

2016

Social media and crisis management: CERC, search strategies, and Twitter content

Kenneth Lachlan, *University of Connecticut*

Patric R Spence, *University of Kentucky*

Xialing Lin, *University of Kentucky*

Kristy M. Najarian

Maria Del Greco



Contents lists available at ScienceDirect

Computers in Human Behavior

journal homepage: www.elsevier.com/locate/comphumbeh

Social media and crisis management: CERC, search strategies, and Twitter content

Kenneth A. Lachlan^{a,*}, Patric R. Spence^b, Xialing Lin^b, Kristy Najarian^b, Maria Del Greco^c^a University of Connecticut, United States^b University of Kentucky, United States^c University of Hawaii, United States

ARTICLE INFO

Article history:

Available online xxxxx

Keywords:

Crisis communication

Risk communication

Social media

Emergency management

ABSTRACT

The current manuscript explores Twitter use and content in the precrisis stages of a major weather event in the northeast. A multi-level content analysis of tweets collected in the lead up to landfall suggests that emergency management agencies largely underutilized the medium, and that actionable information was easier to find when searching along localized hashtags. The findings are discussed in terms of the Crisis and Emergency Risk Communication (CERC) model of crisis management and implications for emergency management agencies.

Published by Elsevier Ltd.

1. Introduction

Instances of risk and crisis abound, and create circumstances under which people are forced to adapt. As noted by Seeger and Reynolds, both risk and crisis communication has a central goal, to limit and mitigate harm during an event. One difference between risk communication and crisis communication is risk communication addresses a situation that has not yet evolved into a crisis; therefore, emergency agencies and communication practitioners have the luxury of time to fully develop and test messages or seek out information in an effort to achieve the desired goal. Thus the common goal of risk communication centers on persuading individuals to feel self-efficacious regarding their ability to limit risk, while crisis communication focuses on responding to immediate public needs for information (Veil, Reynolds, Sellnow, & Seeger, 2008). A crisis can produce additional risks, leading to the need for persuasive messages and information updates concerning mitigation against the risk. The five-stage Crisis and Emergency Risk Communication Model (CERC) assumes that extreme events will develop in generally predictable and systematic ways, from risk, to eruption, to clean-up and recovery, and on into evaluation (Reynolds & Seeger, 2005). This study examines the events of storm Nemo in regards to the first two stages of the CERC model.

Stage one of the CERC model is the precrisis stage and characterized by risk messages, warnings and preparations. The second stage is the initial event which is hallmarked by uncertainty reduction, self-efficacy and reassurance. Stage three is Maintenance, in which

uncertainty reduction, self-efficacy and reassurance continue, and communication during this stage should be transactional, where the public is not only receiving information but providing feedback and partnering in the information distribution. Stage four is Resolution, involving updates, discussions about causes and new understandings of risks. The final stage is Evaluation, which works to examine the adequacy of response, and create consensus about lessons learned in all prepared parties. Thus the CERC framework is a useful, integrated model of risk and crisis communication perspectives that provides explanatory and applied perspectives to academics and practitioners throughout the risk and crisis lifecycle. Two important components seen throughout multiple stages of the model are uncertainty and communication.

Because risks and crises are unexpected, they tend to create uncertainty in individuals. Uncertainty is typically a state of discomfort for people, causing a desire to reduce it (Berger, 1987). One source of uncertainty that risk and crisis situations often create, deal with the beliefs that individuals hold about their world. When these beliefs are suddenly challenged by a crisis, it can create what Weick (1995) calls a cosmology episode, when individuals feel that their world is no longer an orderly place. Weick (1993) believes statements such as “I’ve never been here before, I have no idea where I am, and I have no idea who can help me,” illustrate the human reaction to these types of events (pp. 634–635). Overall, when uncertainty represents potential danger, as is characteristic of risk and crisis, people actively engage in information seeking (Brashers et al., 2000). They will seek this information from a variety of sources, and will constantly update their information. Mass media have historically been a dominant source (Murch, 1971),

* Corresponding author.

possibly because they are generally thought to provide credible, valuable, and timely information (Heath, Liao, & Douglas, 1995).

