2018

# Twitter Use During Hurricane Irma: How the Local Government Agencies Amplify and Attenuate Risk Factors for the Vulnerable Populations

Elizabeth Ann McCarthy
*University of North Florida*

# Twitter Use During Hurricane Irma: How the Local Government Agencies Amplify and Attenuate Risk Factors for the Vulnerable Populations

Elizabeth A. McCarthy

A thesis submitted to the Department of Communication

In partial fulfillment of the requirements for the degree of

Master of Science in Communication Management

UNIVERSITY OF NORTH FLORIDA

COLLEGE OF ARTS AND SCIENCES

November, 2018

Certificate of Approval

The thesis titled "Twitter Use During Hurricane Irma: How the Local Government Agencies Amplify and Attenuate Risk Factors for the Vulnerable Populations" is approved:

(Date)

_____ _____

Dr. Tulika Varma

_____ _____

Dr. Nataliya Roman

_____ _____

Dr. Margaret Stewart

Accepted for the Department of Communication:

_____ _____

Dr. John Parmelee
Chair

Accepted for the College of Arts and Sciences:

_____ _____

Dr. George Rainbolt
Dean

Accepted for the University of North Florida:

_____ _____

Dr. John Kantner
Dean of the Graduate School

Acknowledgements

First, I would like to thank my thesis advisor, Dr. Tulika Varma. Thank you for your assistance and support throughout this entire process. Your guidance has helped me become a better researcher and writer. Additionally, I would like to thank my committee members, Dr. Nataliya Roman and Dr. Margaret Stewart for your feedback and guidance of this project. Thank you all for dedicating your time and experience to this project.

Next, I would like to thank my family for their unconditional support and understanding. My family has continued to encourage me to achieve my goals and I am truly grateful for all the sacrifices they have made for me. I would also like to thank my boyfriend for his unwavering support and patience throughout this journey.

Table of Contents

List of Tables

Abstract

Twitter has become a popular channel for local governments to explore crisis communication during a hurricane. Local governments use Twitter to distribute crisis messages to the public, and are able to amplify or attenuate risk perception. Many factors attribute to individuals' risk perception including control, choice, children, novelty, and risk-benefit tradeoff. The Social Amplification of Risk Framework (SARF) provides a guide to understanding the intensifying or weakening of these risk messages. While these crisis messages are directed to the general public, the local governments may be neglecting information for the vulnerable populations. In order to prepare for a hurricane, vulnerable populations need updates from local governments and emergency agencies before, during, and after the hurricane. Relationships among stages of a hurricane, tweet categories, and risk perception were explored. A sample of 1,043 tweets from six Twitter accounts of local governments in Florida were analyzed to provide insight into what type of messages local governments tweet and what risk perceptions local governments emphasize during the stages of Hurricane Irma. Using a Cross-tabulation analysis, researchers analyzed significant differences for stages of a hurricane, tweet categories, and risk perceptions. Findings for this study indicate that results were significant through each stage of the hurricane.

*Keywords*: *Twitter, Hurricane, Risk Factors, SARF, Vulnerable Populations*

# Twitter Use During Hurricane Irma: How the Local Government Agencies Amplify and Attenuate Risk Factors for the Vulnerable Populations

On September 10, 2017, Hurricane Irma hit the Florida Keys and tracked north through the west coast of Florida affecting the entire state (Cangialosi, Latto, & Berg, 2018). Wind, storm surge, and rain caused structural damage and flooding resulting in $9.7 billion in insured losses (Florida Office of Insurance Regulation, 2018). The state of Florida recorded 87 deaths caused by drowning, lightning, wind, falls during preparation, heart attacks, house fires, electrocutions from downed power lines, carbon monoxide poisoning, chainsaw accidents, and vehicle accidents (Cangialosi, Latto, & Berg, 2018).

Hurricanes are severe tropical storms that cause water surges, high winds, and increased rainfall that produce floods and dangerous debris. These natural disasters form in the Caribbean Sea, Gulf of Mexico, southern Atlantic Ocean, and the eastern Pacific Ocean between June 1 and November 30, and can impact the coastline and several hundred miles inland of the eastern United States (Federal Emergency Management Agency, 2015). The state of Florida is considered the most hurricane-prone state in the U.S. with its more than 1,260 miles of coastline (Rice, 2014). It is surrounded by the Gulf of Mexico on the west and the southern Atlantic Ocean on the east. St. Petersburg, FL and Miami, FL are in the nation's top five most hurricane vulnerable cities (Freedman, 2012). Additionally, coastal cities Clearwater, Cape Coral, Ft. Lauderdale, Hialeah, and St. Petersburg, FL are in the top 10 U.S. cities with populations aged 65 or older (Brandon, 2011).

In fact, 18.6% of the population in South Florida is aged 65 or older, putting Florida in the top 10 for states in the U.S. with the highest percentage of elderly residents (Fukushima, 2014). In any natural disaster, despite the location, the elderly population is generally the most

severely impacted group. Previous hurricanes have showed that the elderly population are not prepared and in some cases, are unable to prepare themselves for a natural disaster (Adams, et al., 2011; Parry, 2013).

Vulnerable population in the context of a hurricane hazard has been defined as a group that can be impacted due to its socioeconomic and health status (Finch, Emrich, & Cutter, 2010). In elderly populations, these health conditions can be impaired physical mobility, physical frailty, decreased sensory awareness, functional and cognitive disability, and social isolation (Burnett, Dyer, & Pickins, 2007). According to data from the American Community Survey (The Florida Assisted Living Federation of America, 2014), almost three-and-a-half million people residing in the state of Florida are over the age of 65, and about one-third reported a disability. In order to properly prepare before, during, and after a hurricane, the elderly and the vulnerable populations needs to be specifically informed by government and emergency officials. Public officials in the state of Florida have been utilizing social media to disseminate emergency communication during natural disasters. Social media has broken down barriers between governments and citizens (Bertot & Jarger, 2010). Now, communication to the public has become more frequent and targeted, which is a direct benefit in times of emergency (Bertot & Jargor, 2010). With the new ways for officials and the public to interact on social media, there should be more in-depth attention to engagement and opportunities to inform the public during an emergency (Turoff, et al., 2013); specifically, the elderly and the vulnerable population.

**Purpose of the Study**

The purpose of this study is to examine how government officials within the state of Florida use Twitter to disseminate information to the public before, during, and after the hurricane. More specifically, the dissemination of information to the vulnerable populations will

be evaluated through tweet categories. Additionally, this study will also examine whether the risk factors were amplified or attenuated.

According to the Pew Research Center (2018), 69% of U.S. adults use some type of social media. Since it is the government officials' responsibility to manage the public's risk during an emergency situation and release updates that inform the public of those risks, there has to be information gathering, standards that are set and suggested behaviors to follow to lessen the severity of the risk (Lodge, 2009; Sellnow & Seeger, 2013). Often it has been observed that the risk perception associated with hurricanes either get amplified or attenuated. This can lead to miscalculations about the risks and subsequently affect the preparation for the hurricane.

Hurricanes differ from other natural disasters in that they can be tracked and their strength can be predicted before they make landfall. Because of the advanced information available on the path and the severity of the risks involved, it is vital to understand how social media use during hurricane can impact risk communication to the public, especially the elderly and the vulnerable. Furthermore, rumors spread over social media can cause unnecessary anxiety and worry unrelated to the hurricane's actual impacts (Oh, Agrawal, & Rao, 2013). This can be especially harmful during emergency situations when the public interprets their risks and forms decisions about what actions to take (Comfort, 2007).

## Theoretical Framework

This study will use the Social Amplification of Risk Framework as the lens to examine the official Twitter messages disseminated by the Florida public officials of different cities before, during and after Hurricane Irma.

