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A Study of the Diffusion of Innovations and Hurricane Response Communication in the U.S. Coast Guard

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A STUDY OF THE DIFFUSION OF INNOVATIONS AND HURRICANE-RESPONSE COMMUNICATION IN THE U. S. COAST GUARD

by

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ABSTRACT

A STUDY OF THE DIFFUSION OF INNOVATIONS AND
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Hurricane Harvey (HH) is considered to be the first natural disaster where social-network applications to request help surpassed already overloaded 911 systems (Seetharaman & Wells, 2017). Increasing interpersonal connectivity via Facebook, Twitter, and other social media sites correspond to an increasing need for researchers and responders to recognize how people use social media platforms to connect, share, and receive information especially during times of crisis such as natural disasters. Heightened public perceptions and expectations of response efforts in the digital era make it especially important for first responders to evaluate, monitor, and adapt to these shifts in communication. Disaster-relief groups and emergency responders are looking for help to navigate in this new landscape in order to better serve to their constituents and explore new, innovative ways to improve both their efficiency and their empathy. Emergency-response managers must act fast to prevent incorrect or misleading information from reaching the public. Some organizations are expressing interest in social media as a potentially cost-efficient way to disseminate information and official communication. However, as research has shown, innovations take time to diffuse (Rogers, 2003). In this thesis I examined the diffusion of social media in the ways the U.S. Coast Guard (USCG) (first responder) and the public communicate during crises. Moreover, I examined facilitative and inhibitive factors shaping the diffusion of digital innovations within the USCG. I conclude that the pacing of the diffusion of social media among everyday users is incredibly rapid and, concurrently, is

pressuring crisis communication systems like the USCG to quickly adopt these new innovations. I further conclude that Hurricane Harvey should function as a historical catalyst, a clarion call, that government agencies should incorporate social media and associated digital media to improve their future emergency response operations because lives will depend on it.

This thesis is dedicated to my daughters, Jayde Isabella and Mya Grace.

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CHAPTER I

INTRODUCTION

In early August 2017, Hurricane Harvey (HH), a category 4 storm that developed off the African coast, made landfall in the United States near Rockport, Texas (Jonkman, Godfroy, Sebastian, & Kolen, 2018). As the United States' first “major” hurricane, a hurricane that reaches category 3 or higher, to make landfall since 2005, Harvey was responsible for at least 68 deaths (Blake & Zelinsky, 2018). The damage caused by Harvey’s flooding was catastrophic. Blake and Zelinsky (2018) further report that the damage estimate from Harvey is $125 billion, with the 90% confidence interval ranging from $90 to $160 billion. The City of Houston, with a population of nearly 2.3 million people (World Population Review, 2017), dealt with 40 to 61 inches of rainfall over the course of 72 hours, as well as significant water damage outside of previously established flood zones (Seetharaman & Wells, 2017).

The treacherous waters isolated economic hubs, shut down electrical power plants, and interrupted city amenities (Blake & Zelinsky, 2018). In many cases, emergency responders were unable to leave their own homes and response efforts were stymied. Search and rescue organizations like the USCG, which is a multi-mission military branch that reports to the Department of Homeland Security, further dealt with workforce and facility shortages (Garamone, 2017). In this maelstrom of chaos, the panicked calls of city residents, predictably, overloaded the capabilities of the call centers designed to direct relief efforts. First responders also initially informed hurricane victims to avoid posts to social media (Silverman, 2017). Instead, they advised citizens to use secondary ad hoc phone lines established by rescue operations directors (Shu, 2017) because first responders’ communications systems did not have the bandwidth to receive, nor the people power to monitor, all of the posts. It was proving to be

an unreliable way to seek help (Silverman, 2017). However, as pleas for help continued to mount, the severity of the destruction was beyond the capability of this auxiliary network. The people who needed help instead received busy signals, had long wait times and were ultimately unable to request assistance (Silverman, 2017). In the context of this void of assistance through traditional communication outlets, residents decided to turn to commercial social media platforms such as Facebook to connect to people who reached out to neighborhood groups and the outside world for help (Silverman, 2017), publicly sharing personal information and tagging news outlets, journalists, and other prominent individuals in their social media posts with hope of being rescued (Rhodan, 2017).

However, Silverman (2017) explained that using commercial social media platforms to alert first responders had (and continues to have) many detractors, especially among law enforcement officials and emergency first responders. Again, this is mostly in part because they do not have the people, power, or bandwidth to receive and monitor communication via these networks. This general concept is visible in a Facebook post, shown in Fig. 1, from the Houston Police Department, which reads, “Please do not use HPD social media accounts for rescue requests. If you have a life-threatening emergency, 911 is the best way to capture your request and make sure it is properly dispatched" (Rhodan, 2017).

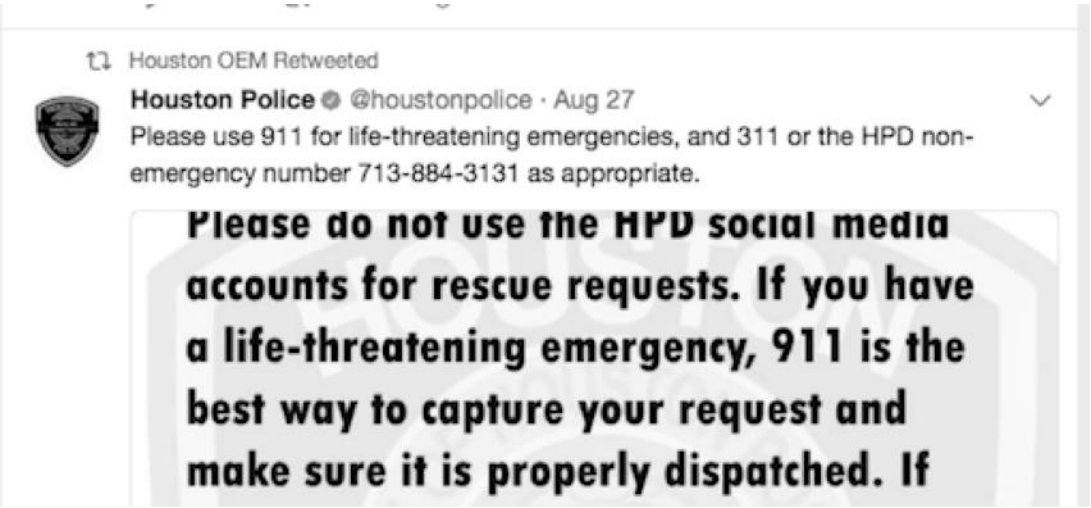

Figure 1. Houston Police Department tweet during HH.

Furthermore, the USCG which currently has a considerable social media presence and following on Facebook (700,000 followers), Twitter (386,000 followers), and Instagram (326,000 followers) issued multiple social media posts (see Fig. 2) that urged people to use established phone lines and not social media as ways to seek help (U.S. Coast Guard, 2017).

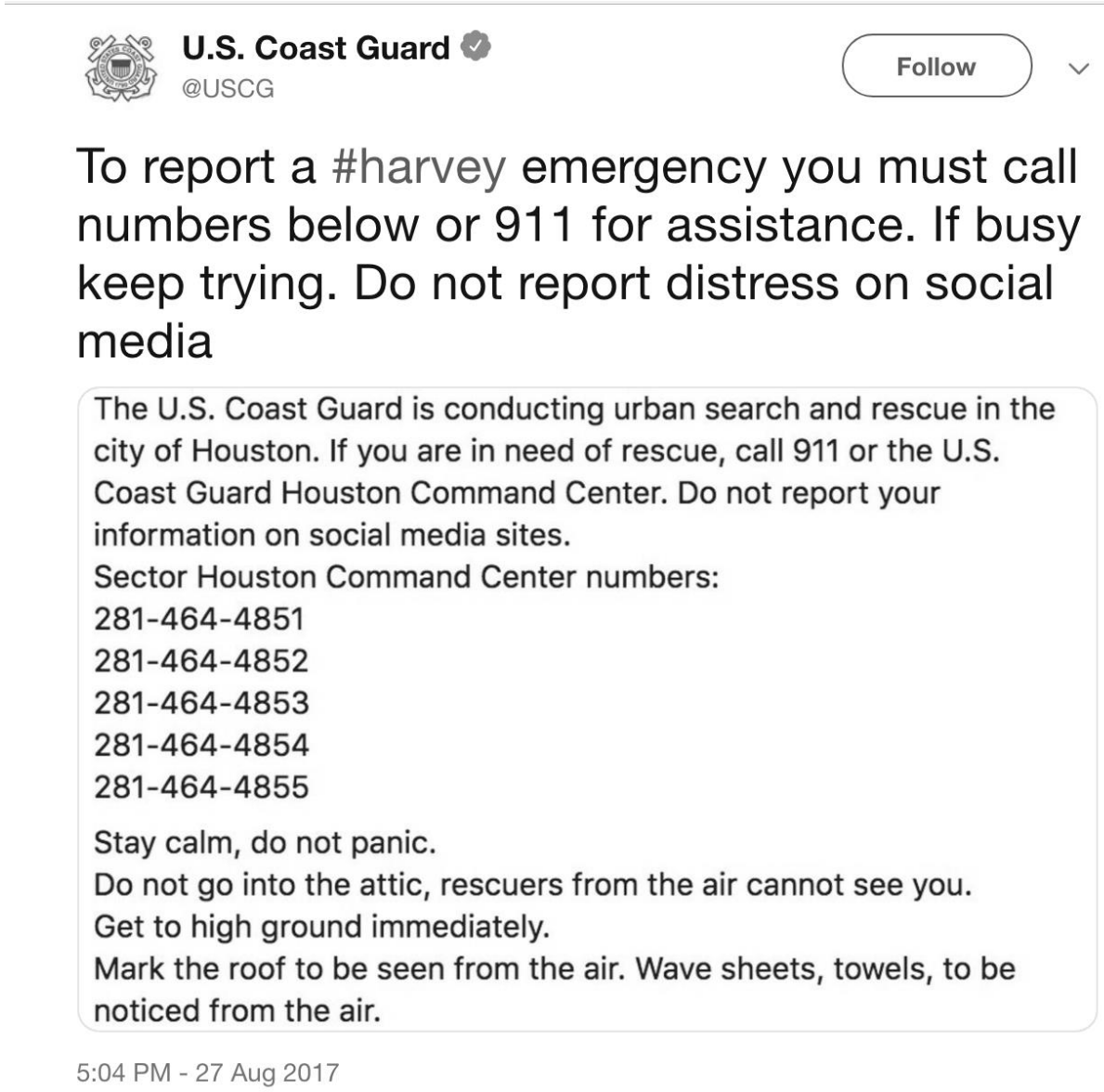

Figure 2. U.S. Coast Guard tweet during HH.

Purpose of Study

As illustrated by HH, changes in evolving digital communication technologies pose challenges to traditional modes of emergency-risk communication. But in the context of emergency-response communication, it is important to not lose sight of the fact that lives depend on these communication systems. Thus, it is important to understand the patterns of first-

responder organizations' adoption of new communications innovations and the forces that are facilitative and inhibitive of adoption in order to help involved agencies move as rapidly as possible towards optimal emergency communication systems (e.g., see Rogers, 2003). The purpose of this thesis is to identify problems in hurricane response/emergency communication and seek to understand them through the lenses of *Diffusions of Innovations Theory* (Rogers, 2003) as well as Kuhn's shifting technologies paradigms (Kuhn, 2008). Recommendations are then made based on the results, which will indicate that an acceleration of technology adoptions may be necessary to keep up with public demand and save lives during emergency situations.

Specifically, prompted by communication problems with social media during HH, this study examines emergency-response communication during HH by means of interviews with policymakers and active duty first responders in the USCG. I will analyze lessons learned from HH using the *Diffusion of Innovations Theory* (Rogers, 2003) and investigate the USCG's pacing of the adoption of social media in emergency response and identify factors that might be facilitative of and/or hindering the pacing of adoptions. Currently, on land, the USCG, which is a multi-mission military branch that reports to the Department of Homeland Security, primarily uses 911 and conventional means of emergency communication; on the water, the USCG relies upon very high frequency (VHF) marine radio or emergency position indicating radio beacons. This study examines the future of emergency response communication facing the USCG that features digital mobile media.

CHAPTER II

LITERATURE REVIEW

Prior to HH, phone calls using 911 were de rigueur. In this chapter, I chronicle the research of the evolution of communication in response to natural disasters leading up to the inclusion of social media use as a form of emergency communication. Within this review, I employ the *Diffusion of Innovations Theory* (DOI) (Rogers, 2003) as a theoretical framework to help explain patterns of communication technology adoptions in emergency management. In this chapter, I will set up a platform for a study through which I describe and explain problems with the inclusion and use of digital communication technologies by first-response agencies, particularly the USCG, as they seek to optimally manage emergency communication during natural disasters.

Traditional Emergency-Response

Dialing a single telephone number to report emergencies was initially used in 1937 in Great Britain (Sieg, Matsuo, & Williams, 2016). The British dialed 999 to call medical, fire, or police departments from any region in the nation (Phillips, 2015). In the United States, before 911 was designated as the countrywide three-digit emergency call number, when someone had an emergency he or she had to dial "0" for help (Engelke, Colwell, & Vitek, 2016). Unfortunately, doing so was stressful and often ineffective, not only for the caller but also for the telephone operator who lacked the training and technology to optimally execute emergency call assistance (Phillips, 2015). By the mid-1950s, there was increasing awareness that operator-configured telephone systems were unable to meet public needs during emergency situations, and in 1957, the National Association of Fire Chiefs proposed the need for a single phone

number for reporting fire incidences across the country (Weinlich, Kurz, Blau, Walcher, & Piatek, 2018).

On January 12, 1968, American Telephone & Telegraph (AT&T) announced its plan to create the universal emergency number, and after 35 days, the first call to 911 was made in Haleyville, Alabama (Matthews, 1975). However, basic 911 services were not officially recognized as the emergency call number in the United States until 31 years later with the passage of the U.S. Public Safety Act of 1999 (Phillips, 2015). From its inception, the 911 system, as a whole, was deemed advantageous because it developed a direct link between a central telephone office and a single matching public-safety answering point (PSAP). Because of this, during emergent situations, first responders arrived "quickly," which elevated the quality of service (Weinlich et al., 2018). Ultimately, in terms of the diffusion of the 911 innovation, we get a glimpse of what was a more than three-decade-long adoption rate of a new communication innovation in response to emergencies.

Since the inception of 911, the system has undergone several changes. For example, in 1996, there was a need for the Federal Communications Commission (FCC) that regulates 911 to respond to the creation of the wireless telephone service by issuing Wireless Enhanced 911 Regulations, which improved 911 services across the country (Phillips, 2015). Other changes included the voice-over-internet protocol (VoIP) introduction, which was deemed one of the most challenging technologies that have been added to the legacy 911 network from both regulatory and technology perspectives (Phillips, 2015). The FCC (2019) explains that VoIP services can be used from "any internet connection anywhere, which raises challenges for the emergency services community in determining the location from which a 911 call has originated."

The early 911 emergency call system also includes criticism. Phillips (2015) noted public safety agencies tend to lag in the diffusion of innovations due to an inability to keep pace with the widespread innovations that have redefined technology in the consumer and commercial markets over the decades (Phillips, 2015). The concern is that this gap in technology can turn into a dangerous chasm since necessary 911-focused policy and legislative changes lag more general technological improvements (Engelke et al., 2016). The potential for modernizing is further hindered because the industry consists of multiple private and public stakeholders who operate independently, complicating the prospect for consensus (Engelke et al., 2016). Consequently, the industry of emergency communication lacks a consistent strategy for funding and the legislative and regulatory changes necessary for the enactment of addressing advances in digital communication technologies, or what has come to be labeled as Next Generation 911 (NG9-1-1), on a widespread scale. Given today's communications technologies, NG9-1-1 is unavoidable, although a successful countrywide rollout requires a collaboration level unlike anything the industry has ever experienced (Engelke et al., 2016).

