyed to the public in the 1950s on commercial television after the U. S. Weather Bureau (now the National Weather Service) was successful forecasting a tornado that struck Tinker Air Force Base in 1948 (Coleman et al. 2011). Beginning in the 1950s at the Yale School of Mass Communication, Hovland and colleagues, explored this new phenomenon through the lens of "persuasion theory," allowing them to define a *process* of how messages might best be communicated to a mass audience (Hovland, Janis, and Kelly 1953). The Yale School process model was originally valued and utilized by advertisers, keen to employ the broadcast media in product adoption; however, in subsequent years, hazard researchers recognized the parsimony and usefulness of the Yale model for conceptualizing a process of communicating risk and

disseminating immediate, short-term warning messages to a large, at-risk populace. Thus, in the early 1970s, hazard researchers set about to adapt, modify, and develop the mass communication process model, specifically towards risk. Today, the "General Model of Risk Communication" (developed by Mileti, Fitzpatrick, Blanchard, and others) continues to govern much of hazards communication research. After decades of exploring the phenomenon of when, how, and why individuals hear and then respond to warning messages, the general model offers a timeless conceptualization of how the process of risk communication comes about (Mileti and Fitzpatrick 1992; Blanchard 1992).

Prior to the 1980s, disaster agencies were tasked with communicating risk by sending out bulletins or warnings, used newspapers, radio, and/or television as channels to inform the public. With the advent of the computer age and the proliferation of the Internet and social media as a popular means of communicating, new channels have opened, creating a need to adapt the process using those channels and the methods in which important information is conveyed to the public. Current literature discusses many different theories for examining who communicates risk and how they do it. This chapter continues below to explore communication methods or models that include: content or theme analysis, one-way communication, information movement, two-way communication, categories for users and uses, tools for analysis, and multi-directional communication.

3.4.1 Communicating Risk: Content and Theme Analysis

Examining the content of social media posts often indicates how much information the person received prior to the event (risk communication), someone's level of discomfort with a crisis situation, where they seek information, how often they seek it,

their level of uncertainty, the channels of communication they choose, and their specific

situation (Lachlan et al. 2016). Risk and crisis communication messages are still issued in

the traditional manner, i.e. by radio and television, but with the increasing use of the

Internet and wireless forms of communication, bulletins and warnings may also be sent

via social media, such as text messages to smartphones, *Twitter* tweets, and messages on

Facebook. Points to consider with respect to risk and crisis communication include the

fact that most people do look for official information, but many official local agencies

have not incorporated social media policies and procedures into their communication

protocols (Lachlan et al. 2016). There is empirical evidence to show that in crisis

situations people have an increased need for media (Lachlan et al. 2016) and that the

absence of timely official communication may lead the public to fill that void with

information from other, less reliable sources, which can cause a perceived loss of

reliability that may taint later messages from the authorities (Reynolds and Seeger 2014;

Kesetovic, Maric, and Ninkovic 2017). The Internet is an open resource, and no one is

required to have their facts checked before posting an item; therefore, misinformation is

often part of the communication stream (Murthy and Gross 2017).   The use of content

analysis to sort through the social "noise," or irrelevant information on *Twitter* and

Facebook, for example, is necessary to emergency management personnel to clarify what

is happening, where it is happening, and who needs assistance (Lachlan, Spence, and Lin

2014; Lachlan et al. 2016; Spielhofer et al. 2016). Content and theme analysis may use

coding to flag specific words or hashtags used, as well as to read the metadata associated

with tweets that identify geolocation of the user (Imran et al. 2013; Lachlan, Spence, and

Lin 2014; Spielhofer et al. 2016). These processes allow for the identification of

demographic attributes and geodata which may generate statistics on underrepresented or underserved populations who are disproportionately affected by disasters. Historic social inequality with respect to location and economic status may also be shown by what is not collected from social media due to a lack of information from particular areas previously identified as culturally or economically disadvantaged (Lachlan, Spence, and Lin 2014). Analysis of social media messages may also indicate whether the message was forwarded (retweeted) to others in the person's social network or posted on a public site where anyone could view it, the person's state of mind, location, discussion topics, and so forth (David, Ong, and Legara 2016).

3.4.2 Communicating Risk: One-way communication

One-way communication is a linear process where a message moves from an authority/agency through various channels to reach an audience (Krimsky 2007) with little to no feedback from the receiver. As discussed above, initial theories for risk communication were developed from the Yale Model of Communication (Hovland, Janis, and Kelly 1953) which was born from persuasion theory (Blanchard 1992). This basic process was interpreted and defined by Mileti and Fitzpatrick (1992) to follow a process of *hearing* and *understanding* a message, then *believing* and *confirming* that message, followed by *responding*. Variables were identified that influenced how a message was perceived, including message, sender, and receiver characteristics, the receiver's perception of risk and the receiver's behavioral responses. In present day, this process is understood to occur in a repetitive process as new information and messages are heard, understood, internalized, confirmed, and acted upon by those in hazardous situations.

3.5 Alternate Models for Communicating Risk

3.5.1 Communicating Risk: The Situational Crisis Communication Theory

Mehta, Bruns, and Newton (2017) conceptualized and developed an intelligence gathering method where the traditional top-down power structure issued information with little access to individuals. They found that form of communication was less effective in most contemporary crisis and emergency management situations as there is little information gathered from those experiencing the crisis (Haataja, Laajalahti, and Hyvarinen 2016; Kesetovic, Maric, and Ninkovic 2017).

The Situational Crisis Communication Theory (Coombs 2007) was primarily developed for corporate public relations personnel to deal with stakeholder reactions and to protect the organization's reputation during a negative event. In this model, stakeholders are required to attribute responsibility of the crisis to the proper party, so that communication for corporate headquarters may: 1) shape the view of the crisis, 2) adjust the public perception of the organization, and 3) reduce the threat of negative outcomes for the organization: in other words, damage control. If corporate communications are not convincing, there will be public backlash via social media, resulting in increased negative press. Stakeholder's needs should be the priority, followed by corporate reputation. This type of communication is not unlike disaster communication. Government authorities would act as the corporate voice in charge of providing warnings, response and assistance in the event of disaster. This model is primarily a one-way communication model, though corporate responses are based on feedback from the stakeholders, though not necessarily through social media. The use of social media has made two-way communication the expected norm, yet many local agencies have yet to incorporate the two-way process into their message systems (Veil,

Buehner, and Palenchar 2011; Haataja, Laajalahti, and Hyvarinen 2016; Kesetovic, Maric, and Ninkovic 2017).

3.5.2 Communicating Risk: Information movement

A classification matrix was developed by Reuter, Marx, and Pipek (2012) and discussed by Haataja, Laajalahti, and Hyvarinen (2016) that describes the movement of information through social media when used in crisis management. The pattern is multi-directional in that there are channels between citizens and organizations/agencies in both directions, but not always between each other. One channel is specifically between citizens with no direct input from any organization. This process is very similar to Pechta, Brandenburg, and Seeger's Four Dynamics of Emergency Communication (2010) that incorporates multiple channels and implies cooperation from all parties. The Four-Channel Communication Framework (Pechta, Brandenburg, and Seeger 2010) was developed in part, from the idea that feedback is a necessary part of successful communication. The author's plan was to show that media is an integral part of current social media processes because the public is posting news-worthy items that may not have been covered by professional journalists, yet. This makes the public part of the media and the traditional media is informed through their (public's) posts. The process of top-down information flow is not evident in this model.

3.5.3 Communicating Risk: Two-way Communication

Those in risk, crisis, and emergency management have long recognized the need for public involvement in all phases of a hazardous situation: mitigation, preparation, response, and recovery (Lundgren and McMakin 2009; Reynolds and Seeger 2014, FEMA 2008). Incorporating two-way communication into the risk communication

process has been suggested by many (Kasperson and Kasperson 1996; Lundgren and McMakin 2009; Reynolds and Seeger 2014; Haataja, Laajalahti, and Hyvarinen 2016; Stewart and Wilson 2016), and not just since the arrival of the current social media blitz. Kasperson and Kasperson (1996) recognized the audience's need to be an active participant in communicating risks and crises because messages must be interpreted and are often seen through a cultural lens. The Social Amplification of Risk Model implies that a connection must be made during the discourse between the sender and receiver in order to make the significance of the message understood (Krimsky 2007). Several models incorporate the phases of a crisis (pre-crisis, crisis, and post-crisis) into the communication process because the type of communication varies, depending on its function. Stewart and Wilson (2016) developed the STREMII Model of Social Media Crisis Communication by examining the three-phase model (Seeger 2006), a four-stage model (Fink 1986) and Mitroff's (1994) five stages of a crisis lifecycle. The STREMII model integrates the functions of social media with the phases of a crisis and aligns the six model stages with the three models mentioned above. By examining crisis communication literature and best practices, this model was designed to be adaptable to any of the three crisis models and is prepared to be applied to an actual crisis communication plan.

3.5.4 Communicating Risk: Categories of Users and Uses

Houston et al. (2014) executed an in-depth review of current literature on social media in disasters through 2012-2013 in order to develop a framework of disaster social media. The authors compiled a list of users and uses of social media that had been a part of disaster studies. This approach was unique in that by isolating the phases of a disaster,

who used social media, when they used it, and for what purpose it was used, the framework developed could single out specific needs of the different groups who used social media. The 15 categories outlined could be grouped by the function social media performed, the type of group the user was a part of, or the phase of the disaster, being either pre-disaster, during the disaster, or post-disaster. By knowing the functions of social media during a disaster, specific tools could be developed to aid the various groups, whether they be emergency management agency, first responder, relief agency, community organization, or individual citizen. This framework also might be used to facilitate new processes of emergency management communications with the community, as well.

3.5.5 Communicating Risk: Tools for Analysis

Tools used to analyze social media such as *Twitter, Facebook, or Instagram* are extremely important because before, during, and after a disaster event there is a plethora of information entered on all varieties of social media. The individual messages can number in the hundreds of thousands (Spielhofer et al. 2016), making it a monumental task for emergency management personnel to sort through for the vital information needed to respond to those in need. A sampling of the tools currently being used are the following: Manual coding and analysis can be done using *CrowdFlower* (Imran et al. 2013), a crowdsourcing tool used to hand code categories found in collected messages. Manual coding is labor-intensive and slower than machine learning tools. Mehta, Bruns, and Newton (2017) discussed a lesser used process of using crowdsourcing as a verification tool to deal with an already available volunteer source. The set-up includes

using those regular or reliable communities in touch with emergency management to evaluate information posted to social media sites and report their findings.

Automated platforms, or machine learning tools for coding messages, include *Artificial Intelligence for Disaster Response*, that classifies individual tweets from user-defined classifications; *Tweedr*, that can cluster tweets into groups by similarity; and *Apache Solr*, which is scalable, or able to expand to multiple servers as needed to accommodate the volume of messages (Spielhofer et al. 2016). One of the processes used to make the enormous amount of data usable is to reduce "noise" or remove irrelevant information or messages. This may be done using the Naive Bayes Classification (Imran et al. 2013; Spielhofer et al. 2016) which uses conditional probability to identify spam. A similar process called Weka, whose development dates back to 1997 at the University of Waikato in New Zealand, also uses Naïve Bayesian classification for predictive modeling and data analysis (Imran et al. 2013). Location detection is important to eliminate messages that reference similar disasters that may be occurring in different locales, so Spielhofer et al. (2016) implemented a gazetteer called *GeoNames* that provides coordinates (latitude/longitude) for specific place names in the U.K. This platform was helpful but required that messages mention a location or be geotagged, which only occurred on a small percentage of tweets examined.

Other algorithms introduced include the Soft Frequent Pattern Mining (SFPM) (Gaglio, Re, and Morana 2016) which they updated to accommodate real-time, dynamic scenario detection in *Twitter* feeds and re-introduced as the *Twitter* Live Detection Framework (TLDF). This process queried *Twitter* using key words that were continually refined as new trending terms emerged. The authors also did a comparison of the basic

SFPM approach with two other real-time algorithms; *enBlogue,* which monitors tagged topics through time-sliding windows, and *TwitterMonitor*, that detects trending topics on *Twitter.* Also mentioned was *TwitterStand*, designed to process groups or clusters of news tweets (Gaglio, Re, and Morana 2016).

3.5.6 Communicating Risk: Multi-directional Communication

Cultural Theory was applied to risk and risk perception by Raynor (1992) to explain that a single message would not be interpreted by all individuals or groups in the same manner; that perceptions of risk would vary along gender lines, age groups, generations, and cultures. These varieties of "receivers" would require different types of messages and communication techniques to insure understanding and proper responses were made. Multi-directional communication, via mass media, community outreach and meetings, phone centers, and the use of flyers and pamphlets would be necessary to get the word out and receive appropriate feedback from the public.

3.5.7 Communicating Risk: 4-Channel Communication Model

Communication channels that function during a disaster or crisis event and the role of various "publics" (defined as non-government organizations, media reporters, and journalist, businesses, and citizens) have become more complex with the advent of social media and wireless technologies, consequently integrating the dynamics of emergency response with the new technology was proposed in order to enhance the richness of information flow (Pechta, Brandenburg, and Seeger, 9).

This research concluded that "the media is included as a "public" because media traditionally has created the public space in which people meet…" (Deane 2007). Because firsthand accounts of a disaster or crisis event can be found in public media

spaces, this provides a medium where traditional media, new social media, and "citizen journalism" have blended, and essentially shows the public talking to itself. (Pechta, Brandenburg, and Seeger, 9). By introducing a four-channel model that visualizes the dynamic flow of information between agency, media, and the public, this process may explain and highlight opportunities for emergency management officials to increase situational awareness while accessing "up to the minute" information from public sources during a crisis situation (Pechta, Brandenburg, and Seeger).

3.5.8 Communicating Risk: Self-organizing Communication Model for Disaster Risk Management

Al-Taie and Ali (2017) propose the exclusion of relief agencies as intermediaries between the public and social media. They suggest that intelligent applications take responsibility for coordinating communications between the different components involved in the communication circuit. Their model was inspired by Pechta, Brandenburg, and Seeger's 2010 4-channel model of communication.

3.5.9 Communicating Risk: Conceptual Framework for Risk Communication

The Conceptual Framework for Risk Communication (Figure 3.5.9) was adopted by Blanchard (1992) in conjunction with non-emergency warnings via public information and notification in order to test why individuals "heard" a long-term, low-key warning and how they responded. The author explained how this communication process was often used to persuade through marketing or advertising practices and assumed the following: 1) one-way information flow from the organization to a particular audience; 2) that understanding the audience was important to effective communication; and 3) that achieving the desired behavior from the audience determined success (Blanchard 1992).

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This model only includes the outflow of a message to a specific audience, but those in risk, emergency and disaster communication understand that this is only one part of the communication process (Reynolds and Seeger 2014). Sending the message is necessary to elicit a response from the target audience. Therefore, how the message is crafted depends on the credibility of the source, characteristics of the organization sending the information, the type of message they want to convey, and their knowledge of the specific audience receiving the message. After the message is prepared, there are many channels that may be used to broadcast the information. In pre-Internet times, mass media was used and included newspapers, television, and radio.

CONCEPTUAL FRAMEWORK FOR RISK COMMUNICATION
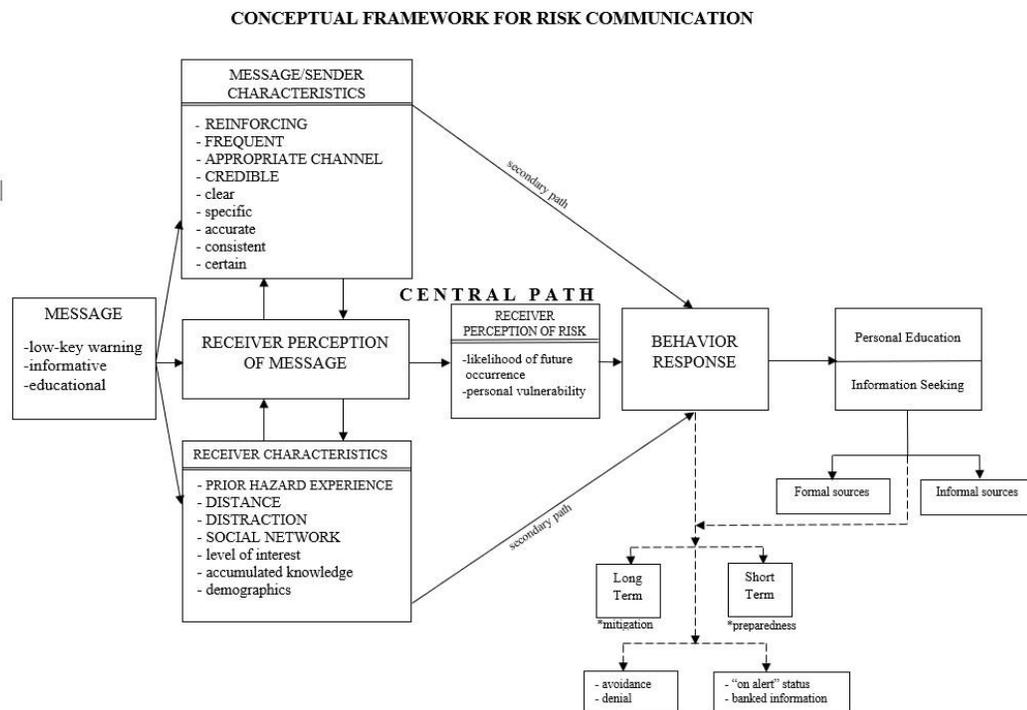
Figure 3.5.9. Conceptual Framework for Risk Communication (Blanchard 1992)

Television news changed in 1980 when cable became readily available to the public and CNN began broadcasting 24-hour news (Stempel 1988). This specific channel showed

international, national, and some limited local news, if interesting enough, and disasters were high on the list of preferred programming.

With the advent of the World Wide Web in the mid-1990s, also known as the Internet, the variety of information channels has expanded exponentially (Peterson, Balasubramanian, and Bronnenberg 1997). These channels are not limited to specific timeframes like the newspapers, which would generally print one edition for the morning and possibly a special edition for extreme circumstances, or the thirty-minute time slots for the morning or evening news, or the 5-minute news breaks on radio programs. The Internet is available to anyone with Internet access and a wired or wireless device, twenty-four hours a day, seven days a week, 365 days per year (Peterson, Balasubramanian, and Bronnenberg 1997). The advantages of the Internet are not limited to the ways an organization can send a message. Individuals may respond immediately to the message via email messages, comment sections on organization web pages, or they may make comments to their friends on social media, spreading the message and their perceptions of it, along to others. The Internet makes any message sent potentially multi-directional because the individuals who hear the message may not reply directly to the sender but may send the message along to others who may forward it to others, bouncing the message across the globe.

For this reason, an organization trying to send risk, emergency, or disaster information needs to be aware of who needs to hear it, how they need to hear it, and the best channel for sending it so that they hear it in a timely fashion. The message must also be perceived as credible, clear, specific, accurate, consistent and frequent (Haataja, Laajalahti, and Hyvarinen 2016; and Veil, Buehner, and Palenchar 2011).

The characteristics of the target audience are very important, as well. Depending on their prior experience with a particular hazard, some individuals may or may not heed information or follow directives from official agencies. They may be listening to those in their personal social network, online or offline. They may lack interest or think that they have enough information to make their own decisions without input from official sources. Their demographic setting may mean that they are economically disadvantaged, or they may be elderly or physically impaired and unable to comply with official directives, as with Hurricane Katrina (Mazur 2011; Houston et al. 2015). Any of these characteristics might prevent the individual hearing the message from giving the desired response. In a crisis or disaster, people may experience high levels of stress and information overload which cause them to misunderstand or misinterpret information, not remember as much information as they might in normal circumstances, and many may fall back on old habits or comfortable practices. People in disaster situations (receivers) may not accept messages that seem illogical or counterintuitive, such as evacuating their home when it seems safe and secure, and by justifying their decision based on previous occurrences (Mazur 2011; Houston et al. 2015). Authority figures (senders) may be new faces, or experts may give conflicting information regarding threat levels or advice, both of which reduce credibility about the information source (Reynolds and Seeger 2014). Trust is important in the exchange of information between sender and receiver because without credibility, the information may not be accepted and acted upon (Mehta 2017). Many people will also need to be reassured that the risk is real and will want to confirm the warning by checking with other news stations, contacting family and friends to see if they received the same information, or checking with social media to see what others are

saying and thinking. People often believe the first message received, no matter how inaccurate it may be. If that message is incomplete or lacks details, many may begin to speculate or try to fill in the blanks via rumors. As new information becomes available, it will be compared to the first message (Reynolds and Seeger 2014).

3.5.10 Communicating Risk: Approaches

Analysis of previous literature on the use of social media during disasters (Houston et al. 2014) produced a comprehensive list of how social media was used, and correlated each use to a disaster phase, either pre-event, event, or post-event. This information was used to discuss a framework for how organizations and communities could make effective future use of social media before, during, and after a disaster event.