The Social Amplification of Risk Framework (SARF) looks at the alignment between the public and organizations perceptions of risk events. Kasperson et al. (1988) define the Social

Amplification of Risk as "the phenomenon by which information processes, institutional structures, social-group behavior, and individual responses shape the social experience of risk, thereby contributing to risk consequences" (p. 181). SARF first looks at the social and individual stations that transmit risk signals from source to receiver. Then, classical communications theory is used as a foundation to discuss the amplification and attenuation of risks (Bakir, 2005; Duckett & Busby, 2013). When the public, which is defined as an end station, receives a signal, or risk message, it is then decoded based on the risk factors present (Kasperson et al., 1988).

Since the public is exposed to different sources of information, there is often a lack of alignment between expert perceptions and the public's perceptions (Kasperson, et al., 1988; Pidegeon, Kasperson, & Slovic, 2003). Perception of risk factors can occur at many stages, and includes the transfer of risk information with related amplification or attenuation of risk factors. Many variables may serve as a reference point for validating perceptions, such as friends or co-workers since these groups are likely to have a similar cultural view or bias. This has the potential to aid in amplifying or attenuating the information received (Kasperson, et al., 1988). Also, SARF suggests that risk related events "interact with psychological, social, institutional, and cultural process" which can increase or decrease an individual's own and social perceptions of the risk (Renn, 2011, p. 154).

Additionally, since hazardous events attract considerable attention and expressions of concern from different types of publics, including the media, the actual hazardous circumstances can be intensified by these intense attention and coverage. In these situations, experts may consider hazards to have low risk, while the public might view it as a high-risk situation; whereas, on the other hand, experts may consider the hazard to have a high risk, but because of the social attention the public might view the situation as a low-risk situation. However, if the

risks are already feared by the public, their risk perception of the event may already be amplified (Kasperson et al., 1988).

The SARF provides a method to identify and catalogue these instances, informal interactions, or actions of risks amplification or risk attenuation and classify them as "stations of amplification" through the communication process (Brenkert-Smith, Dickinson, & Champ, 2013). Through intensifying or weakening signals of the risk event, organizations can filter messages in accordance with their attributes of risk and importance to the public (Kasperson and Kasperson, 1991).

## Literature Review

The following section reviews key research developments in the area of Twitter use during disaster management. The social media platform Twitter has become a popular channel for releasing government issued emergency warnings. Twitter is "being rapidly integrated into disaster management and warrants systematic study of its viability in support of improved public response" (Comfort, et al., 2012, p. 547). Twitter's official warning system, Twitter Alerts launched in 2013, provides a seamless outlet for users to get official alerts from registered authorities such as governmental agencies, environmental agencies, ambulance services, and police forces. Twitter allows for easy user engagement because any user can tweet or directly reply to a government official or government agency registered on Twitter. Twitter thus offers a platform for easy exchange of information between officials and the public, creating a two-way dialogue (Yates & Paquette, 2011). While Twitter is a useful tool for quickly spreading emergency information, only 19% of U.S. adults ages 50 to 64 and 8% of U.S. adults ages 65 and older use Twitter online or on their cellphone. These numbers have increased since 2014, which recorded 9% of U.S. adults ages 50 to 64 and 5% of U.S. adults ages 65 and older using

Twitter (Duggan, Ellison, Lampe, Lenhart, & Madden, 2015). The majority of Twitter users are ages 18 to 29, and account for 40% of Twitter users (Pew Research Center, 2018).

**Twitter Use During Crisis**

Alexander (2014) identified different ways in which social media could be used during crisis management: as a listening function; monitoring a situation; and emergency planning (p. 720-723). Twitter, was found to gain usership during crisis events, indicating the importance of the emergency management function of Twitter (Hughes & Palen, 2009). In related studies, Twitter has been found to be used by the public as a means of communal expression and played a role in self-therapy (Murthy & Gross, 2017).

Graham and Park (2015) observed that local governments were engaging strategically throughout crisis events, with public health crisis presenting the highest immediate informational demands. Their findings also suggest that social media utilization during a crisis is dependent on the type of crisis, as opposed to a "one size fits all" crisis response model approach (p. 393). Governmental use of social media, even on the local scale, allows for efficiency of communication and the potential to reach many individuals quickly (Kavanaugh, et al., 2011).

However, researchers have also found that there may be too much information on Twitter during a crisis, which could make it difficult for the public to find relevant information that would help throughout the crisis timelines. With that amount of information, it could also cause communication from official organizations to get lost and become out of view from the public (Lachlan, et al., 2014a). Rainear, Oeldorf-Hirsch, and DeVoss (2018) suggest that Twitter users understand the "importance of information literacy" and learn how to maximize exposure to helpful information (p. 331). In this case, Lachlan, et al., (2014b) argue that localized hashtags can help to organize information for the public seeking it during a crisis event. By using a

localized hashtag, Twitter users can target a specific audience who will benefit from that information. Localized hashtags may also create a stronger sense of immediacy and relevance as compared to the use of broader hashtags that do not have a narrow target audience (Lachlan, et al., 2014b). It has been observed that the use of geo-locational data plays a significant role in the creation of trust and strengthens the external validity of the tweet (Halse, Squicciarini, & Cargea, 2018). Twitter users can also "tag" their location, which can alert first responders of their location during rescue missions, and also allow closely located users to interact (Vieweg, et al., 2010).

**Twitter Use and Perceptions of Risk**

Sandman (1993) examined hazard and outrage in relation to risk perceptions. Sandman defined risk as a combination of hazard and outrage, and suggested that it is "more symmetrical than the usual complaints about public misperception" (p. 8). According to Sandman (2003) experts or government officials characterize risk as it relates to hazard and the public conflates risks with outrage. By combining hazard and outrage, experts and the public can gain a more complete understanding of risks. Sandman (1993) identified 12 factors of outrage, however Ropeik and Slovic (2003) identify 5 outrage factors related to risk perception, which include: control, choice, novelty, risk-benefit tradeoff, and children (p. 2-3). A thorough understanding of these factors can help officials communicate better with various publics as it relates to their concerns (Ropeik & Slovic, 2003).

The public might respond with blame or outrage (Lachlan & Spence, 2010) during post-natural disaster and recovery situations. Rumors might also be spread over social media and cause the public unnecessary anxiety unrelated to the natural disaster's actual impacts (Oh, et al., 2013). This can be harmful during emergency situations when the public interprets their risks

and forms decisions about what actions should be taken (Comfort, 2007). Risk communication during natural disasters has been observed to have two goals: reduction in uncertainty and reactions caused by hysteria and rumors; and, to inform the public of risks and alerts (Hart, 2013). Emergency preparedness and risk reduction messages disseminated via Twitter are also fraught with challenges of lack of access, which might be due to poverty, disability, or a choice to not possess technology, or little to no knowledge of how to use social media. Computer illiteracy, however, can be somewhat compensated for by word of mouth, when people who do have access to social media relay that information to others who do not (Alexander, 2014).

**Elderly and Vulnerable Individuals, and Emergency Messaging during Hurricane**

In a hurricane preparedness study conducted by Kleier, Krause, and Ogilby (2018), television and radio were the leading media sources for the elderly to get information throughout the timeline of a hurricane. In a study conducted by Thomas, et al., (2016) traditional media were more likely than tweets to include health information during a crisis. In a study of Twitter content from Hurricane Sandy, there were no tweets in the sample containing information about healthcare or how to provide care for the sick and elderly (Spence, et al., 2015). Elderly individuals who lived in households of more than one person were also better prepared than elderly individuals living alone. Preparedness for elderly individuals was also lowered when there was a need for cooperation from others in order to help these elderly individuals. Similar data was also found for the elderly living in homogenous communities (Kleier, et al., 2018).