As noted by Veil et al. (2008) in outlining six propositions in the CERC framework, risks and crises are equivocal and uncertain events or series of events that create specific informational needs and informational deficiencies. Moreover, because of such high levels of uncertainty involved with risk and crises, communication efforts need to be ongoing, two-way transactions which allow for the public, agencies and other stakeholders to make sense of these uncertain and equivocal situations (Lachlan, Spence, & Lin, 2014; Lachlan, Spence, Lin, & Del Greco, 2014; Lachlan, Spence, Lin, Del Greco, & Najarian, 2014). Furthermore they note that the specific medium used for communication will change as the risk evolves. It is likely that the medium will not only change as the risk evolves but will also be dependent upon the specific public and their media choice and dependency (see Lachlan & Spence, 2014; Lachlan, Spence, & Lin, 2014; Lachlan, Spence, Lin, & Del Greco, 2014; Lachlan, Spence, Lin, Del Greco, & Najarian, 2014; Lachlan, Spence, & Seeger, 2009; Spence, Lachlan, Burke, & Seeger, 2007).

One other proposition that has direct relevance to this study is that risk and crisis communication are highly interrelated such that risk messages communicated before a crisis occurs influence subsequent perceptions, expectations, and behavior once the crisis trigger event has happened. In turn, these crisis responses then influence subsequent risk communication, thus making the medium choice important. Therefore, along with traditional forms of media, newer media are increasingly available for information seeking and fit into the framework of CERC. One channel that provides many opportunities for this purpose is the Internet. Research suggests that people use the Internet in seeking information about crises (Jin, Liu, & Austin, 2011; Spence et al., 2006). More recently, social media have provided a new and potentially powerful platform for people to use in seeking such information.

The presence of a risk and subsequent crisis raises an important issue for the consumption of social media. Often the front lines of information come from eyewitnesses who are reporting on recent events. In many cases, even traditional mass media sources such as major news outlets glean information from these sources prior to breaking news. Technological challenges in areas afflicted by crises (i.e., down satellite connections, etc.) may slow official news correspondent reports; however, social media reports may be much more swiftly distributed. For example, during the January 2010 Haitian earthquake, social media played a key role in disseminating information about this tragedy (Bunz, 2010). CNN's iReport website—a site featuring user-generated content—saw a marked (approximately 240%) increase in page-views the day of the Haitian earthquake (Bunz, 2010). In short, people seem to be turning to social media in times of crisis. However, how well the CERC framework is followed, specifically by government and non-profit agencies has not received much attention. This is troubling because it is a highly touted framework and it is uniquely situated to be used with social media. The current study aims to examine the use of social media in the context of winter storm Nemo, specifically examining the communication through the CERC model. Building upon the work of Lachlan, Spence, Lin, and Del Greco (2014), it aims to investigate the effectiveness with which extent to which emergency management agencies were able to effectively disseminate information related to the weather event, and the extent to which this information was placed in messages that could be easily accessed using common search strategies.

2. Winter storm Nemo

A severe winter storm, named “Nemo” by the National Weather Service, moved its way up the east coast of the United States and

the Atlantic provinces of Canada in February of 2013 (February 2013 nor'easter, March 1, 2013). It delivered extreme snowfall, near hurricane-force winds, high storm surge, and coastal erosion. In addition to the economic ramifications of the storm, it led to eighteen known fatalities and left over half a million New Englanders without power (Ariosto et al., February 9, 2013). Massachusetts Bay experienced its fourth highest storm surge since the early twentieth century. (Masters, February 9, 2013). The city of Boston recorded 24.9 inches of snow, ranking in the top five winter storms in the last hundred years (in a region known for severe winter storms) (Klepper & Salsberg, February 10, 2013). Local news media in southern New England began using the hashtag #BOSnow to demark updates, forecasts, emergency messages, and information concerning relief efforts (e.g., CityofBoston.Gov, March 2, 2014).

As the public grows increasingly reliant upon mobile and social media technologies during crises and other unanticipated events, it becomes critical for emergency management agencies and responders to understand the nuances surrounding their use. Nemo provides another example of a growing trend where users spontaneously distinguish between general information and that geared at specific locales through the use of specialized hashtag terms. Although some research has examined the use of social media for mitigating crises and emergencies (e.g., Jin et al., 2011; Lachlan, Spence, & Lin, 2014; Lachlan, Spence, Lin, & Del Greco, 2014; Lachlan, Spence, Lin, Del Greco, & Najarian, 2014; Veil, Buehner, & Palenchar, 2011), little is known about the use of specialized search and demarcation strategies. Further, little is known about the relative effectiveness of information that is demarked as relevant for local or general audiences, or the extent to which emergency management agencies make effective use of these strategies. These specialized methods of demarcation may also help emergency management agencies and first responders in getting their information to affected individuals who would otherwise be overwhelmed by the amount of information tagged with generalized hashtags (see Lachlan, Spence, Lin, Del Greco, & Najarian, 2014); the extent to which the rate of tweets are uploaded along localized and national hashtags under these circumstances is, however, also largely unknown.