Table 3.5.10. Functions and Approaches using Social Media in Disasters

Houston et al. 2014, Functions (15)	Disaster Phase	Lundgren and McMakin 2009, Approaches (11)
1. Provide and receive disaster preparedness information	Pre-event	1. Communication Process Approach 4. Convergence Communication Approach
2. Provide and receive disaster warnings	Pre-event	5. Three-Challenge Approach 6. Social Constructionist Approach
3. Signal and detect disasters	Pre-event and Event	2. National Research Council Approach 3. Crisis Communication Approach 7. Hazard plus Outrage Approach 8. Mental Noise Approach 9. Social Network Contagion Approach 10. Social Amplification of Risk Approach 11. Social Trust Approach
4. Send and receive requests for help or assistance	Event	

Table 3.5.10 Continued

5. Inform others about one's own condition, location, and learn about a disaster-affected individuals condition and location	Event	
6. Document and learn what is happening in the disaster	Event and Post-event	
7. Deliver and consume news coverage of the disaster	Event and Post-event	
8. Provide and receive disaster response information, identify and list ways to assist in the disaster response	Event and Post-event	
9. Raise and develop awareness of an event; donate and receive donations; identify and list ways to help or volunteer.	Event and Post-event	
10. Provide and receive disaster mental/behavioral health support	Event and Post-event	
11. Express emotions, concerns, well wishes; memorialize victims	Event and Post-event	
12. Provide and receive information about (and discuss) disaster response, recovery, and rebuilding; tell and hear stories about the disaster	Event and Post-event	
13. Discuss socio-political and scientific causes and implication of and responsibility for events	Post-event	
14. (Re)connect community members	Post-event	
15. Implement traditional crisis communication activities	Post-event	

In each of the 15 functions discussed, there was at least a two-way

communication occurring, if not multi-directional. A provide/receive action was noted for

each, which indicated the common need to share information in a disaster situation.

Included in the table above (Table 3.5.10), Lundgren and McMakin (2009) discussed eleven approaches that also reinforced the need for communication give and take between agencies/authorities and stakeholders/citizens. Though the authors did not correlate their approaches to specific disaster phases, each one fell into either the pre-event or both pre-event and event phase. Because the approaches were concerned with how best to convey risk, there was a concerted effort to make connections with stakeholders/citizens in the most convenient terms, which included feedback channels, community meetings, and discussions.

These functions, via social media, and approaches consider the best ways to communicate information in a crisis situation, and in the process, may be compared to the Conceptual Framework for Risk Communication. The approaches discussed by Lundgren and McMakin (2009) take into consideration the need to work with stakeholders/citizens when communicating risk, that communicators need to be clear and specific, and that understanding the characteristics of different cultures and groups and how they are influenced will affect how they "hear" the messages being sent.

In sum, the aim of this chapter was to investigate the myriad theories, conceptualization, and approaches to risk communication to provide background, understanding, and insight into the forward progress in this area. In addition, the awareness of prior research will prove useful and necessary in developing the interview protocol as well as plans for "worded" data collection and analysis.

CHAPTER IV. METHODOLOGY

As presented in the Introduction and restated here, four goals guided this research: 1) to shed understanding and perspective on how and why social media was used by individuals at-risk during the Hurricane Harvey event; 2) to learn how individuals viewed social media as an effective means of communicating immediate and urgent needs for assistance; 3) to investigate and understand how emergency managers and other officials perceived and utilized social media as an effective communication tool for assistance during the hurricane event; and 4) to explore how the use of social media might improve risk communication between governmental agencies and the affected public during a hazard event.

To accomplish these goals, the research design and "worded" data collection required more than a singular, 'yes' or 'no' response on the interview protocol. This allowed for participants to explain, elaborate, and describe the role of social media for responding to their urgent and immediate needs during Hurricane Harvey. To that end, this chapter presents phenomenography, a qualitative method of inquiry chosen for collection of "worded" data in this research, and its purpose explained. First, the research questions are re-stated, followed by some background and the development of phenomenography. Second, the study population will be introduced, and the qualitative sampling parameters enumerated. Third, credibility and transferability of results and conclusions are explained along with ethical considerations for the researcher. Finally, "worded" data collection procedures and the survey interview process will be explained.

4.1 Study Questions

According to Merriam and Tisdell (2015), research is the process of gaining knowledge about something through study, and through that process, a contribution is made to a specific field or discipline (p. 5). Applied research is often used to improve policies or procedures by studying effects of an event and using the findings to inform future decisions (p.4). The plan for this research was to examine the positive uses of social media during a disaster event and how social media might be applied to risk and emergency management communication procedures. In this research, qualitative methods provided a unique opportunity to delve into the lived experiences of individuals who turned to social media for help, and reasons for using this medium. The interview protocol was semi-structured, which allowed for questionings that gave participants a chance to give context to, and fully explain, why they chose social media for individual risk communication.

Participants included Houston area residents and emergency management personnel to ensure diverse perspectives. As presented earlier, the research questions that guided the interviews were as follows:

1) To what extent did residents of the Houston-Galveston metro area use social media during Hurricane Harvey?

a) What was the process of risk communication involving social media?

b) Did process of risk communication vary by specific demographic or personal need;

2) To what extent did individuals believe that social media was an effective means of communicating immediate and urgent needs for assistance;

3) To what extent did emergency management procedures provide channels of information gathering during Hurricane Harvey?

a) How was social media instrumental in risk communication?

b) Which method was easiest, most difficult, most effective to use?

c) What were the positive and negative aspects of the methods for the social media used;

4) How might usages of social media be improved for risk communication between governmental agencies and the affected public during a hazard event.

4.2 Phenomenology vs. Phenomenography

There is often some confusion when discussing phenomenology and phenomenography, so below (Table 4.2) is a comparison table to aid in the explanation of similarities and differences in the two research designs (Cibangu and Hepworth 2016).

Table 4.2 Phenomenology vs. Phenomenography

PHENOMENOLOGY	PHENOMENOGRAPHY
Definition: to understand someone's experience; the essence of the phenomenon	Definition: to describe the ways that someone perceives or understands a phenomenon
Similarities	
Looks at a phenomenon	Looks at a phenomenon
Exploratory in nature	Exploratory in nature
Relationship between person and phenomenon	Relationship between person and phenomenon
Purposive sampling – selective/subjective	Purposive sampling – selective/subjective
Differences	

Table 4.2 Continued

Homogeneous sample – people with similar characteristics	Heterogeneous sample – people don't have same characteristics, but have a wide range of experience with the phenomenon
Unstructured questionnaire	Semi-structured questionnaire
Condenses information to the primary understanding of the phenomenon	Categorizes the variations of the phenomenon-focused on conceptions of phenomenon, not the phenomenon, itself

The two designs have similarities in that they both look at a phenomenon, are exploratory, examine relationships, and use purposive sampling (Cibangu and Hepworth 2016). The differences are what make phenomenography most suited to this study. Phenomenography uses a heterogeneous sample so that you have a wide variety of participants with different characteristics who have all experienced the same phenomenon, rather than people with similar characteristics relating to the phenomenon. Semi-structured questionnaires are used in phenomenography to aid in clarification and the collection of specific characteristics of the participants and their experiences. Finally, the most telling difference between the two designs is that the final outcomes are opposites. Phenomenology gathers multiple pieces of information and condenses the ideas into one meaning related to the phenomenon (Cibangu and Hepworth 2016). Phenomenography analyses the variations of use or meaning of the phenomenon to determine the multiple ways (the "how" or "why") or "distinctiveness" (Marton and Booth 1997) in which the phenomenon was used (Figure 4.2). The distinction between the two final outcomes determined that phenomenography would produce the research outcomes needed to show the extents that social media was used during Hurricane Harvey.

Phenomenology

Experiences with phenomenon

Analysis boils
down to
meaning

Meaning of phenomenon

Phenomenography

Relationship with phenomenon

Analysis
categorizes the
variations of
meaning

How or why phenomenon was used
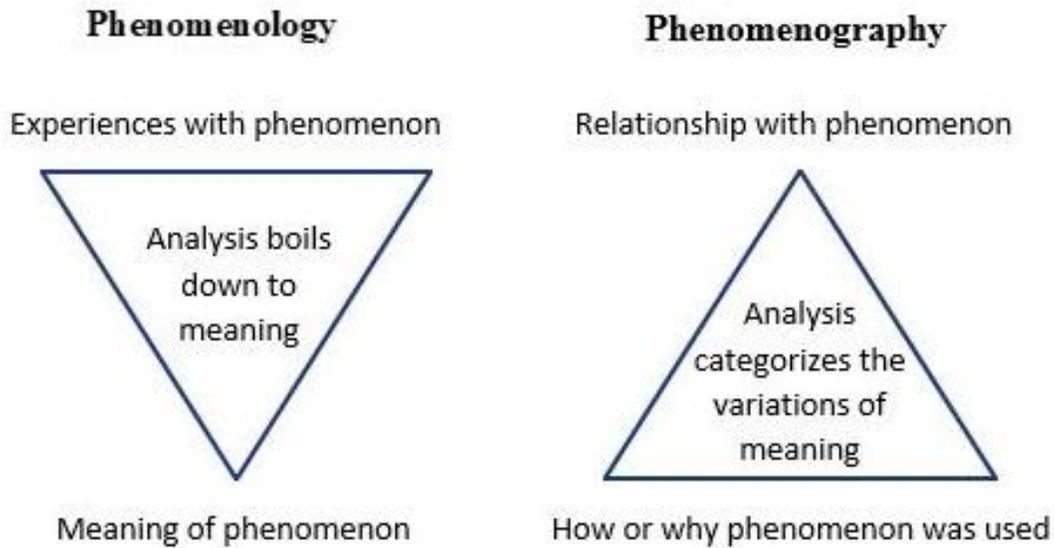
Figure 4.2 Graphic Representation of Analysis Process between Designs

4.3 Phenomenography: Its Criteria for Use and Adaptation to This Research

According to Ference Marton (1981, 180), the aim of phenomenography is "to find and systematize forms of thought in terms of which people interpret aspects of reality--- aspects which are socially significant, and which are at least supposed to be shared by the members of a particular kind of society; mainly our own industrialized Western society." In other words, people in the same place, at the same event, may see the same thing, but due to their frame of mind, cultural background, or other social bias, may interpret that event differently than the person standing next to them. This form of research is meant to map those thoughts into categories and show how they are different, but related.

Phenomenography was not derived from phenomenology, but the two are complementary. While phenomenology looks for the "essence" of an experience (p.180), phenomenography tries to describe how people perceive and conceptualize something (Marton 1981, 181). Trigwell (2006, 368) reiterates that in phenomenography, "the aim is

to discover the key aspects of the variation in how a group of people experience or understand the phenomenon under investigation." Thus, this research was concerned with describing the differences, not the similarities, in how people experienced and understood the use of social media during Hurricane Harvey.

Phenomenography appeared as a new approach in the 1980s, and the term was coined by Ference Marton (1981) from Sweden. It has been popular in the United Kingdom (U.K.), Australia, and China (specifically, Hong Kong), usually being applied to learning and teaching phenomena (Akerlind 2005). Since those at-risk must hear, learn and then respond to disseminated warnings information, this approach was ideal.

Many authors have explained that phenomenography is not philosophically or theoretically based, but more empirical (Akerlind 2005; Svensson 1994) and primarily about outcomes (Trigwell 2006). Marton and Booth (1997) implied an "outcome space" when they developed their "criteria of distinctiveness." This provided a structural process that reflected something distinctive about the phenomenon and where data could be organized in a hierarchy where lower-level categories were grouped under higher-level ones, and where fewer categories depicted a variety of experiences with the phenomenon (Gonzalez 2010). This *outcome space* represents the *collective experience* of a particular phenomenon in a logical and hierarchical manner, such as a table or chart.

Phenomenography is used to process "worded data" or interview information and categorize or group the answers from large and small pieces, either by sentences, phrases or individual words, into concepts. These concepts emerge as the data are examined to show the participant's perceived understanding of the research topic (Khan 2014), that is, the use of social media during Hurricane Harvey. Relationships were developed between

the participants and their particular "aspect of the world" (i.e., social media use) as the

data was evaluated.

There are inherent relationships between the researcher, participants, and the

object being studied, as illustrated by Khan (2014) below (Figure 4.3a).
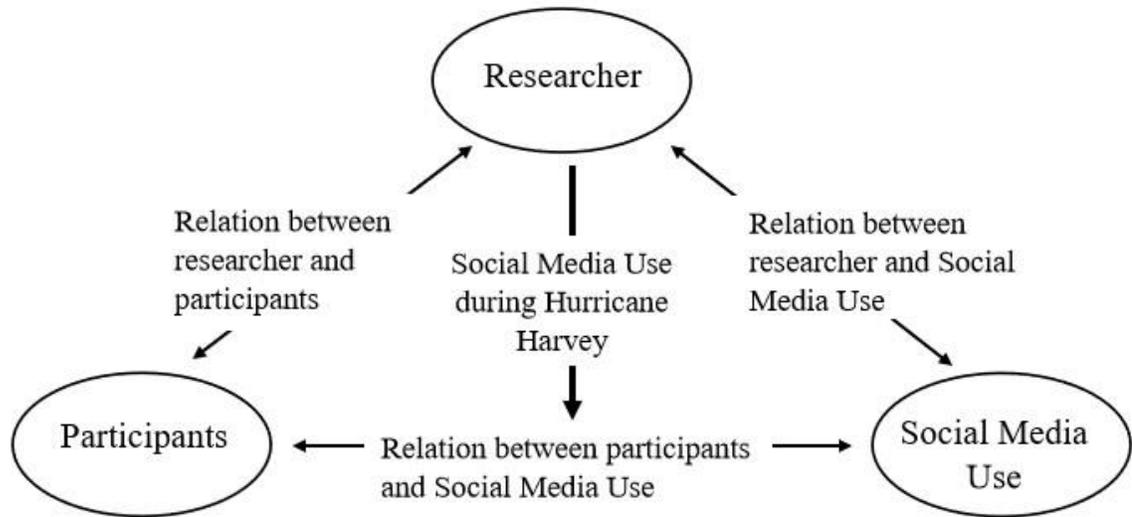
Figure 4.3a Relationship between objects with participants and researcher
Source: Khan (2014)

The object and the participant are not separate after the experience but become

"intertwined." In other words, the process of experiencing the phenomenon generates

relationships between the participant and the object, though those relationships may vary,

depending on the type of experience.

The action of using social media while experiencing Hurricane Harvey provides the

consequence of relationships between participants and the research topic of social media.

Gonzalez (2010) describes the relationships between conceptions as "dimensions of

variations." This process of conceptualizing the use of social media generates the

relationships because the participants may be using social media for different specific purposes; nonetheless those purposes may be categorized in similar ways, such as incoming or outgoing emergency management information or active searching for information. The participant's conception of social media becomes a variation in the relationship structure.

Khan (2014) explains that there is a "Structural and Referential Aspect" to the experience that includes "Internal and External" purposes for the action (Figure 4.3b). The "Structural Aspect" is defined as an action--how someone acts upon or carries out the action. There are two processes associated with the "Structural Aspect"—the "External and Internal Horizons". The "External Horizon" discerns a phenomenon from the outside while the "Internal Horizon" is the way of discerning the experience or phenomenon as its parts, as well as the relationship between those parts (Marton and Booth 1997). Finally, the "Referential Aspect" of the phenomenon refers to highlighting the specific meaning or direct object. Khan (2014) defines it as "a particular phenomenon which we are undergoing (experiencing) as the way it is."
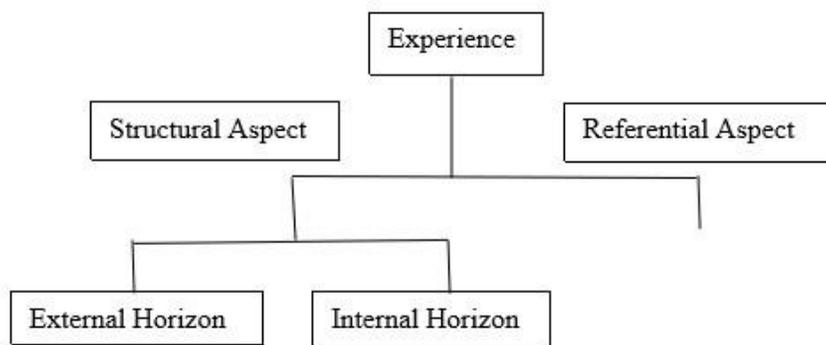
Figure 4.3b Khan's (2014) Component of Experience. Source: Marton and Booth 1997

When applied to this research on the use of social media during Hurricane Harvey, the

interpretation process of data is reflected in Figure 4.3c.
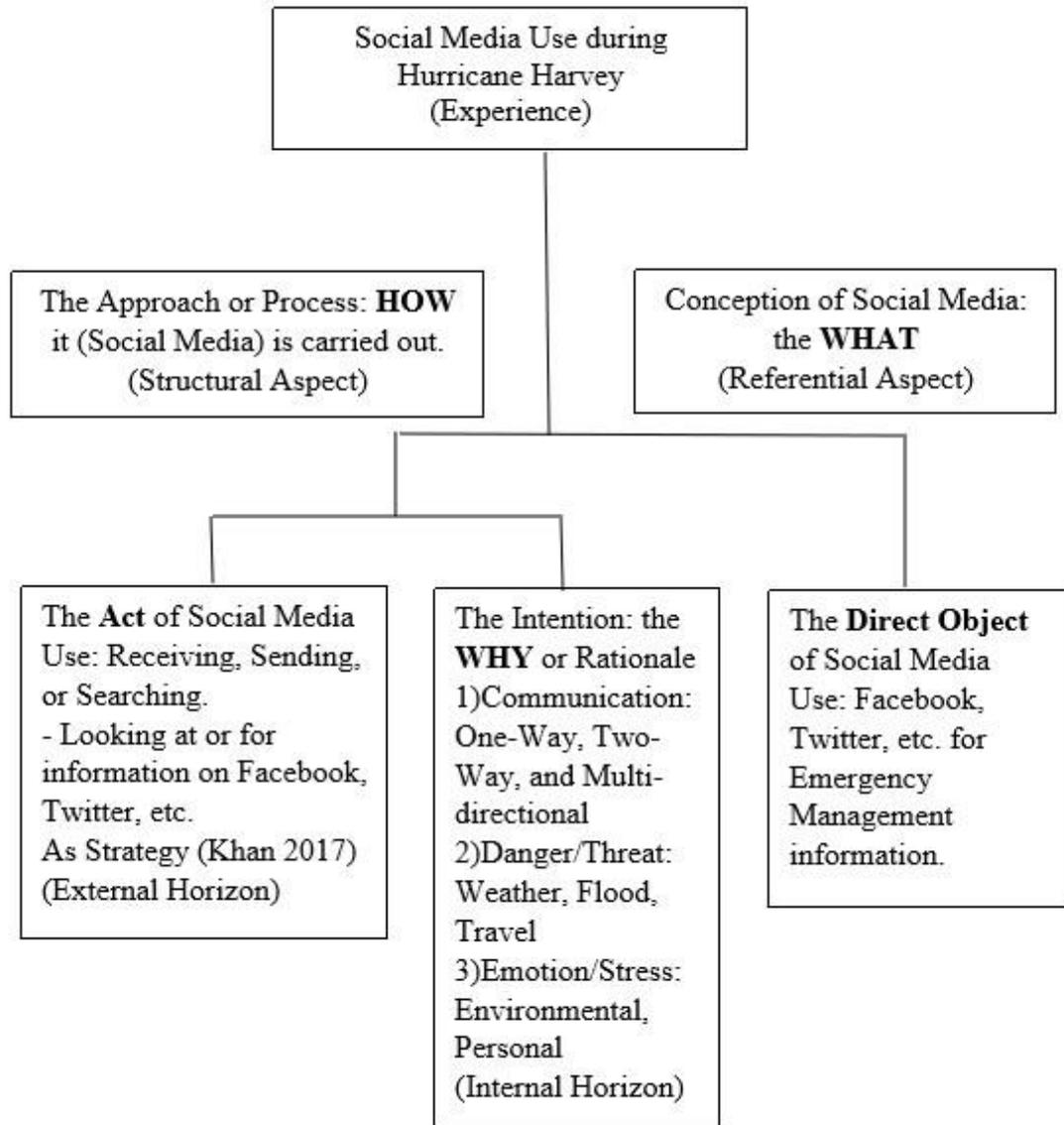
Figure 4.3c Component of Experience Applied to Social Media Use during Hurricane
Harvey. Source: Khan (2014)

In adapting Khan's conceptualization (Figure 4.3c), the Experience component

represents the aim of the study, that is, the use of social media during Hurricane Harvey.

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Experience then has two aspects—a Structural Aspect (left) and a Referential Aspect (right). The Structural aspect considers the "How," or the approach or process of using social media (as in, how that usage is carried out or the methods used). These methods include applications such as *Facebook, Twitter, Instagram*, or *Nextdoor* for general communication and applications for specific information such as WAZE, or similar to wayfinding applications like a Global Positioning System (GPS) or a *Garmin*, and emergency management websites.

The Structural aspect (the "How") is then subdivided into the External Horizon and the Internal Horizon. The External Horizon encompasses the specific Act (or behavior) involved in using social media, or what Khan (2017) refers to as the strategy for use. This bracket includes the applications for the processes of social media use, as well, such as the receiving, sending, or searching for information that relates to Emergency Management Communication during Hurricane Harvey. The second bracket, the Internal Horizon, focuses on the intention for the use of social media, or the "Why." In this case, the "Why" encompasses the participant's need for specific information during Hurricane Harvey.

The Referential Aspect (right side) of Experience depicts the conception of social media, the "What" or the Direct Object (Khan 2017). The object of use, then, includes the range of available social media usages, such as *Facebook, Twitter,* or WAZE, etc., over which the emergency management information is disseminated.