Crisis communication professionals often overlook disseminating information about healthcare to vulnerable populations, such as the sick and the elderly, in emergency messaging on Twitter. Spialek and Houston (2018) found that communication among users on Twitter can be used as a resource to “facilitate and amplify disaster public health efforts” and create

networks that can aid in disaster coping efforts (p. 949). Spence, et al., (2015) recommend publishing continual updates with disaster-related hashtags to help the elderly and the vulnerable population in the early stages of the hurricane preparation.

Burke, Spence, and Lachlan (2010) found that older respondents in Hurricane Ike were less likely to be prepared with an emergency kit likely due to the fact that they have more experience with hurricanes. It has also been argued that those who have experienced a hurricane with minimal harm may treat another hurricane in a similar way. However, researchers also found that as age increases, physical and emotional difficulty coping with a crisis typically also increases as well, causing a lack of confidence. Contrary to older respondents experiencing a hurricane, researchers also found that many elderly individuals who have retired to Florida often move from northern areas, where they leave their family and friends, which lowers the access to social and physical support throughout hurricane preparation and even evacuation for these individuals (Kleier, et al., 2018). Additionally, the broad nature of emergency messages tends to isolate the older population as older individuals do not see many behavioral models of similar age. Without these behavioral models as an example to navigate evacuation, older individuals may not gain the confidence they need from the general modeling in many emergency messages. (Burke et al., 2010).

**Research Questions and Hypotheses**

Based on the literature review, the following research questions and hypotheses are proposed as part of the examination of Twitter messages from local government during Hurricane Irma.

*RQ1. What categories of tweets do local governments post during a hurricane?*

*RQ2. What categories of tweets do local governments post before hurricane?*

*RQ3. What categories of tweets do local governments post after a hurricane?*

*RQ4. Do the tweets amplify or attenuate risk perceptions during the hurricane?*

*H1. The local government agencies are more likely to amplify risk perceptions before a hurricane.*

Risk events, such as a hurricane, attract more attention of concern from the media, organizations, and the public. Because of the increased coverage of the risk event, the messages can be intensified due to the amount of attention and urgency in the flow of messages (Kasperson et al., 1988).

*H2. The local government agencies are more likely to attenuate risk perceptions after a hurricane.*

After a hurricane, there is potential for public blame and outrage (Lachlan & Spence, 2010) and unnecessary public anxiety due to rumors (Oh, et al., 2013). Risk communication aims to reduce uncertainty and reactions caused by hysteria and rumors (‘t Hart, 2013), and organizations can aim to do so by attenuating risk factors in messages.

## Research Method

This study used quantitative content analysis of local governments Twitter messages or Tweets to the public during Hurricane Irma. Tweets were examined for how local governments in the state of Florida use Twitter to communicate with the public before, during, and after a hurricane and how risk perception is amplified and attenuated through the local government’s framing of the Tweet, based on the five factors of risk suggested by Sandman (1993) and Ropeik and Slovic (2003). Tweet categories created by Bowden (2014) and Lachlan et al., (2014) were also used to code Tweets.

**Sample**

The primary unit of analysis was the individual tweet. A systemic sample of every other tweet was used to gather 1,043 tweets from August 30, 2017 to September 30, 2017 from six different Florida cities; Miami, St. Petersburg, Clearwater, Fort Lauderdale, Boca Raton, and Key West. This date range was chosen because Hurricane Irma began as a tropical storm in the eastern Atlantic Ocean on August 30, 2017. Hurricane Irma made landfall in the lower Florida Keys as a Category 4 hurricane on September 10, 2017 (Jansen, 2017). Areas in the state of Florida continued to receive aid past September 30, 2017 (Osborn, 2017), but for the purpose of this research, the sample size date ranges a month from pre-storm communication to post-storm communication.

The six local governments' Twitter handles are listed below:

- @CityofMiami
- @StPeteFL
- @MyClearwater
- @FTLCityNews
- @CityBocaRaton
- @City_of_KeyWest

These local governments were chosen because of hurricane vulnerability and the proportion of the elderly and vulnerable population. St. Petersburg, Florida and Miami, Florida were among the nation's top five most hurricane vulnerable cities (Freedman, 2012), and Clearwater, Florida, Fort Lauderdale, Florida, and St. Petersburg, Florida were in the top ten for U.S. cities with the oldest populations, and are located along the Florida coastline (Brandon, 2011). Boca Raton, Florida, located on the east coast, and Key West, Florida, an island located

south of Florida's southern coast, are also cities at risk during hurricane conditions. Although the city of Cape Coral, Florida (@CapePIO) was included in the top ten U.S. cities with the oldest populations, the lack of Twitter activity excluded the local government from the selection. The sample of 1,043 tweets included retweets from agencies including, police and fire departments, the Federal Emergency Management Agency, the National Oceanic and Atmospheric Administration, and Governor Rick Scott. Tweets were downloaded to Excel and manually coded.

**Data Collection**

Tweets were coded for:

- Long-term storm trajectory predictions
- General storm advice
- Time/location-specific advice
- Post-storm updates
- Descriptions of organizations' efforts or contributions
- Thank-you messages acknowledging volunteers and other organizations
- Call-to-action posts requesting donations, volunteers, etc.

These categories were adopted from Bowden, 2014, p.43.

The following categories were based on Lachlan et al., (2014b):

- Whereabouts of food/shelter
- How to obtain financial assistance
- How to care for the sick and elderly

Categories of risk factors relevant to amplification and attenuation were adopted from Ropeik and Slovic (2003) and Sandman (1993):

- Control
- Choice
- Novelty
- Risk-benefit tradeoff
- Children

Two trained coders coded the tweets based on the coding scheme outlined above. Please refer to appendix A for detailed explanation. Cohen's Kappa was used to measure the intercoder reliability of 50 tweets and a satisfactory Kappa of 0.918 was obtained. Data was analyzed using SPSS 25.

## Results

The first research question explored the different categories of Tweets posted during Hurricane Irma. Overall, the most frequent category of tweet during a hurricane was "Time/location-specific advice" ($n$ = 39). The next most frequent category of tweets was "General storm advice" ($n$ = 23). Frequencies of the rest of the tweet categories were relatively low with "Descriptions of organizations' efforts or contributions" ($n$ =6), "Thank-you messages acknowledging volunteers and other organizations" ($n$ = 3), "Call-to-action posts requesting donations, volunteers, etc." ($n$ =3), and "other" ($n$ = 2). Categories that did not occur during the hurricane were "Whereabouts of food/shelter," "How to obtain financial assistance," and "How to care for the sick and elderly" ($n$ = 0).

Insert Table 1 here

The second research question explored the different categories of Tweets posted before Hurricane Irma. Overall, the most frequent category of tweet before a hurricane was "Time/location-specific advice" ($n$ = 129). The next most frequent categories of tweets were

"General storm advice" (*n* = 123), "Long-term storm trajectory predictions" (*n* = 58), "Other" (*n* =57), "Whereabouts of food/shelter" (*n* = 45), and "Descriptions of organizations' efforts or contributions" (*n* = 25). Less frequent tweet categories were "Thank-you messages acknowledging volunteers and other organizations" (*n* = 11), "Call-to-action posts requesting donations, volunteers, etc." (*n* = 10), "How to care for the sick and elderly" (*n* = 4), and "How to obtain financial assistance" (*n* = 0).

Insert Table 2 here

The third research question explored the different categories of Tweets posted after Hurricane Irma. Overall, the most frequent categories of tweets after a hurricane were "other" (*n* = 118), "Time/location-specific advice" (*n* = 104), "Post-storm updates" (*n* = 102), and "Descriptions of organizations' efforts or contributions" (*n* = 72). Less frequent tweet categories were "Whereabouts of food/shelter" (*n* = 30), "General storm advice" (*n* = 29), "Thank-you messages acknowledging volunteers and other organizations" (*n* = 22), "Call-to-action posts requesting donations, volunteers, etc." (*n* = 21), "How to obtain financial assistance" (*n* = 4), and "How to care for the sick and elderly" (*n* = 4).