Moore (2010) argued that the current 911 system, based on analog technology infrastructure, does not include most features which Americans anticipate are part of an emergency response system. Moore (2010) asserted that 911 callers assume that the advanced technologies they use to call correspond to the same technology level at the 911 emergency centers, which is not the case. For instance, currently the FCC "encourages" emergency 911 call centers to accept texts as "text providers develop text-to-911 capability" (p. 1), but it is not mandatory and each call center to decides "the particular method in which to implement and deploy text-to-911 technology" (FCC, 2019, p. 1). Even where text-to-911 is available, the FCC encourages the public to "always" make a voice call to 911, if possible, instead of using text

(FCC, 2019). The importance of our country's communications systems becomes clear during natural disasters and emergency situations. The FCC (2019) explains these communications systems include “the wireline and wireless telephone networks, broadcast and cable television, radio, Public Safety Land Mobile Radio, satellite systems and increasingly the internet.” (p. 1)

Fig. 3 below represents a “high level, generalized snapshot” of transitional NG9-1-1 progress by state as of Feb. 2, 2018. According to NENA (2018, p. 1):

> NENA NG9-1-1 project work includes tracking of state and sub-state initiatives to establish and activate Emergency Services IP networks (ESInets) that may support NG9-1-1 functions in the future, or that are actively implementing transitional NG9-1-1 or are aimed at pre-NG9-1-1 actions. This tracking effort is basically for three purposes: providing information to other interested parties who may need contacts that have already had experience for identifying those areas where NG9-1-1 related trials may be happening or planned and identifying those areas where transitional NG9-1-1 is being implemented. (No one can implement full long term NG9-1-1 yet since carrier actions on IP interfaces and multi-media support are not yet available to support full NG9-1-1 features)

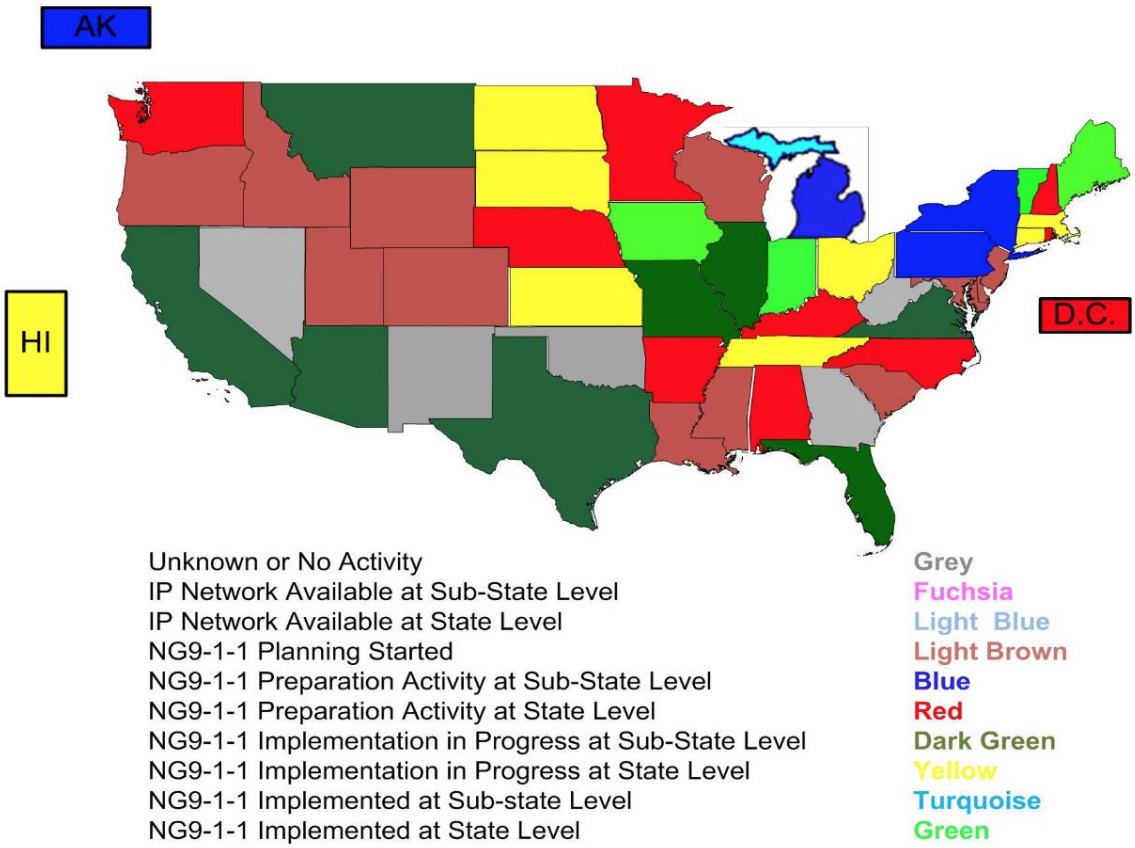

Figure 3. Status of NG9-1-1 state activity map (NENA, 2018).

Evolving Emergency Response Communication

Researchers who have studied crisis management and emergency-risk communication have sought to analyze the role of social media during natural disasters. Social media use increasingly captures the attention of industry and academic scholars intrigued by their reach and affordances. According to Bright, Margetts, Hale, and Yasseri (2014), social media is an application, based on the internet, that allows individuals to communicate, create, and share messages. Additionally, Fuchs and Trottier (2014) described social media as online platforms

that primarily support communication, cognition, collaborative work, and community building. However, Miller et al. (2016) defined social media as the colonization of the space between private dyadic communication and traditional broadcast, offering individuals with a group size scale and privacy degrees, which the authors have termed as scalable sociality. Kapoor et al. (2017) explained social media includes communication websites that "facilitate relationship forming between users from diverse backgrounds, resulting in a rich social structure. User generated content encourages inquiry and decision-making. Given the relevance of social media to various stakeholders, it has received significant attention from researchers of various fields, including information systems" (p. 532).

Social Media Uses during Disasters and Crises

The use of social media has become a platform that is changing the way people in distress seek help. Instead of calling the usual emergency numbers, like 911, they are opting for a different outlet in hopes of a quicker, more instantaneous response and service expectation: social media. Eriksson and Olsson (2016) argued that there is a propensity to assess and explore social media as a homogeneous and generic marvel. Advances in social networks, especially Twitter and Facebook, have propelled social media to become increasingly relevant in crisis and emergency communication, offering new and efficient abilities for governments and residents to access relevant information, assess possible disaster events, and participate in a devolved rapid communication system (Eriksson & Olsson, 2016; Procter, Vis, & Voss, 2013). Previous catastrophic incidents prior to HH—such as Hurricane Sandy in 2012, Typhoon Haiyan in 2013, and the Boston terrorist attacks in 2013—revealed the importance of emergency agencies and members of the public uniting to develop responses to disasters (Eriksson & Olsson, 2016). While social networks may have interactive and vital features, they vary in terms of application

and perceived practicality. Also, it is important to this thesis to highlight that the pacing of the diffusion of these innovations is not likely to be uniform across society. That is, societal organizations and institutions will adopt new technologies at their unique interval. However, the varied pacing of the adoption of communication innovations among emergency-response systems is problematic because effective emergency-response communication should function metaphorically like a symphony orchestra, comprised of different sections that must all perform as one if they are to be effective in responding to emergencies and crises.

Following Hurricane Sandy, the Federal Emergency Management Agency (FEMA) reported that more than 20 million tweets related to the hurricane were posted, even though cell phone service was interrupted when the storm was at its peak (Alexander, 2014). The Public Service Enterprise Group (popularly known as PSE&G) is a New Jersey utility company that confirmed during Hurricane Sandy the company staffed up its Twitter feeds, using them to send notifications on locations of large generators and tents. Empirical research conducted by the Pew Research Center (2015) reported that immediately after the Boston Marathon bombings, one-fourth of Americans checked into Twitter, Facebook, and other social media platforms and that the social networking sites also formed an integral aspect of the information/news cycle.

Twitter emerged as the go-to platform during the five-day search for the Boston Marathon bombing suspects. Initially, the site was used to push out information after two pressure-cooker bombs killed three people and injured 282 near the race's finish line (Swann, 2013). When law enforcement officers from the Boston Police Department posted their final "CAPTURED" Facebook status and tweet after an extensive manhunt, more than 140,000 users re-tweeted the post (Davis, Alves, & Sklansky, 2014). Remarkably, community members in Boston used a simple Google document that offered strangers food, hot showers, or lodging

when the hotels and roads were closed. Google also adopted the Person Finder app, which was previously used during natural disasters (Swann, 2013).

One of the main reasons why social networking sites are increasingly used during crises and emergency situations is because they can potentially offer a fast-paced exchange of information through audio, video, or words in real time (Yates & Paquette, 2011). Through this, the rate of disaster response can increase, and information can be quickly disseminated (Wei, Wei & Lei, 2012). For example, while tracing the devastation caused by a tornado in Oklahoma, Google developed and published a "Google Map," which showed the precise scale, the rank of damage, and the path of destruction for the storm (Alexander, 2014). Because these details were available, emergency responders and organizations were able to plan evacuation programs; likewise, search, rescue, and recovery operations conducted by FEMA and the Red Cross were more efficient (Wei, Wei & Lei, 2012).

In addition to social media platforms acting as channels for fast-paced communication, social networking sites often show users different measures they can take before disasters. For example, in 2013 Twitter created a disaster alert service in the United Kingdom. Through this service, Twitter highlights tweets and users to sign up to receive mobile push notifications. This occurs whenever verified international, national, and local organizations send out tweets that relate to incoming or forecasted weather emergencies, evacuation guidelines, as well as matters about other imminent dangers (Taylor, Wells, Howell, & Raphael, 2012).

Jin, Liu, and Austin (2014) found that through informative and contextually accurate social media services, people are also able to avoid incoming threats. Google has made it possible for people to connect with their loved ones during natural disasters and crises via Person Finder, an application launched by Google during the 2011 Japan earthquake. Person Finder was

also used during Typhoon Haiyan in the Philippines, which left more than 600,000 people displaced and nearly 10,000 people dead (Alexander, 2014). Through the Person Finder application, worried relatives and friends were able to search for missing persons, and other users could help them fill in gaps. In some cases, families were reunited (Gao, Barbier, & Goolsby, 2011). In Japan, Facebook developed a "Disaster Message Board" where users can mark other users and friends as "Safe" during disasters or crises (Keim & Noji, 2011).

Social media platforms are instantaneous because they allow people to describe their situation using live-videos, posts, and still images. Both Facebook and Twitter have "Go Live" tabs that people can use to give live coverage of their status (Kimmelman, 2018). People with smartphones can instantly turn them into live cameras, and people can use social media via a mobile device to view events in real time as they unfold. The live coverage takes viewers to the scene where the activity is occurring, which makes communication more efficient (Craig, Grant, & Achenbach, 2017). Furthermore, Peter (2017) explained that people are more likely to develop empathy when they see victims trying to swim through the floods in real time than when seeing recorded images on the television or in newspapers. Moreover, the victims are likely to obtain instant help when they try to reach more people rather than relying on the first responders (Peter, 2017), because first responders may be too overwhelmed to assist all the victims.

One of the main reasons why social networking sites are increasingly used during crisis or disaster situations is because they offer a fast-paced exchange of information through audio, video, and/or text (Yates & Paquette, 2011). Disaster response times have become faster because of the increased speed offered by social media (Wei, Wei & Lei, 2012), and with the appropriate technology, users can have face-to-face communication even if they are not in the same area (Berger, 2005). In other words, social media permits a new level of client relationship and

service building that insurance agents formerly could not achieve, since it offers access to more spectators.

Utz, Schultz, and Glocka (2013) reported an online study that was focused on the Fukushima Daiichi nuclear disaster, which demonstrated that social sites have beneficial effects and often result in more positive responses due to the fast exchange of catastrophe information. Utz et al. (2013) also stated that sharing information via social sites leads to increased reputation and reduced secondary calamity reactions in comparison to communication through Internet-based newsletters. In another study, Jin et al. (2014) created a social-mediated crisis communication (SMCC) model to evaluate the interaction between conventional (911 call systems) and modern (social media sites) emergency communication systems as critical sources of disaster information. The framework was based on the relevance of various information mediums, both conventional and contemporary, relative to crisis communication practices (Jin et al., 2014). The results indicated that traditional channels, such as 911 call systems, in comparison to other sources of crisis communication, tend to focus on how people exchange critical disaster content (Jin et al., 2014). Conventional applications, such as 911 calls, currently do possess a higher level of "reliability" but are utilized to gather facts and offer information on the disaster (Jin et al., 2014).

Perceptions regarding the value of various social networks for the association, exchange, and dissemination of information tend to vary among many subscribers. Chan-Olmsted, Cho, and Lee (2013) conducted an empirical study with the goal of identifying various publics' perceptions about social sites. The results indicated that perceptions about social media are highly defined by age and degree of usage. Younger and older citizens perceive the uses of social media very differently. Teenage subscribers see Facebook and Twitter as an efficient way to link

to the world, whereas older people perceive social media platforms as better strategies to communicate with people in various parts of the world (Chan-Olmsted et al., 2013).

Previous studies reveal how people use various media systems, both modern and conventional, during catastrophic events (Muralidharan, Rasmussen, Patterson, & Shin, 2011; Schultz, Utz, & Göritz, 2011). Schultz et al. (2013) assessed the effect of Twitter on general communication. They concluded that the exchange of information on Twitter during a catastrophic event elicited fewer detrimental responses in comparison to newspapers and blogs (Schultz et al., 2013).

Utz et al. (2013), in a study of the Fukushima Daiichi nuclear disaster, found that social sites have a tremendously positive impact and often result in more useful responses than the exchange of catastrophe information through conventional media's news channels. Utz et al. (2013) found that sharing information via social sites leads to increased reputation and reduced secondary calamity reactions in comparison to communication through Internet-based newsletters.

Acar and Muraki (2011) examined how Japanese citizens used Twitter for disaster communication during Japan's tsunami catastrophe. Their findings showed how the distribution of crisis content via social sites had an impact on the information given by authorities, broadcast media, and rescue agencies. They found Japanese citizens used Twitter to re-disseminate actual data and eyewitness accounts from individuals proximal to the disastrous event. During Japan's tsunami, many Twitter subscribers dedicated their efforts using the hashtag function to share information widely. Bruns, Burgess, Crawford, and Shaw (2012) conducted a similar study on the South East Queensland floods in Australia. During the floods, people started a hashtag "#qldfloods" to exchange information about the crisis (Bruns et al., 2012).

In the United States and other parts of the globe, Facebook and Twitter platforms are considered to have varying relevance, especially during catastrophic events. Cho, Schweickart, and Haase (2014) affirmed that Facebook promotes balanced reciprocal communication for population support. As a result, this enables people to link with relatives, colleagues, and acquaintances by exchanging posts, individual pictures, and other critical information during a catastrophe (Cho et al., 2014). Further, during disaster communication processes, Facebook enables registered users, both at the organizational and individual level, to select the target population that can see the posted details by choosing various privacy settings (Debatin, Lovejoy, Horn, & Hughes, 2009). Most importantly, Facebook privacy settings allow residents, rescue teams, and government communication experts to exert control over the content and amount of details released. According to White (2016), privacy settings have enabled the social media community to develop, distribute, or conceal Facebook group chats for various forms of group assistance in crisis events.

Sharag-Eldin, Ye, Spitzberg, and Tsou, (2019) explained microblogging sites, like Twitter, have become one of the more popular modes of web-based communication that allow users to communicate brief text updates to the public or to a select group of people. The roll out of Twitter in October 2006 represented a "revolutionary form of communication in social media." Microblog posts on Twitter, which are also called tweets, being at less than 280 characters (originally 140), are short when compared to regular blog posts. "Twitter is currently one of the world's major social media platforms that allows users to express their thoughts publicly in brief messages (Sharag-Eldin, et al., 2019, p. 1).

Twitter communication strategies are categorized into three structural layers: 1) micro-level (interpersonal information exchange), 2) intermediate level (follower-followee systems),

and 3) macro-level (hashtag-oriented communication (Bruns & Moe, 2014). Bruns and Moe (2014) affirmed that the presence of a hashtag option at the macro level is an essential feature in the context of disaster communication. Incorporating hashtags while sharing information about a calamity implies that the content can reach a wide range of people, including users who are not followers of a person who posts an update. According to Bruns and Moe (2014), Twitter has unique communication features that make it a valuable social media tool in both institutional disaster exchange and citizens' participatory information-sharing during a crisis and when the core aim is to distribute vital messages and inform a wide range of users.