The analysis of protocol items was processed through several iterations, examining the data from different perspectives (on the researcher's part), and extracting meaning from individual quotes and comments as well as seeing a single interview from a holistic

perspective. Worded data was categorized and re-examined for relational connections to other data in other categories because often, two people may experience the same event but express what happened in more than one way. Either they felt differently about what happened or perhaps they used different vocabulary to explain it, which might cause a different interpretation of the experience.

There are also social and cultural components related to how a phenomenon is conceptualized and perceived, which may augment an individual's meaning. By re-examining the data, interpretations can be expanded and connected to similar meanings. Marton (1981, 7) enumerated the points to consider, including:

1. What the different phenomena are seen as.

2. What the phenomena appear to be.

3. What their potentially differing meanings are.

4. How they are delimited from and related to their context, as well as other phenomena.

5. From what point of view the phenomena is seen.

During the sorting process, *differences* in responses were emphasized rather than similarities. The focus was on the variety or *variances of meaning* found through the descriptions of experiences (Marton 1981; Walsh et al. 1993; Svensson 1994; Trigwell 2006). By exploring the phenomenon of social media during a disaster event such as Hurricane Harvey, this research aimed to provide support for the implementation and wide-spread use of social media by risk and emergency management communication personnel.

4.4 Population and Sampling

Interviews were conducted in the Houston-Galveston metro area, including Harris County, Fort Bend County, and Galveston County –areas where residents were highly affected by Hurricane Harvey in August of 2017. The parameters noted below are criterion-based, in that the selected participants were exposed to the same event and had similar opportunities to access risk communication via social media (Merriam and Tisdell 2016). The probing nature of the interview questions was used to determine to what extent participants used or were affected by social media during Hurricane Harvey.

The study area was defined to enlist participants who were residents of the Houston metropolitan area affected by Hurricane Harvey as well as emergency management officials of various Houston area governmental organizations. Participants fell within the following parameters:

1) They were in the Houston-Galveston metro area during Hurricane Harvey.

2) They received information about Hurricane Harvey via various types of media, i.e. TV, radio, newspapers, social media (*Facebook, Twitter, Instagram*, etc.), or word of mouth from friends or family.

3) They shared information about Hurricane Harvey via various types of media, i.e. TV, radio, newspapers, social media (*Facebook, Twitter, Instagram*, etc.), or word of mouth to friends or family,

4) They were willing to be interviewed for this study.

The objective was to interview at least 20 participants. The final number was comprised of 21 residents and four emergency management department personnel. This number was

suggested as adequate for a phenomenographic study by Trigwell (2006). Duplications of answers to primary questions such as methods of social media used, information searched for, and suggestions for more effective emergency management communication indicated a saturation of like-minded perceptions which also indicated that the research was considered sufficient. The intent of the interviews was to have participants tell their stories involving social media use during Hurricane Harvey, not to get survey specific short answers, though there were some yes/no, demographic, and Likert scale questions included in the process. Analysis of the participant's stories with explanations of how and why they used social media was necessary to find the "uniqueness" of their answers.

The sampling method was a nonprobability, purposive method (Merriam and Tisdell 2016) used to "discover, understand, and gain insight" about a qualitative problem, and for which quantitative methods were inadequate. Patton (2015) explains that purposeful sampling provides an opportunity to learn what is most important or the primary purpose of an inquiry. Initially, the participants were previously known to the investigator, and then a snowball process (Creswell 2009) was used to invite additional participants who might fulfill a broader demographic of the study. Convenience sampling was also employed (Etikan, Musa, and Alkassim 2016) because of the locality (Houston area), the researcher's familiarity with the locale, and availability of the additional participants. Convenience sampling was applied to this population because there was a high density of possible candidates available, they were affordable to access, and there was still an aspect of randomness to the candidates because not all were previously known to the researcher. It was preferred that there be a variety of socio-economic levels, ethnic backgrounds, gender, and age categories to be interviewed because citizens in all

walks of life experienced the storm, but most certainly were affected in different ways. Participants were less diverse than expected, but there was a representation for each age category, income level, and three racial representatives. U.S. Census data was used to determine specific categories for income levels and age brackets (Figure 4.4). The participants were noted under the U.S. Census data categories and marked on a map of the Houston area to determine spatial coverage of the study area. The snowball method and convenience sampling of additional participants began at the end of each interview by asking the current participants for suggestions and/or contact information of other possible candidates.

Table 4.4 Demographics of Participants – from *NVivo 12 Plus*

	A : Gender	B : Age Group	C : Race or Et...	D : Income level	E : Household Status	F : ZipCode
1 : Participants Citizens	Unassigned	Unassigned	Unassigned	Unassigned	Unassigned	Unassigned
2 : 1001 Nvivo	Female	31-40	White	60-79,999K	Married with children	77503
3 : 1002 Nvivo	Male	51-60	White	More than 150K	Married with children	77479
4 : 1003 Nvivo	Male	61-65	White	More than 150K	Married with children	77459
5 : 1004 Nvivo	Female	23-30	Hispanic	20-39,999K	Single	77072
6 : 1005 Nvivo	Female	41-50	White	60-79,999K	Married with children	77573
7 : 1006 Nvivo	Male	51-60	White	40-59,999K	Single	77089
8 : 1007 Nvivo	Female	23-30	White	40-59,999K	Married with children	77478
9 : 1008 Nvivo	Female	31-40	White	40-59,999K	Single with children	77573
10 : 1009 Nvivo	Female	31-40	White	60-79,999K	Married with children	77096
11 : 1010 Nvivo	Female	31-40	White	80-99,999K	Single with children	77377
12 : 1011 Nvivo	Female	41-50	White	40-59,999K	Single with children	77437
13 : 1012 Nvivo C	Female	51-60	Hispanic	20-39,999K	Married	77072
14 : 1012 Nvivo T	Male	51-60	White	40-59,999K	Married	77072
15 : 1013 Nvivo	Female	31-40	White	60-79,999K	Single	77070
16 : 1014 Nvivo	Male	18-22	Black	Less than 20K	Single	77005
17 : 1015 Nvivo	Male	51-60	White	100-150K	Single	77096
18 : 1016 Nvivo	Male	61-65	White	40-59,999K	Married	77096
19 : 1017 Nvivo	Female	61-65	White	20-39,999K	Married	77096
20 : 1018 Nvivo	Female	61-65	White	40-59,999K	Single	77401
21 : 1019 Nvivo	Female	51-60	White	40-59,999K	Married	77469
22 : 1020 Nvivo	Male	51-60	White	40-59,999K	Single	77380

Case Classifications

Name
Emergency Manageme
Person
 Name
 Gender
 Age Group
 Race or Ethnicity
 Income level
 Household Status
 ZipCode

Figure 4.4 Location of Participants by Zip Code

4.5 Data Credibility in Qualitative Research

Qualitative research encompasses different assumptions from quantitative research such that "more" does not always mean better results. To elaborate; qualitative data is concerned with the features, attributes, and characteristics of phenomenon that can be interpreted thematically (2011 DeFazio). For example, this research, through phenomenography, explored reasons, choices, and behaviors of people who turned to social media during a disaster. On the other hand, a quantitative approach would relate to quantities, amounts, and measurements that can be expressed in numbers and tested for

statistically significant differences. For instance, in Harvey, a researcher might perform a

t-Test between respondents in evacuation zones 1 and 2 on a variable that measures

perceived risk, say using a Likert scale. More importantly, the overarching advantage of a

qualitative approach, because it is conducted in early, exploratory stages, is that ideas

and/or hypotheses emerge from it for later stages of empirical testing using a quantitative

research paradigm. Thus, a major contribution of this research is that is provides

suggestions and future guidance for expanding and empirically testing the "General

Model of Risk Communication" (discussed in Chapter III)—a process model of hazards

communication that is currently the *status quo*, but does not address and/or note the

significance of social media's role (DeFazio 2011). Table 4.5 below provides the general

differences between a qualitative and quantitative approach.

Table 4.5 Comparison of Qualitative and Quantitative Approaches. Source: DeFazio, S.E. 2011.

Qualitative Research Method	Quantitative Research Method
▪ Methods include focus groups, in-depth interviews, and reviews of documents for types of themes	▪ Surveys, structured interviews & observations, and reviews of records or documents for numeric information
▪ Primarily inductive process used to formulate theory or hypotheses	▪ Primarily deductive process used to test pre-specified concepts, constructs, and hypotheses that make up a theory.
▪ More subjective: describes a problem or condition from the point of view of those experiencing it	▪ More objective: provides observed effects (interpreted by researchers) of a program on a problem or condition
▪ Text-based	▪ Number-based
▪ More in-depth information on a few cases (more and deep collect information but few cases…)	▪ Less in-depth but more breadth of information across a large number of cases (less and shallow information but large number of cases)
▪ Fixed response options	▪ Unstructured or semi-structured response options
▪ Statistical tests are used for analysis	▪ No statistical tests]
▪ Can be valid and reliable: largely depends on the measurement device or instrument used	▪ Can be valid and reliable: largely depends on skill and detail of the researcher
▪ Time expenditure heavier on the planning phase and lighter on the analysis phase	▪ Time expenditure lighter on the planning end and heavier during the analysis phase
▪ More generalize	▪ Less generalize
▪ Human behavior model	▪ Natural science model

4.6 Alternative Measures of Credibility in Qualitative Research: Truth Value, Consistency, and Adaptability (Transferability)

It is important to accurately document the thoughts and feelings of participants while keeping the research methods transparent to those who read the study (Merriam and Tisdell 2016). The process should produce plausible interpretations from identified elements reported from participants, but not necessarily an ultimate truth or correct answer (Merriam and Tisdell 2016, p. 240). Noble and Smith (2015) write that, "demonstrating rigour when undertaking qualitative research is challenging because there is no accepted consensus about the standards by which such research should be judged" (34). They further explain that tests and measures used to establish the validity and reliability of quantitative research cannot be applied to qualitative research, as found in ongoing debates about whether terms such as validity, reliability and generalizability are appropriate in evaluating qualitative research (34).

Therefore, given that qualitative methods are inherently different from quantitative methods in terms of philosophical positions and purpose, this research proposes to adopt Lincoln and Gupta's alternative criteria of *truth value, consistency and neutrality,* and *applicability (or transferability).* Table 4.6a below compares quantitative research terminology applied to qualitative research (Long and Johnson 2000) and alternative terminology associated with credibility of qualitative research (Lincoln and Guba 1985).

Table 4.6a Terminology and Criteria Used for Evaluating the Credibility of Qualitative Research

Quantitative research terminology and application to qualitative research	Alternative terminology associated with credibility of qualitative research

Table 4.6a Continued

VALIDITY	TRUTH VALUE
The precision in which the findings accurately reflect the data.	Recognizes that multiple realities exist; the researchers' outline personal experiences and viewpoints that may have resulted in methodological bias; clearly and accurately presents participants' perspectives.
RELIABILITY	CONSISTENCY
The consistency of the analytical procedures, including accounting for personal and research method biases that may have influenced the findings.	Relates to the 'trustworthiness' by which the methods have been undertaken an is dependent on the researcher maintaining a 'decision-trail'; that is, the researcher's decisions are clear and transparent. Ultimately, an independent researcher should be able to arrive at similar or comparable findings.
	NEUTRALITY OR CONFIRMABILITY
	Achieved when truth value, consistency and applicability have been addressed. Centers on acknowledging the complexity of prolonged engagement with participants and that the methods undertaken, and findings are intrinsically linked to the researchers' philosophical position, experiences and perspectives. These should be accounted for and differentiated from participant' accounts.
GENERALIZABILITY	APPLICABILITY
The transferability of findings to other settings and applicability in other contexts.	Consideration is given as to whether the findings can be applied to other contexts, settings, or groups.

Adapted from: Noble, H. and J. Smith (2015, 34); Long, T. and M. Johnson (2000) and Lincoln, Y.S. and E.G. Guba (1985).

By understanding that the perspectives of different participants will produce a complex view of human behavior, the plan for this research was to use concrete data (specific terminology) used by the participants to correlate thoughts and feelings about how risk communication was used, specifically through social media. The interviews were combed for data, specific word choice, and situational responses first by employing

organizational assistance through *NVivo 12 Plus* software and then by hand-coding to
ensure consistency through multiple passes through the information shared with the
researcher. Methodological strategies were developed from the credibility criteria set
forth above to ensure 'trustworthiness' of the findings. The strategies and associated
activities to ensure credibility appear in the table below (Table 4.6b).

Table 4.6b Strategies and Activities for Enhancing Research Credibility

Truth Value
Reflexivity and reflection on own perspectives:
Maintained daily reflections in personal notes; thoughts and decisions well-documented.
Debriefed with Advisor to assist in uncovering biases, or assumptions.
Initial qualitative interviews with participants were focused on obtaining sufficient information and following protocol closely.
Employed a more holistic approach with subsequent reflection.
Representativeness of the findings in relation to the phenomena:
Observed enthusiastic willingness of participants to share their experiences in depth and over time enabled clarification of findings as an ongoing process;
Repeated visiting of semi-structured audio recorded interviews to check *emerging themes* and remain true to participants' accounts of the need to turn to social media during the disaster;
Invited participants to comment on the research findings and themes.

4.6b Continued

Triangulated data for verification - two or three sources were compared against each other to provide substance or validity to statements made. Examples include:

(1) *Reviewed formal reports, information from emergency managers and news accounts on the hurricane's intensity which were then,*

(2) *Compared against participants' responses.*

(3) *Employed "respondent verification"* where participants enhanced their responses with other sources, such as showing the interviewer Facebook postings. (from Merriam and Tisdell 2016; Patton 2015).

(4) *Employed "respondent validation"* where previously interviewed participants were asked if particular information from other participants sounded correct (Merriam and Tisdell 2016, 246).

(5) Included *participants* that were able to document instances of social media use during the interview by *producing social media postings or other forms of social media communication.*

Consistency/ Neutrality

Achieving auditability:

Transparent and clear description of the research process developed and adhered to: from initial outline, through the development of the methods and reporting of findings.

Constant review of transcribed data. Dialog *reliability checks.*

Organization and *coding* of interview data *using NVivo.*

Manual coding of data for comparison *with NVivo.*

4.6b Continued

In addition, *researcher-maintained notes daily documenting challenges and issues assisted in maintaining cohesion between the study's aim, design and methods.*

Emerging *themes discussed with Advisor where assumptions could be challenged, and consensus reached.* Themes *compared with research literature.*

Applicability/Transferability

Application of findings to other contexts:

Rich detail of context

The *transferability* or the ability to apply the information gleaned from this study (Rishi 2014; Merriam and Tisdell 2016, 254) indicated that the use of social media by participants in this research were concrete examples of *positive aspects* of social media as a communication medium for risk and emergency managers. Gathering data rich in detail and specificity provided avenues for further use or development of social media and its applications. There have been many studies that note the barriers to adoption and implementation of social media, including:

1) difficulty processing the large amounts of data (Plotnick and Hiltz 2016; Anson et al. 2017),

2) lack of organizational support (Haataja, Laajalahti, and Hyvarinen 2016; Plotnick and Hiltz 2016; Al Taie and Ali 2017; Anson et al. 2017),

3) lack of resources, such as staff or time (Haataja, Laajalahti, and Hyvarinen 2016; Plotnick and Hiltz 2016; Anson et al. 2017),

4) lack of policy or guidelines for use (Plotnick and Hiltz 2016; Anson et al. 2017),

4.6b Continued

5) problems with trusting data from outside the organization (Plotnick and Hiltz 2016;

Al Taie and Ali 2017).

4.7 Ethical Considerations

Ethical considerations do not lie only with the method used or the techniques used in analysis, but in the researcher, one's values, and adherence to strict thinking as to proper study procedures. This study followed the ethical standards required by the Texas State University's Institutional Review Board (IRB) regarding the protection of human subjects. An application was made to the Texas State IRB for approval of this study. Situational ethics that might occur during the interview process involving relationships or privacy were considered with regard to how they might affect the participant or the study outcome (Merriam and Tisdell 2016), either positively or negatively. Patton (2015) noted that the interviewer should remember the reason for the interview which is to gather data (495) but be sensitive to issues that arise and able to refer a participant to an appropriate source for assistance, if needed. Participants will, undoubtedly, share personal data during the interview process, and it is the obligation of the interviewer to keep that data confidential and anonymous in the application of analysis. To preserve anonymity, each participant was assigned a number associated with their information and known only to them and the researcher. In the case of unique data, where the small sample size might lead to possible identification and anonymity difficult to uphold, the researcher considered the level of sensitivity and importance of the data before including it in the report. All participants were given an informed consent agreement to be signed, which included the reasons for the study and the right to withdraw at any time.

4.8 Data Collection

Interviews were conducted face-to-face when possible, in an informal, semi structured process of guiding the participant through topics that addressed the protocol questions, allowing for explanation and reflection by the participant (Moustakas 1994, Rishi 2014). Participants were contacted to solicit availability and confirmed contact information. Interviews were held in a location determined by each participant, usually their home, but sometimes at a mutually agreed upon location like a coffee shop and lasted anywhere from 20 minutes to one hour. Informed consent forms were signed and collected at that time. The interviews were recorded and then transcribed. Data was analyzed as soon as possible after each interview so that adjustments could be made in interview techniques or questions that might be helpful or necessary for proper data acquisition. Using purposive sampling allowed discovery to aid in adapting questions to the subject matter (Merriam and Tisdell 2016, 197), as well as remaining focused on the specific study topics, i.e. the use of social media to communicate risk.

4.9 Survey Interview Process

This form of research was best suited for interviews using a semi-structured protocol that allowed for extended responses. Guided questions in an interview setting provided a gateway for participants to explain more fully the "how" and "why" of their social media usage, preferred communication media, and who used them. There was an initial invitation letter sent, either via standard mail, or through the email address provided by the participant to explain the study and the selection criteria (Appendix A), followed by contact, either by email or phone, to set up an interview time and place. At

the interview, an Informed Consent Form was read and signed by the participant. The survey questions (Appendix A, Doc 3) were developed as follows:

1) By examining the theoretical research literature.

2) Gleaned from previously tested survey questions from a variety of other applied studies (Blanchard 1992; Childs 2014; Rishi 2014; Brengarth and Mujkic 2016; Holmes 2016).

3) Developing and relating specific survey questions to the research questions for this study.

Several questions were constructed on a Likert-type Scale (1-10) to establish experience with Hurricane Harvey and use of social media, followed by open-ended questions to clarify the participant's perceptions of social media use during the storm, and finally a set of demographic questions to determine gender, age, and socio-economic brackets as determined by the U.S. Census.

Each interview session was audio-recorded and answering the survey questions was expected to take between 30 and 60 minutes. The exception to audio-recording of the interviews was made during an impromptu family gathering where there was an opportunity to interview several family and friends who experienced Hurricane Harvey, but the researcher had no recording device. The responses were documented by hand and converted to an Excel spreadsheet for ease of entry into the *NVivo* software.

CHAPTER V. DATA ANALYSIS

This chapter presents the process of data management and analysis from interview protocol asked of 21 citizen participants and four emergency management personnel participants who experienced Hurricane Harvey and used social media during the time frame of August 25-30, 2017. How the data was processed will be discussed, both through the use of *NVivo 12 Plus* software as well as hand-coding the transcripts.

The interview questions were broken into three groups for clarity and ease of discussion, and to aid in providing a hierarchy of structure (Khan 2014). These groups included various charts for illustration, accompanying explanations of participant answers, and relationships to their personal attributes as described in the Survey section.

5.1 Initial Processing of Data – *NVivo 12 Plus*

Data analysis for this research was a combination of deductive and inductive processes (Schulz 2012) to discover conceptualizations discussed among the participants related to their use of social media during Hurricane Harvey, and to compare choices and actions during Hurricane Harvey with findings from previous research in risk communication, such as the Conceptual Framework for Risk Communication (Blanchard 1992).

Transcription of the interviews took place as soon as possible after completion of the interviews, as suggested by Merriam and Tisdell (2016). Notes and impressions by the interviewer were also processed in conjunction with each interview.

Data analysis included coding or noting specific words or phrases and then forming a categorical list for analysis. Software developed for qualitative analysis, *NVivo*

12 Plus (*NVivo*), was initially utilized in the analysis process to categorize, organize, and aid with interpreting the resulting data as it related to interview questions. The numbers of categories (nodes) were determined by the information given in the interviews, and therefore flexible, and then metadata categories such as location (zip code) and census data categories (age, income level, gender) were noted as case data (Takahashi, Tandoc, and Carmichael 2015).

Interview transcripts were imported into *NVivo* as files which allowed the researcher to copy and paste specific data into a particular node for classification (Figure 5.1a). Each interview was assigned a number to provide anonymity for the participants, and as coding was done, this section noted the number of times each interview transcript was entered into a primary node, as well as the number of references, or pieces of information, that were included in a node per interview (Figure 5.1a).

Interviews	Search Project		
Name	/	Codes	References
1001 Nvivo		132	265
1002 Nvivo		112	197
1003 Nvivo		103	200
1004 Nvivo		98	142
1005 Nvivo		110	209
1006 Nvivo		78	103
1007 Nvivo		99	145
1008 Nvivo		98	126
1009 Nvivo		86	130
1010 Nvivo		84	126
1011 Nvivo		85	100
1012 Nvivo C		95	138
1012 Nvivo T		85	122
1013 Nvivo		84	121
1014 Nvivo		75	87
1015 Nvivo		78	91
1016 Nvivo		82	96
1017 Nvivo		70	79
1018 Nvivo		73	79
1019 Nvivo		71	77
1020 Nvivo		74	84

Figure 5.1a. Example from *NVivo 12 Plus* on Numbering Interviews, Frequency of Coding and Referencing.