Insert Table 3 here

The fourth research question examined the twitter messages for amplification or attenuation of risk perceptions during Hurricane Irma. Twitter messages amplified perception of risk (*n* = 62), as compared to less frequently attenuated tweets (*n* = 13).

Insert Table 4 here

A Chi-square test analysis was performed to examine the relation between risk perception throughout the stage of the hurricane. As predicted, the relation between these variables was significant, $X^2(2, N = 1043) = 295.212$, $p < .001$.

Insert Table 5 here

Cross-tabulation analyses examined the specific tweet categories that were amplified or attenuated throughout the stages of Hurricane Irma. During Hurricane Irma within tweet category, “Other” (100.0%), “Time/location-specific advice” (94.9%), and “General storm advice” (78.3%) were more likely to be amplified, while “Call-to-action posts requesting donations, volunteers, etc.” (100.0%) were more likely to be attenuated.

Insert Table 6 here

H1. The local government agencies are more likely to amplify risk perceptions before a hurricane was supported. Results showed that more tweets amplified perceptions of risk ($n$ = 286), in comparison to attenuation ($n$ = 176). Cross-tabulation analyses examined the specific tweet categories that were amplified or attenuated before Hurricane Irma. Within tweet category, “Long-term storm trajectory prediction” (100.0%), “Time/location-specific advice” (82.9%), and “How to care for the sick and elderly” (75.0%) were more likely to be amplified, while “Thank-you messages acknowledging volunteers and other organizations” (100.0%), “Other” (100.0%), and “Call-to-action posts requesting donations, volunteers, etc.” (90.0%) were more likely to be attenuated.

Insert Table 7 here

H2. The local government agencies are more likely to attenuate risk perceptions after a hurricane was strongly supported. Results showed that more tweets attenuated perceptions of risk ($n$ = 429), in comparison to amplification ($n$ = 77). Cross-tabulation analyses examined the specific tweet categories that were amplified or attenuated after Hurricane Irma. Within tweet category, “Thank-you messages acknowledging volunteers and other organizations” (100.0%),

"Call-to-action posts requesting donations, volunteers" (100.0%), and "How to obtain financial assistance" (100.0%) were more likely to be attenuated.

Insert Table 8 here

## Discussion and Conclusion

The primary purpose of this study was to examine how government officials within the state of Florida use Twitter to disseminate information to the public, and more specifically examine vulnerable population before, during, and after a hurricane through the lens of tweet categories. Additionally, this study also examined whether Twitter messages were more likely to be amplified or attenuated before, and after a hurricane. The findings revealed significant relationships with tweet categories Pre-Storm, During Storm, and Post-Storm and found that messages were more likely to be amplified before a hurricane, and messages were more likely to be attenuated after a hurricane.

The analysis of the 1,043 tweets shows that local governments do not utilize Twitter to disseminate information to the vulnerable population throughout the stages of a hurricane. Out of the sample, "How to care for the sick and elderly" (n = 8) was one of the least used tweet categories. This result contributes to the findings of Burke et al. (2010) that emergency messages tend to isolate elderly populations. Local governments might assume that the elderly is not a large demographic on Twitter, and to make up for their absence, Alexander (2014) argues that word of mouth from Twitter users can help spread information to these vulnerable populations who do not have access to Twitter. However, as Kleier et al. (2018) found, elderly individuals were less prepared for a hurricane when they needed assistance from others to help them prepare. This result supports the findings of Spence, et al. (2015), as local governments should tweet

continual updates with disaster-related hashtags to aid the elderly and the vulnerable population or their caregivers in the early stages of the hurricane preparation.

In the analysis, *H1* and *H2* were supported revealing risk factors were more likely to be amplified before a hurricane ($n$ = 286) and tweets were more likely to be attenuated after a hurricane ($n$ = 429). *RQ4* also revealed that tweets were more likely to be amplified during a hurricane ($n$ = 62). This result supports Comfort's (2007) findings and shows that local governments amplify risks before and during a hurricane in order to make sure the public is well prepared for the potential risks associated with a hurricane, even if they end up being more prepared than necessary.

The findings regarding the category of tweets before, during, and after a hurricane show that "Time/location-specific advice" was the most frequent category through Pre-Storm and During Storm, and was the second most frequent category Post-Storm, although the most frequent category Post-Storm of "Other" can be attributed to the large time span in the sample after the hurricane impact, and some local governments began to tweet more about general city information and events. This result supports Halse, Squicciarini, and Cargea's (2018) study that the use of geo-locational data can be used by local governments on Twitter during a crisis event.

In this study, tweets were examined to understand how local governments in Florida use Twitter to deliver information to the vulnerable population, while also examining amplification and attenuation of tweets before, during, and after a hurricane. The content analysis of tweets reflected a range of strategies from diverse local governments, although geographically similar. As risk communication throughout hurricanes has been observed to aim to reduce uncertainty and reactions caused by hysteria and rumors, and to inform the public of risks and alerts ('t Hart,

2013), the findings from this study can be informative to local governments and reveals the need for a strategic model for crisis engagement on Twitter.

**Limitations and Directions for Future Research**

There are certain limitations that need to be acknowledged. The tweets in the sample come from local governments with diverse communication strategies. Throughout the sample, it was found that some local governments that used Twitter solely as a means to deliver informational content about the city, showed a greater number of tweets about hurricane information and generally included a greater number of amplified tweets. In comparison, local governments that used Twitter mainly as a source to promote tourism and city sponsored events, showed less activity concerning hurricane preparation and tended to more often attenuate tweets. While all Twitter accounts in the sample had a sufficient number of tweets over the time period, some local governments were more active than others and accounted for a larger percentage of the sample.

Future work can build on these findings through further examining the relationship of social media and crisis planning and response. As Turoff et al. (2013) observed, social media may not deliver effective collaboration between officials and the public in crisis situations, there is much more examination needed to create a strategic crisis model for Twitter. Future work should examine how tweet categories and risk perception can be systemically used in order to create a streamlined approach to crisis communication on Twitter during a hurricane or other natural disaster. More specifically, a strategy to reach the vulnerable populations and their caregivers should be examined. In addition, twitter messages should be studied in conjunction with other channels of communications such as news releases and press conferences to fully

comprehend how all forms of communication can be converged to inform and educate the elderly population and their caregivers about the risk perceptions.

## References

Adams, V., Kaufman, S. R., Van Hattum, T., & Moody, S. (2011). Aging disaster: Mortality, vulnerability and long-term recovery among Katrina survivors. *Medical Anthropology. 30*(3), 247–270.

Alexander, D. E. (2014). Social media in disaster risk reduction and crisis management. *Sci. Eng. Ethics*. *20*(3), 717-733.

Bakir, V. (2005). Greenpeace v. shell: Media exploitation and the social amplification of risk framework (SARF). *Journal of Risk Research*, *8*(7–8), 679-691.

Bertot, J. C., & Jarger, P. (2010). Designing, implementing, and evaluating user-centered and citizen-centered e-government. *International Journal of Electronic Government Research, 6*(2), 1-17.

Bowdon, M. A. (2014). Tweeting an Ethos: Emergency Messaging, Social Media, and Teaching Technical Communication. *Technical Communication Quarterly*, *23*(1), 35-54.

Brandon, E. (2011). The 10 cities with the oldest population. *U.S. News.* Retrieved from http://money.usnews.com/money/retirement/articles/2011/06/06/10-places-with-the-oldest-population

Brenkert-Smith, H., Dickinson, K., & Champ, P. (2013). Social Amplification of Wildfire Risk: The Role of Social Interactions and Information Sources. *Risk Analysis*, *33*(5), 800-817.