Hashtags

In social media, hashtags refer to conversation topics about which people actively engage on social media platforms (Bennett & Segerberg, 2014). Hashtag symbols are used as a way of marking a conversation within platforms like Twitter, Facebook, and Instagram. Creating a hashtag is an easy task that does not require software, codes, or experience – to generate a hashtag include no space between words, no punctuation, and no special characters (Carter, 2018). The hashtag, which serves as an indexing system in both the "clerical sense" and the "semiotic sense," allows for the ordering and quick retrieval of information about a specific topic (Bonilla & Rosa, 2015). Hashtags concurrently function:

> semiotically by marking the intended significance of an utterance. Similar to the coding systems employed by anthropologists, hashtags allow users to not simply 'file' comments, but to performatively frame what these comments are 'really about,' thereby enabling users to indicate a meaning that might not be otherwise apparent. (Bonilla & Rosa, 2015, p. 15)

Hashtags offer simultaneity in a critical moment, a form of language where people can organize by using symbols with a multiplicity of meanings that creates an imagined connection between people in an imagined community. Twitter enables users to share multiple perspectives on critical issues by creating hashtags:

> Hashtags, as a means of coordinating a distributed discussion, are more or less large groups of users who do not need to be connected through existing follower networks. Thematic, topically focused hashtags are explicit attempts to address an imagined community of users. They create ad hoc channels rather than groups. (Schneider, Eli, Dolan, & Ulijaszek, 2018, p. 27)

Thus, hashtags quickly connect like-minded users around a specific subject.

Shirky (2011) explained that hashtags act as accelerants that simultaneously allow people to circumvent mainstream media censorship and mobilize quickly. Hashtags help open channels and provide new means of creating a democracy. Shirky (2011) argued “the networked population is gaining greater access to information, more opportunities to engage in public speech, and an enhanced ability to undertake collective action” (p. 6). Hashtags create new discourses for imagining community. These new imagined communities have a lot of political potentials, but also have limits (Koh, 2016). Koh (2016) explained that the internet, as a “networked public sphere,” has changed the "possibilities of political communities that form through related changes in the concepts of time.” The networks of communication supported by the Internet include Twitter, which has a potentially huge audience. The networked public sphere also cuts across boundaries of space and time, allowing for different permutations of identification with others. While Anderson (2006) used the idea of a “nation” of individuals connected in empty, homogeneous time to find commonality with people he did not know,

“hashtags afford spaces for connection over broader, unimagined, and even ephemeral phenomena” (Koh, 2016).

Anderson (2006) explained that print language laid the foundation for “national consciousness” (p. 43) and hashtags, as a form of printed language like the newspaper, also establish “unified fields of exchange” (p. 44) that form “languages of power” (p. 47). “The members of even the smallest nation will never know most of their fellow-members, meet them, or even hear of them, yet in the minds of each lives the image of their communion” (Anderson, 2006, p. 6). That same phenomenon is happening on Twitter every day, and more importantly, the connection was evident during HH. This new mode of communication may prove to be more effective and efficient than the others that came before it.

For example, as rain deluged Houston during HH, citizens cried out for help on social media platforms like Twitter and Facebook. "Hashtags like #sosHarvey and #helphouston were used to flag citizen rescuers and first responders and accounts like @HarveyRescue compiled databases of addresses and names of people in critical need throughout the storm” (Rhodan, 2017). First responders used the provided information via social media to coordinate relief (University of Texas, 2017). Each hashtag offered a different utility and was used with a shared, imagined meaning. Both hashtags and the platforms they are used on, act as a real-time pipeline for information as a crisis is unfolding; the data can be used in planning operations by government, public organizations, and people within affected communities (Bonilla & Rosa, 2015).

According to Haffner, Matthews, Fekete, and Finchum (2018), hashtags provide essential links that researchers may use to reach relevant content. Although hashtags can be used for different reasons, depending on the person, when users create a hashtag it becomes an instantly

clickable link, which creates its own topic-specific conversation. When using Twitter, one can quickly notice trending hashtags at the top left, and hashtags enable researchers to document the chronology of events from the start to the end (Rhodan, 2017). Hashtags contain the latest updates that researchers need to understand how a said event is affecting people's lives (Carter, 2018). Moreover, Bonilla and Rosa (2015) explained that affected populations are often comforted and reassured by audiences across the world, making them feel empowered and in control.

For example, during the 2017 Manhattan terror attack, which took place on Halloween, the hashtag #NewYork and #Manhattan trended in Twitter globally as different users from around the world tweeted how resilient New York was (Sutton et al., 2017). Arguably, the people of New York were not wholly shaken since the annual Halloween party went on as usual across the "city of lights." As digital artifacts, "hashtags locate cultures across time and space. No matter the context—that is, grassroots, institutional, or corporate—hashtags compel us to act" (Conley, 2014, p. 1111).

The United States Coast Guard and Hurricane Harvey

Coast Guard Background

The USCG is an armed service under the Department of Homeland Security comprised of nearly 42,000 men and women (Coast Guard, 2019). The Coast Guard is a unique branch of the military responsible for saving lives, protecting the environment, and defending America's coastlines and waterways. The service performs 11 official missions including port and waterway security, drug interdiction, aids to navigation, search and rescue, living marine resources, marine safety, defense readiness, migrant interdiction, marine environmental

protection, ice operations, and law enforcement (U.S. Coast Guard, 2019). Its motto, Semper Paratus, centers on the concept of being "always ready" to respond.

The fiscal year 2020 President's budget requested $11.34 billion for the USCG, whereas the Coast Guard's 2019 Presidential budget requested $11.65 billion. The 2020 budget aims to address the service's "erosion of readiness through critical investments in the workforce, cybersecurity, and depot maintenance of legacy assets and infrastructure" (U.S. Coast Guard, 2019). The budget also supports what the Coast Guard deems the service's "highest priority acquisition," the Offshore Patrol Cutter (OPC), and "continues recapitalization efforts for capital assets and infrastructure" (U.S. Coast Guard, 2019). Further, the 2020 budget requests: $7.9 billion for Operations & Support, $118 million for requisite military pay and allowances, $59 million for new assets, $27 million for human capital support infrastructure, and vessel, aircraft maintenance, $22 million for the final phase of Federal Aviation Administration (FAA) compliance upgrades, $792 million for vessels, $200 million for aircraft, $174 million for shore infrastructure projects, and $15 million to address obsolete communications equipment on cutters, aircraft, and shore facilities (U.S. Coast Guard, 2019). The 2019 President's budget requested $11.65 billion for the USCG (U.S. Coast Guard, 2019).

Hurricane Harvey

FEMA labeled HH as the first "social media storm" in the United States (FEMA, 2017). Considered one of the most destructive storms on record, HH wreaked havoc in Texas, Kentucky, Louisiana, Mississippi, and Tennessee for more than 16 days. HH gathered momentum in its first landfall and covered more than 280 miles in diameter with wind speeds up to 130 mph (Haffner et al., 2018). Unlike other storms such as Hurricane Irma, HH had three different landfalls within six days, causing an unprecedented rise in the level of water (Blake &

Zelinsky, 2018). By September 1, 2017, the storm surge rose to a height above two feet, forcing more than 39,000 residents out of their homes in Houston (Carter, 2018). Blake and Zelinsky (2018) report that more than 300,000 structures and nearly 500,000 cars were flooded. Roughly 336,000 customers lost power during HH, and an estimated 40,000 flood victims were evacuated to or sought refuge in shelters across Texas or Louisiana. FEMA reported that about 30,000 water rescues were conducted during Harvey (Blake & Zelinsky, 2018).

HH caused a humanitarian, environmental, and economic crisis as the storm affected more than 203,000 homes, 12,700 of which were destroyed (Chason, 2017). At the end of the storm, more than 738,000 people registered with FEMA for assistance. The agency also released other supplies including food, water, blankets, and temporary shelters to host the evacuees. In Texas, about 37,000 temporary shelters were constructed to host thousands of residents evacuated by the storm (Haffner et al., 2018). In Louisiana, about 2,000 temporary homes were developed to assist the evacuees to gain some security. With a population of more than 6,000,000 people, the city of Houston became the most significant casualty of HH, with losses amounting to billions of dollars (Haffner et al., 2018). The governor of Texas applied for federal relief amounting to nearly $125 billion to restore damages incurred across the state.

Although HH will undoubtedly be remembered for its destruction, many of the affected people will also not forget how social media helped them during the disaster. More than 7,041,000 tweets were sent during HH that were directly linked to the storm via hashtags and keywords that include “#Harvey, #Harvey 2017, #HarveyStorm, #HarveyFlood, HoustonFlooding, #HurricaneHarvey, #HoustonFloods, Gulf Coast, Hurricane Harvey, and Twitter” (University of North Texas, 2017) The storm offers a glimpse of the state of emergency-response communications and state of the diffusion of communication innovations in

emergency response communication that spotlights the USCG. When emergency numbers became wholly overwhelmed by millions of calls from different parts of Texas, thousands turned to social media to inform friends and relatives about their status and request help (Holley, 2017). People took videos to show the level of water in their homes and posted physical addresses in hopes that potential rescuers would locate them. Videos and images shared on social media got the attention of citizen rescuers, who responded immediately. Several hashtags were also created to ensure similar videos, pictures, or distress calls were channeled on one platform to enhance accessibility (Haffner et al., 2018).

During HH, many people in Houston and Dallas posted pictures of their houses or neighborhoods on social media using hashtags such as #HurricaneHarvey to increase their chances of being found. Without hashtags, it may have taken longer for the security agencies and rescuers to locate victims of HH, and hashtags provided essential insights that rescuers used to find victims, regardless of their locations (Enenkel et al., 2018).

Nearly 50 hashtags were used during HH to exchange and share information (Rhodan, 2017). Hashtags such as #sosHarvey, #helphouston, #hurricaneharveyrelief, and #HurricaneHarvey were used to ask for help from rescuers, while other hashtags including #HarveyRescue were used to give details and physical addresses so rescuers could locate victims. During HH, the #HurricaneHarvey trended for more than a month (Rhodan, 2017). Professor Nikki Usher describes HH as the first major natural disaster of the social media era (Rhodan, 2017). Speaking from her office at George Washington University in Washington, D.C., Usher compared how people used social media during HH and Hurricane Wilma (CNN, 2017). Usher noted that people realized the importance of social media in crisis communication more than ever during HH. She asserted that social media provides details that many televisions

may leave out due to time limitations. Commercial, broadcast media has many stories to tell the public and finds it difficult to focus on single cases (Seetharaman & Wells, 2017). However, social media provides sufficient time for people to tell their stories without interruption. During HH, people who could not get direct assistance from the USCG or other federal agencies turned to social media to seek help from the citizen rescuers.

The USCG issued a stern warning against the use of social media to ask for help during a hurricane. In many of their social media posts, the USCG asked people to phone them instead of using social media (Silverman, 2017). The agency urged residents to use 911 or other listed numbers to reach first responders. The USCG asked residents to keep trying until they speak to first responders if their numbers are busy. As first responders, the USCG feels it is their responsibility to help victims to overcome disaster (Silverman, 2017). During their response to HH, USCG men and women rescued 11,022 people and 1,384 pets (USCG, 2017).

According to Craig et al. (2017), the USCG does not have enough bandwidth to keep up with thousands of posts on social media. Furthermore, the USCG needs as many officials as possible to be in the field assisting victims instead of answering users on Facebook or Twitter. At least every member of their dispatch team has cellphones routed to the 911 exchanges, as well as other emergency numbers. Therefore, emergency numbers are deemed “safer” because they lead directly to first responders (Silverman, 2017). Furthermore, a tweet on social media may not be enough because it does not target first responders, and victims only hope that their tweets are likely to be seen by citizen rescuers.

Apart from the insufficient capacity to handle social media posts in its current state, the USCG is also concerned about potential cybersecurity threats associated with social media. For example, people in distress may fall victim to stalkers, hackers, or malicious persons with ill

intentions (Silverman, 2017). Sharing personal information on social media exposes vital information that hackers may use to steal or cause physical harm to the victims (Bowd, 2016). Therefore, to protect victims from malicious individuals, the USCG believes only responsible persons should offer rescue services (Silverman, 2017).

In spite of USCG concerns and warnings, during HH, social media became of vital importance to many people when the local 911 systems were overwhelmed by calls coming from people in need of help (Haffner et al., 2018). Several hashtags were created on Twitter to filter information and enable quick responses from rescuers. People relied on the hashtags to give details and physical addresses so people could use them to reach them. Furthermore, people used Facebook's Safety Check to indicate if they were safe, needed help, or ready to offer emergency services (Enenkel et al., 2018). At the end of the hurricane, many people counted significant losses but thanked friends, relatives, and strangers who risked their lives in the middle of the storm to assist them. People also realized how important social media was in asking for help and enhancing quick response (Carter, 2018).

Community Resiliency and Emergency Communication

In times of disaster, today people turn to social networking sites to find relief from the trauma caused, and even seek help. Through the many messages of condolence and hope from social media users, the victims can find emotional support (Sutton et al., 2017). Jin et al. (2014) explained that some victims are usually able to access counseling and support services, which are very crucial at that time. For instance, the Red Cross Organization scoured nearly 2.5 million posts using a team of "digital volunteers" to respond to the members of the public through the Red Cross social media accounts. These volunteers offered messages of help, comfort, and support to affected people. They also highlighted contact information victims could use to seek

counseling and support. In addition to emotional support, those affected were also able to apply for financial support (Merchant, Elmer, & Lurie, 2016).

Social networking companies, like Apple and Facebook, have made it easier for people to donate to organizations, such as the Red Cross, by providing links via social platforms to send money (Merchant et al., 2016). Right after Typhoon Haiyan, Apple created a link on iTunes where people could donate (IFRC, 2013). Because these social networking sites can be accessed from a broad range of devices, they have turned out to be convenient and affordable platforms for emotional and financial support in times of disasters or crisis, attracting a broad range of users from across the world (Keim & Noji, 2011).

Recently, social networking sites and hashtags have turned out to be features of certain platforms that can be used by ordinary people to help whenever the private and government emergency responders are overwhelmed. For instance, during the Nepal earthquake, citizens used Facebook and Twitter to notify other citizens where assistance was urgently needed. When blood donations were required a tweet or post would be sent that specified necessary blood types and the health center where it was needed. Through these efforts, it became possible to access larger audiences over limited periods of time (Yates & Paquette, 2011). Also, the collaborative efforts during the Nepal earthquake were coordinated via Twitter and Facebook. Through these social networking sites, it was possible to gather volunteers to clean up the debris after the disaster and to organize temporary shelters for the affected victims by using hashtags. Remarkably, social networking sites also made it possible for the Nepalese orthopedic society to reach more Indian orthopedists who were willing to volunteer (Yates & Paquette, 2011). Google developed detailed maps that displayed updated reports of assistance provided or needed. The “cartographers” (map makers) were able to collate, attempt to verify, and map close to 1,800

reports (Yates & Paquette, 2011). Crowd crisis maps have also been deployed in other natural or humanitarian disasters to help bring volunteers together (Gao et al., 2011). These disasters include the 2010 Haiti earthquake, the flow of radiation right after the obliteration of the Fukushima Daiichi nuclear plant situated in Japan in 2011, and the deaths, which have occurred due to the ongoing Syrian civil war.

Brummette and Sisco (2015) showed that Twitter is used as a means of dealing with emotions emanating from uncontrollable crises. Brummette and Sisco (2015) investigated how organizational management evaluates tweets, with the purpose of understanding the public response toward a crisis. Besides understanding the stakeholders' response, the analysis of social media messages helps management in drafting messages that are instrumental in coping with the crisis. Brummette and Sisco (2015) showed that victims' emotions before, during, and after an organizational crisis serve a key role in the management of the predicament. The researchers found that the use of an integrated crisis-mapping (ICM) model can assist an organization in designing ways of handling the stakeholders' emotions (Brummette & Sisco, 2015) and such models reveal the emotional challenge stakeholders go through. Also, the ICM model helps in evaluating the available options necessary to cope with the situation. Brummette and Sisco (2015) stated that the most important aspect of crisis management is minimizing negative emotions expressed by the various stakeholders. Fear and anxiety due to uncertainty related to the crisis tend to escalate aggressive responses by stakeholders toward the response. Further, Brummette and Sisco (2015) recommended the use of the "technology-focused approach" to quickly bring the whole situation under control. Social media is a technology-based approach and is useful in delivering messages to the affected parties during a crisis. However, managers

need to design messages for different social media platforms to ensure the information is understood.