In order to explore these issues, the current study takes up a content analysis of the tweets that were posted during the precrisis stage of winter storm Nemo. Building on the methods of Lachlan, Spence, Lin, and Del Greco (2014), Lachlan, Spence, Lin, Del Greco, and Najarian (2014), and Lachlan, Spence, and Lin (2014), the study examines tweets tagged as local or national content using one of two hashtags. During the precrisis stage communication should be targeted to at-risk publics, in an effort to prepare them for the risks associated with an event. Given that the speed at which the public receives messages has a direct impact on organizational credibility and perceptions of trust (Reynolds, 2002; Lachlan, Spence, & Lin, 2014; Lachlan, Spence, Lin, & Del Greco, 2014; Lachlan, Spence, Lin, Del Greco, & Najarian, 2014; Spence, Lachlan, Edwards, & Edwards, 2015), the rate at which tweets are being sent becomes a central concern. Further, rate becomes a concern given the aforementioned problems with information overload reported in past research. In order to determine if social media was used and at what rate, the following research question is offered:

RQ1: At what rate were Tweets uploaded using the hashtags #bosnow and #nemo?

Both public and private agencies have an important role in creating crisis response capacities. As Starbird, Palen, Hughes, and Vieweg (2010) argue the public will seek out and even privilege official information, augmenting, rather than discounting

statements issued by emergency management officials. However, when the public specifically looks for this information, it can often be absent. This can be because official sources are not ready or do not know how to use social media the same way the public does. Adapting social media for new uses and creating synergistic messages with traditional media should be a priority and a promoted part of crisis communication best practices.

RQ2: To what extent were government agencies tweeting during the time leading up to landfall?

As stated the public may find the first source as more credible. As noted by Reynolds (2002) “in a crisis, people do not want to “just pick one” of many messages, they want the best one or the right one to follow” (pg. 6). Messages do not have to be factually incorrect to be damaging. The absence of information or inconsistent information will cause the public to lose trust. Media Dependency Theory (DeFleur & Ball-Rokeach, 1989) argues that dependency processes become stronger under conditions in which either audiences are highly invested in the information presented, or find themselves in scenarios in which conflict and ambiguity are present. Crises and emergencies clearly satisfy both of these criteria. Indeed, a large corpus of research has demonstrated empirical evidence of increased media dependency under crisis conditions, and that increased dependency is closely tied to attitudinal and behavioral changes in the wake of a crisis event (Hindman & Coyle, 1999; Hirschburg, Dillman, & Ball-Rokeach, 1987; Loges, 1994; Lowrey, 2004). However, dependencies may have the ability to promote, or reduce effective communication in the precrisis stage. When a hashtag is promoted by an organization such as NOAA, it may carry with it credibility, which encourages people to use that hashtag. However, people also have relationships with local media, and often have a preferred local media outlet to which they are likely to turn (DeFleur & Ball-Rokeach, 1989).

RQ3: Was there a difference between locally or nationally promoted hashtags in the distribution of useful information?

3. Methods

The content harvesting and analytic methods of Lachlan, Spence, Lin, and Del Greco (2014), Lachlan, Spence, Lin, Del Greco, and Najarian (2014), and Lachlan, Spence, and Lin (2014) were replicated in the current study, with the notable exception that multiple hashtag searches were utilized. Tweets were collected using TweetArchivist (www.tweetarchivist.com) at specified and consistent time points during the prodromal stage of the storm, using searches for the hashtags #nemo and #bosnow. The tag #nemo was selected because it was used on a wide scale by NOAA and other national level government agencies. To differentiate between content generated by local and national level hashtags, the term #bosnow was included as a second search string; this was the hashtag promoted locally in southern New England by the Boston Globe and other media outlets as demarking information germane to those in the area. For both hashtag search strategies, tweets were collected every four hours as the storm approached landfall during the afternoon and evening of February 8, 2013. TweetArchivist provides automated synopses of key variables for the most recent 1900 or so tweets at any given time point, along with exact replications of the most recent 100 tweets generated using the search term in question; these exact replications contain live links and links to user profiles, and can be saved as .html files for further examination.