Burke, J. A., Spence, P. R., & Lachlan, K. A. (2010). Crisis preparation, media use, and information seeking during Hurricane Ike: Lessons learned for emergency communication. *Journal of Emergency Management*, *8,* 27-37.

Burnett, J., C. Dyer, and S. Pickins (2007) Rapid needs assessments for older adults in disasters. *Generations*. *31*(4), 10-15.

Cangialosi, J., Latto, A., & Berg, R. (2018). Tropical Cyclone Report: Hurricane Irma. *National Hurricane Center.* Retrieved from https://www.nhc.noaa.gov/data/tcr/AL112017_Irma.pdf

Comfort, L. K. (2007). Crisis management in hindsight: cognition, communication, coordination, and control. *Public Administration Review, 67,* 189-197.

Comfort, L. K., Waugh, W. L., & Cigler, B. A. (2012). Emergency management research and practice in public administration: emergence, evolution, expansion, and future directions. *Public Administration Review, 72,* 539-547.

Duckett, D., & Busby, J. (2013). Risk amplification as social attribution. *Risk Management*, *15*(2), 132–153.

Duggan, M., Ellison, N. B., Lampe, C., Lenhart, A., & Madden, M. (2015) Social Media Update 2014. *Pew Research Center.* Retrieved from http://www.pewinternet.org/2015/01/09/social-media-update-2014/

Federal Emergency Management Agency [FEMA]. (2015). Prepare for emergencies now: Information for people with disabilities. Retrieved from https://www.fema.gov/media-library/assets/documents/90360

Federal Emergency Management Agency [FEMA]. (2016). About the agency. Retrieved from https://www.fema.gov/about-agency

Finch, C., Emrich, C. T., & Cutter, S. L. (2010). Disaster disparities and differential recovery in New Orleans. *Population and Environment*. *31*(4). 179–202.

Florida Assisted Living Federation of America (2014) *Florida's Economic Future and the Impact of Aging*. Tallahassee, FL: The Florida Legislature Office of Economic and Demographic Research.

Florida Office of Insurance Regulation. (2018). Hurricane Irma Claims Data. Retrieved from https://www.floir.com/Office/HurricaneSeason/HurricaneIrmaClaimsData.aspx

Freedman, A. (2012). Top 5 most vulnerable U.S. cities to hurricanes. *Climate Central.* Retrieved from http://www.climatecentral.org/news/top-5-most-vulnerable-us-cities-to-hurricanes

Fukushima, K. (2014). The state with the oldest population (hint: it isn't Florida). *The Street.* Retrieved from http://www.thestreet.com/story/12954994/5/the-10-oldest-states-in-america.html

Gibson, M. and M. Hayunga (2006) *We Can Do Better: Lessons Learned for Protecting Older Persons in Disasters*. Washington, DC: American Association of Retired Persons.

Golbeck, J., Grimes, J. M., & Rogers, A. (2010). Twitter use by the U.S. Congress. *Journal of the American Society for Information Science and Technology, 61*(8), 1612-1621.

Graham, M., Avery, E., & Park, S. (2015). The role of social media in local government crisis communication. *Public Relations Review, 41,* 386-394.

Halse, S. E., Tapia, A., Squicciarini, A., & Caragea, C. (2018). An emotional step toward automated trust detection in crisis social media. *Information, Communication & Society*, *21*(2), 288-305.

Hand, L. C., & Ching, B. D. (2011). You have one friend request. *Administrative Theory & Praxis, 33*(3), 362 – 382.

Hart, P. 'T. (2013). After Fukushima: reflections on risk and institutional learning in an era of mega-crises. *Public Administration. 91,* 101-113.

Hughes, A. L., & Palen, L. (2009). Twitter adoption and use in mass convergence and emergency events. *International Journal of Emergency Management, 6*(3-4), 248-260.

Jansen, B. (2017). Timeline: Hurricane Irma's progress to monster storm. *USA Today.* Retrieved from https://www.usatoday.com/story/news/2017/09/10/timeline-hurricane-irma-fluctuating-strgrowing-stronger-weaker-crashed-into-caribbean-islands-florid/651421001/

Kaigo, M. (2012). Social media usage during disasters and social capital: Twitter and the Great East Japan earthquake. *Keio Commun. Rev. 34*, 19-35.

Kasperson, R. E., & Kasperson, J. X. (1991). Hidden hazards. In D. G. Mayo, & R. D. Hollander (Eds.), Acceptable evidence: Science and values in hazard management. New York, NY: Oxford University Press, 9-28.

Kasperson, R. E., Renn, O., Slovic, P., Brown, H. S., Emel, J., Goble, R., Kasperson J. X. & Ratick, S. (1988). The social amplification of risk: a conceptual framework. *Risk Analysis, 8,* 177-187.

Kavanaugh, A., Fox, E. A., Sheetz, S., Yang, S., Li, L. T., Whalen, T., Shoemaker, D., Natsev, P., & Xie, L. (2011). Social media use by government: From the routine to the critical. Proceedings of the 12th Annual International Conference on Digital Government Research. College Park, MD.

Kleier, J. A., Krause, D., & Ogilby, T. (2018). Hurricane preparedness among elderly residents in South Florida. *Public Health Nursing*, *35*(1), 3-9.

Lachlan, K. A., & Spence, P. R. (2010). Communicating risks: Examining hazard and outrage in multiple contexts. *Risk Analysis*, *30*(12), 1872–1886.

Lachlan, K. A., Spence, P. R., Lin, X., & Del Greco, M. (2014a). Screaming into the Wind: Examining the Volume and Content of Tweets Associated with Hurricane Sandy. *Communication Studies*, *65*(5), 500-518.

Lachlan, K. A., Spence, P. R., Lin, X., Najarian, K. M., & Del Greco, M. (2014b). Twitter Use During a Weather Event: Comparing Content Associated with Localized and Nonlocalized Hashtags. *Communication Studies*, *65*(5), 519-534.

Lodge, M. (2009). The public management of risk: the case for deliberating among worldviews. *Rev. Policy Res. 26,* 395-408.

Macias, W., Hilyard, K., & Freimuth, V. (2009). Blog functions as risk and crisis communication during hurricane Katrina. *J. Comput. Commun., 15,* 1-31.

Marlon, J., Rosenthal, S., Feinberg, G., Pal, S., & Leiserowitz, A. (2015). *Hurricane perceptions of coastal Connecticut residents: October, 2014*. New Haven, CT: Yale University, Yale Projection on Climate Change Communication. Retrieved from http://climatecommunication.yale.edu.dax.lib.unf.edu/wp-content/uploads/2015/03/Coastal_Storm_Survey_Report_2015Mar20.pdf

Miller, J. (2018). Lessons from Hurricane Irma. *Claims*, *66*(4), 48.

Moon, M. K. (2010). Socially vulnerable populations and the hurricane preparation decision process. *University of Florida*. Retrieved from http://ufdc.ufl.edu/UFE0041479/00001

Murthy, D., & Gross, A. (2017). Social media processes in disasters: Implications of emergent technology use. *Social Science Research, 63,* 356-370.

Neubaum, G., Rosner, L., Rosenthal-von der Putten, A. M., & Kramer, N. C. (2014). Psychosocial functions of social media usage in a disaster situation: a multi-methodological approach. *Comput. Hum. Behav. 34,* 28-38.

Oh, O., Agrawal, M., & Rao, H. R., (2013). Community intelligence and social media services: A rumor theoretic analysis of tweets during social crises. *Mis Q, 37(2),* 401-426.