According to Jin et al. (2014), the reason people seek emotional support from social media platforms is that other members may empathize with and give consolation to the affected individuals. However, even if not all responses given over social media are appropriate for the audience, the essential information is that which comes from the team managing the situation. If there is miscommunication from the organizational management, the response will be debated by the stakeholders and may cause public unrest. Also, the messages to be posted on social media should be brief and clear to avoid misinterpretation by the public. Jin et al. (2014) found that the cause of the crisis is key to managing the situation and should be identified quickly so appropriate strategies can be applied, and communication tools used to inform both the stakeholders and the public should be fed with filtered but clear information. Jin et al. (2014) stated that the audience gives their undivided attention to news coming from the organizational management, and, therefore, there is a need to exercise caution when designing messages to be conveyed.

Tandoc and Takahashi (2016) endeavored to evaluate the idea of collective management of a crisis using social media as a communication tool. Their study was based on the responses and strategies used to cope with the typhoon Haiyan, a significant storm that affected the Philippines. Tandoc and Takahashi (2016) found that resilience and strategies to deal with a disaster are vital and assist society and concerned individuals with recovering from the incident. Resilience refers to "the ability of a social system to respond and recover from disasters," while coping refers to "conscious, purposive behaviors, or cognitions initiated in response to the experience of a chronically stressful situation or following the occurrence of a stressful life

event" (Tandoc & Takahashi, 2016, p. 1779). A collectivist approach to understanding the process of coping, which is at the heart of the concept of collective coping, highlights an important role for social media. Uses of social media as a platform for collective coping through the exchange of stories are consistent with findings that "support the importance of narrative practices when dealing with emotional recovery from disaster events" (Tandoc & Takahashi, 2016, p. 1783). Tandoc and Takahashi (2016) further discussed three collective coping strategies facilitated by social media.

Collective coping depends on the systems such as social media to persuade members of the society to adopt the approach. Through social media platforms, members of the community can share experiences, crisis images, personal concerns, and frustrations regarding a crisis. Collectively, members of a society can propose strategies to be used in empathizing with the victims of a disaster and dealing with the associated psychological problems (Nicholls, 2012). Additionally, the public offers emotional support to assist the victims to recover from the disaster events (Tandoc & Takahashi, 2016). Tandoc and Takahashi (2016) described three collective coping strategies that use social media platforms to unite the participants and convey the intended messages.

Furthermore, researchers have attempted to depict the role or beneficial effects associated with social media during disaster management (Muralidharan et al., 2011; Schultz et al., 2011). For instance, Schultz et al. (2011) showed that with any form of media networks, whether contemporary or conventional, distributing information was more critical than the content itself when it had the potential to generate better attitudes among the receivers. Even though some people are still late adopters of social media platforms, Facebook posts and Tweets comprise the

most effective approaches regarding secondary calamity communication and responses (Schultz et al., 2011).

Theoretical Framework

Emergency-Response Communication as a "Shifting Paradigm"

Kuhn's (2012) cycle of paradigm shift focuses on how science is changing the world; however, Kuhn argued that science cannot make any change until the involved scientists have consensus about explanatory principles, research priorities, ontological commitments, and guidelines. Kuhn (1970) defined the term "paradigm" as referring to a model or pattern of thinking about a problem within a scientific community. While "paradigm shift" remains the key concept, it is essential to acknowledge Kuhn's idea of incommensurability (Kuhn, 1970) and "irreconcilable differences" between paradigms: "irreconcilable differences" unsurprisingly bring about paradigm shifts. Such differences may not be "translatable," but with sufficient effort, they can be learned and explained, thus making comparisons possible (Huang, Wu, & Huang, 2017). The general methodology should be followed when scientists share a paradigm (Orman, 2016). Thus, it can be concluded that Kuhn perceived scientific progress as a socially constructed reality. Furthermore, Kuhn (2012) argued that situations in which scientists share a paradigm are in the normal science phase, and the elements include the tacit knowledge of the scientist. Consequently, technologists can neither articulate what they believe nor easily predict alternative methods of conducting science (Orman, 2016). Kuhn (2012) recognized that real progress did not result from solving the "normal" science puzzle. Rather, Kuhn (2012) contended that real breakthroughs arise in a completely different way when discovering anomalies lead scientists to question the paradigm due to a scientific revolution that he referred to as a paradigm shift (Orman, 2016). In other words, Kuhn (2012) claimed that science does not develop as new

knowledge of linear accumulation, but experiences periodic revolutions known as paradigm shifts. For Kuhn (2012), scientific progress starts with the pre-paradigmatic phase, followed by the emergence of normal science; in this context, crisis and anomaly emerge, and, in turn, produce subsequent scientific revolutions.

Since Kuhn (2012) perceived scientific development as a socially constructed reality, his critics accuse him of being a relativist, suggesting that his model of scientific progress is not concerned with the truth. Kuhn appeared to accept the accusation, although he states that he still trusts the scientific progress since he believes that later theories are often more advanced than earlier arguments in that they deliver greater expectations while being more elegant and precise with the benefit of providing more successful research programs. The other critique of Kuhn's explanation is that science does not develop in an even manner, rapidly accumulating knowledge, and extending its descriptions (Hung, 2017). Instead, critics suggest that disciplines differ between periods of normal science conducted in a dominant paradigm and periods of revolutionary science when an arising crisis suggests the need for a new model (Hung, 2017).

Kuhn (2012) explained that "normal science means research firmly based upon one or more past scientific achievements, achievements that some particular scientific community acknowledges for a time as supplying the foundation for its further practice" (p. 10). According to Kuhn, without a paradigm, one can do science, but cannot create science. This is because without a paradigm, one is only just "looking around" (p. 96) to see what can be seen. The observer within a paradigm, however, is looking, sometimes with difficulty, for something they expect to see. It is generally something that has not yet been observed or demonstrated (Lang, 2013). Similarly, Charles Darwin wrote, "How odd it is that anyone should not see that all observation must be for or against some view if it is to be of any service" (Shermer, 2016, p. 2).

Kuhn argued that "normal science does not aim at novelties of fact or theory and, when successful, finds none" (Kuhn, 1970, p. 52). Kuhn recognized that real progress did not result from the" puzzle-solving" of normal science. Instead, Kuhn argued that true breakthroughs come about in a different way, like when "the discovery of anomalies leads scientists to question the paradigm, and that, in turn, leads to a scientific revolution called a paradigm shift. In other words, Kuhn argues a science does not progress as a linear accumulation of new knowledge but undergoes periodic revolutions called paradigm shifts" (Orman, 2016, p. 48).

For example, as the 911 call centers were overwhelmed during HH, the derision for social media help requests quickly changed, and first responders found ways to be more efficient using posts on social media sites and in groups created by those who were affected, by using hashtags rather than by conventional means like 911. More importantly, during HH, this shift prompted agencies like the USCG to recognize the need to change required national protocol and policy for social media geo-tracking and locating, and to modify current communications and physical infrastructure strategies to better assist with future disasters like Harvey (Ogrysko, 2017).

The USCG set up an impromptu social media reception center during HH at the agency's command center in Washington, D.C., and USCG employees fielded calls for help on social media and. coordinated the use of crisis mapping technology to aid in response efforts (Mieszala, 2017). The technology uses information from social media posts to help first responders locate people in distress. Then, the agency quickly trained its first responders to use a geospatial application that sends direct search and rescue locations to them (Ogrysko, 2017). On September 12, during the Armed Forces Communications and Electronics Association (AFCEA) Homeland Security Conference in Washington, D.C. Vice Adm. Sandra Stosz, the USCG's deputy commandant for mission support said, "That's how we rescued the 11,000 people, leaning in on

how the public was self-selecting to use social media, because they couldn't get through on 911 calls. We decided for the next disaster, we can't be a pick-up game. We have to be looking in advance what we need to develop." According to Ogrysko (2017), Stosz further said a good first step would be:

> national guidelines that describe how agencies can and should use social media to help federal agencies during presidentially declared natural disasters. We need to come up with a required national protocol for social media for geo-tracking and locating and targeting search and rescue. We do not have that yet.

Kuhn's second stage of "model drift" is illustrated here. Kuhn (1996) explained that model drift happens when the model of understanding starts to drift because of different "anomalies and phenomena" the model cannot explain. It allows a "field's members to solve problems of interest. When issues, problems, or phenomenon appear the model cannot handle, the model begins to drift away from Normal Science. As soon there is more than a small amount of drift, the field's paradigm is in "model drift" (Thwink.org, 2014).

Diffusion of Innovations

Diffusion of innovations (DOI) theory (Rogers, 1962) is among the oldest in the social sciences. The DOI framework is grounded in communication theory to clarify how, eventually, a "new" concept or item attains momentum and disperses or disseminates through certain groups of people or social structures (Lachlan, Spence, Lin, Najarian, & Del Greco, 2016; Simin & Janković, 2014).

Rogers (2010) argued that diffusion is the process through which innovation is communicated over time amongst the individuals in a social system. However, decisions of change may be optional, collective, or authority based. Rogers (2010) categorized the five stages

of deciding as 1) knowledge, 2) persuasion, 3) evaluation, 4) implantation, and 5) adoption. Although robust, Lyytinen and Damsgaard (2001) criticized this theory and argued that the diffusion process does not primarily traverse via different stages, which depict no response. Lyytinen and Damsgaard (2001) proposed that diffusion of complex technologies does not occur in sequential phases since it is unclear exactly what these phases would suggest about the perceived behavior. In some incidences, adoptions can happen in dyadic interactions, which present challenges when attempting to observe what the concept of an early adoption might imply (Ma et al., 2014).

Additionally, Rogers (2010) explained that DOI predicts that both interpersonal contacts and media offer information and influence judgment and opinion. However, Ayodele (2012) stated that the primary problem of the theory is that it underrates the power of media, despite its ability to create awareness of the innovations. The argument merely declares that the media inspire early adopters or innovators, who later influence others (MacVaugh & Schiavone, 2010). Furthermore, studying how innovation takes place, Rogers (2010) argued that the primary factors which influence the spread of modern technology or ideas include time, social systems, communication channels, and innovation such as relative advantage, complexity, trialability, compatibility, and observability. The networks' nature and the part played by opinion leaders determine the possibility that the innovation will be adopted (Rogers, 2010). The research of innovation diffusion has tried to discuss the variables that influence why and how users adopt a new information medium, such as the Internet (MacVaugh & Schiavone, 2010). Opinion leaders affect the behavior of the audience through their contact, but gatekeepers and change-agents are also involved in the process of diffusion.

DOI theory may also have granted change agents and opinion leaders too much power since they are believed to be accountable for the adoption of the late adopters, laggards, and the late majority (Rogers, 2010). According to Lachlan et al. (2016), the outcome of DOI theory is that a specific population, as part of a social system, accepts a new concept, conduct, or item. Accepting an idea means that an organization runs its operations differently in comparison with what it did in the past. The primary aim of DOI is to help people or agencies to perceive concepts, habits, or technologies as "new" or creative. In the process, this perception facilitates diffusion.

As was seen earlier in the three-decade long arc of the adoption of the 911 system, in social systems, acceptance of innovation does not happen instantaneously. Instead, it can be a steady (although sometimes bumpy) process where some public or private firms are more willing to apply an innovation than others. Lachlan et al. (2016) claimed that organizations that adopt an innovation at an early stage have different features than those that accept new technology in the late phase. When promoting a new invention to a group of people or organizations, it is essential to comprehend the features of the target destination that will assist or hurdle the implementation of an innovation. According to Rogers (2010), DOI theory involves five adopter phases (see Fig. 3 below). Primarily, many of the organizations accept modern technology in the middle of the process. When promoting new technological innovation, such as social media sites, there are various techniques utilized to attract different adopter levels.

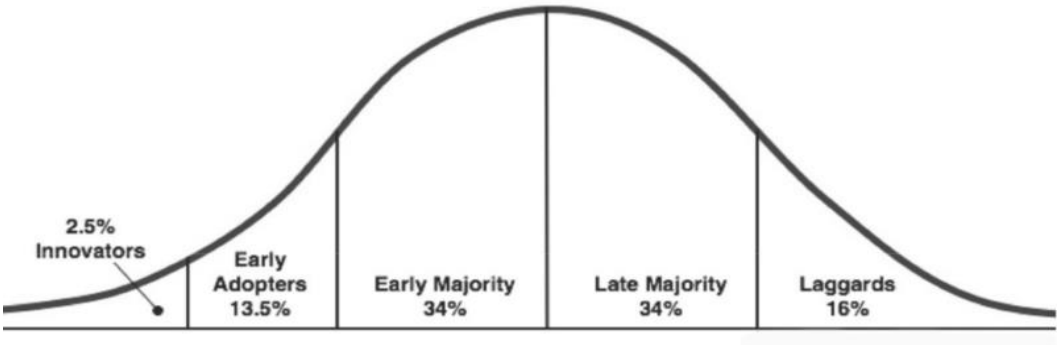

Figure 4. Adoption stages. The five adopter phases involved with DOI theory include 1) innovators (2.5%), 2) early adopters (13.5%), 3) early majority (34%), 4) late majority (34%), and 5) laggards (16%) (Rogers, 2010).

Initially, innovators are a group of individuals who accept new technology or innovation in the society and the population is usually interested in innovative ideas, so they show the willingness to take risks and are regularly the first to develop ideas (Rogers, 2010). For instance, in the United States, Harvard University students were the first people to use Facebook as a social site. Generally, innovators include people or firms who want to be the initial ones to attempt an innovation (Rogers, 2010). They are daring and attracted to new concepts in society. To attract this target group, little or no persuasion effort needs to be implemented. However, it has the smallest percentage of participants, at only 2.5 percent.

The next group involves the early adopters, who are generally opinion leaders and often prefer leadership duties and encourage change openings (Rogers, 2010). In many cases, these groups of people or organizations clearly understand the need to change, and therefore, they are often contented to accept and implement new concepts. The techniques used to appeal to this set of people or companies include offering manuals and information booklets on how to implement

the technology. Such target groups do not require detailed information to persuade them to shift from traditional communication to social media sites.

The third category of the DOI model is the population referred to as the early majority and involves individuals or organizations that are rarely leaders in the marketplace (Rogers, 2010). According to Rogers (2010), its essential for this group of adopters to practically witness or see evidence that the innovation functions before they are willing to use it. For instance, the use of social media platforms in business communication falls under the early majorities. Primarily, this is attributed to the fact that many organizations were reluctant to use these sites in their marketing efforts until they proved from others that they work (Ainin, Parveen, Moghavvemi, Jaafar, & Mohd Shuib, 2015). Techniques to appeal to early majority adopters include success tales and evidence of the technology's success.

The fourth population of DOI is the late category and involves people or companies that are often skeptical of transformation and will implement an innovation only after it has been successfully attempted by a majority group (Rogers, 2010). Late-category individuals or firms often focus on the negative influences of the innovation rather than the positive outcomes (Rogers, 2010).

The last group of DOI framework involves the laggards, who are people overcome by tradition and highly conservative (Rogers, 2010). Further, they are very cynical to change and are often the hardest category to adopt an innovation. Approaches to attract these individuals include extensive data, fear appeals, and pressure from others in previous adopter categories.

For instance, Bode and Vraga (2015) noted that unauthorized or unprofessional use of social media networks by an organization's staff could be destructive to reliability and the ability to gain trust. Competitive use of social media needs adherence to policies and resources.

Moreover, later adoption of social media innovation is linked to the fact that many segments of the population, such as older citizens, low-income earners, non-English speakers, and children, do not generally use social media for communication purposes. Therefore, other communication tools, such as 911 call systems, can be useful in such scenarios. Further, Schivinski and Dabrowski (2016) noted that high and skilled human resources are required to successfully monitor social media communication, evaluate it, and respond accordingly.