Thus, like Lachlan, Spence, Lin, and Del Greco (2014), Lachlan, Spence, Lin, Del Greco, and Najarian (2014), Lachlan, Spence, and Lin (2014), sets of data are subject to analysis in the current study.

The computer driven content analysis, labeled “Level 1” analysis here, consists of the mass content for which TweetArchivist produced descriptive data regarding rate and keyword. This data set contained 7545 tweets for #nemo and 7575 tweets for #bosnow, for a total of 15,120 units of analysis. The second sample of intact tweets consisted of 400 tweets for each hashtag, identified here as “Level 2” analyses. Software inconsistency resulted in the loss of one tweet, for a total of 799 valid cases. Level 2 tweets were then subject to human coding judgments by a team of trained undergraduate coders.

3.1. Data collection

TweetArchivist was used to collect Twitter content between noon and midnight on February 8, 2013. For each hashtag, searches were performed at noon, 4:00PM, 8:00PM, and Midnight, for a total of 8 searches during the first stage (precursor) and the second stage (initial event) leading up to landfall. For each search these replicated tweets were saved as .html files for later coding; each .html file contained both the descriptive data for the Level 1 analyses, and the exact replications used by coders in their judgments for the Level 2 analyses. A total of 15,120 tweets were examined at Level 1, and 799 tweets were examined at Level 2.

3.2. Level 1

Several sets of aggregated data were available for the Level 1 analysis. The computer-generated data included the most commonly used words within the tweets, top users tweeting the search term, the top platforms used (web, mobile app, etc.), the most commonly referenced URLs, most frequent user mentions, estimated impressions and users generating the most impressions, and most popular hashtags within large scale sample. This data was used to address research questions one and two.

3.3. Level 2

Next, the subsample of 799 reproduced tweets were examined by human coders. Several attributes were evaluated regarding the individual or entity transmitting the tweet, including the sex of the user (male, female, cannot tell, not applicable), ethnicity (Caucasian, African American, Latino, Asian, other cannot tell, not applicable), user age (under 20, 20s, 30s, 40s, 50s, over 50, cannot tell, not applicable), the type of user (civilian, celebrity, inanimate object, joke account, government organization, for profit organization, non-profit organization, or unknown), and language (English, Spanish, French, German, Portuguese, Arabic, Mandarin, Vietnamese, cannot tell, other).

Coders were then asked to identify the content type that best described the tweet (information about the storm, expressions of affect, spam, humor, or insult). They were also asked to identify the presence or absence of particular information types that might be associated with the tweets, including the whereabouts of food/shelter, evacuation efforts, the whereabouts of others, how to obtain financial assistance, loss of assets, how to care for the sick and elderly, and general, unspecified risk.

A team of two undergraduate researchers were trained on the coding scheme in one hour sessions every day for a week. In order to check for intercoder reliability, a random subsample of 50 tweets was assembled from the Level 2 sample. Intercoder reliability was evaluated using ReCal2 (Freelon, 2008). Percent agreement was used to evaluate reliability for the binary variables, while Scott's Pi was used for coding categories that contained multiple categorical responses. Minimum reliability of .70 was confirmed for all variables in the Level 2 data set (see Krippendorff, 1980), as all reliability coefficients exceeded .78 (see Table 1).

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

Table 3
Word cloud top 5 words with frequency quotient in parentheses.

#Nemo	1200	blizzard	storm	snow	winter	fish
		(.17)	(.11)	(.11)	(.09)	(.07)
	1600	storm	blizzard	I'm	safe	going
		(.23)	(.20)	(.14)	(.14)	(.13)
	2000	blizzard	snow	inches	take	storm
		(.17)	(.11)	(.09)	(.09)	(.07)
	2400	snow	blizzard	storm	nyc	safe
		(.20)	(.18)	(.08)	(.06)	(.05)
#Bosnow	1200	snow	blizzard	nemo	boston	storm
		(.25)	(.20)	(.19)	(.18)	(.11)
	1600	nemo	snow	blizzard	boston	ban
		(.23)	(.19)	(.18)	(.15)	(.08)
	2000	nemo	blizzard	snow	boston	power
		(.31)	(.18)	(.13)	(.12)	(.05)
	2400	nemo	blizzard	snow	boston	power
		(.32)	(.20)	(.13)	(.11)	(.05)

4. Results

In terms of the first research question, an effort was made to quantify the rate at which tweets were transmitted using the hashtags #bosnow and #nemo in the hours immediately before landfall of the storm. Further, comparisons were made between the hashtags in terms of the rate at which tweets were produced. The automatically generated timecodes for the Level 1 data were used to produce an estimated rate of tweets per minute for each hashtag at each data collection time point.

