2015

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Communication Studies
Vol. 65, No. 5, November–December 2014, pp. 519–534

Twitter Use During a Weather Event: Comparing Content Associated with Localized and Nonlocalized Hashtags

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Social media are becoming relied upon for information concerning large-scale weather events, crises, and other occurrences that pose potential risks. Little is known about the effectiveness of social media strategies in delivering information effectively to at-risk audiences, or the ease with which audiences can locate information. A content analysis examined a sample of 800 tweets retrieved using localized and national hashtags in the early stage of a major winter storm. Results are consistent with past research suggesting that Twitter may be used more for affective display than for information seeking. It also extends previous research by offering that actionable information appears to be more common with localized hashtags. Results are discussed in terms of implications for future research and practical applications.

Keywords: Crisis; Risk; Snow Storm; Social Media; Twitter

In early February 2013, a major winter storm, dubbed "winter storm Nemo," struck the northeastern United States and parts of Canada ("February 2013 nor'easter," n.d.). The blizzard delivered rapidly accumulating snowfall, combined with hurricane-force winds and destructive tides. It caused at least 18 storm-related

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ISSN 1051-0974 (print)/ISSN 1745-1035 (online)
DOI: 10.1080/10510974.2014.956940

fatalities, over 600,000 customer power outages, and widespread economic damage to New England (Ariosto et al., 2013). According to National Oceanic and Atmospheric Administration (NOAA) and National Weather Service (NWS), the city of Boston recorded 24.9 inches of snowfall, ranking Nemo as one of the top-five winter storms since 1935 (Klepper & Salsberg, 2013). On February 8, 2013, Boston reported a storm surge that peaked at 4.21 feet, making it the fourth-highest storm surge since 1921 (Masters, 2013). The blizzard caused a buzz on social media; Bostonians and local organizations spontaneously used #bosnow on Twitter to track blizzard updates, to send out emergency alerts, and to offer relief assistance in real time (e.g., ''Boston winter weather guide,'' 2013). It is one of many examples in recent history of the development of social media hashtags intended to categorize information specialized to particular regions or cities, or to specific segments of the population.

As publics increasingly rely on social media during extreme weather events, it is necessary for government agencies and organizations to understand how to effectively incorporate these new technologies into crisis management. Previous research regarding the utilization of social media during natural disasters has examined the functions of social media for nationwide or regional disaster management (e.g., Acar & Muraki, 2011; Jin, Liu, & Austin, 2014; Sinnappan, Farrell, & Stewart, 2010; Spence, Lachlan, & Lin, in press; Veil, Buehner, & Palenchar, 2011; Vultee, & Vultee, 2011). Although such research is becoming more common, scientific studies about the nature of social media content that is used in the management of these events or its availability is absent within the literature. Further, the degree to which different search strategies (such as reliance on hashtags with regional or localized connotations) may aid in the access of the information that is available is understudied. In order to expand and solidify the understanding of social media functions, the current study utilized a content analysis of information on Twitter in the time leading up to the impact of winter storm Nemo, in southern New England. This study aims to describe the public expressions of risk awareness and concern, to build off of past psychometric work in risk analysis categorizing different types of risk perception, to evaluate the needs and concerns of different sectors of the audience, and to evaluate the ways in which this information may be used to inform emergency management operations. To this end, the study aims to replicate the findings of Spence et al. (in press), while extending these research questions to include delineation between localized and government-promoted hashtag searches.

Natural Disasters

A natural disaster is typically defined as a naturally occurring event that causes varying degrees of destruction or harm to vulnerable populations (Combs, Quenemoen, Parrish, & Davis, 1999; Coombs & Holladay, 2002). As the intensity and frequency of natural disasters increase, there exists a pressing need for government agencies and private organizations alike to seek best practices for informing and motivating affected publics, using their particular media ecologies (Coombs, 1999; Seeger, Sellnow, & Ulmer, 2003; Sellnow, Seeger, & Ulmer, 2002). A substantive body of literature

suggests demographic differences in traditional media usage and response during natural disasters, based on factors such as the gaps in social economic status, degree of risk knowledge, and discrepancies in risk expression and perceptions (e.g., Fothergill, Maestas, & Darlington, 1999; Lachlan, Burke, Spence, & Griffin, 2009; Peacock, 2003; Spence, Lachlan, & Burke, 2008, 2011; Spence, Lachlan, & Griffin, 2007; Van Ardosol, Sabagh, & Alexander, 1965). Less is known about uses and responses to social media by at-risk populations.