Parry, W. (2013). Why disasters like Sandy hit the elderly hard. *Live Science.* Retrieved from http://www.livescience.com/27752-natural-disasters-hit-elderly-hard.html

Pew Research Center. (2018). Social Media Fact Sheet. Retrieved from http://www.pewinternet.org/fact-sheet/social-media/

Pidgeon, N. F., Kasperson, R. K., & Slovic, P. (2003). *The Social Amplification of Risk*. Cambridge University Press, Cambridge. 14-85.

Rainear, A. M., Lachlan, K. A., Oeldorf-Hirsch, A., & DeVoss, C. L. (2018). Examining Twitter Content of State Emergency Management During Hurricane Joaquin. *Communication Research Reports*, *35*(4), 325-334.

Renn, O. (2011). The social amplification/attenuation of risk framework: Application to climate change. *Wiley Interdisciplinary Reviews: Climate Change*, *2*(2), 154-169.

Rice, D. (2014). Hurricane danger zone: The 10 places most at risk. *USA Today.* Retrieved from http://www.usatoday.com/story/weather/2014/06/17/counties-hurricane-vulnerability/10678675/

Ropeik, D., & Slovic, P. (2003). Risk communication: A neglected tool in protecting public health. *Havard Center for Risk Analysis: Risk in Perspective, 11*(2), 1-4.

Sandman, P. M. (1993). *Responding to community outrage: Strategies for effective risk communication.* Fairfax, VA: American Industrial Hygiene Association.

Sellnow, T. L., & Seeger, M.W. (2013). Theorizing Crisis Communication. Malden, MA: John Wiley & Sons, Inc.

Spence, P. R., Lachlan, K. A., Lin, X., & del Greco, M. (2015). Variability in Twitter Content Across the Stages of a Natural Disaster: Implications for Crisis Communication. *Communication Quarterly*, *63*(2), 171-186.

Spialek, M. L., & Houston, J. B. (2018). The Development and Initial Validation of the Citizen Disaster Communication Assessment. *Communication Research*, *45*(6), 934-955.

Thomas, T. L., Friedman, D. B., Brandt, H. M., Spencer, S. M., & Tanner, A. (2016). Uncharted Waters: Communicating Health Risks During the 2014 West Virginia Water Crisis. *Journal Of Health Communication*, *21*(9), 1062-1070.

Turoff, M., Hiltz, S. R., Banuls, V. A., & Van Den Eede, G. (2013). Multiple perspectives on planning for emergencies: an introduction to the special issue on planning and foresight for emergency preparedness and management. *Technol. Forecast. Soc. Chang. 80,* 1647-1656.

Twitter Alerts. (2015). Authorities that participate in twitter alerts. *Twitter.* Retrieved from https://about.twitter.com/products/alerts/participating-organizations

Vieweg, S., Hughes, A. L., Starbird, K., & Palen, L. (2010). Microblogging during Two Natural Hazards Events: what Twitter May contribute to situational awareness. *Paper presented at the Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, Atlanta, Georgia, USA, April 10-15*, 1079-1088.

Yates, D., & Paquette, S. (2011). Emergency knowledge management and social media technologies: A case study of the 2010 Haitian earthquake. *International Journal of Information Management, 31*(1), 6-13.

Appendix 1

Code Sheet

**I. Social Media Id. -** _____

**II. Coder Id. -** _____

**III. Tweet Content - _____**

**IV. Date Posted -** _____

**V. Tweets posted before Hurricane Irma (8/30/17-9/9/17): _____**
1. Long-term storm trajectory predictions
2. General storm advice
3. Time/location-specific advice
4. Descriptions of organizations' efforts or contributions
5. Thank-you messages acknowledging volunteers and other organizations
6. Call-to-action posts requesting donations, volunteers, etc.
7. Whereabouts of food/shelter
8. How to obtain financial assistance
9. How to care for the sick and elderly
10. Other

**VI. Tweets posted during Hurricane Irma (9/10/17): _____**
1. General storm advice
2. Time/location-specific advice
3. Descriptions of organizations' efforts or contributions
4. Thank-you messages acknowledging volunteers and other organizations
5. Call-to-action posts requesting donations, volunteers, etc.
6. Whereabouts of food/shelter
7. How to obtain financial assistance
8. How to care for the sick and elderly
9. Other

**VII. Tweets posted after Hurricane Irma (9/11/17-9/30/17): _____**
1. General storm advice
2. Time/location-specific advice
3. Post-storm updates
4. Descriptions of organizations' efforts or contributions
5. Thank-you messages acknowledging volunteers and other organizations
6. Call-to-action posts requesting donations, volunteers, etc.
7. Whereabouts of food/shelter
8. How to obtain financial assistance
9. How to care for the sick and elderly
10. Other

**VIII. Risk Perception: _____**
1. Amplify
2. Attenuate

**Coding protocols/instructions:**

**I.** **Social Media Id.** Copy and paste the twitter handle of the account

**II.** **Coder Id.** Enter "1" for the first name of the first coder and "2" for the first name of the second coder

**III.** **Tweet Content:** Copy and paste content of the tweet

**IV.** **Date Posted:** It should be in the format mm/dd/yy

**V. Tweet posted before Hurricane Irma:** Select which category tweet is in
1. Long-term storm trajectory predictions
2. General storm advice
3. Time/location-specific advice
4. Descriptions of organizations' efforts or contributions
5. Thank-you messages acknowledging volunteers and other organizations
6. Call-to-action posts requesting donations, volunteers, etc.
7. Whereabouts of food/shelter
8. How to obtain financial assistance
9. How to care for the sick and elderly
10. Other

**VI. Tweets posted during Hurricane Irma:** Select which category tweet is in
1. General storm advice
2. Time/location-specific advice
3. Descriptions of organizations' efforts or contributions
4. Thank-you messages acknowledging volunteers and other organizations
5. Call-to-action posts requesting donations, volunteers, etc.
6. Whereabouts of food/shelter
7. How to obtain financial assistance
8. How to care for the sick and elderly
9. Other

**VII. Tweets posted after Hurricane Irma:** Select which category tweet is in
1. General storm advice
2. Time/location-specific advice
3. Post-storm updates
4. Descriptions of organizations' efforts or contributions

5. Thank-you messages acknowledging volunteers and other organizations
6. Call-to-action posts requesting donations, volunteers, etc.
7. Whereabouts of food/shelter
8. How to obtain financial assistance
9. How to care for the sick and elderly
10. Other

**VIII. Risk Perception**

1. Amplifying: Risk information that has a high-risk evaluation, hazard is feared more than it should be
2. Attenuating: Risk information that has a low-risk evaluation, hazard is feared less than it should be

The presence of amplifying or attenuating risk perception is based on the risk factors "control", "choice", "children", "novelty", and "risk-benefit tradeoff".

**a. Control:**

1. Amplifying: Risk information that has a high-risk evaluation, hazard is feared more because the public does not have control over the event, such as a hurricane

   Example:
   "(Retweet) IF winds do calm, you're in the eye. Stay inside! Winds dramatically shift and will do so violently! STAY INSIDE!"

   "There are power outages throughout the city. Please contact Duke Energy to find out about your specific area 1-800-228-8485"

   "We are under storm surge watch, life-threatening surge possible Sat. p.m., stay safe, stay off beach @JackSeiler http://ow.ly/pkbJ30eZGj3"

2. Attenuating: Risk information that has a low-risk evaluation, hazard is feared less because the public has control over, such as preparation, evacuation, and post-storm relief.

   Example:
   "Hurricane Irma debris cleanup has begun. Pls follow directions below + separate debris curbside to expedite cleanup"

   "Today kicks off Burg Buys Local Week - spend $ locally this week + support #StPetes neighborhood businesses"

   "Here is a complete list of shelters. The closest one to the Hialeah area is Hialeah Gardens Senior High School."