Previous research has offered that during the precrisis stage, tweets may be posted at such a fast rate that it may difficult for emergency management agencies to compete with an overflowing amount of information if affected publics are conducting simple searches for information (Lachlan, Spence, & Lin, 2014; Lachlan, Spence, Lin, & Del Greco, 2014; Lachlan, Spence, Lin, Del Greco, & Najarian, 2014). The current results, parsing out the rate of tweets across different hashtags, indicate that this may be more of a concern when looking at nationalized hashtags as opposed to local ones. In fact, there is a substantial difference in the rate of tweets containing the hashtags under consideration in the current study, regardless of time point (see Table 2). At noon and 4:00, tweets appear with the tag #bosnow about once every 12 s, accelerating slightly to once every 10 s at 8:00 and midnight. By way of comparison, between 2 and 5 tweets *per second* are being sent along the hashtag #nemo at the times under consideration.

Research question two asked if differences would exist between the two hashtag search strategies in terms of the most commonly tweeted words and URLs at each given time point. For the most part, the URL content were comprised almost entirely of graphics and weather maps related to the landfall of the storm and expected snowfall amount.

In terms of the word cloud, the top five terms used in the approximately 1900 tweets collected at each time point for each hashtag are listed in Table 3. Following the analytic plan of Lachlan, Spence, Lin, and Del Greco (2014), Lachlan, Spence, Lin, Del Greco, and Najarian (2014), Lachlan, Spence, and Lin (2014), the frequency of occurrence was divided by the total number of

tweets collected at its given time point, in order to produce a standardized index score reflecting the relative prominence of each term within that particular search. It is worth noting that the localized hashtag seems to produce key terms and commonly used words that are more consistent and more predictable than those found along the hashtag “nemo.” Commonly tweeted terms along #bosnow include specific mentions of snow, the name of the storm, and specifically mention the city of Boston (not surprising, given that the hashtag was coined by the Boston Globe). Further, the tweets retrieved along #bosnow mention specific relief concerns such as “power” and “ban” (presumably the overnight parking ban common during northeast snowstorm). By way of comparison, the tweets produced by hashtag “nemo seem less focused in terms of keyword, and the commonly used terms in the word cloud occur with less frequency than do those associated with “bosnow.”

4.1. Level 2

Research question three sought to investigate the degree with to government agencies were utilizing each hashtag, relative to the amount of information that was tagged with the same term at that time. The results indicate previously mentioned concerns regarding the overflow of information may be less problematic in Tweets derived from searches using more localized hashtags. To explore this question, a cross tabulation analysis was conducted on all 799 tweets in the data set, crossing the hashtag used in the search by the entity or organization from which the tweet was broadcast. The results indicate that out of 399 valid cases across the hashtag #nemo, only 1 could be identified as having stemmed from a government agency (0.3%). By way of comparison, 5 out of 400 valid cases along the hashtag #bosnow were identified as originating from such sources. Although the results are not encouraging for tweets retrieved from either search strategy, the results indicate that it may be easier to locate tweet stemming from government agencies when using a designated, localized hashtag search, $\chi^2 = 14.65$, $p < .04$, $V = .135$. Of further note, in both categories civilians were by far the most common producers of tweets, as 88.3% of the tweets retrieved with hashtag #bosnow and 88.7% of those retrieved with #nemo were sent by common citizens.

The final research question investigated the extent to which tweets using each hashtag were used to distribute useful information, and whether this would vary across tweets retrieved using localized or national level hashtag searches. The results suggest that previously indicated concerns regarding the proportions of usable information and affective release may be less pronounced along tweets using localized hashtags, $\chi^2 = 34.48$, $p < .001$,

Table 2
Rate of Twitter postings containing #nemo and #bosnow.