Social Media Functions in Disasters

The evolution and adoption of social media technologies have given the public the opportunity to seek information concerning natural disasters and extreme events, especially slow-moving events. To illustrate the growth in reliance on social media for information concerning these matters, consider the following examples. During the 2009 H1N1 influenza pandemic, there were over 2 million related tweets posted between May 1 and December 31, 2009 (Chew & Eysenbach, 2010); during 2012's Hurricane Sandy, individual users distributed more than 20 million tweets about the storm between October 27 and November 1, 2012 (Guskin & Hitlin, 2012). Social media has, to an extent, recast members of affected publics as resources, as opposed to liabilities, in the management of risks (Seeger, 2006; Veil et al., 2011). Citizen journalists have used social media to chronicle natural disasters around the world, providing more and more breaking news and firsthand accounts in a timely manner. After a devastating 2013 Oklahoma tornado, the most viewed video on YouTube was recorded by a local resident unaffiliated with any news organization, who provided an instant and graphic account of the devastation caused by the storm (Jurkowitz & Hitlin, 2013).

Past research has argued that traditional linear media also acquire "backchannel news" from social media and consider it a legitimate information source during extreme events (Sutton, Palen, & Shklovski, 2008). Private and public organizations, such as the US Centers for Disease Control and Prevention or the American Red Cross, use social media platforms to rapidly share information with the public concerning risk preparation and education (e.g., Aikin, 2009; Reynolds, 2010). However, after the initial post, the organization loses control of this information because individuals can retweet, repost, edit, or comment on the original message (Spence, Lachlan, Westerman, & Spates, 2013). This raises a number of concerns regarding the effectiveness of social media in getting a consistent and accurate message to the audience, regardless of its size.

The function of social media and information processing has been discussed across a range of extreme events, such as the risk awareness about H1N1 virus, the norms of citizen photography in 2007 Southern California Wildfires on Flickr, the reliability and credibility of tweets during 2010 Chile earthquake, and the 2011 Japan earthquake and tsunami, as well as the information utilities for public emergency responders during 2012 Hurricane Sandy (Acar & Muraki, 2011; Hughes, Denis, Palen, & Anderson, 2014; Liu, Palen, Sutton, Hughes, & Vieweg, 2008; Mendoza, Poblete, &

Castillo, 2010; Spence et al., in press). However, little scientific research is available about the ideal techniques for retrieving information related to an impending threat via social media. Because individual users cannot realistically look through millions of tweets related to a given event, they must use particular search strategies to acquire the information. This raises the question of what search strategies may work best under trying circumstances and varying degrees of proficiency with the technology that may lead users to utilize these search strategies.

If affected publics are to use social media to acquire information for the protection against harm, then the Prodromal Stage may be an advantageous time for distributing information concerning the crisis and specific, behavioral recommendations that can protect against harm (Fink, 1986). At this stage of crisis development, government agencies and nongovernmental organizations (NGOs) can distribute information that may be received ahead of an impending threat.

Disasters and Stage Models of Crisis

The literature in crisis and disaster management offers numerous approaches to understanding the ways in which emergencies evolve, climax, and eventually resolve. Although conceptualized in a number of different ways, these stage models consistently identify some kind of precrisis stage. During this time, affected publics typically seek out information concerning the impeding event, assuming they have received some type of initial warning of its imminence. They are likely to be concerned with tangible, behavioral steps that can be taken in order to abate loss of life, health, and damage to property (Coombs, 1999; Pauchant & Mitroff, 1992; Turner, 1976).