Additionally, social media emergency-risk communication can elicit erroneous public views on disaster and the response process. Such scenarios need instant corrections to necessitate a commitment to communication resources. Lastly, social media platforms are seen as sites that promote negative public remarks regarding the way first responders managed a crisis, thus, developing post-calamity public relations problems. Likewise, multiple social media sites can overwhelm those mandated with monitoring the communication process. The slow and unexpected adoption of innovations has motivated practitioners and scholars to make efforts to understand, predict, and manage its diffusion.

Chile (2018) criticized Rogers' work on diffusion theory, asserting that DOI often focuses only on innovation, ignoring multifaceted cultural, economic, and societal aspects that also influence the way the product is accepted into society. Chile (2018) concluded that diffusion research focusing on limited chosen innovations does not draw a significant conclusion on the broader theory.

Lyytinen and Damsgaard (2001) explained that DOI relies upon assumptions that need to be reconsidered before using the theory. For example, the authors argue that the diffusion of technologies does not occur in fixed and uniform social ether. However, the DOI theory asserts that relationships between technology adopters and suppliers are anticipated to take place in

comparatively the same space (MacVaugh & Schiavone, 2010). With sophisticated technologies such as social media or networks, however, diffusion is neither homogenous nor fixed. Instead, Lyytinen and Damsgaard (2001) argued that business context, economic, and technological constraints also reshape the diffusion. Therefore, in analyzing the social media diffusion in the USCG, it is crucial to consider the institutional notions to understand the institutional regimes and measures which are included in defining the mandate and scope for the process of diffusion (Baskerville et al., 2014). Prospect institutional alterations can dramatically affect the course and speed of any means of diffusion through changing incentives, redefining included entities, and redrawing its boundaries (MacVaugh & Schiavone, 2010).

Summary

This chapter began with a recitation of the origins of the traditional emergency response network, specifically, the birth and evolution of the 911 emergency call center. The chapter highlighted technological-based atrophy within the infrastructure of the 911 networks, where the needs of the user are no longer being satisfactorily met by an inflexible system. Bereft of an emergency network capable of keeping up with dynamic changes in a crisis situation, users began experimenting with social media sites to fill the void between what technology was capable of, vice what the current network offers. With HH as the tipping point, the breakthrough of social media sites as a viable method to respond to a catastrophe occurred. Despite resistance at the onset of the emergency, first responders found themselves able to mine valuable information from social media sites to affect life-saving rescues. Lastly, two theories were introduced as methods to highlight what factors may be inhibiting or promoting the use of social media for emergency communication within the USCG.

CHAPTER III

METHODOLOGY

The purpose of this study is to better understand the process of the adoption of social media as an emergency communication channel in the USCG by means of a content analysis of interviews with USCG personnel with hurricane-related duties. This study used Krippendorff's (2004) "assertions content analysis," which provides "the frequency with which certain objects are characterized in a particular way, that is, roughly speaking, thematic analysis," (Krippendorff, 2004, p. 45) coupled with an inductive logic that allowed for the discovery of emergent themes. In this chapter, I discuss the study's research questions, outline the study's design, the study's sampling procedures, data collection, data processing, analysis, limitations, and trustworthiness. To conduct this study, I used a semi-structured interview protocol process to gather data to answer the following research questions.

Research Questions

The research five questions for the study were:

RQ1: What is the current state of the diffusion of innovations of social media within the context of emergency communication?

RQ2: What is the pacing of the diffusion of innovations of social media in the USCG concerning emergency communication during hurricanes?

RQ3: What variables or factors affect the pacing of the USCG adopting the diffusion of innovations of social media in emergency communication during hurricanes?

RQ4: Are generational differences in the USCG's leadership shaping policies that prevent the agency from adopting modern technology, creating new policy, and preventing change?

RQ5: What might an accelerated adoption plan for the use of social media during hurricane crises look like within the USCG?

Research Methods and Design

Prompted by communication problems with social media during HH, in conducting this study I interviewed policymakers and active duty first responders in the USCG. I asked questions like, "Do you think social media can be an effective tool to coordinate rescues during large incidents like Harvey," and "In general, did the Coast Guard experience any communication problems during Hurricane Harvey?" I further asked participants to describe typical decision making and communication patterns during hurricane management and communication.

To analyze the data, I used content analysis (CA) to create replicable and valid inferences with themes by interpreting and coding textual material. Krippendorff (2004) explained "content analysis is a research technique for making replicable and valid inferences from text (or other meaningful matter) to the contexts of their use" (p. 18). A social scientific method of categorizing and comparing messages in specific contexts, CA often uses deductive logic where researchers "sort messages into categories and then compare the frequency with which different categories of messages occur" (Merrigan & Huston, 2019, p. 138), although some studies tend to be more interpretive, "inducing themes from message data" (Merrigan & Huston, 2019, p. 138).

Many CA analysts believe that "the nature of the messages can be discovered by any careful knower through precise, systematic, and repetitive observation (Merrigan & Huston, 2019, p. 138). The goal is to represent "one reality by classifying messages and identifying generalizable conclusions" (Merrigan & Huston, 2019, p. 139). I further used "horizontalization" where the researcher "read across the interviews," continually, to identify significant statements in the data and then group these the statements into themes (Padgett,

2017, p. 159). I also followed Krippendorff's (2004) frequency indices with which, "a symbol, idea, reference, or topic occurs in a stream of messages is taken to indicate the importance of, attention to, or emphasis on that symbol, idea, reference, or topic in the messages" (p. 59). Also of importance, Krippendorff (2004) notes "content analysis in institutional contexts can lead to inferences regarding the weakening or strengthening of certain institutions, and frequencies play important roles in such inferences" (p. 73).

Thematic unitizing was also employed in this study. Importantly, Krippendorff (2004) explains:

> The term thematic connotes the analysis of story-like verbal material, and the use of relatively comprehensive units of analysis such as themas, themes. . . combinations of categories, motifs imagery, and thoughts, and although the choice of units is always dictated by the purpose of an analysis, because of the descriptive richness of thematic units and their link to readers' understanding, many content analysts with representational aims find thematic definitions of units attractive. However, because thematic units may have to rely on textual features that are distributed throughout a text, even carefully trained coders can easily be led in different directions, making reliability difficult to achieve. Themes, even when they are relatively formalized or limited in scope, are not as easily analyzed as simpler units (p. 108-109). In unitizing, analysts aim to select the empirically most meaningful and informative units that are not only efficiently and reliably identifiable but also well suited to the requirements of available analytical techniques (p. 110).

Sample

First, prior to data collection, the study was reviewed and approved as following all human subjects' protections and exempted from full IRB review by the College of Arts & Letters Human Subjects Review Committee (Project # 134032-1; 11/19/18, see Appendix C). Second, as an active duty, chief public affairs specialist in the USCG, the researcher used professional connections to obtain a purposive, nonrandom sample of participants for the study. The inclusion criteria for participants included being an active duty member of the USCG who specialized in CG policy or hurricane response or acted as front-line hurricane responder. Initially, I planned to conduct 20 interviews, including five senior officers (SO) (rank O-5 – O-6), five junior officers (JO) (rank of O-1 – O-4), five senior enlisted (SE) (rank of E-7 – E-9) and five junior enlisted (JE) (rank of E-1 – E-6). After 18 interviews, though, I stopped gathering data after three junior enlisted because the data had reached saturation (see Fig. 5 below).

COAST GUARD

ENLISTED	(IN ASCENDING ORDER)
SR	Seaman Recruit (E-1)
SA	Seaman Apprentice (E-2)
SN	Seaman (E-3)
FN	Fireman (E-3)
PO3	Petty Officer 3rd Class (E-4)
PO2	Petty Officer 2nd Class (E-5)
PO1	Petty Officer 1st Class (E-6)
CPO	Chief Petty Officer (E-7)
SCPO	Senior Chief Petty Officer (E-8)
MCPO	Master Chief Petty Officer (E-9)
CMDCM	Command Master Chief PO (E-9)
AMCPO	Area Command Master Chief PO (E-9)

OFFICERS	(IN ASCENDING ORDER)
ENS	Ensign (O-1)
LTJG	Lieutenant Junior Grade (O-2)
LT	Lieutenant (O-3)
LCDR	Lieutenant Commander (O-4)
CDR	Commander (O-5)
CAPT	Captain (O-6)
RDML	Rear Admiral (O-7)
RADM	Rear Admiral (O-8)
VADM	Vice Admiral (O-9)
ADM	Admiral (O-10)

Figure 5. USCG officer and enlisted ranks.

For the first three interviews, I used professional connections made throughout a 13-year career. Following the third interview, all initial participants recommended someone else that would be a good candidate for this study. Therefore, I turned to a snowball sample method for subsequent interviews. Snowball sampling is a method that has been widely used in qualitative research and yields a study sample through referral methods "made among people who share or know of others who possess some characteristics that are of research interest" (Biernacki & Waldorf, 1981, p. 141). By using the snowball sampling technique, I could secure interviews with higher-ranking senior officers not easily accessible and had more immediate access to USCG members who were directly involved in the HH response.

Data Collection, Processing, Analysis, Limitations, and Trustworthiness

After human subjects' review and approval, I first contacted colleagues to schedule face-to-face interviews. I asked participants if they were interested in a face-to-face interview, an over-the-phone interview, or an email interview. Once people agreed to participate in the study, I set appointment dates and times with each participant. After obtaining a signed informed consent form (see Appendix A) from each participant, I obtained verbal consent to use two voice recorders, with the understanding that I would destroy the recordings following transcription, mask participants' names, and use generic terms for description like senior officer, junior officer, senior enlisted and junior enlisted or Participant 1, 2, 3. I used two recording devices, in case one failed. Finally, I conducted all interviews formally, with myself wearing civilian attire and each participant in his/her USCG uniform.

I asked each participant 14 semi-structured interview questions (see Appendix B) and asked follow-up questions when necessary. With the exception of two email interviews, I conducted the interviews in offices on USCG bases and ships on the East Coast. I conducted the interviews between January 9, 2019, and January 29, 2019. To increase understanding and engagement with participants, I did not take detailed notes during interviews. Instead, I recorded interviews and transcribed them at a later time to prepare for coding. Following approved Old Dominion University protocol and per the informed consent document, I kept recordings and transcriptions on a password-protected computer and destroyed them upon completion of the analysis.

Transcription

The researcher transcribed all interviews using the playback feature on the Phillips Digital Pocket Memo Recorder, a device provided by Old Dominion University, used Microsoft Word to type the transcription removing all identifying information, “uhms,” “ahs,” and pre/post interview chatter not relevant to the study. This resulted in 118 pages of transcribed data.

Analysis

Krippendorff’s (2004) CA was employed to carefully analyze and uncover the most meaningful perceptions and experiences of the interviewed participants. The method allowed the researcher to thoroughly analyze the data gathered and then report the findings directly from the participants’ responses, increasing the trustworthiness of the study. In addition to CA, the researcher followed O'Connor and Gibson's (2003) qualitative data analysis steps. The following steps were followed:

(1) organizing the data;

(2) finding and organizing ideas and concepts;

(3) building overarching themes within the data;

(4) ensuring of reliability and validity in the data analysis and findings;

(5) searching for the possible explanations for the findings;

(6) review of the overall steps. (p. 65)

To begin analyzing the data, interview transcripts were read and reread to get a full understanding and familiarize the researcher with the data. The responses of the participants were then manually coded by hand, based on the research questions of the study, categorizing parts of the text and sorting chunks of the data that fit with specific research questions. Highlighting, memoing and labeling important pieces of data was done multiple times allowing for some initial codes to be collapsed into others. The research questions helped in forming more precise codes/themes, to better address both the purpose of this thesis and study questions.

After the manual coding of the interviews, five MS Word files containing the initial study themes/codes, per research question, were uploaded on NVivo 12, a data management tool. NVivo 12 was crucial in the methodical tabulation and organization of the manually coded themes. Chunks of data were highlighted and placed in nodes. NVivo Nodes allowed me to gather evidence about the relationships between excerpts in the data, as well as place all relevant references linked to a specific research question in one place. Nodes were organized in hierarchies—moving from major themes at the top (the parent node) and similar, less-referenced topics (child nodes) underneath, and new nodes were added, as necessary, as the researcher worked through the interviews. Frequency queries were also run that consisted of the most used words within the data per research question. Themes with the greatest number of references were considered *major themes* of the study, or the most significant findings from the

analysis. However, *minor themes* or other important findings were also incorporated, and those had fewer references. Finally, *subthemes* were reported to better explain or provide examples of the major and minor themes as needed.

Limitations

This study holds limitations that center around the trustworthiness and reliability of the study. First, due to confidentiality protocols needs for participant protections, peer debriefing was limited to my thesis advisor. According to Creswell and Miller (2000), qualitative researchers need to demonstrate their studies are credible and having peer debriefers adds credibility to the study. Second, as an active duty member of the USCG who specializes in hurricane response, the researcher's personal experience and knowledge had the potential to influence observations and conclusions related to the research problem. Although the researcher made every attempt to remain completely unbiased, it is important to recognize that initial interpretations of the data could have been influenced by personal experiences. Reflexivity and an audit trail were not employed as confirmability practices during this study.

The dependability of this research may be low due to the novice experience of this researcher. Krippendorff (2004) explains, "beginners are often attracted to thematic content analysis because it seems to preserve the richness of textual interpretations, but they often fail to satisfy the reliability requirements (p. 110). In regard to reliability, a second coder was not utilized. According to Krippendorff (2004), "if there are no other experts against whom the performance of the available expert observers can be checked, the observers' interpretations may be insightful and fascinating, but the analyst cannot claim that they are reliable. This is the basis of arguments against a content analyst doing his or her own coding unless the analyst's performance is compared with that of at least one other coder" (p. 211). Moreover, this was the

first time the researcher had conducted a qualitative study outside of a classroom environment, and the researcher had not been introduced to the NVivo 12 software program prior to the start of the analysis. A colleague was utilized to explain the NVivo program and explain the steps and processes required for data analysis and coding within the program.

Trustworthiness

The researcher followed Lincoln and Guba's (1985) criteria for developing trustworthy qualitative data results. The first standard was the credibility of the study. According to Polit and Beck (2013), credibility is the researcher's "confidence in the truth of the data and interpretations of them" (p. 492). To attain the research study's credibility, the researcher was careful in ensuring that all data reported were directly gathered from the responses of the participants. Member checking was offered to participants; they were asked if they wanted to review their responses and the initial interpretations of the researcher. By offering member checking, the validity process shifts from the researcher to study participants (Creswell and Miller, 2000). Lincoln and Guba (1985) designate member checks as “the most crucial technique for establishing credibility” (p. 314) in a study. “It consists of taking data and interpretations back to the participants in the study so that they can confirm the credibility of the information and narrative account” (Creswell and Miller, 2000).

Another criterion was the dependability of the data, which pertains to the "stability of data over time" (Polit & Beck, 2013, p. 492). The researcher incorporated the participants' actual perceptions and experiences while considering their background and condition at the time of the interview. In addition, the extensive discussion of the findings and the presentation of the verbatim responses of the participants from the interviews further increased the confirmability of the data. Finally, the last criterion was the transferability of the study which was identified by

Korstjens and Moser (2018) as the "degree in which the results can be transferred to other contexts or settings" (p. 121). In this case, the researcher discussed the processes and data findings in a rich and detailed manner. Future researchers can then refer to the writing to gain a better understanding of the current study and apply them accordingly.

CHAPTER IV

RESULTS

The fourth chapter of this thesis contains the presentation of the themes from the content analysis of the interviews with 18 study participants. A CA that induced themes was employed to analyze the 18 interview transcripts collected from active duty USCG members. The method allowed the researcher to generate the most common but significant themes from the responses of the participants. NVivo 12 also assisted the researcher in systematically coding and tabulating manually coded themes from the 18 interviews.

Demographics

Eighteen participants were interviewed for the study. All interviewed participants have been serving for more than 10 years in the USCG during the time of the interview. The shortest interview lasted 12 minutes, whereas the longest one lasted 47 minutes; many lasted approximately 20 minutes. Fourteen members of the sample were men, and four were women. Participants also had active and varying roles in the USCG as seen in Table 1 below.