Time	Seconds between tweets containing hashtag	
	#Nemo	#Bosnow
1200	.31	12.37
1600	.17	12.31
2000	.40	10.57
2400	.43	10.48

$V = .208$. Previously identified tendency toward the use of Twitter as a means of affective release was found once again for #nemo, as 29.3% of the tweets in this category were classified as providing information, while 33.1% were classified as primarily affective in nature. By way of comparisons, along #bosnow, 42.8% contained information, while 37.5% were classified as primarily affective release. The tag #nemo was also more likely to contain other forms of non-informative tweets, such as 142 that were classified as humor (35.6%), as opposed to 74 along #bosnow (18.5%).

5. Discussion

The results of the current study serve to extend and build upon previous findings, but do so in a manner that explores the results brought back from hashtag Twitter searches using both localized and national level search terms. During a major weather event, it is likely the case that official emergency management messages may be difficult to find during these weather emergencies, and that obtaining usable information in a universe of tweets containing multiple types of content may be challenging. Still, there are subtle differences that emerge between the search strategies, and they generally suggest that official responders and emergency management agencies should identify organically emerging local hashtags to identify information that is usable by highly specific publics. While initial efforts offered a more general analysis of the content found on Twitter related to a large scale weather event, the current study suggests for the first time that this content may be variable contingent upon the hashtags or search strategies that are used to retrieve it.

In their study of Twitter content associated with Hurricane Sandy, Lachlan, Spence, Lin, and Del Greco (2014), Lachlan, Spence, Lin, Del Greco, and Najarian (2014), Lachlan, Spence, and Lin (2014) note that tweets marked with general hashtags were being sent at such a high rate that it would be next to impossible for an emergency management organization to effectively use the medium; any individual messages would be simply swallowed in a sea of hundreds of thousands of tweets. The results of the current study suggest that the volume of tweets – while still posing a challenge – may be possible to manage when it comes to localized hashtags. At various points during the pre-crisis stage, tweets along the tag #nemo were being uploaded at a rate *over twenty times greater* than those using the tag #bosnow. While five to six tweets per minutes still presents challenges in terms of breaking through the volume of associated tweets, with repeated uploading and constant updating of emergency messages it may be possible to get information to affected publics savvy enough to search along localized hashtags. It may also be advisable to designate localized hashtags as relevant to emergency relief information, or to monitor localized hashtags as they emerge and are used by mainstream media outlets and individuals, in order to make emergency messages available to those thinking locally in their search strategies.

The results also shed some light on the extent to which users can locate information from government agencies, and are consistent with past observations concerning upload rate. While scant messages from government agencies were detected, when they were they were almost entirely found using the search term #bosnow. This seems to indicate, again, that messages sent by emergency managers are easier to detect when using localized search terms. Combined with the findings concerning upload rate, this has implications for our understanding of emergency messages on Twitter from a media dependency standpoint. If it is the case that a particular search strategy produces effective results for a given user, they are then likely to return to that strategy repeatedly in order to access the information they are looking for. Even better, if the user is satisfied with the information they receive, they may

begin following the Twitter feed of the organization in question directly in order to obtain information that they find satisfying under the circumstances. Where this departs from traditional media dependency thinking lies in the timeframe. Media dependency processes are typically thought of as taking place over a long time frame; in the case of an evolving crisis or disaster, emergency managers would applying this reasoning would assume that dependency on search terms would develop rather quickly, and that they would remain consistent throughout the crisis lifecycle. Still, if it can be demonstrated that accessibility engenders trust and/or repeated use of a particular search strategy, this would be a critical consideration for emergency management agencies utilizing Twitter. Future research should attempt to examine the plausibility of short-term dependency processes related to both accessibility and perceptions of information quality.

Tweets retrieved using the hashtag #bosnow were also more likely to contain useful information. Consistent with the findings of Lachlan, Spence, Lin, and Del Greco (2014), Lachlan, Spence, Lin, Del Greco, and Najarian (2014), Lachlan, Spence, and Lin (2014), those retrieved using the national level hashtag were more likely to be classified as primarily a form of affective release, as opposed to primarily related to informational content about the storm. These tweets were also twice as likely to be humor or gag tweets, and were also more likely to contain content other than pertinent information. By way of comparison, almost half of the tweet retrieved using #bosnow were primarily informative in nature. Coupled with the arguments above, it is not difficult to see the advantages to the use of the localized hashtag. Not only are there more tweets available from government agencies, but more tweets are available containing actionable information, regardless of the tweet's origin. Once again, ease of access and quality of content may make users likely to turn to these sources repeatedly if initial placement is performed carefully using these localized tags.