NVivo12 Plus employs the use of nodes as a way to categorize or list specific ideas or information. These nodes can have multiple sub-nodes for including smaller bits of information related to the primary node (Figure 5.1b). For example, under the node for Interview Question 12 about sharing information, sub-node Yes, sub-node Platform Used, sub-node *Facebook*, there were 18 interviews coded as "yes" in the *Facebook* category and 23 different responses from those 18 interviews.
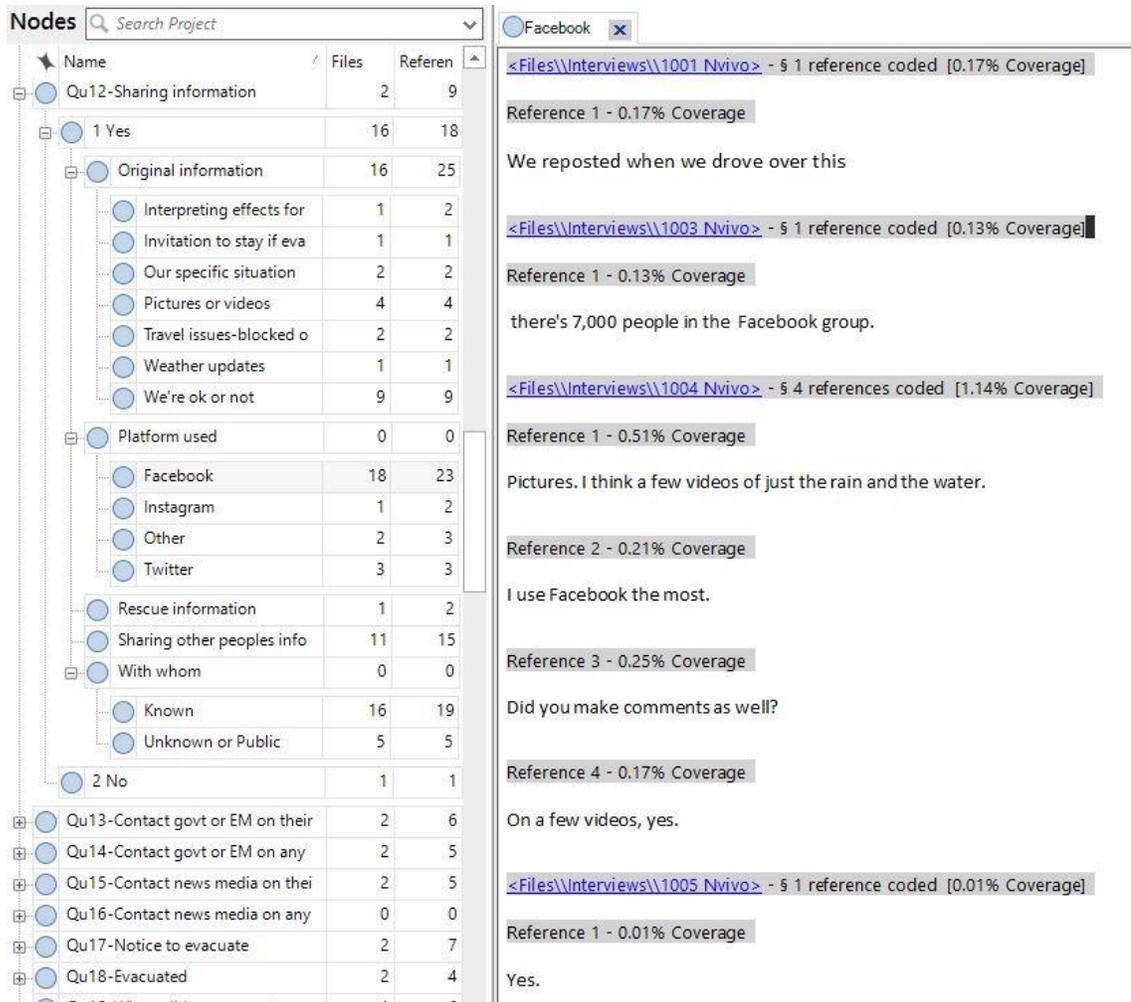
Figure 5.1b. Example of Multiple Sub-Nodes and the Interviews Coded Using *NVivo*

Responses that related to more than one node could be duplicated and inserted into as many nodes as needed. The interviews were formatted in such a way as to allow *NVivo* to track which interview was included in each node (Figure 5.1b). Each interview was also entered into Case Classifications which allowed for the assignment of various attributes to each interview participant, such as the demographics or Census Data Categories for each participant (Figure 5.4a). This case data was sorted by category as

needed to aid in visualizing most frequent users or least. Node information could also be categorized by most or least in the visualization options.

NVivo 12 Plus software was instrumental in organizing the data from the 39 interview questions answered by most of the participants but was not sufficient to visualize all aspects of the relationships between answers and the research questions. Therefore, grouped data from *NVivo 12 Plus* was transferred to *Excel* spreadsheets for manipulation via column shifting, zero elimination, and A-Z listing. For instance, Interview Question 1 read*: I will ask this on a scale from 10 to 1, where 10 is where you felt "extremely threatened" and 1 is where you did not feel threatened in the least, overall, how threatened [how afraid] were you?* Data could be charted, but only by one case attribute, such as gender or age. By moving that data as a group to Excel, a spreadsheet could be developed that included more than one case attribute and a relationship could be viewed. *NVivo12 Plus* did not allow the deletion of categories with zero, making the list much longer than needed and difficult to see clusters of data in relationship to the Likert value and attribute, so again, *Excel* allowed data to be displayed next to each other and more easily compared (Figure 5.1c).

Node IQ10	Gender	# of cases coded
Automatically popped up on FB	Female	10
Automatically popped up on FB	Male	5
Following on Facebook	Female	7
Following on Facebook	Male	3
News Media sites	Male	2
Searched on FB	Male	2
Searched on Twitter	Male	1

Node IQ10	Household Status	# of cases coded
Automatically popped up on FB	Married	5
Automatically popped up on FB	Single	4
Automatically popped up on FB	Married with children	4
Automatically popped up on FB	Single with children	2
Following on Facebook	Married with children	4
Following on Facebook	Married	2
Following on Facebook	Single	2
Following on Facebook	Single with children	2
News Media sites	Married	1
News Media sites	Married with children	1
Searched on FB	Single	1
Searched on FB	Married with children	1
Searched on Twitter	Single	1

Node IQ10 Automatically popped up on FB		
Gender	Household Status	# of cases coded
Female	Married	3
Female	Single	2
Female	Single with children	2
Female	Married with children	3
Male	Married	2
Male	Single	2
Male	Married with children	1

Figure 5.1c. Comparing IQ 10 Question Data Attributes in *Excel*

5.2 Manual-coding of Data

Multiple iterations of data interpretation were processed, as suggested by Marton (1981), Svensson (1994), Akerlind (2005), and Trigwell (2006). NVivo was used first to extract interview question specifics by node, and then interview transcripts were printed in order to use hand-coding methods to extract themes from the data. A color-coding system was used that included a variety of highlighter colors and coordinating post-it colors to tag and add notes to pertinent information in the transcripts (Flaim and Speckart 2016). These marks and notes were then transferred to Concept sheets where they were sifted into sub-concepts. These sub-concepts were often repeated under other concepts, aiding in the understanding of relationships between pieces of data. The researcher's biases were considered and held in check to determine salient categories, and consultation with the dissertation chair and a second party was made before the exclusion of items that were deemed unrelated to social media usage (Merriam and Tisdell 2016).

5.3 Primary and Secondary Interview Questions

As the interview questions were being coded, it became apparent that some questions were more vital than others when examining social media usage during Hurricane Harvey, so the questions were tagged as Primary1, Primary2, and Secondary on the Excel sheets. This process helped to provide a hierarchy for structuring the responses (Khan 2014, Gonzalez 2010). Primary1 questions were determined to be those that were answered by all participants and related directly to the use of social media and Emergency Management (Figure 5.3a). Primary2 questions dealt with personal threat, coping issues during Hurricane Harvey, types of social media used, or contacting Emergency Management and the media. Secondary questions covered evacuation issues,

rescues, affects from flooding, and the need for other assistance that may or may not have involved the use of social media.

Primary1, Primary2, and Secondary IQs related to Research Questions
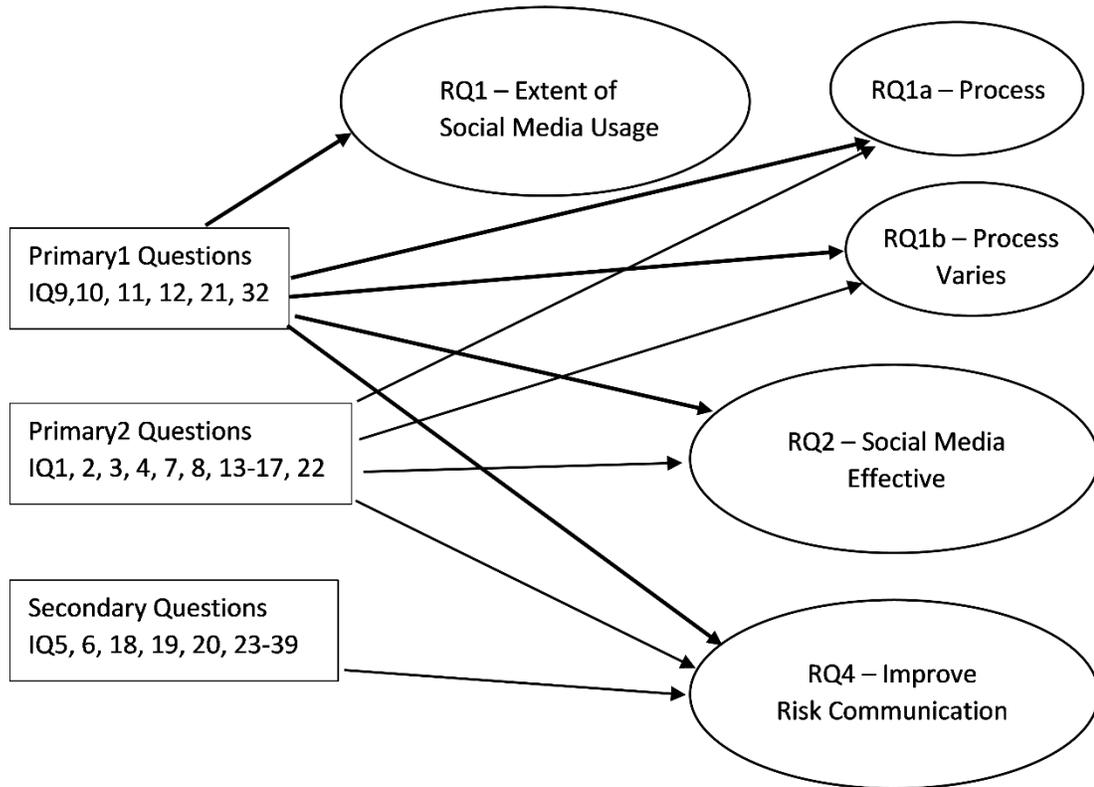
Figure 5.3: Primary1, Primary2, and Secondary IQs Related to Research Questions

An additional matrix displaying the relationships between the interview question groups and the research questions is shown in Table 5.3 on the following page.

Table 5.3: Matrix to Represent Primary1, Primary2, and Secondary IQs Related to Research Questions

Research Questions: Main Idea	Primary1 Interview Questions 9, 10, 11, 12, 21, 32	Primary2 Interview Questions 1, 2, 3, 4, 7, 8, 13-17, 22	Secondary Interview Questions 5, 6, 18, 19, 20, 23-31, 33-39
1) Extent of Social Media Usage	X		
1a) Process	X	X	
1b) Process varies	X	X	
2) Social Media Effective	X	X	
4) Improve Risk Communication	X	X	X

5.4 Interview Question Responses – Citizen Participants

There were 21 citizen participants who agreed to be interviewed for this study: eight males and 13 females. Five were married, six were married with children, seven were single, and three were single with children. Ages ranged from 18, a college student, to the 61-65 Census age bracket. None in the over 65 age category who were contacted said that they used social media during Hurricane Harvey. There were two Hispanic participants and one Black. The remaining 18 were White. Incomes ranged from under $20,000 to more than $150,000 (Table 5.4). Numbers of participants who gave specific answers will be expressed in a count and the percentage of the total number of participants unless otherwise noted.

Table 5.4. Citizen Participants and Their Attributes

	A : Gender	B : Age Group	C : Race or Et...	D : Income level	E : Household Status	F : ZipCode
1 : Participants Citizens	Unassigned	Unassigned	Unassigned	Unassigned	Unassigned	Unassigned
2 : 1001 Nvivo	Female	31-40	White	60-79,999K	Married with children	77503
3 : 1002 Nvivo	Male	51-60	White	More than 150K	Married with children	77479
4 : 1003 Nvivo	Male	61-65	White	More than 150K	Married with children	77459
5 : 1004 Nvivo	Female	23-30	Hispanic	20-39,999K	Single	77072
6 : 1005 Nvivo	Female	41-50	White	60-79,999K	Married with children	77573
7 : 1006 Nvivo	Male	51-60	White	40-59,999K	Single	77089
8 : 1007 Nvivo	Female	23-30	White	40-59,999K	Married with children	77478
9 : 1008 Nvivo	Female	31-40	White	40-59,999K	Single with children	77573
10 : 1009 Nvivo	Female	31-40	White	60-79,999K	Married with children	77096
11 : 1010 Nvivo	Female	31-40	White	80-99,999K	Single with children	77377
12 : 1011 Nvivo	Female	41-50	White	40-59,999K	Single with children	77437
13 : 1012 Nvivo C	Female	51-60	Hispanic	20-39,999K	Married	77072
14 : 1012 Nvivo T	Male	51-60	White	40-59,999K	Married	77072
15 : 1013 Nvivo	Female	31-40	White	60-79,999K	Single	77070
16 : 1014 Nvivo	Male	18-22	Black	Less than 20K	Single	77005
17 : 1015 Nvivo	Male	51-60	White	100-150K	Single	77096
18 : 1016 Nvivo	Male	61-65	White	40-59,999K	Married	77096
19 : 1017 Nvivo	Female	61-65	White	20-39,999K	Married	77096
20 : 1018 Nvivo	Female	61-65	White	40-59,999K	Single	77401
21 : 1019 Nvivo	Female	51-60	White	40-59,999K	Married	77469
22 : 1020 Nvivo	Male	51-60	White	40-59,999K	Single	77380

Case Classifications: Name, Emergency Manageme, Person (Name, Gender, Age Group, Race or Ethnicity, Income level, Household Status, ZipCode)

5.4.1 Primary1 Questions

Social media has become mainstream for a large portion of the population and because of the accessibility to information anywhere and anytime, emergencies and hazard events no longer require outdoor sirens or a special news bulletin on the television. *Smartphones* are all you need to stay informed of weather warnings or Amber Alerts, thanks to subscription opportunities offered by media and many local agencies.

This research revolves around the use of social media as a communication tool in an emergency situation, so the primary questions were focused on how participants made use of social media. The Primary1 interview questions included numbers 9, 10, 11, 11a, 11b, 12, 21, and 32a. The following paragraphs state the specific questions and note the highest numbers/percentages of answers from the participants for the Primary1 questions. Attributes of the participants were used in the *NVivo 12 Plus* application to determine if there were major differences in answers because of age, gender, or household status.

Question 9 asked, *what kind of information about Hurricane Harvey were you looking for during the storm on social media?* There were 14 different answers (Figure x), with 33% (7/21) of males/females (m/f) looking for flooding locations. Nine (43%) females were most interested in flooding locations (4) and how long the storm would last (5) and seven (33%) males were most interested in flooding locations (3) and rainfall forecasts (4). Females were least interested in where to evacuate and males were least interested in needing to evacuate. In the process of looking for storm information, many of the participants were finding useful information from other friends or official information from pages that they followed and then sharing that with others on *Facebook*. Someone from each of the Household Status groups was interested in finding information not on the TV news. Comments were made that indicated there was too much unnecessary drama on the local news and that they were not interested in spending 20 minutes watching a local news guy walk through his flooded house.

Question 10 asked, *how did you go about finding information about Hurricane Harvey on social media?* The most popular answer from both male (5 or 63%) and females (10 or 77%) was that it "automatically popped up," usually on *Facebook*, but also on *Twitter*. On both these applications, you must "follow" someone or some group in order to see whatever they post on their page. If the participant was following a local news station on *Facebook* or *Twitter,* any time there was a post on that page it popped up on the participant's news feed. This answer was also most popular with all the Household Status groups. No females said that they searched for anything on *Facebook* or *Twitter,* but three males did.

Questions 11, 11a, and 11b had to do with how social media affected perception regarding the information participants received. Question 11 asked, *did the information you received through social media change your perception of your own personal risk from Hurricane Harvey?* Six (29%) said "No" and 15 (71%) said "Yes". Of the males, four (19%) said "Yes" and four (19%) said "No", but females were 11 or 52% "Yes" and two (10%) with "No". The effect of seeing live videos of friends and neighbors, some near and some across town, experiencing flood waters or having to evacuate seemed to increase the perception of risk during Hurricane Harvey, particularly for females. Those married or single with children said "Yes" at a count of 7 or 33% of the total, but of the nine participants with children, that was 78% of the group.

Question 11a asked, *how did the information through social media change your perception*? Four participants were concerned with evacuating, and two more about evacuating with pets, but the most popular comment with a count of 10 (48%) was that the information on social media made them more aware of the danger.

Question 11b asked, *on a scale from 10 to 1 where 10 was "extremely useful" and 1 was "not useful at all," how useful (for you) was the information on social media?* Of the 21 participants, 15 (71%) responded with "10". An additional three participants said "9", for a total of 18 (86%) who thought social media was extremely useful. There were no responses below five.

Question 12 asked, *did you share any information about the risks during Hurricane Harvey on social media?* and *if "Yes", what did you share?* All participants shared information on social media. When asked about original information shared, the most popular answer was, "We're ok" by nine (43%) participants, five female (24%) and

four males (19%). Sharing about their specific situation by seven (33%) and sharing

pictures or videos by six (29%) were the next answers most given. Four Singles (19%)

and three marrieds (14%) shared "We're ok", as well as their specific situation with three

(14%) for each. Regarding the sharing of other people's information, only six (29%) said

that they had, and of those six, four (19%) shared weather information.

Question 21 asked, *how much emergency management information did you*

receive via social media? Percentages of 100, 75, 50, 25, and zero were suggested to the

participants. Only one participant said that they received 100 percent of their emergency

management information on social media, six (29%) responded with 75 percent, eight

(38%) said 50 percent, and six (29%) said 25 percent. Of the eight who responded with

50 percent, four were male and four were female; four were married, three were single,

and one was married with children.

Question 32 asked, *by what method did you receive warnings?* The top two

answers were *Text* with 14 (67%) participants (eight females, six males), and TV, also

with 14 participants (eight females, six males).

All of the questions noted above directly relate to the participant's use of social

media in an emergency situation, show how necessary they deemed this channel of

communication, and are components of Research Questions 1, 1a, 1b, 2, and 4. Specific

relationships will be explained in Chapter 6.

5.4.2 Primary2 Questions

Primary2 questions (1, 2, 3, 4, 7, 8, 13, 14, 15, 16, 17, and 22) included items

asked about how threatened the participants felt and how well they coped with the

emergency situation with Hurricane Harvey. Almost all threat levels were represented, but five (24%) indicated level nine or ten. Only three (14%) indicated that they needed assistance coping during the storm and one needed assistance immediately after the storm. Ten participants needed assistance during the storm, but only two called 9-1-1 and neither got assistance directly from a 9-1-1 department. Their assistance came from contacts through social media, either from friends or family who directly assisted or contacted someone who could assist them. Three participants contacted a government agency, but only for information, not assistance. Three participants posted pictures or videos on a news media site. Six participants received notification to evacuate, with four who got that information through social media, but social media was not necessarily the only channel of notification. All participants used a *smart phone* as at least one of the devices to participate with social media and all participants used *Facebook* as the primary channel of communication for their social media. No participants had reliability issues with information on social media because they either knew the parties posting information or the information was from official sources.

5.4.3 Secondary Questions

Secondary questions covered evacuation issues, rescues, affects from flooding, and the need for other assistance that may or may not have involved the use of social media. The Secondary questions (Q5, 6, 18, 19, 20, and 23-39) were not directly used for social media but could be considered contributing factors in the need for the use of social media. If the participant had to evacuate, be rescued, or need other assistance, then social media was the preferred way to stay informed of where to go, how to get there, weather conditions, flood conditions, etc. The fact that only four participants had a landline

speaks to the lack of dependence on a stationary form of communication, and that *smartphones* make vital information available no matter where the participants had to go. There was no mention of a lack of cell phone service during this emergency situation, though one participant noted that during a previous hurricane there was a severe lack of cell service due to many cell towers not functioning.

5.5 Interview Question Responses as Related to Research Questions

The interview questions were designed to answer and support the research questions for this study. Research Question 1 asked: To what extent did residents of the Houston-Galveston metro area use social media during Hurricane Harvey? The interview questions (IQ) to support this were IQ 5, 6, 8-17, 20-22, and 32a. A matrix was designed to show aggregate answers and some specific responses to the IQs in a more orderly fashion for Research Question 1 (Table 5.5). The participant's extent of use of social media included searching for information about the storm, sharing their personal experiences and those of others, contacting official agencies and news agencies, and receiving Emergency Management information.