Table 1

Participant Demographics

Participant Number	Years of Service in the Coast Guard	Role (when responding to hurricanes)
Participant 1	10 years	Public Information Officer
Participant 2	10 years	Logistics Coordinator
Participant 3	14 years	Aviation Maintenance Technician
Participant 4	15 years	Part of Communications Team

Participant 5	15 years	Communications; Command and Control
Participant 6	Almost 16 years	Aviation Survival Technician
Participant 7	17 years	Social Media Department
Participant 8	19 years	Communication Leader
Participant 9	19 years	Pilot
Participant 10	19 years	Public Affairs Officer
Participant 11	20 years	Force Allocation
Participant 12	20 years	Command Center
Participant 13	21 years	Principal Legal Advisor
Participant 14	Almost 24 years	Operational Communications
Participant 15	25 years	Aviation Resource Manager
Participant 16	27 years	Incident Management
Participant 17	27 years	Operations
Participant 18	30 years	Sector Commander

Presentation of Findings

In this section, the complete themes uncovered from the CA of the 18 interview transcripts are presented. In all, 21 themes emerged that pertain directly to the five research questions of the study. In particular, five major themes, 10 minor themes, and six subthemes were generated. This section is organized according to the study research questions, while the themes are discussed along with the verbatim responses of the participants.

Research Question 1: What is the current state of the diffusion of innovations of social media within the context of emergency communication?

For the first research question, a word frequency query was completed within NVivo 12 that identified the most frequently occurring words for this research question (see Fig. 6 below).

Figure 6. Research Question 1 frequency query word cloud.

All 18 participants indicated awareness of the demand of the need for social media in relation to emergency communication, but also noted that it is still not formally incorporated in the Coast Guard's system. For the participants, the USCG faces many issues and challenges that hinder the members and stakeholders from fully employing social media as an integral tool during emergency situations. Table 2 contains the display of theme and the corresponding number and percentage of references.

Table 2

RQ1 Themes

Themes	Number of References	Percentage of References
Presence of awareness but not formally incorporated in the system	18	100%

Major Theme 1: Awareness of need but not formally incorporated in the system. The first major theme of the study was the finding that all 18 participants had an adequate awareness on the demand of social media as a means of communication but indicated that there is still a lack of formal adoption or incorporation. The participants believed that social media has great potential to help the USCG's current communication system. Issues of accuracy, reliability, resources, funding, lack of training, lack of acceptance, and ceding authority of innovating social media emergency response technology to other agencies were mentioned. Participant 1 (Public Information Officer with 10 years of service) explained social media is a challenge during their emergency response operations. Although it is helpful, this participant, believed that the coverage of social media is too extensive, and their team and organization are not capable to access and even respond to each report provided to them. The participant provided an example, saying:

> I think one of the challenges is the social media piece. Like we don't have the technology or the ability to respond. The public, like, for example, in Harvey, you had a scenario

> where mass metropolitan area, millions of people, and they didn't evacuate because there was no need. They didn't think the hurricane was going to hit Houston. And they all started going to their social media. They used social media as the most effective ways for 911. The Coast Guard did not have a system set up, and we still don't have a system set up to address that.
>
> During the last hurricane season, basically, our messaging was, you know, social media is not the most effective way. And it still isn't the most effective way for rescue because the best way is 911, VHF, bridge-to-bridge radio, that sort of thing. Because there are unreliable things. We don't know if the stuff on social media is verified. There's a lot of other issues. So, I think that's why the Coast Guard is struggling with what do we do with this? How do we address this? We can't just get the technology. We don't have people. Like who's going to monitor it? Is it SAR coordinators, is it PIOs, is it intel people? Who does that? But then you have the piece of how useful is it, right? Is it effective? I don't know.

Meanwhile, Participant 8 (Communication Leader with 19 years of service) also believed social media can be used during emergency situations. However, Participant 8 discussed how they are currently not equipped with the proper skills and resources to monitor the data that will be reported to them. This participant then indicated that more developments and improvements are needed before fully incorporating social media in their standard operations. The participant expressed:

> Yeah. It's a problem because we don't monitor that. We don't have the ability to monitor that at all the units and we're not constantly refreshing it. We don't get notifications. If

> that's their only means, then, by all means, use it and somebody, hopefully, would be able to see it. But I don't think social media is a good source to use unless it's your last option.

Participant 9 (Pilot, 19 years of service) stated that social media indeed has the potential to help and assist them during emergency situations. However, similar to the other participants' perceptions, the organization is not prepared to incorporate the said tool into their system. The participant noted that although the organization is capable and flexible, the broadness of social media must be carefully reviewed and studied first:

> I think it has the potential to be, but I don't think it's ready yet. I think, ideally, and actually, there is a pilot—and remind me after this to try to get in touch with him. Lieutenant S. Have you heard of him?... So, the Coast Guard has created a new policy since Hurricane Harvey that only area commanders can open up Coast Guard phone lines to supplement 911. So, we have made steps toward that. And we also specifically, in our messaging, public affairs wise, say to contact 911 and we say do not use social media and expect to get help. So, from that standpoint, we are mitigating the situation as best we can. And if any organization is good at adapting and being flexible, it's us. So that's a tough question. I mean, we're ready as in we'll respond as best as we can with the information we have because we still have only a limited number of assets. So, if you've got thousands of people calling social media, it doesn't mean we can rescue them anyway because we only have a finite number of assets. So, I'd say we're ready, but there's definitely room for improvement.

Participant 16 (Incident Management, 27 years) also touched on the issue of the extensive content of social media. This participant stated that they have started with social media monitoring but admitted they are still lacking adequate resources to fully incorporate the tool in

their system. Participant 16 also shared how they are doing their best to accommodate the demands of the American public but was also careful in managing their expectations:

> Social media is so vast that we can't be everywhere at all times. So, we do the best with the personnel that we have to monitor and then pass it on to the IMT or area command for action. We would overpromise to the American public if we were to say anything along that we're monitoring all social media, because social media comes in so many different forms. So, the objective is to steer the public to either calling 911 or using channel 16 to alert distress. That's all of our public affairs announcements. That's the best we can do. We do monitor to the best of our ability social media and we do embed a PA in our IMT, but the most secure way is 911 and channel 16.

Finally, Participant 12 (Command Center, 20 years) described social media as having the potential to be a great communication tool for them. However, similar to the responses of the previous participants, social media can also be too complex when not managed accordingly. This participant still believed and regarded 911 as the preferred and centralized tool for them:

> Oh, completely. I think it can also get convoluted, too. So, I think instead of having multiple resources to put into, I think it just needs them to be in one spot, so that somebody who is monitoring that can just, it's all coming into one place.
>
> I think social media is a great tool, but it's also a big crutch, too. It also can hinder a lot, but yeah. I think it was a good resource. The only problem is who is specifically managing that. Do we have one person assigned to just follow the social media requests? So, ultimately, we've said the 911 call centers are the best place because it's one stop.

These results are evidence that barring the USCG moving toward inclusion of social media in the near future, it could be classified in a yet-to-adopted either among the late majority

or laggard category of DOI. Kuhn's (2008) step of "Model Drift" can be seen in these results, as new questions the current model of understanding cannot answer are present. Moreover, as more "anomalies or violations of expectations appear," (Thwink, 2014) specifically within the context of social media and emergency communication, the model grows weaker.

Given this, research question two examined the pacing of diffusion.

Research Question 2: What is the pacing of the diffusion of innovations of social media in the U.S. Coast Guard concerning emergency communication during hurricanes?

For the second research question, a word frequency query was completed within NVivo 12 that identified the most frequently occurring words for this research question (see Fig. 7 below).

Figure 7. Research Question 2 frequency query word cloud.

From the content analysis of the interviews, one *major* theme was generated to address the second research question. The majority, or 11 of the 18 participants, reported how the

stakeholders of the USCG are aware of the demand of the public to incorporate social media as a tool for emergency communication during hurricanes. However, they also stated how there is a need for support from the organizational leaders to move toward an examination into the effectiveness of social media and technology, and to ensure the structure of system and accuracy of data from social media. Additionally, two minor themes emerged from the analysis, which discussed the current development of new applications but was believed to need further improvement/s and the presence of the perception that the use of social media will not last long. Table 3 contains the breakdown of themes in response to the second research question of the study.

Table 3

RQ2 Themes

Themes	Number of References	Percentage of References
Having the awareness of the public demand to use social media	11	61%
**Needing support from the organizational leaders to look into the effectiveness of social media and technology*		
**Ensuring the structure of system and accuracy of data from social media*		
Developing new applications	5	28%

but may need further improvement		
**Lack of support from the organization*		
Having the belief that social media will not last	1	6%

Major Theme 2: Having the awareness on the demand of the public to use social media.

The second major theme of the study focused on awareness of the demand of the public. However, the participants were also quick to explain that certain changes and developments must be addressed before doing so. Specifically, 11 of the 18 participants called for support from the organizational leaders to examine the effectiveness of social media and technology and find concrete ways to ensure the structure of system and accuracy of data from social media.

Subtheme 1: Needing support from the organizational leaders to look into the effectiveness of social media and technology. The first subtheme that emerged was the call for the support of the USCG and other government leaders to look into the effectiveness of social media and technology. Participant 1 (Public Information Officer) again emphasized the current demand for social media from American society. In line with this, the participant wanted to open the discussion on how to create the proper strategies and methods that will adhere to the public's call. However, the participant also stressed the importance of safety before concretely incorporating social media into their system.

> I think we are going to eventually have to. Like I think eventually society is going to have a demand. When we talk about public affairs, you know, external affairs outcomes, we talk about informing the public. The public has an expectation that we're supposed to do something. In a disaster response, they expect us to save them. And if we are not saving them, we are not meeting their expectation. That looks bad on the brand of the organization. So, I think we need to eventually figure out how to adapt and, again, that's going to take technology. That's going to take policy. It's going to take training. All those things. But I think eventually we're going to have to figure out something. We can't ignore it.

In addition, Participant 3 (Aviation Maintenance Technician, 14 years) noted how the USCG must already start taking action with regard to the possible integration of social media into their emergency communication practices. The participant stated that the organization must realize the growth of technology and must find ways on how to maximize them. Participant 3 said,

> I really would like to see the Coast Guard at least start thinking along these lines. In aviation, it can feel like the only time we see a change in our airframes or procedure is in response to a loss of life. I would hate that there were people looking at this obvious need and doing nothing about it until tragedy happened. The times have changed, and the Coast Guard needs to start thinking about how we can leverage this change into something we can take advantage of rather than just sticking with what we are comfortable.

Lastly, Participant 5 (Communications; Command and Control, 15 years) did not believe in the effectiveness of using Facebook as a tool or source of communication. However, the participant

stated that the organization could develop centralized applications. These applications must be well researched and developed to guarantee its accuracy and efficiency:

> Yes, with the set-up that we have now, I would say that its best for them not to use FB as a means of seeking help. We would need a centralized location of reporting, enough personnel on hand to effectively and accurately monitor the site and report back to the ICPs for them triage and prioritize responses
>
> An app would be greatly beneficial to CG responses because it would be able to streamline and correlate accurate data in a timely manner, greatly reducing the overall cost and time spent searching.

Subtheme 2: Ensuring the structure of system and accuracy of data from social media. The second subtheme that followed was the call to ensure the structure of the system as well as the accuracy of data coming from social media. For the participant who referenced the theme, reports coming from social media can only be useful if validated and proven by the system or management. As Participant 2 (Logistics Coordinator, 10 years) indicated, social media can be accepted but the organization needs to find ways on how to ensure accuracy coming from the reports of the users online. The participant explained:

> I do. And actually I have used certain tools during like the RNC and DNC to kind of keep tabs on social media and verify, you know, if there's a post about a threat in a specific area, then what normally happens is that you will see numerous accounts of a singular event in that confined location and then you can use multiple reporting sources to validate or verify that an event has happened. And so those tools do exist, and that does help to add some credibility to a single social media post, but it's not foolproof. And I think that

> even when utilizing those tools, it would need to be developed further to be an effective tool for the military or for the Department of Homeland Security.

Meanwhile, Participant 15 (Aviation Resource Manager, 25 years) shared an example of how they have previously used social media during their emergency operations during Hurricane Harvey. This was when all lines were not working and 911 could not be accessed. They then assigned individuals to monitor the different social media sites to search for those in need of help and rescue. The participant shared that during Harvey they started to use social media to answer emergency calls for rescue, but the tool but is still far from developing a formal and effective method of social media use:

> Like Harvey was a good example. The 911-call center went down because it was such a big hurricane, so the Coast Guard was flooded with 911 calls. So, relying solely on voice transmission or even an initial voice transmission is a big problem. We have gone to starting to work within the digital realm a little bit more and that seems to be working good. We've got people who are scouring Facebook and other social media aspects who are looking to see if anybody has posted, hey, I need help, I'm here, and then putting that on like a common operating picture so that we have a map that shows, hey, there's somebody impacted here and they are asking for help. So that all helps.

These results further highlight that the USCG may like to move towards adoption of communication technology innovations but are hesitant to do so. This offers evidence that the USCG will likely fall either into the late majority or laggard group in DOI. Given this RQ3 asked about what participants perceive to be affecting the pacing of the adoption of new communications technologies. Further, the results also indicate how Kuhn's (2012) cycle of paradigm shift cannot also fully occur due to the lack of support from the stakeholders. Given

this, RQ3 asked about what participants perceive to be affecting the pacing of the adoption of new communications technologies.

Research Question 3: What variables or factors affect the pacing of the USCG adopting the diffusion of innovations of social media in emergency communication during hurricanes?

For the third research question, a word frequency query was completed within NVivo 12 that identified the most frequently occurring words for this research question (see Fig. 8 below).

Figure 8. Research Question 3 frequency query word cloud.

From the analysis of the 18 interview transcripts, one major theme is presented that addresses the third study question. For the majority (11 of 18) of the interviewed participants, the most significant factors affecting the pacing of the adoption of social media are the lack of infrastructure and lack of resources (funding, training, personnel, etc.). Meanwhile, another important finding was the need to fight the notion that social media content is unreliable or

inaccurate (liability issues on hoax content and reports). Three other minor themes but with fewer references were also uncovered; these were the factors of encountering the legalities of the use of the internet (restricted pages) using the Coast Guard computer; having the capacity to adapt to the recent changes and growth of technology; and fighting the traditional communication norms and methods of the organization. Table 4 contains the display of themes in response to the third research question of the study.

Table 4

RQ3 Themes

Themes	Number of References	Percentage of References
Encountering the lack of infrastructure and resources (funding, training, personnel, etc.)	11	61%
Fighting the notion that social media content is unreliable or inaccurate (liability issues on hoax content and reports)	9	50%
Encountering the legalities of the use of the internet (restricted pages) using the Coast Guard computer	3	17%
Having the capacity to adapt to the recent changes and	1	6%

growth of technology		
Fighting the traditional communication norms and methods of the organization	1	6%

Major Theme 3: Encountering the lack of infrastructure and resources (funding, training, personnel, etc.). The third major theme of the study was the finding that one significant barrier is the lack of infrastructure and resources (e.g. funding, training, personnel, etc.). For the 11 of the 18 participants, the biggest issue has been the lack of resources to cover the needs for funding, professional development, acquisition of personnel, and building of other infrastructure related to the use of social media. Participant 8 (Communication Leader, 19 years) simply commented: "… But also, I think that's a funding issue. I think that's another training issue that I don't think the Coast Guard has the money or the manpower to do." Furthermore, Participant 4 shared how they have always faced budget constraints when dealing with new projects and innovations within the organization. The participant narrated,

> Nine times out of ten, it's budget. Yeah. I mean, right now there's a push to have more marine inspectors because we're lagging behind marine inspectors. We're having to do more bonuses to retain aviators because they are leaving the service to go fly commercial airlines because there's a mass hiring going on. So, we're having to patch holes every which way, and your 74 PAs get left behind. So, yeah, I definitely think it's a budget. And then there are the tail-end effects like, okay, you invest in this and you need training, how else can we partner with that? It's interesting. If you look at all of the other services

> and how they came about with public affairs, it was about telling of stories. How the Coast Guard's public affairs program started was we were getting slammed in the press over rum running. So, our public affairs program started out in a place of fear. And I wonder if somehow that place of fear has just continued down the road where we're always scared of how the public is going to negatively perceive us, to the point that we won't be bold in getting the public to positively perceive us.