Fink's (1986) four-stage model of crisis development and resolution may be especially relevant to the consideration of social media use in the time leading up to crises and other extreme events. This model posits that crises begin, develop, culminate and resolve in roughly four steps. They begin with the Prodromal Stage, at which time, information begins to avail itself to the public that a threat is imminent, along with the specific nature of that risk and any predicted negative outcomes that may be associated with it. Next is a trigger event, which signals the beginning of the Acute Stage, during which time it is readily apparent that a crisis is unfolding and that risk or damage to stakeholders is imminent. This is followed by the Chronic Stage, in which the reputation of those impacted may be tarnished as they attempt to return to normalcy. Finally, the Termination Stage, where the crisis in question resolves and is no longer detrimental to those who were originally involved.

The Prodromal Stage may be a critical focus area for crisis and risk communication practitioners. In this stage, emergency managers can convey information about actions and activating response systems designed to protect the public (Quarantelli, 1988; Sturges, 1994). Furthermore, because it can be expected that the public will have a strong desire to engage in uncertainty reduction during the Prodromal Stage, it becomes an excellent time to place these messages, as it can be safely assumed that the public will seek them out (Massey & Larsen, 2006).

Despite the importance of alerting and informing the public, the use of social media during the Prodromal Stage of crisis development has received little specified attention in the literature. If this stage presents a critical opportunity to control the crisis, then social media may be one way of getting this information directly to people who are in harm's way. At the same time, it may be the case that this information is largely uncontrolled, because anyone with a social media account has more or less the same opportunity to publish information as an organization or response agency. They may also be able to broadcast misinformation, fear, or unfounded opinion presented as fact by the medium's 140-character limit. It is also possible to associate links to URLs and other social media sites, for better or worse.

Given the glut of information that can be expected under the circumstances, it becomes critical to examine the search and retrieval strategies that individuals may use during the Prodromal Stage and the types of content that may be obtained by doing so. Although one study (Spence et al., in press) made an attempt at doing so, it examined these processes using content retrieved through the use of a single hashtag. It may be the case that the use of the medium by those with a greater degree of related-information literacy may lead to alternate search strategies, which may beget more or less useful returns.

Twitter in Extreme Weather Events

The utility of Twitter during extreme events is also supported by general reliance on the medium for news (Holcomb, Gottfried, & Mitchell, 2013). A survey from the Pew Research Center indicates that 52% of Twitter users obtain news from the site, and that 8% of all adults in the United States turned to Twitter for news in 2013 (Holcomb et al., 2013).

In a study by Spence et al. (in press) following Hurricane Sandy, results suggest that during the Prodromal Stage, information concerning specific behavioral recommendations may be difficult to acquire, given both the overwhelming demand for information and the overwhelming amount of information posted through the medium. The Spence et al. study suggests that as an event moves from the Prodromal to Acute Stages, it may be increasingly difficult to obtain desired information as it becomes buried in thousands of tweets expressing sorrow, anger, and fear or tweets unrelated to the crisis. As the reality of the impending event becomes more and more evident, affective displays related to fear, dread, and anxiety become more and more commonplace, supplanting information concerning remedial actions that could have been used to protect self or property.

However, these findings were drawn from a large-scale weather event, using a single government-promoted hashtag. It is possible that results could change using a more localized event and a correspondingly localized hashtag. Previous research during a flood found that radio stations in larger markets had more training and resources to cover a crisis but were less likely to provide coverage once a crisis erupted (Spence, Lachlan, McIntyre, & Seeger, 2009; Spence, McIntyre, Lachlan, Savage, & Seeger, 2011). Stations in smaller markets were more connected to the

community and more likely to broadcast crisis-related information. This may also be true of social media, as more localized hashtags may encourage participation and interaction that would not manifest with a nationally promoted hashtag.

In order to investigate the different patterns of risk and crisis communication on social media between nationwide and local events, this study replicates the aforementioned study on Hurricane Sandy, doing so in the context of winter storm Nemo. It will replicate the findings related to information and affect and determine if the shift from information to affective tweets over the course of the Prodromal Stage is consistent with a crisis that is localized and not as historic in proportions. It will also replicate the findings concerning the relative absence of clearly identifiable information categories across Twitter content. Critically, it will extend the prior study by investigating whether or not there are substantive differences in the nature of content retrieved using localized or nonlocalized hashtags.