Table 5.5 Aggregate Answers to Interview Questions Related to Research Question 1

Research Question 1: Extent of Social Media Use	Yes	No	Scale of 10-1	How or What
IQ5: seek information	21/100%			
IQ5: source				Local TV News -19 Natl TV Weather -7 Another Source -13
IQ6: use social media	21/100%			

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Table 5.5 Continued

IQ7: device				Phone- 21 Laptop -3 Tablet -3 Desktop -2
IQ8: platform				Facebook- 21 Snapchat- 4 Twitter - 3 Instagram-2
IQ9: information looked for				Flood locations -7 Rainfall forecast -7 How long will storm last -6 Info not on TV -5 Status of friends, family -5 Hardest hit areas -3 River rise info -2 Need to evacuate -2 Radar -2 Rescue requests -2 Weather warnings -2 Report to work -1 Status of employees -1 Where to evacuate-1
IQ10: how information found				Automatically popped up -15 Following on FB -10 News Media sites -2 Searched on FB -2 Searched on TW -1
IQ11: perception changed	15/71%	6/29%		
IQ11a: how				More aware of danger -10 Concerns about evac -4 Concerns about evac with pets - 2 Tailored information -2 More info made them less afraid -1
IQ11b: how useful was social media			10- 15(71%) 9 - 3 (14%) 8 - 1 (5%) 7 - 1 (5%) 6 - 0 5 - 1 (5%)	
IQ12: shared information	21/100%			
IQ12a: type shared-original				We're Ok -9 Our specific situ -7 Pictures or videos -6

Table 5.5 Continued

				Weather Updates -3 Supply Update -3 Travel Issues -3 Invite to stay -2 Interpreting for others -1
IQ12b: type shared-other people's				Weather info -4 Travel issues -2 Need help posts -2 Closings(schools) -1 Official posts -1 Where to evac -1 Supplies located -1
IQ13: contact govt agency-their site	2/10%			Shelter info -1 HCEM gen info -1
IQ14: contact govt agency-any site	1/5%			City of Houston- when to return to work -1
IQ15: contact news outlet-their site	3/14%			Ch 11 (CBS affiliate) Fox 26 Ch 2 (NBC affiliate) All with pictures or videos
IQ16: contact news outlet-any site	0%			
IQ17: receive notice to evac	5/24%, 1 - standby			
IQ17a: what channel				Social Media -4 Text from Official Agency -2 Family notified -1
IQ20: stayed informed	100%			
IQ21: amount of emergency management information				100% -1 75% -6 50% -8 25% -6 0% -0
IQ22: social media information reliable			10- 12 (57%) 9- 3 (14%) 8- 2 (10%) 7- 2 (10%) 6- 1 (5%) 5- 0 4- 0	

Table 5.5 Continued

			3- 1 (5%) 2- 0 1- 1 (5%)	
IQ32a: channel for warnings				TV- 14 Text – 14 Radio – 2 Social Media – 6 Work email - 2

5.5.1 Looking for Information

All 21 participants searched for information about Hurricane Harvey as it was

happening (IQ5). Almost all watched the local TV news stations for regular updates, but

they supplemented that information with what they found on social media. The device of

choice (IQ7) to access social media was a smartphone, but some also used laptop

computers, desktop computers, or tablets. All participants utilized *Facebook*, but a few

used *Snapchat, Twitter*, or *Instagram* (IQ8). *Facebook* was described as a place where

they could scroll through their news feed to see what was happening with their friends,

see local news postings, or official information that they had chosen to follow. *Twitter*

was said to be a fast route to official information. By using a hashtag (#), it was easy to

find information, verify postings from *Facebook* as authentic, or see local information

without waiting for TV news.

The specific sorts of information sought by participants (IQ9) included flooding

locations, rainfall forecasts, finding out how long the storm would last, the status of

friends and family, and information not found on TV. The primary method of finding

information (IQ10) was to see it "automatically pop-up" on *Facebook* or see it posted

from a person or agency that they followed. A few looked around for specific news sites

on *Facebook* or *Twitter*, but most found what they needed without searching. A majority

of participants (71%) said that the information found on social media changed their perception of personal risk during the storm (IQ11). The reasons stated (IQ11a) included making them more aware of the danger of the storm, concerns about needing to evacuate, how to evacuate with their pets, and getting tailored information specific to their part of Houston. Several participants mentioned that they had previous experience with hurricanes and initially discounted the impacts predicted because landfall was not expected near Houston, but as they watched the storm strengthen through images and information on social media, they began to be more concerned. As the rains continued and the posts became more emotionally charged, they weren't sure what to expect. Those along the Brazos River were ordered to evacuate due to concerns about a levee breach or over-wash if the river continued to rise from upstream precipitation. Participant 1003's search for coherent river rise data that related to flood levels in the subdivision were unsuccessful, causing more stress. They were ordered to evacuate but the lack of available information about how high the water might get in their homes did not ease the worry. He said "But what about my house? How much danger is my house in the flooding? And nobody could figure it out because the information flat out is not available. That made people angry." Ultimately, the levee held, and the river level decreased.

Participant 1002 stated that his neighborhood association was posting information: "we were getting updates from the county, and from the sheriff's department, and from my homeowners' association on the same *Facebook* page that I was on" and "we were able to get updates tailored specifically about our location on the river." He was able to avoid wading through non-specific, Houston area information and

see what was important to him by "following" his county commissioner's *Facebook* page.

5.6 Interview Question Responses – Emergency Management Personnel Participants

Emergency Management personnel are responsible for communicating risk to those parties who may be affected by an emergency situation, i.e. some sort of natural or manmade hazard, such as severe weather, a toxic spill, pandemic of infectious disease, or terrorist attack (Reynolds and Seeger 2014). Their ability to notify the public quickly, and accurately instruct them on safety procedures related to the hazard event is critical to the protection and well-being of all concerned. Failure to do so could result in personal injury to members of the public, property damage, loss of reputation, or ultimately, loss of life (Reynolds and Seeger 2014). Four emergency management personnel were interviewed for this study. The questions asked were different from those asked of the citizen participants, and specific to the job of informing the public using social media, the process employed, staffing, the platforms employed, and positive or negative aspects of social media use.

5.6.1 Interview Question Responses – Emergency Management Personnel

Question 2 asked, *does your agency or organization maintain an internet website?* All (100 percent) responded that they did (Figure 5.5a). Question 3 asked "Does your agency or organization have a presence on a social media platform, such as *Facebook* or *Twitter*? All (100 percent) did have a presence on *Facebook*, three (75 percent) also used *Twitter* and *Instagram*, two (50 percent) had *YouTube* accounts, and one (25 percent) also had a *Snapchat* site (Table 5.6.1).

Table 5.6.1 Platforms used by Emergency Management Personnel

EM Personnel	Platforms Used					
	Facebook	Twitter	Instagram	YouTube	Snapchat	Agency Internet Site
EM 1001	X	X	X		X	X
EM 1002	X	X	X	X		X
EM 1003	X					X
EM 1004	X	X	X	X		X
	100%	75%	75%	50%	25%	100%

Question 4 asked, *Is there a staff member or members assigned to monitor your social media site?* All said "yes", but the number of staff varied. Three of the four (75 percent) said that they only had one staff member assigned on any given day, but during an emergency there were others who could step in to assist. Hurricane Harvey was an event that caused several emergency management groups to combine in one place, so there were four people monitoring, 24 hours per day. They used laptops and *smartphones* to monitor, produce, and send emergency information on social media. One manager explained that they were the only person involved with social media so there was not 24/7 coverage, even during an emergency, but their involvement with social media was new and hoped to have additional personnel at some point. Staffing for the monitoring of social media was also answered in Question 11, where they were asked if there was always someone monitoring (EM1001, EM1002), occasionally monitored (EM1004), or only when someone was not busy with something else (EM1003).

Emergency managers explained that their primary purpose for using social media during a hazard emergency was to get information out to the public quickly, in a uniform manner, and to as wide spread an area as possible. They used three methods to do this: 1) *Smart phone* texts or push notifications; 2) posting specific information on their organization's website; and 3) posting on their social media platforms (*Facebook*,

Twitter, Instagram, etc.). The messages that were sent out on social media were identical for each platform so as not to confuse people who were on more than one site. In addition, emergency managers or staff would monitor social media by reading comments or questions with the intent of responding directly to the public when possible, directing the public to the proper authority by giving phone numbers or website information, correcting misinformation or rumors as soon as possible, and making note of where and what was happening in order to pass along information to first responders. Because the social media platforms operated using different protocols, monitoring them could be easy or difficult, depending on the data that was observed. For this reason, Question 5 asked, *which social media site seems to be the easiest to monitor?* and Question 7 asked, *Which social media site seems to be the most difficult to monitor?* (Table 5.6.2). For three of the four interviewed, *Twitter* was easier to monitor because they could scroll through the tweets quickly and other government agencies also used it, so the information put out by others was easy to find. Problems were easy to spot and address on *Twitter*, and one emergency manager had a free software called *TweetDeck*, that helped to filter information so that searching for specifics was easier. The responses about the most difficult platform to monitor were about *Facebook*. *Facebook* had more conversation and comments that were not directly about assistance, rumors got started easily, and the public often expected a more immediate answer to a question than was possible. Without software to monitor public posts, there was no way to know that someone was addressing the agency unless they were tagged or messaged directly.

Table 5.6.2 Emergency Managers Responses to Which Platform was Easiest or Most Difficult to Monitor.

EM Personnel	Social Media easiest	Why?	Social Media most difficult	Why?
EM 1001	Twitter	Easy to scroll through information, other government agencies use it, too	Facebook	No news feed like Twitter, so many comments on Facebook, rumors get started
EM 1002	Twitter	Easy to address problems quickly	Twitter	So much information coming through it was hard to keep up until more staff arrived. Then Facebook was more difficult because of all the conversation and direct requests
EM 1003	Facebook	Familiar and only platform used	n/a	
EM 1004	Twitter	Had *TweetDeck* software (free) to assist in filtering information	Facebook	Public had to tag them or direct message in order to know the agency was being addressed. Without software to monitor, there was no way to know.

Question 6 asked, *which social media site seemed most effective in communicating*

information to citizens? One response (EM1004) specified *Facebook* because their

agency was looking for boats to assist the public, so *Facebook* allowed for more back and

forth conversational interaction. Conversation was also noted by another responder

(EM1003) as effective when trying to assist. *Twitter* was noted by two responders

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(EM1001, EM1002) as most effective, particularly if the information was urgent, and one (EM1002) chose the *Nextdoor* application because it is neighborhood specific and only notifies targeted areas with the information they need.

Question 10 asked if emergency personnel responded to questions asked on social media and all responders said that they did, when possible. Because of the amount of information and number of posts that occurred during Hurricane Harvey, they were not able to respond to all comments. If people were looking for specific information like where to find a shelter or if they needed to evacuate, they were directed to the proper website or given a phone number to get more information. If they were requesting rescue, emergency personnel (EM1002) would respond with "Hey, you understand that we're going to take your information and we're going to give it to first responders who are also in the building with us and they're going to try to handle your call.", and were also directed to call 9-1-1, and stay on hold until someone answered.

Question 12 asked, *on a scale of 10 to 1 where 10 is "very important" and 1 is "not important at all", how important was it to your agency to have someone monitor your social media site during Hurricane Harvey?* Three responders answered with "10" and one answered "7". Though the importance of using social media was apparent to these responders, government agencies were not so quick to join the social media band wagon, per EM1004, "…I begged and begged and begged for us to have a social media account. It was a government agency, and they fought me tooth and nail. They finally gave me one with very limited or more restrictive, and you can only do this, and all messages have to be this blah, blah, blah, whatever. And they're like, "Oh we're only going to allow X amount of time a day, and that's all it's going to take. It's not going to be

a big deal." Okay. Well, that's most of my job now. I could probably hire a fulltime

person to only do our social media; manage it, do the graphics, all of that kind of stuff. So

absolutely. There's so much that's out there, and it's hard to keep up especially during an

event."

Questions 13 and 14 asked about the positive and negative aspects of having a

presence on social media (Table 5.6.3). Several positive aspects were duplicated, such as

the ability to control rumors quickly, controlling the message, getting the information out

quickly and on multiple platforms. The negative aspects expressed included rumor

control being difficult to deal with, correcting incorrect information, lack of adequate

staff, and not being able to answer every post or question.

Table 5.6.3 Positive and Negative Aspects of Using Social Media

EM Personnel	Positive Aspects	Negative Aspects
EM 1001	Use of social media carries a good image for the agency	Rumors move fast and are hard to control because so many are posting, and information moves so quickly
EM 1002	Rumor control; can coordinate messages across platforms so that the same information is going out; could target neighborhoods with Nextdoor	Have to check for accuracy of messages going out because incorrect information can slip through; messages must be approved before posting
EM 1003	Can post quick updates	
EM 1004	Can control the "message"; there is a time lag to update website, so social media is faster	Have one person to monitor, so not 24/7; can't respond to every post as quickly

Overall, emergency management personnel saw a great need to use and expand the scope

of social media usage during emergency situations. They found it to be the fastest way to

provide information to the public and monitor how that information was received and

understood.

CHAPTER VI. RESULTS

This chapter synthesizes and analyzes worded data (interview responses) through the lens of phenomenography, recalling that the focus of phenomenography is on people's varying concepts of a given phenomenon, *not* on the phenomenon itself (Hepworth 2016, 152). Martin and Pang (2013) explain that, "The research specialization of phenomenography is the study of categories of description depicting appearances, experiences, and meanings . . . Hence, phenomenography does not tell you what individuals' ways of seeing something are. It tells you how their ways of seeing something vary (between people under the same circumstances and/or within people under different circumstances)" (p.31). The emphasis is on how things appear to people in their world and the way in which people explain to themselves and others what goes on around them and how these explanations changes (Barnard et al. 1999).

6.1 Robust and Reliable Results

In order to make this study viable as a process for continued research, the results must be considered robust and reliable through the data being reproducible, replicable, and generalizable. The information produced through analysis must be reproducible by others, such that a different researcher could interview participants using the same procedures and determine similar results. The process must have replicability so that a different group of participants may be chosen and, using the same procedures, determine similar results. Finally, the results must be generalizable so that using participants from a different location or hazard event, using the same procedures, would also produce similar results (Cacioppo, Kaplan, Krosnick, Olds, and Dean 2015).

6.2 Categories of Description (Themes) and Final Outcome Space

Chapter IV, "Methodology" presented in graphic form the two perspectives of phenomenography—the Structural Aspect (the "How" and "Why") and Referential Aspect (the "What"). The results of this analysis focus on the Structural Aspect—the how and the why of social media use during Harvey. The Referential Aspect was not pertinent to the final discussion as it concerns social media as a phenomenon in itself and was not the focus of this research. Figure 6.1 reintroduces the graphic and is modified to show "how" participants used social media and the variation in "why" they chose this medium for communicating their needs during Harvey. The "How" consists of the Act of Using Social Media which in Harvey consisted of. … The "Why" is composed of the categories of description, or the themes that emerged from the interviews, and is discussed below.
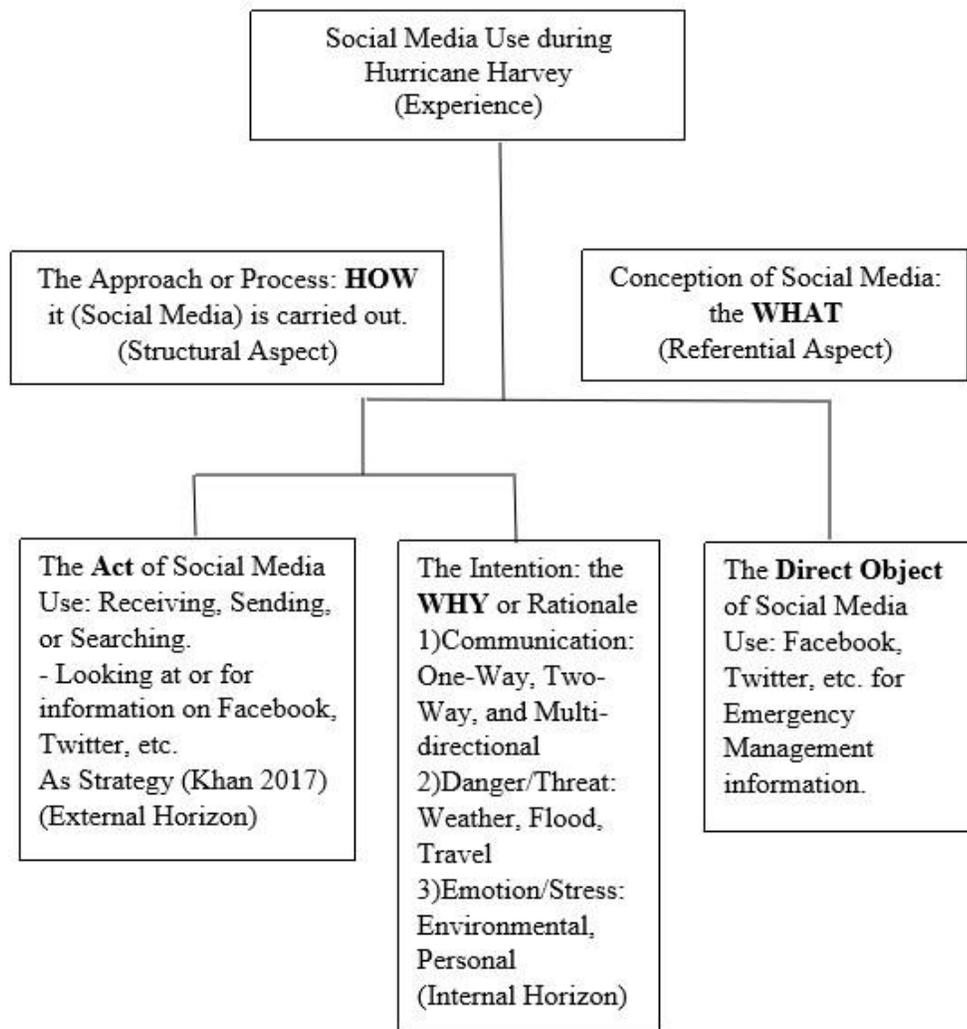
Figure 6.2 Reintroduction of Khan's Component of Experience with Adaptations of Participants' Social Media Use during Hurricane Harvey

6.2.1 Categories of Description: The Emergence of Themes

Through the lens of phenomenography, results are presented in two ways: first, through categories of description, and second depicted graphically in an outcome space. This section focuses on *categories (or themes) of description* which describe the similarities and differences in meaning and reflect the number of qualitatively different ways phenomenon can be described, analyzed and understood from the human

experience. Categories of description are formed from the analysis of data abstracted

from interview transcripts or any other forms of communication and are used to

characterize understanding (Barnard et al. 1999, 219). Here, interview transcripts first

provided a formalized summary of description; second, parts of the data were abstracted

from the entire transcript and coded to portray meaning; and, third, common meanings

were then presented as categories (themes) that were then compared and grouped for

understanding. Table 6.1 below provides a matrix of Approaches and/or Processes (the

"How") and Intentions (the "Why" or themes) regarding the use of social media during

Hurricane Harvey. The Approaches categorize the ways, or the "how", that social media

was used, and in this case, it was used as the direction of information movement. The

participants could receive, send, or search for information. The Intentions are the "why",

or the impetus for using social media, such as communication, the danger or threat caused

by Hurricane Harvey, or the emotion or stress generated by the situation. These

Intentions were sub-divided into specific categories. Communication could have been

any of three directions: one-way, two-way, or multi-directional. These directional

categories differ from the Approach categories in that they reflect the perception of a

need to have information. If the participant was only receiving information and that was

sufficient for their needs, no other direction was required, so they only used one-way

communication. The danger or threat was caused by weather, flood, or travel, meaning

that weather warnings or tornadoes in the area were different threats than rising water or

having to travel through flooded areas to get to safety. Emotion or stress had either an

environmental cause or a personal cause. Environmental causes were usually weather

related, like concerns about how much more rain would fall or will the levee be breached,

and personal causes were most often the result of worry about their children's well-being

or other family members in dangerous situations also related to Hurricane Harvey.

Table 6.2.1 Categories of Description (Themes) in the Structural Aspect of Social Media
during Harvey: How Participants Acted and Why (Their Intentions)

Intention: "WHY" Themes	The ACT (the How" of Turning to Social Media)		
	1) Receiving information	2) Sending (sharing) information	3) Searching for information
Role of Communication			
One-Way	X	X	X
Two-Way		X	X
Multi-directional		X	X
Role of Danger/Threat			
Weather	X	X	X
Flood	X	X	X
Travel	X	X	X
Role of Emotion/Stress			
Environmental	X	X	X
Personal	X	X	X

Under participants' "Acts" there were three ways that social media was engaged: 1)

Receiving information, 2) Sending (sharing) information, and 3) Searching for

information. The type of information varied but was primarily focused on Hurricane

Harvey and its effects.