Meanwhile, Participant 16 (Incident Management, 27 years) described social media as a possible effective tool for the organization. The participant also shared how the organization must also be mindful of the next generation and must find ways on how they can accommodate the preferences and respond to their needs accordingly. Consequently, the participant mentioned that the process is not easy, as the resource personnel, and those spearheading the project must secure proper resources:

> Well, it can be an effective tool if there's a certain amount of sources of social media that the public is encouraged to go to because, as you said, it's the next generation, the millennials. This is an easier way for them to provide that notification. So as long as it can be controlled and sent to the right dispatch. The concern we all have with that is that you could put something on social media in a form that could be missed and then you could be left. So, to have that standard application using social media to ensure that you have a first responder that can get to you.

Finally, Participant 14 (Operational Communications, 24 years) discussed the presence of resources and infrastructure limitations. Additionally, this participant admitted that they do not have the platform/s to accommodate the changes required with the incorporation of social media in their organizational processes and standards. The participant explained:

> Resources and infrastructure. I don't think we have the training program or system platforms to do that yet, and so, it's just not set up in place. And also, every other international sign of distress that's in the law, or whatever, doesn't recognize social media.

Minor Theme 1: Fighting the notion that social media content is unreliable or inaccurate (liability issues on hoax content and reports). The first minor theme that followed was the barrier of the perception that social media is unreliable, and the contents are false and inaccurate. The theme was shared by nine of the 18 participants or 50% of the sample. Participant 1 (Public Information Officer) admitted that there are reliability issues with the use of social media. The participant said,

> I think if you had the systems and processes and the appropriate mechanisms in place, it could assist. I don't know if it's the end all, be all. Like I don't know if that's the answer to mass rescues just because, again, there's an unreliability with social media. I know that there are other platforms that people are using, some other things that other organizations use to effect rescues, but I just don't have enough knowledge on that to know if social media is the best way.

Meanwhile, Participant 11 (Force Allocation, 27 years) added how one of their issues of the liability of the teams with the use of social media. They are often faced with the question of the accuracy of the calls and reports being sent to them over social media. This participant wanted to guarantee the validation and legitimacy of the said reports, saying:

> So that's one problem that we have against us. And then going back to the piece where we need to get away from the restrictive internet practices that we have, but then we can't because of the additional liability that we incur with regard to foreign entities, domestic

> entities, trying to do damage to our networks and whatnot. I don't think we have the training, and I don't know how to get trained up on that. And I think the biggest piece is just validation of whether or not a report is legitimate or not.

Furthermore, Participant 6 (Aviation Survival Technician, 16 years) discussed the trustworthiness of social media content. The participant was unsure of how the organization can transform the negative perception on the validity of the report coming from social media. This participant indicated:

> I will kind of piggyback on what I just said. I do think it's a problem about using social media as it stands right now. I'm not sure what could be created to make it more of a trustworthy application for that.

Lastly, Participant 3 (Aviation Maintenance Technician) touched on the concerns with regard to accountability especially once fake calls and false information are accommodated. The participant called for the management and the leaders to be "smarter" on this issue and address it accordingly. The participant explained:

> I honestly don't know. Maybe like, bureaucracy or something? Are we worried about fake calls for assistance or the legalities of it? There has to be something like that going on because I think social media has proved it's an effective means of getting responders in the fight a lot quicker than playing a telephone game with someone at a call center. I'd be interested in seeing the Coast Guard work a little smarter on this issue. I get that we maybe don't need a system like this for our more routine calls that come in, but just something to help ease the load when you have a big national event pop off makes sense.

This evidence provides further support that the USCG is currently slow to adopt new communications technologies and is offering justifications that are consistent with the laggards

category in DOI, that is, those who prefer the status quo to change. Further, it is not clear that there is a "will" to undertake this change, which is consistent with the laggard category in DOI. Given that prior research indicates generational differences in the adoption of social media, RQ4 more closely examined whether or not this is the case in the USCG.

Research Question 4: Are generational differences in the USCG's leadership shaping policies that prevent the agency from adopting modern technology, creating new policy, and preventing change?

For the fourth research question, a word frequency query was completed within NVivo 12 that identified the most frequently occurring words for this research question (see Fig. 9 below).

Figure 9. Research Question 4 frequency query word cloud.

From the analysis of the interviews, only one major theme emerged. All participants believed in the presence of generational differences within the organization. Specifically, they expressed the following concerns: lacking preparedness to accept the current innovations, being hindered by the required effort and budget, and lacking confidence in the effectiveness of social media. Table 5 contains the display of themes in response to the fourth research question of the study.

Table 5

RQ4 Themes

Themes	Number of References	Percentage of References
Presence of generational differences within the organization	18	100%
**Lacking preparedness to accept the current innovations*		
**Hindered by the required effort and budget*		
**Lacking confidence in the effectiveness of social media*		

Major Theme 4: Presence of generational differences within the organization. The fourth major theme of the study reported the presence of generational differences within the USCG,

affecting the integration and employment of social media during their emergency response operations. The participants stated the factors that hinder the top management and senior leaders from fully accepting the new tool of communication, such as the lack of preparedness accept the current innovations hindered by the intensive effort and budget needs and the overall lack of confidence in the validity of social media content. Participant 9 (Pilot) explained how the majority of the senior leaders of the organization have a specific and traditional mentality that they follow:

> I think some of it is just… it's such a new thing that we don't really know where to begin. And we're trying to begin, but a lot of people have the mentality like well we just need to stick to 911 because that's what we've always done. And you don't want to admit it, but there is some of that mentality like we've always done it this way, even if it's a little bit subconsciously. I do think there is value, though, in realizing that we have a system that works, 911, that works most of the time, and that we can't just drop it all for this new thing until the new thing really is well developed, and it's not yet. So we definitely need to open ourselves up to more. And I think that will be like I said, 15 or 20 years from now I think that will be part of it because the younger generation is going to be a lot more computer savvy.

Meanwhile, Participant 16 (Incident Management) admitted the presence of the organization members' old school thinking. The participant shared how senior members have a traditional and standardized way of leadership. Participant 9 (Pilot) stated:

> Maybe we don't adapt with the times and maybe we are old school thinking. We are trying to be very standard because there are lives at risk. But can we incorporate a Coast

> Guard app that people can go to or something that we include in addition to 911 and channel 16? I think that's worth looking at. And I think that's a good question.

Another issue again was the USCG's required effort and budget. Participant 5 (Communications; Command and Control) shared how the full and operational integration of the new system requires much budget and changes from their system. The participant explained,

> Funds, training, a lack understanding of how it works, a lack of research and development, and because senior leadership will typically shoot down new concepts they cannot control. I mean, we can't even keep a steady paycheck or even get funding for more important missions like ice breaking right now.

Finally, Participant 13 (Principal Legal Advisor, 21 years) indicated how there is a belief that social media might just be a current trend. Changes and modifications in their system might take long and there is no assurance that social media might still be as significant once the full integration has occurred. The participant said,

> Because I think it's—we haven't even defined the problem, and I'm not sure that there is a problem because I'm not sure that social media is going to be a routine way in which people ask for help. I think it was unique in the response to Hurricane Harvey because we had an unprecedented outage of the normal communication system, and I know that there is an entire nationwide 911 plan that, when one 911 center goes down, the call is automatically routed to the next one. What was unprecedented in Harvey is you had an entire region system go down, and the normal backup plan didn't work. I don't think that that's going to be a common occurrence where we would need to have a plan for the Coast Guard to monitor social media.

These findings suggest that generational divides are present in the USCG and that these divides may contribute to slower pacing of adoption. The narratives of the participants demonstrate the examples and are offering justifications that are consistent with the "laggards" category in DOI. That is, individuals who prefer the status quo to change. Further, it is not clear that there is a "will" to undertake this change, which is consistent with the laggard category in DOI. Although the thesis does not have evidence to establish that age is the primary factor slowing adoption. Given that in DOI diffusion's pacing can be enhanced as well as slowed, RQ 5 asks about what a plan for change might look like.

Research Question 5: What might an accelerated adoption plan for the use of social media during hurricane crises look like within the U.S. Coast Guard?

For the last research question, a word frequency query was completed within NVivo 12 that identified the most frequently occurring words for this research question (see Fig. 10 below).

Figure 10. Research Question 5 frequency query word cloud.

The last research question of the study explored the participants' recommendations and perceptions on what an accelerated adoption plan for the use of social media during hurricane crises might look like within the USCG. The analysis of the interviews then led to the discovery of two themes. The majority of the participants shared the need for the organization's stakeholders to have the openness to explore the effectiveness of social media during hurricane crises. This can be done by coordinating with other departments, sectors, and technology experts; having a leader to spearhead the use of the new communication tool and integrating the old and new communication methods. Meanwhile, another recommendation with fewer references was the call for the development of an accurate and reliable centralized application (seek for help containing location, etc.). Table 6 contains the display of the themes in response to the final research question of the study.

Table 6

RQ5 Themes

Themes	Number of References	Percentage of References
Having the openness to explore the effectiveness of social media during hurricane crises	11	61%
**Coordinating with other departments, sectors, and technology experts*		
**Having a leader to spearhead the use of the new*		

communication tool		
**Integrating the old and new communication methods*		
Developing an accurate and reliable centralized application	8	47%

Major Theme 5: Having the openness to explore the effectiveness of social media during hurricane crises. For 11 participants, coordination, leadership, and change in their way of thinking can be the first steps to the successful acceleration and acceptance of social media into their system. Participant 7 (Social Media Department, 17 years) discussed how the organization is currently trapped in their traditional beliefs and ways. This is believed to be one of the major reasons why social media is still not accepted as a formal communication tool that can be used during their emergency operations. The participant explained:

> I focus more on the design and the system. But, in fact, I understand we don't want to get out in front of things before we have to because we don't want to add fuel to the fire, and I disagree with that. I think if we changed our tone in social media and we were more personable, we could get out in front of things in this environment first so when there is a demand signal and we need to get out in front of things at the podium, that we kind of have a precedent.
>
> And it only takes one. That's really happening. And so, I think we could be more forward leaning in a passive environment, which is probably the least useful environment

> on a day-to-day basis, but for emergency communications, might be the most useful. And then be in the normal for medrel, which is, you know, passive until the actual demand signal is there. So, I want to clarify that. I'm trying to think of the other thing that I said. Well, that's the biggest kind of gray area.

Given these barriers and issues, Participant 6 (Aviation Survival Technician) suggested the need for someone to take the lead and spearhead the change with the employment of social media in their system: "I'm really not sure. I think technology is a very evolving platform, and it's hard to really keep up and kind of have someone take the lead and kind of create something that is the most beneficial." Meanwhile, Participant 10 (Public Affairs Officer, 19 years) also added the importance of cooperation and collaboration between government agencies and social media companies. The participant noted:

> So, it would require a lot of work with those platforms directly to say okay, you know, if this happens again, here's what we need, here's what would have made it easier for us. And are companies like Facebook and Twitter and whoever able to build something on their system to allow for that? So, it's possible, but it would need a lot of work on both ends, both the corporate side and the government side to make it a viable option.

Finally, Participant 11 (Force Allocation, 20 years) also found the importance of integrating old and new communication methods. This suggestion can be more attainable as the preferences of the older and younger generation will be accommodated. The participant stated:

> And I think we can get past that if we figure out a way to reconcile not the age disparity or the technology, but how to underpin the new demand, if that makes sense, and tie it with the traditional way of doing our business. If we can do that, then I don't think it will

be a problem. And I don't have Twitter, personally speaking. I don't have Facebook. I loathe social media. That's just me.

Given the above, it seems that the USCG has the potential to become a late adopter, but only if there is a greater will to develop a more, well-defined plan. However, the interviewees' responses to the above questions are not currently specific enough to likely propel change.

Summary

The fourth chapter of this thesis contains the results from the analysis of the 18 interviews with the study participants. The purpose of this research aimed to identify problems in hurricane response/emergency communication and attempts to understand them through the lenses of DOI theory (Rogers, 2003), as well as Kuhn's shifting technologies paradigms (Kuhn, 2012). Upon completion of the CA of the interviews, a total of 21 themes were uncovered that addressed the five research questions of the study. From the CA of the interviews, it was revealed that awareness is present, but is not formally incorporated within the USCG. It was also found that generational difference, and a lack of understanding, training, funding and trustworthiness may be inhibiting the adoption of social media uses within the context of emeregency communication in the USCG.

The pacing of the diffusion of innovations of social media currently stands at the presence of awareness of the public demand to use social media. However, in its current state, the USCG is lacking infrastructure, understanding, and resources (funding, training, personnel, etc.). The majority of the participants reported the most effective component of the adoption plan as having the openness to explore the effectiveness of social media during hurricane crises. These specific strategies were then uncovered: (1) coordinating with other departments, sectors, and technology experts; (2) having a leader to spearhead the use of the new communication tool;

and (3) integrating the old and new communication methods. The final chapter contains the discussion of the major study findings in relation to the literature, the researcher's recommendations, implications, and conclusions.

CHAPTER V

CONCLUSIONS

Connection to Literature

Chapter two presented the foundation of literature for positioning this study within a framework of existing publications, offering an explanation of how social media has previously been used during emergency situations. This framework displays how social media has the proven capacity to function as not only a valuable source of information but also as a tool easily accessible and waiting to be leveraged during emergency situations.

The literature contained in this thesis further confirmed the phenomena of HH revealing how quickly a government agency can be outpaced by the diffusion of social media across the emergency response network. Despite repeated attempts to channel requests for aid back onto the traditional pathways of 911 and other call centers, the information shared across social media mobilized the citizenry. Not only were calls for aid shared, but resources and support were also leveraged to increase the overall resiliency of an entire community and improve the efficiency of an entire rescue effort. The USCG found itself on the wrong side of the DOI curve having to innovate on the fly by creating ad-hoc call centers of their own (even though managing 911 is not a mission of the USCG), and innovating impromptu crisis mapping technologies during HH using social media posts with hashtags.

Data from social media were combined with a spreadsheet containing a user's location, and volunteers keep track of everyone who had been rescued while continuously updating the list (U.S. Coast Guard, 2018). The staffing for these call centers consisted of people near at hand with little to no experience or training in handling emergency calls. The USCG also had to muster online social media indexers to sift through the massive backlog of posts for help. Despite

the USCG's initial failure to capture this new information source, connections between those who needed assistance and those who were equipped to render that assistance developed organically along social media lines and first responders were able to complete rescues and save lives utilizing those new pathways of information. Although the USCG's performance was exemplary overall, with more than 11,000 people and 1,350 pets rescued in a matter of days, they recognized that they were not adequately prepared for the collapse of the 911 systems and the grassroots shift to social media.

Connection to Theory

Using the DOI theory against the backdrop of HH, it is apparent that the vast majority of emergency response organizations, including the USCG, are allowing themselves to fall further toward the very late majority, or more accurately according to this study into laggard end of the curve. By not taking the initiative to find a solution to the question of leveraging social media networks during large-scale emergencies, the requirement of a whole-of-government approach to rescue citizens and mitigate property damage is absent. The social media network responded to the enervation of emergency response agencies by motivating the citizenry into doing more than passing along information or support, but in taking direct physical action crowdsourcing rescues on their own.

There is considerable societal pressure for the USCG to adopt new digital, mobile communication innovation that will mount as public trust in government rescue agencies wanes due to perceived inadequacies with the 911 network. The diffusion of innovations theory (Rogers, 2010) can explain that the pacing of this process will not be uniform or smooth as the USCG battles internal inertia against changing the fundamental ways it responds to disasters in

light of new communications innovations and lags behind the private sector and other government agencies.

When concurrently viewed through the lens of Kuhn's paradigm shift theory, HH, as a single event, could potentially signal a future watershed event that could alter how citizen users interact with responders as the current infrastructure could fail repeatedly under the weight of national crises or large-scale emergencies. A new emergency response system that fully incorporates the viability of social media lies on the horizon in some form, a sentiment shared by all of the respondents to the study conducted in this thesis. Somewhere between then and now lies an inflection point that will cause government agencies responsible for search and rescue to cross the intervening distance. At issue is whether it will be an inflection point reached with a government agency fully prepared, funded, equipped, and staffed to meet the challenges ahead, or another event that leaves the agency scrambling to adapt to a rescue environment that moves too dynamically for an archaic system to properly manage.