To that end, the following research questions are proposed:

RQ1: How does the balance between affect display and useful information shift over the course of the storm?

RQ2: What specific information regarding relief efforts is available through Twitter as the Prodromal Stage develops?

RQ3: How does available information on Twitter change as a widespread crisis moves from the Prodromal to Acute Stages?

RQ4: Are there differences in these content attributes between tweets retrieved using localized and nonlocalized hashtags?

Methods

In order to address the current research questions, the data collection and coding methods of Lachlan, Spence, and Lin (2014) and Spence et al. (in press) were replicated with the methods extended to examine the use of multiple hashtag searches. TweetArchivist (www.tweetarchivist.com) was used to collect tweets at exact time points, using the search terms #nemo and #bosnow. As with Spence et al., #nemo was selected because it was a widely used hashtag that was promoted by federal-level relief agencies such as NOAA. In the current data, the "localized" hashtag #bosnow was also included for purposes of comparison, as this was the hashtag used and promoted by the Boston Globe and other media outlets in southern New England. For both #nemo and #bosnow, tweets were collected at 4-hour intervals during the afternoon and evening of February 8, 2013, producing a total of 400 tweets for each hashtag. When performing hashtag or keyword searches, TweetArchivist provides exact replications of the most recent 100 tweets containing the term in question, including user information and live links. A team of undergraduate coders was then used to make judgments concerning the content attributes of each tweet.

Numerous content attributes were identified for each tweet. In addition to the time the tweets was sent, a number of attributes about the user were identified. These included the type of user (civilian, celebrity, inanimate object, joke account, government organization, for-profit organization, nonprofit organization, or unknown), the sex of the user (male, female, can't tell, not applicable), age (under 20, 20 s, 30 s, 40 s, 50 s, over 50, can't tell, not applicable), ethnicity (Caucasian, African American, Latino, Asian, other can't tell, not applicable), and the language in which the tweet was written (English, Spanish, French, German, Portuguese, Arabic, Mandarin, Vietnamese, can't tell, other).

The coding scheme further identified, in broad terms, the content type that best described the tweet (information about the storm, expressions of affect, spam, humor, or insult). Further codes were added for instances in which specific types of information could be identified, based on instrumentation used in previous studies (Burke, Spence, & Lachlan, 2010; Spence et al., 2008). These information types included general risk, loss of assets, the whereabouts of food/shelter, evacuation efforts, the whereabouts of others, how to obtain financial assistance, and how to care for the sick and elderly.

Two undergraduate researchers were recruited for coding purposes and trained on the coding scheme over the course of one week. A random subsample of 50 tweets was assembled in order to check for intercoder reliability between them. ReCal2 (Freelon, 2008) was used to assess reliability between the coders, using percent agreement for the binary variables and Scott's Pi for those with multiple response categories. Reliability above the minimum standard of .70 was confirmed for all variables in the data set (see Krippendorff, 1980), with minimum reliability found to be .72 (see Table 1).

Data Collection

Tweets were collected using Tweet Archivist between noon and midnight on February 8, 2013. Tweets were collected at noon, 4:00 PM, 8:00 PM, and Midnight, using one of two search strategies (#bosnow and #nemo), for a total of eight searches at evenly spaced time points during the hours leading up to the onset of the storm in the northeast. As indicated above, Tweet Archivist produces exact replications of the most recent hundred tweets at a given collection point, including links to user profiles and active URLs. For each of the eight searches that were conducted, these replicated tweets were saved as .html files. One missing case led to a total of 799 valid cases for the analysis, with this missing case attributable to a software error.

Results

A series of chi-squared analyses were used to address the research questions in the current study. The first research question asked if the balance between usable information and affective content would vary over the span of the Prodromal Stage. To examine this, an analysis was performed across information type by both hashtag

Table 1 Intercoder Reliability Coefficients

	Scott's Pi
User Type	.84
User Sex	.82
User Age	.82
User Ethnicity	.72
Language	.78
Message Type	.88
	% Agreement
Food/Shelter	94
Evacuation	96
Whereabouts of others	100
Financial Assistance	100
Health Care	100
Needs of Elderly	92
Needs of Sick	94

and time. An examination of the frequency of different tweet types within hashtag and time reveals results consistent with past research, as well as relevant differences between information retrieved by when searching on local- versus national-level hashtags.