The "Intentions" (or themes) that emerged for turning to social media were

categorized according to the roles they played and are divided into three groups: 1) the

Role of Communication, 2) the Role of Danger/Threat, and 3) the Role of

Emotion/Stress, with related sub-categories. The relationships are shown by the "X"

where Approach and Intention converge. For example, the Receiving Information

approach is only a one-way form of communication, so it has no relationship to the sub-categories of two-way or multi-directional communication because the receiver may not do anything else with that information. All other sub-categories of the Intentions have a relationship with the other two approaches.

6.3 Structural Approach-Acts: Excerpts from Interviews

6.3.1 Structural Approach (Act): Receiving Information

The following excerpts from interview transcripts convey additional understanding and justification to summarized findings in Figure 6.1 and Table 6.1. Participants *received information* through *Facebook, Twitter* and "push" notifications via texts on subscribed Emergency Management sites, in addition to, local TV news broadcasts. The types of information received included weather bulletins in the form of advisories or warnings from official Emergency Management sites, news organizations that the participants subscribed to online, or friends and family sharing similar information. Several participants received specific emergency management information from their homeowner's association on *Facebook*, including evacuation notices. Many participants noted that information "popped up" on *Facebook* from people and pages already followed, including news and government agencies, making it easy to scroll through the posts to see local or new information. Relevant quotes include:

1001 "We used most people's posts to see, "Oh, this neighborhood's flooded. This isn't. This street is."

1002 "We were getting updates from the county, and from the sheriff's department, and from my homeowners' association on the same *Facebook* page that I was on." And "Twice a day they [Fort Bend County Commissioner] would do the scientific--

down to the quarter inch on the river rising from further up north where it was flowing down, and then exactly where we were, and that sort of thing. So, I didn't really have to communicate with them. It was all right there."

1005 "I look at what popped up." and "The TV; that was on to distract us. This [social media] was on to keep us informed."

1012T "Social media had information that TV news did not."

6.3.2 Structural Approach (Act): Sending (Sharing) Information

Participants sent or shared information using social media regarding their personal situation such as *Facebook's* "I'm OK" messages, and pictures or videos of what was happening where they were. They shared official emergency management information and requests for assistance such as what roads were open, where to find bread, or "help, we need to be rescued." More than one participant was actively researching and providing answers to questions from other *Facebook* friends (1003), coordinating assistance between other *Facebook* parties (1013), or answering calls for rescue (1015). Relevant quotes include:

1001 " My husband went out to try to help and he reposted, 'This road's closed. This road is open. This section's open. Oh my God, there's bread being delivered here.' That kind of thing."

1003 "I found it very useful, especially because I'm trying to communicate to other people, too."

1006 "Social media was good for letting everybody know that I was okay.

1007 "I would share if there was somebody who posted they were in danger and someone needed to be rescued."

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1009 "I said, if anyone has a boat in the [blank] area, please come and save my girls and I. There's a lot of water in our house and it's not safe." And "We shared a post about how high is the water."

1010 "I shared a lot of what I saw. And it was just random people, it was friends that were sharing. I was finding out information on school closures. I had found out on social media through friends that Hurricane Harvey had been upgraded to a Category 4. I had seen on *Facebook* a picture of how devastated the downtown area was. There's no certain one page that I went to." And "I had posted something that The Weather Channel had done, showing the differences between categories 1, 2, 3, 4, and 5 hurricanes. Just showing that I posted where people could find water because nobody could find water anywhere. I posted that. I posted about the school district being closed because that's how I found out, too. I posted the video of what it looked like maybe a mile down the road from my apartment where the water was up almost to the lights on the traffic lights. I posted before and after pictures of what Houston looked like before and after the flooding and my comment is "Only the beginning." I posted that Gallery Furniture was a place that people could go to for evacuation and it ended up being I posted something with a bunch of red exclamation points saying, "Help," asking if anybody was in the Richmond-Rosenberg area with a big truck that could help my parents because they were being forced to evacuate and could not make it through the water."

1012T "We posted a video of us taking our push broom and pushing it [water] that way out into the street."

1013 "And so, we were trying to get information to people that we knew had boats. And some of them weren't from around here. So, we were trying to send coordinates because you couldn't see street signs."

6.3.3 Structural Approach (Act): Searching for Information

Searching for information is a different action from just sending or receiving information. Hurricane Harvey generated the need for some participants to actively look for information. Some were looking for general information on the storm such as how long it would last, how much rain was expected, when would it be over, where can I evacuate with my pets, and the like. Some participants needed immediate assistance from rising water and/or flooding in their homes. After trying to get help from 9-1-1, they reached out to find the Cajun Navy (1009) or the Coast Guard (1005) by searching those sites for contact information. Two other participants who lived near the river (1002, 1003) were searching for data on how much water to expect if the levee was breached. This type of information was not likely to just "pop-up" on their *Facebook* news feed. Relevant quotes include:

Participants searched for:

1001 "If we were going to have to evacuate." And "where the hardest hit sections were going to be."

1002 "Rise of the Brazos River since it's located just behind our house."

1003 "I wanted river levels, absolutely." And "evacuation orders"

1004 "water levels. The amount of rain we were supposed to get."

1005 "We called 9-1-1. We called the Coast Guard."

1007 "how long it's going to stay here."

1009 "to see if my house was going to flood." And "And so I called the Cajun Navy. They were not in the area, so they were not able to help."

1011 "The track of the hurricane, the speed of the hurricane, and just how big it was getting or how strong it was getting and, of course, the predictions that are never right but—"

1012C "Radar"

1014 "how long is this going to last"

1016 "What areas were flooding."

1017 "When will the rain stop?"

1019 "Where do we go if we flood?"

6.4 Structural Approach-Intentions (the "Why"- themes)-Excerpts from Interviews

The Structural Approach or actions taken using social media during Hurricane Harvey were considered essential by the participants for their safety and well-being. The information received, sent, or searched for provided specific information that may not have been immediately available by other means, such as TV news broadcasts.

These actions had Intentions or roles that generated the need to use social media, and, thus emerged as the categories of description or themes.

There were three primary Intentions or roles that emerged: 1) The Role of Communication, 2) The Role of Danger/Threat, and 3) The Role of Emotion/Stress. These provided the "Why" for using social media because the participants needed

specific information. They may have needed to know if there were ordered evacuations for their specific location (Communication). They may have felt threatened by rising water in the neighborhood (Danger). They may have been concerned or worried about being able to escape safely with children or pets (Stress). Each of these primary roles had sub-roles noted for specific categories.

6.4.1 Structural Approach (Intention): The Role of Communication

The Role of Communication was noted as a need to receive, send, or find information. The sub-roles or categories expressed through analysis were One-Way, Two-Way, and Multi-Directional Communication. One-Way Communication was the push notifications via text from Emergency Management subscriptions or information through TV news broadcasts. Almost all participants got some information through the local TV news but felt the need to supplement that with information on social media, either through *Facebook* or *Twitter* feeds. Social media can be a one-way form of communication if you only observe what is posted by others and don't engage in conversation or share what you see. Examples of relevant quotes for One-Way Communication are:

1001 "We used most people's posts to see, "Oh, this neighborhood's flooded. This isn't. This street is."

1002 " We received a emergency notification weather alert alarm, I think, on our phones."

1003 "I find *Twitter* to be very, very valuable during emergencies--- Everybody's posting what's going on in their area and they're posting videos and they're posting

photographs, comments. And you can aggregate this information and get a much better, clearer picture of what's going on. And you're getting it almost instantaneously instead of waiting for the news people—" And "I use *Twitter* for information."

1011 "Yes. I follow all of our local emergency management *Facebook* pages."

1012C "And then we would get the emergency management where your phone makes that horrible noise.

1012T "We were just checking everybody's posts. And of course, when you like a page. We like Channel 13, and we like this one. And so, every time they posted an update-- It would pop-up. And we would get our information that way."

1019 "Friends were posting."

Sending information through social media could be one-way communication, as well, but it is unlikely that a person would not "see" or "receive" information in the process of posting their own information.

Two-Way Communication is the process of sending and receiving information which is the true forte of social media. *Facebook* and *Twitter* are made for posting or sending information that can be seen and commented on by those who follow that page or hashtag (#). Participants followed their friends on *Facebook*, observing pictures and videos of what was happening in other parts of the city, seeing comments about danger, Emergency Management notifications, asking questions about how to find supplies, or what roads were open. They could lend support by offering shelter to those evacuating (1001, 1012C), help with arranging assistance (1001, 1013), or answer those in need of

rescue by putting their kayaks in the water and getting those stranded to high ground (1009, 1015). Relevant example quotes are:

1001 "We got on social media and told other people that we knew that if they had to evacuate, come." And "We had a couple people that were worried about their-- we have some older people on the street, so they contacted us through social media because my husband grew up in this house. And he would go and check on the girl's father--- Her elderly father wasn't picking up his phone. It turns out it had died with the power being out. So, she used that [social media] to contact my husband to go check on him. So, we did a couple house checks on the older people on the street using social media, basically."

1012C "People at work knew that my husband was posting information like every 15 minutes to an hour, depending on how it came in. So, they were coming by me wanting to know what's the storm doing now."

1012T "The gas was still working. I had tons of charcoal. We could feed anybody that could get here. As I was asking, I know [my friend], he was out in the Fulshear area. He had to be air boated out. "Do you have a place?" "Yes, we're okay," that type of thing."

1015 "I didn't get any water in my house and my friend posted that he was parked at the elementary school with his canoe, ready to help anyone who couldn't drive out. The school parking lot is higher than the street, so I drove my truck over and we took off to help this lady's mom who was 84 and stranded in her house by Braeswood Bayou. We paddled over and pulled up to her steps to get her into the canoe. Then we waded her out, pulling the canoe up to the next high ground."

Two-Way Communication was not the only way to give and get information. Multi-Directional Communication was the process used by a couple of participants to aid with answering questions or assisting others. They would receive information, give information, and search for information in order to provide whatever was needed. They might receive an Emergency Management bulletin about street flooding, share the information on *Facebook*, then answer someone's question about how deep the water really was because they had just seen another post about that intersection. Example quotes are:

1003 Answering about how useful social media was: "I mean, it wasn't perfect, but there was enough information to give informed opinions." And "Because I know there were a whole lot of other people that apparently couldn't-- they could see the reports, but they couldn't translate that to how it affected them. And that's a lot of what I did. So based on this information, this is what I think will happen. And I tell them, I'm no expert but this is what I think. That gave them more than they had."

1013 "I mean mine was mostly trying to coordinate with people who needed to get out and ways to get them out." And "And then people were putting out, in their newsfeed, "So and so needs a boat at this address." Or, "If anyone that has a boat, let me know." Or, "I've got a boat, who needs help?"

Social media allowed people to communicate in various directions; to receive warnings, contact others, get site-specific information, make requests, and provide assistance all from one device – a smart phone, a laptop, or desktop computer.

6.4.2 Structural Approach (Intention): The Role of Danger/Threat

The Role of Danger or Threat was a catalyst for many participants to use social media during Hurricane Harvey. The sub-categories that emerged through analysis were the Weather, Flood, and Travel. Weather during Hurricane Harvey produced torrential rains of over 50 inches in some areas, as well as tornadoes. There were constant warnings about severe weather over the first few days of Harvey, so communication with those affected was essential. There were multiple ways of getting needed information, as stated earlier in the Role of Communication, and weather was one of the primary reasons. Participants were looking for specifics about when the rain would stop, how much rain was expected, and current warnings. Examples of relevant quotes are:

1001 "Where it [Harvey] was located."

1004 "How much rain there was coming. And then the wind speed."

1007 "Oh, I disabled it [Emergency Management app] because it would beep all the time at night."

1008 "Mostly how long things were going to last."

1009 "There was tornado warnings that kept going off all day."

1017 "When will the rain stop?"

The excessive rainfall was responsible for the second Danger sub-role or category: Flood.

The Houston-Galveston metro area is located on a coastal plain with gumbo soil (Webster 2019), a fine-grained soil mixed with clay that becomes very sticky mud when wet, which is not conducive to soaking up run-off, particularly when there has been rainfall in the previous two weeks. The creeks and bayous filled up quickly, causing

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Flood Danger for those in low-lying areas or near these creeks and bayous. Over half the

participants were concerned about rising water, either from direct rainfall or because of a

nearby water channel. They were looking on social media for flooding locations, river

rise information, rainfall forecasts, and whether or not they needed to evacuate. Six

participants evacuated, either voluntarily or by order, and three others were not told to

evacuate but had to be rescued from high water in their homes. Those six who evacuated

kept informed through their *smartphones* using weather applications and social media.

The three who were rescued used social media to get their assistance. Two (1005, 1009)

were rescued by local kayakers who were contacted through *Facebook* friends or

neighbors and the third (1006) was picked up by the National Guard through a *Facebook*

connection. Relevant quotes are:

1001 "Where the hardest hit sections were going to be."

1003 "I wanted the rainfall forecast."

1005 "So first you got-- you called 911, then you got the Coast Guard. And they

came but then you declined them because they wouldn't take the dog and then…

Neighborhood people took us to the front of the neighborhood where it was dry. I was on

Nextdoor and they were saying, 'Okay, we're sending our husbands with kayaks.'

Everybody up there pretty much was opening their doors for everyone back here."

1006 "I didn't want to leave without some place to go. I didn't want to be a

refugee, but Chuck kept telling me look, his son Barrett is in the car, and he's got his guys

[National Guard] on duty down there. Let's have them come pick you up." "Until I have

someplace to go, I'm not leaving." So, my buddy, Rob, he's in Alaska, and his daughters

said they would come get me if I could get to the freeway. So, I got in touch with Chuck

again and he said, "Hey, I'll send some guys." And they pulled right up in my front yard in a five-ton truck."

1009 "...to see if my house was going to flood." And "I posted and yeah, so I got responses. People were sharing it. I was getting responses from random people I didn't know saying, "If you can make it to this intersection," they can pick you up. But I didn't know how. All I could see outside of my house-- I couldn't even make it across the street to my neighbor's house --- I mean, the water was just rushing down our street. 3:30pm: That's when we were picked up. So, then they asked if I had a kayak, which my husband did in the garage, but I've never steered a kayak before. So, he gave me a two-minute lesson, he picks up my youngest daughter who, at that point, had fallen asleep on the couch, and the first guy just goes and takes off with her. And I have never met this man, and now he's in a kayak with my child. And then the second guy grabs my oldest, and he just goes. And then the third guy was going to take the dog. And the dog was so worried about me that she wouldn't sit in the kayak. She was howling. So, we get out onto Chimney Rock, and then my kayak goes into the bayou that's right there on Chimney Rock. And so, he's jumping out of his kayak and is going to try to grab me. He got me, but I had no life jacket on. He tried to give me his life jacket, and I told him, "Absolutely not. How can I have you lose your life for me?" So, then we just cruised on out."

1016 "How much more rain expected."

1020 "What areas were flooding."

Flood Danger led to the third sub-role: Travel.

Several participants were marooned in their subdivisions because they were surrounded by flood waters and it was not safe to travel, so they stayed where they were (1001, 1014). Some had to evacuate and depending on how early they got out of their area, they might have had to deal with finding a clear path to safety (1003, 1019). Two participants (1004, 1012C) had to report to work during the storm, so finding safe travel routes was essential. Those who were rescued had to find a way to someone's home or a hotel after being delivered to dry land. Social media played a part in finding unflooded roads and detours for those who had to move around. People could post on *Facebook* about which roads were open or closed (1012C), or they could use an application called *WAZE*, where people could post on a map as they drove through areas and mark open or closed, under water or clear. Relevant quotes are:

1001 "This road's closed. This road is open. This section's open."

1003 "I didn't feel like we were in any serious risk until I was in a car away from my home and didn't know where I was going to be able to stay because the city was shutting down and all the roads were closed."

1005 "After a few hours, someone in a big Excursion or something was able to get us down 45. 45 only was down to one lane. The southbound lanes were shut down because they were flooded. And only the inside lanes on northbound was open. And people would have to take turns--

1006 "So anyhow, they got me to the freeway, and then Rob's daughters came and picked me up. And we went to Baytown. And the subdivisions all around them proceeded to flood, and all except their subdivision. Water got about halfway up their yard and that was it."

1012T "And they [News Talk Radio] were also telling us these are the road closures. Don't go down here."

The Role of Danger or Threat was high during Hurricane Harvey and caused the need for immediate access to weather, flood, and travel information. Social media was the quickest and easiest way to access local, specific information from Emergency Management sites (one-way), friends and family on *Facebook* (two-way), and to coordinate movement of information, supplies, and travel via messages on *Facebook* and *Twitter*.

6.4.3 Structural Approach (Intention): The Role of Emotion/Stress

The Role of Emotion or Stress generated a need for receiving, sending, and searching for information during Hurricane Harvey and social media made connections to friends, family, information, and assistance easy. The sub-roles for Emotion or Stress were shown through analysis to be caused by Environmental issues or Personal issues. The Environmental sub-role or category relates to the physical aspects of the storm, such as the weather, tornadoes, rainfall, and subsequent flooding of the Houston area. Not all participants experienced a high level of concern, but many did. Those who had to evacuate their homes were concerned about finding a way through the flood waters, if flood waters would reach their house, flood effects on the house, would the water breach the levee, or would the creek get higher and flood the house. Those still in their homes were concerned with when the rain would stop, or how much longer would the storm last. Examples of relevant quotes are:

1002 "--it was imminent. Not even iffy, it was really almost imminent that the river was going to, in fact, breach the front levee and flood our houses. Luckily, it quit raining."

1003 "It took us a couple of hours to get everything together and get all our children and our clothes and animals and so on into the vehicle. And then we couldn't find a way out of the city. And we had gone on the west side. And apparently, they had already opened the gates at the Barker Cypress dam. So, it closed 6, it closed the Beltway north, and you had to go at least to 6 Center beyond. And I wasn't sure that I can get out on the north side because the rivers were flooding too. So, the stress the moment when I had my five children and our four animals in my car, and it's pouring down rain, and I can't escape the city was very---stressful." And "Well, we had a tornado in the neighborhood. We had a 24-hour period where we had like 100 - and somewhere it's documented - 150 alerts on the phone in a 24-hour period, which is more than have been issued in the last 5 years combined. And this was the pinnacle of that. And we've been worried about the river."

1005 " The water came up and hit our basement and our garage. And that's when we realized that we were stuck. And so, we were at about a seven or an eight (on a scale of 10 to 1 for Threat Level) because we knew we couldn't get out but we still kind of felt that with the house things that stood on the ground that we would be safe inside. And then the morning of the 27th, by 7:00 AM, the water was about two to three inches from our door. And that's when we were at a 10. We both called 9-1-1 and contacted the Coast Guard."

1009 "And by the time that-- when we were picked up, the couch was completely soaked. My daughter was covered in flood water, covered in sewage."

1012T "The biggest fear we had was losing our power and losing our Wi-Fi. That was our biggest fear."

The Environmental issues were hard on their nerves and produced the Personal issues that constituted the second sub-role. Some participants had children that they didn't want to be worried about what was happening outside, so they found other things for them to do besides watch the TV news, like movies or games, and the parents used social media to get their information (1001, 1009). Other participants had concerns about family in other areas hit by the storm (1003, 1012C). Those who did not evacuate to a family member's house, but to a hotel, were hard pressed to find supplies for several days. One had evacuated to a hotel that had run out of provisions, so they had to figure out where to find food and supplies. Relevant examples are:

1001 "For a while, it was water and dog food [needed]. So of course, we didn't stock up on that." And "We were worried because the kids knew something was going on. So, they were super light sleepers that night. So, we used mostly social media, the news outlets and stuff like that, on our *Facebook* to keep track of things just so the kids wouldn't overhear anything."

1003 "And then you also have to add the stress level of like, my adult son at the time was living in Port Arthur. They got 57 inches of rain and he was home alone with two children under five. And the water was up, lapping at the bottom of the siding on his house. And so, I'm in one place, evacuated from my home. I can't possibly help him, and he's stuck in a home that I don't know if he's going to be flooded out overnight.

1005 "This was a time of panic."