According to Kuhn's (2008) cycle, HH was a model drift level event and a level 2 step along that cycle. According to the literature, this event is marked by the presence of abnormalities and phenomenon as more and more questions arise about the viability of the 911 systems in handling these large-scale events. A true paradigm shift would occur if social media were fully incorporated into the decision-making and operational planning of emergency response units. This study is helping to push that paradigm shift closer to reality, as more and more attention is given to the growing dissatisfaction amongst the public and first responders with being forced to use 911 call centers during national emergencies; call centers that grow more and more unreliable as the area of effect of a crisis increases.

Implications of the Findings

The stakes of national-level catastrophes are too high to be poorly managed. It is imperative to consider the human cost of a miscalculation by a government agency responding to a crisis on the magnitude of an inland hurricane. As the citizenry reacted quicker to the wellspring of information spread across social media than the USCG and other government agencies, those impromptu rescues faced HH with limited training, procedure, and equipment than the USCG and other agencies that are trained to respond had at their disposal. Personal property was damaged and destoyed, financial losses were widespread, and families were kept wondering if help would ever arrive. Volunteers died in the rising waters of HH, facing an event that they may not have prepared for, where a better experienced and equipped crew might have survived.

But even that tragic cost pales in comparison to the loss of life that could result, should the 911 networks once again fail when depended upon by emergency responders. Hurricane Harvey's victims benefited from having access to several USCG units in the state, along with numerous other homegrown, local, and national emergency aid organizations, as well as proximity to a highly motivated volunteer force familiar with a citywide urban rescue. As much as the limited loss of life for such a large event brings credit to the passion and dedication of first responders, some consideration must be given to the variables that fell in Houston's favor.

Based on the results of this study, the USCG is not currently in a position to have a positive significant effect on the paradigm shift. As expressed by several respondents, there is no funding, no personnel, no understanding, no training and no infrastructure in place within the USCG to begin confronting this need. Further, as some of the participants pointed out in this study, the current 911 system is regulated by the FCC and not the USCG. Thus, the question

remains where responsibility lies for innovating official social media emergency communication technology, and it is evident this innovation would require a whole-of-government approach where multiple agencies need to work together. Additionally, there is no guidance from senior leadership on a national level across multiple agencies to either innovate or incorporate social media into the 911 system; or, to develop a new system for the USCG that harnesses social media connections during a national emergency. In its current state, the 911 systems have barely incorporated and have limited text-to 911 capabilities. Organizational reluctance to acknowledge social media as a viable tool for search and rescue and emergency communication keeps the USCG well out of the innovators or early adopter groups according to DOI, which limits their social media efficiency to informing the public, sharing photos, links and relevant news, and telling the USCG's story within the platforms.

In addition, the study revealed that social media, agitated with the government's languid response and perception of emergency response deficiencies, can cause a mobilization of citizen rescued whom the governments may have a responsibility to train or equip with the necessary skills for rescuing victims during natural disasters. As the government response-time to calls of distress continues to falter or fail, and grassroots organizations begin to respond to the need, the populace may naturally begin to depend more on these groups of citizens, which are often unregulated, untrained, and unarmed with the most basic knowledge of search and rescue. In a crisis that lasts over several days, this can increase the confusion as groups of rescuers compete for or respond to different calls of assistance.

Recommendations

The USCG has successfully leveraged several social media campaigns in the past, with boating safety and the use of emergency position indicating radio beacons being two high-profile

campaigns. However, that experience has not been successfully duplicated in regard to social media calls for assistance. A consistent campaign, rather than a few sparsely connected posts in the midst of hurricanes or hurricane season, that effectively directed the citizenry to approved call centers would align messaging with senior leadership and national policy. This realignment could ease confusion among first responders and ultimately save lives during a national emergency. Although the USCG's current message is to not use social media to request assistance, paradoxically a message that was rapidly spread during HH thanks to social media, and a realignment of senior leadership goals could provide a framework for the USCG to operate within. The messaging of the USCG benefits most from a more coherent or marginally self-aware messaging campaign about social media requests for help during an emergency. Without clear messaging or an engaging social media campaign, the USCG could lose their standing online and fail to reach the public in times of need with not just information, but also rescue. Conversely, however, despite ironic posts telling the public not to post to social media for help HH proved that the public would take any necessary action during an emergency, regardless of the USCG or other government/rescue agency's messages.

Additionally, if the Coast Guard opted to take a progressive approach to emergency response using social media to request assistance, a recommendation would be to establish a pilot program that leveraged geospatial technologies and social media indexing. A pilot program would require a collaborative effort within the Coast Guard to innovate new technologies and integrate them within the USCG's technical infrastructure and policies. Furthermore, this pilot program could provide an opportunity to utilize the USCG Auxiliary to provide more human capital to this program during large-scale national emergencies. With information collected from the pilot program coupled with a forward-thinking response, the USCG could transition to the

innovators phase of the DOI theory curve and pioneer new paths forward in emergency response and disaster preparedness.

Emergency communication should involve the use of a more aggressive, more robust social media presence with the purpose of educating potential rescuers on how to enhance safety before, during, and after disasters. The USCG might not have the funding or peoplepower to stand up a specialized social media unit; however, they certainly do not lack highly skilled personnel steeped in innovation and adaption. Additionally, the USCG has a history of using highly technical components, as reflected in the current messaging revolving around utilizing the most technologically advanced cutter in the fleet, the National Security Cutter, as well as goals of continuing this push for more complex technical applications for maritime law enforcement in the OPC acquisition.

But still, the greatest contribution social media could gift to an emergency situation is the rapid spread of information to a large community. With the Coast Guard, an agency centered around first responders who were innovating new ways to explore the capabilities of social media during HH, and who are governed by a command structure actively hunting new approaches to guide this exploration, the collateral damage of the "Model Crisis" predicted by Kuhn could be significantly mitigated. Federal and local governments could develop an online team to assist the USCG in monitoring, evaluating, and responding to distress calls on social media and provide continuity across changes in senior leadership. At the least, the government holds the responsibility to inform the populace that they are severely lagging behind private entities in leveraging digital technologies during inland emergency situations such as HH. In other words, a social media campaign, rather than a few tweets and Facebook posts during a hurricane telling the public not to use social media to seek help, should be initiated. This would

alert the younger, and more technologically aware citizenry that, although they can arrange a drone to fly a package to their location or have touch and swipe to have groceries delivered to their home within an hour, emergency responders will still require a 911-call center to initiate rescues during critical inland emergency situations.

HH should serve as a catalyst to motivate government agencies, including the FCC, to begin work to incorporate social media and associated digital media to improve their future emergency response operations. For instance, the use of hashtags should be expected to provide local and federal agencies with enough information in case there are delays in providing rescue services through traditional means. Hashtags could also greatly increase the ease of social media indexers working for emergency response agencies to catalog and track the progress of ongoing rescue operations on a macro-level.

Future Research

The study featured in this thesis identified there are key inhibiting and facilitating factors that help explain the current state of the adoption of technological communications innovations within the USCG concerning emergency-response communication. Future research could benefit from looking at the effect the culture of the USCG has with incorporating innovation into the structure of their organization. The technological divide between each successive generation might be a contributing factor to the adoption of new technologies within standard operating practices. A common refrain throughout the research and data responses highlighted the untrustworthiness of social media in an emergency scenario, without considering that the same scams, fraud, and other criminal activities could be achieved over a phone line to a 911 call center as easily. It could be that the pace of innovation in technology has left senior leadership uneasy as they contend with faster and wider leaps in knowledge and technology than their

predecessors. Their position is juxtaposed by the more technologically literate junior membership within the organization. These junior members have grown up around social media and were among the first to leverage it during HH, while simultaneously innovating ways to use Google combined with “heat map technology” to coordinate rescues when 911 lines were down. This same Google/heat map technology, according to Participant 15, was leveraged during hurricane seasons following Harvey and will continue to be used, though the technology is not officially approved for use.

The culture of the USCG is one that supports a very adaptive agency, especially when considered in the same framework of a large governmental agency. The speed that they were able to mobilize assets and personnel during national disasters does the service much credit. The USCG will continue to be challenged by the evolving digital landscape of social media and will require the cooperation and coordination of forward-thinking senior leaders and vociferous junior members to identify and overcome the hurdles faced by an organization that prides itself on being “always ready.”

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APPENDICES

APPENDIX A.

Informed Consent Form

PROJECT TITLE: Crisis Communication and Emergency Response in the U.S. Coast Guard

INTRODUCTION

The purposes of this form are to give you information that may affect your decision whether to say YES or NO to participation in this thesis research, and to record the consent of those who say YES. This experiment is a part of the study of Crisis Communication and Emergency Response: Diffusions of Social Media in the U.S. Coast Guard.

RESEARCHERS

- Melissa Leake, Lifespan & Digital Communication Graduate Student, Old Dominion University
- Thomas J. Socha, PhD, GPD, and Thesis Advisor, Old Dominion University

DESCRIPTION OF RESEARCH STUDY

This study examines the U.S. Coast Guard's crisis communication policies and practices in response to hurricanes. In particular, the potential of social media and new digital media technologies as platforms for emergency communication and rescue coordination are considered.

If you consent to participate, you will take part in a 15-minute face-to-face interview about your role in hurricane response. I will record your interview and transcribe the interview removing any and all identifying information. I will then destroy all recordings to ensure confidentiality.

If you say YES, then your participation will last for no more than 15 minutes at the location of your choice. Approximately 15 members of the U.S. Coast Guard will be participating in this study.

EXCLUSIONARY CRITERIA

Only active duty members of the U.S. Coast Guard whose role involves hurricane response are eligible to participate.

RISKS AND BENEFITS

RISKS: The researcher will take all due precautions to protect your privacy (see the confidentiality section below) however, in organizational face-to-face interview studies of this nature it may not be possible to reduce risks of participation to zero.

BENEFITS: There are no direct benefits to participating in this study.

COSTS AND PAYMENTS: The researchers are unable to give you any payment for participating in this study

CONFIDENTIALITY

The records and recordings of this study will be kept confidential. This informed consent document will be kept secured in the investigator's office and will be destroyed once the research is completed. All public reports (i.e., the MA Thesis and subsequent conference papers) will mask the identities of participants in transcriptions (e.g., Officer A) and report summary

statistics. Your personal identity will not be revealed. The results of this study will be used in reports, presentations, and publications; but again you will not be personally identified. Records from this study may be subpoenaed by court order or inspected by government bodies with oversight authority, but the sources of information used in the study will not be revealed in any form.

WITHDRAWAL PRIVILEGE

It is OK for you to say NO. Even if you say YES now, you are free to say NO later, and walk away or withdraw from the study—at any time.

COMPENSATION FOR ILLNESS AND INJURY

If you say YES, then your consent in this document does not waive any of your legal rights. However, in the event of injury or illness arising from this study, neither Old Dominion University nor the researchers are able to give you any money, insurance coverage, free medical care, or any other compensation for such injury. In the event that you suffer injury as a result of participation in this research project, you may contact Melissa Leake the responsible project investigator at 570- 898-2577; Dr. Thomas J. Socha, PhD, thesis advisor 757-683-3833; Dr. Tancy Vandecar-Burdin, the current IRB chair at 757-683-3802 at Old Dominion University (tvandeca@odu.edu); or the Old Dominion University Office of Research at 757- 683-3460, all of who will be glad to review the matter with you.

VOLUNTARY CONSENT

By signing this form, you are saying several things. You are saying that you have read this form or have had it read to you, that you are satisfied that you understand this form, the research study, and its risks and benefits. The researchers should have answered any questions

you may have had about the research. If you have any questions arising later on, researcher staff will be available to answer them: Melissa Leake at mleak001@odu.edu or 570-898-2577.

If at any time you feel pressured to participate, or if you have any questions about your rights or this form, then you should call Dr. Tancy Vandecar-Burdin, the current IRB chair at 757-683-3802 or the Old Dominion University Office of Research, at 757-683-3460.

And importantly, by signing below, you are telling the researcher YES, that you agree to participate in this study. The researcher should give you a copy of this form for your records.

Subject's Printed Name & Signature _____ Date: _____

INVESTIGATOR'S STATEMENT

I certify that I have explained to this subject the nature and purpose of this research, including benefits, risks, costs, and any experimental procedures. I have described the rights and protections afforded to human subjects and have done nothing to pressure, coerce, or falsely entice this subject into participating. I am aware of my obligations under state and federal laws, and promise compliance. I have answered the subject's questions and have encouraged him/her to ask additional questions at any time during the course of this study. I have witnessed the above signature(s) on this consent form.

Investigator's Printed Name & Signature _____ Date: _____

APPENDIX B.

Semi-structured interview questions

1. How long have you served in the Coast Guard?
2. What is (are) your role(s) in responding during hurricanes?
3. Please describe what you consider to be typical communication patterns during hurricanes?
4. Please describe what you consider to be typical decision-making procedures during hurricanes?
5. What kinds of problems, if any, do you perceive regarding typical communication processes concerning hurricane management?
6. What kinds of problems, if any, do you perceive in typical decision-making processes concerning hurricane management?
7. In general, did the Coast Guard experience any communication problems during hurricane Harvey? If so, please explain.
8. Do you think social media can be an effective tool to use to coordinate rescues during large incidents like Harvey?
9. If so, why, or if not, why not?
10. Evidence shows that US citizens are using social media to request help even though the Coast Guard and other similar agencies continue to tell them not to. In your opinion is this a problem?
11. If you think this this is problem, why do you think the Coast Guard has not come up with a way to monitor those requests?

12. In a perfect world, what might an ideal US Coast Guard emergency communication response system look like?
13. And, in this ideal plan, do you see a need for the Coast Guard to create an app of some kind, and/or enhanced GPS-based mobile technology to help coordinate rescues?
14. Is there anything you would like to add concerning communication and hurricane management?

APPENDIX C.

IRB exemption

IRBNet ID: 1343032-1 USER PROFILE LOGOUT

IRBNet

Welcome to IRBNet
Thomas Socha

Help
My Projects
Create New Project
My Reminders (108)

Project Administration
Project Overview
Designer
Share this Project
Sign this Package
Submit this Package
Delete this Package
Send Project Mail
Reviews
Project History
Create a New Package
Messages & Alerts (3)

Other Tools
Forms and Templates

Review Details

[1343032-1] Hurricane Harvey, Social media, and Coast Guard Response

Old Dominion University Arts & Letters Human Subjects Review Committee, Norfolk, VA

Submission Details

Submitted To Old Dominion University Arts & Letters Human Subjects Review Committee, Norfolk, VA
Submitted by Thomas Socha
Submission Date 10/26/2018
Submission Type New Project
Local Board Reference Number

Review Details:

Agenda	Review Type	Board Action	Effective Date	Project Status	Expiration Date
Unassigned	Exempt Review	Exempt	11/19/2018	Exempt	

Board Documents:

There are currently no documents from Old Dominion University Arts & Letters Human Subjects Review Committee.

VITA

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EDUCATION

M.A. Lifespan and Digital Communication, 2019
Old Dominion University, Norfolk, VA
Thesis Title: A Study of the Diffusion of Innovations and Hurricane-Response in the U.S. Coast Guard

B.A. Advertising and Public Relations, 2018
Penn State University, University Park, PA

PROFESSIONAL EXPERIENCE

United State Coast Guard, 2006 – Present
Chief Public Affairs Specialist

- Joint Information Center and risk communication instructor
- Coordinate press/media events
- Media relations specialist
- Multi-agency strategic planning
- Create talking points, communication action plans and public affairs guidance
- Provide public affairs, public information, social media training
- Deploy to major contingencies to support joint information centers
- Write news releases and feature articles, shoot still and video imagery
- Official spokesperson for U.S. Coast Guard

CONFERENCE PAPERS

Socha, T. J., Bohrer, K., Daniel, T., Garcia Mendoza, C., Leake, M., & Reyes, R. (2019, April). *Interpersonal agitation: An exploratory study and preliminary scale development*. A paper to be presented at the annual meeting of the Southern States Communication Association, Montgomery, AL.