The significance tests for these analyses indicated $\chi^2 = 74.67$, $p < .001$, and $V = .249$ for the tweets retrieved using #bosnow, and $\chi^2 = 116.95$, $p < .001$, and $V = .312$ for those retrieved using #nemo. For the hashtag #bosnow, 42.8% of the tweets were categorized as information, compared to 37.5% affect and 18.5% humor. Examining the time-series analysis, results indicated the balance between information and affect shifts dramatically between noon and midnight. At noon, 70% of the tweets using #bosnow are informative, but only 18% are informative by midnight. The opposite pattern can be seen with affect, as 10% are categorized as affect display at noon, soaring to 59% by midnight.

For the hashtag #nemo, 29.3% of the tweets were categorized as information, 33.1% were categorized as affect displays, and 35.6% were categorized as humor. Broken out by time, the pattern in the data is similar to that for #bosnow. At noon, half of the tweets retrieved using #nemo are categorized as information, dropping to 14% by midnight, while affect display increases from 37.5% at noon to almost half by midnight. It appears based on these analyses that information may be more readily available along localized hashtags; but, in either case, a pattern is once again revealed where the nature of tweeted content shifts away from usable information and more toward expressions of fear and worry as a crisis unfolds.

A deeper examination of specific informational outcomes indicates few instances of the specific information categories under consideration. Across 799 valid cases,

eight tweets contained information related to food/shelter, while seven contained information concerning evacuations. Two tweets each were detected for information concerning the whereabouts of others, caring for the elderly, and caring for the sick. One tweet contained information concerning health care, while no tweets were detected addressing financial concerns. The paucity of tweets makes more advanced statistical analyses impossible, but the breakdown of tweets concerning food/shelter and evacuation may shed some light on the third research question.

Notably, all seven tweets concerning evacuation efforts were found in the tweets collected when searching for #bosnow. In terms of breakdown by time, two were detected at noon, three at 4:00, two at 8:00 and none at midnight. A similar pattern was seen in the tweets concerning food/shelter, as seven of the eight tweets identified in this category were found using #bosnow; all eight were detected at noon. In sum, while there are few occurrences of the types of information under consideration, they occured almost entirely when searching along a localized hashtag and were more likely to be observed during the developing moments of the Prodromal Stage, before being drowned out by affective displays and other types of content as the crisis progressed toward some kind of trigger event.

Discussion

Social media, and specifically Twitter, provide the public the opportunity to participate in the information management process throughout the crisis lifecycle. However, with the number of individuals who have access to this medium, emergency managers and practitioners need to better understand the medium if they are to reach their targeted publics. Emergency managers and government agencies who hold critical information may have difficulty disseminating it, and members of the public may find it difficult to find the information desired.

With respect to Research Questions 1, 3, and 4, the findings suggest a pattern of use and information distribution during the Prodromal Stage indicating that localized hashtags may present a more advantageous place to seek needed information on social media in the event of a crisis. Although preliminary, this finding is consistent with previous research (Spence et al., in press). For example, in a series of studies examining the willingness and ability of radio stations to broadcast crisis-related information, results suggested that stations in smaller markets (more localized) indicated a stronger willingness and ability to alert the public of potential risks and crises (Spence et al., 2009, 2011). From the current data, a similar argument may be made concerning localized hashtags.

Content on Twitter is user generated, thus individuals may choose to use a local hashtag in order to target a specific audience that needs the information. Social media by definition is social, and providing information to specific audiences in need of that information serves this underlying function of the medium (Vultee & Vultee, 2011). Further, previous crisis research has shown that individuals prefer information from within their social networks rather that messages from centralized sources (Spence et al., 2007). Although using a hashtag allows individuals to communicate

to anyone with a Twitter account, the use of a localized hashtag may provide a closer or stronger sense of immediacy and relevance than would information associated with broader hashtags. Given a choice between information stemming from NOAA, which may be largely unfamiliar to everyday Twitter users, and that stemming from regional media and identified with a local hashtag, individuals may believe the localized information is more credible.