6.5 Conceptual Model of the Role of Social Media

Responses and comments from participants reflect some of their feelings and needs during Hurricane Harvey as well as their dependence on social media to find and share information with others in similar circumstances speaks to the high level of importance for this form of communication during hazard events. These examples help to demonstrate the relational connections or "intertwining" of the participants with the Direct Object of Social Media (Khan 2017). The interconnectedness of the roles were also evident by the fact that most of the communication on *Facebook* or *Twitter* by the participants during Hurricane Harvey was centered around the roles/themes of *Danger/Threat* or *Emotion/Stress* motivated the decision to turn to social media as a means for obtaining one-way, two-way, or multi-directional dialogues with others on the platforms. Thus, Figure 6.5 illustrates, conceptually, through the lens of phenomenography, the interconnectedness of participants where the triangular components represent the intentions/roles or themes (i.e., categories of description) –the "why" and the rectangular components represent the Acts, or behavior choices of "how" social media was employed for personal disaster communication.
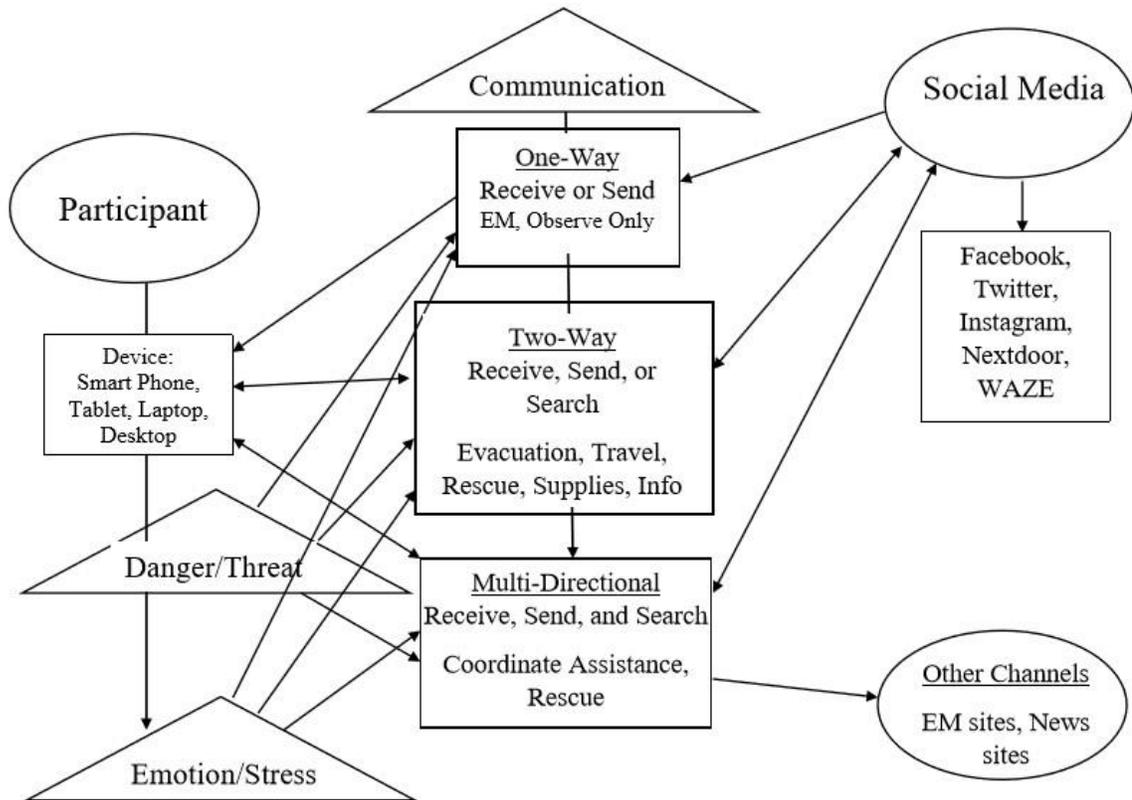
Figure 6.5 Relational Model of How and Why Social Media is Used during Disaster through the Lens of Phenomenography

Conceptualization of the use of social media as a primary communication tool is evidenced by the fact that all participants were well-versed in its use, i.e., available platforms (*Facebook, Twitter, Instagram*, etc.) and for what purpose, as well as how to contact others for assistance, how to find safe routes through flooded roadways, how to post videos or pictures, etc., and that only four participants have a landline, though most don't actually use it.

6.6 Emergency Management Personnel

The analysis of emergency management personnel's responses was processed through a Phenomenographic view, but as a checklist of operations to determine the

extent of use and effectiveness, from the standpoint of the workers. Posting information and monitoring responses was their job. Their perception of that job's effectiveness was explored, but not extensively. The priority for this set of questions was to determine whether or not social media was being used by emergency management personnel, how they were using it, and could social media improve risk communication between governmental agencies and the public. The Final Outcome Space (Table 6.6) shows:

Table 6.6 Final Outcome Space: Emergency Management Personnel

Intention	Approaches- (Structural)		
	1) Receiving information	2) Sending information	3) Monitoring information
Role of Communication			
One-Way		X	X
Two-Way	X	X	
Role of Danger/Threat			
Weather	X	X	X
Flood	X	X	X
Travel	X	X	X

The phenomenographical analysis of emergency management responses showed similar relationships to the citizen participants, though the approaches were slightly different. Emergency management personnel were not concerned with searching for information, but rather monitoring the information that was being passed around on social media. Therefore, their one-way communication included sending emergency management bulletins or warnings and observing (monitoring) posts from the public with the intention of preventing rumors or incorrect information from spreading. If emergency management personnel came across a rumor, they would take immediate steps by posting the corrected

information. Their two-way communication was limited to responses to citizen participant requests or questions on social media pages, which was usually to provide appropriate contact information for the agency who could help.

The roles of danger or threat were what caused the relationships between the approaches and the citizens, and how the emergency management personnel were integrated into the group. Without the danger factor, there would be no need for citizens to interact with emergency management personnel because there were no weather issues, no flooding, and no need to travel to escape the danger, and therefore, no cause to send or receive information. Monitoring social media would still be needed for the occasional possibility of a hazard occurring, but there would be little need to interact until then.

6.7 Conclusion

To sum up the analysis, *phenomenography* provided a structural framework to emphasize the acts and intentions by individuals as they related to a particular phenomenon. In this case, social media was the focus or object and the participation in its use by citizens in the Houston-Galveston metro area during Hurricane Harvey can be shown to have a relationship to the cause by explaining the "why" of their different but related needs to communicate. The participants used a variety of methods of communication by sending, receiving and searching for information which was prompted by their perception of danger or stress. These methods were different but could be categorized under an umbrella of related needs.

CHAPTER VII. IMPLICATIONS AND CONCLUSIONS

The overriding problem that arose during Hurricane Harvey, which inspired this research, was the observation that many people in the Houston-Galveston metro area had dire need for information and/or assistance and called 9-1-1 but could not get through to an operator. Consequently, many turned to social media to seek assistance for myriad problems --from being stranded in their vehicles in high water, to needing rescue from flood-inundated homes. Some needed to evacuate but didn't know where to go. Some had to travel to work but had no idea which roads were open. Whatever the problem, people sought out social media, whether it was *Facebook, Twitter, Instagram*, or *Nextdoor,* to obtain pertinent and important information. Government agencies have been reluctant to engage in the use of social media for diverse reasons, typically related to resources and available personnel during disasters; however, increasingly, emergency managers and first responders have come to see that social media is useful and valuable as a means to communicate with a public at-risk. Some emergency management agencies have a presence on the Internet, as a website or *Facebook* page, but do not always have adequate personnel to respond when a citizen sends a message. In small towns and communities, many agencies only have one 9-1-1 dispatcher, and then, only during standard business hours.

Because it was so difficult to reach 9-1-1 operators during Hurricane Harvey, this research sought to explore the extent to which social media was used by citizens and emergency management agencies, alike, during the storm. The intent was to find out: why citizens turned to social media, by what means did they employ social media, and to what extent did social media meet their needs. To understand the lived experiences of

people who used social media as a life-saving medium, this research employed the perspective of phenomenography—a qualitative research method that aims "to discover the key aspects of the variation in how a group of people experience or understand (collectively) a phenomenon under investigation" (Trigwell 2006, 368). It identifies similarities and differences in the way we experience and understand phenomenon in the world around us. According to Barnard and colleagues (1999) . . . "it is essential to recognize the qualitatively different ways that phenomena are experienced and understood" (212). The overriding goal was to assess whether social media serves as a viable and useful means for communicating risk during disaster, and, if so, to what extent might emergency management personnel develop this medium for application in future disaster occurrences.

7.1 Research Question 1: *What was the Extent of Social Media Use by Citizens*

The primary research question was: *To what extent did residents of the Houston-Galveston metro area use social media during Hurricane Harvey?* Participants' extent of use of social media included searching for information about the storm, sharing their personal experiences and those of others, contacting official agencies and news agencies, and receiving emergency management information. Participants received information from official emergency management agencies through text applications (push notifications) and from social media platforms, such as *Facebook* or *Twitter*, if they were following those pages. If an emergency management agency posted an alert or warning on *Facebook*, it popped-up on a participant's newsfeed. Participants also received posts from friends and family on social media platforms that apprised them of their friends' experiences as Hurricane Harvey unfolded. Social media postings included descriptions,

comments, pictures and/or videos. Other postings included road closure information, links to radar, and/or locations of flooding. Homeowner's associations re-posted emergency management information to their residents, including evacuation notices and information on possible flooding. *Nextdoor*, a neighborhood application, was used to keep neighborhoods in touch during the storm. Participants sent information, as well, by sharing their particular situations through comments and/or video, forwarding official information, and notifying friends and family that they were safe. Many sent out requests for help and rescue.

If the information needed was not already on their *Facebook* page, participants searched for pages with the proper information or sought out the Internet to "pull-up" sites with pertinent information. All 21 participants searched for information about Hurricane Harvey as it was happening (IQ5). Almost all watched local TV news stations for regular updates, while supplementing that information with that appearing on social media. The device of choice (IQ7) for accessing social media was a *smartphone*, although some used laptop computers, desktop computers, or tablets. All participants utilized *Facebook*, but a few used *Snapchat, Twitter*, or *Instagram* (IQ8). *Facebook* was described as a place where they could scroll through their newsfeeds to see what was happening with their friends, find local news postings, or view official information that they had chosen to follow. *Twitter* was promoted as a fast route to official information. By using a hashtag (#), participants said that it was easy to find information, verify postings from Facebook as authentic, or view local information without waiting for TV news reports.

The specific sorts of information sought by participants (IQ9) included flooding locations, rainfall forecasts, finding out how long the storm would last, the status of friends and family, and information not found on TV. The primary method for finding information (IQ10) was to see it "automatically pop-up" on *Facebook* or see it posted from a person or agency that they followed. A few looked around for specific news sites on *Facebook* or *Twitter*, but most found what they needed without searching. A majority of participants (71%) said that the information found on social media changed their perceptions of personal risk during the storm (IQ11). The reasons stated (IQ11a) included increasing their levels of awareness of the danger of the storm, concerns about needing to evacuate, how to evacuate with their pets, and getting tailored information specific to their location in Houston. Several participants mentioned that they had previous experience with hurricanes, and initially, discounted the hurricane's predicted impact because landfall was not expected near Houston; however, as they watched the storm strengthen, through images and information on social media, their levels of concern increased. As the rains continued and the posts became more emotionally charged, participants were not sure what to expect. Those along the Brazos River were ordered to evacuate due to concerns about a levee breach or over-wash if the river continued to rise from upstream precipitation. Participant 1003's search for coherent data about the rate of discharge related to flood levels in the subdivision were unsuccessful, causing more stress. In this instance, the participant was ordered to evacuate, but the lack of available information about the increase in water levels that might affect their homes did not ease the worry. Participant 1003 said: "But what about my house? How much danger is my house in from the flooding? And nobody could figure it out because the information flat

out is not available. That made people angry." Ultimately, the levee held, and the river level decreased.

Participant 1002 stated that his neighborhood association was posting information: "We were getting updates from the county, and from the sheriff's department, and from my homeowners' association on the same *Facebook* page that I was on." and, "We were able to get updates tailored specifically about our location on the Brazos River." This participant was able to avoid wading through non-specific, Houston area information to obtain information important to him by "following" his county commissioner's *Facebook* page.

7.2 Research Question 1a: *The Process of Risk Communication on Social Media*

Secondary to Research Question 1 was Research Question 1a, asking: *What was the process of risk communication involved in using social media?* By process, this study meant to look at what was needed to actively participate on social media. All participants owned a *smartphone*, and some also had access to tablets, laptops, or desktop computers, all of which were connected to the Internet. The platforms accessed included *Facebook, Twitter, Instagram, Snapchat, Nextdoor,* and *WAZE*. All participants were active on *Facebook*. Most participants were savvy enough to post pictures or videos, search for specific data, or open links for additional information.

7.3 Research Question 1b: *How Did the Process Vary by Demographic or Personal Need?*

Also secondary to Research Question 1 was Research Question 1b, asking: *Did the process of risk communication vary by specific demographic or personal need?* The only demographic that seemed impeded was the over 65 group, many of whom had not

adopted the *smartphone* as more than a mobile telephone. Several older friends were contacted to participate but were not active users of social media. Personal need stood out as a quantifier for applying the process. The more danger/threat that was perceived by the participant, the more imperative was the search for information or assistance.

7.4 Research Question 2: *Usefulness of Social Media for Communicating Urgent Needs*

Research Question 2 asked: *To what extent did individuals believe that social media was a useful means of communicating immediate and urgent needs for assistance?* The usefulness of the information on social media (IQ11b) was ranked as a "10" by 71% of the participants and a "9" by 14%, however, no one ranked it lower than a five. A major reason given by participants included locus of control—explaining that if they knew what was going on around them, then they could plan and take some control. Another important reason concerned travel or evacuation—if this was necessary, then posted information was crucial for identifying roads that were passable and other routes to avoid. One participant worked at a local grocery store and began posting information about available staples like bread, milk, and water. Her husband was sending regular updates throughout the day and when her phone would "ding" in her pocket, customers would ask to know what information she had received. They didn't mind that she had to stop bagging their groceries to share the information. She said, "I was a public service person. I was bringing a lot of comfort to people that felt like, "Do we have to rush now? We have time. We can do this."

Another participant, 1001, noted a benefit of using social media instead of watching local TV news was that it kept her kids from knowing exactly what was going on. That is, here kids could watch a video, and not be afraid, while the parents could still

stay informed by using their *smartphones*. She also said that storms sometimes affected the cable or satellite transmission but having social media access via *smartphones* meant there was no loss of communication.

Social media was very useful according to two participants who had to be rescued from their homes. Participant 1009 had moved to a new home only two months before and was not aware of any flooding issues, but during the hurricane, as the water began to rise and her husband was not able to reach her and the children for 17 hours, she became worried. She tried 9-1-1 but they kept hanging up; then, she contacted the Cajun Navy on their *Facebook* page, but they would not help unless she had at least three feet of water in the house. She posted a request on the NBC local affiliate's, KPRC, *Facebook* page posting that, "if anyone has a boat in the Meyerland area, please come and save my girls and I." Eventually, they were rescued by the father of her pre-school daughter's friend "and two other boy scout dads in kayaks" who she had never seen before. When asked if there was anything she wanted to add about using social media she said, "I mean, it was my lifeline."

Participant 1005 used social media to be rescued when creek water flooded the downstairs garage and was threatening the doorstep of their living quarters. "We both called 9-1-1 and contacted the Coast Guard. When I put my newsfeed up on *Facebook* a friend that I'd gone to high school with is head of the Coast Guard out of Virginia and he called me. And he said, "What can I do?" And I said, "You need to get people in here." And about 30 minutes later we had the Coast Guards coming. Well, the Coast Guard came to our back door, boated right up near to our door, and they wouldn't let us take our dog. So, we sent them on their way," and "neighborhood people had little john boats and

little kayaks, and they boated up and they started taking us one at a time." She had used

Nextdoor, a neighborhood application that a person subscribes to for free and had been

conversing with other neighbors throughout the storm. When she shared about the Coast

Guard, they replied with "Okay, we're sending our husbands with kayaks. We're coming."

7.5 Research Question 3: *The Extent that Emergency Management Provided Channels of*

Information Gathering

Information gathering was not the primary purpose of the emergency management

personnel interviewed for this study who were more concerned with getting critical

information out to the public quickly and accurately during Harvey. They monitored

social media for rumors and incorrect information and then made posts to correct the

information as soon as possible.

7.6 Research Question 3a: *Viability of Social Media Instrumental in Risk Communication*

Research Question 3a asked: *How was social media instrumental in risk*

communication? Social media was instrumental to getting the information out quickly

and easily. Emergency management personnel could reach people anywhere, not only

those at home with reverse 9-1-1 or watching a crawl line at the bottom of the television.

Sending out bulletins and warnings on social media meant that those who received the

messages could re-post or forward those messages to others, increasing the range of

signal for the information.

7.7 Research Question 3b: *Which Method was the Easiest, Most Difficult, and Most*

Effective?

Research Question 3b asked: *Which method is easiest, most difficult, most*

effective to use? As discussed in Chapter 5 and enumerated in Table 5.6b, *Twitter* was

noted as easier to use for quick posting of urgent information. *Facebook* was deemed most difficult because the agency did not have monitoring software to classify or filter data, and that people tended to expect more conversation on that platform. *Nextdoor* was also noted as particularly effective in targeting specific neighborhoods in need of warnings rather than an entire city.

7.8 Research Question 3c: *Positive and Negative Aspects of Social Media Methods*

Research Question 3c asked: *What were the positive and negative aspects of the social media methods used?* The positive and negative aspects of the social media used were discussed in Chapter 5 and noted in Table 5.6c. The primary positive aspect of using social media was how quick the message could be sent out and how wide the range could be. Unlike TV and radio, social media was, and is, not limited by how far the signal can travel through the air or become disrupted by electrical outages. If there is an internet connection, anyone can open a *Facebook* page and interact with someone across the globe. The primary negative aspect was dealing with rumors, because like the original message, rumors can travel just as fast. They are difficult to stop and must be quickly handled and corrected.

7.9 Research Question 4: *Improving Risk Communication between Agencies and the Public*

Research Question 4 asked*: How can the use of social media improve risk communication between governmental agencies and the affected public during a hazard event?* Though almost half (10/21) said that the emergency management personnel did the best that they could during Hurricane Harvey, some noted that more specific or targeted information would have been helpful, such as the locations of flood prone

neighborhoods or areas of the heaviest precipitation. Another participant suggested that a more clear and concise explanations of impacts of heavy rainfall would have been helpful to some, as well as, letting people know what they might anticipate from heavy rains.

7.10 Implications of Findings

The implications from this research point toward an increased need for emergency management to engage in the use of social media to not only send information but receive requests for assistance. Dialing 9-1-1 and waiting for a limited number of operators to answer seemed unacceptable to many who were in need of assistance. The lack of full-time staffing for social media monitoring at emergency management agencies should be addressed, as well as the need to acquire monitoring software to filter and categorize social media information that is received. Communication channels are evolving from general broadcast news stations to world-wide accessible websites that can inform in an instant. Government agencies need to be aware of the gaps in the safety net that they say they provide through the current channels.

7.11 Future Directions in Risk Communication: Modifying the Conceptual Framework for Risk Communication

One of the advantages of a qualitative approach is that suggests theoretical directions and lays the groundwork for future quantitative, empirical research. A long-established framework for risk communication in the research literature is the General Framework for Risk Communication (Figure 3.5.9), a process model developed by hazard risk communication researchers in the mid-1980s. One conceptualization of the model developed by Blanchard (1992) is presented below. With the advent of social media as a relatively new communication tool, this framework might be modified given

the information from this research to show how the communication process has changed. The message regarding risk remains, but the channels have been augmented and, in some cases, amplified, so that opportunities to be informed are increased. The adapted process (Figure 7.11) is explained with regard to the interview information received and the explanations given by the participants in this research.
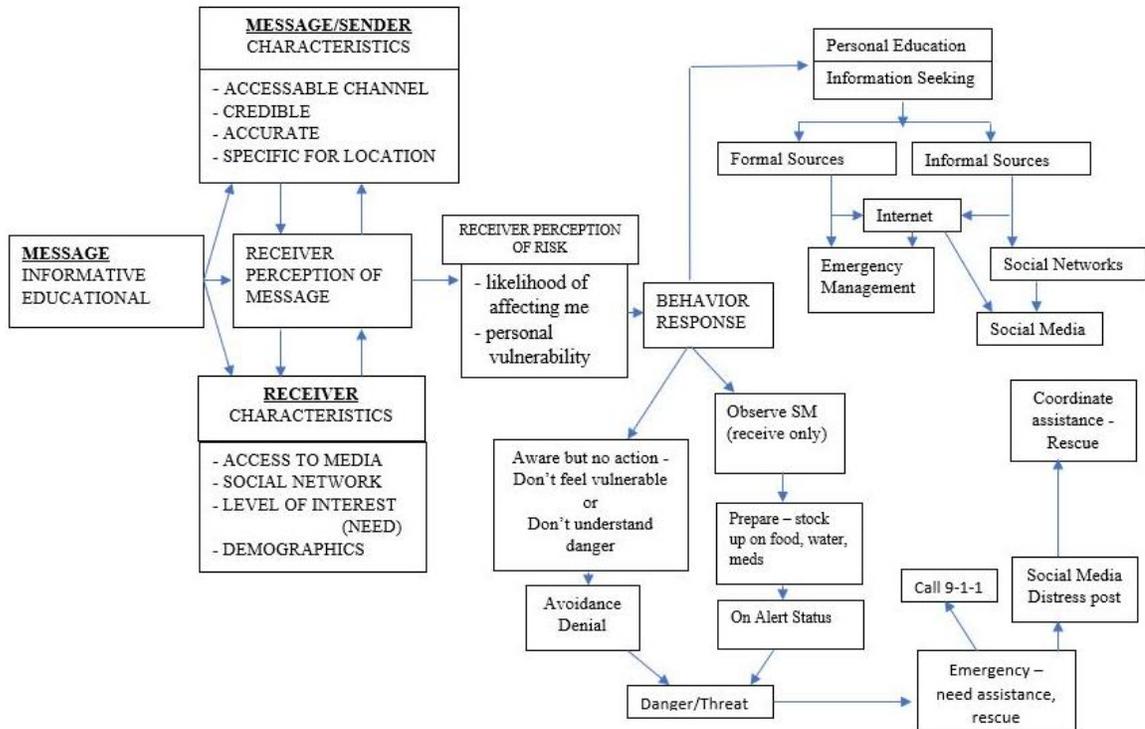
Figure 7.11 Conceptual Framework for Risk Communication – Adapted from Blanchard (1992)

The findings from this research, suggest that future risk communication researchers might modify the Conceptual Framework for Risk Communication to reflect changes in the way general communication is practiced, as well as how emergency managers and others in risk communication need to be aware. The message being sent must be credible and accurate, identify the location affected and must be accessible. Figure 7.11 shows that social media has broadened the list of accessible channels to

include any platform with internet access, which can connect anyone with a smart phone or computer access to the message. The receivers only need to have access to the internet and social media to have access but must also have an interest in the information. Demographics affect the ability to receive the message if there is no access to the internet or a smart phone, or if they do not participate in social media. An example of this would be some people over 65 who have not adopted wireless technology, or the very few who cannot afford a cell phone. This is not to say that only those on *smartphones* or the internet will get emergency communications. Mass media in the form of TV, Radio, and Newspapers can continue to share the messages, but because communication no longer requires a plug, the location of a broadcast is not a boundary.