**b. Choice:**

1. Amplifying: Risk information that has a high-risk evaluation, hazard is feared more because the risk is imposed on the public

   Example:
   "Follow the curfew & stay off the road. Water, debris and powerlines make driving unsafe. @JackSeiler @leefeldman @FLPD411 @FtLaudFire"

   "FLPD411 reminds everyone that beach/barrier island is still closed. Please stay off streets unless absolutely necessary. Curfew until 10am."

   "A curfew is in place from 10 p.m. to 5 a.m. daily until further notice. We ask all to help keep everyone safe by staying off the streets."

2. Attenuating: Risk information that has a low-risk evaluation, hazard is feared less because the public chooses the risk, such as to prepare or not prepare, to evacuate or not evacuate, and to return home before it may be safe to

   Example:
   "Stay connected with us and the @bocapolice..we will be here with you throughout the storm. Retweet & share, #BocaRaton."

   "Don't know if you're in a evac zone? put in your address here: http://bit.ly/2j711cr"

   "Looking for a pet friendly shelter? Recently opened - Highland Oaks Middle, 2375 NE 203rd Street. Keep your pets safe during #HurricaneIrma"

**c. Children:**

1. Amplifying: Risk information that has a high-risk evaluation, hazard is feared more than it should be because it involves risks to children

   Example:
   "(Retweet) All elementary and middle school child care programs at the St. Petersburg Parks and Rec Centers will be canceled this Wed. Sept. 13 through Friday, Sept 15, 2017"

   "Palm_Lakes families and friends - closing of school has been extended to Monday, September 11. Stay safe @cityofhialeah"

   "This morning @CityofMiamiFire crew was able to transport baby and mom to Jackson Hospital."

2. Attenuating: Risk information that has a low-risk evaluation, hazard is feared less than it should be because it does not involve risks to children

   Example:

"In addition to the free breakfast all students are entitled to @MDCPS, they will be provided free lunch for the foreseeable future."

"Thank you @cityofhialeah for helping us clear debris around our church and school! Thx also to @CommBovo and his team. Great servants #Irma – at Immaculate Conception Catholic Church"

"Join your friends for a FREE Dade-licious school breakfast each day & enter a contest to win a $25 gift card. #MDCPSWellness @MDCPS_Food"

**d. Novelty:**

1. Amplifying: Risk information that has a high-risk evaluation, hazard is feared more than it should be

   Example:
   "#ADVISORY: There is a Precautionary Boil Water Notice for residents in some areas of the city. See below for areas affected. #Hialeah"

   "A reminder - Mandatory evacuations in Zone A have begun - this includes #ClearwaterBeach - #HurricaneIrma"

   "(Retweet) #Irma will bring life-threatening wind and storm surge to the FL Keys and much of central and western FL tonight and Monday"

2. Attenuating: Risk information that has a low-risk evaluation, hazard is feared less than it should be

   Example:
   "Looks like #Irma made it snow in #Miami. Actually it's insulation from a high rise under construction. Photo taken by @CityofMiamiFire"

   "Thanks to @leefeldman @clagerbloom for great leadership and service during the storm. We have been very fortunate so far. @FTLCityNews"

   "This warning ended at 8AM this morning"

**e. Risk-benefit tradeoff:**

1. Amplifying: Risk information that has a high-risk evaluation, hazard is feared more because the public does not benefit

   Example:
   "11:04 AM: Eye of #Irma heading towards the SW #Florida coast. Everyone needs to remain sheltered in place."

   "Events postponed in #Clearwater due to effects of #Irma"

"There will be NO lifeguards patrolling #ClearwaterBeach starting Sat. - Guards will return when conditions are safe again. #IrmaHurricane"

2. Attenuating: Risk information that has a low-risk evaluation, hazard is feared less because the public will receive a benefit, such as hurricane relief, rebuilding efforts, volunteering, and financial help

   Example:
   "Cool off for FREE today at Grapeland Water Park! Admission fees are waived for City Residents/employees all weekend #Miami @miamiparks"

   "Feeding Tampa Bay will be @ The Trop TODAY from 5-6:30 pm handing out meals-ready-to-eat, bananas, and water"

   "Looking for water? @WynwoodBrewing, @TheTankBrewing, @JWBrewing, and more will fill your containers with water."

Tables

Table 1 *Frequencies;* category of tweets during a hurricane

| Tweet Categories | During Storm *n* |
|---|---|
| Time/location-specific advice | 39 |
| General storm advice | 23 |
| Descriptions of organization's efforts or contributions | 6 |
| Thank-you messages acknowledging volunteers and other organizations | 3 |
| Call-to-action posts requesting donations, volunteers, etc. | 2 |
| Other | 2 |
| Whereabouts of food/shelter | 0 |
| How to obtain financial assistance | 0 |
| How to care for the sick and elderly | 0 |
| Total | 75 |

Table 2 *Frequencies;* category of tweets before a hurricane

| Tweet Categories | Pre-Storm *n* |
|---|---|
| Time/location-specific advice | 129 |
| General storm advice | 123 |
| Long-term storm trajectory predictions | 58 |
| Other | 57 |
| Whereabouts of food/shelter | 45 |
| Descriptions of organization's efforts or contributions | 25 |
| Thank-you messages acknowledging volunteers and other organizations | 11 |
| Call-to-action posts requesting donations, volunteers, etc. | 10 |
| How to care for the sick and elderly | 4 |
| How to obtain financial assistance | 0 |
| Total | 462 |

Table 3 *Frequencies;* category of tweets after a hurricane

| Tweet Categories | Post-Storm *n* |
|---|---|
| Other | 118 |
| Time/location-specific advice | 104 |
| Post-storm updates | 102 |
| Descriptions of organization's efforts or contributions | 72 |
| Whereabouts of food/shelter | 30 |
| General storm advice | 29 |
| Thank-you messages acknowledging volunteers and other organizations | 22 |
| Call-to-action posts requesting donations, volunteers, etc. | 21 |
| How to obtain financial assistance | 4 |
| How to care for the sick and elderly | 4 |
| Total | 506 |

Table 4 *Frequencies;* amplification and attenuation throughout stages of a hurricane

| | Pre-Storm *n* | During Storm *n* | Post-Storm *n* |
|---|---|---|---|
| Amplification | 286 | 62 | 77 |
| Attenuation | 176 | 13 | 429 |
| Total | 462 | 75 | 506 |

Table 5 *Chi-Square analysis;* amplification and attenuation throughout stage of a hurricane

| | Value | *df* | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 276.839[a] | 2 | .000 |
| Likelihood Ratio | 295.212 | 2 | .000 |
| Linear-by-Linear Association | 220.553 | 1 | .000 |
| N of Valid Cases | 1043 | | |

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 30.56.

Table 6 *Cross-tabulation*; amplification and attenuation of tweet categories during a hurricane

| | | Amplify | Attenuate | Total |
|---|---|---|---|---|
| General storm advice | Count | 18 | 5 | 23 |
| | % within Tweet Category | 78.3% | 21.7% | 100.0% |
| | % within Amplify/Attenuate | 29.0% | 38.5% | 30.7% |
| | % of Total | 24.0% | 6.7% | 30.7% |
| Time/location-specific advice | Count | 37 | 2 | 39 |
| | % within Tweet Category | 94.9% | 5.1% | 100.0% |
| | % within Amplify/Attenuate | 59.7% | 15.4% | 52.0% |
| | % of Total | 49.3% | 2.7% | 52.0% |
| Descriptions of organizations' efforts or contributions | Count | 3 | 3 | 6 |
| | % within Tweet Category | 50.0% | 50.0% | 100.0% |
| | % within Amplify/Attenuate | 4.8% | 23.1% | 8.0% |
| | % of Total | 4.0% | 4.0% | 8.0% |
| Thank-you messages acknowledging volunteers and other organizations | Count | 2 | 1 | 3 |
| | % within Tweet Category | 66.7% | 33.3% | 100.0% |
| | % within Amplify/Attenuate | 3.2% | 7.7% | 4.0% |
| | % of Total | 2.7% | 1.3% | 4.0% |
| Call-to-action posts requesting donations, volunteers, etc. | Count | 0 | 2 | 2 |
| | % within Tweet Category | 0.0% | 100.0% | 100.0% |
| | % within Amplify/Attenuate | 0.0% | 15.4% | 2.7% |
| | % of Total | 0.0% | 2.7% | 2.7% |
| Other | Count | 2 | 0 | 2 |

| | | | | |
|---|---|---|---|---|
| | % within Tweet Category | 100.0% | 0.0% | 100.0% |
| | % within Amplify/Attenuate | 3.2% | 0.0% | 2.7% |
| | % of Total | 2.7% | 0.0% | 2.7% |
| Total | Count | 62 | 13 | 75 |
| | % within Tweet Category | 82.7% | 17.3% | 100.0% |
| | % within Amplify/Attenuate | 100.0% | 100.0% | 100.0% |
| | % of Total | 82.7% | 17.3% | 100.0% |