Results suggesting that the NOAA-endorsed hashtag of #Nemo contained a small amount of useable information are consistent with previous research (Spence et al., in press), as usable information was absent from Twitter in the aftermath of Hurricane Sandy. Although a localized hashtag was not examined in the previous study, the absence of useable information within tweets with the national hashtag further supports this argument. The results suggest that government agencies need to work on their own image and work on providing relevant and useful information within the hashtags they promote.

It may also be the case that large government agencies do not understand how social media is used and, therefore, are not utilizing it in the most effective means possible. The absence of usable information therefore encourages members of the public to continue to search for information with which to engage (Lachlan, Spence, & Eith, 2010; Spence et al., 2011). An important aspect of social media is being active. As Kaplan and Haenlein (2010) noted, sharing and interaction is a central component of this medium, and organizations should take the lead. People are using Twitter to find information and to obtain answers to questions. If a government agency is not active within the hashtag it promotes, people will either seek information elsewhere or give up seeking information. Through promotion of a hashtag, a government agency is taking ownership of the information distribution during the event.

Moreover, the data also suggest a change in the content of tweets over the course of the storm in both the localized hashtag and the NOAA-promoted hashtag; the pattern of change in the content of tweets is identical to the results reported by Spence et al. (in press). Useful and needed information is more available during the beginning of the storm and then begins to dissipate into the late evening. At the same time, as the heavy snowfall begins to accumulate, the event becomes more visceral, producing affective displays related to fear, dread, and anxiety. This creates a problem because often in crises and other extreme weather events, it is at the Acute Stage that people realize the severity and magnitude of the event. Therefore, those who did not prepare or obtain information during the Prodromal Stage begin their information seeking at or slightly before the trigger event, signaling the onset of the Acute Stage. The data suggest that needed information was not available at this time.

One feature of Twitter and other social media is that the most recent information can change by the second. If a member of the public waits until the Acute Stage to seek information, it is possible that information provided during the Prodromal Stage is absent or hard to find because of new information in the feed. Moreover, during crises, people are likely to continue to seek and update information (Murch, 1971; Spence et al., 2006). Therefore, messages with specific behavioral recommendations and information should be tweeted regularly to allow late information seekers

to obtain it and to simultaneously reinforce those recommendations for those who continued to use Twitter for surveillance. Although the medium is social and allows for constant updates, ensuring there is some consistency in behavioral recommendations appears advantageous.

Furthermore, regarding Research Question 2, specific information types that have been demonstrated as critical during large-scale weather events were largely unavailable. During a large-scale weather event, survival needs, such as food, water, and shelter, are paramount. In some cases, evacuation to a safer location is a key consideration. Across the entire data set, only 15 messages were identified that appealed to these specific needs. The paucity of information of this type is completely consistent with previous research. What is interesting, however, is that in the current data, almost all of the specific information types that have been demonstrated as critical information needs were detected when searching along the localized hashtag (#bosnow).

It may be the case that as a matter of practicality, national-level hashtags lend themselves better to distributing information that is less specific in nature. If every open shelter, evacuation endeavor, relief effort, and health care outcome were associated with a generalized hashtag, the results would be impossible to detect. Although difficult to find, they appear in the current data when searching along localized hashtags. This suggests that granular information about specific, remedial behaviors may be more readily available when conducting localized searches.

This finding also provides implications for government agencies using the medium to communicate to the public. If government agencies and relief organizations wish to provide information to the public concerning specific interventions, then they must survey the Twitter landscape as an event begins to unfold, detect the specific hashtags that are germane to particular at-risk locations, and use those hashtags to connect local audience with information that is specifically geared toward their needs. Future content analytic research in this area should aim to examine the feeds of specific relief agencies to understand the extent to which they use location-specific hashtag strategies in getting information to localized publics.