Finally, the results for the word cloud provide more evidence for content that is systematic and more closely related to the issue at hand when examining localized hashtags. There appears to be little consistency from timepoint to timepoint in terms of the commonly used terms in tweet marked with #nemo. However, the most commonly used terms in the #bosnow tweets seem to revolve around very specific informational outcomes, such as power outages and parking bans. Once again, we find evidence that Twitter content retrievable using the localized search term may be easy to access and more germane to the event at hand. If this perception is shared by users of the medium in a given locale, then these localized hashtags may be an effective tool for getting information to very specific publics with particular informational needs, or for whom the advice given by emergency managers is likely to vary over time of physical space.

In times of crisis, people are turning to Twitter and other social media to share information, react to the situation, and make affective displays, as other examples in this paper suggest. Therefore, social media can be seen as a tool that is emerging to disseminate information throughout the crisis lifecycle, as social media can be advantageous in the face of crises as information and pleas for help can spread across the world in a matter of minutes. Further investigations into issues of localized vs national hashtags would be fruitful. For example, integrating the results with the CERC model could further illuminate how social media is used in the pre-crisis stage could provide valuable knowledge on how to best educate followers about risks and potential crises. When the crisis erupts, social media can facilitate aid and coordination of response.

The changing nature of risk and crises has contributed to growing concerns about the best ways various publics can obtain information. Further research is needed on the use of social media and crisis events overall. For example, even though Twitter was not designed for emergency response or crisis communication, the

medium appears to be diffusing to aid in disaster response. In literature on diffusion of innovations, this is known as re-invention, which occurs when a user makes changes to an innovation while adopting it. Understanding more about this re-invention process in the diffusion of social media for crisis communication would be very valuable research for future studies. Therefore, crisis and emergency practitioners need to be open to the re-invention process and avoid the temptation to impede the process during an extreme event.

The data also suggests that Twitter, and social media in general, may be able to be used throughout the CERC model. Much of the data focused on Stage One, the precrisis. However, the results allow for suggestions throughout the model. The second stage of the CERC model is the initial event which is hallmarked by uncertainty reduction, self-efficacy and reassurance. The content of the tweets from the public bolster the elements suggested in the model. In stage three (Maintenance), in which uncertainty reduction, self-efficacy and reassurance continue, and communication during this stage should be transactional, where the public is not only receiving information but providing feedback and partnering in the information distribution. The data from the current study suggest a missed opportunity in stage three. As the public is engaging in information seeking and uncertainty reduction, government agencies are not communicating through the clutter of Twitter content, and are not engaging in two way communication with the public. The data also shows that stage four (Resolution), involving updates, discussions about causes and new understandings of risks, presented a missed opportunity, while little is known about the final stage (Evaluation).

6. Conclusion

The current findings add to a growing body of knowledge concerning the use of Twitter during crises and emergencies, and the opportunities for informing and motivating the public that may be overlooked in current emergency response practices. First responders and emergency managers should continue to work to reach both specialized and more general Twitter audiences, and consider the search strategies that are likely to be utilized by affected audiences under these highly equivocal and stressful circumstances. Future research should attempt to more closely integrate the CERC model with Twitter content and user motivations, in order to further inform these practices.