Table 7 *Cross-tabulation*; amplification and attenuation of tweet categories before a hurricane

| | | Amplify | Attenuate | Total |
|---|---|---|---|---|
| Long-term storm trajectory prediction | Count | 58 | 0 | 58 |
| | % within Tweet Category | 100.0% | 0.0% | 100.0% |
| | % within Amplify/Attenuate | 20.3% | 0.0% | 12.6% |
| | % of Total | 12.6% | 0.0% | 12.6% |
| General storm advice | Count | 89 | 34 | 123 |
| | % within Tweet Category | 72.4% | 27.6% | 100.0% |
| | % within Amplify/Attenuate | 31.1% | 19.3% | 26.6% |
| | % of Total | 19.3% | 7.4% | 26.6% |
| Time/location-specific advice | Count | 107 | 22 | 129 |
| | % within Tweet Category | 82.9% | 17.1% | 100.0% |
| | % within Amplify/Attenuate | 37.4% | 12.5% | 27.9% |
| | % of Total | 23.2% | 4.8% | 27.9% |
| Descriptions of organizations' efforts or contributions | Count | 8 | 17 | 25 |
| | % within Tweet Category | 32.0% | 68.0% | 100.0% |
| | % within Amplify/Attenuate | 2.8% | 9.7% | 5.4% |
| | % of Total | 1.7% | 3.7% | 5.4% |

| | | | | |
|---|---|---|---|---|
| Thank-you messages acknowledging volunteers and other organizations | Count | 0 | 11 | 11 |
| | % within Tweet Category | 0.0% | 100.0% | 100.0% |
| | % within Amplify/Attenuate | 0.0% | 6.3% | 2.4% |
| | % of Total | 0.0% | 2.4% | 2.4% |
| Call-to-action posts requesting donations, volunteers, etc. | Count | 1 | 9 | 10 |
| | % within Tweet Category | 10.0% | 90.0% | 100.0% |
| | % within Amplify/Attenuate | 0.3% | 5.1% | 2.2% |
| | % of Total | 0.2% | 1.9% | 2.2% |
| Whereabouts of food/shelter | Count | 20 | 25 | 45 |
| | % within Tweet Category | 44.4% | 55.6% | 100.0% |
| | % within Amplify/Attenuate | 7.0% | 14.2% | 9.7% |
| | % of Total | 4.3% | 5.4% | 9.7% |
| How to care for the sick and elderly | Count | 3 | 1 | 4 |
| | % within Tweet Category | 75.0% | 25.0% | 100.0% |
| | % within Amplify/Attenuate | 1.0% | 0.6% | 0.9% |
| | % of Total | 0.6% | 0.2% | 0.9% |
| Other | Count | 0 | 57 | 57 |
| | % within Tweet Category | 0.0% | 100.0% | 100.0% |
| | % within Amplify/Attenuate | 0.0% | 32.4% | 12.3% |
| | % of Total | 0.0% | 12.3% | 12.3% |
| Total | Count | 286 | 176 | 462 |
| | % within Tweet Category | 61.9% | 38.1% | 100.0% |

| | | | | |
|---|---|---|---|---|
| | % within Amplify/Attenuate | 100.0% | 100.0% | 100.0% |
| | % of Total | 61.9% | 38.1% | 100.0% |

Table 8 *Cross-tabulation*; amplification and attenuation of tweet categories after a hurricane

| | | Amplify | Attenuate | Total |
|---|---|---|---|---|
| General storm advice | Count | 6 | 23 | 29 |
| | % within Tweet Category | 20.7% | 79.3% | 100.0% |
| | % within Amplify/Attenuate | 7.8% | 5.4% | 5.7% |
| | % of Total | 1.2% | 4.5% | 5.7% |
| Time/location-specific advice | Count | 37 | 67 | 104 |
| | % within Tweet Category | 35.6% | 64.4% | 100.0% |
| | % within Amplify/Attenuate | 48.1% | 15.6% | 20.6% |
| | % of Total | 7.3% | 13.2% | 20.6% |
| Post-storm updates | Count | 26 | 76 | 102 |
| | % within Tweet Category | 25.5% | 74.5% | 100.0% |
| | % within Amplify/Attenuate | 33.8% | 17.7% | 20.2% |
| | % of Total | 5.1% | 15.0% | 20.2% |
| Descriptions of organizations' efforts or contributions | Count | 4 | 68 | 72 |
| | % within Tweet Category | 5.6% | 94.4% | 100.0% |
| | % within Amplify/Attenuate | 5.2% | 15.9% | 14.2% |
| | % of Total | 0.8% | 13.4% | 14.2% |
| Thank-you messages acknowledging volunteers and other organizations | Count | 0 | 22 | 22 |
| | % within Tweet Category | 0.0% | 100.0% | 100.0% |

| | | | | |
|---|---|---|---|---|
| | % within Amplify/Attenuate | 0.0% | 5.1% | 4.3% |
| | % of Total | 0.0% | 4.3% | 4.3% |
| Call-to-action posts requesting donations, volunteers, etc. | Count | 0 | 21 | 21 |
| | % within Tweet Category | 0.0% | 100.0% | 100.0% |
| | % within Amplify/Attenuate | 0.0% | 4.9% | 4.2% |
| | % of Total | 0.0% | 4.2% | 4.2% |
| Whereabouts of food/shelter | Count | 1 | 29 | 30 |
| | % within Tweet Category | 3.3% | 96.7% | 100.0% |
| | % within Amplify/Attenuate | 1.3% | 6.8% | 5.9% |
| | % of Total | 0.2% | 5.7% | 5.9% |
| How to obtain financial assistance | Count | 0 | 4 | 4 |
| | % within Tweet Category | 0.0% | 100.0% | 100.0% |
| | % within Amplify/Attenuate | 0.0% | 0.9% | 0.8% |
| | % of Total | 0.0% | 0.8% | 0.8% |
| How to care for the sick and elderly | Count | 0 | 4 | 4 |
| | % within Tweet Category | 50.0% | 50.0% | 100.0% |
| | % within Amplify/Attenuate | 2.6% | 0.5% | 0.8% |
| | % of Total | 0.4% | 0.4% | 0.8% |
| Other | Count | 1 | 117 | 118 |
| | % within Tweet Category | 0.8% | 99.2% | 100.0% |
| | % within Amplify/Attenuate | 1.3% | 27.3% | 23.3% |
| | % within Total | 0.2% | 23.1% | 23.3% |
| Total | Count | 77 | 429 | 506 |
| | % within Tweet Category | 15.2% | 84.8% | 100.0% |
| | % within Amplify/Attenuate | 100.0% | 100.0% | 100.0% |

| | | | | |
|---|---|---|---|---|
| | % within Total | 15.2% | 84.8% | 100.0% |