Further, this illustrates the importance of information literacy in these processes. In addition to the need for government agencies to use the medium in the most effective manner possible, at-risk audiences must be savvy enough with the medium to locate and retrieve this information. There are of course multiple ways of doing so, including knowledge of what specific Twitter or Rich Site Summary (RSS) feeds to attend to, or what specific localized hashtag strategies are likely to beget useful results in terms of remedial actions. It is, however, increasingly apparent from this and previous studies that the use of naïve hashtag searches along generalized search terms is unlikely to generate content that can be used to guide specific behavioral responses to an impending crisis or disaster.

Practical Implications

Social media provide an outlet whereby government organizations can share information, establish a presence, and build relationships through exchanges with the public (Kietzmann, Hermhens, McCarthy, & Silvestre, 2011). Twitter allows for both

mass broadcasts and conversations between individuals, specifically through the use of hashtags. These exchanges may allow government agencies to share information with the public and to obtain feedback from the public. However, it may be the case that the medium is best used when it establishes (or at least creates an impression of establishing) a conversation with specific members of the public. A promoted best practice of crisis communication is partnering with the public (Seeger, 2006), and Twitter provides an ideal platform for such partnerships. Members of the public can exchange, distribute and receive information through Twitter, helping government agencies complete their mission. Moreover, if these agencies use the medium to maximum effectiveness, media dependency processes would suggest that the public will be more likely to seek that agency out in the future. Thus, organizations can create a presence that is sustained and a relationship that is reciprocal.

Another commonly suggested best practice is to listen to the public's concerns and understand the audience (Seeger, 2006). Twitter is a unique tool in that it will allow government agencies to listen to the public in real time and to make changes based on the feedback provided. However, the data in the current study suggest that these agencies may be unlikely to hold a conversation with the public through promoted hashtags and are therefore missing opportunities to implement best practices. It is common for organizations and government agencies to have a social media manager, who has the responsibility of maintaining all departmental social media. A problem with this approach is that a social media manager may understand aspects of social media but may not understand risk or crisis management or the mission of the agency. Therefore, taking the time to train multiple members of an organization or agency to use social media and instructing them to use the promoted hashtag may result is useful conversations with the public. These conversations have implications for the quality and timeliness of information provided and can bolster the public image of the organization or agency (Vultee & Vultee, 2011).

Finally trust, credibility, and timeliness are key components of crises messages (Lachlan, Spence, Edwards, et al., 2014; Spence, Lachlan, Omilion-Hodges, & Goddard, 2014). As noted by Reynolds (2006), organizations need to "communicate openly and honestly . . . speedily enough to satisfy a population savvy in gathering information but apt to respond emotionally in crisis decision making" (p. 251). The act of promoting a hashtag and then not adequately utilizing it runs the danger of undermining trust, damaging credibility, and leading tech-savvy audience members to seek information elsewhere.

Limitations

The current data provide useful information about how Twitter was used during a localized extreme weather event and outlines a potential advantage of using locally promoted hashtags; however, a few limitations to the data will be acknowledged. First, the data are confined to a single event and to one that had unique parameters in terms of its size and scope. However, the results do replicate and extend to a previous study, offering consistent findings.

Another limitation of the data is the sampling procedure. However, methods of collecting data through social media and in crisis research are still largely unstructured, and scholars have not agreed upon an ideal method for data collection or sampling techniques in social media (Lachlan, Spence, & Nelson, 2010). With social media and crises in particular, this may be due to the relative recency of scholarly inquiries into these processes. It may also be attributable to the fact that crises are, by definition, novel events; crisis researchers are still making sense of the best ways to address these concerns. However, the sampling procedure used in this study represents the population of tweets available and addresses the questions of interest (see Spence & Lachlan, 2010).

Conclusion

The current study examined the content of communication and frequency of communication on Twitter during Snowstorm Nemo. A comparison was made between locally and nationally promoted hashtags. Results suggested that local sources provided more useable information and that, although rare, specific information types identified in previous research were available exclusively when using the localized search term. As social media become a more heavily used information source, specifically for extreme weather events, the study of social media becomes all the more important. As such, it is important to continue learning more about this process and learning about how and why people create and consume crisis-related information through social media.

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