References

- Brashers, D. E., Neidig, J. L., Haas, S. M., Dobbs, L. K., Cardillo, L. W., & Russell, J. A. (2000). Communication in the management of uncertainty: The case of persons living with HIV or AIDS. *Communication Monographs*, 67, 63–84.
- Bunz, M. (January 14th, 2010). In: Haiti earthquake coverage, social media gives victim a voice. <<http://www.guardian.co.uk/media/pda/2010/jan/14/socialnetworking-haiti>> Retrieved 25.03.13.
- DeFleur, M. L., & Ball-Rokeach, S. (1989). *Theories of mass communication* (5th ed.). White Plains, NY: Longman.
- Freelon, D. (2008). *ReCal2 (computer software)*. Seattle: University of Washington.
- Heath, R. L., Liao, S. H., & Douglas, W. (1995). Effects of perceived economic harms and benefits on issue involvement, use of information sources, and actions: A study in risk communication. *Journal of Public Relations Research*, 7(2), 89–109.
- Hindman, D. B., & Coyle, K. (1999). Audience orientations to local radio coverage of a natural disaster. *Journal of Radio Studies*, 6(1), 8–26.
- Hirschburg, P. L., Dillman, D. A., & Ball-Rokeach, S. J. (1987). Media system dependency theory: Responses to the eruption of Mt. St. Helens. In S. J. Ball-Rokeach & M. G. Cantor (Eds.), *Media, audience and social structure* (pp. 117–126). Beverly Hills, CA: Sage.
- Jin, Y., Liu, B. F., & Austin, L. L. (2011). Examining the role of social media in effective crisis management: The effects of crisis origin, information form, and source on publics' crisis responses. *Communication Research* (0093650211423918).
- Krippendorff, K. (1980). *Content analysis: An introduction to its methodology*. Newbury Park, CA: Sage.
- Lachlan, K. A., & Spence, P. R. (2014). Does message placement influence risk perception and affect? *Journal of Communication Management*, 18(2), 122–130.
- Lachlan, K. A., Spence, P. R., & Lin, X. (2014). Expressions of risk awareness and concern through Twitter: On the utility of using the medium as an indication of audience needs. *Computers in Human Behavior*, 35, 554–559.
- Lachlan, K. A., Spence, P. R., Lin, X., & Del Greco, M. (2014). Screaming into the wind: Twitter use during Hurricane Sandy. *Communication Studies*, 65(5), 500–518.
- Lachlan, K. A., Spence, P. R., Lin, X., Del Greco, M., & Najarian, K. (2014). Twitter use during a weather event: Comparing content associated with localized and non-localized hashtags. *Communication Studies*, 65(5), 519–534.
- Lachlan, K. A., Spence, P. R., & Seeger, M. (2009). Terrorist attacks and uncertainty reduction: Media use after September 11th. *Behavioral Sciences of Terrorism and Political Aggression*, 1(2), 101–110.
- Loges, W. E. (1994). Canaries in the coal mine: Perceptions of threat and media system dependency relations. *Communication Research*, 21(1), 5–23.
- Lowrey, W. (2004). Media dependency during a large-scale social disruption: The case of September 11. *Mass Communication & Society*, 7(3), 339–357.
- Murch, A. W. (1971). Public concern for environmental pollution. *Public Opinion Quarterly*, 35, 100–106.
- Berger, C. R. (1987). Communicating under uncertainty. In M. E. Roloff & G. R. Miller (Eds.), *Interpersonal processes: New directions for communication research* (pp. 39–62). Newbury Park, CA: Sage.
- Reynolds, B. (2002). *Crisis and emergency risk communication*. Atlanta, GA: Centers for Disease Control and Prevention.
- Reynolds, B., & Seeger, M. W. (2005). Crisis and emergency risk communication as an integrative model. *Journal of Health Communication Research*, 10(1), 4355.
- Spence, P. R., Lachlan, K. A., Edwards, A., Edwards, C. (2015). Being fast matters, but only if I think about it: Information updates in social media. *Communication Quarterly* (in press).
- Spence, P. R., Lachlan, K. A., Burke, J., & Seeger, M. (2007). Media use and information needs of the disabled during a natural disaster. *Journal of Health Care for the Poor and Underserved*, 18(2), 394–404.
- Spence, P. R., Westerman, D., Skalski, P., Seeger, M., Sellnow, T., & Ulmer, R. R. (2006). Gender and age effects on information seeking after 9/11. *Communication Research Reports*, 23, 217–223.
- Starbird, Kate, Palen, Leysia, Hughes, Amanda, & Vieweg, Sarah (2010). Chatter on the red: What hazards threat reveals about the social life of microblogged information. In *Proceedings of the 2010 ACM conference on computer supported cooperative work – CSCW '10* (pp. 241). Savannah: ACM. <<http://portal.acm.org/citation.cfm?doid=1718918.1718965>>.
- Veil, S. R., Buehner, T., & Palenchar, M. J. (2011). A work-in-process literature review: Incorporating social media in risk and crisis communication. *Journal of Contingencies and Crisis Management*, 19(2), 110–122.
- Veil, S. R., Reynolds, B., Sellnow, T. L., & Seeger, M. W. (2008). Crisis & emergency risk communication as a theoretical framework for research and practice. *Health Promotion Practice*, 9(4), 265–345.
- Weick, K. (1993). The collapse of sensemaking in organizations: The Mann Gulch disaster. *Administrative Science Quarterly*, 38, 628–652.
- Weick, K. (1995). *Sensemaking in organizations*. Thousand Oaks, CA: Sage.