The receiver may perceive the danger or not and follow with the expected behaviors noted: They do not feel vulnerable, so do nothing or they do not understand the danger and take no action. That may be followed by avoidance or denial by continuing to not acknowledge the risk. If they do understand the risk, even if only by observing the message on social media, they may prepare and remain on alert for further developments. When danger or a threat occurs and warnings are sent or posted on social media, the receiver may require emergency assistance. They may call 9-1-1, but in the case of Hurricane Harvey, that was not always a successful option. Many people tried to reach a 9-1-1 operator during the storm and were unsuccessful or were on hold for many minutes only to be told that their situation was not dire enough to warrant assistance. Social media became the next best option for those who perceived that they were threatened and needed assistance. Sending a distress post could conjure neighbors or good Samaritans to appear in canoes, kayaks, or large vehicles to carry them to safety. Often these rescuers

were being coordinated by others on social media who were not being affected at the time.

An alternative behavioral response to perceiving the message would be to seek more information in order to educate themselves on what the risk was and how to deal with it. There are formal sources such as the official governmental sites that have offices to call or webpages to browse for specific information. These sources would refer you to official emergency management personnel or websites on the internet. Secondly, there are the informal sources for information such as social media platforms where you may get official information as well as rumors and opinions. Which route a person takes to get information or assistance will often lead them to social media, regardless of their demographic or economic status.

7.12 Limitations

This was an exploration of the phenomenon of social media in a disaster setting. In-depth, face-to-face interviews were conducted with Houston-Galveston metro area residents previously known to the researcher, using the snowball method of acquiring additional participants who experienced the Hurricane Harvey event. This method of sampling was also used to identify a variety of demographic categories, i.e., age and economic status, within the study region. The requirement that all participants had to have used social media made finding possible participants in the over 65 age range difficult. None were interviewed in that demographic category. An attempt was made to find participants from each county represented in the Houston-Galveston metro area, as well as residents who were and were not directly affected by the flooding or did or did not have to evacuate their homes. There were participants from Harris County, Fort Bend

County, Montgomery County, Galveston County, and Waller County. There were participants who were barely affected by the storm, with no flood issues; there were three participants who had to be rescued from flooded homes; there were several who gave assistance to those in need, and one who paddled a canoe to rescue people. Only seven participants lost power, but only for a few hours. This situation did not affect their ability to stay in contact with social media as they had no issues with keeping their *smart phones* charged.

7.13 Future Directions for Emergency Management and Risk Communication Research

This was a small, limited study of 21 citizen participants and four emergency management personnel. Further study should include a greater number of participants and a wider swath of coverage over an affected area with more specific data on demographics, such as income level and ethnicity, to test for negative indicators of risk perception. Another possible angle for study would be acquiring specific data on parallel social media platforms to assess the effectiveness of the risk message. By comparing the responses from those who use both *Twitter* and *Facebook*, an interpretation could be made for effectiveness that could guide emergency management agencies with regard to which monitoring software would be most cost effective. There were few in this study who were without electricity long enough to affect their ability to access social media via their smart phones, therefore, future studies might target areas where there were long-term power outages to determine if social media access or usage was affected. Finally, this study did not have responses from specifically vulnerable populations, i.e. those who were visually or hearing-impaired, or those over 65. Many members of these populations are actively mobile and must be able to receive emergency notifications when they are

away from home. An investigation into the most effective methods of mobile

communication for these populations could assess a change in their level of vulnerability.

APPENDIX SECTION

APPENDIX A

Cover Letter for Survey - Document 1

Date

Susan E. Street, a graduate student at Texas State University, is conducting a research study to investigate how individuals and emergency managers perceive social media as a viable means of communicating risk information. You are being asked to complete this survey because your name was given to me as someone who was in the Houston area during Hurricane Harvey and used social media.

Participation is voluntary. The survey will take approximately 30-60 minutes to complete. You must be at least 18 years old to take this survey.

This study involves no foreseeable serious risks. We ask that you try to answer all questions; however, if there are any items that make you uncomfortable or that you would prefer to skip, please leave the answer blank. Your responses are anonymous.

If you have any questions or concerns, feel free to contact Susan E. Street or her faculty advisor:

Susan E. Street, graduate student	**Dr. Denise Blanchard, Professor**
Department of Geography	**Department of Geography**
210-313-7131	**1-512-245-3090**
Ss1733@texasstate.edu	**rb06@texasstate.edu**

This project #2018532 Texas State IRB on March 15, 2018. Pertinent questions or concerns about the research, research participants' rights, and/or research-related injuries to participants should be directed to the IRB chair, Dr. Jon Lasser 512-245-3413 – (lasser@txstate.edu) or to Monica Gonzales, IRB Regulatory Manager 512-245-2334 - (meg201@txstate.edu).

If you would prefer not to participate, please do not fill out a survey.

If you consent to participate, please complete the survey.

Informed Consent - Document 2

Image 1 Informed Consent page 1 pdf

TEXAS ★ STATE ®

INFORMED CONSENT

Study Title: The Viability of Social Media for Communicating Risk during Disaster: Assessing User Experience during 2017 Hurricane Harvey

Principal Investigator: Susan Street
     Email: ss1733@txstate.edu
     Phone: 210-313-7131

Co-Investigator/Faculty Advisor: Dr. Denise Blanchard
     Email: rb06@txstate.edu
     Phone: 512-245-3090

This consent form will give you the information you will need to understand why this research study is being done and why you are being invited to participate. It will also describe what you will need to do to participate as well as any known risks, inconveniences or discomforts that you may have while participating. We encourage you to ask questions at any time. If you decide to participate, you will be asked to sign this form and it will be a record of your agreement to participate. You will be given a copy of this form to keep.

PURPOSE AND BACKGROUND
You are invited to participate in a research study to learn more about social media use during Hurricane Harvey. The information gathered will be used to analyze the level of usage of social media and its effectiveness during a disaster. You are being asked to participate because you were in the Houston metropolitan area during Hurricane Harvey, used social media, and are willing to be interviewed.

PROCEDURES
If you agree to be in the study, you will be asked to participate in one interview, arranged by appointment. Each interview will last approximately one hour. During the interview, you will be asked to describe how and why you used social media during Hurricane Harvey. The interview will be (audio-recorded) and the researcher may take notes as well.

RISKS/DISCOMFORTS

In the event that some of the survey or interview questions make you uncomfortable or upset, you are always free to decline to answer or to stop your participation at any time. Should you feel discomfort after participating, you may contact Family Services of Greater Houston for counseling services at 713-861-4849. They are located at 4625 Lillian St., Houston, TX, 77007.

Image 2 Informed Consent page 2 pdf

BENEFITS/ALTERNATIVES

There will be no direct benefit to you from participating in this study. However, the information that you provide may aid in increasing the ability of residents and emergency management personnel to communicate in real-time during disasters and support positive reasons for emergency management to implement the use of social media in their communication systems.

EXTENT OF CONFIDENTIALITY

Reasonable efforts will be made to keep the personal information in your research record private and confidential. Any identifiable information obtained in connection with this study will remain confidential and will be disclosed only with your permission or as required by law. The members of the research team and the Texas State University Office of Research Compliance (ORC) may access the data. The ORC monitors research studies to protect the rights and welfare of research participants.

Your name will not be used in any written reports or publications which result from this research. Data will be kept for three years (per federal regulations) after the study is completed and then destroyed.

PAYMENT/COMPENSATION

You will not be paid for your participation in this study.

PARTICIPATION IS VOLUNTARY

You do not have to be in this study if you do not want to. You may also refuse to answer any questions you do not want to answer. If you volunteer to be in this study, you may withdraw from it at any time without consequences of any kind or loss of benefits to which you are otherwise entitled.

QUESTIONS

If you have any questions or concerns about your participation in this study, you may contact the Principal Investigator, Susan Street: 210-313-7131 or ss1733@txstate.edu.

This project was approved by the Texas State IRB on March 15, 2018. Pertinent questions or concerns about the research, research participants' rights, and/or research-related injuries to participants should be directed to the IRB Chair, Dr. Denise Gobert 512-245-8351 – (dgobert@txstate.edu) or to Monica Gonzales, IRB Regulatory Manager 512-245-2334 - (meg201@txstate.edu).

Image 3 Informed Consent page 3 pdf

DOCUMENTATION OF CONSENT

I have read this form and decided that I will participate in the project described above. Its general purposes, the particulars of involvement and possible risks have been explained to my satisfaction. I understand I can withdraw at any time.

_____   _____   _____

Printed Name of Study Participant   **Signature** of Study Participant   Date

_____   _____

Signature of Person Obtaining Consent   Date

Survey Instrument – Document 3

Interview Proceedings:

Good morning/afternoon/evening. I want to thank you, again for agreeing to be interviewed for my research on social media during disaster events.

Do I have your permission to record our session? Thank you.

If you have not already done so, please read and sign the Informed Consent document. Thank you.

As I explained when I contacted you, I am doing research to explore the use of social media during disaster events. By social media I mean the use of internet applications on your computer, tablet, or cell phone to communicate with others, such as Twitter, Facebook, Instagram, or other similar platforms. Although you will not receive compensation for your participation in this research, I hope that the findings of this research will benefit anyone who might experience a disaster by helping emergency management personnel to communicate better during disasters, and for citizens like you to be better prepared and informed about disasters, such as hurricanes, through the use of social media.

The records of this research will be kept private. I will assign a code number to this interview so that when I transcribe the recording, your identity will be kept confidential. The digital recordings will be loaded onto my personal home computer and later stored on a hard drive that will be secured in a locked office cabinet. I will be the only person to have access to your identity. Let me remind you that this interview is voluntary, and you may decline to answer any question or stop the interview at any time.

Would you like to participate in this research? Thank you.

This interview should take 45 minutes to an hour, so please make yourself comfortable. I have water here, and if you need to take a break at any time, feel free to let me know.

Do you have any questions before we begin?

Great. Let's get started.

To begin, I have a few questions on a scale from 10 to 1 where I just need to get an idea of your overall experience with Hurricane Harvey:

[PERCEPTION OF PERSONAL THREAT] *I want to start by getting an idea of how threatened you felt you were during Hurricane Harvey.*

1. I will ask this on a scale from 10 to 1, where 10 is where you felt "extremely threatened" and 1 is where you did not feel threatened in the least. So, overall, how threatened [how afraid] were you?

10   9   8   7   6   5   4   3   2   1

Thank you.

[PERSONAL RESILIENCY]

I want to ask about your overall ability to cope during and immediately after Hurricane Harvey. Coping would refer to your ability to use your own resources to survive the storm without any help from anyone else.

2. Again, I will ask on a scale from 10 to 1 where 10 is where you needed no help at all in coping, and 1 is where you were desperate for outside assistance.

DURING THE HURRICANE:

10   9   8   7   6   5   4   3   2   1

IMMEDIATELY AFTER THE HURRICANE:

10   9   8   7   6   5   4   3   2   1

Thank you.

3. If you needed assistance, then who gave the assistance? For instance, did you call on

family and friends for help, (informal sources) or did you call for emergency (9-1-1)

assistance (formal), or did you need both?

What kind of assistance was provided?

Thank you.

4. If you called on emergency (9-1-1) assistance, what was your opinion of the assistance

that was provided? Again, on a scale from 10 to 1 where 10 would be extremely helpful

assistance and 1 would be assistance that was not helpful at all.

10   9   8   7   6   5   4   3   2   1

Thank you.

I have a couple of questions about how you got information about the storm.

5. Did you seek information about Hurricane Harvey as it was happening?

YES   NO

If you did [YES], which source did you rely on the most for information?

Local TV News

National TV Weather News (like The Weather Channel)

Emergency Management Workers in your neighborhood

Some other source

Thank you.

Many of the following questions will be YES or NO questions with a follow-up clarifying

your answer.

6. Did you use Social Media during Hurricane Harvey?   YES   NO

7. [IF YES] what type of device was used?   Desk top, lap top, tablet, smartphone, etc.

8. What type of social media was used? Facebook, Twitter, Instagram, YouTube, etc.

9. What kind of information about Hurricane Harvey were you looking for during the storm on social media?

10. How did you go about finding information about Hurricane Harvey on social media?

11. Did the information you received through Social Media change your perception of your own personal risk from Hurricane Harvey?   YES   NO

     [IF YES] How?

     On a scale from 10 to 1 where 10 was "extremely useful" and 1 was "not useful at all", how useful (for you) was the information on social media?

10   9   8   7   6   5   4   3   2   1

Thank you.

12. Did you share any information about the risks during Hurricane Harvey on Social Media? YES   NO

     [IF YES] What did you share?

     What platform did you use?

     Who did you share with? (Known/Unknown general public)

13. Did you contact any government/emergency management agency on THEIR Social Media website during Hurricane Harvey?   YES   NO

     [IF YES] What agency?

     For what reason?

     Did they respond?   YES   NO

     [IF YES] How?

14. Did you contact any government/emergency management agency on ANY Social Media during Hurricane Harvey?   YES   NO

    [IF YES] What agency/agencies?

    For what reason?

    Did they respond?   YES   NO

    [IF YES] How?

15. Did you contact any news media outlets on THEIR Social Media <u>website</u> during Hurricane Harvey?

    [IF YES] Which one(s)?

    For what reason?

    Did they respond?   YES   NO

    [IF YES] How?

16. Did you contact any news media outlets on ANY Social Media during Hurricane Harvey?

    [IF YES] Which one(s)?

    For what reason?

    Did they respond?   YES   NO

    [IF YES] How?

17. Did you receive notification to evacuate?   YES   NO

    [IF YES] By what channel of communication? Phone call, email, TV bulletin, SM type, knock on door, neighbor, family member

    Did the notification reach you immediately?   YES   NO

    Why or why not?

18. Did you evacuate?   YES   NO

      Why or why not? (WERE YOU ABLE TO EVACUATE?)

19. If you evacuated, where did you go?

      Family   Friends   Hotel   Shelter   Other

20. Were you able to stay informed while away?

      By what method(s)?   TV   Radio   Social Media (platform)   Other

21. How much emergency management information did you receive via Social Media?

      All   Some (75%   50%   25%)   None

22. How reliable did you feel the information was on Social Media, on a scale from 10 to

1 with 10 being "very reliable" and 1 being "not reliable at all"?

10   9   8   7   6   5   4   3   2   1

      Was the information from people you knew?   YES   NO

      If not, who/what was the source?

23. Did you have a home phone [LANDLINE]?   YES   NO

24. Did you lose power during Hurricane Harvey?   YES   NO

      [IF YES] Did losing power affect your ability to communicate?

      YES   NO

      [IF YES] What did you do?

25. Did your residence flood?   YES   NO

26. Did your neighborhood flood?   YES   NO

27. Were you stranded in your home because you were surrounded by flood waters, even

though your home did not flood?   YES   NO

      [IF YES] What did you do?

Did you use Social Media?   YES   NO

[IF YES] For what purpose?

28. Did you have to report to work during Hurricane Harvey?   YES   NO

[IF YES] How far did you have to travel?

< 1 mile   1-4 miles   5-9 miles   10+ miles

Was any of that distance flooded?   YES   NO

[IF YES] Did you have to detour?   YES   NO

29. Was your place of business flooded during Hurricane Harvey?

YES   NO

Were you there at the time?   YES   NO

[IF YES] Did you use Social Media? YES   NO

[IF YES] For what purpose?

30. Did you need to travel to get supplies during Hurricane Harvey?

YES   NO

[IF YES] Did you have to travel through flood waters?

What supplies did you need?

Where did you go to get them?

Were supplies available?

If that location did not have what you needed, how did you find what you were

looking for?

31. On a scale from 10 to 1 where 10 is "very prepared" and 1 is "not prepared at all",

did you feel that you were prepared for Hurricane Harvey?

10   9   8   7   6   5   4   3   2   1

32. Did you feel that emergency management officials gave adequate warnings about Hurricane Harvey?   YES   NO

    Why or why not?

    By what method did you receive warnings? (TV, Radio, Text, Social Media, etc.)

33. How could emergency management officials done better?

34. By what communication channels could emergency management officials have communicated more efficiently or effectively?

    On Local TV stations?

    On Local Radio stations?

    On their Internet websites?

    Through emergency management texting apps?

35. Did you call for assistance?   YES   NO

    [IF YES] Who did you call?

    What assistance did you need?

36. Did they answer?   YES   NO

    If not, what did you do?

37. How long did it take for someone to assist you?

    Minutes   < 1 hour   1-2 hours   >2 hours   Other _____

38. Did you need to be rescued?   YES   NO

    Were you rescued?   YES   NO

    [IF YES] By whom?

    Was social media involved in the rescue? If yes, how?

39. Is there any information that you would like to add about your use of social media during Hurricane Harvey?

Thank you so much for your time, today. Your answers, as well as the other participant's answers, will be very helpful to this research.

Questions specific to Emergency Management participants:

EM1. Do you work for a government agency?   YES   NO

     [IF NO] What type of Emergency Management organization do you work for?

EM2. Does your agency or organization maintain an Internet website?

     YES   NO

EM3. Does your agency or organization have a presence on a social media platform, such as Facebook or Twitter?   YES   NO

[IF NO] Why do you think your agency or organization does not have a presence on social media?

[IF YES] Which social media sites?

Is there a staff member or members assigned to monitor your social media site?

     YES   NO

[IF YES] Which social media site seems to be the easiest to monitor?

Why is it the easiest?

[IF YES] Which social media site seems to be the most effective in communicating information to citizens?

[IF YES] Which social media site seems to be the most difficult to monitor?

Why is it difficult?

EM4. Do you post event-specific information on your social media site?

    YES   NO

EM5. Did you post Hurricane Harvey information on your social media site?

    YES   NO

EM6. Did anyone in your agency or organization answer questions or comments from

citizens on your social media site specific to Hurricane Harvey? [CARRY ON

DIALOGUE]

    YES   NO

[IF YES] What kind of questions or comments were asked/answered?

EM7. How often was your social media site monitored during Hurricane Harvey?

    There was always someone monitoring the social media site [24/7]

    There was someone monitoring the social media site occasionally.

    There was someone monitoring the social media site only when they weren't busy

doing something else.

EM8. On a scale of 10 to 1 where 10 is "very important" and 1 is "not important at all",

how important was it to your agency or organization to have someone monitor your

social media site during Hurricane Harvey?

10   9   8   7   6   5   4   3   2   1

EM9. Has your agency or organization discussed the positive aspects of having a

presence on social media?   YES   NO

[IF YES] What were some of the positive aspects?

EM10. Has your agency or organization discussed the negative aspects of having a

presence on social media?   YES   NO

[IF YES] What were some of the negative aspects?

EM11. Did any members of your agency or organization make use of social media, not through an official site, in the course of doing their work during Hurricane Harvey?

> YES   NO

[IF YES] For what purpose?

Did you use your personal social media for personal reasons related to Hurricane Harvey? Would you be willing to answer some questions about that? Thank you. [Return to Q1]

Thank you. Now, if I could get some demographic information from you, it might help to identify general categories that participated in the research. These categories were taken from U. S. Census information and will be coded and not personally associated with you but represented within the group of participants interviewed. May I continue?

Thank you.

1. Gender -   Male   Female

2. Age –   18-22   22-30   31-40   41-50   51-60   61-65   >65

3. Race/Ethnicity –   White   Black   Hispanic   Asian   2 types   More than 2 types

> Other_____

4. Income - <20k   20k-39,999   40k-59,999   60k-79,999   80k-99,999   100k-150k

> > 150k   Other_____

5. Household Status – Single   Married   Single w child   Single w >1 child

> Other_____

6. Zip Code during Hurricane Harvey _____

Thank you so much for your time, today. Your answers, as well as the other participant's answers, will be very helpful to this research.

Document 4

Tables for Census Categories and Participant Codes

Census Categories and Codes											
Gender 01	Code	Age 02	Code	Race/Ethnicity 03	Code	Income 04	Code	Household Status 05	Code	Section of Houston area by Zip Code	Code
M	A	18-22	C	White	J	< 20,000	P	Single	W	77072	1
F	B	22-30	D	Black	K	20,000-39,999	Q	Married	X		2
		31-40	E	Hispanic	L	40,000-59,999	R	Married w children	Y		3
		41-50	F	Asian	M	60,000-79,999	S	Single w children	Z		4
		51-60	G	2 types	N	80,000-99,999	T				5
		61-65	H	More than 2	O	100,000-150,000	U				6
		>65	I			>150,000	V				7

Participant List with Codes		
Participant # with Code	Date of Interview	Census codes
Example 0. 0001	February 15, 2018	A, G, J, S, X, 1
1. 1001		
2. 1002		
3. 1003		
4. 1004		
5. 1005		
6. 1006		
7. 1007		
8. 1008		
9. 1009		
10. 1010		
11. 1011		
12. 1012		
13. 1013		
14. 1014		

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